The Dynamics of Language

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FINAL DRAFT
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For the whole of the last half-century, all of us studying language from a formal perspective have assumed that knowledge of language is different from the tasks of speaking and understanding. This idea was first introduced by Saussure at the turn of the century, and later recast by Chomsky (1965) as the distinction between competence and performance. On both these views knowledge of language is some capacity identifiable through abstraction away from the use of language in communication and languages, hence language itself, have to be studied entirely independently of the way they are used, because explaining the phenomena of speaking and understanding a language have to make reference to this use-neutral knowledge which underpins them. During the course of the century, there were some dissenters, but, since no alternative was ever formally articulated, by and large, this view held total sway.

This book takes a different tack: it continues the task set in hand by Kempson et al. (2001) of arguing to the contrary that the common-sense intuition is correct and that knowledge of a language consists in being able to use it in speaking and understanding. What we argue is that defining a formal model of how interpretation is built up across a sequence of words relative to some context in which it might be uttered is all that is needed to explain structural properties of language. The dynamics of how interpretation is built up just is the syntax of a language system. The capacity for language is thus having in place the architecture which enables us to produce and understand language input in context. What is central to the explanation, through every twist and turn of the formal intricacies, is the faithful reflection of the dynamics of processing a string: bit by bit, each unit of information that constitutes the next input picks up on what is presented before and adds to it to provide the context for the next addition to be processed.

Given this commitment, such a model might look like a new variant of use-theories of meaning, a continuation of the later Wittgenstein’s admonition that all there is to meaning is to look at the usage, nothing more need be said. However, out of this earlier work, a resolutely anti-formalist stance developed, so that this tradition is in danger of being anti-theory, dismissing the need for any formal explanation. What we are arguing, however, is that there is room for views in between these extremes. Our proposal is that properly formal theories of language can be articulated in terms of the dynamics of how a language enables interpretation to be progressively built up. Against the use-theory of tradition, we are committed to the same methodology of previous grammar-writers in the tradition of theoretical linguistics that a grammar must define what it means for an expression of the language to be well-formed, and that it must couch such explanations in terms of distributional properties of the expressions of the language. Indeed, just like anyone else in this tradition, we present a formal framework for articulating such structural properties of language. In this respect, the structure of the book is within the tradition of formal linguistic modelling: we introduce the formal framework; we apply it to individual analyses in individual languages to show that it provides a reasonable way of addressing standard structural properties of that language; and from there we enlarge the horizon to show how it can be used to articulate general properties across languages. In particular we show how it is competitive in addressing a whole range of phenomena that are extremely puzzling seen from the perspective of other frameworks. In all these respects, the methodology is familiar.
However, there is a very different twist, because the formal framework we present has an attribute which grammars of the past century, with a few honourable exceptions, have not had. The formalism which we present as the basis for articulating grammars of natural language is able to define processes of growth of information across sequences of expressions; and we argue that natural-language grammars, by definition, reflect the dynamics of real time processing in context. In essence, we take syntax to be a process, the process by which information is extracted from strings of words uttered in some context. This stance not only leads to different analyses of individual phenomena, and a commitment to very different forms of explanation; but it opens up a whole new debate about the nature of language, the formal properties of natural-language models, and the relation of language to explanations of the way linguistic ability is nested within a more general cognitive perspective.

The formal framework of Dynamic Syntax was set out in Kempson et al. (2001), but in writing this book we have had different objectives. First, our task has been to convey to a general linguistic audience with a minimum of formal apparatus, the substance of that formal system, without diminishing the content of the explanations. Secondly, as linguists, we set ourselves the task of applying the formal system defined to as broad an array of linguistic puzzles as possible. On the one hand, we have covered the kind of data other books might cover – problems displayed by English. On the other hand, we have shown how the very same system can be used to develop a detailed account of Japanese as a proto-typical verb-final language showing that from the perspective we set out, Japanese looks just as natural as any other language. This is a good result: verb-final languages comprise about half the world's languages; yet, to all other current theoretical frameworks, they present a cluster of properties that remain deeply puzzling. Indeed, on looking back from this new perspective in which they fall so naturally into the same type of explanation, it is at the very least surprising that the community of linguists should have been content for so long with theoretical frameworks that found these languages such a challenge. We have also looked in some detail at the intricacies of the agreement system in Swahili, one of a language family – Bantu – which seems to pose quite different problems yet again from either of these two languages. Having set out a range of detailed analyses, and a demonstration of how each fits into general typologies for language structure, the book then closes with reflecting on the novel perspective which it opens up, showing how old questions get new answers, and new challenges emerge. Amongst these is the demonstration that with the gap between a formal competence model and a formal performance model being so much narrowed, we can fruitfully address challenges set by psycholinguists. One of these is the challenge to provide a basis for modelling dialogue, the core phenomenon of language use; and we argue that the Dynamic Syntax framework provides a good basis for modelling the free and easy interchange between the tasks of speaking and understanding, displayed in dialogue.

In writing such a book, it is always more fruitful to write as a community, and, first of all we would like to take the opportunity of thanking each other for having got ourselves to a point where we none of us feel we would have got to without the other. As one might expect from such collaboration, the book has spawned other publications during the process of its completion. Parts of chapter 3 were written up as Kempson (2003), Kempson and Meyer-Viol (2004), parts of chapters 4-5 as Cann et al. (2003), Cann et al. (2004), Cann et al. (2005), Kempson, Kiaer and Cann (forthcoming), Kempson, Cann and Kiaer (2004). Part of chapter 6 is written up as Kempson and Kiaer (2004), Kempson (2005), parts of chapter 7 as Marten (2000, 2003, 2005), parts of chapter 8 as Cann (forthcoming a,b) The implementation of
the parsing and generation models discussed in chapter 9 is reported in Purver and Kempson (2004 a,b,c); and Bouzouita and Kempson (forthcoming) reports diachronic work on Spanish, established in Bouzouita (2001).

As this array of jointly authored papers makes plain, it is almost an accident of history who turns out to be a listed author. In particular, we have to thank Wilfried Meyer-Viol for his influence on almost every page. A substantial part of chapters 2-3 overlaps with that of Kempson et al. (2001). And the discussion of quantification chapter 3, section 3 relies very heavily on chapter 7 of Kempson et al. (2001), which is largely his work. So our biggest vote of thanks goes to him. He cannot however be blamed for any of the analyses presented here, and he would certainly disavow the particular cognitive stance which we have adopted. So we thank him for the high standards of formal rigour he has demanded of all explanations articulated within the framework, and for the challenge of disagreeing with him almost every step of the way over the cognitive underpinnings of the system as set out.

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Chapter 1

The Point of Departure

To the vast majority of us, knowing a language is a simple matter. It means, minimally, being able to understand someone when they speak to you, and being able to speak to them in a way they can understand across a sufficiently broad array of sentences to constitute a reasonable conversation. Yet, in theoretical linguistics in recent time, no such simple answer has seemed sufficient, for it is taken as an incontrovertible fact that there is no simple correspondence between intrinsic properties of language and its use in context. What this book is about is convincing its readers that the simple intuition is recoverable while nevertheless sustaining a properly formal account of language. We no longer have to be hampered by the gulf between some abstract concept of language competence and some concept of language performance which is some uncontrollable conflation of linguistic and nonlinguistic parameters: to the contrary, we can establish a view of language capacity as, simply, having the capacity to process language input. Structural properties of language are displayed in setting out the architecture needed to process natural language input. So knowing a language is knowing how to parse it. And production follows the same steps as parsing, with the only difference that the speaker has in mind what they want to say. This is the claim we set out in the pages that follow.

The problem that we start from is the accepted wisdom that knowledge of language is quite different from knowing how to use it. The justification for this stance is that language is used in a number of ways - in production (mapping some thought onto some sequences of sound), in perception (mapping a sequence of sounds onto some thought), in expressing our thoughts (which might lack either realisation). The grammar formalism which encapsulates the knowledge of a language that can lead to such realisations must therefore be neutral as between the ways in which it is used, whether to understand or to speak. In the light of this order of dependence, it is the concept of language which has to be explained first, independently of any application of that knowledge - the intrinsic properties of a language as set out in a grammar comprising the capacity enjoyed by some idealised speaker/hearer. It is the applications of the knowledge, then, that have to make reference to the body of knowledge, and not it to them. So psycholinguists may set up experimental conditions for the study of language use, assuming some given formalism as the background against which tests are designed to evaluate some claimed phenomenon of use relative to some particular theory of language competence; but linguists studying core properties of structural/semantic aspects of language cut themselves off from such data, as a matter of principle. How, you might wonder, can this view ever be shifted? Indeed, why should it? Well, it will take a bit of
CHAPTER 1. THE POINT OF DEPARTURE

time, but it does not take much scratching at the surface before the problems start to emerge.

Within the perspective which the current methodology imposes, there are two central properties displayed by all languages; and these pose a recognised major challenge for theoretical explanations of language. On the one hand there is the compositionality problem of how words and what they are taken to mean can be combined into sentences across an indefinite array of complexity. We have various means of saying the same thing, using words in a variety of orders:

(1.1) Tomorrow I must see Bill.
(1.2) Bill I must see tomorrow.

And any one of these sequences can always be embedded at arbitrary depths of complexity:

(1.3) You insisted I think that Harry I must interview today and Bill I must see tomorrow.
(1.4) The friend of mine who told me that Sue was insisting that tomorrow I must see Bill was lying.

On the other hand, there is the problem of context-dependence. Pronouns are a familiar case: they have to be understood by picking up their interpretation from some other term in some sense recoverable from the context in which they are uttered. However the phenomenon is much, much more general. Almost every expression in language displays a dependence on the context in which the expression might occur. The effect is that any one sentence can be taken to express a vast number of different interpretations. Even our trivial examples (1.1)-(1.2) differ according to who is speaker, who Bill is, and when the sentence is uttered. The first challenge, then, to put it another way, is to be able to state the interaction between order of words and interpretation within a sentence. The second challenge is to explain how the interpretation of words may be related to what has gone before them, either within the sentence itself or in some previous sentence.

The types of solution for addressing these problems are almost never challenged. The first problem, right across theoretical frameworks, is taken to require a syntactic solution. The second, equally uniformly, is taken to present a semantic problem, only. These challenges are then taken up by different breeds of theoretical linguist: syntactician on the one hand, semanticist (or pragmaticist) on the other. Given this separation, we might reasonably expect that two-way feeding relations between the phenomena would be precluded. Indeed systematic interaction is virtually inexpressible given many of the solutions that are proposed. Yet such expectation would be entirely misplaced. There is systematic interaction between the two phenomena, as we shall shortly see, with context-dependent expressions feeding into structural processes in a rich assortment of ways.

The significance of this interaction is, we believe, not sufficiently recognised. The phenomena themselves have not gone unnoticed, but their significance has. Such interactions as are identified are generally analysed as an exclusively syntactic phenomenon, with those expressions that display interaction with syntactic processes, characteristically pronouns, analysed as having distinct forms, one of which is subject to syntactic explanation, the other semantic. We shall see lots of these during the course of this book. The result is that the phenomena may be characterised by the various formalisms, but only by invoking suitable forms of ambiguity; but the
underlying significance of the particular forms of interaction displayed has gone almost entirely uncommented upon (though exceptions are beginning now to emerge: Boeckx (2003), Asudeh (2004)).

What we shall argue to the contrary is that what these systematic interactions show is that the problem of compositionality and the problem of context-dependence are not independent: syntactic and semantic aspects of compositionality, together with the problem of context dependence, have to be addressed together. Making this move, however, as we shall demonstrate, involves abandoning the methodological assumption of use-neutral grammar formalisms in favour of a grammar formalism which directly reflects the time-linearity and context-dependent growth of information governing natural language parsing.\footnote{The term time-linearity in this context is due to Hausser, who defines left-associative grammars for natural languages that, in defining well-formedness of strings in terms of possible continuations, also induce strings on a left-right basis (Hausser 1989, 1998).} Intrinsic properties defining language, we shall argue, reflect the way language is used in context so directly that the structural properties of individual languages can all be explained in terms of growth of structure relative to context. We shall argue accordingly that parsing is the basic task for which the language faculty is defined; and that both syntactic and semantic explanations need to be rethought in terms of the dynamics of language processing.

Setting out the argument is the burden of the entire book, together with the presentation of the framework of Dynamic Syntax (Kempson et al. 2001). In this first chapter, by way of preliminary, we set out these two challenges in some detail, provide some preliminary justification for the stance we take, and give some indication of the type of analysis we shall provide.

### 1.1 Compositionality and recursion in natural language

The compositionality problem, as it is very generally known, is the problem of how it is that humans are able to systematically build up indefinitely complex sentences and ascribe each one of these some interpretation. Knowledge of our language does not mean simply being able to string words together in some arbitrarily structured way. It means being able to string them together in such a way that they can be seen to have an interpretation that has itself been assigned in a systematic way. We know that this property has to be defined in terms of some small finite set of procedures able to apply recursively, as there is no concept of fixed size for natural language sentences. The procedures we have for building such strings, for whatever purpose of communication we use them, can always be extended to yield a larger and more complex string. And in all cases, the interpretation for such strings has to be built up from the structures assigned to them. So the infinite potential which a language presents to a speaker of that language, and the attendant ability to compose interpretations for those strings, are, in some sense, two sides of the same coin.

The point of departure for defining appropriate formalisms to express this property of natural languages is to take simple strings, define a vocabulary for describing syntactic structures which express such a recursive property, and from these structures define procedures that will induce the full set of strings that are taken to be well-formed sequences of the language. Let us suppose, to take a toy example, that there are “syntactic” rules/principles that determine that a verb can combine with an object noun phrase to yield a verb phrase, which combines with a subject...
noun phrase to yield a sentence, or, as a closer rendering of what the rules actually determine, a sentence may be made up of an NP and a VP, and a VP can be made up of a Verb and an NP. By a very general convention, any realisation of some application of these rules gets represented as a tree structure into which the words are taken to fit:2

\[
S \rightarrow NP \quad VP \\
VP \rightarrow V \quad NP \\
\]

\[S = \text{sentence} \]
\[VP = \text{verb phrase} \]
\[NP = \text{noun phrase} \]
\[V = \text{verb} \]

(1.5)

John upset Mary

As the starting point for articulating a semantics for such structured strings, we might assume that there are “semantic” rules which determine how meanings for sentences are built up on the basis of the meanings of their words and such structural arrangements. So we might express what it is that (1.5) means on the basis of first knowing that upsetting is a relation between individuals – something that people can do to us – that the term Mary refers to some individual bearing that name, John to some individual called by the name ‘John’. What knowing the meaning of the sentence then involves, is having the capacity to combine these pieces of information together following the structure of the sentence to yield the assertion that John upset Mary (not the other way round). Somewhat more formally, providing the semantic characterisation of a sentence involves specifying the conditions which determine the truth of any utterance of that sentence; and, as part of this programme, the meaning of a word is defined as the systematic contribution made by its interpretation within the sentences in which it occurs. The semantic rules that guarantee this rely on an independently articulated syntax. So, for (1.5), following the syntactic structure, the meaning assigned to the verb upset applies as a function to the individual denoted by the name Mary to yield the property of upsetting Mary, which in its turn applies to the individual denoted by the name John in subject position to yield the proposition that John upset Mary at some time in the past, relative to whatever is taken to be the time of utterance.3 The example we have given is trivial. But the underlying assumptions about design of the grammar are extremely widespread. This pattern of defining a syntax that induces structure over the strings of the language, with an attendant truth-conditional semantics that is defined in tandem with the defined syntactic operations, has been a guiding methodology for the last thirty odd years, even though individual frameworks disagree over the detailed realisation of such formalisations.

2In some frameworks, S corresponds to IP or CP (Inflection Phrase or Complementiser Phrase), NP corresponds to DP (Determiner Phrase).

3See Cann (1993) (amongst many others) for an exemplification of this view of the syntax-semantics interaction, based on ideas taken from Generalized Phrase Structure Grammar, see Gazdar et al. (1985).
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The particular toy grammar we have given here does not allow for recursion. But on the assumption that we introduce appropriate syntactic rules to allow for recursion, this model will have the advantage of being able to reflect the infinitely recursive property for both syntax and semantics, given the definition of semantic modes of combination running on the back of the defined syntactic rules. As a reflection of the systematicity of this syntax-semantics relation, we might dub this view “the jigsaw view of language”: each word and its meaning add together with its neighbouring words and their meaning to give bigger and bigger pieces which fit together to form a sentence plus meaning pair for a sentence when all these various parts are combined together. Knowledge of language, then, constitutes knowledge of this set of principles; and, accordingly, models of language use will have to take such models as their point of departure.

1.1.1 The “Imperfection” of Natural Languages

Looked at from this perspective, it looks, somewhat surprisingly, as though natural languages fail to be the evolutionarily “perfect” systems one might expect (Chomsky 1995). On the jigsaw view, both syntactic structure for a string and compilation of a semantic interpretation of it involve a step by step process of combining a word (or, in semantics, its denotation) with some other word to which it is adjacent to project some larger structure (constituent) and its interpretation, each such building block being combined on a bottom to top basis with an interpretation being assignable to each such determined constituent. The problem that Chomsky brought out so vividly forty or so years ago is that there are sequences which appear to be far from optimal for this view of language, with a word or word sequence able, apparently, to be in quite the wrong place for combining straightforwardly with its immediate neighbours. For example, in (1.7) the first word Mary is somehow misplaced, since it has to be interpreted as subject of the phrase should never have gone out, and not as anything directly to do with its neighbouring word John.

(1.7) Mary, John says should never have gone out on her own.

Such phenomena seem to present a case where information can in some sense be presented too early, before the position from which it can be combined with neighbouring elements in the semantic structure. These are structures which Chomsky made famous – they are called “long-distance dependency” phenomena because the “displaced” item, here Mary, can be an arbitrarily long distance away from where it needs to be interpreted.

There are converse cases where information seems to come later than is optimal:

(1.8) It is obvious that I am wrong.
CHAPTER 1. THE POINT OF DEPARTURE

The subject of *obvious*, which we might expect on the pattern of (1.7) to occur before the predicate word *obvious*, is the clause *that I am wrong* (this is what is obvious); but all we have in subject position is the word *it* as some kind of promissory note, itself giving much less information than we need, merely acting as a wait-and-see device.

To add to the puzzle, there are restrictions on these correlations which do not seem to be reducible to any semantic considerations. So while establishing a connection between a left dislocated expression and some position in a string indefinitely far from this initial position is possible across certain clause boundaries, it is not across others. Thus, (1.9) is well-formed where each clause is the complement of some verb, while (1.10)-(1.11) are not. In the latter cases, this is because the containing clause inside which the removed item is intended to be correlated is a relative clause.

(1.9) That book of Mary’s, Tom tells me he is certain you can summarise without difficulty.

(1.10) *That book of Mary’s, Tom tells me he has met the author who wrote.

(1.11) *The book which Tom told me he had met the author who wrote was very boring.

Left dislocation, though subject to constraints, nevertheless may involve the indefinite “removal” of an expression from its interpretation site. Analogous “removal” to some right-periphery position is very much more restricted, however. Dislocation from the point at which the expression has to be interpreted can only be within the domain provided by the clause in which the expression is contained, and not any further. This is shown by (1.12)-(1.15):

(1.12) It was obvious I was wrong.

(1.13) That it was obvious I was wrong was unfortunate.

(1.14) It was unfortunate that it was obvious I was wrong.

(1.15) *That it was obvious was unfortunate I was wrong.

(1.12) shows that a right peripheral clausal string like *I was wrong* can be associated with an expletive pronoun, *it*, in subject position, providing the content of that pronoun. (1.13) shows that this form of construction can be contained within others. (1.14) shows that this process can be repeated, so that the main subject pronoun can be provided with its interpretation by the string *that it was obvious I was wrong*.

What is completely impossible, however, is the establishment of a correlation between a right dislocated clausal string such as *I was wrong* with expletive *it* which is subject, not of the matrix clause, but of the clausal subject. *That it was obvious*. As (1.16) illustrates, this is the structure exhibited by (1.15) which is completely ungrammatical and any meaning for the sentence as a whole is totally unrecoverable. That it might mean the same as (1.13)-(1.14) is impossible to envisage. This is despite the fact that the clausal sequences are all arguments which, as noted above, freely allow leftward movement.

(1.16) *That it, was obvious [I was wrong] was unfortunate [I was wrong].

Such right peripheral displacements are said to be subject to a “Right Roof Constraint” (Ross 1967), imposing a strict locality restriction on how far the clausal
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String can be removed to the right from its corresponding pronoun, limiting this to a single, containing clause.

It was the existence of such apparently semantically blind restrictions that led in the 70’s to agreement across otherwise warring theoretical factions that syntactic and semantic explanations could not be expressed in the same terms:6 and following this agreement, a number of grammar formalisms were articulated (Gazdar et al. 1985, Bresnan 2001, Sag and Wasow 1999) all of which presumed on the independence of theoretical vocabulary and formal statements to be made for syntactic and semantic generalisations.7 More idiomatically, as Chomsky has expressed it (Chomsky 1995), natural languages seem in some sense not to be “perfect”, and this in itself is a challenge which linguists have to address. A core property of natural languages lies in these irreducibly syntactic properties - those which, in minimalist terms, cannot be reduced to properties of either the semantic or phonology interface; and it is these above all which Chomsky pinpoints as evidence of the uniquely defining structural properties of natural language.

1.1.2 Meaning and Context

A second problem arises in establishing word meaning. When we reflect on what a word means – that is, what it contributes to interpretation – we find over and over again that the meaning words have may be far weaker than the interpretation they have in context. Pronouns are the most familiar type of case:

(1.17) He upset her.

(1.17) means that some identified male person upset some female individual at some previous point in time - but who upset who and when is not provided by the words themselves, it is provided by the context within which the sentence is uttered. (1.18.a,b) show that this choice is not a trivial matter of picking up on what has most recently been mentioned, but may involve reasoning with whatever information is provided by that context:

(1.18) a. Though John and Mary adored each other, he married Sue. Whenever he upset her subsequently, she would remind him that it was Mary he should have married.

6In the early 70’s Richard Montague articulated the ‘English as a Formal Language’ approach (Montague 1974) in which syntax and semantics were expressed directly in tandem, following earlier articulation of categorial grammar formalisms in which this is true by definition (Lambek 1961, Bar Hillel 1964 and many others since). Though this assumption was agreed to be unsustainable, given the existence in particular of strong island constraints such as extractability from complex structures to the left periphery (eg. The Complex NP Constraint), and no-extractability from complex structures to the right periphery (The Right Roof Constraint), the methodology of striving to establish denotational underpinnings for structural properties of language continues to this day, attempting in so far as possible to preserve the strongest form of compositionality of meaning for natural language expressions, by invoking lexical and structural ambiguity for all departures from it.

7Categorial grammar formalisms preserve the Montague methodology in its purest form, defining a mapping from natural-language string onto model-theoretically defined denotations without any essential invocation of a level of representation, using an array of lexical type assignments and operations on these types which determine compositionality of meaning despite variability in word order (Ranta 1994, Morrill 1994, Steedman 1996, 2000, Moortgat 1988). Lexical Functional Grammar (LFG) is the only framework which systematically abandons any form of compositionality defined directly on the string of expressions, for c-structure (the only level defined in terms of a tree-structure configuration inhabited by the string of words) is motivated not by denotational considerations, but solely by distribution (Bresnan 2001, Dalrymple 2001).
b. Though John and Mary adored each other, he married Sue. The only
time they subsequently met, he upset her so badly she was glad he
had married Sue, not her.

Despite the fact that he upset her is in much the same context in (1.18.a,b), never-
theless in (1.18.a) her means ‘Sue’ and in (1.18.b) it means ‘Mary’, due to the use of
they in (1.18.b) and the assertion that whoever they are had only met once subse-
quent to the marriage, which rules out interpreting her as picking out Sue (at least
given conventional marriages). The problem is that the assumption that semantics
is given by articulating the contribution each word makes to the conditions under
which the containing sentence is true would seem to lead to the assertion that all
sentences containing pronouns are systematically ambiguous: the conditions under
which John upset Mary are not the same as the conditions under which John upset
Sue, ‘Mary’ and ‘Sue’ being the discrete interpretations associated with the pro-
noun her. Ambiguity defined in terms of truth conditions holds when an expression
makes more than one contribution to the truth conditions of the sentence in which
it is contained. The word bank is an obvious example, any one use of the word in
a sentence systematically providing more than one set of truth conditions for the
containing sentence. Problematically, pronouns seem to be showing the same prob-
lem; yet we do not want to be led to the conclusion that a pronoun is an ambiguous
word. For this leaves us no further forward in expressing what it is that constitutes
the meaning of an anaphoric expression: it simply lists the different interpretations
it can have, and there are too many for this to be plausible.

There is a more general problem than this. Pronouns stand in different types of
relation to the denotational content they can be assigned in context, making it look
as though the ambiguity analysis of pronouns is unavoidable in principle. In (1.19),
the pronoun is construed as a bound variable, that is, a variable to be construed
as bound by the quantifier every girl, its interpretation dependent entirely on what
range of girls every is taken to range over:

(1.19) I told every girl that she had done well.

But this is not an appropriate analysis of (1.20). In (1.20), the pronoun is gener-
ally said to be a coreferring pronoun, both it and its antecedent having the same
interpretation, denoting the same individual:

(1.20) Edwina came in. She was sick.

But this form of analysis will not do for the pronoun she in (1.21) - the pronoun
has to be construed as ‘the woman I helped over the road’:

(1.21) I helped an old woman over the road. She thanked me.

But the pronoun in (1.21) is not functioning as a bound-variable, as in (1.19), either.
Different from either of these, the construal of the pronoun in (1.21) involves some
kind of computation over the entire preceding clause.

The particular significance of the differences between (1.19)-(1.21) is that, on
the one hand, the problem does not seem to be reducible to a syntactic problem.
This is not a problem that can be solved by analysing the pronoun as a stand-in
device for the expression that provides its antecedent, since (1.19) and (1.22) mean
entirely different things:

(1.22) I told every girl that every girl had done well.

(1.21) and (1.23) also:
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(1.23) I helped an old woman over the road. An old woman thanked me.

Deciding on the most appropriate analysis for this type of pronoun, as is the standardly acceptable way of describing the problem, has led to an immense amount of debate; and pronouns that give rise to this form of construal in such contexts are currently distinguished from other uses by the term E-type pronouns.\(^8\)

With there being different types of truth conditions which a pronoun can contribute to its containing sentence, it seems that analysing the meaning of a pronoun in terms of its contributions to the truth conditions of sentences in which it occurs seems bound to involve diversity, hence ambiguity of the pronoun itself. Yet there is good reason to think that any solution which freely invokes lexical ambiguity cannot be right. Not only does this phenomenon of multiple variable-type, referential-type and E-type interpretations extend systematically across pronouns in all languages. It also extends systematically across anaphoric expressions in all languages. Here are a range of paired examples from English, showing the availability of bound variable and E-type interpretations provided by both the definite article and for both forms of demonstrative.

(1.24) Every house I have put on the market I have checked, to make sure the house will not be hard to sell.

(1.25) Most students were there. The entire group got drunk.

(1.26) Every day I drink any wine, I know that later that day I shall have a migraine.

(1.27) Most people who came early left well before a few people got drunk. That group were no problem.

(1.28) Every time I don’t take my pills, I think that this time I am better and will not need them.

(1.29) I went to a party at which several of my friends were playing dominos. This group were very quiet, though the musicians got very drunk.

The availability of such types of construal also extends to tense, with (1.30) indicating a bound-variable form of construal for the present tense, (1.31) indicating a referential form of construal, (1.32) an E-type form of construal:

(1.30) Whenever the dog goes out, she pees.

(1.31) The dog went out. She didn’t pee.

(1.32) I saw each student for an hour. I was very patient despite the fact that I had a headache.

In (1.32), the type of construal is again an E-type form of construal, for the understanding of the time interval contributed by was in I was very patient is over the whole time it took to see the students one after the other.

There is also verb-phrase (VP) anaphora, and nominal anaphora:

(1.33) Even though I write my own songs, most of my friends don’t.

(1.34) Even though I like to sing John’s songs, that particular one isn’t much good.

\(^{8}\) E’ for existence, so we understand, and not for Gareth Evans, who coined the term (Evans 1980).
And this is still not much more than the tip of the iceberg. There are also a number
of different forms of nominal and verbal ellipsis, where the required interpretation
isn’t expressed by words at all, but is picked up directly from the context:

(1.35) Whenever I sing my own songs, Sue refuses to.

(1.36) Even though I like to sing John’s recent songs, not one is as good as most
he had written while a student.

(1.37) She can sing some of my songs, but not John’s.


(1.39) What Lloyds promotes is its own interests.

(1.40) She can sing some of my songs, but I haven’t decided which.

Though VP ellipsis has been taken to be a broadly unitary phenomenon since Dal-
rymple et al. 1991, as in (1.33) and (1.35), VP ellipsis and nominal ellipsis (as
in (1.34), (1.36)-(1.37)) are invariably distinguished, with different forms of input
structure. So too are fragmentary answers to questions (1.38), and the correspond-
ing so-called pseudo-cleft structures (1.39), for which a recent analysis has proposed
that the final expression (and correspondingly the fragment answer) is really a full
sentential form ‘Lloyds promotes its own interests’ in which all but the final expres-
sion is deleted (Schlenker 2003). There is so-called sluicing (1.40), generally also
analysed as a form of sentential ellipsis in which only the wh expression remains

The list goes on and on from there. For each major construction, distinct forms
of interpretation are seen to be associated with subtly distinct structural restric-
tions. As we shall see in chapters 3 and 6, there are a number of different types
of relative clause construal, suggesting at least rather different forms of relativis-
ing element, supposedly needing quite distinct forms of analysis. And in chapter
8, we shall confront the problem of be for which at least five different forms have
been posited - presentational, existential, predicative and equative be plus the aux-
iliary. Despite the temptation to posit discrete structures coinciding with discrete
forms of interpretation, the consequences of any decision simply to invoke ambi-
guity have to be faced, as part of the challenge of confronting the phenomenon of
context-dependence in general. Any such decision is no more than an evasion of the
challenge of providing an explanation of what intrinsic contribution the expression
or structure brings to the interpretation process, which at one and the same time
licenses and yet limits the flexibility of its interpretation.

The alternative conclusion stares one in the face, begging to be drawn. The
phenomenon of context dependence is general. It dominates the problem of pro-
viding an adequate account of natural language construal; indeed it constitutes its
very heart. This is not a phenomenon that can be swept aside as a mere ambiguity
of the expressions that display it.9 Furthermore, once we grant that the meaning
of words contained in a sentence is not sufficient to establish the interpretation of
what is conveyed in an utterance, we have to articulate meanings for expressions
that are systematically weaker than the interpretation they may be assigned, with
a definition of the forms of update that take place during the process of building up
such interpretations.10 So what we shall be seeking to provide is a formal charac-
terisation of an expression’s lexical meaning in terms of some specification which is

9See Carston (2002) for a demonstration that it also infuses conceptual content, with the
concept a word expresses varying from context to context.
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only the input to an interpretation process that is sensitive to the context in which the expression is uttered.

1.1.3 Putting the two problems together

As we have so far expressed it, the problem of the correlation of syntax and semantics and that of context dependence may seem not to have anything to do with each other: one concerns interfaces between discrete components of the grammar, the other the nature of the embedding relation between some concept of partial interpretation and the overall model. They certainly have been treated completely differently in the many analyses provided for them in the last two decades, the one syntactic, the other purely semantic. Semantic accounts, throughout the eighties and nineties, have recognised the centrality of context and developed formal models of context to reflect the way in which words are enriched to yield their interpretation in use; and it has not gone unnoticed that this phenomenon is at least in part a time-linear process (Kamp 1981, Kamp and Reyle 1993, in particular). After all, the context against which interpretation is built up at least includes the sentences most recently processed. So in modelling the concept of context, the left-to-right dynamics of language processing is, in semantics, not ignored. In syntax however this aspect of language has, until very recently, not been taken up at all. To the contrary, it is almost universally set aside as a matter of principle. One of the untouchable laws of theory construction about language has been that structural properties of language should be characterised independently of the dynamics of language processing – hence any notion of how language is processed in context – preserving the assumption that linguistic knowledge is prior to any application of such knowledge; and any word-order effects in natural language which are taken to be due to processing considerations are set aside as not relevant to the articulation of structural properties of language. And in so far as linear order of words is a reflex of left to right parsing in real time, linear order has generally not been taken to be a syntactically relevant property.

Of course, there is no logical necessity to associate linear order and the dynamics of processing in context in the explanation; and the refusal to consider linearity as a

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11 Into this category, fall so-called stylistic movement processes such as Heavy NP Shift, whereby expressions that are in some sense long are moved to the right periphery of a string. However, this has sometimes led to bizarre conclusions, e.g. that variability in constituent order known as scrambling is a PF phenomenon, outside core syntax (see Karimi (2003) for different representative views about scrambling). Indeed, since all dislocation processes are to some extent context-dependent, this line of thought logically leads to the conclusion that no such phenomena should be characterised as part of core grammar.

12 Despite the fact that linear precedence is encoded in LFG at the level of c-structure, it is uniformly agreed that the substantial core of linguistic generalisations has to be expressed at f-structure, which retains no record of linear order. In Head-Driven Phrase Structure Grammar (HPSG, Sag et al. 2003), discussions of linear order have tended to be concerned with capturing generalisations about word orders within particular languages and linear precedence rules are in general treated independently of the principal syntactic operations on feature structures (e.g. Uszkoreit 1987, Sag and Wasow 1999), although there are exceptions (Kathol 1995, 2000, Reape 1993). See also Hoffman (1995), Baldridge (2002) who set out a Combinatory Categorial Grammar (CCG) characterisation of local scrambling in free word order languages in terms of a set-theoretic type specification which reflects the view that the grammar simply fails to dictate local NP-ordering relative to the verb.
syntactic primitive is subtly shifting in recent minimalist work, without concern that this might be undercutting basic theoretical assumptions. This move started with Kayne (1994), who observed that the mapping of dominance structures onto linear strings imposes an asymmetry on the structures to be licensed, with such constraints as ‘specifier’ precedes ‘head’, ‘head’ precedes ‘complement’, a view which has been extremely influential despite the fact that these constraints are highly problematic to sustain in the face of verb-final languages, imposing a large number of movement processes in any characterisation of those languages (Simpson and Bhattacharya 2003). Nevertheless we take it as no coincidence that the increasing interest in issues of linearity has also led within minimalism to a view which directly correlates the grammar formalism with the dynamics of language performance (Phillips 1996, 2003), in a view not dissimilar to our own.

There is a major problem caused by the disavowal of explanations that make reference to the dynamics of processing order: it creates a tension between the characterisation of how words are put together to form strings (syntax), and characterisation of interpretation of such strings (semantics). Though syntax is assumed to provide the input for semantic characterisation (at some LF interface in minimalist terms), the remit of semantics is assumed to be an explanation of how information is built up in context to yield a new context for what follows, a task which has to be fulfilled despite the fact that syntactic processes are not defined in terms that support this remit. This creates two problems, one formal, one empirical, the empirical evidence showing that the formal stance adopted cannot be right. First, we face a design problem for the language model: it is far from obvious how to fit syntax and semantics together as distinct but correlated components of a formal system that is designed to reflect what a speaker/hearer knows independent of any application of that knowledge, given that one of these components but, apparently, not the other has to be defined in dynamical update terms with essential reference to context. On the empirical side, the facts simply deny the sharp separability of anaphora construal and the articulation of structural restrictions that this separation of considerations of structure and context-dependence might lead one to expect. To the contrary, there is pervasive inter-dependence of anaphora and structural processes, as we shall spend much of this book showing. All that can be done to preserve the encapsulation of the grammar formalism and its separation from more general concepts of context-dependence and the dynamics of language processing in context is to assume a bifurcation between anaphoric processes which display interaction with structural processes, and those which appear to depend, in some sense more loosely, on the larger dialogue context. But this is difficult to reconcile with the fact that any one pronoun can be used in both ways. The result for such types of solution (Aoun and Li 2003) is a lack of integrated explanation of any single anaphora/ellipsis process. The formalism merely defines a subset of cases to which some arbitrarily delimited anaphoric process applies, generally one that can be reduced to some binding mechanism independently articulated in the grammar (see Morrill (1994), Hepple (1990) for categorial grammar examples).

We are grateful to Øystein Nilsen for informing us of recent research moves in the direction of taking precedence rather than dominance as the primitive syntactic relation.

The only pronouns which do not occur freely in both uses are the first and second person pronouns.

Despite the emphasis in Discourse Representation Theory of providing a framework in which a unitary account of anaphora can be expressed (Kamp and Reyle 1993), the same bifurcation occurs if the version of Discourse Representation Theory presupposes an attendant grammar formalism which assigns co-indexing between anaphoric and antecedent expressions for grammar-internal processes, for the DRS construction algorithm which dictates construal of pronouns through an identification of variables will apply only to supposedly discourse-general processes, excluding...
Any language can be used to illustrate this. In this chapter, we stick to English. We start with the resumptive pronoun strategy in English where the pronoun serves to pinpoint the position in the relative-clause construal at which some reflex of the head noun has to be seen as contributing to the interpretation of the relative (the pronoun \textit{it} in (1.41)).

(1.41) There was this owl which it had got its foot caught in the goal netting.

The problem that examples like these display is that, on standard assumptions, the requisite interpretation of the pronoun is the result of a structural process, but this process is characterised independently of, and logically prior to, the process of assigning semantic interpretation to the assigned structure. The characterisation is in terms of some form of co-dependency of elements in a long-distance dependency structure. Whatever the particular mechanisms of the particular formalism, it forces an analysis of this use of anaphoric expression of an entirely different sort from the more general phenomenon of context-dependence. One possible way to avoid the theoretical consequences which these data apparently present is to label the problematic subcases as a discrete lexical property of some itemised form of pronoun, possibly phonologically weakened. This is an instance of the problematic ambiguity tactic very generally adopted in the face of problematic data. But this tactic really is not well motivated, as all other definite and demonstrative NPs can be used in the same way where there is no possible analysis in terms of some phonologically weakened form, and the goal of analysing resumptive pronouns in a way that integrates them with the more general phenomenon of anaphora is a recognised challenge (Boeckx 2003, Asudeh 2004):

(1.42) I watched this woman, who the idiot had got herself into a dreadful muddle trying to sort out her papers in the middle of the conference hall.

(1.43) This afternoon I’m interviewing a mature student, who this woman is asking for extra time, and we may not be able to avoid giving it to her.

The other alternative is to exclude the data altogether. Asudeh (2004), for example, analyses these as ungrammatical (as does Boeckx (2003)), requiring an additional production mechanism that licenses local strings which determines their acceptability to the speaker. Yet, this common occurrence of optional resumptive pronouns in relative clauses that are nevertheless deemed to be substandard is not peculiar to English. It is displayed in other European languages - Italian, Spanish, Portuguese at least. In contrast, strikingly, resumptive pronouns are not usable at all in German. But this makes a pure production analysis seem unlikely: how could the requisite production strategy not be applicable in speaking German? This problem should not be dismissed as just a one-off production error associated with

pronouns captured by the grammar from its remit. In this connection, it is should be noted that the Dynamic Predicate Logic (DPL) characterisation of anaphora (Groenendijk and Stokhof 1991) presumes on a prior indexing of pronouns provided by some attendant grammar formalism, so there is no formal reflex of the underspecification intrinsic to anaphoric expressions.

This is a strategy which is used much more freely in other languages. See chapter 4, and Cann et al. forthcoming. The example was uttered spontaneously by the second author, 13.08.04.

This is achieved in various ways in the different frameworks: feature sharing in HPSG, term sharing in LFG, feature checking, copy-and-delete or movement in minimalism.

Asudeh (2004) claims to provide a characterisation of resumptive pronouns which forms part of a general characterisation of anaphora, but his analysis involves positing a morphologically null operator which has the effect of removing the pronominal properties of the resumptive, thereby ensuring its function as a gap needing binding by the associated gap-binding \textit{wh}-operator.

It is notable, in this connection, that these are often reported as possible to parse, but with the observation that “I wouldn’t say it that way”, an observation which is at odds with his analysis.
sloppy conversational forms of English. The use of resumptive pronouns within relative clauses is a general cross-linguistic pattern and so its use in English should not be seen as so surprising. There are a lot of different types of interaction between anaphora and structural processes, and, as we shall see in due course, these are systematic across languages (see chapter 4).

To pursue the case of relative clauses a bit further, there is also interaction between personal and relative pronouns when the personal pronoun does not indicate the position that should be associated with the head, but performs some other function. These are the phenomena called in the literature ‘strong crossover’. In these cases, there is a restriction which, loosely, could be expressed by saying that “the position in the relative to which the head noun has to contribute, has to be closer to the occurrence of that head, than any pronoun”; or, to put it another way, “if a pronoun intervenes between the head and that position, it cannot be interpreted as identical to these”:

(1.44) a. John, who Sue said thinks he’s sick, isn’t coming to the party.

b. John, who Sue said he thinks is sick, isn’t coming to the party.

In (1.44a) the pronoun may be identified as John, but in (1.44b) it cannot. This restriction, called the strong cross-over restriction, is a very general cross-linguistic one. Looked at from a processing perspective, what seems to go wrong in the precluded interpretation of (1.44b) is that if the pronoun is construed as John, thus identifying where in the relative clause the head is to be interpreted as contributing (as in the resumptive use of the pronoun in (1.41)), then there will not be anything left to function as the subject for the predicate sick. As long as the pronoun in (1.44b) is construed as picking anyone else out, so not identifying the role of the head in the relative clause, nothing of course will go amiss. Moreover, if such a subject is explicitly indicated by a second occurrence of a pronoun, then interpretation of both pronouns as identified with the head John becomes acceptable again:

(1.45) John, who Sue said he thinks he is sick, isn’t coming to the party.

(1.44a) causes no such problems because the order of ‘gap’ and pronoun is the opposite of that in (1.44b) – the ‘gap’ precedes the pronoun.

This is a matter we return to in chapter 3, where we shall give an account in exactly these terms. The problem is that a structural account, as articulated within a use-neutral formalism which makes no reference to the order of processing, cannot make reference to any such dynamic notions. Indeed on a structural account in which pronouns may be analysed as the equivalent of a gap-providing device in order to license examples such as (1.41), (1.44b) on the precluded interpretation and (1.45) might be expected to be equally ungrammatical, for if the second of the two pronouns is by analysis a ‘gap’, then whatever restriction it is that debars the construal of he as ‘John’ in (1.44b) should also apply in (1.45).

Another form of structure-pronoun interaction occurs in the placement of expressions at the left periphery, which in some cases require attendant use of pronouns or anaphoric use of definite noun phrases, others not. So, though (1.46.a) is well-formed, (1.46.e) is not:

(1.46) a. As for John, I interviewed him.

b. As for the woman at the cash desk, I think she short-changed me.

c. As for the woman at the cash desk, I think the idiot short-changed me.

d. *As for the woman at the cash desk, I think short-changed me.
1.1. COMPOSITIONALITY AND RECURSION IN NATURAL LANGUAGE

e. *As for John, I interviewed.
f. As for John, him I have interviewed.
g. As for John, I intensely disapprove of the woman he is going out with.

In these, it is clear that no processing constraint is going to help in the explanation. Though the use of anaphoric devices may seem to increase in naturalness in a more complex environment (with (1.46.a) being less acceptable than (1.46.b)), mere processing constraints are transparently not the sole basis for explaining these data. (1.46.c), where the structure and words selected are simple and processing costs therefore low, is completely ungrammatical without an attendant pronoun suitably construed. And (1.46.f), where the pronoun immediately follows its antecedent, is fine. So the explanation here has to involve an inter-dependence between anaphoric element and structure, moreover imposing a particular construal of the pronoun: the pronoun has to be interpreted as picking out the same individual as the left-placed expression (see chapter 4).

When we bring forward-looking anaphoric dependencies into the picture, what is referred to as ‘cataphora’, we find a further constraint. Unlike backward anaphoric dependencies, where the antecedent for the pronoun or other anaphoric expression (as in (1.46.c)) can be in any structural configuration, anaphoric expressions that have a fixed structural role in the clause such as subject, object etc, have only very restricted cataphoric use. As we saw in section 1.1.1, these are subject to a strict locality restriction: the value to be provided for the pronoun has to be provided within the same local structure as the pronoun itself.

(1.47) It is unlikely that Bill will have cooked supper.

Intuitively, the explanation is simple. In the normal case in which the use of an anaphoric expression follows its antecedent, its content can be established directly and so the interpretation process can continue straightforwardly. However, the use of an anaphoric expression where the antecedent is given subsequently runs the risk that the interpretation of the containing structure will not be able to be established unless its value is provided almost immediately. For example, in (1.47), the interpretation of the whole sentence depends on having established the interpretation of the subject of which the property ‘unlikely’ is predicated. Unless what that subject pronoun stands for is identified once the predicative expression is processed, it will not be possible to build up the meaning of the whole sentence and the interpretation process is put in jeopardy. It is this form of explanation which will be given in chapter 5.

The difficulty is that such reference to how long the interpretation of an anaphoric expression can be delayed is just the kind of explanation which is difficult to state in current syntactic theories, for reference to order of processing is debarred. Instead, explanations necessarily rely on the structural relationships between terms in some configuration. If the explanation of pronominal-antecedent dependencies is to be given in purely structural terms, however, there is no reason to expect any asymmetry between left- and right-ward dependencies. Categorial formalisms define semantic composition in terms of either left or right dependence and so by definition impose symmetry between left and right modes of application. In transformational grammar, licit movement processes are defined in terms of c-command domains over the tree (whether in terms of copy-and-delete or feature checking) and

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20 At least within the same clause. We do not discuss cataphora in preposed adjunct clauses:

(i) When he arrived, John was crying.
again, in principle, there should be no distinction between cataphoric and anaphoric reference.\textsuperscript{21} Both HPSG and LFG, with their reliance on attribute-value matrices, also treat word order effects as in general inconsequential and so again provide no basis for expecting such left/right asymmetry. In these frameworks, there seems no alternative but to define distinct lexical items that serve this specialised purpose, so-called expletive pronouns, and define them as a distinct form of dependency subject to their own form of structural restriction. But, quite apart from the fact that this does not explain the left-right asymmetry, such a lexically based definition of expletives leaves unexplained why it is always pronouns which can play this restricted forward-looking role, and not some other form of item.

Standing back from the details of individual constructions, what we see is that some rearrangements of words need anaphoric expressions to prop them up in a language, others do not, but nevertheless may use them; and yet others preclude such pronominal props altogether. And languages vary as to when such anaphoric supports are required, and what kind of structural constraints are imposed on the process, as we shall see in chapters 4 to 6. With a sharp separation between semantic and syntactic explanations, in terms of both in terms of vocabulary and in terms of the intrinsic dynamics of semantics as against the almost universal view of syntax as non-dynamic, the ability to capture any such interactions while preserving the unitary characterisation of anaphoric expressions has simply not been possible. Different sub-cases of pronoun have had to be defined as distinct lexical items.

If we add relative clauses to the catalogue of different phenomena, the number of discovered ambiguities rises yet further. There are restrictive, nonrestrictive, head-final, head-internal, and correlative, structures at least. All of these supposedly discrete structures require distinct forms of analysis, according, apparently, as the different orders in which the words occur need distinct structural forms of analysis. Indeed, in recent times, there is regular announcement of some new type of relative or pronoun, invariably introduced with excitement at the fascinating diversity of natural languages (see Aoun and Li (2003), Landman and Grosu (1998), for recent examples). And even those who take up the challenge of attempting to reduce the heterogeneity either of relative structures or of pronouns, rest content with setting aside subcases as not reducible to the variable-binding perspective invariably taken to be presented by the core cases (Boeckx 2003, Asudeh 2004).

The methodological separation of syntactic and semantic explanations in which syntax lacks any reflex of the dynamics of processing has thus led to a scenario in which multiple ambiguities and multiple types of structural analyses have had to be posited. If there is to be a stop to this ever-increasing multiplication of ambiguities, as we think there should be, we have to look for an alternative style of analysis, which does not yield this result, one for which the criterion of success might be the ability to define natural forms of interaction between anaphora construal and discontinuity effects.

One way to achieve this to is to define a system in which the projection of both content and structure are expressed in terms of relatively weak specifications, updated in different ways in different contexts. In this connection, we might consider how long-distance dependency could be reinterpreted as a dynamic process that involves initial underspecification of structure and subsequent, context dependent, update to provide the information that is missing. This turns out to be surprisingly straightforward.

\textsuperscript{21}With something like Kayne (1994)’s theory of the relation between hierarchy and linearisation, there could be some interaction between order and binding. The theory is, however, problematic in requiring the explosion of functional categories to allow anything like the full range of word order phenomena found even in a single language.
Consider what is involved in parsing a left-peripheral expression in a sentence, in the appropriate sense ‘removed’ from the position appropriate for reflecting semantic compositionality, such as:

(1.48) Mary, I’m certain my friend said would never have gone out on her own.

What is involved in modelling the point in the interpretation process at which the word *Mary* is parsed? The problem is that one cannot identify the precise form of the contribution of this initial expression to the overall interpretation, because this is not determined at this point in the parse. There is no definitive indication, even, as to whether it should not be construed as the subject (though intonation might rule out such a straightforward assumption). Put crudely, in parsing of *Mary* in (1.48), no decision can be made about its precise contribution to the whole. This comes later, when the position between *said* and *would* is reached. One way of reflecting this structurally is to define that initial expression as having some position within the semantic representation under construction, but what that is is initially under-specified. (Note the deliberate sharing of vocabulary with the description of the intrinsic lexical specification for a pronoun.) The eventual position of the term within the structured representation of content is identified later on in the time-linear process of parsing, as more words come in.

Long-distance dependency is, on this view, a form of underspecification involving structure, an early structural underspecification subsequently resolved, much like construal of anaphoric expressions, but in the structural domain. Taking this approach enables us to view the various forms of interaction between anaphora construal and long-distance dependency effects in the same terms, and so potentially provides us with the means of accounting for the ways in which the process of anaphora construal either can be fed by the process of long-distance dependency construal (the resumptive pronoun strategy), or can interfere with it (the crossover effect). We thus have the promise ahead, or rather the challenge, of being able to bring together anaphora resolution and long-distance dependency so that both provide aspects of interpretation that under-determine the final result, their resolution being part of the dynamics of the interpretation process. Of course any such account needs to be fleshed out in detail, and moreover within an appropriately defined formalism, and this is what this book is about.

In making such a move into explaining what have been deemed to be structural properties of language in terms of the ongoing process of building up interpretation, there will have been a substantial shift in our assumptions about the basis of syntactic explanations. The characterisation of long-distance dependency as involving underspecified input and subsequent emergence of structure, will be being used as a basis not merely for characterising how such a sequence is parsed but as a characterisation of the phenomenon of long-distance dependency itself. We will, that is, have shifted to articulating concepts of underspecification as part of the account of structure, i.e. as syntax. And with that move, we shall be articulating operations intrinsic to the grammar formalism that are a direct reflection of the dynamics of parsing. Everything from there on will start to look very different.

Of course the challenges will remain, but there will be new ways of solving them. The challenge of the asymmetry between left- and right- discontinuities, for example, becomes the problem of explaining why nesting incomplete structures at an arbitrary level of embedding is fine if the expression that completes them has already been introduced as in (1.49.a), whereas nesting some structure whose interpretation depends on some completion that is provided by an expression that is higher in the tree and to the right as in (1.49.b) - repeated from 1.1.1 - remains irremediably bad:
CHAPTER 1. THE POINT OF DEPARTURE

1.49 a. The report on our project Sue has warned us will be first on next meeting’s agenda.

b. That it was obvious was unfortunate I was wrong.

These and other challenges we shall take up in due course.

Before getting into any of the details, we now set this putative shift in perspective against the larger psychological background. It is no coincidence that the concept of underspecification that we espouse provides the tool which will bring anaphora construal and long-distance dependency together. We shall find that underspecification of interpretation assigned to some signal is intrinsic to all signals processed by the cognitive system, a phenomenon much broader than some language-internal property. And once we grant the need for a general cognitive explanation of this phenomenon, it opens up the way for articulating in detail the particular forms of underspecified input plus update which natural languages make available, against a background in which the phenomenon of language is grounded directly in a general cognitive framework.

1.2 Interpreting the World around us: the construction of representations

The Representational Theory of Mind (Fodor 1981, 1983, and subsequently) is a programme for research that advocates that all cognitive processing takes place via the construction of mind-internal representations in what has been called a Language of Thought, an internal representational system in terms of which we process incoming information from external stimuli. According to this type of view, assigning interpretation to a signal by a cognitive system involves pairing some signal (say light waves on the retina in the case of vision) with some object via the mind-internal construction of a representation of that object. Very approximately, we see a pigeon ahead of us flying across the car, if the given stimulus to the retina causes some cognition-internal representation to be set up which we take to provide the means of individuating that pigeon in flight.

Behind this apparently simple observation lies a vast research problem; for the function from the retinal image onto whatever we take to constitute what we have seen is a function of arbitrary complexity: there simply is not sufficient information in the image itself to determine the scene, hence for the perceiver to be certain what is recovered from the image. This means that vision has to be seen as involving internally constructed “best guess” representations which feed into a complex subconscious system of reasoning about consistency and plausibility in our conceptualisation of the world. As Fodor (1998) expressed it, concepts are essentially mind-dependent.22 Common-place illustrations of this abound. Proof-reading is one such, though it is often misconstrued as sloppiness on the part of the proof-reader. People quite simply see what is not there, as anyone who has had to proof-read their own manuscript can tell you. Bird-watching is another: what to one person is merely some twittering is to someone else the thrill of “seeing” a migrating bee-eater. The significance of such every-day examples is how they illustrate the essential role played in all processing by what we informally call an act of imagination in constructing from a given stimulus some representation in virtue of which we interpret stimuli as seen, or heard. As Crick (1994) puts it: “it is difficult

22Since Marr 1982, who advocated a modular approach to vision, with different modules addressing different sub-tasks, there has been a recent, rapid growth of interest in inferential approaches, using Bayesian models of probabilistic reasoning (Knill and Richards 1996).
for many people to accept that what they see is a symbolic interpretation of the
world – it all seems so like the ‘real thing’. But in fact we have no direct knowledge
of objects in the world” – a view which goes back at least to Helmholtz (1925), who
argued that perception is unconscious inference.

These examples highlight a very important aspect of this process which Fodor
did not lay much emphasis on. This is the systematic gap between the information
provided by the stimulus itself and the information humans recover from it. We
are all always adding to what it is we have literally “seen” in virtue of what else we
know that is available to us at the time. But if signals do not themselves determine
the interpretation that we impose on them, because the retinal image itself fails to
uniquely determine the information to be recovered, what is it that determines how
signals are interpreted?

1.2.1 How are interpretations chosen?

Fodor himself was in fact extremely sceptical of there being any sufficiently con-
strained theory of the central cognitive system which could answer this question.
However Sperber and Wilson (Sperber and Wilson 1995) took up the challenge of
articulating appropriate general constraints to make this a manageable task. As
they observed, inferential activities are all-pervasive not only in communication,
but also in the way we interact with our environment in general. Humans are infor-
mation processing animals. As Fodor expressed it, we have “input modules” that
constantly extract information from the environment, largely automatically. It is
not that we choose to see the things in front of us (unless we close our eyes), or to
smell a smell in the air; and it is not that we choose to process incoming natural
language. These are simply activities that we do in a reflex-like way. As a result, at
any given moment, there is much more sensory information than can be processed
by central reasoning processes. One of the central challenges for the human cogni-
tive architecture is to make relatively fast and relatively reliable choices as to which
incoming information is worth attending to, and to distribute cognitive resources
so as to improve our information state as efficiently as possible.

With this observation in mind, Sperber and Wilson argued that our reasoning is
goal-directed to the maximally efficient processing of maximally relevant informa-
tion (Sperber and Wilson 1995: 49). That is, all cognitive processing, they argue,
is subject to the very general constraint of balancing any interpretational effect
(which is a benefit) against the filter of minimising the cognitive effort required
(the cost) in achieving that effect: hence meeting the requirement of maximally
efficient processing for the effect gained. Humans have to make choices given par-
tial information, and they do so relative to their needs to maximise information
derived as economically as possible. Sperber and Wilson characterise this in terms
of a very general principle called the Cognitive Principle of Relevance, which con-
strains all selections made, whatever the form of input.23 Assessing the “relevance”
of some piece of information according to this story involves assessing the nature
of information change achieved (information being some arbitrary set of assump-
tions) by adding the new piece of information to information already available. If
nothing changes, the gain in information is zero, hence processing the information
is not relevant. On the other hand, if the new information changes the initial in-
formation state drastically, the information is very relevant.24 But maximisation

23Relevance theory assumptions have been criticised for lack of formalisability. However, in
recent years, game-theory characterisations of pragmatics have been developed which provide a
remarkably close reflection of the relevance-theoretic intuition of the tension between cognitive
24This change of information state can have a number of instantiations, depending on how
on its own cannot explain how choices about which information to attend to can be made. Somehow or other, most information probably interacts with what we believe already in some way or other, so in practice it is not possible to process all incoming information and check for potential contextual effects. So Sperber and Wilson propose that maximisation of contextual effects is counter-balanced by processing cost. Mental activity involves “cost”: thinking, information retrieval from long-term memory, deriving conclusions are all activities which need cognitive resources. These resources have to be allocated so as to derive maximally relevant information with justified cognitive effort. This Principle of Relevance is then taken to underpin how all input to the cognitive system is enriched to determine a specific interpretation in context, whatever the form of input.

In applying such considerations to language construal, Sperber and Wilson (1995) argue that there is one additional consideration: the signal provided is a manifest display of the speaker having an intention to communicate, and this in itself provides extra information. In virtue of this display of intention, the hearer is justified in spending cognitive effort on processing a communicated message, and furthermore minimal cognitive effort, because she can assume that the form of the utterance used is selected as the most relevant one possible in the given situation. From this perspective, the puzzle presented by pronouns and elliptical structures is just part of what is a quite general cognitive process and is not some idiosyncracy of natural language. All human processing involves constructing a representation which we take, following Fodor, to be the interpretation provided by some given signal. The choice as to which interpretation to construct from a signal is dictated by the very general cognitive considerations encapsulated in a constraint such as the principle of relevance. We can see this from the examples given earlier, e.g. (1.18.a,b), repeated below.

1.18  

a. Though John and Mary adored each other, he married Sue. Whenever he upset her subsequently, she would remind him that it was Mary he should have married.

b. Though John and Mary adored each other, he married Sue. The only time they subsequently met, he upset her so badly she was glad he had married Sue, not her.

We interpret he upset her in (1.18.a) as ‘John upset Sue’ because this is the only choice consistent with what the speaker has said in the clause that follows. Such an interpretation, easily constructed in the provided context gives us inferences which are informative in that context in a way that the competing interpretation is not. In (1.18.b), the same string has to be interpreted as ‘John upset Mary’ for similar reasons, given the difference in the following clause. Least effort is not enough: in these cases this yields two competing interpretations. But neither is maximisation of inferences. It is the two together that determine the particular interpretation assigned in context. That is, we make decisions swiftly, with least effort scanning the smallest structure for a term which could provide an interpretation the speaker could have intended, with the specific context determining what that choice can be.

The insight that anaphora and elliptical processing are interpreted by the same general pragmatic principles that drive all interpretive procedures is not uncontro-

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25 This involves a weaker principle which Sperber and Wilson call The Communicative Principle of Relevance.
1.3. COMPETENCE AND PERFORMANCE: TOWARDS A NEW VIEW

Prior to Sperber and Wilson’s work, linguists and psychologists had very generally assumed that the free processing of language in context, what we label pragmatics, was different in kind from the process of assigning interpretation to expressions such as pronouns, which was taken to form part of establishing the content directly expressed in uttering a sentence. In Gricean pragmatics in particular, a sharp division is drawn between the propositional content associated with an utterance, and further more indirect pragmatic effects that might follow from the fact of its being uttered, with only the latter being constrained by the so-called maxims of conversation. Part of Sperber and Wilson’s contribution has been to demonstrate to the contrary that the way we assign interpretation to words such as pronouns is subject to the very same constraints as determines the much richer array of interpretational effects such as metaphor, irony, and so on.

1.3 Competence and performance: towards a new view

This leads to a further challenge: What is the form of the interface between language-particular information and such general cognitive processes? To this Sperber and Wilson give much less emphasis, simply assuming, as with everyone else, that natural language grammars will provide some interface level which general processes of reasoning can take as input. Indeed, they assume that grammar-internal principles determine some concept of meaning for each individual sentence which corresponds to a partial logical form, and it is this incomplete vehicle for expressing propositional content which is evaluated against a presumption of optimal relevance to determine the particular interpretation of an uttered sentence in a given context. The concept of context is thus presumed to be updated sentence by sentence, as each sentence is uttered.

This is the background against which the articulation of Dynamic Syntax (DS) was developed. Early in the 1990’s, Kempson and Gabbay set out to articulate a model of how information is built up on a left-to-right word-by-word basis in the interpretation process in order to get a clearer picture of the nature of the interaction between system-internal processes and general cognitive processing (Kempson and Gabbay 1998). Following Fodor, the process of building up interpretation was defined as leading to a formula representing interpretation over which inference can be defined which is not an expression of the natural language itself, for, by assumption, natural language is the vehicle for getting on to some transparent representation of intended interpretation. What was articulated was a process whereby semantically transparent structures are progressively built up, bit by bit, as the words come in. Starting with very incomplete structures with almost no information presented, some representation of content is gradually established in some particular context through a mixture of encoded and pragmatic actions. This is the conceptual starting point for what became the Dynamic Syntax framework (Kempson et al. 2001).

Put in these terms, Dynamic Syntax might not seem to be of any great theoretical consequence for the general linguist, with no consequences whatever for the logically prior task of defining a formal model of the phenomenon of language itself. At best, it might seem to be of interest only to those articulating formal

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26 See Grice (1989); and Levinson (2000) for a more recent discussion.
27 See Wedgwood (2003, forthcoming) for extended discussion of the relation between syntactic and pragmatic processes with respect to Relevance Theory and a vigorous defence of the view that inferential processes permeate the grammar.
models of pragmatics. However, there is the puzzle of the various forms of interaction between anaphora construal and structural processes waiting to be solved. If, as already suggested, we take on the challenge of solving this puzzle by modelling discontinuity effects and anaphoric processes as forms of underspecification which undergo processes of update, then we can no longer assume that all linguistic processes happen first and pragmatically driven processes operate solely on their output. Rather, what is needed is a model which articulates not merely some requisite set of logical structures, but also a process of growth of such structures given natural-language input, with an assumption that general constraints, such as that of optimal relevance, can determine how individual choices might be made during any one such growth process which the model licenses. So the resulting model does not have the same property of encapsulation as assumed by Sperber and Wilson, along with many others. The twist in the tale is that a formal account of the individual time-linear steps whereby structure corresponding to interpretation can be built up turns out to have just the right flexibility for capturing structural properties of language without being vacuously general.

Of course, we do not expect anyone to believe this stance without argumentation; and the purpose of the rest of this book is to provide this. Having set out the Dynamic Syntax framework, we shall look first at long-distance dependency, anaphora construal and their various forms of interaction, an account which will include accounts of all the major types of relative clause formation, and the major structures that have been distinguished as left and right periphery effects, such as, Hanging Topic Left Dislocation, Clitic Left Dislocation, expletives, pronoun doubling and Right Node Raising. We shall then turn to looking at Japanese, which, as a prototypical verb-final language, is notoriously problematic for current formalisms: these languages at best are assigned analyses which makes parsing them seem irreducibly non-incremental, despite the fact that there is lots of evidence that the parsing of Japanese is just as incremental as parsing any other language (Inoue and Fodor 1995, Kamide and Mitchell 1999, Fodor and Hirose 2003, Aoshima et al. 2004). Chapters 7 and 8 pursue the enterprise to show how co-ordination and agreement patterns in Bantu are constrained by time linearity and how the concept of underspecification can be used to articulate a uniform account of a range of copular clauses in English. In contrast to standard and static approaches, we shall see that the time-linear perspective of Dynamic Syntax allows an entirely natural set of analyses of these phenomena using the same concepts of tree growth, while preserving incrementality of parsing. In addressing these and other current puzzles, our claim in each case will be that the model we set out will be uniformly simpler than other more conventional models that are designed not to reflect the time-linearity of natural language processing.

As a result of this shift in perspective, the competence-performance distinction looks very different. Though there remains a distinction between the linguistic-competence model and a general theory of performance, the articulation of that competence model is no longer disconnected from the articulation of the latter. To the contrary, the competence model is developed on the assumption that it provides the architecture within which the choice mechanisms of performance have to be implemented. The claim that the system is parsing-oriented is nonetheless a far cry from making the claim that no abstraction from the data of performance is needed. We are not providing a performance model, despite the concern with the dynamics of language processing. What we are claiming is that the explanation of the intrinsic patterns displayed in natural language is best explained in terms of

\footnote{See Phillips (2003), Schneider (1999) for attempts to devise parsing formalisms which render minimalist assumptions compatible with incremental parsing of Japanese.}
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the dynamics of how interpretation is built up in real time, and the model itself
defines a concept of tree growth that does indeed reflect the dynamics of processing
linguistic input in time, with the left periphery of a sentence string presumed to
provide information that has to be used first in developing the emergent structural
configuration.

1.3.1 Comparing the Simplicity of Grammar Formalisms - a
First Attempt

Some indication of the relative simplicity to be claimed for the Dynamic Syntax
framework can be given right away. Unlike the Minimalist framework (and its
predecessors), all concepts of movement are replaced by the concepts of structural
underspecification and update following the parsing dynamics. There are thus
no multiple, successive applications of movement, possibly completely reversing
order of constituents from the initial derivation to the final output (Rizzi 1997,
Kayne 1994, Simpson and Bhattacharya 2003, papers in Szabolcsi 1997, etc.), be-
cause there is no movement at all. As will be seen, an immediate advantage over
movement accounts is the way Dynamic Syntax assumptions make available as
natural an account of verb-final languages as of verb-medial languages. Further-
more, the framework naturally leads one to expect asymmetries in left-periphery
and right-periphery effects without having to postulate structure-particular stipu-
lations. Having said this, there is much in common with the Minimalist framework.
In particular, DS shares with Minimalism a “minimalist” architecture in only hav-
ing levels of representation that reflect the two interfaces: with phonetics (PF),
and with semantics (LF). There is in particular no mode of syntactic represent-
ation other than that used to articulate representations of semantic content. As in
the Minimalist program, LF is the only syntactically significant level of representa-
tion. However, unlike this framework, this representation is a direct representation
of content, by hypothesis an object in the language of thought itself, not some
independently defined syntactic object.

In its advocacy of but a single level of structural representation, Dynamic Syn-
tax is unlike Lexical Functional Grammar (LFG, Dalrymple 2001, Bresnan 2001,
etc.), despite similarities in the formal tools used. LFG defines a number of different
levels of representation, each with its own primitive terms, with rules of correspon-
dence mapping one type of representation onto another. There is c-structure which
corresponds to the surface string. There is f-structure from which most syntact-
ic generalisations are expressed. There is semantic structure, which is the level at
which semantic generalisations are expressed. And others have suggested additional
levels such as information structure and argument structure (King 1995, Butt and
King 2000). In principle, the number of levels of representation is open-ended, as
long as for any such level, its properties are well-defined (Muysken 2002), and its
correspondence to other levels of representation is appropriately articulated.
Indeed much recent interest has been shown in the nature of the languages needed
to define such correspondences (see Dalrymple et al.’s results on glue languages,
Dalrymple 1999).

A similar form of challenge can be addressed to Head-driven Phrase-Structure
Grammar (HPSG), whose unifying attribute-value matrix (AVM) notation allows
multiple different vocabularies for different types of statement within this general
format (Sag et al. 2003). So, AVMs contain information not only about morpho-
syntactic properties of expressions, but also about their phonology, semantics and
pragmatics (including information structure, Engdahl (1999)). Since in principle
any data structure can be expressed in an attribute-value system and since any
new structure can be added to the overall system without effects elsewhere, it is hard to see what linguistic phenomena this richness in expressive power excludes. While minimalist approaches to syntax still maintain a rich array of grammatical devices, the aim of restricting the vocabulary for expressing linguistic properties nevertheless has important implications for linguistic theory, not least with respect to simplifying the relation between knowledge of language and language use.

Dynamic Syntax also differs from Discourse Representation Theory (DRT: Kamp and Reyle 1993), though it shares with DRT the commitment to articulating a level of representation not inhabited by the string of words as an essential intermediate step in characterising compositionality of denotational content. The difference between the two systems lies in the fact that, in DS, this form of representation also constitutes the basis for syntax: there is no other level of structure with independently defined primitives over which syntactic generalisations are expressed. DRT, on the other hand, simply takes as input to the interpretation algorithm whatever syntactic formalism is selected as appropriate, defining a construction algorithm mapping such syntactic structures onto discourse representation structures, in this respect falling into the same family of formalisms as LFG.

There are however some real similarities between the formal notations which these theories use and Dynamic Syntax, a matter to which we will return; and the arguments in favour of DS over either of these is mainly in terms of simplicity, and the ability to articulate more principled explanations. The Right Roof Constraint is one such case. This is the constraint alluded to earlier in introducing the syntax-semantics mismatch, which applies to rightward dependencies but not leftward ones, enforcing a strict locality of dependencies at the right-periphery of a clause. This asymmetry is unexpected in all frameworks in which structural generalisations depend solely on structural configuration: there is no reason in such frameworks to expect asymmetry between left and right peripheral effects. However, as chapter 5 will show, this constraint emerges as a direct consequence of what it means to be establishing forms of construal in the latter stages of the construction process, rather than in the early stages. Given the richness of vocabulary of HPSG and LFG, the more restricted set of facts can doubtless be described by formal specification of the structures over which such dependencies are articulated, but the underlying explanation of this asymmetry eludes such static formalisms. So despite the heavy machinery that the frameworks make available, we shall see that a simpler architectural assumption can lead to simpler individual analyses. It might seem that in only defining one type of structural representation, Dynamic Syntax would be less expressive than multi-level theories, but, as we shall see, DS is nonetheless able to articulate a rich array of variation in linguistic distribution by the ability to make reference to intermediate stages in the construction process.

At the other extreme lies Categorial Grammar, which explains natural language phenomena solely in terms of mappings from phonological sequences onto denotational contents without any essential reference to a level of representation at all. This is the pure Montague approach to natural languages following the formal language pattern (see section 1.1.1). The DS framework shares with Categorial grammar formalisms the assumption that syntactic categories reflect semantic combinatorial operations, as reflected in type theory, and there are other similarities too. However, DS has the edge over these formalisms in at least two respects. Categorial grammar formalisms fail altogether to take up the challenge of reflecting the wealth of interaction between anaphora and structural processes, and in general no unitary characterisation of anaphora is provided (see Hepple (1990), Morrill (1994), Steed-
1.4 CODA: PARSING AS THE BASIC ACTIVITY

man (1996, 2000), though for a notable exception see Ranta (1994)). It might be argued that there is a concept of delay in semantic combinatorics expressed through the type-lifting of an NP expression to a functor from VP contents to sentence contents, which might be taken as equivalent in effect to structural underspecification plus update hence not requiring additional mechanisms to express; but as we shall see, the left-peripheral placement of expressions is only one of several forms of underspecification plus update. There is a problem in principle in expressing underspecification of content in categorial grammars, as their explicit commitment to the view that grammars are logics leaves no room for expressing such systematic underspecification and enrichment. It is a consequence of this commitment that verb-final languages, which display a high degree of context-dependence, constitute a major challenge for categorial grammar formalisms.

30 Of all the extant formalisms, the DS formalism is perhaps closest to LTAG - Lexicalized Tree Adjoining Grammar (Joshi and Kulick 1997). LTAG projects typed structures directly from lexical expressions over which type-deduction is defined (as in categorial grammar formalisms and Dynamic Syntax). Long-distance discontinuity effects are characterised by processes of tree-adjunction, mapping pairs of trees into a single composite tree. In particular, the long-distance dependency of left-peripheral expressions is defined by splitting apart some lexically defined tree-structure and injecting into it a further tree corresponding to all the non-local material intervening between the left-peripheral expression and its site of dependency. This is unlike the DS system, in which the process of tree growth is defined to apply in a way that strictly follows the dynamics of parsing. Indeed, in being intrinsically dynamic, the DS system is unlike all these systems, despite many similarities at the level of tools of description, for the time-linear incrementality of natural-language construal is built into the formalism itself. The simplicity that we gain, as we shall set out case by case, lies in the fact that the concepts of underspecification are twinned with a monotonic tree growth mechanism that is defined over the left-right sequence of words.

1.4 Coda: Parsing as the basic activity

Starting on the details of the framework is the burden of chapter 2, but before leaving these preliminary considerations, we feel we should say something in direct defence of taking parsing as basic. Despite its departure from current assumptions, this stance is not a priori surprising. There is, in acquisition, reason to think that the task of parsing might justifiably be said to be the more basic of the two core language activities. In language acquisition, perception invariably precedes production at every stage. Children universally undergo a number of stages in the task of learning to speak a language, using increasingly more complex structures. Furthermore, there is strong evidence that at any given stage they are able to understand utterances which are at least as complex as the ones they produce, generally considerably more so. This is indeed implicit in all theories of language acquisition; and the pattern of asymmetry between perception and production repeats itself in second language acquisition (Trubetzkoy 1939).

Second, there is reason to believe that production involves the very same strategies as parsing, constructing representations of content using information from con-
text, with one additional constraint: the structures being constructed must match some intended content. Consider the case of answering a question:

\[ (1.50) \quad A: \text{What shall we eat?} \]
\[ B: \text{Curry.} \]

Speaker A sets out a structure by providing a string for B to process where her request is for a value for the place-holding \textit{wh} expression. Once B has established this by parsing the string, all she has to do in replying is to provide this value. She does not have to make any distinct hypothesis as to the structure A, her hearer, has as context with which to interpret that answer: she “knows” the context A has, because she herself has just parsed the string A said. All she has to do in choosing the word \textit{curry} is to check that the concept it expresses, rather than, say \textit{apples}, matches the content she has in mind when put into the structure set up by A’s question. One could of course analyse ellipsis as involving a high level production strategy that is quite independent of parsing, which involves first assuming that some thought has to be constructed by some process, say the thought ‘B wants to eat curry’, then selecting the words to express it on the basis of having made a strategic decision as to what A has as their immediate context, and only then deciding which of those words need to be said, and in what order. If this were the appropriate account of production, then the correlation of parsing and production, as presumed in the informal account just given, would break down. However, in dialogue, where context dependence is extensive, there is little evidence that such high level judgements are a necessary part of production, as we shall see in chapter 9. To the contrary, there is increasing evidence that use of context at all levels of production choice is a means of cutting to the minimum such high level decisions (Pickering and Garrod 2004). The whole point of being able to rely on information which one has just parsed oneself and which therefore by definition is part of the private cognitive context that one brings to bear in any cognitive task, is that making choices that are got from one’s own context-store will completely side-step the need to search through one’s general store of words; and this makes the production task much easier. In short, like hearers, speakers rely on their own immediate context, but with the additional constraint that all choices made have to be checked for consistency with what they have in mind to convey.

Finally, as long as we adopt even the outlines of Relevance Theory, we are committed to the primacy of understanding, for this explains inferential abilities in communication as resulting from cognitive abilities relevant for \textit{processing} information, so from interpretation rather than production. Sperber and Wilson derive communicative behaviour as expressed in the communicative principle of relevance from general cognitive behaviour, namely from relevance-driven processing as embodied in the cognitive principle of relevance and definition of relevance. In other words, our ability to assess and choose information in linguistic communication is a reflex of our ability to handle information in general. Indeed, as things will turn out, general concepts of information processing, though with language-particular instantiations, will turn out to be central to every single analysis of syntactic phenomena we provide, for concepts of underspecification and monotonic growth of representation will be at the heart of them all. In all cases, we shall argue, it is these which directly make available simpler, more intuitive accounts of linguistic phenomena. Moreover, the account will have the bonus of providing formal expression to what might otherwise be dismissed as naive functionalism. So the challenge we shall be setting out is this: take the dynamics of the parsing process seriously, and you get a grammar that is simpler both at the level of individual analyses, and at the level of the grammar architecture.
Chapter 2

The Dynamics of Interpretation

We have a two-fold challenge ahead. The first is to set out a model of how interpretation is recovered in context. The second is to establish why this constitutes the basis for syntactic explanations. As we saw in chapter 1, the heart of the explanation is our commitment to reflecting the way humans can manipulate partial information and systematically map one piece of partial information into another in language processing, using each piece of information provided as part of the context for processing each subsequent input. The challenge is to use these, intrinsically dynamic, concepts to replace analyses which depend on a discrete syntactic vocabulary, involving processes such as movement, feature passing, etc. It is in this respect, above all, that this formalism will depart from all other widely adopted grammar formalisms.

In this chapter, we set out the basic framework, beginning with a sketch of the process of building representations of content and subsequently developing the concepts and technical apparatus. The discussion will be kept as informal as possible, but more formal material is introduced so that readers can get a feel for the formal basis of the theory.\(^1\)

2.1 A sketch of the process

What we will be modelling is the process whereby information is built up on a left-to-right, word-by-word basis relative to some context against which choices may be made as the construction process proceeds. To do this, we take the concept of a tree structure familiar in syntax and use it to represent, not structure defined over words in a string, but the interpretations assigned to words uttered in context.\(^2\)

Thus, the tree we assign to a string like *Hilary upset Joan* is not something like those in (2.1) but like that in (2.2).

---

\(^1\)Full details of the formal characterisation of the system can be found in Kempson, et al. (2001).

\(^2\)We shall use text-capitals for technical terms, in particular for rules defined in the theory.
(2.1) Representing the structure of strings

\[
\begin{align*}
S & \quad \text{CP} \\
NP & \quad C \\
V & \quad IP \\
N & \quad DP \\
Hilary & \quad \text{I'} \\
upset & \quad \text{VP} \\
Joan & \quad \text{NP} \\
\end{align*}
\]

So what is the difference between these trees? In the first place, the tree in (2.2) contains no information about word order. There is no claim here that English is verb final - not even with respect to some hypothetical ‘deep structure’. Instead, the tree represents the semantic structure of the propositional content expressed by the string \textit{Hilary upset Joan} so that what labels the nodes in the tree are compositionally derived concepts, expressed in some lambda calculus, just as in certain versions of categorial grammar (Morrill 1994, Carpenter 1998, etc.). The tree thus reflects a jigsaw view of how we can entertain complex concepts (Fodor 1998), but notably not a jigsaw view about words.\textsuperscript{3} The trees in Figure 2.1, on the other hand, reflect putative properties of words in strings that define structure over those strings. So, \textit{VP} labels a node that consists of a word that is a verb plus another word that functions (simultaneously) as a noun and a noun phrase (and possibly a determiner and determiner phrase). The syntactic structure determined (or projected) by the words exists independently of the words themselves and is constrained by independently defined rules or principles, again stated over strings of words.

\textsuperscript{3}To maintain a distinction between words and the concepts they express, when we refer to words we will use italic script, and when we refer to the concept we will use non-italic script, an initial capital letter and a following prime. The proper name \textit{John} thus expresses the concept \textit{John'}. We also use italic script occasionally for emphasis, as here, but we assume it will always be obvious in context which is intended.
Tree structures in Dynamic Syntax are, however, not representations of the structures of sentences, where a sentence is a string of words in a particular order. They are structured representations of the interpretation assigned to sentences in the contexts in which they are taken to be uttered. And these are importantly different. Given the Fodorian perspective on interpretation, the representations constitute the means we have for interpreting the sequence of words, and are essentially not just some structural arrangement of the words themselves.

A second difference between the Dynamic Syntax conception of trees and that of declarative frameworks like HPSG (Sag and Wasow 1999) is that the steps by which one reaches the final output are as important as that output itself. As we shall see later in this book, certain interpretations are constrained by the way that the final tree is constructed; and concepts like topic and focus may be derived through the process of tree construction rather than being attributed either to some other layer of information (Vallduvi 1992) or being encoded directly in the syntactic representation (Rizzi 1997). Furthermore, unlike derivational theories such as Principles and Parameters or the Minimalist Program (Chomsky 1981, 1995), the process by which a representation such as that in (2.2) is built up is on a strictly time linear, word-by-word basis from initial to final. The process is thus, as discussed in chapter 1, the process of parsing, extracting information from a string in context.

The way this is achieved is to begin from a goal associated with some very partial structure and progressively enrich that structure through the parse of a string of words. Following Sperber and Wilson (1995), the starting point for any parsing effort is simply the goal to establish some propositional formula as interpretation, and this overall goal may lead to other subgoals as more information comes in. Thus, in establishing the structure in (2.2), we assume progressive stages like those shown in (2.3), starting from the goal to build a tree with propositional content (shown as the requirement $\text{Ty}(t)$, see below) and adding information as each word is parsed and finally building up the dominating nodes in the tree with the semantic information associated with those words.

(2.3) Parsing Hilary upset Joan:
2.2 The Tools of Dynamic Syntax

We now start providing the tools for deriving interpretations of strings in context. The presentation in this chapter (and throughout the book) will remain relatively informal, while at the same time introducing the technical concepts needed to understand how the system works. This chapter is thus of necessity fairly technical to allow the reader to understand the formal basis of the framework. In later chapters, this formality will be eschewed in favour of a more informal exposition. Although the details will necessarily remain somewhat technical, readers will not need to fully comprehend the full technical apparatus. What is important is grasping the essential dynamics of the system and the way we model the progressive building up of representations of propositional content. As indicated above, we are assuming that logical forms for sentences are represented as trees with each subterm of the logical form decorating a discrete node in the tree. The first step we have to take is to be more explicit about the representation language itself and then the trees that show the content of utterance strings. To do this, we need to define what it means to be a tree, what it means to be a partial tree, and what it means to grow from one tree into another.

2.2.1 Treenode Decorations

We have seen how the nodes of our trees are decorated with semantic expressions (or concepts). We call these *formulae* and express them as values of a predicate $F_o$. So we write $F_o(Sing'(John'))$ for the semantic information expressed by the string *John sang* (ignoring tense here). Formula values, we take as representations of the concepts that words are taken to mean. So we assume that from the English word *John*, we construct the concept $John'$, itself a term denoting a particular individual called John; from the word *sing* we construct the concept $Sing'$, and so on.\(^4\) The first step we have to take is to be more explicit about the representation language itself and then the trees that show the content of utterance strings. To do this, we need to define what it means to be a tree, what it means to be a partial tree, and what it means to grow from one tree into another.

---

\(^4\)Such objects are thus by hypothesis objects in some language of thought (LOT). See also Cresswell (1985) for arguments that support such a view with respect to the objects of verbs of propositional attitude.

\(^5\)It should be noted here that we are not in this book probing the internal structure of concepts themselves. So we have nothing to say about the concept Sing' or Love'; and indeed nothing to say about the relation between the word *loves* and the concept which it expresses, other than that it expresses the concept Love'. This is a huge and complex topic. At the two extremes, some have argued for definitions associated with words (e.g. Bierwisch 1969), others for a one-to-one word-concept correspondence (Fodor 1981), with various intermediate positions (e.g. Pustejovsksy 1995, Rappaport and Levin 1998). Yet others have noted that concepts vary according to the particular context in which they are used, so there is a context-dependency to the use of words to express concepts much like the context-dependence in using pronouns (Carston 2002). For the purposes of this book, we adopt the view of Fodor (1981) that words express primitive concepts, with a word and the concept it expresses being in one-to-one correspondence (see also Marten (2002b)).
The formula is just one of several labels that can decorate a node. In addition to the formula label, we also have a label that gives information about the type of the formula expression. The type of an expression is its semantic category, associating an expression with a particular sort of denotation. So, an expression of propositional type $t$ denotes a truth value; that of type $e$ is a term that denotes some entity. Functor types are represented as conditional statements so that an expression of type $e \rightarrow t$ expresses a (one-place) predicate, since when it combines with a term (of type $e$) it yields a proposition (of type $t$) and denotes a set (see any number of introductory books on formal semantics, e.g. Chierchia and McConnell-Ginet (1990), Cann (1993), Gamut (1991), Carpenter (1998)). Although most theories of types assume a recursive definition of types, yielding an infinite set of types, Dynamic Syntax makes use of only a small, predefined, set consisting of three basic types $e, t, cn$, and a restricted set of functors based on these to provide sufficient structure to account for the number and types of arguments of verbal and nominal predicates. There is also a type $cn \rightarrow e$ that is assigned to quantifiers. Type raising operations and the higher order types associated with Montague and Categorial Grammar play no part in the grammar formalism, since concepts of underspecification of update replace those of type-lifting and composition of functions, as we shall shortly see. The table in (2.4) lists the most common types used in this book with a description and examples.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Example expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Ty(e)$</td>
<td>Individual term</td>
<td>$Fo(Mary'), Fo(e, x, Student'(x))$</td>
</tr>
<tr>
<td>$Ty(t)$</td>
<td>Proposition</td>
<td>$Fo(Sing'(John'))$, $Fo(Upset'(Hilary')(Joan'))$</td>
</tr>
<tr>
<td>$Ty(e \rightarrow t)$</td>
<td>(1-place) Predicate</td>
<td>$Fo(Upset'(Hilary'))$, $Fo(Run')$</td>
</tr>
<tr>
<td>$Ty(e \rightarrow (e \rightarrow t))$</td>
<td>(2-place) Predicate</td>
<td>$Fo(Upset')$, $Fo(Give'(John'))$</td>
</tr>
<tr>
<td>$Ty(t \rightarrow (e \rightarrow t))$</td>
<td>(3-place) Predicate</td>
<td>$Fo(Give')$, $Fo(Put')$</td>
</tr>
<tr>
<td>$Ty(cn)$</td>
<td>Nominal</td>
<td>$Fo(λP.ǫ, P)$</td>
</tr>
<tr>
<td>$Ty(cn \rightarrow e)$</td>
<td>Quantifier</td>
<td>$Fo(∃P.e, P)$</td>
</tr>
</tbody>
</table>

Trees, therefore, display nodes decorated not only with formulae but also their associated types, as in (2.5). In fact, all information holding at, or annotating, a tree node is stated as a declarative unit, or a tree node description. Declarative Units (DUs) consist of consistent sets of labels expressing a range of different sorts of information.

(2.5) Representation of content of Eve likes Mary

$$Ty(t), Fo(Like'(Mary')(Eve'))$$

$$Ty(e), Fo(Eve')$$  $$Ty(e \rightarrow t), Fo(Like'(Mary'))$$

$$Ty(e), Fo(Mary')$$  $$Ty(e \rightarrow (e \rightarrow t)), Fo(Like')$$

6The latter being the type assigned to common nouns where the formula consists of an ordered pair of variable plus a propositional formula where that variable occurs free. See chapter 3.

7All quantifying expressions are analysed as terms of type $e$, for example the term $e, x, Student'(x)$ listed is the analogue in these terms of existential quantification $∃, x, Student'(x)$. 

---

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7All quantifying expressions are analysed as terms of type $e$, for example the term $e, x, Student'(x)$ listed is the analogue in these terms of existential quantification $∃, x, Student'(x)$.
This tree displays how information from the functor nodes combines with information from the argument nodes to give the complex formula value at the mother node. As in Categorial Grammar, application of modus ponens over type values is paralleled by function-application over formula values.\(^8\)

### 2.2.2 Requirements and Tree Growth

We now have the minimum required to introduce the vocabulary for talking about how complex concepts can be incrementally built up. The dynamics of the DS system is defined by characterising how trees grow. This means that DS derivations, or parses, start from only minimal trees and proceed through stages of partial trees until the tree is fully developed, providing the propositional content of a string in some context of utterance. What pushes the parsing process along is the need to specify underspecified information through the process of satisfying **requirements**. A requirement specifies a goal to be met with respect to providing an instance of some label at the current node and is shown by a question mark in front of the label to be instantiated.\(^9\) While requirements may operate with respect to any label, the building blocks of a tree are provided by requirements to establish formulae of particular types. So, for example, the universal requirement to establish propositional content is shown by the requirement \(\text{?}T_y(t)\). This requirement provides the minimal initial ‘tree’ of a derivation, a tree with only a root node, underspecified of content but with a goal to derive a formula of type \(t\). Thus, \(T_y(t)\) holding at a node means that some formula of type \(t\) is constructed at that node, while \(\text{?}T_y(t)\) holding at a node shows that all that has been established is a **goal** of constructing such a formula. This goal is then satisfied when the information provided by some string of words yields a propositional formula, allowing the label \(T_y(t)\) to be annotated on the root node.

Requirements may be satisfied in a number of ways but a common way is to break the current task down into subgoals – in effect replacing the current goal with smaller goals which, if successful, will lead to the satisfaction of the current goal. At any stage in a derivation of a tree, therefore, some information might have been established, and some other goals might remain outstanding. The derivation is completed if, after all information from the lexicon has been incorporated into the tree, all requirements have been fulfilled.

For any stage in a derivation, a current node can be identified. This is by the use of a “pointer” – \(\Diamond\), itself part of the language for describing trees. When a pointer is at a node, the requirements holding at that node show what task state is currently under development. So the initial tree in a derivation should look like:

\[\text{?}T_y(t), \Diamond\]

We assume that the parse of *Eve likes* gives rise to the tree in (2.6) through mechanisms that we shall see below.

---

\(^8\)However, in this notation, DS types are conditional types without any implication for the order of natural language expressions (unlike the “forward-slash” and “backward-slash” of Categorial Grammars).

\(^9\)Requirements may be modal in form in which case the specified goal may be achieved by an instance of the label at some other node, see below.
2.2. THE TOOLS OF DYNAMIC SYNTAX

(2.6) Parsing *Eve likes*

\[
\begin{array}{c}
?Ty(t) \\
Ty(e), Fo(Eve') \\
?Ty(e \rightarrow t) \\
?Ty(e), \Diamond \quad Ty(e \rightarrow (e \rightarrow t)), Fo(Like')
\end{array}
\]

At this stage, there are three outstanding requirements, ?Ty(t), ?Ty(e \rightarrow t), and ?Ty(e). The pointer symbol, \(\Diamond\), shows that, following the processing of *Eve likes*, the node under development is the internal argument node of the predicate, as determined by the lexical actions associated with parsing the verb *likes* (see below). The current task state is thus ?Ty(e), a requirement to construct a term. If, in this situation, information from the lexicon provides an expression of Ty(e) (such as by a parse of *Harriet*), it can be introduced into the tree at that node, since it matches, and so satisfies, the current requirement. However, if the next word is *sing*, its associated predicate Fo(Sing') cannot be introduced into the tree even though its type, Ty(e \rightarrow t), matches one of the requirements in the tree. This is because the pointer is not at the node at which this requirement holds. No update can, therefore, be provided by the word *sings*, and the sequence of actions induced by parsing the verb cannot lead to a completed logical form. The parse must be aborted and, hence, the sequence of words *Eve likes sings* is not a grammatical one. The pointer thus gives important information about the current state of a parse and the theory of how the pointer moves will form a significant role in the analyses to be presented in later chapters of the book. As you can see from this sketch of a simple example, the notion of grammaticality rests, not merely on whether a certain parse leaves requirements unsatisfied, but also on where the pointer is at any particular point in a parse.

2.2.3 The Logic of Trees

The formal backbone of the theory of tree growth sketched above, and elaborated in the next section, is the logic of finite trees (LOFT) (Blackburn and Meyer-Viol 1994, Kempson et al. 2001). This is a modal logic which describes binary branching tree structures, reflecting the mode of semantic combination in functional application. Nodes in a tree may be identified by a numerical index ranging over 0 and 1 as in (2.7).

(2.7) Tree Locations

\[
\begin{array}{c}
0 \\
00 \quad 01 \\
010 \quad 011 \\
0110 \quad 0111
\end{array}
\]
By convention, the left daughter node of a node \( n \) is assigned the index \( n_0 \) and the right daughter is assigned the index \( n_1 \). This information may form part of a Declarative Unit (the information collected at a node) and is expressed by the predicate \( Tn \) (tree node) which takes as value some index, as illustrated in the tree in (2.8).

(2.8) Tree-locations from a parse of *John sings*

\[
Tn(0), Ty(t), Fo(Sing'(John'))
\]

\[
Tn(00), Ty(e),
Fo(John')
\]

\[
Tn(01), Ty(e \rightarrow t),
Fo(Sing')
\]

In this tree, the left daughter is decorated with an argument formula, the right daughter is decorated with a formula which is a functor that applies to that argument to yield the decoration at the mother. As a convention, this is a pattern we shall retain throughout: arguments as left daughters, and functors as right daughters.

So far our vocabulary can only describe individual nodes. However we can describe the relation between tree nodes if we add modal operators to the language of description. The relations between tree nodes can then be described by modal statements which provide a means to state that some information holds at a daughter or at a mother node, and more important, as we shall later see, a means to express requirements that need to be satisfied at some node other than the current node.

There are two basic modalities, one corresponding to the daughter relation, \( \langle \downarrow \rangle \) ‘down’, and one corresponding to the mother relation, \( \langle \uparrow \rangle \) ‘up’. These can be used with and without the numerical subscript, depending on whether it is important to distinguish between left (argument) and right (functor) branches. Hence, \( \langle \downarrow_1 \rangle \) refers to the functor daughter, while \( \langle \downarrow_0 \rangle \) refers to the argument daughter node (and similarly for the mother relation, \( \langle \uparrow_1 \rangle, \langle \uparrow_0 \rangle \), but in this case there is only ever a single mother). As these symbols form part of a modal logic, an expression like \( \langle \downarrow_0 \rangle Ty(e) \) at node \( n \), means ‘there exists an argument daughter that node \( n \) immediately dominates which is decorated by the label \( Ty(e) \)’ (i.e. node \( n \) has a term as its argument daughter).

Furthermore, modality operators can be iterated, e.g. \( \langle \downarrow \rangle \langle \downarrow \rangle, \langle \downarrow \rangle \langle \uparrow \rangle \), etc. This provides a means of identifying from one node in a tree that some property holds of some other node.

(2.9) \[
Tn(0), Q
\]

\[
Tn(00), P
\]

\[
Tn(01), P \rightarrow Q
\]

\[
Tn(010), R
\]

\[
Tn(011), R \rightarrow (P \rightarrow Q)
\]

It is thus possible to describe the whole of the tree in (2.9) from any node within it. Hence, the statements in (2.10) are all true of this tree from the node with treenode address 010, i.e. that one decorated by \( R \).
2.2. THE TOOLS OF DYNAMIC SYNTAX

(2.10) a. \( \langle \uparrow 0 \rangle P \rightarrow Q \)  
       at my mother, \( P \rightarrow Q \) holds
b. \( \langle \uparrow 0 \rangle \langle \downarrow 1 \rangle R \rightarrow (P \rightarrow Q) \)  
       at my mother’s functor daughter, \( R \rightarrow (P \rightarrow Q) \) holds
c. \( \langle \uparrow 0 \rangle \langle \downarrow 1 \rangle Q \)  
       at my mother’s mother, \( Q \) holds
d. \( \langle \uparrow 0 \rangle \langle \downarrow 1 \rangle \langle \downarrow 1 \rangle R \)  
       at my mother’s mother’s argument daughter, \( P \) holds

The tree may be described in many different ways using the modal operators, depending on the ‘viewpoint’, the node from which the description is made. Another is shown in (2.11) which takes the topnode as the point of reference and provides a complete description of the tree. In this description, each node is described in terms of the information that holds at that node.

(2.11) a. \( Tn(0), Q \)  
       at node 0, \( Q \) holds
b. \( \langle \downarrow 0 \rangle P \)  
       at my argument daughter \( P \) holds
c. \( \langle \downarrow 1 \rangle P \rightarrow Q \)  
       at my functor daughter \( P \rightarrow Q \) holds
d. \( \langle \uparrow 0 \rangle \langle \downarrow 1 \rangle R \)  
       at the argument daughter of my functor daughter \( P \rightarrow Q \) holds
e. \( \langle \downarrow 1 \rangle \langle \downarrow 1 \rangle R \rightarrow (P \rightarrow Q) \)  
       at the functor daughter of my functor daughter \( R \rightarrow (P \rightarrow Q) \) holds

As we shall see shortly, the use of this logic is crucial for many analyses in the system. It allows, for example, a specification of the lexical actions associated with parsing some word to construct nodes within a tree or to annotate the current or other nodes with some information, as we shall see below. The modal operators also come into play with respect to parsing particular words to check aspects of the local linguistic context (the partial tree constructed so far) to ensure that the parse is well-formed. As an example, one way of expressing case relations is to articulate them as a constraint on decorating the current node only if its mother bears a certain kind of decoration. Hence, one might define a subject pronoun in English, such as \( \text{they} \), as licensed just in case the node that dominates the current node carries a propositional requirement, \( \langle \uparrow 0 \rangle Ty(t) \), i.e. the current node is a subject node. Such a constraint is satisfied in the first tree in (2.12) (showing part of the analysis of \( \text{They sing} \)) but not in the second (disallowing \( \text{*Kim likes they} \)).

(2.12) Proper and improper contexts for parsing \text{they}

\[ \text{OK} \quad Tn(0), Ty(t) \quad \text{NOT OK} \quad Tn(0), Ty(t) \]

\[ \langle \uparrow 0 \rangle Ty(t) \quad \langle \downarrow 1 \rangle Ty(t) \]

The modal operators may also be used in conjunction with the notion of requirement to constrain further development of the tree. So while an annotation such as \( \langle \uparrow 0 \rangle Fo(\alpha) \) indicates that the formula value \( \alpha \) holds of my argument daughter (and is therefore only true if within the tree as currently constructed, \( Fo(\alpha) \) actually
does decorate that node), one such as $\langle \downarrow 0 \rangle F_o(\alpha)$ merely states that at some point in constructing the current tree, $F_o(\alpha)$ must decorate my argument daughter. This gives us another way to express case – as providing a filter on the output tree. So we might also express nominative case as providing a decoration of the form $\langle \uparrow 0 \rangle T_y(t)$. 10

Notice that in this second characterisation of case that the ‘?’ precedes the modal operator, so this formulation expresses the constraint that in order to achieve a well-formed result, the current node must be immediately dominated by a node which has the decoration $T_y(t)$. This is of course not achieved at any stage prior to the final goal, hence it is a filter on the output tree. As we can already see, this will give us a flexibility with respect to the analysis of case; and individual languages or indeed individual case specifications may differ in the restrictions they impose. Quite generally, we shall see that such modal requirements are very important and will be used extensively throughout this book.

2.3 Constructing Trees

We are now in a position to flesh out the framework for tree growth and show how full propositional trees can be gradually constructed from an initial requirement $\langle \uparrow 0 \rangle T_y(t)$ through a step-by-step parsing procedure. The development of tree structure involves the step from one parse state to another. A transition from one tree description to another can be licensed in two ways; either by one of a number of general transition rules, or by lexical actions (Kempson et al. 2001: 80-95).

2.3.1 Starting Off

We begin by considering a pair of transition (or construction) rules that allow one goal to be broken down into subgoals and so permit a development of a tree decorated with a type requirement on some node to grow into another that has daughter nodes decorated with other type requirements. Transition rules are general rules for tree construction, assumed to be universally available, and akin in many ways to the schematic Immediate Dominance Rules of HPSG with the important difference that transition rules do not characterise hierarchical relations between words, but between concepts. Formally, transition rules are stated in terms of tree descriptions, with an input tree description and an output description, as illustrated in (2.13), the form being reminiscent of a rule of natural deduction with the ‘premises’ on the topline leading to the ‘conclusion’ shown in the bottom line. Notice that in the schematic rule in (2.13b), we have shown the pointer, $\hat{\cdot}$. This is to emphasize the importance of this element in the process of tree construction: transition rules always make reference to the pointer, developing nodes decorated with it or moving it on to some other node. This means that rules do not apply arbitrarily to tree structures and always make reference to the node currently under construction.

10 We recognise that this sort of specification of case as just involving conditions on tree position (i.e. of argument status) is insufficient as a complete characterisation of case in languages that have well-articulated systems of morphological case. It is, however, sufficient for our limited purposes and will be used to provide the basis for a theory of constructive case in chapter 6 with respect to scrambling in Japanese.
2.3. CONSTRUCTING TREES

(2.13) Transition Rules

a. \[
\begin{array}{c}
\text{Input Tree description} \\
\text{Output Tree Description}
\end{array}
\]

b. \[
\begin{array}{c}
\{\ldots \phi \ldots \hat{\diamond} \ldots \} \\
\{\ldots \psi \ldots \hat{\diamond} \ldots \}
\end{array}
\]

As already noted, a pair of transition rules together drive the process of growth by breaking down goals into subgoals. The rule of Introduction is effectively an inference from an initial goal to one in which two subgoals are added in the form of requiring the tree to grow and be annotated by information that together can satisfy the original goal. Specifically, the rule unpacks a requirement to find an expression of one type into requirements to have daughters which are decorated by expressions of other types which can be combined through functional application to give an expression of the appropriate type. In other words, the rule adds to a node with a requirement to be decorated with an expression of type \( X \) on one node and type \( Y \rightarrow X \) on the other. This is formally defined in (2.14) in terms of tree descriptions and shown in terms of tree growth in (2.15).\(^{11}\) Notice that the tree in (2.15) has not actually grown the daughter nodes: it has merely acquired requirements to have such nodes. So the tree, as in the input, consists of only one node.

(2.14) Introduction (Rule)

\[
\begin{array}{c}
\{\ldots \{\ldots T_y(Y) \ldots \hat{\diamond} \ldots \} \ldots \} \\
\{\ldots \{\ldots T_y(Y), ?(\langle \downarrow 0 \rangle T_y(X), ?(\langle \downarrow 1 \rangle T_y(Y \rightarrow X), \ldots \hat{\diamond} \ldots) \ldots \}
\end{array}
\]

(2.15) Introduction (Treegrowth)

\[
?T_y(X), \hat{\diamond} \implies ?T_y(X), ?(\langle \downarrow 0 \rangle T_y(Y), ?(\langle \downarrow 1 \rangle T_y(Y \rightarrow X), \hat{\diamond})
\]

The outermost brackets in such tree descriptions allow the rule to apply at any point in the tree-construction process, and will be a general property of the rules unless explicitly defined otherwise.

The second rule, called Prediction, introduces the required nodes and decorates them with requirements to be decorated by expressions of the required type. As before, we give the formal definition in terms of tree descriptions (2.16) followed by the same information shown in terms of tree growth (2.17).\(^{12}\)

(2.16) Prediction (Rule)

\[
\begin{array}{c}
\{\ldots \{\ldots T_n(n), \ldots, ?(\langle \downarrow 0 \rangle \phi, ?(\langle \downarrow 1 \rangle \psi, \hat{\diamond}) \ldots \} \ldots \} \\
\{\ldots \{\ldots T_n(n), \ldots, ?(\langle \downarrow 0 \rangle \phi, ?(\langle \downarrow 1 \rangle \psi, \hat{\diamond}), \{\langle \langle \downarrow 0 \rangle T_n(n), ?\phi, \hat{\diamond} \}, \{\langle \langle \downarrow 1 \rangle T_n(n), ?\psi \} \ldots \}
\end{array}
\]

\(^{11}\)Recall that \( \langle \downarrow 0 \rangle \) indicates a relation from mother to argument daughter, \( \langle \downarrow 1 \rangle \) a relation from mother to functor daughter.

\(^{12}\)Notice that the rule builds the two required nodes and puts the pointer on the argument node, as the first of the two nodes to be expanded. Although this is not necessary from the point of view of the grammatical formalism, we take this move to be universal and a reflection of the fact that (for example) subjects are typologically more frequently found before their verbs than after them. We will see below and throughout the book how other word orders may be achieved.
CHAPTER 2. THE DYNAMICS OF INTERPRETATION

(2.17) Prediction (Treegrowth)

\[ T_n(n), \text{Ty}(X), \langle \downarrow 0 \rangle \text{Ty}(Y), \langle \downarrow 1 \rangle \text{Ty}(Y \rightarrow X), \diamond \rightarrow T_n(n), \text{Ty}(X), \langle \downarrow 0 \rangle \text{Ty}(Y), \langle \downarrow 1 \rangle \text{Ty}(Y \rightarrow X) \]

\[ \text{Ty}(Y), \diamond \rightarrow \text{Ty}(Y \rightarrow X) \]

Introduction thus licenses the introduction of modal requirements which Prediction ‘transforms’ into non-modal type requirements, by constructing the appropriate nodes. These rules are very general rules for unfolding tree structure. Together they license, for example, the introduction of the requirement for a subject when the type variables are instantiated as \( t \) for \( X \) and \( e \) for \( Y \). (2.18) shows the effect of this instantiation for the rule of Introduction and (2.19) the effect for the rule of Prediction.

(2.18) Introduction - Subject and Predicate

\[ \text{Ty}(t), \langle \downarrow 0 \rangle \text{Ty}(e), \langle \downarrow 1 \rangle \text{Ty}(e \rightarrow t), \diamond \rightarrow \text{Ty}(t), \langle \downarrow 0 \rangle \text{Ty}(e), \langle \downarrow 1 \rangle \text{Ty}(e \rightarrow t) \]

(2.19) Prediction - Subject and predicate

\[ \langle \uparrow 0 \rangle T_n(0), \text{Ty}(e), \langle \uparrow 1 \rangle T_n(0), \text{Ty}(e \rightarrow t) \}

The effect of these rather complex looking rules is, in fact, best illustrated by a single step of tree growth as shown in (2.20) which shows a tree growing from just one node decorated with a requirement of type \( t \) to a new tree with two new nodes decorated with requirements to find expressions of types \( e \) and \( e \rightarrow t \).

One property of these rules should be noted immediately: all rules are optional, so the system is constraint-based and in this respect like HPSG and LFG and unlike minimalism.\(^{14}\)

---

\(^{13}\)In fact, it is solely this variant of Introduction that we shall use, narrowing down the set of possibilities which the tree logic itself makes available.

\(^{14}\)See Pullum and Scholz (2001) for discussion of the difference between constraint-based systems and what they call generative-enumerative ones.
2.3. CONSTRUCTING TREES

2.3.2 Lexical Information

Introduction and Prediction, then, permit the initial unfolding of a propositional requirement in a language like English. The parsing process in Dynamic Syntax is, however, principally driven by the lexicon. In this, the framework follows recent trends towards assigning lexical items a more central role in syntax, as found, for example, in LFG (Bresnan 2001) or HPSG (Sag and Wasow 1999). Unlike these frameworks, however, lexical information within DS is dynamic and essentially procedural, inducing tree growth with a sequence of actions whose effect may go well beyond the simple annotation of terminal nodes. Parsing a word can add information to non-terminal nodes, add further requirements or build partial trees, even to the point of inducing the construction of full propositional structure (see below). This approach incorporates into the syntactic domain ideas from Relevance Theory in which words are taken as providing instructions on how to construct an interpretation of an utterance (Sperber and Wilson 1995, etc.). Since the trees constructed within the framework are representations of content, parsing words necessarily achieves this goal, albeit in a rather different sense to that intended within Relevance Theory.

The structure of lexical entries interacts with the general format of tree description introduced so far. Lexical information provides annotations on nodes and specifies how a particular lexical item contributes to the process of structure building. To this end, the general structure of a lexical entry is shown in (2.21) as a conditional statement, where the initial condition is of a particular sort, the trigger that induces the successful parse of the word (in other words, the appropriate context in which the word may appear). Typically, this takes the form of a type requirement, but other information may make suitable triggers in certain cases. The consequent of the initial condition being met provides a sequence of actions which include the predicates make(…) which makes a new node; go(…) which moves the pointer to the node specified in the value; and put(…) which annotates a node with certain information. Finally, there is an ELSE statement that induces other actions if the original trigger is not met which will, in the general case, be an instruction to abort the current parse process.

\[(2.21) \quad \text{Format of Lexical Entries}\]

\[
\begin{align*}
\text{IF} \quad & ?\text{Ty}(X) \quad \text{Trigger} \\
\text{THEN} \quad & \ldots \quad \text{Actions} \\
\text{ELSE} \quad & \ldots \quad \text{Elsewhere Statement}
\end{align*}
\]

For example, an expression like a proper name is of \(Ty(e)\) and requires that there be a current requirement \(Ty(e)\) at the stage at which the lexical entry is scanned. This provides the appropriate trigger. The THEN statement lists the particular actions which are performed if the condition in the IF statement is met. In the case of a proper name, this can be taken to be a simple annotation of the current node with type and formula information, using the predicate put(). Finally, the only other possibility is to abort the parse. The lexical entry for a name like Hilary is thus as shown in (2.22) and its effect is to induce the transition shown in (2.23) from the output tree in (2.20) above.\(^{15}\)

\[(2.22) \quad \text{Hilary} \quad \begin{align*}
\text{IF} \quad & ?\text{Ty}(e) \quad \text{Trigger} \\
\text{THEN} \quad & \text{put}(\text{Ty}(e), \text{Fo}(\text{Hilary}'), [\ldots, \bot]) \quad \text{Annotation} \\
\text{ELSE} \quad & \text{abort} \quad \text{Failure}
\end{align*}
\]

\(^{15}\)This view of proper names as having no internal structure will be revised in Chapter 3, when we incorporate an account of quantification.
(2.23) Parsing *Hilary*

\[
\begin{array}{c}
?Ty(t) \\
\downarrow
\\
?Ty(e) \downarrow \\
\downarrow
\\
?Ty(e) \downarrow \\
\end{array}
\mapsto
\begin{array}{c}
?Ty(t) \\
\downarrow
\\
?Ty(e), Ty(e), Fo(Hilary') \downarrow \\
\downarrow
\\
?Ty(e) \downarrow \\
\end{array}
\]

The one strange decoration in this sequence of actions is \([\downarrow] \bot\), what we call “the bottom restriction”. This annotation is to express that the word is used to decorate a terminal node in the tree. Formally it reads: “necessarily below the current node (for every node the current node immediately dominates), the falsum holds”: i.e. the current node has and will have no daughters with any properties at all. Intuitively, this is the reflection in this system that words provide the minimal parts from which interpretation is built up. So we reflect a compositionality of meaning principle like anyone else; but the information projected by words may be considerably more than merely providing some concept.

Within lexical entries, the order of the action predicates is important. For example *put(...) before make(...) means ‘put information at current node, then build a new node’, while make(...) before put(...) means ‘build a new node and put some information there’. This is important, for example, in parsing verbs in English. We take the parsing of verbs in English to be triggered by a context in which there is a predicate requirement, \(?Ty(e \rightarrow t)\).\(^{16}\) The actions induced by parsing finite verbs involve at minimum the annotation of the propositional node with tense information and the annotation of the predicate node. This is all that will happen with intransitive verbs, as shown in the lexical entry for *danced* in (2.24).

(2.24) \textit{danced}

\[
\begin{array}{ll}
\text{IF} & ?Ty(e \rightarrow t) \\
\text{THEN} & \text{Predicate Trigger} \\
& \text{Go to propositional node} \\
& \text{Go up to the immediately dominating node decorated by a propositional requirement}. \\
& \text{Add tense information} \\
& \text{Go to predicate node} \\
\text{ELSE} & \text{Abort} \\
& \text{Add content} \\
\end{array}
\]

There are a number of things to notice about the information in this lexical entry. In the first place, the condition for the introduction of the information from *danced* is that the current task state is \(?Ty(e \rightarrow t)\). Then there is movement from that node up to the immediately dominating propositional node, given by the instruction \(\text{go}((\text{↑})?Ty(t))\) ‘go up to the immediately dominating node decorated by a propositional requirement’. This node is then annotated by tense information which we have represented simplistically in terms of a label \(Tns\) with simple values \(\text{PAST}\) or \(\text{PRES} (\text{ENT})\) (for English).\(^{17}\) Notice that this means of encoding tense obviates the need for ‘percolation’ or ‘copying’ devices, as required in HPSG and other frameworks, to ensure that information introduced by a word gets to the place where it is to be interpreted. This is done entirely through the dynamics...

---

\(^{16}\)Differences in the trigger for classes of expression is one of the ways in which cross-linguistic variation is accounted for in DS, see section 2.5.1.

\(^{17}\)This should not be taken to be a serious account of tense: its use here is purely illustrative. A better account would include proper semantic information manipulating indices so that the tense label does not look like a simple syntactic label. See also chapter 3 where the account of tense is slightly expanded in conjunction with the discussion of quantification.
of parsing the verb. The pointer then returns to the open predicate node and annotates that with type and formula information (and the bottom restriction) as we saw with parsing Hilary.

Notice that the order in which the action predicates occur is important, reflecting the dynamic nature of the analysis. If the action \( \text{put}(Tns(PAST)) \) preceded the action \( \text{go}((\ell_1)?Ty(t)) \), the predicate node would be decorated with the tense information and not the propositional node. Similarly, the ordering of \( \text{put}(Ty(e \rightarrow t), Fo(Dance'), [\ell]\top) \) before \( \text{go}((\ell_1)?Ty(e \rightarrow t)) \) would fail to satisfy the propositional requirement on the node and so lead to a failure of the parse.

So intransitive verbs add information about tense and supply a one-place predicate. Transitive verbs, however, not only add tense, but create new nodes: a two-place predicate node which it annotates with type and formula values and a node for the internal argument, decorated with a type \( e \) requirement. This is illustrated in the lexical entry for \( \text{upset} \) in (2.25).

\[
\begin{array}{ll}
\text{IF} & \text{get}(\ell_1)?Ty(e \rightarrow t) \\
\text{THEN} & \text{Predicate trigger} \\
& \text{go}((\ell_1)?Ty(t)); \\
& \text{Go to propositional node} \\
& \text{put}(Tns(PAST)); \\
& \text{Tense information} \\
& \text{go}((\ell_1)?Ty(e \rightarrow t)); \\
& \text{Go to predicate node} \\
& \text{make}(\ell_1)); \\
& \text{Make functor node} \\
& \text{put}(Fo(\text{Upset}'), Ty(e \rightarrow (e \rightarrow t)), [\ell]\top); \\
& \text{Annotation} \\
& \text{go}(\ell_1)); \\
& \text{Go to mother node} \\
& \text{make}(\ell_0)); \\
& \text{Make argument node} \\
& \text{go}(\ell_0)); \\
& \text{Go to argument node} \\
& \text{put}(?Ty(e)) \\
\text{ELSE} & \text{Annotation} \\
& \text{Abort}
\end{array}
\]

The condition for the introduction of the information from \( \text{upset} \) is that the current task state is \( ?Ty(e \rightarrow t) \). If this condition is met, a new functor node is built and annotated with the formula and type values specified, and following the return to the mother node, a new daughter node is built with a requirement for a formula of type \( e \). To be fully explicit, the decoration \( Fo(\text{Upset'}) \) should be given as \( Fo(\lambda y \lambda x[\text{Upset'}(x, y)]) \), with \( \lambda \)-operators indicating the number and type of arguments with which the predicate \( \text{Upset'} \) has to combine, and the order in which this functor will combine with them.\footnote{It might be objected that tense information should be generalised, otherwise one might expect different verbs within the same language to behave differently with respect to such inflectional matters. Possibly, in morphologically regular constructions, the phonological information provided by the consonant cluster indicates a separate lexical specification for the suffix, an analysis of phonological clustering advocated within Government Phonology (Kaye 1995). In fact, it is relatively easy to structure the lexicon within Dynamic Syntax as is done in HPSG (Sag and Wasow 1999, etc.) so that past tense (for example) can be stated generally as an instruction to go up to the mother node and decorate that with the past tense label:}

\[
\begin{array}{ll}
\text{tense-past} & \text{IF} \\
\text{THEN} & Ty(e \rightarrow t) \\
& \text{content} \\
& \text{get}(\ell_1); \text{put}(Tns(PAST)); \text{go}(\ell_1))
\end{array}
\]

where content is the basic actions induced by all forms of the verb, in the case of \( \text{dance} \) merely the decoration of the predicate node with the appropriate formula, type and bottom restriction. There are differences between HPSG accounts and what is necessary in the current dynamic framework, but we do not pursue these refinements in this book. What cannot differ between lexical specifications is the specification of tense necessary for the appropriate semantics to be given, here specified as a decoration on the type \( t \)-requiring node as a promissory note for a formal characterisation. See also chapter 3, and chapter 6, where we see that the past-tense morpheme of Japanese plays a particular role in determining the way in which interpretation is incrementally built up.
To illustrate the effect of the parse of a transitive verb, (2.26) shows the transition from the output tree in (2.23) to a tree with the pointer at the open predicate node, which triggers the parse of the verb *upset* to give the second tree.

(2.26) Parsing *Hilary upset*

```
Ty(e), Fo(Hilary')
[|]⊥

Ty(e → t), ♦
```

(2.26) Parsing *Hilary upset*

```
Ty(e), Fo(Hilary')
[|]⊥

Ty(e → t), ♦
```

With the pointer again at an open Ty(e) node, it is possible to parse another proper noun, say *Joan*, to yield the tree shown in (2.27).

(2.27) Parsing *Hilary upset Joan*

```
Ty(e), Fo(Joan')
Ty(e → t)
Ty(e → (e → t)), Fo(Upset'), [|]⊥
```

2.3.3 Completing the Tree

While the rules discussed in the preceding subsection are concerned with the unfolding of tree structure during the parse of a string, the rules presented in this section deal with the accumulation of established information. We need three things:

- a means of eliminating requirements;
- a means of moving the pointer away from completed nodes;
- a means for compiling the information gathered at the terminal nodes in the tree to satisfy higher requirements.

determined output. Here the formula \( \lambda y \lambda x [\text{Upset}'(x, y)] \) is a function from a pair of arguments of type \( e \) taken in order onto an output of type \( t \). Taking the arguments in the formula given here from outside in, the \( \lambda \) operator binding \( y \) is a function from variables of type \( e \) onto a formula which is itself a function from variables of type \( e \) onto the formula \( \text{Upset}'(x, y) \) which is of type \( t \). Hence a two-place predicate with individual-type arguments is of type \( (e → (e → t)) \) (see any introduction to Formal Semantics, e.g. Cann (1993), Gamut (1991), Dowty *et al.* (1981)).
2.3. CONSTRUCTING TREES

The first rule provides a means for stating that requirements have been fulfilled:

\[(2.28) \text{ Thinning} \]

\[
\{\ldots \{\ldots ,\phi ,\ldots ,\?\phi ,\ldots ,\Diamond \} \ldots \} \\
\{\ldots \{\ldots ,\phi ,\ldots ,\Diamond \} \ldots \}
\]

All this rule does is to simplify the information accumulated at a node (a Declarative Unit (DU)): if, at the current node, a DU holds which includes both a fact and the requirement to fulfil this fact, the requirement is deleted and the pointer remains at the current node. This is the only means of getting rid of decorations, rather than adding them. Hence, in (2.23), there is a further step before the pointer moves to the predicate node: getting rid of the type requirement, as shown in (2.29).

\[(2.29) \text{ Parsing Hilary with thinning} \]

\[
\begin{align*}
?Ty(t) & \mapsto ?Ty(t) \\
\begin{array}{c}
?Ty(e), Ty(e), \\
Fo(Hilary'), [\!] \bot, \Diamond
\end{array}
& \quad \begin{array}{c}
Ty(e), Fo(Hilary'), \\
[\!] \bot, \Diamond
\end{array}
\end{align*}
\]

We also need transition rules that move the pointer on from a type-complete node and by so doing to satisfy the modal requirement imposed by INTRODUCTION. In Kempson et al. (2001), this is done by a rule called completion (which can be regarded as the inverse of PREDICTION) which moves the pointer up from a daughter to a mother and, crucially, annotates the mother node with the information that it indeed has a daughter with certain properties. This latter move has the effect of satisfying the modal requirement introduced by INTRODUCTION. The rule of completion is given in (2.30) and the effect in terms of tree growth is shown in (2.31). Hence, completion states that if at a daughter node some information holds which includes an established type, and the daughter is the current node, then the mother node may become the current node. In the tree-display, we use a ternary branching format to emphasise the neutrality of Completion between functor and argument daughters.

\[(2.30) \text{ Completion (Rule)} \]

\[
\begin{align*}
\{\ldots\{Tn(n)\ldots\},\{\langle i \rangle Tn(n),\ldots,Ty(X),\ldots,\Diamond\}\ldots\} \quad & \quad \{\ldots\{Tn(n)\ldots,\langle i \rangle Ty(X),\ldots,\Diamond\},\{\langle i \rangle Tn(n),\ldots,Ty(X),\ldots\}\ldots\} \\
i & \in \{0,1,\ast\}
\end{align*}
\]

\[(2.31) \text{ Completion (Treegrowth)} \]

\[
\begin{align*}
Tn(n) & \mapsto Tn(n), \langle i \rangle Ty(X), \Diamond \\
\ldots \langle i \rangle Tn(n), Ty(X), \Diamond \quad & \quad \ldots \langle i \rangle Tn(n), Ty(X) \quad \ldots
\end{align*}
\]

\[20\text{In general, however, we will not show the final transition determined by thinning, assuming its application whenever a task is fulfilled.}\]

\[21\text{We state this as a restriction on daughter nodes, } i \in \{0,1,\ast\} \text{ since we will shortly generalise this to cover the return of the pointer having constructed and decorated an unfixed node (symbolised by the } \ast \text{ notation).}\]
CHAPTER 2. THE DYNAMICS OF INTERPRETATION

Notice how this formulation of completion brings out how the use of modal statements reflects the perspective of the node in the tree at which they hold. So in the rule as formulated, some daughter node is defined to have a mother node \( T_n(n) \) above it: i.e. it itself is defined as \( \langle \uparrow \rangle T_n(n) \). In the input state defined by the rule, \( Ty(X) \) holds at the daughter node. The effect of the rule is to license the pointer to shift up to the mother node; and from the perspective of the mother node, to record the fact that \( \langle \downarrow \rangle Ty(X) \) holds. The latter annotation, as noted, satisfies the requirement \( ?(\langle \rangle) Ty(X) \) written to the mother node by introduction and the node can duly be thinned.

We also need a rule for moving the pointer down a tree which we call anticipation and which moves the pointer from a mother to a daughter which has an outstanding requirement.\(^{22}\) The rule is given in (2.32) and the effect on tree growth is shown in (2.33).

(2.32) **Anticipation (Rule):**

\[
\{ \ldots [T_n(n), \phi, \ldots] \}
\]

(2.33) **Anticipation (Treegrowth):**

\[
T_n(n), \phi \quad \Rightarrow \quad T_n(n)
\]

The rules for pointer movement mean that the transitions in (2.26) are mediated by the further transitions shown in (2.34): the first licensed by completion; the second by thinning and the third by anticipation. Although these transitions are formally necessary (and have an effect on licit derivations, as we shall see in later chapters), we will, in general, ignore this sort of straightforward development, assuming that the pointer always moves directly from a type-complete node to a (sister) node hosting an open requirement.

(2.34) Parsing *Hilary* with completion and anticipation

a. After thinning

\[
\langle \downarrow \rangle Ty(t), ?(\langle \rangle) Ty(e), \langle \downarrow \rangle Ty(e), Ty(e \rightarrow t)
\]

b. Completion

\[
\langle \downarrow \rangle Ty(t), ?(\langle \rangle) Ty(e), (\langle \rangle) Ty(e), Ty(e \rightarrow t), \phi
\]

---

\(^{22}\)The term ‘anticipation’ being intended to convey the idea that the movement of the pointer is in anticipation of satisfying some open requirement.
2.3. CONSTRUCTING TREES

c. Thinning

\[ Ty(t), \langle \downarrow 0 \rangle Ty(e), ?(\langle \downarrow 1 \rangle (Ty(e \rightarrow t)), \diamond \]

\[ Ty(e), \langle \downarrow \rangle, \downarrow Fo(Hilary') \]

\[ Ty(e \rightarrow t) \]

d. Anticipation

\[ Ty(t), \langle \downarrow 0 \rangle Ty(e), ?(\langle \downarrow 1 \rangle (Ty(e \rightarrow t)) \]

\[ Ty(e), \langle \downarrow \rangle, \downarrow Fo(Hilary') \]

\[ Ty(e \rightarrow t), \diamond \]

Finally, in the derivation of the complete tree representing the propositional content of the string *Hilary upset Joan*, we need a means of satisfying the outstanding type requirements holding at the non-terminal nodes in the output tree in (2.27d). This is achieved by means of a rule of elimination which can be regarded as the opposite of introduction. This rule takes the formulae on two daughter nodes, performs functional application over these and annotates the mother node with the resulting formula and type, thus satisfying an outstanding type requirement on the non-terminal mother node. There is, furthermore, a condition on node $Tn(n)$ that no daughter has any outstanding requirements. We shall see the effects of this elsewhere in the book.23 As before, the rule is given first in (2.35) and its effect on tree growth is illustrated next in (2.36).

(2.35) Elimination (Rule):

\[ \{ \ldots \{ Tn(n) \ldots Ty(X), \langle \downarrow \rangle (Fo(\alpha), Ty(Y)), \langle \downarrow \rangle (Fo(\beta), Ty(Y \rightarrow X)) \ldots, \diamond \ldots \} \ldots \]

\[ \text{Condition: } \langle \downarrow i \rangle ?\phi, \ i \in \{1, 0\}, \ does \ not \ hold \]

(2.36) Elimination (Treegrowth):

\[ ?Ty(X), \diamond \rightarrow ?Ty(X), Ty(X), Fo(\beta(\alpha)), \diamond \]

\[ Ty(Y), Fo(\alpha) \]

\[ Ty(Y \rightarrow X), Fo(\beta) \]

\[ Ty(Y), Fo(\alpha) \]

\[ Ty(Y \rightarrow X), Fo(\beta) \]

Notice that elimination does not introduce a new node, but only changes annotations holding at one node: if a given node immediately dominates an argument and a functor daughter which are both annotated with a formula and a type value, then the two type values can combine by modus ponens, with the corresponding formula expressions combined by function-application. For example, in completing the analysis of *Hilary upset Joan* from the output tree in (2.27d) (shown as the initial tree in (2.37)), completion licenses the movement of the pointer to the open predicate node. Then elimination applies to satisfy that type requirement as shown in the last of the partial trees in (2.37).

---

23Note that if construction rules were stated in the same format as lexical actions (as they could be), the condition could be stated straightforwardly as an instruction to abort the actions, just in case a daughter has an unsatisfied requirement:

\[ \ldots \text{IF } \langle \downarrow \rangle ?\phi \]

\[ \text{THEN } \text{abort} \]

\[ \text{ELSE } \ldots \]
(2.37) Decorating the predicate node in processing *Hilary upset Joan*

a. Parsing $Joan \mapsto \rightarrow Tns(PAST), ?Ty(t), ?\langle 1 \rangle Ty(e \to t)$

\[
Ty(e), \lbrack \lbrack \bot \rbrack, Fo(Hilary') \quad ?Ty(e \to t)
\]

b. Completion

\[
Tns(PAST), ?Ty(t), ?\langle 1 \rangle Ty(e \to t)
\]

\[
Ty(e), \lbrack \lbrack \bot \rbrack, Fo(Hilary') \quad ?Ty(e \to t), \langle 1 \rangle Ty(e), \Diamond
\]

\[
Ty(e), \lbrack \lbrack \bot \rbrack, Fo(Joan') \quad Ty(e \to (e \to t)), Fo(Upset'), \lbrack \lbrack \bot \rbrack
\]

c. Elimination

\[
Tns(PAST), ?Ty(t), ?\langle 1 \rangle Ty(e \to t)
\]

\[
Ty(e), \lbrack \lbrack \bot \rbrack, Fo(Hilary') \quad ?Ty(e \to t), Ty(e \to t), \Diamond, \langle 1 \rangle Ty(e), Fo(Upset'(Joan'))
\]

\[
Ty(e), \lbrack \lbrack \bot \rbrack, Fo(Joan') \quad Ty(e \to (e \to t)), Fo(Upset'), \lbrack \lbrack \bot \rbrack
\]

Thinning applies to (2.37c), followed by an application of completion and then a final application of elimination at the top node and a subsequent application of thinning as shown in (2.38), the first of which starts with the transition via thinning from (2.37c).\(^{24}\) The result, in the end, is a fully decorated tree with all nodes, terminal and non-terminal, sporting *Formula* and *Type* decorations, hence with all requirements fulfilled.

\(^{24}\) Notice that in the function-argument notation in the *Formula* language, the functor always precedes the argument. So if we have two successive applications of functional application, as in the projection of interpretation for *Hilary upset Joan*, the result at the top node will be the formula $Fo(Upset'(Joan')(Hilary'))$, since the functor $Fo(Upset')$ will have applied to $Fo(Joan')$ to yield $Fo(Upset'(Joan'))$, and this functor term will have applied to $Fo(Hilary')$ to yield the final result.
(2.38) Completing the parse of *Hilary upset Joan*

a. THINNING

\[\text{Tns}(PAST) , ?Ty(t), ?(\langle 1 \rangle Ty(e \rightarrow t)) \]

\[ Ty(e), [\langle 1 \rangle \perp , Fo(Hilary') \rightleftharpoons Ty(e \rightarrow t), \diamond , Fo(Upset'(Joan')) \]

\[ Ty(e), [\langle 1 \rangle \perp , Ty(e \rightarrow (e \rightarrow t)), Fo(Joan') \rightleftharpoons Fo(Upset'), [\langle 1 \rangle \perp ] \]

b. COMPLETION

\[\text{Tns}(PAST) , ?Ty(t), ?(\langle 1 \rangle Ty(e \rightarrow t), (\langle 1 \rangle Ty(e \rightarrow t), \diamond \rightleftharpoons

\[ Ty(e), [\langle 1 \rangle \perp , Ty(e \rightarrow t), Fo(Hilary') \rightleftharpoons Fo(Upset'(Joan')) \]

\[ Ty(e), [\langle 1 \rangle \perp , Ty(e \rightarrow (e \rightarrow t)), Fo(Joan') \rightleftharpoons Fo(Upset'), [\langle 1 \rangle \perp ] \]

c. THINNING

\[\text{Tns}(PAST) , ?Ty(t), (\langle 1 \rangle Ty(e \rightarrow t), \diamond \rightleftharpoons

\[ Ty(e), [\langle 1 \rangle \perp , Ty(e \rightarrow t), Fo(Hilary') \rightleftharpoons Fo(Upset'(Joan')) \]

\[ Ty(e), [\langle 1 \rangle \perp , Ty(e \rightarrow (e \rightarrow t)), Fo(Joan') \rightleftharpoons Fo(Upset'), [\langle 1 \rangle \perp ] \]

d. ELIMINATION

\[\text{Tns}(PAST) , ?Ty(t), Ty(t), Fo(Upset'(Joan')(Hilary'), \diamond \rightleftharpoons

\[ Ty(e), [\langle 1 \rangle \perp , Ty(e \rightarrow t), Fo(Hilary') \rightleftharpoons Fo(Upset'(Joan')) \]

\[ Ty(e), [\langle 1 \rangle \perp , Ty(e \rightarrow (e \rightarrow t)), Fo(Joan') \rightleftharpoons Fo(Upset'), [\langle 1 \rangle \perp ] \]

e. THINNING

\[\text{Tns}(PAST) , Ty(t), Fo(Upset'(Joan')(Hilary'), \diamond \rightleftharpoons

\[ Ty(e), [\langle 1 \rangle \perp , Ty(e \rightarrow t), Fo(Hilary') \rightleftharpoons Fo(Upset'(Joan')) \]

\[ Ty(e), [\langle 1 \rangle \perp , Ty(e \rightarrow (e \rightarrow t)), Fo(Joan') \rightleftharpoons Fo(Upset'), [\langle 1 \rangle \perp ] \]
In the remainder of this study, we will display derivations in considerably less detail, and concentrate on the growth of tree structure, as opposed to the combination of information, as it is in the growth of emergent structure that variation is possible. We also omit information from the DU statements unless pertinent to the point at hand. So, as in displays in other frameworks, the trees used as illustrations should not be taken as more than a convenient form of display. The formal content has always to be checked by establishing what rules have applied and how.

### 2.3.4 A more complex example: embedding

The process of building trees that we have seen above can, of course, be extended to instances of embedding in a straightforward manner. So, reflecting standard assumptions about the logical type of *think*, we can define the verb *think* as projecting a two-place predicate of which the object argument is type $t$, and this will ensure that a tree of toplevel $Ty(t)$ may be nested inside another tree of that type. The steps of establishing interpretation unfold as before, yielding a more complex but essentially similar tree. The process is one of time-linear parsing, using general transition rules and lexical information, not the building up of structure bottom-up as is normally assumed.

We take as our example the string in (2.39).

(2.39) John thinks that Hilary upset Joan.

The parse unfolds as we have seen previously with a transition from the underspecified propositional node to a tree with subject requirements, permitting the parse of *John*, followed by thinning and completion of the subject node and subsequent Prediction of the predicate node. This is shown schematically in (2.40), but without the detail of the exposition in the last section.

(2.40) Parsing *John*

\[
\begin{array}{c}
\text{IF} \quad Ty(t), \Diamond \\
\text{THEN} \quad Ty(t) \rightarrow Ty(t) \rightarrow Ty(t) \\
\quad Ty(e), \Diamond \quad Ty(e \rightarrow t) \quad Ty(e \rightarrow t), \Diamond
\end{array}
\]

The verb *thinks* is now parsed. This is associated with the lexical information in (2.41) which shows present tense and the creation of an internal argument node with a type $t$ requirement. The effect of parsing the verb is shown in (2.42).

(2.41) *thinks*

\[
\begin{array}{l}
\text{IF} \quad Ty(e \rightarrow t) \\
\text{THEN} \quad \text{go}((1)\downarrow Ty(t)); \\
\quad \text{put}(\text{\text{\text{\text{Tns\text{(PRES)}}}}}); \\
\quad \text{go}((1)\downarrow Ty(e \rightarrow t)); \\
\quad \text{make}((\downarrow 1)), \text{go}((\downarrow 1)); \\
\quad \text{put}(Ty(t \rightarrow (e \rightarrow t)), F_{o}(\text{Think'}) \rightarrow Ty(t), (1)\downarrow); \\
\quad \text{go}((1)); \text{make}((\downarrow 0)); \text{go}((\downarrow 0)); \\
\quad \text{put}(\downarrow Ty(t)) \\
\text{ELSE} \quad \text{Abort}
\end{array}
\]
(2.42) Parsing John thinks

\[
\begin{array}{c}
\text{IF } ?Ty(t) \\
\text{THEN IF } ⟨[1] ⟌ \text{THEN Abort}
\end{array}
\]

(2.43) that\_comp

IF ?Ty(t) THEN IF ⟨[1] ⟌ THEN Abort ELSE put (?∃x. Tns(x)) ELSE Abort

(2.44) Parsing John thinks that

\[
\begin{array}{c}
\text{IF } ?Ty(t) \\
\text{THEN IF } ⟨[1] ⟌ \text{THEN Abort}
\end{array}
\]

At this point in the parse, the complementiser that is encountered. This is an example of a word that does not significantly progress the parse by developing the tree. All that it appears to do is to require the following clause to be finite, a requirement that clearly does not involve the type (Ty) predicate. However, requirements may involve any label that may decorate a node (or appear in a declarative unit) and so we may encode it with reference to the tense (Tns) predicate, requiring some tense information to be established (something that only results from a parse of a local finite verb). We show this as ?∃x.Tns(x) which is a requirement to establish some value for the tense predicate. The lexical entry associated with that as a ‘pure’ complementiser is given in (2.43) which also contains an additional contextual requirement: abort the parse if the trigger node is the topnode (⟨↑⟩⊥, i.e. nothing holds of an immediately dominating node). This prevents the successful parse of the complementiser in matrix clauses (*That Kim sang) and illustrates an effect of embedding conditional clauses in lexical entries.

The effect of parsing the complementiser is shown in (2.44) and the parse of the rest of the string proceeds exactly as discussed in the previous section, yielding the tree in (2.45) up to the point at which the embedded proposition has been completed. Notice that THINNING applies twice to the internal propositional node: once to eliminate the type requirement ?Ty(t) and once to eliminate the requirement for tense information ?∃x. Tns(x).
(2.45) Parsing *John thinks that Hilary upset Joan*

\[
Ty(e), [\top], \ F_o(John')
\]

\[
Ty(t), Tns(PRES), \top, \ F_o(Upset'(Joan')(Hilary'))
\]

\[
Ty(t, (e \rightarrow t)), \ F_o(Think'), \bot
\]

\[
Ty(e), \bot, \ F_o(Hilary')
\]

\[
Ty(e \rightarrow t), \ F_o(Upset'(Joan'))
\]

\[
Ty(e), [\bot] \ F_o(John')
\]

\[
Ty(t), Tns(PAST), \bot, \ F_o(Upset'(Joan')(Hilary'))
\]

\[
Ty(t, (e \rightarrow t)), \ F_o(Think'), \bot
\]

\[
Ty(e), [\bot], \ F_o(Hilary')
\]

\[
Ty(e \rightarrow t), \ F_o(Upset'(Joan'))
\]

\[
Ty(e), [\bot] \ F_o(John')
\]

\[
Ty(t, (e \rightarrow t)), \ F_o(Think'), \bot
\]

\[
Ty(e), [\bot], \ F_o(Hilary')
\]

\[
Ty(e \rightarrow t), \ F_o(Upset'(Joan'))
\]

\[
Ty(e), [\bot] \ F_o(John')
\]

\[
Ty(t, (e \rightarrow t)), \ F_o(Think'), \bot
\]

The completion of the tree then proceeds through steps of completion, elimination and thinning on the predicate and top propositional nodes to yield the final output shown in (2.46).  

(2.46) Completing *John thinks that Hilary upset Joan*

\[
Ty(e), [\top], \ F_o(John')
\]

\[
Ty(t), Tns(PRES), \bot, \ F_o(Think'(Upset'(Joan')(Hilary'))(John'))
\]

\[
Ty(t, (e \rightarrow t)), \ F_o(Think'), \bot
\]

\[
Ty(e), [\bot], \ F_o(Hilary')
\]

\[
Ty(e \rightarrow t), \ F_o(Upset'(Joan'))
\]

\[
Ty(e), [\bot] \ F_o(John')
\]

\[
Ty(t, (e \rightarrow t)), \ F_o(Think'), \bot
\]

\[
Ty(e), [\bot], \ F_o(Hilary')
\]

\[
Ty(e \rightarrow t), \ F_o(Upset'(Joan'))
\]

\[
Ty(e), [\bot] \ F_o(John')
\]

\[
Ty(t, (e \rightarrow t)), \ F_o(Think'), \bot
\]

Notice in this connection that lexical specifications may do more than just decorate the terminal nodes of a tree, but decorating the terminal nodes is essential to what they do. So there is a sense in which the simple form of the traditional principle of compositionality (that sentence meanings are composed of meanings of words in a certain configuration) is retained. It is just that the information that a word may convey may be more than just some concept: it may provide information about what other concepts it may combine with; it may introduce other nodes in the tree (e.g. the object argument for a verb); or in the case of tensed verbs, the word may project decorations on other nodes. On the other hand, a word like the subordinating complementiser *that* does not decorate a terminal node; indeed, it  

\[25\text{At this point, the simplistic account of tense we have provisionally adopted means that we cannot express the compilation of tense as part of the propositional formula. Defining this involves essential interaction with quantification, so this aspect has to wait until chapter 3.}\]
fails to provide a formula decoration at all. All it does is to provide a requirement for some non-terminal, propositional, node to bear some tense specification.

Once all nodes in an overall tree are decorated, and all requirements satisfied, we have the final result – a root node decorated with the pair of a propositional formula and its type specification of the form

\[ F_0(\text{Think'}(\text{Upset'}(\text{Joan'})(\text{Hilary'}))(\text{John'}), T_y(t) \]

In words, this is the interpretation ‘John thinks that Hilary upset Joan’ in which the formula itself is derived compositionally in a regular bottom-up way from the terms introduced into the tree structure. The primary difference from the normal syntax-semantics correspondence is that this structure has been introduced on a left-to-right basis, rather than on a bottom-up basis as is standard.

### 2.4 Left Dislocation Structures

Focusing as we have done on the process of building up interpretation, it might seem that we would have to give a much more abstract analysis of constructions such as left dislocation structures (topics, questions, relative clauses, etc.) which in other frameworks have posited movement, or feature passing. However, it is very straightforward to express such structures in ways that reflect the dynamics of processing them. The key to our approach lies in the notions of underspecification and requirement, just as in the analysis of non-dislocated constructions given in the previous section. The intuition we wish to express is that dislocated left-peripheral expressions decorate nodes that are not yet fixed within the unfolding tree, and that continuing on with the parsing process will establish their contribution to the overall structure later on.

The principal basis for the analysis is in terms of two (mirror-image) underspecified modal relations. The modality \( \langle \uparrow \ast \rangle \) is an underspecified modal relation pointing to some node that dominates the current node. It is defined over the reflexive, transitive closure of the mother relation as shown in (2.47) and has an obverse relation, \( \langle \downarrow \ast \rangle \), over the daughter relation defined in (2.48).

\[
(2.47) \quad \langle \uparrow \ast \rangle \alpha = \text{def} \quad \alpha \lor \langle \uparrow \rangle \langle \uparrow \ast \rangle \alpha
\]

\[
(2.48) \quad \langle \downarrow \ast \rangle \alpha = \text{def} \quad \alpha \lor \langle \downarrow \rangle \langle \downarrow \ast \rangle \alpha
\]

A modality like \( \langle \uparrow \rangle T_y(t) \) holds just in case either the current node is decorated by \( ?T_y(t) \) or some node dominating the current node is so decorated. These recursive definitions provide a means to express the underspecification of tree locations. Consider the tree in (2.49).

\[
(2.49) \quad \text{An Unfixed Node}
\]

\[
T_n(0), Q, \langle \uparrow \ast \rangle R \quad \langle \uparrow \rangle T_n(0), R \quad \langle \uparrow \rangle T_n(0), P \quad \langle \downarrow \rangle T_n(0), P \rightarrow Q
\]

There are four decorated nodes in this tree, but only three of them are in fixed locations. The fourth is described as holding at \( \langle \uparrow \rangle T_n(0) \) indicating that it holds at some node within the tree along a sequence of daughter relations from the topnode but without that sequence being further specified. In short, the only information...
provided is that it is dominated by \( Tn(0) \). Correspondingly, the modal statement at \( Tn(0) \) indicates that at some dominated node, \( R \) holds (where this dominated node may turn out to be the current node). This underspecified relation is indicated shown by the dashed line in the figure (and subsequently).

This definition of underspecified tree location is the tool employed in DS for the analysis of preposed constituents such as \( wh \)-pronouns or left dislocated topics.26 Intuitively, our analysis rests on the idea that an initial phrase in a string may be parsed, but without being assigned a fixed position within the partial tree that is currently being developed. All that is known is that the unfixed subtree is dominated by the top, propositional, node and, crucially, that it needs to be assigned a fixed position for the resulting tree to be interpreted. Confirming this very weak relation at this point in the parse, all such nodes will be introduced with a requirement that the node obtain a fixed tree relation, which we write as ?\( \exists x.Tn(x) \). This is just like the tense requirement we saw associated with the complementiser \( that \): it is satisfied just in case some fixed value is provided for the appropriate label, in this case for the treenode predicate. This illustrates the general principle that all aspects of underspecification are associated with a requirement for update to a fixed value. As the parse of the remainder of the string proceeds, there will occur, in any well formed dislocation construction, a fixed position into which the unfixed subtree can be slotted, thereby satisfying some outstanding type requirement and the requirement to find a fixed position for the unfixed node. The output tree thus contains no indication that it was formed in such a way, through fixing an unfixed node. It merely expresses the same content as a structure in which there was no left dislocation.

We will go through the analysis of the left dislocated version of the string we discussed briefly in section 2 (uttered in a context like \( John, Bill amused, but \)):  

(2.50) Joan, Hilary upset.

What we need in the first place is a means to introduce an unfixed node. This is achieved by a rule of \( ^*\text{Adjunction} \)27 which defines a transition from (i) a partial tree containing only one node decorated only with the requirement ?\( Ty(t) \) and a treenode address \( Tn(n) \), to (ii) one that has a new node dominated by node \( Tn(n) \) and decorated by ?\( Ty(e) \). This dominated node is not necessarily a daughter (although it may turn out to be) but must bear, to the top node, some relation describable by the ‘daughter of’ relation. This is what the modality \( \langle \uparrow \ast \rangle \) gives you: there may be any number of ‘daughter of’ relations between the unfixed node and the node it is dominated by.

However, the unfixed node cannot remain unfixed and lead to a well-formed output; and to ensure this it is decorated with a requirement to find a fixed position within the unfolding tree ?\( \exists x.Tn(x) \). Finally, the pointer is left at this unfixed node, indicating that it is the next to be developed. The rule is given formally in (2.51) with its effect on tree growth shown in (2.52).

(2.51)  \( ^*\text{Adjunction} \) (Rule):

\[
\begin{array}{l}
\{ \ldots \{ \{ Tn(a) , \ldots , ?Ty(t) , \Diamond \} \} \ldots \} \\
\{ \ldots \{ \{ Tn(a) , \ldots , ?Ty(t) \} , \{ \{ \langle \uparrow \ast \rangle Tn(a) , ?\exists x.Tn(x) , \ldots , ?Ty(e) , \Diamond \} \ldots \} \ldots \}
\end{array}
\]

---

26The use of the Kleene* operator to characterise an underspecified tree relation is essentially similar to the concept of ‘functional uncertainty’ of LFG (Kaplan and Zaenen 1989), though the resulting analyses are distinct: see chapter 5 section 5.6.

27Pronounced ‘*star adjunction’, the name being intended to express the idea of a node which is currently ‘adjoined’ to a tree without a fixed function within it.
2.4. LEFT DISLOCATION STRUCTURES

(2.52) *ADJUNCTION (Treegrowth):

\[ ?Ty(t), \diamond \rightarrow Tn(a), ?Ty(t) \]

\[ (\uparrow \ast)Tn(a), ?Ty(e), ?\exists x.Tn(x), \diamond \]

The output tree in (2.52) provides an environment in which the proper name Joan can be parsed. COMPLETION can apply to the type-complete node because \((\uparrow \ast)\) is one of the modalities that it refers to (see (2.30)) and the pointer moves back up to the topnode.\(^{28}\) The parse of the string in (2.50) then proceeds through INTRODUCTION and PREDICTION to provide subject and predicate requirements, permitting the parse of Hilary upset, with the unfixed node remaining on hold, so to speak, as shown in (2.53).\(^{29}\)

(2.53) Parsing Joan, Hilary upset

a. Parsing Joan

\[ Tn(0), ?Ty(t) \]

\[ (\uparrow \ast)Tn(0), Ty(e), Fo(Joan'), ?\exists x.Tn(x), \diamond \]

b. INTRODUCTION and PREDICTION of subject and predicate \(\rightarrow\)

\[ Tn(0), ?Ty(t) \]

\[ \text{Fo(Joan'), Ty(e)}, Tn(0), ?Ty(e), \diamond \]

\[ Tn(00), ?Ty(e), \diamond \]

\[ Tn(01), ?Ty(e \rightarrow t) \]

c. Parsing Joan, Hilary

\[ Tn(0), ?Ty(t) \]

\[ \text{Fo(Joan'), Ty(e)}, Tn(0), ?\exists x.Tn(x) \]

\[ Tn(00), Ty(e), \diamond \]

\[ Tn(01), ?Ty(e \rightarrow t), \diamond \]

\(^{28}\) This generalisation of completion is not a license to move the pointer up through arbitrary fixed nodes in a tree. Kempson et al. (2001) make a distinction between a relation of ‘internally dominate’, which applies to unfixed nodes only, and one of ‘externally dominate’ which is the general dominate relation ranging over all dominated tree positions, fixed or unfixed. External domination is shown using up and down arrows without the angle brackets. So, \((\uparrow \ast)\), is the external modality corresponding to the internal modality \((\uparrow \ast)\). Only the latter is referred to in the rule of completion so movement of the pointer upwards can only take place from a currently unfixed node (decorated also by the treenode requirement \(?\exists x.Tn(x)\)) or from a fixed argument or functor daughter, but not from any other nodes.

\(^{29}\) In all trees that follow, the bottom restrictions imposed by lexical specifications will be omitted, unless relevant.
d. Parsing *Joan, Hilary upset*

At the point reached in (2.53d), the pointer is at a node with an open type \( e \) requirement. Since this matches the type of the unfixed node, the latter may merge with that position.\(^{30}\) The output of this process is the unification of the information on the unfixed node with that on the internal argument node. This ensures that the open type requirement on the latter and the outstanding requirement on the unfixed node to find a treenode address are both satisfied, as can be seen from the DU in (2.54a). Thinning applies (over \( ?\exists x. Tn(x) \) and \( Tn(010) \) and \( ?Ty(e) \) and \( Ty(e) \)) to give (2.54b), where because the specific modality \( (\langle \uparrow \ast \rangle \langle \uparrow 0 \rangle)Tn(0)) \) is subsumed by the general one \( (\langle \uparrow \ast \rangle Tn(0)) \), only the former need be retained.

\[
(\langle \downarrow \rangle Tn(0), ?Ty(e), Ty(e), Tn(00), Ty(e), \langle \uparrow 0 \rangle \langle \uparrow 1 \rangle Tn(0))
\]

\( Tn(010), Ty(e \rightarrow (e \rightarrow t)) \)

\( Ty(e \rightarrow t), Ty(e), Ty(e) \)

\( Tn(011), Fo(Upset') \)

\[
(\langle \uparrow 0 \rangle \langle \uparrow 1 \rangle Tn(0), Tn(010), Ty(e), Fo(Upset'), [\llbracket 1 \rrbracket \downarrow, \downarrow])
\]

This process is shown informally in (2.55) where the dashed arrow indicates the merge process and the second tree shows the output. Notice that when compiled and completed, the tree in (2.55b) is identical to the output tree for *Hilary upset Joan* in (2.38). The informational differences between the two strings are thus not encoded in the representation, as in many current theories of syntax, either as a separate layer of grammatical information (Vallduvı̈ 1992) or in terms of functional categories projected at the left periphery of the clause (Rizzi 1997, and others following him). Instead, the differences, we assume, derive from the different ways that the final tree is established. With the left dislocated object, a term is presented to the hearer which provides an update for a propositional structure to be established from the rest of the string — a type of focus effect (see Kempson et al. (2004) for further discussion).\(^{31}\)

\(^{30}\)The process of merge used in DS should not be confused with the entirely different process of Merge in the Minimalist Program (Chomsky 1995). A better term in DS would be unify, but we adhere to the term introduced in Kempson et al. (2001).

\(^{31}\)Note, in passing, how the process directly reflects an idea of focus as involving an isolated term which provides an update to some, given, propositional form (Rooth 1985, Erteschik-Shir 1997), a perspective which we pursue somewhat further in chapter 4.
2.4. LEFT DISLOCATION STRUCTURES

(2.55) Parsing Joan, Hilary upset with Merge

a. The Merge process:

\[ T_n(0), ?Ty(t) \]
\[ \langle \cdot \rangle T_n(0), ?\exists x.T_n(x), Fo(Joan'), Ty(e) \]
\[ T_n(00), Ty(e), Fo(Hilary') \]
\[ T_n(01), ?Ty(e \rightarrow t) \]
\[ T_n(010), ?Ty(e), \Diamond \]
\[ T_n(011), Ty(e \rightarrow (e \rightarrow t)), T_n(01), Fo(Upset') \]

b. The result of Merge:

\[ T_n(0), ?Ty(t) \]
\[ T_n(00), Ty(e), Fo(Hilary') \]
\[ T_n(01), ?Ty(e \rightarrow t) \]
\[ T_n(010), Ty(e), Fo(Joan'), \Diamond \]
\[ T_n(011), Ty(e \rightarrow (e \rightarrow t)), T_n(01), Fo(Upset') \]

At this point, we need some reflection on the differences between the formal apparatus and what the tree displays seem to be reflecting. With the unfixed node appearing to the left of the main propositional tree attached to the topnode, it looks from the tree displays that it is somehow associated with some position on the left periphery, analogous perhaps to some Topic or Focus projection. However, this is merely an artefact of the use of tree diagrams to illustrate the concepts used. Recall that trees give representations of meaning, not words and phrases, so the representation of the node to the left or the right is immaterial. More importantly, unfixed nodes do not inhabit any determinate position in the tree and, technically, the information associated with the unfixed structure (i.e. the declarative unit that describes that structure), is checked against each partial tree as successive pairs of daughter nodes are introduced. So in effect, the information from such nodes is passed down the tree, step by step, until a fixed position for the node can be established. Merge may then take place at any stage where the information on the unfixed node is compatible with that on the fixed position. The development shown in (2.53) might thus be more accurately shown as (2.56), where the information associated with the unfixed node is carried down the tree along with the pointer. The information associated with the unfixed node is shown inside the dashed boxes.

(2.56) Parsing Joan, Hilary upset

a. *Adjunction \[ \rightarrow \]

\[ T_n(0), ?Ty(t) \]
\[ \{ \langle \cdot \rangle T_n(0), ?Ty(e), ?\exists x.T_n(x), \Diamond \} \]

b. Parsing Joan

\[ T_n(0), ?Ty(t) \]
\[ \{ \langle \cdot \rangle T_n(0), Ty(e), Fo(Joan'), ?\exists x.T_n(x), ||, \Diamond \} \]
c. Parsing Joan after subject and predicate growth

\[ T_n(0), ?T_y(t) \]

\[ \langle \uparrow \ast \rangle T_n(0), ?T_y(e) \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e) \rangle \]

\[ \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \]

d. Parsing Joan, Hilary

\[ T_n(0), ?T_y(t) \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

\[ \langle \exists x.T_n(x), \ 
\quad \langle \exists x.T_n(x), \ 
\quad \langle \uparrow \downarrow \perp \rangle T_n(0), ?T_y(e \rightarrow t) \rangle \]

Note that at each of these intermediate nodes, the decorations on the unfixed node are checked for consistency with that intermediate node. And at any one of these nodes \(T_n(a)\), the unfixed node can be described as \(\langle \uparrow \ast \rangle T_n(a)\) because, according to this concept of ‘be dominated by’, the relation holds between two nodes if there is any sequence of daughter relations between the two nodes in question, including the empty one, hence if the property holds at that node.\(^{32}\)

At this point we need to be a bit more precise as to what the process of merge involves. Quite simply, all it does is to unify two node descriptions, here referred to as \(DU, DU'\) (a pair of DUs) as indicated in the formal rule in (2.57).

\[(2.57) \text{ Merge} \]

\[ \{\ldots\{DU, DU'\ldots\}\ldots\} \]

\[ \{\ldots\{DU \sqcup DU'\ldots\}\ldots\} \]

\[ \diamond \in DU' \]

The only constraints on this completely general rule are that: (a) the pointer is one of the decorations on one of the DUs (the fixed node) and (b) that the two

\(^{32}\)In this way, the concept of the unfixed node shows some similarity with the SLASH passing mechanisms of HPSG (Sag and Wasow 1999). A significant difference, however, is that, once discharged through \text{merge}, no record remains of the fact that the left peripheral expression was ever unfixed.
2.4. LEFT DISLOCATION STRUCTURES

DU's unify. This in effect is a concept of unification of information familiar from such theoretical frameworks as Generalised Phrase Structure Grammar (Gazdar et al. 1985, Bennett 1999) and Head-driven Phrase Structure Grammar (Pollard and Sag 1987, 1994). For example, the rule does not need to refer explicitly to any unixed node: two fixed nodes will not be able to MERGE, as they will not meet the entailment/unification constraint. Hence, while \( \langle i_0 \rangle \langle i_1 \rangle Tn(0) \models \langle i \rangle Tn(0) \) (since the fixed modality entails the underspecified modality or conversely is subsumed by it), \( \langle i_0 \rangle \langle i_1 \rangle Tn(0) \leq \langle i \rangle Tn(0) \), \( \langle i_0 \rangle \langle i_1 \rangle Tn(0) \not\models \langle i_0 \rangle Tn(0) \) (the modalities are inconsistent and one does not subsume the other). Also, no node can have more than one specification of any individual category unless one such specification entails the other. So in general two formula values decorating a node will be inconsistent (unless one is a metavariable, see section 2.5). Although in Chapters 5, and 8, in discussing conjunction and apposition, this condition will be modified for Fo values, no clashes of type are ever permitted. A DU containing \{..., Ty(t), Ty(e \rightarrow t),...\} is simply incoherent.

Characteristically MERGE takes place where there is an unixed node annotated with a formula of a certain type and a fixed node requiring that type (although this is not determined by the rule in (2.57)). Consider the trees in (2.56). In the second tree with the information on the unixed node currently matched with that on the subject node, MERGE could occur, but such a move would cause the parse to abort. This is because, with the treenode condition of the unixed node being satisfied by the fixed treenode address and the type requirement of the subject node being satisfied by the information on the unixed node, COMPLETION and ANTICIPATION would subsequently move the pointer on to the predicate node. The next word in the string, however, is Hilary which projects an expression of type e, hence incompatible with the type requirement on the currently open (predicate) node. The only way to avoid this is for the DU decorating the unixed node to get passed to the predicate node, without MERGE. At the predicate node, incompatible type information prevents MERGE from taking place, so the information is finally passed to the internal argument position, where MERGE can, and indeed must, take place.

Notice that though there is a specific principle which deletes requirements, there is no specific principle to delete any annotations which are entailed by other updating annotations upon an application of MERGE. They will always simply be irrelevant to subsequent updates, and so can be ignored. So in (2.55), \(?\exists x.Tn(x)\) and \(?Ty(e)\) get removed from node \(Tn(010)\) once Merge has taken place, but \(\langle i_0\rangle Tn(0)\) remains as a decoration, coexisting with \(\langle i_1\rangle Tn(0)\), both of which after MERGE will hold at \(Tn(010)\). The underspecified modality, however, no longer provides information because the specific modality holds. In this way, underspecified information becomes redundant as more specific updates occur.

A common question at this juncture is: What does this concept of underspecification of tree relations consist in? Since, in English, one may not know until the verb is parsed, whether the constituent just parsed is the subject, shouldn’t one be analysing all nodes before the verb as unixed? Why does the subject get introduced by application of INTRODUCTION and PREDICTION, and left-dislocated constituents by *ADJUNCTION? The answer is that it is perfectly possible for subjects to be introduced by *ADJUNCTION, rather than by INTRODUCTION and PREDICTION - and in some languages this must be what is happening (see next section). Both processes are available to the hearer and she must make a choice between a discrete fixed number of alternative moves. The situation is analogous to ambiguity
of meaning. Indeed, what we confront is a form of ambiguity, a processing ambiguity. As we know from studies of lexical ambiguity, the fact that a hearer may not necessarily be able to determine which sense of an ambiguous item such as bank is intended without reference to context is not in itself a criterion for analysing the word bank as underspecified, rather than homonymous. The choice of whether some word should be said to be ambiguous or simply underspecified with respect to some property depends on the patterns elsewhere in the language. Whether or not to analyse all noun phrases as unfixed until the verb is processed, therefore, turns not solely on the lack of information available to the parser, but on whether there are grounds elsewhere in the language to wish to preserve the distinction between the concepts of subject and long-distance dependency, and indeed topic structures (sometimes called Hanging Topic Left Dislocation, see Anagnostopoulou et al. (1997)). We shall see in later chapters a great deal of evidence to distinguish these three concepts and so, for these reasons, we elect to characterise only left-dislocation structures for English as involving a form of underspecification, while at the same time preserving an ambiguity between distinct processing alternatives which distinguish subjects from left-dislocated or topic structures (see chapter 4).

Before leaving the more technical discussion of *Adjunction and merge, it is worth reflecting on the analysis of long-distance dependency proposed. Concepts of underspecification and subsequent tree growth replace altogether the concept of 'movement', acclaimed in GB and minimalism, with its presumption of discrete levels of representation. At different stages in the parsing process, a node may be described in different ways: first as unfixed, and subsequently as identified with a fully determinate position. An immediate advantage of this analysis is that it matches the intuitive concept of information growth during the parse process for such sentences. As will emerge in chapter 3, the concept of tree growth for such structures is also just what we need to explain how the supposedly syntactic phenomenon of long-distance dependency can interact with context-dependent processes which have previously been thought to be semantic or pragmatic and so of no consequence to the articulation of syntax as the central component of the grammar. So the supposed indication of the imperfection of language (Chomsky 1995) as discussed in chapter 1, will turn out to be nothing more than what it means to be a parsing-directed system.

It is worth noticing also why the concept of an unfixed node is so naturally expressed in the vocabulary which Dynamic Syntax makes available, specifically the modal logic, LOFT. This is due, not so much to the specifics of LOFT, as a modal logic, since this is expressible in any language for describing trees, but resides, rather, in the move to describe trees explicitly using a tree description language, rather than simply taking their formal properties for granted, as in certain standard linguistic formalisms, such as minimalism. In particular, in order to describe what it means for a tree to be partial, we needed a language to describe such objects: they cannot simply be drawn. This move is exactly analogous to the move within semantics to set up languages to describe partial contents, as in Discourse Representation Theory (see Kamp and Reyle (1993), or, for more general discussion of partial information, Landman (1986)). In order to articulate what it means to have a representation of partial content for some expression, one needs a language that describes such contents. Once one has to hand such a language, articulating explicitly the set of properties necessary to be one such object, it is straightforward to express what it means to have part of one such object. Essentially, to go partial is to need a language of description.
2.5  Anaphora

We have so far been considering the processing of sentences pretty much as though in isolation. We now have to rectify this, and take up the challenge put out in chapter 1 to provide a unitary characterisation of pronominal anaphora. To do this, we assume that a pronoun gives rise to a place-holder for some logical expression which has been constructed within the context of utterance. Antecedents, though they may be given by previous words, cannot be the words themselves as this gives quite the wrong result over and over again. Presuming that the antecedent of the pronoun in (2.58a) is the quantifying expression wrongly fails to predict what is the appropriate interpretation of (2.58a), and wrongly predicts that it should have the same interpretation as (2.58b).

(2.58)  a. Every child thinks that he should get a prize.
       b. Every child thinks that every child should get a prize.

Assuming the general stance that words provide lexical actions in building up representations of content in context, in contrast, gets us on the right track. We can thus say that the pronoun may pick out some logical term if that term is provided in the discourse context, whether it is a full logical name or a variable introduced by some quantifying expression, and so on. We consider only the simplest cases here, leaving a discussion of the quantificational cases until the next chapter, but the effect of such an assumption, together with the adoption of the epsilon calculus to provide an account of quantification (see chapter 3) is to capture both the fact that pronouns contribute very differently to interpretation depending on the antecedent that they have, and that a pronoun is nevertheless not lexically ambiguous in the sense of having a number of quite different interpretations defined in the lexicon.

To achieve the simple notion that pronouns pick out some logical term from the discourse context, we again have recourse to underspecification, in this case to the underspecification of content, rather than underspecification of position, as with our account of left dislocation. So we extend the vocabulary of our Formula values to allow for placeholders for specific values. These we call metavariables in the logical language and represent as boldface capitals $U, V$ and so on. A pronoun then projects one such metavariable as the $Fo$ value given by its lexical actions. As a metavariable is just a placeholder for some contentful value, it is associated with a requirement to establish such a value, $\exists x. Fo(x)$, just as unfixed nodes with the underspecified modality $\langle \uparrow \ast \rangle Tn(n)$ are associated with a requirement to find a value for its treenode label, $\exists x. Tn(x)$. Following the general pattern that all requirements have to be eliminated in any well-formed derivation, the formula requirement ensures that metavariables will be replaced by a term in the Formula language as part of the construction process. Such replacement is established through a pragmatically driven process of substitution which applies as part of this construction process.

As an illustration, in processing an example such as (2.60), uttered in the context of having just parsed an utterance of (2.59), we assume the steps of interpretation in processing the subject and object expressions shown in (2.61).

(2.59)  John ignored Mary.

(2.60)  He upset her.

34The trees are shown schematically; and types and other requirements, once established, are not further represented.
As is now familiar, Introduction and Prediction license the introduction of subject and predicate nodes, the first of which is decorated by the pronoun he (2.61a). Substitution then occurs to yield the tree in (2.61b) and the pointer moves to the predicate node through completion and anticipation, permitting the parse of the verb to give the tree in (2.61c). Parsing her satisfies the type requirement on the internal argument node, but leaves a formula requirement (2.61d) which is satisfied through substitution to yield the tree in (2.61e).

(2.61) Stages in processing *He upset her*

a. Parsing *He*

\[
\begin{array}{c}
?Ty(t) \\
Fo(U), Ty(e), \\
?\exists x. Fo(x), \Diamond \\
?Ty(e \rightarrow t)
\end{array}
\]

b. Substitution

\[
\begin{array}{c}
?Ty(t) \\
Ty(e), \\
Fo(\text{John}') \\
?Ty(e \rightarrow t), \Diamond
\end{array}
\]

c. Parsing *He upset*

\[
\begin{array}{c}
Tns(Past), ?Ty(t) \\
Ty(e), \\
Fo(\text{John}') \\
?Ty(e \rightarrow t)
\end{array}
\]

\[
\begin{array}{c}
?Ty(e), \Diamond \\
Ty(e \rightarrow (e \rightarrow t)), \\
Fo(\text{Upset}')
\end{array}
\]

d. Parsing *He upset her*

\[
\begin{array}{c}
Tns(Past), ?Ty(t) \\
Ty(e), \\
Fo(\text{John}') \\
?Ty(e \rightarrow t)
\end{array}
\]

\[
\begin{array}{c}
Fo(V), \Diamond, \\
Ty(e), \\
?\exists x. Fo(x) \\
Ty(e \rightarrow (e \rightarrow t)), \\
Fo(\text{Upset}')
\end{array}
\]
2.5. ANAPHORA

e. SUBSTITUTION

\[ T_{ns}(Past), ?T_y(t) \]

\[ T_y(e), F_o(John') \]

\[ ?T_y(e \rightarrow t) \]

\[ T_y(e), T_y(e \rightarrow (e \rightarrow t)), F_o(Mary'), \Diamond F_o(Ups) \]

It is important to notice that the metavariables are replaced, at steps (2.61b), and at step (2.61e), so there is no record thereafter of there having been a pronominal form of input. The tree resulting from the parse of *John upset Mary* and that of *He upset her*, as uttered in the context of having just parsed (2.59), is effectively identical in the two cases, the only difference being the occurrence of meta-variables redundantly decorating the node once SUBSTITUTION has taken place in the construal of the string containing pronouns.

The lexical specification for the pronoun *he* can now be given. It must express both the need for the pronoun to have a value established in context, and specify whatever other constraints the pronoun imposes. So, for example, *he* is associated with a constraint on substitution that whatever term is substituted for the metavariable projected by the pronoun is describable (in context) as having the property *Male*.

Additionally, the case of a pronoun constrains which node in a tree the pronoun may decorate. For nominative pronouns in English, where the morphological specification of case is very restricted, we take nominative case specification to take the form of an output filter: a requirement that the immediately dominated node be decorated with type \( t \). In English, of course, there is a further constraint that nominative pronouns only appear in finite subject positions, so that the actual constraint is shown as a requirement to be immediately dominated by a propositional node with a tense decoration.

(2.62)  
\[
\text{he} \\
\text{IF } \quad \exists T_y(e) \quad \text{Type statement} \\
\text{THEN } \quad \text{put}(T_y(e)); \quad \text{Metavariable and Presupposition} \\
\quad \text{F_o}(U_{Male}); \quad \text{Formula Requirement} \\
\quad \exists x. F_o(x); \\
\quad ?(\exists T_y(t) \land \exists x. T_{ns}(x)); \quad \text{Case Condition} \\
\quad \downarrow [\perp] \quad \text{Bottom Restriction} \\
\text{ELSE } \quad \text{Abort} 
\]

Other pronouns and other case-forms project analogous information. So, for example, the first and second pronouns project presuppositions that whatever is substituted for the metavariable must be the speaker or the hearer/addresssee, respectively (i.e. \( U_{\text{Speaker}}, U_{\text{Hearer}} \)). Notice that, just as with third person pronouns, the metavariable projected by *I/me or you* will be replaced by some logical term, picking out the speaker or hearer, and so the output propositional form ceases to

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35 We do not, in this book, go into presuppositional effects or the formal analysis of such things, but see Cann (forthcoming a) for some discussion.

36 We make no pretense that this gives a complete characterisation of case. As we saw in section 3, there is more than one way to express case restrictions. This will be taken up in more detail in chapter 6, where we shall see that in Japanese, nominative case specification is arguably different from other case specifications.
CHAPTER 2. THE DYNAMICS OF INTERPRETATION

contain a semantic deictic expression, requiring anchoring in the discourse domain. Instead, the representation of the content of the string *I’m going to Wales* uttered by Hilary is \( Go'(\text{To-Wales}')(\text{Hilary}') \), directly expressing the appropriate proposition.

The process of substitution is thus entirely free relative to the constraints imposed by any presuppositions projected by an expression. However, it also applies relative to a more general filter, which precludes any substitution which results in any two *co-arguments* being identical, i.e. an analogue of Principle B of the Binding Theory of the Principles and Parameters framework (Chomsky 1981), but restricted to an argument domain.\(^{37}\) Consider the schematic tree in Figure 2.63, with its labelling of argument relations in terms of grammatical relations as defined on the semantic tree (Indirect Object is the lowest argument, Subject is the highest argument, Direct Object is the intermediate object).

(2.63) Locality Tree

![Diagram of Locality Tree](image)

On this tree, we can show the relations between the lowest argument node, the indirect object, and the other argument nodes using tree modalities as in (2.64a-c). These all involve going up from an argument node, up through one or more functor nodes and then down to an argument node. To abstract from these to a general concept of locality, we can generalise these relations to that shown in (2.64d), where the underspecified modality \( \langle \uparrow \ast \rangle \) expresses a path through a series of (possibly null) dominating nodes, all of which are functor nodes. This is formally defined in (2.64e).

(2.64)

a. IND-OBJ to IND-OBJ: \( \langle \downarrow_0 \rangle \langle \downarrow_0 \rangle \)

b. IND-OBJ to DIR-OBJ: \( \langle \downarrow_0 \rangle \langle \uparrow_1 \rangle \langle \downarrow_0 \rangle \)

c. IND-OBJ to SUBJ: \( \langle \downarrow_0 \rangle \langle \downarrow_1 \rangle \langle \downarrow_1 \rangle \langle \downarrow_0 \rangle \)

d. \( \langle \downarrow_0 \rangle \langle \uparrow_1 \rangle \langle \downarrow_0 \rangle \)

e. \( \langle \downarrow_1 \rangle \alpha =_{\text{def}} \alpha \lor \langle \downarrow_1 \rangle \langle \uparrow_1 \rangle \alpha \)

Taking the relation in (2.64d) as the relevant locality domain, we can now define *Substitution*, along the lines of Kempson et al. (2001), as an operation that substitutes only formulae that do not decorate local nodes, as in (2.65).

(2.65) \( \text{Subst}(\alpha) \)

| IF \( Fo(U), Ty(e) \) THEN IF \( \langle \downarrow_0 \rangle \langle \uparrow_1 \rangle \langle \downarrow_0 \rangle Fo(\alpha) \) THEN Abort ELSE put(\( Fo(\alpha) \)) |

\( ^{37} \)See Huang (2002), Sag and Wasow (1999), for arguments and discussion.
What this does is to exclude all local arguments as possible substituends for any metavariable. Additionally, it also excludes as a potential substituend a formula decorating an unfixed node. This is because, as we saw above, the unfixed node is evaluated at each node along the path between the node where it is introduced and the node where it merges. The decorations on the node, including $Fo(\alpha)$, are evaluated for whether they hold at that very node, and this entails $\langle |0_0| |1_1| |0_0|Fo(\alpha)$. Hence, an unfixed node is always local in the sense intended. With this approach, then, neither Hilary likes her nor Hilary, she likes can ever be associated with the propositional formula Like'(Hilary')(Hilary'). The tree-description vocabulary can thus capture the type of generalisations that other frameworks rely on such as familiar concepts of locality (indeed rather more, since the characterisation of partial trees is the central motivation for turning to a formal tree-description language).

This substitution process is assumed to be defined over a context of structures from which putative antecedents are selected. At this stage, we rely on a purely intuitive concept of context, with context construed as an arbitrary sequence of trees, including the partial tree under construction as the parsing process unfolds incrementally (see chapter 9 for a more detailed discussion of context). So we presume that the context relative to the parsing of John thinks that he is clever at the stage of parsing the pronoun includes the partial tree under construction, hence making available $Fo(John)$ as a putative antecedent. This is so because John decorates the matrix subject which is not a co-argument of the node decorated by he, the modality between the latter node and the former is mediated by a second argument node: $\langle |0_0| |1_1| |0_0|$.\(^{38}\)

### 2.5.1 Pro drop and word order variation

A point to notice about the analysis of pronouns in English suggested above is that they are associated with the ‘bottom restriction’ $[|_0] \bot$, a statement meaning that “below me nothing holds”, i.e. a node so decorated is necessarily terminal. As we have seen, this means that the node decorated by a pronoun cannot be further developed. One of the consequences of this is that, in English, pronouns cannot be used to resolve initially unfixed nodes in questions or analogous ‘topicalisation’ structures (2.66):\(^{39}\)

\[
(2.66) \quad \begin{align*}
\text{a. } *\text{Which barman did Mary upset him?} \\
\text{b. } *\text{Bill, Hilary amused but John, she upset him.}
\end{align*}
\]

As we shall see in chapter 4, however, there are languages in which some pronouns do not have this restriction and so can be associated with such left dislocated

\(^{38}\)Notice that the same locality condition can be used to ensure reflexives get properly ‘bound’ in the most common circumstances. However, Substitution is not involved here but the lexical actions associated with a reflexive identify a local formula and use that as a substitute as part of the parsing process directly. A word like herself is thus associated with a lexical entry like:

```
IF $T(y(e))$ THEN IF $\langle 0_0|T(y(t))$ THEN Abort \\
ELSE IF $\langle 0_0|\langle 1_1|\langle 0_0|Fo(\alpha)$ THEN put($T(y(e), Fo(\alpha), [|0] \bot$) ELSE Abort \\
ELSE Abort
```

See chapter 6 for a discussion of the anaphor ジブンジシン in Japanese.

\(^{39}\)The terminology in this area is extremely confusing, with ‘topicalisation’ as one standard term for long-distance dependencies that are characteristically used for the focus effect of isolating one term as update to some remaining structure.
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material. Such an effect can be seen in the clitic doubling structures evident in languages such as Modern Greek, as illustrated in (2.67). The phrasal expression ti Maria we take to project internal structure (that of an iota expression, a position we take up for all proper names from chapter 3) and hence necessarily developing the treenode decorated by the clitic tin.

(2.67) ti Maria tin ksero

theACC Maria herACC I know

‘I know Maria.’

We go into such constructions in more detail later in the book, but essentially the clitic tin in (2.67) projects a metavariable but does not decorate that node with the bottom restriction. This allows the unfixed node decorated by ti Maria to merge with that node, yielding a structure identical to that derived by parsing the non-dislocated string ksero ti Maria.

The example in (2.67) also shows another common property of natural languages: pro-drop. This is the phenomenon in many languages of licensing the occurrence of a verb without any independent expression providing the argument for the predicate, presuming on its identification from context. The dissociation of a metavariable from the bottom restriction illustrated by clitic doubling, however, also provides a straightforward way to analyse such languages.

As we have seen in this chapter, subject nodes in English are introduced by the construction rules INTRODUCTION and PREDICTION while the lexical actions associated with verbs are triggered by a predicate requirement, $?Ty(e \rightarrow t)$. As such, transitive verbs do not decorate their subject nodes and overt subjects are thus necessary to guarantee the well-formedness of strings because, without one, the pointer can never reach the triggering predicate node. However, certain languages are best treated as having the parsing of verbs triggered by a propositional requirement, rather than a predicate node. So, for example, in a VSO language like Modern Irish, we may analyse (non-copular) verbs as being triggered by a type $t$ requirement and providing a full propositional template with the pointer left at the subject node for development next. Thus, the verb chonaic ‘saw’ in (2.68) may be given the lexical entry in (2.69) which has the effect shown in Figure 2.70. The fact that the pointer is at the subject node allows the immediate parsing of the first person pronoun mé in (2.68) and the pointer then travels down the tree using ANTICIPATION (twice) to allow the internal object to be parsed.40

(2.68) Chonaic mé an cú

saw I the dog

‘I saw the dog.’

(2.69) chonaic

<table>
<thead>
<tr>
<th>IF</th>
<th>THEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>$?Ty(t)$</td>
<td>put$(Tns(PAST))$</td>
</tr>
<tr>
<td></td>
<td>make$((\downarrow 1))$; go$((\downarrow 1))$; put$(?Ty(e \rightarrow t))$; Predicate Node</td>
</tr>
<tr>
<td></td>
<td>make$((\downarrow 1))$; go$((\downarrow 1))$;</td>
</tr>
<tr>
<td></td>
<td>put$(Fo(Chon), Ty(e \rightarrow (e \rightarrow t)), [\downarrow \perp];)$ Main Functor</td>
</tr>
<tr>
<td></td>
<td>go$((\downarrow 1)); make((\downarrow 0)); go((\downarrow 0)); put(?Ty(e));$ Internal Argument</td>
</tr>
<tr>
<td></td>
<td>go$((\downarrow 1)); make((\downarrow 0)); go((\downarrow 0)); put(?Ty(e))$ Subject</td>
</tr>
</tbody>
</table>

40Here and below, we represent the concepts expressed by content words in some language in terms of primed versions of the stems of those words. So we express the content of chonaic in (2.69) as Chon’, not in terms of their translations into English such as See’. We do this in order to sidestep the issue of whether lexicalised concepts can be realised fully in terms of simple translation equivalents.
There is, of course, much more to say about the analysis of Modern Irish, but this brief sketch of the parsing of main verbs shows one of the ways in which word order variation can be achieved within Dynamic Syntax: through the manipulation of triggers (between propositional, main predicate and n-place predicate requirements) and where the pointer remains after the lexical actions have occurred. It also provides a means of accounting for subject pro drop languages such as Modern Greek. While in Modern Irish the subject node is decorated by a type requirement (at least for analytic forms such as chonaic), indicating the need for an overt subject, in Modern Greek we may analyse verbs as decorating their subject nodes with metavariables. Such metavariables, like those projected by pronouns in the way we have seen, are associated with a formula requirement and so must be updated with some contentful expression. This is achieved by lexical actions such as those associated with the verb ksero ‘I know’ shown in (2.72). (2.73) shows the parse of the sentence in (2.71) with substitution of the subject metavariable being made on the assumption that Stavros utters the string.\(^\text{43}\) The resulting proposition is, as expected:\(^\text{42}\) \(\text{Fo(Kser}'(\text{Maria}')(\text{Stavros}')\).}

\((2.71)\)  
\[
\text{ksero ti } \text{Maria}  \\
\text{I know the } \text{ACC} \text{ Maria}  \\
\text{‘I know Maria.’}
\]

\((2.72)\)  
\[
\text{ksero}  \\
\begin{align*}
\text{IF} & \quad ?Ty(t) \\
\text{THEN} & \quad \text{Tense} & \quad \text{Predicate Node} \\
& \quad \text{put}(\text{Tns}(\text{PRES}));  \\
& \quad \text{make}((11)); \text{go}((11)); \text{put}(?Ty(e \rightarrow t));  \\
& \quad \text{go}((11)); \text{make}((11)); \text{go}((11)); \text{put}(?Ty(e));  \\
& \quad \text{go}((11)); \text{make}((11)); \text{go}((11)); \text{put}(?Ty(e));  \\
& \quad \text{go}((11)); \text{make}((11)); \text{go}((11)); \text{put}(?Ty(e));  \\
& \quad \text{put}(Ty(e), \text{Fo(U}'\text{Speaker}'));  \\
& \quad \exists x.\text{Fo(x})
\end{align*}
\]

\((2.73)\)  
\[
\text{Parsing ksero ti Maria}  \\
a. \text{AXIOM:}  \\
?Ty(t), \diamond
\]

\(^{41}\) The analysis ignores the import of the definite article.

\(^{42}\) We leave on one side here the question of how to express the VSO ordering, except to say that the rule of Late*Adjunction to be proposed in chapter 5 provides a straightforward mechanism for accounting for this frequent structure. For a first account of a verb-initial language using the DS framework, see Turner 2003.
b. Parsing ksero:

\[ ?T_y(t) \]
\[ T_y(e), ?x.Fo(x), Fo(U_{Speaker'}), \Diamond \]
\[ ?T_y(e \rightarrow t) \]
\[ Fo(Kser'), [1] \bot, T_y(e \rightarrow (e \rightarrow t)) \]

c. Substitution:

\[ ?T_y(t) \]
\[ T_y(e), Fo(Stavros') \]
\[ ?T_y(e \rightarrow t) \]
\[ ?T_y(e), \Diamond \]
\[ Fo(Kser'), [1] \bot, T_y(e \rightarrow e \rightarrow t) \]

d. Parsing ti Maria:

\[ ?T_y(t) \]
\[ T_y(e), Fo(Stavros') \]
\[ ?T_y(e \rightarrow t) \]
\[ T_y(e), \Diamond, Fo(Maria'), Fo(Kser') \]
\[ T_y(e \rightarrow (e \rightarrow t)) \]

Greek, like Irish, generally shows verb-subject-order (a ‘verb-initial’ language), though with subject pro-drop. This is reflected in this analysis in terms of the node at which the pointer ends up, after the end of the macro of actions provided by the verb. In (2.72) this is at the subject node. It is then a simple matter to reflect subject pro-drop languages in which subject-verb-object is the unmarked order, such as the Romance languages of Spanish, Italian, etc. We define a macro of actions for the verb identical in format to that of Greek except that, by a simple re-ordering of the sequence of lexical actions, the pointer ends up at the object argument node. In this case, because the object node is only decorated with a requirement for a node of type \( e \) (i.e. without any metavariable), there is an immediate need for some expression to immediately follow the verb.

There is a consequence to giving distinct lexical specifications for verbs (and other expressions) in different languages. All languages, equally, can realise pairs of expressions corresponding to a subject plus its verb, though some apparently do not have to project such pairs in order to convey a subject-predicate relation as interpretation. This might seem to pose a problem: in all these languages in which the verb decorates the subject as part of its own actions, if the subject is also explicitly marked by a discrete constituent, the subject position in the resulting logical form will get decorated twice, once by the subject expression, and once by the verb itself, as illustrated in (2.74).
2.5. ANAPHORA

\((2.74)\) o kseri ti Maria theNOM

\[\text{Stavros he knows the}^{\text{ACC}} \text{ Maria}\]

‘Stavros knows Maria.’

Should we avoid this outcome by characterising verbs in pro-drop languages as sometimes projecting a subject from the lexicon, and sometimes not? The answer is that this is not necessary. There are several alternatives. For example, all cases in which there is an explicit subject expression will allow a derivation in which that expression is taken to decorate a node which is initially introduced as unfixed, only subsequently merging with the subject node projected by the verb. This is the analysis we have already motivated in English for left-dislocation structures, such as Mary, John dislikes. The string in (2.74) could then be analysed with the subject \(o\) Stavros as providing an update for the propositional template given by the verb through the merge process as illustrated graphically in Figure 2.75. Notice that merge is licit here because the subject node is not decorated by the bottom restriction, \([1]\bot\). The node may, therefore, grow and accommodate an initially unfixed subtree.\(^{43}\)

\((2.75)\) Parsing \(o\) Stavros kseri with unfixed initial term:

\[\text{\includegraphics[width=\textwidth]{figure2.75}}\]

There is, however, a further way in which subjects can be accommodated in pro-drop languages: through the straightforward use of introduction and prediction. The subject is introduced as we have seen for English, as in (2.78a). The verb is parsed to yield a full propositional template with the subject node decorated by a metavariable to give the apparently inconsistent tree in (2.78b). However, the inconsistency is only apparent as can be seen if we consider the description of the tree, rather than its representation. From the point of view of the toppnode tree B has the description in (2.76) – six introduced nodes, each with their itemised properties, including a description of their relation to the top node:

\[(2.76)\] Description of (2.78b):

\[\begin{align*}
\text{a. } &\{Tn(0), ?Ty(t)\} & \text{Topnode} \\
\text{b. } &\{\langle 1_0 \rangle Tn(0), Ty(e), Fo(Stavros'), [1]\bot\} & \text{Initial Subject Node} \\
\text{c. } &\{\langle 1_0 \rangle Tn(0), Ty(e), Fo(U), ?\exists x. Fo(x), \Diamond\} & \text{Introduced Subject Node} \\
\text{d. } &\{\langle 1_1 \rangle Tn(0), ?Ty(e \rightarrow t)\} & \text{Predicate Node} \\
\text{e. } &\{\langle 1_1 \rangle \langle 1_0 \rangle Tn(0), ?Ty(e)\} & \text{Internal Argument Node} \\
\text{f. } &\{\langle 1_1 \rangle \langle 1_1 \rangle Tn(0), Ty(e \rightarrow (e \rightarrow t)), Fo(Kseri'), [1]\bot\} & \text{Functor Node}
\end{align*}\]

\(^{43}\)The fact that the subject node grows in (2.75) is not obvious as we currently do not show the internal structure of proper names which in chapter 3 will be rectified when they are treated as terms which have internal structure, as a form of quantifying expression.
The important thing to notice about this description is that lines b and c, giving the descriptions of the initial and introduced subject nodes, describe the very same node, the argument node immediately dominated by the top node. The full description of that node should thus be that in (2.77a) with the two descriptions unified, which itself reduces to (2.77b) once fulfilled requirements and uninformative information (i.e. the metavariable) are removed.

\[(2.77)\]

\[a. \{\langle \downarrow 0 \rangle Tn(0), Ty(e), Fo(Stavros'), [[\bot], Fo(U), ?\exists x.Fo(x), \Diamond}\}
\[b. \{\langle \downarrow 0 \rangle Tn(0), Ty(e), Fo(Stavros'), [\bot], \Diamond}\}

The tree in (2.78b) is thus equivalent to that in (2.78a). This example thus shows the usefulness of the tree description language which highlights directly the number and type of nodes in a tree which may be obscured by apparently contradictory sets of computational and lexical actions.

\[(2.78)\] Parsing of Stavros kseri with fixed initial term

\[a. \text{INTRODUCTION and PREDICTION for subject and predicate:}\]

\[Ty(t)\]

\[\begin{aligned}
&Ty(e), Fo(Stavros'), [\bot], \Diamond \\
&\text{?Ty}(e \rightarrow t)
\end{aligned}\]

\[b. \text{Parsing kseri}\]

\[\begin{aligned}
&Ty(t) \\
&\begin{aligned}
&Ty(e), [[\bot], \Diamond \\
&Ty(e) \rightarrow (e \rightarrow t), Fo(Kser'), [\bot]
\end{aligned}
\end{aligned}\]

\[c. \text{The result:}\]

\[\begin{aligned}
&Ty(t) \\
&\begin{aligned}
&Ty(e), [[\bot], Fo(Stavros'), \Diamond \\
&Ty(e \rightarrow t)
\end{aligned}
\end{aligned}\]

It might be objected that having multiple ways of deriving a parse is problematic for the framework. But this is not the case. The fact that there are multiple paths to achieve a successful parse is not inimical to the exercise provided that the output is appropriate and each step of a derivation is licensed by computational or lexical actions. In frameworks such as Combinatorial Categorial Grammar (Steedman 1996, 2000), flexibility in constituency assignment is deemed to be a positive aspect of the system, exploited in accounting for non-constituent co-ordination. Unlike CCG, however, what is important in Dynamic Syntax is the process by which
an output is achieved and, as we shall see later in this book, different parsing strategies (possibly signalled by variations in prosodic information) may give rise to different pragmatic effects that may be exploited to convey non-truth conditional information.

Before turning to a more detailed discussion of well-formedness and ungrammaticality it is useful to note, in concluding this section, that the basis for our account of linguistic variation is in differences in lexical actions associated with classes of words. So, in Greek, unlike Irish and English, the parse of a verb induces a structure in which the type-assignment of the subject node is already satisfied by the projection of a metavariable, thus giving rise to pro-drop effects. In both Greek and Irish, on the other hand, unlike English, the parse of a verb projects a full propositional template, giving rise to VSO orders that are excluded in English.\textsuperscript{44} In the chapters that follow, we will use different sets of lexical actions for verbs and pronouns along lines suggested in this section in accounting for different grammatical properties, in particular in accounting for the interaction of dislocated or scrambled expressions with anaphora.

2.6 Well-formedness and ungrammaticality

This chapter has set out the basic framework of Dynamic Syntax that will be exploited in the following chapters to account for more complex constructions. But before we move onto a consideration of these, there is one more essential preliminary step: we need to be clear about the concept of well-formedness that this formalism provides. In what sense can such a parsing-oriented formalism constitute a grammar formalism? More pointedly, given the way we have set out the framework so far, how can only considering one sequence of transitions through a set of options be sufficient to determine well-formedness? This is a good question; because the answer is of course that it cannot. If a system is to constitute a grammar formalism, then it has at the very least to provide a filter determining which sequences made up of English words are not well-formed sentences of the language. In order to determine how this works in DS, we need to look at sequences of transitions which are well-formed, and at what it is that causes a given sequence of transitions to abort.

The well-formed sequences that we have so far established have a number of properties in common. First, the concept of tree growth is central. Decorations are invariably added to the tree: nothing is taken away except requirements, and these go only when fulfilled. Secondly, this concept of growth is essentially progressive: no trivial additions are allowed.\textsuperscript{45} Thirdly, all sequences of transitions share the following properties: the starting point is the axiom, the initial statement that imposes the goal of establishing a logical form of type $t$; the output for all successful sequences is reaching that goal, and with no outstanding requirements: all goals, and all subgoals have to be met. Furthermore they have to be met by following the actions as provided by the words in the linear sequence in which the words are presented. No actions from any word can be put on hold, and used at some arbitrary point later.

These observations give us enough to articulate a preliminary concept of well-formedness:

\begin{equation}
\text{(2.79) To be a well-formed string, there must be:}
\end{equation}

\textsuperscript{44}For main verbs, at least. See chapter 8 for some discussion of auxiliary verb behaviour.

\textsuperscript{45}More formally, the process of growth is upward monotonic, a property which is developed in depth in Kempson et al. (2001).
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- a sequence of actions (lexical and computational) that follows from the initial goal to the construction of a logical form decorating the top node of a tree;
- the lexical actions associated with each word in the string have been used in the sequence in which they appear;
- and there are no outstanding requirements decorating any node in the resulting tree.

More than one logical form may be available, and more than one sequence of actions to establish a logical form. It is notable in fact, given that the concept of interpretation that we invoke is that of an interpretation selected relative to context, that there may be a large number of logical forms that can be associated with a given sequence of words. This has a consequence for ungrammaticality, which represents something of a challenge. In order to be excluded as ungrammatical, given the rules of the system, there must be no possible sequence of transitions using the information presented incrementally by the words in combination with computational actions that yield a single logical form. This means that in checking claims of ungrammaticality, one has to check all possible sequences and establish that no logical form is derivable.\footnote{This is, of course, not a problem specific to Dynamic Syntax, but is actually true of all major theories of syntax.}

To see that this is no mean task, let us take a simple case. How is it that the system guarantees that \textit{John, Mary upset} must map onto the tree equivalent to the string \textit{Mary upset John}, i.e. (2.80), and not that in (2.81)?

\begin{align*}
(2.80) & \quad F_o(\text{Upset}')(\text{John'})(\text{Mary'}) \\
& \quad F_o(\text{Mary'}) \quad F_o(\text{Upset}')(\text{John'}) \\
& \quad F_o(\text{John'}) \quad F_o(\text{Upset}') \\
& \quad F_o(\text{Upset}')(\text{Mary'})(\text{John'}) \\
(2.81) & \quad F_o(\text{John'}) \quad F_o(\text{Upset}')(\text{Mary'}) \\
& \quad F_o(\text{Mary'}) \quad F_o(\text{Upset}')
\end{align*}

Given what the framework provides, why is it not possible for \textit{John} to be construed as subject and \textit{Mary} as object in parsing \textit{John, Mary upset}? Several possible derivations might spring to mind. For example, \textit{Mary} might be taken to decorate an object node which is introduced first on developing the predicate-requiring node or, alternatively, to be taken to decorate an unfixed node introduced after the subject node is established and decorated, which is then merged with the object node. Why are these not licit alternatives to the parse that achieves the correct result?

The answer is simple enough, though a bit laborious to establish. As so far set out, there are two choices at the outset of the construction process. Either \*\text{Adjunction} applies and the word \textit{John} is taken to decorate an unfixed node with \(F_o(\text{John}')\); or \text{Introduction} and \text{Prediction} are applied and \textit{John} is taken to decorate the subject node. The former strategy gives us what we want, so we can leave that on one side as unproblematic. Suppose to the contrary that \textit{John}, as the first word in the string, is taken to decorate the subject node as in (2.82).
At this point, we immediately face a difficulty in parsing the second noun phrase Mary, for once the subject node is parsed, the pointer goes back to the top node, by completion and moves onto the predicate-requiring node, via anticipation. *Adjunction cannot now apply: it is defined to apply only when the pointer is at the node decorated with ?Ty(t) (i.e. not from the predicate-requiring node). *Adjunction also cannot apply more than once from any one node: this is ensured by the requirement that it apply only when there are no other nodes in the (sub)tree of which it is the top. This is the significance of the double brackets ({{}) in the input tree description condition in the definition of *Adjunction in (2.51):

\[
\{\{\{Tn(a),...,?Ty(t),\}\}\}
\]

As soon as either one application of *Adjunction has taken place, or one application of Prediction, this condition will no longer apply. With *Adjunction inapplicable, given the assumption that John has been taken to decorate a subject node, then the only option available is to develop the predicate goal.47 But if Prediction indeed non-trivially applies yielding a node to be decorated with the predicate requirement, ?Ty(e \to t), then the condition for carrying out the actions of the name Mary cannot be applied – its trigger of ?Ty(e) has not been provided and no parse can proceed.

Applying the actions of the verb could of course be carried out if the verb were next in the sequence, as this requirement is the appropriate condition for its sequence of update actions. However, it is Mary that lies next in the sequence of words. But with Introduction and Prediction only applying in English at the level of expanding a propositional node, i.e. with ?Ty(t) as the condition on their application, the trigger for the actions provided by the word Mary is not provided and the sequence aborts. Hence, the impossibility of building an interpretation ‘John upset Mary’ from the sequence John, Mary upset. The only way for a successful derivation to take place, once the decoration on the subject node has been established, is for the update action of the verb to be carried out first. And to enable this to take place, the verb has to be positioned before the noun phrase to be construed as object.

This explanation turns on what may seem to be an ad hoc stipulation that the only form of Introduction and Prediction that is available in English is the one that leads to the formation of subject and predicate nodes. If, instead of this stipulation, Introduction and Prediction are taken to apply in the general, type-neutral, forms given in the rules in (2.14) and (2.16), then they could apply in principle at the predicate-requiring node to yield the (schematic) tree in (2.83) with the pointer at the object node.48

47In principle, another daughter node could be introduced, but any such move would be trivial, as any such node being already introduced would immediately satisfy the requirement ?Ty(e) removing the requirement. By a very general principle of tree growth, such trivial updates are debarred.

48Recall that Prediction puts the pointer at the open argument node.
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(2.83)  

?Ty(t), ?⟨↓0⟩Ty(e), ?⟨↓1⟩Ty(e → t)

Ty(e), Fo(John')

?Ty(e → t), ?⟨↓0⟩Ty(e), ?⟨↓1⟩Ty(e → (e → t))

?Ty(e), ♦

While such type-neutral application of Introduction and Prediction may be necessary in the analyses of certain SOV languages, we would need to ensure that no such application would lead to a well-formed output in English. This is straightforwardly definable by adding one level of complexity to the lexical specification of verbs that forces the sequence of actions to abort in the presence of some constructed daughter node. Since such a definition provides a useful illustration of how lexical specifications can be manipulated, we show it here as an option in (2.84).

(2.84)  

upset

IF ?Ty(e → t) THEN IF ?↓⊤ THEN Abort
ELSE make(⟨↓1⟩); go(⟨↑1⟩); make(⟨↓0⟩); put(?

ELSE Abort.

The only novel aspect to this definition is the use of ↓⊤ in the second condition. The symbol ⊤, the verum (or “the true”) is the converse symbol to the falsum (or “the false”), ⊥, which we have already used in characterising lexical actions as decorating terminal nodes in the tree structure. The verum holds of a node just in case that node has any properties at all. Since in building a node, a value for the Tn (tree-node) predicate must hold, this specification holds of any node that is constructed. The plain downarrow, ↓, without angle brackets refers to the internal daughter modality, mentioned in footnote 28, which holds only of fixed nodes. So ↓⊤ is satisfied just in case there is some constructed daughter node, whatever its properties may be. Thus, if the tree in (2.83) were to be constructed, the parsing of a verb in English would inevitably be aborted, given such a general constraint.

We do not take this stance in what follows, assuming merely that Introduction and Prediction in English only ever builds subject and predicate nodes. Little hangs on such a decision but it shows the challenge ahead. For a string to be ungrammatical, there must be no possible sequence of actions whereby a logical form can be constructed. To check a well-formedness prediction then is easy: there merely has to be at least one route through the maze. To check that something is excluded is much more laborious: there must be no possible route. A consequence of this is that the system does not select between possible parse strategies. In this, it is unlike real-time parsing - it simply makes available a set of sequences of partial trees for a string, any one of which might be used in parsing, and any one of which is sufficient to determine that the string is well-formed.

49 And even, perhaps, in some SVO ones. See Wu (forthcoming) on Chinese.
Chapter 3

Relative Clause Construal

In chapter 2, we introduced the basic machinery of Dynamic Syntax and showed how the framework determines the growth of partial trees that represent the content of strings of words. On the way, we presented accounts of basic sentences in English, including those involving embedded complement clauses and sketched some initial accounts of crosslinguistic variation in such structures. Centrally, we discussed the use of underspecification to provide accounts of both long distance dependencies and anaphora. In this chapter, we take up the challenge posed in chapter 1 to show how the two concepts of underspecification that we have so far used, that of tree position and semantic content, interact and provide coherent explanations of a range of linguistic phenomena. We turn, initially, to an account of relative clause formation in Dynamic Syntax, a construction whose analysis is central to most syntactic theories and which, we argue, displays just the sort of interaction of anaphora resolution and long distance dependency that we expect to find, given concepts of underspecification and time-linear processing.

3.1 Linked Structures

In the last chapter, we saw how individual trees can be built up using information provided by both general rules and lexical instructions, these trees providing the interpretation of some string of words. With respect to our account of anaphora, it is necessary that such trees are not constructed in isolation. The pragmatic process of substitution requires some given context to provide an appropriate substituend for a metavariable projected by a pronoun. Strictly speaking, a sentence containing a pronoun uttered without a context to provide the content of that pronoun will be ungrammatical. This is because, as discussed in the previous chapter, a well-formed string is one that gives rise to a tree without any outstanding requirements. If there is no available substituend for a metavariable, therefore, there will be a formula requirement, ?∃x.Fo(x), that remains unsatisfied. Altering the order of the clauses in (3.1), therefore gives rise to incoherence where there is no preceding context.

(3.1) John entered the room. He was crying.

We return to the issues of context and grammaticality properly in the final chapter of the book, but we adopt here, as in chapter 2, the intuitive idea that a context consists of a set of trees, trees that represent the content of previous utterances.¹

¹The context may be expanded to include trees that represent the content of constructed inferences over these. We leave this aspect of context entirely to one side.
The context also, of course, includes the current tree under construction, allowing
substitution of some term, already constructed, for a metavariable projected later in
the parse process, as in (3.2), without any recourse to other trees in the context.

(3.2) Mary thought she was overworked.

In order to characterise relative clauses, we extend our notion of context to
allow one partial tree to be built which provides the context in which some other
structure is then built. The process of completing the first tree then takes place
in the context of having constructed the intermediate tree as a side-routine. In
this way, we allow the processor to build structures in tandem, which provide
contexts of interpretation for each other. This is what we propose happens in
relative clause construal, which we take as the proto-typical case of such joint
structure-building. In this way, our analysis treats a major subpart of natural-
language recursion as the progressive projection of individually simple structures
which share a context. The methodology, as before, is to closely follow the dynamics
of time-linear processing, showing how complex interpretations can be established
through the use of underspecification interacting with tree growth processes.3

3.1.1 Analysing non-restrictive relative clauses

As before, we start with English, and we take first the process of adding a relative
clause modifier to a name, the so-called non-restrictive relative clause construction.
Standard frameworks often have little to say about this construction and begin (and
usually end) their analysis of relative clause formation with respect to restrictive
relative clauses such as every man who I like. However, unlike other frameworks,
as we shall see, non-restrictive relative clauses provide the most transparent illus-

To start us off, consider what is going on in the processing of (3.3):

(3.3) John, who Sue likes, smokes.

(3.3) involves a dual assertion about John, namely that Sue likes him and that
he smokes, though the assertion that Sue likes John is, in some sense to be made
precise, subordinate to the assertion that he smokes. In standard predicate logic,
the content of this sentence is expressed in terms of two conjointed propositional
formulae containing two instances of the logical name John, as in (3.4), the first
conjunct expressing the content of the matrix clause and the second, that of the
relative clause.

(3.4) Smoke(John) \land (Like(John))(Sue)

Taking the English string in (3.3) together with its predicate logic counterpart in
(3.4), we might interpret the process of getting from the first to the second as
involving:

• the initial identification of a term John through a parse of the name John;
• a copying of that term over to a second propositional structure which is con-
  structed through a parse of the relative clause;

2 We shall use the same style of analysis for Hanging Top topic constructions, co-ordination and copular clauses, see chapters 4, 7 and 8.
3 This chapter, like the previous one, incorporates results of Kempson et al. (2001), though
with some additions, in particular the discussion of non-restrictive relative clause construal.
4 We take up the analysis of restrictive relatives once we have introduced quantification: see
section 3.2.
3.1. LINKED STRUCTURES

- and then a subsequent completion of the main clause through a parse of the verb *smokes*.

This is exactly the process we use to account for relative clause construal in general. We take the process of projecting a second propositional structure as involving the notion of a “link” between one completed node of type *e* in a partial tree and the top-node of another tree decorated by a propositional requirement (?Ty(t)). The word *who*, which we treat as a relative pronoun, following Jespersen (1927) and many another traditional grammarian, provides a copy of the formula decorating the node from which the link is projected (the “head”). The parse of the remaining string then proceeds in the way that we have seen for other left dislocation structures in chapter 2, to give an output formula value Fo(Like′(John′)(Sue′)) just as in a parse of the string *John, Sue likes*. The initial tree is then completed through a parse of the verb to yield a propositional formula Fo(Smoke′(John′)), with the whole structure then being interpreted in terms of conjunction of the two propositions decorating the two trees. We show the output structure schematically in the figure in (3.5) where the “link” relation is shown by the thick black arrow.

(3.5) The representation of (3.3):

```
Ty(t), Fo(Smoke′(John′))
```

3.1.2 Defining LINK

We now turn to a formal definition of the “link” relation and the details of the analysis of non-restrictive relative clauses. To model this, we introduce a new pair of modal operators ⟨L⟩ and its inverse ⟨L⁻¹⟩. The former ‘points’ to a tree linked to the current node, while the latter naturally ‘points backwards’ to that node. We now refer to any node plus tree involved in this relation as LINK structures to differentiate the technical use from its common interpretation. Thus in the tree in (3.5), the black arrow symbolises the forwards LINK relation ⟨L⟩ and, because the treenode from which the LINK is projected has an address Tn(00), the relation from the top-node of the so-called “LINKed” tree can be shown using the inverse modality as ⟨L⁻¹⟩Tn(n) to the head node (or, equivalently, in (3.5) ⟨L⁻¹⟩⟨↑0⟩Tn(0)) to the top-node of the matrix tree).

Kempson et al. (2001: 110) extends the notion of treenode address to LINK structures so that L is a valid argument of the treenode predicate Tn in addition to 0 and 1, the address of a node which is inversely “LINKed” to a head with address Tn(a) being given as Tn(aL). So we
Such LINK relations are introduced by a rule of LINK ADJUNCTION. This rule, specified in (3.6) for English, additionally imposes a requirement on the new LINKed structure that it should contain somewhere within it a copy of the formula that decorates the head node from which the LINK relation is projected. The result of applying the rule to a particular node in terms of treegrowth is shown in (3.7) which projects from a matrix subject node decorated by a parse of the word John in the way we have now seen many times.

(3.6) LINK ADJUNCTION (English) (Rule)

\[
\begin{align*}
\text{head} \rightarrow \{ \ldots \{Tn(a), Fo(a), Ty(e), \varnothing \} \ldots \} \\
\{ \ldots \{Tn(a), Fo(a), Ty(e) \ldots \}, \langle L^{-1} \rangle Tn(a), Ty(t) \}, ?\langle \downarrow \ast \rangle Fo(John'), \varnothing \}
\end{align*}
\]

Firstly, notice that, in requiring a copy of the formula of the head to be found within the LINK structure, this rule encapsulates the idea that the latter tree is constructed in the context provided by the first partial tree. The rule thus cannot operate on a type-incomplete node and ensures that both structures share a term. Secondly, the requirement to find the copy of the shared term (Fo(John')) in this case is modal in form, indicating that the copy should be found somewhere in the unfolding propositional tree but without specifying where in that tree it should occur. This, recall, is the means by which left-dislocation structures are characterised as having an initially unfixed node. Expressed here as a requirement, it embodies the restriction that somewhere in the ensuing construction of the tree from this node, there must be a copy of the formula decorating the head. This restriction is notably transparent, stated in this modal logic vocabulary. The structure thus develops for English with an application of *Adjunction to provide an unfixed node in anticipation of securing that copy, giving rise to the tree in (3.8).

We do not use this type of address, preferring to show LINK relations in terms of the inverse LINK operator directly.

\[
\langle L^{-1} \rangle Tn(a) \iff Tn(aL)
\]

In fact, a family of such rules, as we shall see in later chapters.

7Irrelevant details, such as bottom restrictions, tense, etc., are not shown in this and subsequent tree displays.
3.1. LINKED STRUCTURES

(3.8) Parsing *John* with **Link Adjunction** and **Adjunction**

```
Tn(0), ?Ty(t)
\langle 1_0 \rangle Tn(0), ?Ty(e), F_o(John')
\langle L^{-1} \rangle \langle 1_0 \rangle Tn(0), ?Ty(t), \langle \downarrow * \rangle F_o(John')
\langle 1_* \rangle \langle L^{-1} \rangle \langle 1_0 \rangle Tn(0), ?Ty(e), \diamond
```

This requirement need not be satisfied immediately: all that \(\langle \downarrow * \rangle F_o(John')\) requires is its satisfaction at some point before the LINKed tree is completed. When we turn to other languages, this will be significant, as this combination of requirement and modal statement provides a natural means of expressing a range of non-local discontinuities between either the head or some clause-initial complementiser and a pronoun within that clause functioning resumptively. At no point does there need to be adjacency in the structure between the term providing the requisite formula as head and the term realising the requirement for a copy of it: the modality in the formula specification captures all that is needed to express long-distance dependencies of this form. In English, as it happens, the requirement imposed by the construction of a LINK transition is met immediately, a restriction, as noted, which is induced by the lexical actions of the relativisers who, which, and that. These are defined as rule-governed anaphoric devices that decorate an unfixed node within a LINKed structure, as shown by the lexical actions associated with who given in (3.9).

```
(3.9) who_{rel}
      IF \quad ?Ty(e), ?\exists x. Tn(x), \langle \downarrow * \rangle (L^{-1}) F_o(x)
      THEN \quad \text{put}(F_o(x), Ty(e), [\downarrow])
      ELSE \quad \text{Abort}
```

The context for parsing the word is complex in order to enforce its strict distribution. What the conditional action says is that if from an unfixed node, there is the LINK relation defined to some node decorated by some formula \(F_o(x)\), then a copy of that formula should be provided for the current node. This action is notably like that of a pronoun, even to the decoration of the node with a bottom restriction, except that the value is fully determined as being that decorating the head from which the LINK transition is defined. The effect of these actions in parsing *John, who* is shown in (3.10), the copy requirement now being obviously satisfied.
(3.10) Parsing John, who

\[ T_n(0), \text{Ty}(t) \]

\[ \langle \|_a \rangle T_n(0), \text{Ty}(e), \text{Fo}(John') \]

\[ \text{Ty}(e \rightarrow t) \]

\[ \langle L^{-1}\rangle \langle \|_a \rangle T_n(0), \text{Ty}(t), \text{Ty}(e \rightarrow t) \]

\[ \langle \|_a \rangle T_n(0), \text{Ty}(e), \text{Fo}(John') \]

\[ \text{Ty}(e \rightarrow t) \]

The process of tree construction then proceeds as in a standard left-dislocation case. The subject and predicate nodes of the LINKed tree are introduced and decorated by lexical actions. The unfixed node then duly has its position established through the process of MERGE with the internal argument node, as shown in (3.11).

(3.11) Completing the parse of John, who Sue likes

\[ T_n(0), \text{Ty}(t) \]

\[ \langle \|_a \rangle T_n(0), \text{Ty}(e), \text{Fo}(John') \]

\[ \text{Ty}(e \rightarrow t) \]

\[ \langle L^{-1}\rangle \langle \|_a \rangle T_n(0), \text{Ty}(e), \text{Fo}(John') \]

\[ \text{Ty}(e \rightarrow t) \]

\[ \langle \|_a \rangle T_n(0), \text{Ty}(e), \text{Fo}(John') \]

\[ \text{Ty}(e \rightarrow t) \]

\[ \exists x. T_n(x) \]

\[ \text{Ty}(e \rightarrow t) \]

\[ \text{Fo}(Like') \]

Once the MERGE step has taken place, the linked structure can be completed by steps of COMPLETION, THINNING, and EVALUATION, all as before, until the top of the LINKed tree is reached. At this point, however, we can get no further as there is currently no rule to move the pointer back to the head node to allow a completion of the parse. However, we may revise the rule of COMPLETION from the last chapter as in (3.12) to move the pointer from a type-complete node across any daughter or inverse LINK relation.

(3.12) COMPLETION (Revised):

\[ \{ \ldots \{ T_n(n) \ldots , \{ \mu^{-1} T_n(n) , \ldots , T_y(X), \ldots , \hat{\diamond} \} \ldots \} \ldots \} \]

\[ \{ \ldots \{ T_n(n) , \ldots , \{ \mu \} T_y(X) , \ldots , \hat{\diamond} \} , \{ \mu^{-1} T_n(n) , \ldots , T_y(X) , \ldots \} \ldots \} \ldots \}

\[ \mu^{-1} \in \{ \|_a , \|_1 , \|_s , L^{-1} \} \quad \mu \in \{ \|_a , \|_1 , \|_s , L \} \]
With this small revision in place, the matrix proposition can be completed, essentially to yield the tree in (3.5).

There is, however, one further step to take and that is to provide a means of interpreting such a tree. As noted above, non-restrictive relative clauses give rise semantically to a conjoined propositional structure. We therefore introduce the first in a series of what we call LINK evaluation rules, as given in (3.13). This rather complex looking rule takes a completed propositional tree with treenode address $Tn(a)$ that has embedded in it somewhere a propositional structure LINKed to some node dominated by $Tn(a)$ and returns a conjunction of the two formula values decorating the rootnodes of those propositional trees. We end up, therefore, with the tree in (3.14).

(3.14) Completing a parse of *John, who Sue likes, smokes*

Notice what this account of relative clauses involves and how this differs from most other accounts. In the first place, the whole account rests on two concepts of underspecification, of position within a tree and of content, both of which are used to characterise other phenomena. Secondly, and most importantly, the story of relative clause construal is fully anaphoric, involving no concepts of quantification or binding. Relative pronouns are analysed in the same way as we have analysed personal pronouns: as expressions that have underspecified content. The difference between the two types of pronoun is that personal pronouns may get their content through a pragmatic process of substitution (fairly) freely from the context, while relative pronouns directly copy some term specifically identified in the unfolding structure, i.e. that provided by the head. Because of this, and because of the properties of merge which merely unifies the information associated with two constructed treenodes, there is no record in the output that the string that gives rise to the structure contains a relative pronoun. Indeed, as we shall in later chapters, the structure given in (3.14) is exactly the same as the output that would
result in a successful parse of (3.15), where the LINK structure is projected by the conjunction and and he is construed as John.

(3.15) John, and Sue likes him, smokes.

We will be exploring the consequences of this account of relative clauses throughout much of the rest of this book, but before we do so, it is worth noticing a further property of the analysis, associated with the concept of LINK. This has to do with our account of left dislocation. The modality introduced for unfixed nodes by *Adjunction is, as we have seen, ⟨↑∗⟩ (and its inverse ⟨↓⟩). This modality ranges over the closure of ‘dominated by’, ↑ (or ‘dominate’ ↓) relations. It does not range over LINK relations ⟨L⟩ or ⟨L−1⟩. This means that no unfixed node of this sort can be merged with a position that is contained within some structure LINKed to the tree into which it is introduced, as schematically shown in (3.16).

(3.16) Illicit merge:

\[ \ast T_n(a), T_y(t) \]

\[ ⟨↑∗⟩T_n(a) \phi \quad ⟨↑⟩T_n(a) \]

\[ ⟨L−1⟩⟨↑⟩T_n(a), ?T_y(t) \]

\[ ⟨↑⟩⟨L−1⟩⟨↑⟩T_n(a) \]

This provides us with a straightforward account of strong islands and precludes the derivation of strings like those in (3.17), which exhibit violations of Ross (1967)’s Complex NP Constraint.

(3.17) a. *Who did John, who likes, smoke?
    b. *Sue, John, who likes, smokes.

3.1.3 Interactions of Anaphora and Long-Distance Dependency

There is a more general significance to this analysis. Long-distance dependency, anaphoric expressions, and relative clause construal each display the property of projecting some weak specification of structure which is subsequently enriched. Of these, we have already seen the feeding relation between introducing a linked structure, the construction of an unfixed node, and the parsing of the relative pronoun.

One type of underspecification that has not so far been brought into this sketch of relative clause construal is the less constrained pragmatic process of anaphora resolution. Yet in analysing the construal of anaphora, relative clause and long-distance dependency all as different aspects of the same sort of process, that of tree growth, we might expect there to be interaction between the three processes of interpretation, and, as we saw in a preliminary way in chapter 1, indeed there is. It is to this topic that we now turn.
### 3.1. LINKED STRUCTURES

#### 3.1.4 Crossover

In (3.18) the word *he* cannot be construed as picking out the same individual as the expression *John*, while, in (3.19), it can:

(3.18) John, who Sue is certain he said would be at home, is in the surgery.

(3.19) John, who Sue is certain said he would be at home, is in the surgery.

When first observed by Postal (Postal 1970), this phenomenon was called crossover to reflect the fact that analysing word order variation in terms of moving expressions from one position to another, the *wh* expression is moved, “crossing over” a pronoun, an effect which debars interpretation of *wh*, pronoun and gap as co-referring. In more recent work such as Postal (1993), this restriction is still classified as a mystery, and remains a major challenge to any linguistic theory.

The problem is that the data have to be seen, as in the original Postal analysis, as splitting into at least two different phenomena, called strong and weak crossover, and each is yet further subdivided into two further subcategories: ‘extended strong’ and ‘weakest’ crossover. In Lasnik and Stowell’s (1991) account, a discrete concept of gap called a ‘null epithet’ is posited in addition to the array of empty categories already posited at the time. There remains no satisfactory integrated explanation within movement frameworks. Indeed it has become standard to treat these phenomena entirely separately, all requiring very different analyses, as though such a proliferation of discrete categories is not problematic (see e.g. Boeckx (2003), de Cat (2002), for recent discussion). There have been a number of relatively recent analyses in non-movement frameworks attempting to reduce the plethora of facts to a single phenomenon, but it remains very generally intransigent in any account which fails to reflect the linearity intrinsic to the distribution.

The extent of the puzzle can be traced directly to the static methodology of the jigsaw view of language. The problem arises in that type of framework, because the observed patterns are analysed exclusively in terms of the hierarchical relationship between a pronoun and a posited empty position, ‘the gap’. All reference to the dynamics of left-right processing is, by standard assumptions, debarred in syntactic explanations of linguistic data (see chapter 1). According to this standard perspective, if pronoun and gap are both arguments and the pronoun c-commands the gap (as (3.18) would standardly be analysed), an interpretation in which the pronoun and *wh*-expression are taken to denote the same entity is not possible given binding principle C. This is because that principle debars an empty category from being interpreted as referring to the same entity as any c-commanding argument expression whatever, the gap supposedly having name-like properties which require it to be free.

---

8We cite these here without any indexing indicating the licensed interpretation, contrary to normal methodology, as these sentences are fully well-formed. It is simply that some interpretations are precluded.

9See Hepple (1990), which requires an account of all cross-sentential anaphora as entirely distinct; and Safir (1996), which the author himself notes fails to extend appropriately cross-linguistically. Dalrymple et al. (2001), Kempson and Gabbay (1998), Kempson and Meyer-Viol (2002), Shan and Barker (forthcoming), by contrast all invoke concepts of linearity as an integral part of the explanation.

10Incidentally, this observation of unique binding of the gap by the *wh* expression, which is construed as an operator, guarantees that, despite the adoption of predicate-logic forms of binding as the working metaphor for LF representations, nevertheless the “binding” of the gap by the associated *wh* has to be distinct from a quantifier-variable binding operation because quantifiers can bind an arbitrary number of variables, hence the specially defined concept of a “syntactic operator” (Chomsky 1981, Koopman and Sportiche 1982).
This principle-C style of analysis will not apply if the pronoun precedes but does not c-command the gap, because the filter will not apply. Crossover environments in which the pronoun is contained in a complex determiner are accordingly analysed as a distinct phenomenon “weakest crossover”, since under some circumstances these are able to be construed as co-referring as in (3.20).\footnote{In this and the following examples, we revert to the standard methodology of co-indexing to indicate the relevant possible interpretation. In particular, we use the trace notation without any commitment to such entities to indicate the position in the interpretation process at which the unfixed node associated with the parsing of who will be resolved.}

\begin{equation}
(3.20) \text{John, who, Sue said his, mother worries about } e_i, \text{ has stopped working.}
\end{equation}

The surprise for this form of analysis, in the standard terminology, is that if the pronoun c-commands the gap but the binder is complex, then judgements of grammaticality do not coincide with strong crossover cases as might be expected. Instead, they pattern with those observed of weak crossover in allowing co-referring interpretations, despite their classification with the much stronger ‘strong crossover’ restriction, the so-called ‘extended strong crossover’ restriction (3.21).\footnote{Boeckx (2003) and Asudeh (2004) are recent advocates of an integrated account of what they both identify as resumptive pronouns, in the Asudeh analysis purporting to nest this as a mere sub-case of pronominal anaphora; but, as things turn out, many of the relevant phenomena, in particular the use of resumptive pronouns in English, they both set aside as involving a distinct form of pronoun, “an intrusive pronoun”, thereby denying the possibility of the complete account that is claimed.}

\begin{equation}
(3.21) \text{John, whose, mother, he, worries about } e_j \text{ far too much, has stopped working.}
\end{equation}

The parallelism in the acceptability judgements of examples such as (3.20) and (3.21) is entirely unexplained. It is problems such as these that led Lasnik and Stowell to posit the “null epithet” as a further form of empty category needed for what is itemised as $e_i$ in (3.20). This behaves, not like a name as the principle C account would expect, but like a pronoun, hence subject to principle B. But positing an additional type of empty category just adds to the puzzle (see Safir 1996, 1999). Whatever the merits of the analysis in providing new theoretical constructs that are compatible with the data, it is clear that this does not constitute anything like an explanation of how anaphoric processes and long-distance dependency interact; and indeed the phenomenon has never been addressed by syntacticians at this level of generality.\footnote{The debate is often discussed in connection with wh-question data, but here we restrict our attention to crossover phenomena in relatives. See Kempson et al. (2001) for a fuller discussion which includes wh-questions.}

With a shift into a methodology which pays close attention to the way in which interpretation is progressively built up within a given structural context, the account is, by comparison, strikingly simple. Using steps introduced in chapter 2 and section 1 of this chapter, the emergent structure of (3.18), which we now take in detail, can be seen as built up following a combination of computational and lexical actions. The expression John is taken to decorate a fixed subject node, and, from that, a LINKed structure is projected by LINK Adjunction which imposes the requirement to find a copy of $Fo(John')$ in this structure, as we have seen. An unfixed node is constructed within that newly introduced structure via *Adjunction which is duly decorated with that formula by the lexical actions associated with parsing the relative pronoun. Subsequent parse steps then lead in succession to the setting up of a subject node, and its decoration with $Fo(Sue')$; the introduction of a predicate-requiring node (decorated with $?Ty(e \rightarrow t)$); the construction of a function node (decorated with $Fo($Certain$')$) and its attendant second-argument node.
(decorated with \(?Ty(t)\)). This leads to the construction of the embedded subject node, with the lexical actions of the pronoun providing a metavariable \(Fo(U)\) of type \(e\) as decoration. The structure at this point in the parse is shown in the tree display in (3.22).

(3.22) Parsing John, who Sue is certain he:

\[
\begin{align*}
&\text{Ty}(e), \quad ?Ty(e \to t) \\
&\text{Fo}(\text{John'}) \\
\end{align*}
\]

\[
\begin{align*}
&Ty(e), \quad ?Ty(e \to t) \\
&Ty(t \to (e \to t)), \quad \text{Fo}(\text{Certain'}) \\
\end{align*}
\]

The question is, can the metavariable provided from the pronoun be updated by \(Fo(\text{John'})\), thereby licensing an interpretation of the embedded subject as the same John as already being talked about? And what are the consequences of selecting this interpretation? The answer is that there is nothing in the content of either the formula \(Fo(\text{John'})\) or the formula assigned to the pronoun, \(Fo(U)\), to prevent the latter from being updated by the former. \(Fo(\text{John'})\) is thus a possible update for the metavariable. But if that is the adopted choice, then there will be a fixed node in the structure decorated by the term given by \textit{John}, i.e. the tree position decorated by the pronoun. So the necessary update to the unfixed node by determining its fixed role within the structure will be available by a step of \textsc{merge}.

As it turns out, this use of \textsc{merge} to unify these partially specified nodes is the only way of updating the metavariable projected by the pronoun under this interpretation. \textsc{Substitution} is inapplicable here. This follows from the condition that this excludes substitution by a formula decorating a co-argument node. This was given in chapter 2 and is repeated below:

\[
\begin{align*}
\text{Subst}(\alpha) & \quad \text{IF} \quad \text{Fo}(U), Ty(e) \\
& \quad \text{THEN} \quad \text{IF} \quad \langle\{0\}\rangle \langle\{\rangle \langle\{0\}\rangle Ty(e), \quad \text{Fo}(\alpha) \\
& \quad \text{THEN} \quad \text{Abort} \\
& \quad \text{ELSE} \quad \text{ELSE} \quad \text{put}(\text{Fo}(\alpha)) \\
& \quad \text{ELSE} \quad \text{Abort}
\end{align*}
\]

This might seem not to apply to unfixed nodes, but it does, because between the step introducing an unfixed node into a partial tree and the step at which that
CHAPTER 3. RELATIVE CLAUSE CONSTRUCTION

structural underspecification is resolved, the unfixed node is evaluated step by step against each new node that is introduced in the emergent tree, as discussed in the last chapter. Hence, the contents of an unfixed node are passed through a tree, node by node, as each is introduced, seeking a point of merge. This means that at the point of evaluation the embedded subject node in (3.22) is being evaluated for the putative set of decorations shown below, the first line giving the DU associated with the unfixed node \( \text{DU}_1 \) and the second that of the fixed position \( \text{DU}_2 \).

\[
\text{DU}_1: \quad \{ \langle ↑^* \rangle \langle L^{-1} \rangle \langle ↑^0 \rangle \langle ↑^0 \rangle Tn(0), \exists x. Tn(x), F_0(\text{John}'), Ty(e), [\| \perp] \}
\]

\[
\text{DU}_2: \quad \{ \langle ↑^0 \rangle \langle ↑^0 \rangle \langle ↑^1 \rangle \langle L^{-1} \rangle \langle ↑^0 \rangle Tn(0), \exists x. F_0(x), F_0(U), Ty(e), [\| \perp, \Diamond] \}
\]

For application of merge, this situation is impeccable: there are two \( Tn \) values and two \( F_0 \) values, but in both cases, the one value entails the other, so the growth relation is preserved, and nothing prevents this set of decorations decorating the same node. There is a terminal-node (“bottom”) restriction associated with all updates to values for the pronoun’s metavariable. This is, however, preserved in the merge step, for the relativiser who also imposes a terminal node restriction. What the latter copies from the head is only its formula value, not any structure that gives rise to that value. Hence, the copy decorates a single node with no internal structure and the bottom restriction is not violated.

Unlike merge, however, substitution does not lead to a successful result. Substituting the formula \( F_0(\text{John}') \) as the selected value for the metavariable \( F_0(U) \) is debarred, because of the locality restriction associated with the updating of the pronominal metavariable in (2.65) which excludes as potential substituends any formulae that decorate nodes which match the locality restriction:

\[
\langle ↑^0 \rangle \langle ↑^* \rangle \langle ↓^0 \rangle F_0(\alpha)
\]

Given that all Kleene star relations include the empty relation, this description applies to any formula decoration that is at the node itself (i.e. \( \langle ↑^0 \rangle \langle ↓^0 \rangle \)). So substituting the formula \( F_0(U) \) by \( F_0(\text{John}') \) as value is precluded, even though the node from which some other copy of that formula has been established might be in a suitably non-local relation (such as the matrix subject node in (3.22)).

Hence, merge is the only means of securing \( F_0(\text{John}') \) as the selected update to the metavariable projected by the pronoun in the embedded subject position. Yet this also turns out to be a precluded choice of strategy. This is because, if merge is adopted at the point of having processed the pronoun, things go wrong thereafter, because the unfixed node, being now fixed, is no longer available for updating some later partial structure. In parsing John, who Sue is certain he said would be at home, is in the surgery, the crunch point comes after parsing the verb said. The word in the string that follows this is another verb requiring (in English) a predicate goal to trigger its lexical actions. However, what follows said is a propositional structure in which introduction and prediction apply to derive subject and predicate goals, but with the pointer on the subject node. This is decorated with the requirement \( ?Ty(e) \). If no merge of the unfixed node has previously occurred, then it can provide the necessary update, satisfying the type requirement and the parse can continue. However, if the unfixed node has been fixed earlier, there is no possible update to satisfy the type requirement and the parse will abort.

Since substitution is precluded and merge of the unfixed node with the embedded subject node in (3.22) leads inevitably to a failed parse, he in (3.18) cannot be construed as being co-referential with John. The strong crossover effect is thereby accounted for straightforwardly in terms in terms of the interaction of updating different types of underspecification: tree position and content.
3.1. LINKED STRUCTURES

Notice how the difficulty here arises solely because the pronoun is construed as picking out the doctor in question. If however, he had been interpreted as ‘Tom’, or ‘Dick’, or ‘Harry’, etc., indeed anything other than the name picking out the indicated individual John, then there would be no problem at any juncture in the parsing process. The unfixed node with a term picking out John would still be described as unfixed at the point at which the embedded predicate is reached, and so at this point, this unfixed node could be updated appropriately. Hence it is only interpretations of the pronoun as anyone other than John that lead to a well-formed result in (3.18).

In (3.19), no such problem arises. This is because the process which merges the unfixed node with the first embedded subject node occurs before the pronoun is processed. So when the interpretation process reaches that point, there is no problem interpreting the pronoun. It can be interpreted as John because there is no local node now decorated with $Fo(John')$, because the information associated with the unfixed node, now fixed, is no longer being passed down the tree. The tree display in (3.23) illustrates this process schematically up to the point where substitution applies to the metavariable (shown by the double uparrow, $\uparrow$, as regularly from now on).

(3.23) Parsing John, who Sue is certain said he:

$$
Tn(0), ?Ty(t)
$$

\[\langle\downarrow\rangle Tn(0), Ty(e), ?Ty(e \rightarrow t) \]

\[\langle L^{-1}\rangle\langle\downarrow\rangle Tn(0), ?Ty(t) \]

\[Ty(e), Fo(Sue') \]

\[Ty(t \rightarrow (e \rightarrow t)), Fo(Certain') \]

\[Ty(e), Fo(U), \uparrow \]

\[Ty(e \rightarrow t) \]

The answer to the question as to why the pronoun can be identified with the wh relativiser in both (3.20) and (3.21) now reduces to the question of whether the

\[14\text{Notice that the figure is purely schematic, and is intended to show the main steps in the derivation, up to the point at which the pronoun is parsed. It does not show strictly just the structure at the point at which substitution takes place, since by this time the unfixed node would be fixed properly in the relevant position.}\]
node decorated by the pronoun is relevant to identifying the fixed tree position for
the unfixed node. The simple answer is that it is not, in either case. In (3.24), if the
pronoun, he, is identified as having a formula value identical to the wh expression,
whose, by virtue of being interpreted as a copy of the head, this has no consequences
for identifying the tree position of the unfixed node. This follows because the wh
expression projects merely a subterm for the formula decorating the unfixed node.
That is, construal of he as ‘John’ cannot be the result of establishing the tree
position for the node annotated by a formula constructed from whose mother:

(3.24) John, whose, mother Sue says he, worries about e_j far too much, is at
the hospital.

Not only will consistency of node annotations rule out any application of MERGE;
so too will the terminal node restriction imposed by the pronoun. To similar effect,
in the case of weak crossover, no node internal to a determiner can provide an
update for the unfixed node projected by the relative pronoun who. In this case,
with the wh expression not being complex, the account turns on the analysis of
genitive pronouns such as his. These might be analysed as defining a complex
operator introducing a metavariable as part of its restrictor without assigning it
any independent node, in which case the terminal node restriction imposed by
the wh pronoun will fail to be met. Alternatively, his might be analysed along
with more complex genitive constructions as projecting a distinct linked structure
whose internal arguments cannot provide an update for a node unfixed within the
structure initiated by the relativising particle. Either way, as with extended
strong crossover effects, there will be no interaction between the construal of the
wh expression and the pronominal, and so an interpretation of the pronoun as
picking out the same individual as is picked out by the head is available:

(3.25) John, who Sue said his mother was very worried about e_j has stopped
working.

The short version of this rather long story about crossover is that we get
crossover effects whenever there is interference between the updating of an unfixed
node and the updating the underspecified term provided by a pronoun. Whenever
no such interference is possible, for whatever reason, the interpretation of
the pronoun is free. We thus have the beginnings of an account of crossover data
that spans strong, weak and extended strong crossover data without any grammar-
internal stipulations particular to these sub-cases: the different forms of interpre-
tation available emerge solely from the interaction of the process of building up
structure for the construal of the relative and the process of establishing a value
for a pronoun.

This kind of feeding relation between processes of construing strings displaying
long-distance dependency and the construal of a pronoun is extremely surprising
if the problem of pronoun construal is taken as different in kind from the problem
posed by long-distance dependency (the “imperfection” problem – see chapter 1).

15 See Kempson et al. (2001: 144-148).
16 The analysis of genitives as ‘implicit relatives’ is well attested in the literature (Baker 1996,
Kayne 1994, etc). Notice that this form of analysis provides a basis for characterising their island-
like status: dependencies are in general not available between a pair of terms, one external to some
structure projected from a genitive marker and one within that structure. An alternative is to
analyse genitives as locally unfixed with respect to the node introduced from a &Ty(e) decoration.
This characterisation of a genitive as decorating an unfixed node will prevent application of some
unfixed node as putative argument of a genitive imposed structure, as the appropriate tree update
will not be available (see chapter 6 for discussion of Local*Adjunction in connection with
Japanese).
Indeed, this feeding relation can only be modelled directly if we assume that the interpretation of both involves updating tree structures on a left to right basis with decorations leading to constructed logical forms. So the explanation turns on treating pronoun construal and long-distance dependency as two sides of the same coin: both project aspects of underspecification in a structure building process.

It also provides our first case where explanation of a syntactic distribution has invoked intermediate steps in the interpretation process. The distribution cannot be defined over the input to the relative construal process (trivially, since the input is on this assumption merely a single top-node requirement); but nor can it be defined over the output structure. What is critical is the dynamics of how some interpretation may be licensed only if a certain kind of choice is made at an intermediate step.

The significance of this account is that there has not been any need to define strong, weak, weakest, or extended strong crossover, as discrete sets of data, to be analysed in terms of different structures requiring quite different analyses.\(^{17}\) This is quite unlike most analyses, in which weak crossover is uniformly seen as a separate phenomenon from strong crossover, not even requiring a related basis of explanation; and the generality of the underlying explanation as a consequence of the feeding relation between two simple and independently motivated processes is missed altogether.\(^{18}\)

### 3.2 Quantifier Phrases and Restrictive Relative Clauses

Before we can extend our account of relative formation to restrictive relative clauses, we need to present the DS account of quantified noun phrases. Against the normal trend, we presume on an analysis of natural language quantification in which the mapping of quantified expressions is never onto a type higher than type \(e\). The type of structure we define is given schematically in (3.26).

\[(3.26) \text{Structure of Terms:} \]

```
T_y(e)  
\downarrow                   \downarrow
T_y(cn)  T_y(cn \rightarrow e) 
\downarrow                   \downarrow
T_y(e)  T_y(e \rightarrow cn) 
\text{VARIABLE}  \text{RESTRICTOR}
```

This tree shows how quantified noun phrases, although taken to project terms of type \(e\), are nevertheless associated with internal structure, indeed, more or less the structure that one would expect on any standard account of quantified noun phrases. Given our perspective that what is built by syntactic processes is semantic structure for a resulting logical form, this may seem surprising. How can this be what is wanted for quantifying expressions?

To see what is going on here, we need to start from the stance that others adopt about quantification, and the internal structural properties of noun phrases, in order to see to what extent the Dynamic Syntax account is different. The point

\(^{17}\)We have not discussed crossover in WH-questions: see Kempson et al. (2001: 213-216).

\(^{18}\)This is not to deny that the challenge of reducing the plethora of crossover types to a single phenomenon is not recognised by some (Hepple 1990, Dalrymple et al. 2001), but without the dynamics of intermediate stages in the update process, no fully integrative approach is possible.
of departure for all formalisms is that predicate logic, in some sense to be made precise, provides an appropriate underpinning for representing the semantic properties of natural language quantification. The existential and universal quantifiers of predicate logic give the right truth conditions, at least for the analogous natural language quantifiers, every and the indefinite singular a/some. However there is an immediate problem, because, at least on the face of it, the syntax of predicate logic and the syntax of natural languages are not alike. In predicate logic, the quantifiers are propositional operators: they take open propositional formulae, and bind variables in them to yield a closed propositional formula. Moreover, the open formulae are complex and require different connectives depending on the quantifier selected. So, the existential quantifier is associated with conjunction (\(\land\)) and the universal with material implication (\(\to\)). The predicate logic translations of (3.27a) and (3.28a) are thus (3.27b) and (3.28b), respectively.

\[(3.27)\]
\[\begin{align*}
\text{a. Every student laughed.} \\
& \forall x (\text{Student}'(x) \to \text{Laugh}'(x))
\end{align*}\]

\[(3.28)\]
\[\begin{align*}
\text{a. A lecturer cried.} \\
& \exists y (\text{Lecturer}'(y) \land \text{Cry}'(y))
\end{align*}\]

Considered in terms of its combinatorial properties, in other words its logical type, the quantifier \(\forall\) is accordingly of type \(t \to t\), an expression that maps propositional formulae into propositional formulae. This makes it structurally quite unlike quantified expressions in natural languages, which fill argument positions just like other NP expressions.

The move made in Montague semantics and all formal semantic formalisms following that tradition (Montague 1974, Dowty et al. 1981, Carpenter 1998, Morrill 1994, etc.) is to retain the insight that the predicate logic formula for a universally quantified statement expresses the right truth conditions for a sentence such as Every student laughed, but recognise that the words of English are not mapped onto the predicate logic formula directly. Montague’s proposed solution is to define the types of every, student and laughed so as to make sure that the determiner may combine first with the noun, and then with the predicate (as its argument) to yield a propositional formula. Since student and smoke are (one-place) predicates according to standard assumptions of predicate logic, this means defining every as having a high type \(((e \to t) \to (e \to t) \to t)\). When such a type combines with a noun the result is an expression of type \((e \to t) \to t\) which may combine with a (one-place) predicate, expressed by some verb phrase, to yield a propositional formula (of type \(t\)). The derivation of the formula in (3.27b) proceeds as follows:

<table>
<thead>
<tr>
<th>Expression</th>
<th>Type</th>
<th>Translation</th>
</tr>
</thead>
<tbody>
<tr>
<td>every</td>
<td>(((e \to t) \to t)) \to \lambda Q \lambda x. Q(x) \to P(x)</td>
<td></td>
</tr>
<tr>
<td>student</td>
<td>((e \to t))</td>
<td>Student'</td>
</tr>
<tr>
<td>every student</td>
<td>(((e \to t) \to t)) \to \lambda Q \lambda x. Q(x) \to P(x)</td>
<td>(Student') \to P(x) = \forall x. Student'(x) \to P(x)</td>
</tr>
<tr>
<td>laughed</td>
<td>((e \to t))</td>
<td>Laugh'</td>
</tr>
<tr>
<td>every student laughed</td>
<td>((e \to t))</td>
<td>(\lambda P \forall x. Student'(x) \to P(x)) \to P(x) = \forall x. Student'(x) \to Laugh(x)</td>
</tr>
</tbody>
</table>

The details are not in fact important here.\(^{19}\) A significant consequence, however, is that the noun phrase subject in particular is no longer the last argument

\(^{19}\)See the introductory semantics textbooks for discussion, Dowty et al. (1981), Gamut (1991), Cann (1993) for full explanations.
that the predicate combines with to yield a propositional formula. Instead, it is the verb phrase which provides the argument: the functor/argument roles of subject and predicate are flipped from what they might be expected to be. An advantage of this move is that the semantics of universally quantified sentences of English can be preserved as being that of the corresponding predicate logic formula, while preserving the parallelism with syntax that all noun phrases can be analysed as having a single type. However, its disadvantage is that the argument-predicate roles in the case of the subject to some verb are different from those of all its other arguments (unless the type of verb, and everything else accordingly is driven up to increased levels of complexity of type specification).\textsuperscript{20} The general problem underpinning this is the methodology it presumes, which might well be called “preparing for the worst”. That is, the analysis is being driven by the example which displays the need for greatest complexity.

However, there is an alternative point of departure for looking at NPs in natural languages, and that is to look not at predicate-logic formulae, but at predicate-logic proofs. In particular, given the goal of modelling the way in which information is incrementally established in natural language, it is instructive to look at the closest analogue to natural language reasoning. This is the natural deduction proof method, in which valid inference is defined through the step-by-step process by which some conclusion is established from a set of premises. Natural deduction proofs for predicate logic all follow the same pattern: there are licensed steps for getting rid of the quantifiers, replacing them with so-called arbitrary names substituted in place of the variables. The body of the proof is then carried out with these names as illustrated in (3.29).\textsuperscript{21}

\textsuperscript{20}There have always been problems in manipulating the higher type \((e \rightarrow t) \rightarrow t\) to non-subject noun phrases, as the predicate with which it is defined to combine is never available. The problem of type-raising is further compounded if things like plurality are properly incorporated in the system.

\textsuperscript{21}There is a regular objection to the move to use arbitrary names for natural-language semantics. It is that quantifiers such as most are essentially generalized quantifiers, for which no proof-theoretic account is available. Only the generalized quantifier analysis has the appropriate generality to be applicable to all noun phrases. This, however, is not an appropriate form of criticism to the proposed analysis. In the DS system, it is the progressive compilation of the logical form which requires all terms projected by noun phrases to be of type \(e\). (This style of natural deduction proof is due to Prawitz (1965). For an introduction to logic in terms of such natural deduction, see Lemmon (1965).) The logical forms that result are then subject to a step of evaluation, as we shall see shortly; and in this step, one might define a step onto a generalized quantifier formula, e.g. in cases involving most. The system as it stands is restricted by the expressive power of the selected calculus, but in principle the assumption that computation of semantically relevant structure is via the working assumption of type \(e\) terms has more general application.
As this simple proof shows, the end, like the beginning, involves steps specific to the quantifiers, but in between these opening and closing steps, simple proof steps are defined over the interim names that are introduced. These rules of proof involve constructed so-called arbitrary names; and the sequence of proof steps is defined over these names. The effect of the arbitrary names is however to keep things simple, enabling regular rules of inference to be carried out: all the complexity is in the semantics of the names (or in proof terms, the control on the elimination and introduction of the quantifiers).\footnote{A particularly clear characterisation of these names and their status is provided by Makinson (2004).}

Suppose then that instead of taking predicate-logic itself as the point of departure for natural language quantification, we take the arbitrary names of the predicate-logic natural deduction system.\footnote{The formal study of such arbitrary names was provided by Hilbert in the epsilon calculus, and it is this we are going to adopt (Hilbert and Bernays 1939). For a recent study, see Meyer-Viol (1995).} The resulting construction of logical forms defined over trees will have to be in two steps. We can incrementally introduce name-like devices as a determiner-noun sequence is parsed; but the full interpretation of these names will have to depend on some form of scope statement for this and other such names, and so will have to be stated at the closing steps in compiling an interpretation for the clause as a whole. The details of this, we shall get to in due course. But, in the meantime, let us consider what advantages this step brings. The first is that it allows syntax and semantics to be brought back in tandem, synchronised for all NPs, but as the lower rather than higher type, that is as type $e$. The primary formal (and methodological) advantage is that the complexity of the semantics of quantification is hidden in favour of the relative simplicity of the presumed naming devices, which represent that content.

However, this aspect is not what we wish to emphasise here. Rather, there is empirical evidence for thinking that this is the right route to try. The evidence we present is of two sorts: the variation in scope effects across different quantifying determiners, and the distinction between restrictive and non-restrictive forms of relative-clause construal. What we shall do in the remainder of this chapter is as follows. First we set out how quantified noun phrases are analysed to provide arbitrary names, represented in terms of the epsilon calculus. Then we show how this provides a natural basis for the analysis of restrictive relative clause construal. Finally, we discuss how scope relations may be defined in this framework and how this produces some interesting results with respect to the interpretation of relative clauses.

### 3.2.1 The Process of Name Construction

Our analysis of quantification (which follows that set out in Kempson et al. 2001) has two aspects. Firstly, there is the way that noun phrases are parsed to yield representations with structures like that in (3.26) with formulae that act as arbitrary names. Secondly, we shall define a way of accounting for the interpretation
of such terms and, in particular, the scopal relations between terms. The latter involves collecting scope statements at a propositional node and then evaluating the propositional formula of that node with respect to these. This is the topic of section 3.3. Here we are concerned with the process of building up the logical forms of the terms from the words.

As noted above, what we need as a projection of structure for a noun phrase is a complex form of name, of type $e$ but containing within its structure a quantifier node to carry the information about the kind of quantification to be projected, a node to be decorated with the restrictor predicate, $Man'$, $Book'$, etc., and another node for a variable, itself also of type $e$, as set out in (3.26).

In the process of constructing such a tree, a determiner projects the variable-binding term-creating operator, in the case of the indefinite, a promissory note for an epsilon term (what this is we shall take up shortly), shown as a lambda term binding a variable $P$ of type $cn$. There is also a classification feature $Indef(+)$. This is shown in the lexical actions associated with the indefinite article in (3.30). The tree growth associated with this is shown in (3.31) which begins a parse of A lecturer cried.\footnote{The sequence of actions that achieves the ‘freshput’ instruction is a rather primitive device scanning the set of variables already associated with a scope statement, and aborting the lexical action for each one that corresponds to such a variable. For a full account, see Kempson et al. (2001) ch.7.}

Unusually, we take common nouns to project complex structure, containing an individual variable (one that is new in the tree)\footnote{The feature ‘+INDEF’ is a classifying mechanism so that the rule for fixing quantifier scope distinguishes between indefinites which are relatively unconstrained, and non-indefinites, which follow linear order more closely, see section 3.3. Such features are used as sparingly as possible here and are, given our commitment to the hypothesis that syntactic processes create semantic structures, merely promissory notes for a semantic characterisation that needs to be made explicit.} and a functor that takes that variable into a common noun representation. This is, as we have already stated, an expression of type $cn$ and such expressions consist of an ordered pair of a variable and a proposition in which that variable occurs free. Consider the lexical entry for lecturer given in (3.32).
CHAPTER 3. RELATIVE CLAUSE CONSTRAUL

(3.32) lecture

IF $\overline{Ty(cn)}$

THEN $\text{go(}\langle 1 \rangle); \text{put(}\text{?SC}(x));$

$\text{go(}\langle 1 \rangle); \text{make(}\langle 1 \rangle); \text{put(}\text{Fo}(\lambda y(y, \text{Lecturer}'(y))), \text{Ty}(e \rightarrow cn), [][\bot]);$

$\text{go(}\langle 1 \rangle); \text{make(}\langle 1 \rangle); \text{freshput}(x, \text{Fo}(x)); \text{put(}\text{Ty}(e));$

ELSE Abort

There are a number of things to notice about this complex of actions. In the first place, it imposes on the dominating $\overline{Ty(e)}$ node a new requirement $\overline{SC}(x)$ which is satisfied just in case a scope statement is constructed at some point in a parse. (We will discuss this aspect later in section 3.3.) Secondly, the content of the common noun, lecturer, is shown as a complex lambda term $\lambda y(y, \text{Lecturer}'(y))$, which binds the fresh variable that it introduces on the internal type $e$ node. The effect of parsing the first two words of *A lecturer cried* is thus as shown in (3.33).

(3.33) Parsing *A lecturer*:

The formula, $\text{Fo}(\epsilon, x, \text{Lecturer}'(x))$, is called an ‘epsilon’ term which stands for some arbitrary ‘witness’ of the set denoted by the restrictor, here Lecturer’. Although we will discuss the evaluation of such terms in more detail later in this
chapter, it is useful to have some understanding of how their semantics works. Essentially, an epsilon term is taken to pick out some element of the set denoted by the restrictor, just in case this set is not empty. If it is empty, then any arbitrary entity is chosen as a witness. This means that $P(\epsilon, x, P(x))$ has the same truth conditions as $\exists x. P(x)$, i.e., it is true just in case there is at least one entity in the denotation of $P$. This forms the basis of the evaluation algorithm discussed in detail below, but, for the moment, it is sufficient to understand that an epsilon term stands for an arbitrary object which needs to be discharged by some rule that introduces the existential quantifier, just as in (3.29) above, so that a formula like $Fo(Cry'(\epsilon, x, Lecturer'(x)))$ is ultimately interpreted as $\exists x. Cry'(x) \land Lecturer'(x)$.

The universal counterpart of an epsilon term is called a tau ($\tau$) term and is introduced by parsing words such as every or all and gives rise to terms such as $Fo(Laugh'(\tau, y, Student'(y)))$ which turn out to be evaluated as $\forall y. Student'(y) \rightarrow Laugh'(y)$. Again, we leave the details until later.

In the light of setting out these assumptions about the way in which determiners and nouns lead to the elaboration of term-internal structure, we can spell out more precisely our earlier statement that names might be analysed as projecting complex structure. Linguistic names can be seen as inducing a quantifying term, the single word projecting an iota term. The $\iota$ (‘iota’) operator constructs a type of epsilon term expressing Russellian uniqueness. So the witness it picks out is necessarily unique. Like English indefinite plurals, names in English impose the projection of a full type $e$ template of structure. And like other quantified expressions, they impose the choice of a fresh-variable, thereby inducing the effects of what has been known in the syntactic literature as principle C effects. A name like John will thus project the structure in (3.35) through its associated lexical actions.27

(3.35) Parsing John:

$$\begin{align*}
&Ty(e), Fo(\iota, x, John'(x)) \\
&Ty(cn), Fo(x, John'(x)) \\
&Ty(e \rightarrow cn), Fo(\lambda y. (y, John'(y)))
\end{align*}$$

With this form of characterisation, it is of course straightforward enough to specify a disjunctive entry that allows a name either to project a complete type $e$ as in (3.36a) or merely a predicate, as in (3.36b,c):

(3.36) a. John, who I met in Birmingham, was very clever.
    b. The John that I met in Birmingham was clever.
    c. Most Matthews I know come from Scotland.

As this discussion of names shows, there is considerable variation in noun phrases as to what structure is projected by the linguistic elements, both in an individual language as well as cross-linguistically. English singular nouns project only a

---

26A similar analysis of indefinites is independently proposed by von Heusinger (2000), though without incorporating any syntactic reflex of these terms.

27There is a vast literature on the semantics to be assigned to proper names, and nothing turns on the particular choice made here.
substructure of what is needed for a quantifying term to be projected, indefinite plurals might be said to project the full structure, and pronouns project merely a place-holder for some requisite formula (possibly with internal structure). The context-dependence of words such as the, that, this was set out very informally in chapter 1, and this would have to be reflected by defining these determiners in terms similar to pronouns. In the DS formulation this is reflected in defining such determiners as projecting a metavariable. However, unlike pronouns, occurring with these metavariables is a recursively complex restrictor specification, constraining the substituend of the metavariable, so that, for example, the man projects a partial specification of a term, which we might articulate provisionally as $Fo(U_{\text{Man}}((U))), Ty(e), \exists x.Fo(x)$.28

### 3.2.2 Restrictive Relative Clauses

Having set out the structures projected through parsing noun phrases (albeit with a proviso that the full interpretive machinery has not yet been explained), we are in a position to show how restrictive relative clauses may be analysed in the same terms as non-restrictives as involving the building of paired structures.

By way of preliminary to this, it is worth rehearsing what is the distinction between restrictive and non-restrictive relative clauses that we are about to model. The distinction can be seen in the pair of construals for two utterances of the string, differentiated only by some distinguishing intonation, or, as in the written form, punctuation:

(3.37) Two students who are from Philosophy are taking our course.

(3.38) Two students, who are from Philosophy, are taking our course.

In (3.37), with no distinguishing intonation, the likely interpretation is that out of some larger group of students there are two that are from Philosophy, with the relative clause contributing to the restriction on the set the quantifier ranges over. With a pause after students, and again after Philosophy, the information about the relative clause is taken to be an additional fact about a set of students sufficiently described by just the determiner-noun sequence two students, hence the term ‘non-restrictive’. However, it should not go unnoticed that there is no morphological distinction on which these interpretations depend: the distinction is made solely by the intonation (or punctuation) used to indicate the units to be built up in the interpretation of the string. Like anaphora, this is another phenomenon where linguists talk about non-restrictive relative clauses and restrictive relative clauses as though these were clearly distinct forms of expression, which they singularly are not. Advocating of linguistic ambiguity as though effectively there were distinct forms is purely a construct of the analysis.

Recall that our posited logical structure for noun phrases involves two type $e$ nodes, the top node, and an internal node decorated by a variable as its Formula value. In our characterisation of non-restrictive relative construal, what we presumed on was the construction of a LINK transition from the higher of these two nodes.29 Now, with our more fine-grained analysis, we expect a transition from

---

28We return to a more detailed specification of how such terms might be constructed in chapter 8. See also Kempson et al. (2001) where such a specification is taken to be a constraint on model-theoretic evaluation of the resulting term. See also Cann (forthcoming b) for an interpretation of such formulae as involving LINK structures.

29Though in the case of names, with which we started, we simply presumed that the logical form assigned to them had no internal structure.
the internal node equally to be available. This provides a natural basis for restrictive relative construal, since we have to hand a means of articulating further propositional structures containing a copy of the variable.

Notice that our characterisation of the lexical actions associated with common nouns, such as in (3.32), leaves the pointer on the node decorated by the variable it introduces. There is nothing to prevent \textit{LINK Adjunction} from applying at this point to launch a propositional LINKed structure containing a requirement to find a copy of this variable somewhere inside it. In parsing a string like that in (3.39), there is a transition from the tree constructed after parsing a \textit{man} and before parsing \textit{who} that gives the tree in (3.40).

(3.39) A man who Sue likes smokes.

(3.40) Parsing \textit{A man} with \textit{LINK Adjunction}:

\[
\begin{array}{c}
T_n(0), T_y(t) \\
?T_y(e) \\
?T_y(e \rightarrow t) \\
?T_y(cn) \\
T_y(cn \rightarrow e), \quad Ty(e \rightarrow t), \quad \forall y. \quad \text{Man}(y)
\end{array}
\]

This rule of \textit{LINK Adjunction} thus applies exactly as for non-restrictive forms of construal. As before, what the rule does is to introduce a new LINKed structure built from the node decorated by the variable as ‘head’, and at the top node of that LINKed structure it puts a requirement for the occurrence of a copy of the very variable projected by the noun.

There is then an intermediate step of \textit{*Adjunction}, which then provides the condition which enables the relative pronoun to provide the required copy (3.41), the latter being indifferent to \textit{what} formula decorates the head. There is thus no need to define any ambiguity for the relative pronoun between restrictive and non-restrictive uses.
CHAPTER 3. RELATIVE CLAUSE CONSTRAUL

(3.41) Parsing A man who:

\[ T_n(0), ?T_y(t) \]

\[ \quad \quad \quad ?T_y(e) \quad \quad \quad ?T_y(e \rightarrow t) \]

\[ \quad \quad \quad ?T_y(cn) \]

\[ Ty(cn \rightarrow e), \]

\[ Fo(\lambda P.(e,P)), [i] \perp \]

\[ T_n(000), Ty(e), Ty(e \rightarrow cn), || \perp, \]

\[ Fo(x) \quad Fo(\lambda y.(y, Man'(y))) \]

\[ \langle L^{-1}\rangle{T_n(000)}, ?T_y(t), ?(\downarrow)Fo(x) \]

\[ \langle \downarrow \rangle \langle L^{-1}\rangle{T_n(000)}, Ty(e), Fo(x), [i] \perp, \Diamond \]

From this juncture on, the process of parsing the string is exactly as in simple clauses. Nodes are introduced by the rules of INTRODUCTION and PREDICTION or by lexical actions given by the verb, and a step of MERGE duly takes place unifying the unfixed node that had been decorated by the relative pronoun with some open node, in a parse (3.39), the object node projected by parsing likes.

The only additional rule needed to complete a full parse of (3.39) is a second rule of LINK evaluation for restrictive relative clauses that puts together the information provided by the completed LINKed structure with the nominal predicate to yield a complex restrictor for the variable at the cn node. The somewhat complicated rule in (3.42) actually has a simple effect: it takes the propositional formula (φ) decorating the LINK structure and conjoins it with part of the formula decorating the Ty(e → cn) node (ψ) applied to the variable, x, decorating the internal type e node (ψ(x)). This yields a complex restrictor of the variable because the formula, φ, derived from the LINK structure contains a copy of the variable. The final step, then, is to ‘abstract’ the variable to give a well-formed common noun representation \(Fo(x, φ(x) \land ψ(x))\).

(3.42) LINK Evaluation 2 (Restrictive construal)

\[
\{ \ldots \{T_n(a), ?T_y(cn) \ldots \}, \{[i_0]T_n(a), Fo(x), Ty(e)\}, \{[i_1]T_n(a), Fo(\lambda x. (x, ψ(x))), Ty(e \rightarrow cn)\} \ldots \} \\
\{[L^{-1}][i_0](T_n(a), Fo(\phi), Ty(t), \Diamond) \}
\]

\[
\{ \ldots \{T_n(a), Fo(x, \phi \land ψ(x)), Ty(cn)\ldots , \Diamond \}, \{[i_0]T_n(a), Fo(x), Ty(e)\}, \{[i_1]T_n(a), Fo(\lambda x. (x, ψ(x))), Ty(e \rightarrow cn)\} \ldots \} \\
\{[L^{-1}][i_0](T_n(a), Fo(\phi), Ty(t)) \}
\]

30 This rule has to be stated distinct from LINK evaluation 1 for non-restrictive relative constructions, because the resulting decoration is of a Ty(cn) node, and not a propositional one. Nevertheless, it involves conjunction of two propositions, one in the matrix tree and one derived from the LINKed structure, thus sharing common properties.
The effect of this rule in a parse of the subject noun phrase *A man who Sue likes* is shown in the tree display in (3.44) (with much irrelevant detail omitted). Once this nominal restrictor is compiled, here as the complex conjunction, the compound type \( cn \) formula can be combined with the quantifying formula to provide the specified epsilon term: \( \text{Fo}(e, x, \text{Man}(x) \land \text{Like}(x)(t, z, \text{Sue}(z))) \), an epsilon term that picks a witness from the intersection of the set of men with the set of things Sue likes, as expected. The rest of the parse of *A man who Sue likes smokes* continues as expected and we ultimately derive the propositional formula in (3.43)

\[
\text{(3.43)} \quad \text{Fo}(\text{Smoke}(e, x, \text{Man}(x) \land \text{Like}(x)(t, z, \text{Sue}(z))))
\]

\[
\text{(3.44) Parsing *A man who Sue likes* with LINK evaluation:}
\]

\[
\begin{array}{c}
Tn(0), Ty(t) \\
\begin{array}{c}
\text{?Ty(e)} \\
\begin{array}{c}
Tg(cn), \diamond, \\
\text{Fo}(x, \text{Man}(x) \land \text{Like}(x)(t, z, \text{Sue}(z))) \\
\text{Ty}(cn \rightarrow e), \\
\text{Ty}(e \rightarrow t)
\end{array}
\end{array}
\end{array}
\]

\[
\begin{array}{c}
Tn(000), Ty(e), Ty(e \rightarrow cn), \\
\text{Fo}(x) \\
\text{Fo}(\lambda y.(y, \text{Man}(y)))
\end{array}
\]

\[
\langle L^{-1}\rangle Tn(000), Ty(t), \text{Fo}(\text{Like}(x)(t, z, \text{Sue}(z)))
\]

\[
\begin{array}{c}
\text{Fo}(t, z, \text{Sue}(z)) \\
\text{Fo}(\text{Like}(x))
\end{array}
\]

\[
\begin{array}{c}
\text{Fo}(x) \\
\text{Fo}(\text{Like}(x))
\end{array}
\]

Notice how, just as in the process of building up a non-restrictive form of construal, the relativising element *who* acts as an anaphoric device. This is quite unlike the analysis of restrictive relative clauses in most other frameworks. Standardly, the relativising element is defined as a variable-binding operator. In the analysis here, everything is the other way round. The noun projects the variable, which is the element to be copied into the structure projected by the relative. The relative pronoun simply has the job of ensuring that the LINKed structure introduced has the appropriate copy at an unfixed node.

We do not go into further detail of relative clause constructions in English, but in passing we note that it is a simple matter to impose restrictions on the various relativisers in English, so that they appear only in the correct places. For example,

---

31In movement accounts, this involves the binding of a gap in some constructed structure resulting from the movement of the *wh* expression to some (Spec)-CP position. See Chomsky (1981) and many references thereafter. In Minimalist analyses, this movement of the *wh* expression itself may not be necessary, since in some analyses, movement is restricted to feature-movement. Nonetheless, the underlying variable-binding operator analysis of relative clauses is retained, as it is in essence in all other generative frameworks that we are aware of (Sag et al. 2003, Dalrymple 2001, Morrill 1994).
while English allows restrictive relative clauses without any overt relativiser this is not true of non-restrictive relative clauses.\footnote{It is also claimed that the relativiser that cannot be used in non-restrictive relatives, although these are found in conversational English.}

(3.45)  
\begin{itemize}
\item[a.] The student Bill admires won the class prize.
\item[b.] *The student, Bill admires, won the class prize.
\end{itemize}

The availability of restrictive relative construal without any relative pronoun is very simple to define. We have to allow the analogue of a null complementiser, a phonological free-ride that is defined to allow the free creation of a copy at some unfixed node (introduced by successive steps of LINK ADJUNCTION and *ADJUNCTION) as long as the node which constitutes the head is itself immediately dominated by a cn-requiring node. The lexical characterisation in (3.46) is identical to that of the relative pronoun which except for the extra condition that the head formula be internal to the type e sub-structure, so even in this null complementiser construction, we sustain an anaphoric style of analysis.

\begin{center}
\begin{tabular}{|c|c|}
\hline
(3.46) \(\emptyset_{\text{recomp}}\) & IF \(\langle 1,\rangle\langle L^{-1}\rangle Ty(e), \exists x. Tn(x), \\langle 1,\rangle\langle L^{-1}\rangle Fo(x)\)  \\
& THEN IF \(\langle 1,\rangle\langle L^{-1}\rangle \langle 1,\rangle ?Ty(cn)\) THEN put\((Fo(x),Ty(e),[1]\downarrow)\) ELSE Abort  \\
& ELSE Abort \\
\hline
\end{tabular}
\end{center}

\subsection{3.2.3 Constraints on the ordering of relative clauses}

Seeing the distinction between restrictive and non-restrictive construals in terms of the dynamics of the update process enables us also to capture a syntactic restriction which is generally thought not to be related to its semantic properties.\footnote{Potts (2001) introduces the data of non-restrictive relative clauses as a case of syntax-semantics mismatch, given the display of semantic co-ordination properties, but syntactic subordination.} This is that non-restrictive relative construals must always follow restrictive ones.

(3.47)  
\begin{itemize}
\item[a.] A man who/that/\emptyset I met in Prague who/that/\emptyset you disliked is coming to dinner
\item[b.] A man, who you dislike, who/?that/*\emptyset I met in Prague is coming to dinner
\end{itemize}

In (3.47b), given a non-restrictive construal of who you dislike as adding information about the entity in question without constituting an additional restrictor on what is quantified over, the relatives who I met in Prague and that I met in Prague have also to be interpreted as non-restrictive. This has the effect that the variant with that is of dubious acceptability since it is said that use of that tends to preclude non-restrictive construals, and the null variant which requires a restrictive construal is ill-formed.\footnote{Relative clauses formed with that have an intermediate status. They are often reported to license restrictive construal only, but (i) is not unacceptable: (i) Every interviewer, who I was on good terms with, that you disliked but fortunately that didn’t matter, liked our cv’s enough to recommend us for the job. However, as we would expect, if the first relative is interpreted non-restrictively, then the second, despite the presence of that, must also be interpreted non-restrictively.} If non-restrictives are, in some sense, an additional inserted commentary, not disturbing the primary structure, why can they not be inserted anywhere?
If this restriction really were independent of any semantic-related property of the two forms of construal, then this might seem bad news for the Dynamic Syntax stance that syntactic properties can always be explained in terms of the interpretation to be projected and the process of building up that interpretation. But as it turns out, this stance is thoroughly vindicated, as the Dynamic Syntax analysis provides an immediate answer to this problem. The restriction follows as a consequence of the analysis of restrictive and non-restrictive construals as differing in the stage of the construction process at which the LINK construction step takes place. The result follows from the restrictiveness of pointer movement.

To see why this is so, consider the (schematic) tree in (3.48) intended to show part of the parse of a sentence containing both a restrictive, and a non-restrictive, relative clause, like *A man who Sue dislikes, who Bill likes, is coming to my party*.

As can be seen from this tree, the projection of a LINK structure that provides a non-restrictive construal involves building that structure from the higher of the two Ty(e) nodes in the term. Hence, this can only be introduced once this higher type e node has been completed and decorated with a Fo value. But this satisfaction of the type requirement on this node only takes place if the determiner node and cn node have been fully decorated, with their type requirements fulfilled. Of necessity

---

(3.48) Parsing *A man who Sue dislikes, (who Bill likes)*

\[
\begin{align*}
T_n(0), & \text{ Ty}(t), \Diamond \\
T_n(00), & \text{ Ty}(e \to t) \\
& \text{ Fo}(e, x, \text{Man}'(x) \land \text{Dislike}'(x)(i, y, \text{Sue}'(y))) \\
& \text{ Fo}(\lambda P. (e, P)) \\
& \text{ Fo}(\lambda y. (y, \text{Man}'(y))) \\
& \langle L^{-1}\rangle T_n(000), \text{ Fo}(\text{Dislike}'(x)(i, y, \text{Sue}'(y))) \\
& \text{ Fo}(i, y, \text{Sue}'(y)) \\
& \text{ Fo}(\text{Like}'(x)) \\
& \text{ Fo}(\text{Like}) \\
& \text{ Fo}(x) \\
& T_n(\langle L^{-1}\rangle T_n(00), \text{ Ty}(t), \text{ Ty}(e \to t), \text{Ty}(e \to t), \text{Ty}(e \to t), \Diamond) \\
\end{align*}
\]

---

35 Scope information is not specified here, but in fact there would be a scope statement associated with the type e term immediately prior to the introduction of this second LINKEd tree. See section 3.3.
then, this step must follow any process which involves constructing and completing some LINKed structure introduced as a transition defined on some \( Ty(e) \) node dominated by a \( cn \) node and decorated by a variable.

The pointer can never return to some daughter of the \( Ty(cn) \) node from the top \( Ty(e) \) node, so no construal of a relative clause restrictively can be achieved after some clause that has a non-restrictive construal. Indeed, even if it could, the process of constructing a LINKed structure at that later stage would involve retracting the decorations on the \( cn \) and higher type \( e \) nodes, in order to introduce the newly added modification from this latterly introduced LINKed structure. But this is independently precluded: all building up of interpretation is monotonic, involving progressive enrichment only. The only decoration that can ever be removed from a node is a requirement, once that has been satisfied – nothing else.

Given that this linear-order restriction emerges as a consequence of pointer movement, and not from any idiosyncratic decoration on the individual nodes, we would expect that it would apply equally to all noun phrases, indefinite and non-indefinite alike. And indeed it does:

\[(3.49)\]

a. Every interviewer you disliked, who I was on good terms with, liked our cv’s.

b. *Every interviewer, who I was on good terms with, you disliked, liked our cv’s.

Finally, contrary to a conventional implicature analysis, on the present analysis, we expect that non-restrictively construed relative clauses can contain antecedents for subsequent pronouns:

\[(3.50)\] I saw a man, who ignored a friend of mine. When she hit him, he continued to ignore her.

The data present no more of a problem than regular cross-sentential identification of a pronoun with some epsilon term as antecedent, leading to the construction of a new extended epsilon term in the logical form constructed for the sentence containing the pronoun. As we would expect, this pattern may also occur within a single sentence:

\[(3.51)\] A parrot, which was loudly singing a song, appeared to understand it.

So, given an analysis of all noun phrases as type \( e \) terms, and the processing of building up paired linked structures, the distinction between restrictive and non-restrictive forms of construal is remarkably straightforward to reflect. There are no hidden mysteries of a discrete level of structure, in some sense beyond logical form, no structures which have to be assigned some unexpected status as filters on content, and no radical difference in computation between the two forms of construal.

### 3.3 Quantifier Scope and its Effects

We have, so far, provided the basis of our analysis of quantified noun phrases with some promissory notes concerning quantifier scope and the interpretation of epsilon and tau terms. What we now need to set out is some indication of the mechanism

\[\text{Such data are problematic for Potts' (2001) conventional implicature account, because by definition a conventional implicature is a filter on content, and not part of it. Yet for the pronoun-antecedent relation to be established, the content of the conventional implicature must have become part of the context, requiring a specific accommodation process.}\]
which collects scope-relevant information during the construction process, and the subsequent scope-evaluation process (see Kempson et al. (2001) ch.7 for details). Scope information takes the form of statements of the form \( x < y \), which is shorthand for “a term with variable \( x \) has scope over term with variable \( y \)”. These statements are collected at the local node requiring a formula of type \( t \) as they are made available by words and their actions during the parsing process.\(^{37} \) Once a propositional formula of type \( t \) is derived at the top node of some local tree, this node will have a pair of (i) a scope statement of the form \( \text{Scope}(S_i < x < \ldots) \) and (ii) a formula of type \( t \). (i) and (ii) together will then be subject to a scope evaluation algorithm which spells out what that pairing amounts to. We take this lexically driven route because there is lexical variation in how much scope freedom the terms projected have, which comes primarily from the determiners (but may also come from verbs). We begin with a discussion of the major problem case: the indefinites, noun phrases containing determiners include such as \( a \), \( some \), all numeral expressions, and \( many \).

### 3.3.1 Scope Effects of Indefinites

Unlike most other quantified noun phrases, singular and plural indefinites, such as \( a \) man, \( three \) books, \( two \) examiners, etc., freely allow interpretations in which they are interpreted as taking scope wider than the clause in which they are contained. (3.52) thus has several interpretations:

(3.52) Everyone agreed that most examiners marked two good scripts.

It can either mean that the general agreement is that the largest proportion of examiners each marked two good scripts (in which \( two \) good scripts \( has \) narrow scope with respect to \( most \) examiners, and hence also narrow scope with respect to \( everyone \)). Or it can mean that for each of two good scripts everyone agrees that most examiners marked that script (in which \( two \) good scripts has wide scope over both \( most \) examiners and over \( everyone \)).

(3.53), on the other hand, does not have this range of interpretations:

(3.53) Everyone agreed that two examiners marked most good scripts.

It can have the interpretation in which \( most \) good scripts is interpreted as taking wide scope with respect to \( two \) examiners, but it cannot be interpreted as meaning that for some large proportion of scripts it is the case that for each such script everyone agreed that two examiners had marked it. In other words, \( most \) cannot have widest scope over the structure projected by the whole containing clause.

More generally, indefinites, and only indefinites, can be freely interpreted both with respect to their own clause and with respect to some expression outside their immediately containing clause. If we take a mixed quantified sentence with no indefinites, the ambiguity disappears:

(3.54) Most students studied every book by Chomsky.

Can (3.54) be understood as an assertion about every book by Chomsky that most students have studied it (not necessarily the same students for each book)? Surely not. The same problem goes for (3.55):

(3.55) Few students understand most papers by Chomsky.

\(^{37}\)This is, in effect, a quantifier-storage process (Cooper 1983) and has certain similarities with Minimal Recursion Semantics used in versions of HPSG (Copestake et al. 1997).
CHAPTER 3. RELATIVE CLAUSE CONSTRUAL

This asymmetry between individual quantifiers is a puzzle for all standard accounts of quantification. On the basis of the freedom with which indefinites can be construed, it has been assumed that this will have to be a general process: since quantifier scoping has to be defined over a propositional domain, it cannot be treated as a lexical property. All quantifiers, accordingly, are said to be subject to such scope variation, with a general process of either quantifier raising (in the syntax, e.g. May (1985)) or quantifier storage (in the semantics, e.g. Cooper (1983)). But this then leaves as a complete mystery as to why there should be variation between individual quantifiers in the first place.

One response to this is to suggest that indefinites are ambiguous between a regular quantifier and some kind of name, referring to a particular individual (or group) taken to be picked out by the speaker. Such an analysis has the advantage of leaving undisturbed a generalised quantifier analysis of a sub-class of indefinites, analysing the others as a specialised naming device. On such an analysis, there would be no need of a general process of quantifier-storage. However, as observed by a number of people over the years (Farkas 1981, Cormack and Kempson 1991, Abusch 1994, Winter 1997, Reinhart 1997), such an ambiguity account fails to capture cases in which the indefinite can be construed as taking intermediate scope, with scope over the clause or noun phrase within which the indefinite is contained but nevertheless still interpreted as within the scope of some preceding quantifier:

(3.56) a. Every professor insisted every student of theirs read a recent MIT thesis.

b. Each student has to come up with three arguments that show that some condition proposed by Chomsky is wrong.

Each of the examples in (3.56) allows an interpretation, as one amongst several, in which the indefinite in the embedded clause can be understood as taking broader scope than the nearer of the two quantified expressions preceding it, but narrower scope than the subject quantifier. For example (3.56a) allows as one possible interpretation: ‘For each professor there is a recent MIT thesis that the professor insisted that their students read’. So the scope relation is every professor < a recent MIT thesis < every student: one MIT thesis per professor for all their students, but not the same thesis. So for these cases, in any event, indefinite expressions must apparently be analysed as expressions that function as quantifiers taking scope over some arbitrarily larger domain. Analysing a sub-case of interpretations of indefinites as name-like does not solve the problem.

If, however, we look at this phenomenon from a processing perspective, then there is an alternative account in terms of interpreting the indefinite relative to its context, which is naturally expressible only if we analyse quantified expressions as a form of name, initially underspecified. We can get at this alternative way of looking at the problem by asking how ambiguity displayed by (3.56a) arises. How, for example, does it differ from a simpler structure such as (3.57)?

(3.57) Every student is reading a recent MIT thesis.

One obvious answer is that (3.56a) has three quantified expressions, (3.57) only two. The clue, we suggest, lies exactly in this.

The ambiguities in (3.57) are straightforward enough. Either the second quantifier is interpreted relative to the first, or the first quantifier is interpreted relative to the second. This is the standard way of describing this phenomenon. However, there is another way of expressing this observation, by expressing the dependence solely in terms of the indefinite. Either the expression a recent MIT thesis in (3.57)
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is understood relative to the interpretation assigned to every student, or it is understood relative directly to the speaker’s time of utterance. Schematically, we have the two readings in (3.58).

(3.58) a. For each student _x_ there is now a recent MIT thesis _y_ such that _x_ is reading _y_.
   b. Now there is a recent MIT thesis _y_ such that for each student _x_, _x_ is reading _y_.

In the case of (3.56a), the ambiguities multiply, because there is another quantifier. There are the analogues to (3.58a) and (3.58b) in (3.59a) and (3.59b):

(3.59) a. For each professor _x_ and for each of his students _y_, there is a recent MIT thesis _z_ such that _x_ insists _y_ read _z_.
   b. There is a recent MIT thesis _z_ such that each professor _x_ and each of his students _y_ _x_ insist _y_ read _z_.

However, there is, in addition, the reading in which the indefinite is interpreted as dependent on the first quantified expression but not on the second as in (3.60).

(3.60) For each professor _x_, there is a recent MIT thesis _z_, such that for every student _y_, _x_ insist _y_ read _z_.

There are more than three readings that can be distinguished for (3.56a), but these three are sufficient to tease out what is going on. The number of interpretations available for indefinites depends on the number of terms elsewhere in the structure under analysis. Such terms may include other quantifying expressions, but they may also include expressions in the structure representing time construal. Interpretation of an indefinite involves choosing some other term in the structure to be dependent on. As we shall very shortly see, this choice may be made both with respect to what has already been constructed in the partial tree, but may also be made with respect to terms that are constructed later. Furthermore, as (3.56b) shows, this free availability of interpretations is not restricted by syntactic considerations: even though the indefinite may be contained inside a relative clause, a classic so-called “strong island” restriction, it may nevertheless be interpreted as dependent on terms which are constructed from expressions occurring in the sentence but outside that clause.38 (3.56b) can be interpreted with the term some condition proposed by Chomsky dependent on either the time of utterance or on the students. The very lack of structural restrictions of a familiar sort, and the fact that the numbers of interpretations are directly computable given the number of appropriate terms constructed in the context, suggests that the problem of multiple scope-ambiguities is parallel to that of pronouns in the following sense: the interpretation of indefinite noun phrases and their scope potential are resolved in context during the process of logical-form construction. Indefinites, that is, have to be interpreted as dependent on something, even if it is only on some temporal specification having been made available by the tense information, and what that is gets decided on the basis of what else is available during the interpretation process.

38 It has been argued by Ruys (1992) that indefinite plurals display island sensitivity in disallowing the construal of individual members of the set quantified over independently of the island in which the indefinite expression is contained. However, in (i), given the disambiguation provided by the presented elaboration, wide scope potential for the indefinite seems possible ((ii) is Ruys’ example):

(i) If two of my sons ever help me do the washing up I buy them a beer by way of thanks. If they both do, I get out the champagne.
(ii) If two of my uncles give me a house, I shall receive a fortune.
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It might seem surprising that choice of scope should be said to parallel choice of pronoun construal, because cataphoric interpretations for pronouns in English are generally not available in English, yet scope inverted interpretations surely textitare. We can interpret (3.61) as meaning that all the patients got interviewed, but not necessarily all by the same nurse because of what we know about the burdens of the national health service:

(3.61) A nurse interviewed every patient.

Yet he in (3.62) cannot be interpreted as picking up on its interpretation from the following occurrence of John:

(3.62) He knows that John is clever.

This is certainly true; but this is not the end of the matter. There are the expletive pronouns, which are interpreted in precisely a forward-looking manner:

(3.63) It is likely that I’m wrong.

The it in (3.63) is construed as identical to the interpretation assigned to the following clausal expression I’m wrong. In the literature, such pronouns are analysed as completely different phenomena, the so-called expletive pronouns, unrelated to their anaphoric counterparts. However, there is reason to think that they are nevertheless but a subcase of the pronoun it, a matter we come back to later (chapters 5 and 8). Here it is sufficient to know that cataphoric processes of anaphora are available subject to certain locality constraints.

There is further evidence that allowing indefinites to depend on some quantifier introduced later in a sequence is the right move to make. Analysing the apparent reversal of scope of a pair of quantifiers when the first is indefinite and the second non-indefinite provides a solution to what is otherwise a baffling form of variation in the scope construal of non-indefinites poses. The puzzle is that quantifiers such as most appear to give rise to wide-scope construal when they follow an indefinite noun phrase, but not when they follow a non-indefinite noun phrase. In (3.53), for example, we observed that the expression most good scripts may take wide scope over two examiners but nevertheless not wide scope over everyone:

(3.53) Everyone agreed that two examiners marked most good scripts.

Beside that, however, the interpretation of (3.64) generally follows the linear order in which the quantified expressions occur. The only natural interpretation of (3.64) is as an assertion about all examiners that each marked most scripts:

(3.64) All examiners marked most scripts.

39 Apart from expletives, cataphoric effects may be expected if there are grounds for analysing the node the pronoun decorates as unfixed, since there is a later stage at which the needed substitution operation can apply. But this is not the operative consideration in simple SVO sequences.

40 These scope inverted interpretations are regularly said not to be preferred, but nevertheless agreed to be available.

41 There are also cases of cataphora involving initial adjunct clauses, often generically interpreted but not necessarily:

(i) If she sees a cat, Mary always has to cuddle it.
(ii) When he came into the room, John was crying.

It is interesting to note that such cataphoric effects can only be established if the adjunct clause precedes the main clause, indicating again the need for a processing perspective in analysing such constructions. (See Cann and McPherson (1999), for some discussion of these cataphoric effects.)

(iii) She always has to cuddle a cat, if Mary sees it.
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And, conversely, the only natural interpretation of (3.65) is an assertion about each member of some larger proportion of scripts that all examiners checked it:

\[(3.65) \text{Most scripts, all examiners marked.}\]

If we analyse all quantified expressions as having a wide-scope potential, these facts are mysterious, for sometimes quantified expressions containing most seem to allow interpretations in which they take scope over other quantified expressions, but sometimes not. On the other hand, the puzzle is resolved if we analyse all scope inversion for pairs of quantified expressions as an idiosyncracy of indefinites: that they can be interpreted as taking scope narrower than some term, and that in some contexts this can be constructed from an expression following them in the sequence of words. Most itself provides no potential for being interpreted outside the immediate structural context within which it is processed. It is only the indefinite which provides an underspecified term, with a choice of scope dependency that ranges over any term made available during the construction process.\(^{42}\)

In any case, the analysis that is being proposed is not that indefinites and pronouns are identical in their process of interpretation, so the expectation is not for absolute parallelism in their mode of interpretation. The claim is simply, more weakly, that both have a context-dependent element to their interpretation: for pronouns, it is the context that provides the value of the metavariable which these pronouns project, for indefinites, it is the context of the proposition under construction that provides a discrete term relative to which the relative scope of the indefinite can be identified.

3.3.2 Formulating context-dependent constraints on scope construal

This bringing together of the process of interpretation of anaphoric expressions, and the process of choice of scope-dependence for indefinites can be fitted in to the account of quantifiers as arbitrary names, and remarkably smoothly. As already stated in section 3.2.1, we take all determiner noun sequences to project only a preliminary specification of the appropriate quantifying operator in terms of the epsilon calculus. For example, \(Fo(\epsilon,x,\text{Man}'(x))\) is the formula projected by the singular indefinite a man, \(Fo(\tau,x,\text{Man}'(x))\) is that for the universally quantified expression every man, and \(Fo(\iota,x,\text{John}'(x))\) for proper names like John. These are not, however, fully specified terms until they are evaluated with respect to some full propositional context. The way this is achieved is in distinct stages which combine together ultimately to provide a fully evaluated propositional formula. First, the determiner provides the particular quantifier to be used, \(\epsilon, \tau \text{ or } \iota\), as we expect, together with a feature on its mother node which classifies what kind of a type \(\epsilon\) term this is going to be: indefinite, definite and so on. Then, there are the lexical actions projected by the parse of common nouns. In addition to the expected actions building the nodes both for the noun’s predicate and its associated variable, there are actions that decorate this second node with a fresh variable, there is also an action which adds to the higher type-\(\epsilon\)-requiring node a requirement for a scope statement involving the variable that decorates the internal \(Ty(\epsilon)\) node which we wrote in section 3.2.1 as \(?SC(x)\) (see the lexical actions associated with the common noun lecturer in (3.32) on p.91). This requirement seems to be rather

\(^{42}\text{Confirming this analysis is the fact that parallelism between indefinite construal and pronoun choice go hand in hand in all languages. If the language is very sensitive to linearity in its choice of pronouns, then so is its choice of scope construal for indefinites. For detailed demonstration of this see Kempson and Meyer-Viol (2004) and Kempson et al. (2001).}\)
different to the other requirements that we have seen because, although it is non-modal in form, it is satisfied only when a scope statement is established on the most local propositional node. It should, therefore, more accurately be written as a modal requirement to establish a relation in the \textit{Scope} predicate with the variable introduced by the common noun:\footnote{Notice the modality \(\langle \uparrow_0 \rangle \langle \uparrow_1 \rangle\) which is more constrained than \(\langle \uparrow_1 \rangle\) in pointing to a node that can be reached by going up one argument node and zero or more functor nodes. See the locality defined for \textit{Substitution} in chapter 2, (2.64) on page 62.}

\[ ?SC(x) =_{def} ?(\langle \uparrow_0 \rangle \langle \uparrow_1 \rangle \exists y. Scope(y < x) \lor Scope(x < y) \]

In general, we will continue to represent this complex requirement in its simpler form, as \(?SC(x)\). Once the information provided by the determiner and by the common noun are put together, determiner-particular scope statements get added to the local type-\(t\)-requiring node to satisfy this scope requirement. A sequence of scope statements is thereby accumulated during the construction process at some type node decorated by \(?Ty(t)\).

In general, quantifier scope follows linear order, so a quantifier processed first on a left-right basis is presumed to have scope over a quantifying term that follows it, with each scope statement successively added to the end of the sequence and fixing its scope relative to what precedes. Indefinites, however, provide a systematic exception to this general principle, and are lexically defined to have a more open characterisation of scope effects, subject to choice.\footnote{Another exception is when the terms decorate a node which is not yet fixed in the structure. Some languages allow quantified expressions to decorate such nodes, others do not. Those that license such left-peripheral occurrence will allow scope statements to be entered, subsequent to the step of \textit{merge} which assigns the unfixed node, a definitive position in the tree. There is some indication here of sensitivity to whether the process allows separation of the quantifying term from that position across a propositional boundary. See chapter 7.} We can now express the parallelism between indefinites and pronouns by defining an indefinite as adding to the set of scope statements a relatively weak scope restriction that it be interpreted as taking \textit{narrow} scope with respect to some term to be chosen, represented by the meta-variable \(U\):

\[ U < x \]

The value of a metavariable \(U\) as projected by the lexical specification of a pronoun, is established in the structural context in which it occurs. Though these statements are collected locally, the value of the metavariable \(U\) itself is not structurally restricted, so a term may get entered into a scope statement for which there is no corresponding occurrence in the formula itself. As a result the scope requirement \(?SC(x)\) may be satisfied; but evaluation of the effect of that particular scope dependency cannot be resolved until higher in the tree. In all such cases, this scope statement gets progressively lifted up the tree until it arrives at a node where the locally compiled formula contains an occurrence of this selected term.

In determining the value for \(U\) in a scope statement, there is one difference from regular anaphoric processing in that there can be no possible indexical construal, where the value for \(U\) is taken from some external context. The term under construction is a quantifying term and must thus ultimately be subject to evaluation as part of the overall proposition being constructed, as we shall see below. However, apart from the constraint that the choice of value to be made for the metavariable must range only over other terms used in the interpretation of the string, it is otherwise structurally unrestricted. This gives us a basis for characterising the arbitrarily \textit{wide} scope properties of indefinites, if we make the additional assumption that representations of time are also taken as a term in the language.
3.3. QUANTIFIER SCOPE AND ITS EFFECTS

Suppose that every formula of type $t$ is of the form $S_i : \psi$, with $S_i$ a term denoting the time at which the formula $\psi$ is said to hold. This is the one entry in the scope statement which is assumed to be fixed independently. To reflect this, we also modify the starting point $?Ty(t)$ so that it also contains one term in the attendant scope statement, namely $S_i$, the constructed index of evaluation. Morphological tense (or adjuncts) then add predicates on $S_i$, restricting its construal, so that what we have been writing as $Tns(PAST)$ may be construed as $Tns(S_i < S_{now})$. With this in place, the relatively unrestricted range of scope effects for indefinites follows immediately. If the value selected for the first argument of the scope relation is some variable associated with a discrete quantifying determiner, we get narrow scope interpretations, if it is chosen to be a term of the form $S_i$, which is itself not construed as taking narrow scope with respect to such quantifying expressions, then the indefinite will be construed as able to take wide scope relative to those quantifying expressions. In (3.66), there is only one choice, this being that the indefinite is interpreted relative to $S_i$, the term representing the index of evaluation:

(3.66) A student fainted.

Notice the mode of interpretation for indefinites and pronouns do not project identical forms of dependence on context. To start with, indefinites cannot be interpreted as dependent on some term outside the process of construction. They are in any case distinct forms of input: pronouns are not scope-inducing terms. Any idiosyncrasy distinguishing them is thus easily expressible in the distinct sets of lexical actions. By contrast the parallelism between anaphora and indefinites is inexpressible on accounts of quantification in model-theoretic terms, as generalised quantifiers. There is no room to express under-specification of a generalised quantifier. So the very smoothness with which the anaphoric-style of account of indefinites and the analysis of all quantifying expressions as names goes together provides further evidence for this analysis of the compilation of quantification structures in type-$e$ terms.

To illustrate the process of scope construction, we will go through the relevant steps in parsing (3.67) with narrow scope for the indefinite.

(3.67) A student read every book.

As we saw in section 3.2.1, parsing the determiner introduces the node for the binding operator itself and the $cn$-requiring node, adding to the type-$e$-requiring node the feature Indef(+). The actions associated with parsing a common noun noun then introduce the two daughter nodes of the $?Ty(cn)$ node: a $Ty(e \rightarrow cn)$ node decorated with the formula that expresses the concept associated with the noun; and an internal type $e$ node decorated with a fresh variable. It also adds to the higher type-$e$-requiring node, as we have seen, the requirement for a scope statement for that variable $?SC(x)$ interpreted as a modal requirement for the variable to appear as part of the Scope predicate on some dominating node, without

45Throughout this book, we make no attempt to formally address tense or mood construal. See Perrett (2000) for an preliminary DS characterisation.

46Unlike DRT, where wide scope effects for indefinites have been said to involve movement of the discourse referent to the top box (Kamp and Reyle 1993), the assumption that scope of an indefinite is a relatively unrestricted choice allows for intermediate interpretations in addition.

47See Kempson et al. (2001) for full lexical specifications of the determiners every, a.

48This lexicalised approach to projection of scope effects allows idiosyncratic specifications for other determiners. For example, no should arguably be analysed as projecting a composite sequence of actions, the projection of a falsity operator at the closest type $t$ node, and an epsilon term defined to take narrow scope with respect to this operator. Since we do not address problems of negation in this book, we do not define this here.
which the term cannot be completed. The non-terminal nodes on this subtree then get accumulated in the normal way by Completion, Thinning and Evaluation and the result at this point is (3.68):

(3.68) Parsing A student:

\[
Tn(0), \text{Scope}(S_1), ?Tg(t)
\]

\[
Ty(e), ?SC(x), Indef(+), Fo(\epsilon, x, \text{Student'}(x)), \diamond \\
?Ty(e \rightarrow t)
\]

\[
Ty(cn), Fo(x, \text{Student'}(x)) \\
Ty(cn \rightarrow e), Fo(\lambda y.(\epsilon, \text{Student'}(y)))
\]

With the combination of properties accumulated at the higher \(Ty(e)\) node through parsing the determiner and the common noun, i.e. \(Indef(+)\) and \(?SC(x)\), a set of actions is now initiated that causes the pointer to move to the most locally dominating node decorated with \(?Ty(t)\) and, because the term is marked as indefinite, adds the statement \(U < x\) to the \(\text{Scope}\) predicate at the top node to yield \(\text{Scope}(S_i, U < x)\).

Because of the underspecification associated with the use of the metavariable, the choice of which term the variable is dependent on is determined by pragmatic factors. However, this choice is not as free as the analogous choice for pronouns: what is being constructed is one of a number of terms all of which have to be interpreted relative to the particular propositional formula. So what the metavariable ranges over is other fully determined terms in the construction process, at the point in the construction process at which the choice is made, where “fully determined” means a term with a fixed scope-depency relation. For a wide-scope reading of the indefinite, its scope relation can be fixed relative to the index of evaluation, \(\text{Scope}(S_i, U < x)\), immediately upon processing the expression itself. However, like all other processes, this substitution process is optional, and so the scope relation can be left open at this point, allowing it to be determined after some later term is introduced, when the pointer is able to get back to the node where the scope statement is by licensed moves, i.e. by moves associated with Completion, Elimination and Anticipation.

Despite the fact that the scope requirement \(?SC(x)\) is not yet satisfied, the provision of a type \(e\) specification and a formula value has sufficiently completed the parse of the indefinite expression for the pointer to move on (Completion only needs a specification of a type value and is blind to other requirements that may sit on the node, unlike Elimination). So the pointer can move to the predicate node and proceed with the parse of the verb phrase, i.e. \(\text{read every book}\). This is shown in (3.69), again up to the point at which Elimination applies to yield the universal term as formula at the higher of the two type \(e\) nodes (notice where the pointer is in (3.69)).

---

49 The details of how these scope actions are formulated is not going to be needed later, so these we leave on one side. See Chapter 7 of Kempson et al. (2001) for formal details.

50 Recall that universal quantification is indicated by the tau (\(\tau\)) operator.
3.3. QUANTIFIER SCOPE AND ITS EFFECTS

(3.69) Parsing every book in A student read every book:

\[
Tn(0), \text{Scope}(S_1, U < x), Tns(S_i < S_{\text{now}}), \text{?Ty}(t)
\]

\[
T_y(e), \text{Indef}(+), \\
F_0(e, x, \text{Student}'(x))
\]

\[
\text{?Ty}(e \rightarrow t)
\]

\[
T_y(cn), \\
F_0(x, \text{Student}'(x))
\]

\[
T_y(cn \rightarrow e), \\
F_0(\lambda P.(\tau, y, \text{Book}'(y))), \diamond
\]

\[
F_0(\text{Read}')
\]

\[
T_y(cn), \\
F_0(x, \text{Student}'(y))
\]

\[
T_y(cn \rightarrow e), \\
F_0(\lambda P.(\tau, P))
\]

Just like the indefinite, the created quantifying term has a feature determining what kind of determiner it is, \text{Indef}(\ldash), and also a scope requirement. The scope requirement on this higher type-\(e\) node now needs to be satisfied, and this takes place by the creation of a scope statement on the propositional node, thereby determining the relation of the the term binding the variable \(y\) to the remainder of the formula under construction. As the term is non-indefinite, its associated scope action simply adds the variable \(y\) to the last term that has been entered into the scope statement with a fixed scope dependency relation. This is the reflection of the fact that the scope of non-indefinites is determined strictly linearly. However, here is where the incompleteness of the scope specification for the previously parsed indefinite makes a difference. Had the choice been taken previously for the indefinite to have wide scope over any later introduced term, the term projected from the indefinite would have been construction-wise complete (with no requirements outstanding), and this would have given rise to the scope statements:

\[
\text{Scope}(S_i < x, x < y) \quad (\Rightarrow \text{Scope}(S_i < x < y))
\]

However, in the derivation leading to the \textit{inverse} scope interpretation, the scope of the indefinite was left undetermined so the specification of that term is not yet complete. This means that there is only one possibility for fixing the scope of the universal term; and that is to enter the variable \(y\) projected by the expression \textit{every book} into the scope statement as dependent on the one term in the sequence of scope statements that \textit{does} have a fixed value, and that is \(S_i\), the temporal variable. So the scope statement associated with the term \(\tau, y, \text{Book}'(y)\) is \(S_i < y\). With a specified scope statement now on the local propositional node, the requirement \textit{?SC}(y) (interpreted in the way specified above as a local modal requirement over the \textit{Scope} predicate and the variable \(y\)) is now satisfied, completing the specification of all requirements on this node. Since there are no requirements outstanding on the object node, \textsc{elimination} can apply to to yield the predicate \(F_0(\text{Read}'(\tau, y, \text{Book}'(y)))\). \textsc{completion} moves the pointer back onto the propositional node and the value of the metavariable \(U\) in the scope statement at the top node can be satisfied through being identified as \(y\), since the term containing \(y\) is at this juncture one of those with a fixed scope statement. With this sequence of actions, the effect is wider scope for the universal:

\[
\text{Scope}(S_i < y, y < x) \quad (\Rightarrow \text{Scope}(S_i < y < x))
\]
A scope relation for \( x \) is now established, satisfying the requirement, \( ?SC(x) \), on the subject node. As previously, Elimination can take place to yield the propositional formula \( \text{Read}'(\tau, y, \text{Book}'(y))(\epsilon, x, \text{Student}') \). So the sequence of actions has led to a pair consisting of a logical formula of type \( t \) and a scope statement which constitutes the input to the scope evaluation procedure:

\[
(3.70) \quad \langle S_i < y < x \rangle \quad \text{Read}'(\tau, y, \text{Book}'(y))(\epsilon, x, \text{Student}'(x))
\]

Overall then, whatever the various scope-dependency choices and when they are made, the collection of scope-dependency statements gradually accumulates as terms are progressively introduced into the structure through the regular tree construction process. The separating out of determining scope for indefinites into two parts - the projection of an incomplete scope specification, and the choice of value that completes it - allows for a delay in establishing the scoping of the indefinite which is essentially similar to the characterisation of expletives that we give in chapter 5.

3.3.3 Term-Operator Evaluation Rules

Once the various scope statements have been incrementally collected, everything is in place for the application of a scope evaluation process. This algorithmically determines a full specification of interpretation from a pair of a sequence of scope statements and some associated logical formula as input. As we have to expect, it is in this algorithm that the complexity emerges, since it provides an explicit rendering of the semantic dependencies. What the algorithm does is to take the scope statements, one by one, on an inside-out basis, and the quantificational force of the term, given its internal quantifier.\(^{51}\)

The algorithm follows the pattern given by the predicate-logic epsilon-calculus equivalence that we came across informally in section 3.2.1:

\[
\exists x \phi(x) \\
\phi(\epsilon, x, \phi(x))
\]

There is an important property shown by this two-way equivalence. All information projected by the propositional formula \( \phi \) which is bound by the existential quantifier in the familiar predicate logic formula is, in its epsilon calculus equivalent, repeated in the restrictor of the corresponding term. The term denotes exactly that property \( \phi \) that makes \( \exists x. \phi(x) \) true: hence, the two occurrences of \( \phi \) in the formula \( \phi(\epsilon, x, \phi(x)) \). By definition, that is, an epsilon term denotes an arbitrary witness of the truth of the containing formula and, equally, it is an arbitrary witness of the corresponding predicate-logic formula, as noted above.

To see what this correspondence resides in, and how it relates to natural-language quantification, consider a simple statement such as (3.71a) and its predicate logic formulation (3.71b):

(3.71) a. Something is burning.

\( \exists x. \text{Burn}'(x) \)

To represent this information in the epsilon calculus, we have to construct a formula where there are two instances of the predicate \( \text{Burn}' \), one inside the term itself.\(^{52}\) Hence from (3.71b), we get the epsilon formula (3.72).

\(^{51}\)This work is that of Wilfried Meyer-Viol’s as reported in Kempson et al. (2001).

\(^{52}\)Notice the heuristic for making the appropriate conversion from predicate logic formula to equivalent epsilon-calculus formula. From some predicate logic formula, here (3.71a), the algorithm takes the predicate and applies it to some constructed term. That term is itself constructed by replacing the predicate logic formula with the corresponding epsilon operator.
(3.72) \( \text{Burn}'(\epsilon, x, \text{Burn}'(x)) \)

The natural language pattern is one step more complex than this. The normal pattern is not some predicate on an \textit{unrestricted} variable, as in the pairing of (3.71) as (3.72), but a statement on some term with a \textit{restricted} variable, the restriction normally given by the information associated with some common noun phrase. Consider (3.73a) and its predicate logic characterisation (3.73b).

(3.73) a. A cake is burning.
   b. \( \exists x. \text{Cake}'(x) \land \text{Burn}'(x) \)

To construct an epsilon formula with the same truth conditions, both predicates, \( \text{Cake}' \) and \( \text{Burn}' \) need to apply to some epsilon term that picks out a witness for \textit{both} predicates, as in (3.74a) which we will generally write as (3.74b).

(3.74) a. \( \text{Cake}'(\epsilon, x, \text{Cake}'(x) \land \text{Burn}'(x)) \land \text{Burn}'(\epsilon, x, \text{Cake}'(x) \land \text{Burn}'(x)) \)
   b. \( \text{Cake}'(a) \land \text{Burn}'(a) \)
   where \( a \) is \( (\epsilon, x, \text{Cake}'(x) \land \text{Burn}'(x)) \)

This is the form of evaluation that we are aiming to achieve, showing within the epsilon calculus the quantificational content of the individual epsilon terms. So what we need is to establish is how this content is projected from the propositional formulae projected by the parse process, such as (3.75).

(3.75) \( \text{Burn}'(\epsilon, x, \text{Cake}'(x)) \)

To get the appropriately general form of rule of evaluation, we take the predicate-logic statement of the semantics we want, and define an algorithm from the corresponding logical form as just parsed onto the epsilon-calculus equivalent of the appropriate predicate-logic statement.

To see what the general rule yields by way of an individual illustration, notice that the internal structure of the final compound formula (3.74b) has four distinctive properties:

(i) a \textit{first} conjunct made up of the restrictor of the term under evaluation;

(ii) this restrictor is predicated of a term which is defined to represent a witness for the containing propositional formula;

(iii) a \textit{second} conjunct made up of the predicate of the logical form as just parsed applied to that same term;

(iv) a connective reflecting the particular quantificational construal of the operator in the term.

It is this pattern which the rule of evaluation reflects. The construction step takes the restrictor of the expression under evaluation and presents it as a predicate to a name (which is under construction - more of this in a minute). This predicate-argument formula by definition of the algorithm forms the first conjunct of a compound formula. The connective in this formula is the connective appropriate to the truth conditions of the particular expression under evaluation: \( \land \) for existential quantification, \( \rightarrow \) for universal quantification. And the second conjunct is then the propositional formula in which the expression under evaluation is contained, in

\[53\] Notice how the same recipe for constructing the appropriate epsilon term applies – take the predicate-logic equivalent, and replace the operator by the epsilon operator.
which all occurrences of the expression under evaluation are replaced by the constructed name. The name itself then has exactly the same internal structure as this compound formula (reflecting the epsilon/predicate-logic equivalence), except that the name is replaced by the variable and the whole is prefixed by the appropriate operator.

The formal definition of this algorithm is given in (3.76).

(3.76)  **Scope Evaluation Algorithm:**

Formulae of the form:

\[ \phi(\nu_1, x_1, \psi_1), \ldots, (\nu_n, x_n, \psi_n) \]

are evaluated relative to a scope statement:

\[ \langle S_i < x_1 < \ldots < x_n, \ldots, t \rangle \phi[\nu, x_n, \psi_n/x_n] \]

where for \( x \) occurring free in \( \phi \) and \( S_i \) a (temporal) index, the values \( f_{\nu x \psi}(\phi) \), for \( \nu \in \{\epsilon, \tau, Q\} \), and \( f_{S_i}(\phi) \) are defined by:

a. \( f_{\tau x \psi}(\phi) = (\psi[a/x] \rightarrow \phi[a/x]) \)
   where \( a = \tau, x, (\psi \rightarrow \phi) \)

b. \( f_{\epsilon x \psi}(\phi) = (\psi[b/x] \land \phi[b/x]) \)
   where \( b = \epsilon, x, (\psi \land \phi) \)

c. \( f_{\iota x \psi}(\phi) = (\psi[c/x] \land \phi[c/x]) \)
   where \( c = \iota, x, (\psi \land \phi) \)

d. \( f_{S_i}(\phi) = (S_i : \phi) \)

In the case of the formula in (3.75), there is only a single possible scope statement \( S_i < x \), so the algorithm proceeds in two steps. First we evaluate the epsilon term (because \( x \) has narrower scope). By (3.76), we first construct (3.77b) from (3.77a).

(3.77)  a. \( \langle S_i < x \rangle \text{Burn}^{\prime}(\epsilon, x, \text{Cake}^{\prime}(x)) \)
        b. \( \langle S_i \rangle \ f_{x, \text{Cake}^{\prime}(x)}(\text{Burn}^{\prime}(x)) \)

(3.76b) now applies to this to replace \( x \) in the argument position with the relevant constructed term, at the same time conjoining this with the restrictor, again with its instance of \( x \) replaced by the constructed term (3.78a) (= (3.75)). The evaluation is completed by ‘discharging’ the index of evaluation to give the fully evaluated propositional formula in (3.78a).

(3.78)  a. \( \langle S_i \rangle \text{Cake}^{\prime}(a) \land \text{Burn}^{\prime}(a) \)
        where \( a = (\epsilon, x, \text{Cake}^{\prime}(x) \land \text{Burn}^{\prime}(x)) \)

b. \( S_i : \text{Cake}^{\prime}(a) \land \text{Burn}^{\prime}(a) \)
        where \( a = (\epsilon, x, \text{Cake}^{\prime}(x) \land \text{Burn}^{\prime}(x)) \)

This example involves just one occurrence of the term under evaluation; but in more complex cases the enriched term will replace all occurrences of the partial term under evaluation. To see this, let us take a case of universal quantification with a pronoun that is to be construed as bound by the quantifying expression. A parse of the string in (3.79a) yields the propositional formula in (3.79b) with two occurrences of the partial tau term, as it has been used as substituend of the metavariable provided by the pronoun in the embedded clause.
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(3.79) a. Every student insisted that she had worked.
   b. \((S_i < x) \quad \text{Insist}'(\text{Work}'(\tau, x, \text{Student}'(x)))(\tau, x, \text{Student}'(x))\)

In this formula, both occurrences of the tau term will be replaced by \(a\) in the expansion resulting from the Evaluation rule:

(3.80) \(\text{Student}'(a) \rightarrow \text{Insist}'(\text{Work}'(a))\)

where \(a = (\tau, x, \text{Student}'(x) \rightarrow \text{Insist}'(\text{Work}'(x)))\)

Notice how the problems which arise in any analysis of pronominal anaphora in which the pronoun constitutes a copy of its antecedent linguistic expression do not arise on the present account: anaphora resolution involves constructing a copy of the partial but unevaluated term, not a copy of the linguistic expression.

The general result is as we would expect of an epsilon calculus analysis. The formula as represented by the names is relatively simple; and indeed names can always be represented in a form that maximises the simplicity. The complexity is hidden in the terms themselves, and it is these that make explicit the relative quantificational scope of terms in the containing formula, hence the semantic dependencies.

This pattern can be extended to all quantifiers; with the same form of result. Expressed in a shorthand form, the schematic names \(a\), \(b\), etc give a clear display of the structural dependency: spelling out their dependency in full however reveals the semantic complexity. We take (3.67) (repeated below) by way of illustration of the simplest type of mixed quantification with its propositional structure given in (3.70) giving the indefinite narrowest scope.

(3.67) A student read every book

(3.70) \(\langle S_i < y < x \rangle \quad \text{Read}'(\tau, y, \text{Book}'(y))(\epsilon, x, \text{Student}'(x))\)

The relative evaluation of the two quantifiers is in two steps. In the first case, we evaluate the epsilon term, because its variable is the rightmost term in the scope statement. So, by the general rule in (3.76) we get (3.81a) to which (3.76b) is applied to give (3.81b).

(3.81) Step 1 evaluating the epsilon term:
   a. \(\langle S_i < y \rangle \quad f_{\epsilon,x,\text{Student}'(x)}\text{Read}'(\tau, y, \text{Book}'(y))(x)\)
   b. \(\text{Student}'(a) \land \text{Read}'(\tau, y, \text{Book}'(y))(a)\)

where \(a = (\epsilon, x, \text{Student}'(x) \land \text{Read}'(\tau, y, \text{Book}'(y))(x))\)

In the second step, the same process applies to this tau term. So by the general rule from (3.82a) we get (3.82b).

(3.82) Step 2 evaluating the tau term:
   a. \(\langle S_i < y \rangle \quad \text{Student}'(a) \land \text{Read}'(\tau, y, \text{Book}'(y))(a)\)

where \(a = (\epsilon, x, \text{Student}'(x) \land \text{Read}'(\tau, y, \text{Book}'(y))(x))\)
   b. \(\langle S_i \rangle \quad f_{\tau,y,\text{Book}'(y)}(\text{Student}'(a) \land \text{Read}'(y)(a))\)

Again the restrictor of that term forms the first conjunct, predicated of a newly introduced name, but this time the connective is implication, reflecting the truth conditions contributed by the expression every book. In the remainder of the formula, all occurrences of that incomplete tau term get replaced by the newly constructed name, and that includes all the occurrences inside the already constructed epsilon term. The subscripted names indicate this dependency: the form \(a_b\) indicates that the term \(a\) depends on the term \(b\). As before, the new name itself reflects the entire structure of its containing propositional formula. This is shown in (3.83):
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(3.83) Book′(b) → (Student′(a_b) ∧ Read′(b)(a_b))

where:

\[ a_b = (\epsilon, x, \text{Student}'(x) \land \text{Read}'(b)(x)) \]

\[ b = (\tau, y, \text{Book}'(y) \rightarrow (\text{Student}'(a_y) \land \text{Read}'(x)(a_y))) \]

\[ a_y = (\epsilon, x, \text{Student}'(x) \land \text{Read}'(y)(x)) \]

Notice that in the finally expanded formulae, \( b \) occurs as a subterm of the narrower scoped term \( a \), and \( b \) itself contains a further occurrence of \( a \), this time with \( y \) as a subterm. But \( y \) is bound by the \( \tau \) operator, hence the entire term \( a \) has all variables in it duly bound. This is why \( a_b \) and \( a_y \) are both necessary, despite looking very similar. The former effectively reintroduces the tau term back into the formula so that the variable \( y \) in the latter can be properly bound. So, the full expansion of \( a_b \) is:

\[ (\epsilon, x, \text{Student}'(x) \land \text{Read}'(\tau, y, \text{Book}'(y) \rightarrow (\text{Student}'(\epsilon, x, \text{Student}'(x) \land \text{Read}'(y)(x)) \land \text{Read}'(x)(\epsilon, x, \text{Student}'(x) \land \text{Read}'(y)(x))))(x) \]

In general, not surprisingly, we stick to the short-hand equivalent as in (3.83).

3.3.4 Quantification and non-restrictive construal

Given the complexity of the scope evaluation process we have just got through, it is worth emphasising the simplicity of the distinction between restrictive and non-restrictive forms of construal discussed in section 3.2: an immediate benefit of having transferred the complexity of expressing scope-dependency out of the tree-growth process. As noted several times, the structure associated with quantifying terms contains two type \( e \) terms and the difference between restrictive and non-restrictive construals of a relative clause then lies solely in which of these nodes projects the LINK transition. The difference, that is, results from the distinct stages in the interpretation process at which the LINK transition is initiated, a choice which leads to different evaluation processes.\(^{54}\) As we have seen, with the construction of a LINK transition from an introduced variable on the internal type \( e \) node, the result is an open propositional formula contributing to the restriction of the domain of that variable. With the construction of the LINK transition from a constructed term, on the other hand, the result will be a conjunction of predicates containing one and the same term, forming part of the overall assertion made despite the use of a processing form of subordination, and not part of that term’s restrictor.\(^{55}\)

A first consequence of this analysis is that we expect non-restrictive relative modification to be freely available to all noun phrases, not merely indefinites or

\(^{54}\)This is unlike many analyses of non-restrictive relatives, which are often said to be some form of discourse-licensed parenthetical, merely adding incidental information about the object described. See Fabb (1990), Safir (1996) who analyse them as involving some post-LF level of LF’, a level whose status is not well understood, either formally or conceptually.

\(^{55}\)The observation that there is some form of semantic distinction between the two types of construal is currently analysed using the only other conventional means of characterising content, viz as a type of conventional implicature (Chierchia and McConnell-Ginet 1990 and Potts 2001). On this analysis, the content of a non-restrictive relative is a filter on the projection of the primary content, but not part of its resulting truth-conditions; an analysis which does not provide a basis for explaining the interaction of anaphora and non-restrictive relative construal in many of the data listed in this section.
3.3. QUANTIFIER SCOPE AND ITS EFFECTS

names:  

(3.84)  
a. Every referee, who I had personally selected, turned down my research application.

b. Every parachutist, who the pilot had instructed meticulously, was warned not to open his parachute too early.

c. Before I left, I managed to see most of my students, who I gave something to read to discuss with me when I got back.

In these cases, it is the term under construction that is imposed as a requirement on the linked structure, duly copied at the unfixed node by the actions of the relative pronoun, and subsequently unified as an argument node in the predicate structure.

In (3.84b), for example, it is the tau term decorating the subject node that is copied into the LINK structure, as shown schematically in (3.85).  

(3.85) Parsing (3.84b):

\[ S_i < x, ?Ty(t) \]

\[ Tn(00), Ty(e), Fo(\tau, x, Parachutist'(x)) \]

\[ ?Ty(e \rightarrow t) \]

\[ (L^{-1})Tn(00), ?Ty(t), Fo(\tau, x, Parachutist'(x)), Fo(p_{21}), Ty(e), Ty(e) \]

\[ ?Ty(e \rightarrow t) \]

\[ Ty(e \rightarrow (e \rightarrow t)), Fo(Instruct' \bullet) \]

Notice how in this case, the scope statement \( S_i < x \) is assigned at the top node prior to the construction of the LINK transition, since the type e term is provided. It is then the combination of the LINK evaluation rule and a subsequent single process of scope evaluation which ensures that the construal of the linked structure forms a conjunction in the consequent of the conditional associated with the evaluation of the tau term. The resulting logical form of (3.84b) is given in (3.86a) with its fully evaluated form in (3.86b).  

(3.86)  
a. \( (S_i < x) \ (\text{Warned}'(\tau, x, Parachutist'(x)) \land \ (\text{Instructed}'(\tau, x, Parachutist'(x))) \)

b. \( S_i : \text{Parachutist}'(a) \rightarrow (\text{Warned}'(a) \land \text{Instructed}'(a)) \)

\[ a = \tau, x, \text{Parachutist}'(x) \rightarrow (\text{Warned}'(x) \land \text{Instructed}'(x)) \]

56 On the assumption that \( wh \)-question words are place-holding devices (see Kempson et al. 2001), they will disallow non-restrictive modification, since the value to be assigned to the relative pronoun must be some fixed \( \text{Formula} \) value, and not some open place-holder.

57 Much irrelevant structure is omitted from this tree display and the content of the definite the pilot is shown as an arbitrary term \( p_{21} \).

58 The internal structure of the two verb-phrases the pilot instructed meticulously and was warned not to open his parachute too early are simplified to Instructed' and Warned', respectively, for ease of exposition.
The LINK evaluation step for non-restrictive relative clauses thus has the effect of a scope-extending device, despite being combined merely as the addition of a conjoined formula. This is the result of having an incremental method of building up scope dependencies as terms are constructed and an account of non-restrictive relative construal as anaphorically inducing a copy of such terms into a LINKed structure.

A further consequence of our analysis is that we expect that quantifiers in the main clause should be able to bind pronouns in the relative clause (Safir 1996):

(3.87)  
  a. Every nurse alerted the sister, who congratulated her on her prompt reaction.
  b. Every parrot sang a song, which it ruined.

In the processing of (3.87b), there are two terms under construction, \((τ, x, \text{Parrot}'(x))\), and \((ε, y, \text{Song}'(y))\). The non-restrictive relative clause modifying the object thus has a copy of the epsilon term within it. Nothing, however, precludes the tau term from being identified as the antecedent to the pronoun, \(it\) in that relative clause structure, as illustrated (again schematically) in (3.88) where the substitution step is shown by \(↑\).

(3.88) A possible parse for *Every parrot sang a song which it*:

The subsequent LINK evaluation statement will be essential to the interpretation, creating the necessary conjunctive formula; and the result may be a logical form in which the epsilon term takes narrower scope than the tau term as in (3.89) whose subsequent evaluation yields (3.90).

(3.89)  
\[
\langle S_i < x < y \rangle \text{Sing}'(ε, y, \text{Song}'(y))(τ, x, \text{Parrot}'(x)) \land \\
S' : \text{Ruin}'(ε, y, \text{Song}'(y))(τ, x, \text{Parrot}'(x))
\]

(3.90)  
\[
S_i : \text{Parrot}'(a) \rightarrow (\text{Song}'(b_α) \land \text{Sing}'(b_α)(a)) \land S' : \text{Ruin}'(b_α)(a)
\]

where

\[
a = (τ, x, \text{Parrot}'(x) → \text{Song}'(b_α) \land \text{Sing}'(b_α)(x) \land S' : \text{Ruin}'(b_α)(x)
\]
\[
b_α = \text{Song}'(y) \land \text{Sing}'(y)(a) \land S' : \text{Ruin}'(y)(a)
\]
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\[ b_x = \text{Song}'(y) \land \text{Sing}'(y)(x) \land S': \text{Ruin}'(y)(x) \]

Notice how the content of the non-restrictive emerges to the right of the major connective. The LINK EVALUATION rule, as before, acts as a scope extending device so that terms in any linked structure may be interpreted as within the scope of a term introduced in the primary structure, a result that in other frameworks would require an itemised rule of accommodation to license the binding across the clausal boundary (Roberts 1989).

Finally, we also expect that such pronouns may occur in restrictive relative construals also:

(3.91) Every parrot sang one song which it ruined and one which it sang quite well.

In these cases too, in just the same way, the anaphoric metavariable may take as its value the partially specified term \( \tau, x, \text{Parrot}'(x) \) prior to any scope evaluation process.

3.3.5 Anaphora, co-ordination, and relatives

We now come back full circle to the desideratum of a unitary account of anaphora as a substitution device, set out in chapter 1. With natural language quantifiers seen as projecting terms denoting witness sets we have a straightforward basis for the E-type effects associated with cross-sentential anaphora; and also a natural means of expressing the relation between such interpretations and their relative-clause congener in which two structures are, in some sense, presented as one.

The E-type effects of cross-sentential anaphora have often been observed, most notably by Evans (1980), Kamp (1981), and Kamp and Reyle (1993).

(3.92) A child cried. John had upset her.

In (3.92), the pronoun her stands not for a child, nor for the term \( \epsilon, x, \text{Child}'(x) \), but for \( \epsilon, x, \text{Child}'(x) \land \text{Cry}'(x) \); that is, as a representation of some child that cried, a term that in some sense compresses the entire content conveyed by some previous structure within an individual term. This is all as this account of quantification would lead one to expect. In (3.92), the term that provides the value for the pronoun her is the epsilon term that is constructed once the logical form for the first sentence is, not only constructed, but also evaluated, i.e. the richer term \( (\epsilon, x, (\text{Child}'(x) \land \text{Cry}(x))) \). This term is then used as the basis of a new logical structure so that for the second sentence in (3.92) we get (3.93a) which is in turn evaluated relative to a further scope statement as (3.93a) (ignoring tense).

(3.93) a. \( \text{Upset}'(\epsilon, x, \text{Child}'(x) \land \text{Cry}'(x))(\epsilon, y, \text{John}'(y)) \)

b. \( \text{Child}'(a) \land \text{Cry}'(a) \land \text{Upset}'(a)(\epsilon, y, \text{John}'(y)) \)

where: \( a = (\epsilon, x, \text{Child}'(x) \land \text{Cry}'(x) \land \text{Upset}'(x)(\epsilon, y, \text{John}'(y))) \)

So, even these E-type construals, where the antecedent of the pronoun involves a computation over the whole containing structure, the process of construal for the anaphoric expression itself requires nothing more than a simple substitution process copying a term constructed in the context.

Unlike other accounts, we can naturally reflect the distinction between such sequences of sentences involving pronouns, and the near equivalent, sentence-internal forms:

(3.94) A child, who John had upset, cried.
The distinction between the three construction types in (3.92), (3.94) and (3.95) turns on the differences in the process whereby the structures are built up, despite their truth-conditional equivalence. This has the bonus of capturing the notion of semantic subordination expressed by a non-restrictive relative clause, which is otherwise so hard to express. The non-restrictive construal of (3.94) thus involves the construction of an epsilon term, \((\epsilon, x, \text{Child}'(x))\), prior to a process which copies that term into the LINKed structure. This copy process is, however, is prior to any application of the Scope Evaluation Algorithm. The logical form that is constructed is (3.96a) which when evaluated yields (3.96b).

\[(3.96) \quad \text{a. Cry}'(\epsilon, x, \text{Child}'(x)) \land \text{Upset}'(\epsilon, x, \text{Child}'(x))(\iota, y, \text{John}'(y)) \]
\[\quad \text{b. Child}'(a) \land \text{Cry}'(a) \land \text{Upset}'(a)(\iota, y, \text{John}'(y)) \text{ where:} \]
\[a = \epsilon, x, \text{Child}'(x) \land \text{Cry}'(x) \land \text{Upset}'(x)(\iota, y, \text{John}'(y)) \]

In the restrictive construal (3.95), on the other hand, the LINK transition takes place prior to the construction of any quantified term, so the conjunction derived from the linked structure is compiled as part of the restrictor for the epsilon term under construction, which is:

\[\text{(Child}'(x) \land \text{Upset}'(x)(\iota, y, \text{John}'(y)))\]

Hence, we predict the truth-conditional equivalence of the results (at least in the singular indefinite case) despite the different procedures used to construct them. We have, correctly, a processing ambiguity, but not one necessarily resulting in denotational distinctiveness.

The two forms of subordination differ from co-ordination in that the latter is constructed as two entirely independent structures, with, solely, possible anaphoric links. The restrictive form of construal involves subordination in the sense of the content derived from the LINKed structure being compiled in as a compound restrictor on the domain of the variable quantified over. And the non-restrictive form of construal, as the intermediate case, involves subordination only in the sense of the content derived from the LINKed structure being quantified over as a single scope-binding domain, hence lacking the independence of quantification possible with conjoined sentences.

### 3.4 Summary

Let us take stock of what we have achieved. We have an account of relative clauses which provides a natural basis for distinguishing restrictive and non-restrictive relative clause construal, while nevertheless assuming a single rule for introducing the structures which underpin these different types.\(^{59}\) Quantification is defined in terms that allow maximum correspondence between the syntactic properties of quantified noun phrases and the requisite scope-taking properties of quantifying expressions. We have a preliminary account of crossover phenomena in relative clauses, which shows how anaphoric and strict update processes can interact.\(^{60}\)

\(^{59}\)Closely related to non-restrictive relative clause construal is the phenomenon of apposition: (i) John, a friend of my mother’s, is staying.

\(^{60}\)The analysis of crossover here was developed in connection with non-restrictive relative forms of construal, as the data are said to be less clearcut with restrictive forms of construal. See
In all cases set out so far, the syntactic properties of the structures have been shown to follow from the process of tree growth. Long-distance dependency phenomena, crossover phenomena, and restrictive and non-restrictive relative forms of clause construal, have all been characterised exclusively in terms of the structure representing the final logical form, the input provided by lexical specifications, and the process of goal-directed tree growth that is defined over a sequence of update actions. The different syntactic and semantic properties of expressions are seen to emerge from the dynamics of how logical structures are built up in a time-linear parsing perspective.

So, though incomplete in many respects, we have the first detailed evidence that the formalism set out can be seen not just as a tool for modelling the process of interpretation, but as a putative grammar formalism. We now turn to seeing how these three strategies of building linked structures, building unfixed nodes, and decorating nodes with underspecified metavariables can interact in different ways to yield cross-linguistic generalisations.

Kempson et al. (2001) for a full discussion of crossover phenomena across relative clauses and questions, and Cann et al. (forthcoming) for discussion of the problem of how best to characterise borderline judgements of grammaticality.
Chapter 4

Tree growth and language typologies

In setting out the analysis of long-distance dependency in chapter 2, and of English relative clause construal in chapter 3, we have been consolidating a perspective that is quite distinct from orthodox frameworks. We have rejected the concept of there being a fixed position in a tree which hosts left-dislocated expressions in a sentence, for which there has to be some defined mapping relating this node to some other position in the sentential structure; such as Move $\alpha$ in transformational theories; feature passing rules in HPSG; or mapping conditions from c-structure to f-structure in LFG. We have replaced these various mechanisms with an account that utilises underspecification of structure and growth of structure during the time-linear construction of an overall logical form. Applying this methodology to relative clause construal, we turned our back on the analysis of a relativising complementiser as a variable-binding operator defined solely in terms of the hierarchical structure within which it is contained. Instead, we have adopted a contextually driven analysis in which anaphoric links are constructed between one structure and the next, through a copy process induced by the building of a LINK relation. As we have already seen in taking up the case of crossover with non-restrictive relative forms of construal, the articulation of anaphoric and structural processes using the same vocabulary of underspecification and update opens up a new perspective for analysing the interaction between structural and pragmatic processes.

In this central section of the book (chapters 4 and 5), we follow up on the characterisations of lexical variation set out at the end of chapter 2, and turn to exploring these interactions in developing cross-linguistic typologies, in exactly the spirit of the methodological commitment of articulating universal properties of language systems made standard by Chomsky throughout the past forty years. However there is a new twist, because the typologies emerge from paying careful attention to the time-linear way in which interpretation is built up over partial structures across some sequence of words which the individual languages license. In articulating these typologies, it is important to bear in mind that the framework is constraint-based, and not encapsulated. At any point in the development of a partial tree, the system determines a set of legitimate next moves, which may include the substitution of a value for some metavariable. And, though the system will not dictate what particular choice amongst such alternatives might be made, choices may nevertheless be made at that intermediate point; and the application of additional constraints superimposed externally may play a role in fixing interpretation of that partial structure. Part of the task in developing a cross-linguistic
account, then, is to determine which forms of update are particular to human language, which are particular to the individual language, and which are a consequence of general cognitive constraints.

Our over-all aim in chapter 4 and 5 is to explain the interaction between anaphoric construal and structure building processes, and left and right periphery effects. The first step is relatively modest. We set out a preliminary partial typology of restrictive relative clauses, focusing on head-initial relatives. We then build on the partial parallelism between this and construal of left-peripheral expressions to set out a typology of left-periphery effects, using the concepts of LINKed structures, unfixed nodes and anaphora resolution. These areas have been subject to intensive study, and, in this chapter, we aim merely to show that the DS tools provide a natural basis for the gradient set of effects observable in left periphery constructions while retaining a unitary analysis of any individual pronoun. As things turn out however, the feeding relations between the different tree-update processes provide the basis for a more fine-grained characterisation of the data both in relative clause and left-periphery constructions than a two-way distinction between structural and anaphoric forms of dependency is able to express. The principles remain simple and general even though the interactions between the various constraints on their implementation may give rise to overlapping tree-growth processes, giving the appearance of complexity.

Then in the following chapter, we turn to right-periphery effects which, expletive pronouns aside, have been the subject of much less study; and we shall show that the same concepts of anaphorically pairing LINKed structures and building unfixed nodes can be applied to rather different effect to capture generalisations about how interpretation is built up at later stages of the construal process. This is a more surprising result, as many right-periphery effects are subject to the much tighter Right Roof Constraint, which in other frameworks remains a poorly understood constraint, requiring structure-specific stipulation.

From there we shall turn to head-final languages and use the same tools all over again, both to characterise word order effects in Japanese, and to capture the various forms of relative clause construal. Thereafter, we shall turn to the Bantu languages and look at the puzzle of co-ordination and mis-matching agreement data, where again we shall see the influence of the dynamics of processing. The result will be a rounding out of the typology of relative clauses to determine predictions of both the limits on the type of processes that natural languages make available, and on the type of variations to expect within that landscape. Right across the different types of languages, asymmetries between left and right periphery effects will be explained as consequences of the dynamics of on-line processing.

4.1 Towards a Relative Clause Typology

As a preliminary to setting out the sort of typologies that the framework leads us to expect, we need to set the limits on variation which it imposes. Adopting a parsing perspective on the articulation of syntactic properties of natural language imposes a tight constraint on natural language variation. First, it disallows any variation in types of Formula decoration. We assume all languages express the same types of predicates, term-binding operators, etc. To drop the assumption of a shared language of inference, at least in structure, would mean adopting a wildly

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1 Although we do not assume a one-to-one mapping between the concepts lexicalised in different languages. Modern Irish glas does not map on to Modern English green, since part of its spectrum includes grey (of animals).
“Whorfian” position with respect to the culture-relativity of thought. Since we do not wish to adopt any such stance, we expect the structure of the resultant trees to be identical, particular Formula decorations apart.

But we can go further than that, since there is no possibility of variation in the design properties of the construction process from language to language. All language is interpreted relative to context; and all language processing involves systematic update from one context to another. Given our modelling of these concepts as the progressive building of decorated LINKed trees, we take the basic patterns of tree growth over such LINKed partial trees to constitute the core formalism, common to all languages. But this means that variation in language can only come from the relative distribution of computational and lexical actions, and any language-particular constraints on those actions.

As our first illustration of this, we take up the challenge of setting out a relative-clause typology. In the account of English relative clauses set out in chapter 3, our analysis involved three principal processes:

- the construction of a LINK relation between a completed node of type e to a proposition-requiring node;
- the concomitant imposition of a requirement on the LINKed tree that it contain ‘somewhere within it’ a copy of the formula that decorates the head;
- the construction of an unfixed node which is decorated by the anaphoric properties of the relative pronoun with that copy.

In turning to the articulation of a typology of relative clause types relative to this, there are two types of variation that we are led to expect. First, there is the issue of the anaphoric properties of the relativising element. Does it itself provide a copy of the term in the LINKed structure under construction, as in English? Or does it convey some weaker instruction on building that transition, enforcing some regular anaphoric device to carry the burden of providing the copy? Then there are the locality constraints on where the copy of the head should be constructed in the emergent LINKed structure. Given that the form of requirement which induces the presence of the copy in that emergent structure is modal in nature, what modality is it that constrains the placement of that copy? And finally, as we shall see, there is the question of whether the relativising element is a pronominal device, as in English, or is a complex term with internal determiner-nominal structure.

### 4.1.1 Resumptive pronouns in Arabic

The most obvious form of variation in head-initial relative clauses is the way in which the copy of the head is provided in the structure induced by the relative clause. What we have assumed so far is that relative clause modification signals the building of paired propositional structures with a requirement of shared terms, and this is realised by the relativising element which provides the encoded anaphoric dependency. One basis for variation, however, is the form of update provided by that relativising element. If, for example, it fails to provide the encoded anaphoric copy, despite effecting the transition of introducing a LINKed structure and imposing the necessary requirement, then the regular anaphoric system of the language will have to be used instead. And this, we propose, is the underpinning to the presence of resumptive pronouns in relative clauses in languages where this is the canonical way of forming relative clauses.
Arabic is a case in point. It is a prototypical subject-pro-drop language, generally taken to be underlyingly verb-initial (Ouhalla 1994) and never requires specification of subject if this can be recovered contextually. However, it does require the use of resumptive pronouns in relative clauses in all positions being relativised upon except subject.2

(4.1) a. \textit{il mudarris \\ zill\-
\textit{i} \textit{Magdi} darab-u} \textit{Magdi}
\textit{the teacher who Magdi hit him}
\textit{‘the teacher who Magdi hit’}

b. \textit{il mudarris \\ zill\-
\textit{i} darab \textit{Magdi}}
\textit{the teacher who hit Magdi}
\textit{‘the teacher who hit Magdi’}

The general rule in this language is that something other than the relativising expression must provide the copy of the head within the relative-induced structure. The apparent exception of subject specification does not need any special characterisation on this view, for the restriction holds of the structure which represents the assigned interpretation, and not of the morphological sequence of the natural language itself. So subjects do not need to be defined as exceptions to the general rule: it is merely that the subject node is decorated by actions of the verb (see chapter 2), and so needs no explicit morphological provision.

What kind of analysis would Dynamic Syntax assumptions lead us to expect for such a distribution? Why, given this perspective, should one language obligatorily require use of the regular anaphoric device within the language, and another language license this, but only as a dispreferred option, as in English, and yet another debar them totally, as do German and Dutch? The need to invoke different kinds of pronouns in different languages might seem irresistible.

Yet we can reflect this difference naturally without any shift away from the analysis of the resumptive pronoun as an anaphoric device, if we pin down the differences between the three languages as a difference in the properties of the relativising element in those languages (a point of agreement between our analysis and that of Asudeh (2004)). Analysing the relativising elements in English relative clauses as pronominal devices has a consequence that no anaphoric device is needed subsequently, either to provide the copy of an item as the LINK analysis requires, or to indicate the position in the construction process at which \textsc{merge} takes place. Suppose, then, we analyse the relativising element in Arabic as \textit{not} providing the necessary copy. It is not, let us suppose, a relative \textit{pronoun}, even though it does indeed induce some \textsc{link} transition. All the Arabic complementiser \textit{zill\-
\textit{i}} does, we suggest, is to introduce a \textsc{link} relation between the head node just parsed, and a node which is to be the topnode of a LINKed structure. As before, the node dominating the emergent LINKed structure gets decorated with a requirement that somewhere in the development of that tree there should be a copy of the formula decorating the head node. The result will be that we expect the obligatory use of a regular anaphoric device to provide that copy. So the lexical actions that we take to be associated with the complementiser \textit{zill\-
\textit{i}} are those in (4.2).

(4.2) \begin{tabular}{ll}
\textbf{IF} & \{\textit{Fo}(x),\textit{Ty}(e),\textit{Def}(+),[[],]\} \\
\textbf{THEN} & \textsc{make}((L)); \textsc{go}((L)); \\
\textbf{ELSE} & \textsc{put}(\textit{Ty}(t),\textit{D})(\textit{Fo}(x),\textit{Ty}(e)) \\
\end{tabular}

2The relativising complementiser takes somewhat different forms in the different variants of Arabic, all related to the definite article. In the main, the Arabic we shall use as illustration is Egyptian Arabic.
4.1. TOWARDS A RELATIVE CLAUSE TYPOLOGY

What these actions stipulate is that in the presence of a terminal type e node, a LINK transition is constructed onto a new topnode with two requirements: one of \( ?T_y(t) \) and an additional requirement for a copy of the formula decorating the head node from which the LINK relation was built. This specification is notably like the computational action of LINK INTRODUCTION as defined for English, but here defined as a lexical action, triggered by the complementiser \( \hat{\text{illi}} \). However, there are differences. Firstly, this sequence of actions is restricted to applying to nodes decorated only by variables, since the condition on action lists the bottom restriction as a necessary condition, so it will only trigger restrictive forms of construal. Secondly, this complementiser is restricted to occurring with definite noun phrases and we stipulate a definite environment. Thirdly, the requirement for the copy involves a modality not yet encountered. This is shown by the operator \( \langle D \rangle \) which ranges over both daughter, \( \langle \downarrow \rangle \), and LINK relations, \( \langle L \rangle \), while its inverse, \( \langle U \rangle \), conversely ranges over mother, \( \langle \uparrow \rangle \) and inverse LINK relations, \( \langle L^{-1} \rangle \). Because it ranges over LINK relations this modality does not observe strong islands and thus imposes no structural constraint whatever on where in the construction process the copy head is to be found. Indeed, the required pronoun may occur across a relative clause boundary, a classic island-restriction violation:

\[
\begin{align*}
(4.3) &
\text{tarrafa} & \hat{\text{illa}} & \text{t-mafriz} & \text{yalli} & \text{laila} & \text{sheef} & \text{t-masra}\hat{\text{iy}y} \\
& \text{met}_{1\text{st.sg}} & \text{on} & \text{the-director} & \text{that} & \text{laila} & \text{saw}_{3\text{rd.sg.fem}} & \text{the-play} \\
& \text{yalli} & \text{huwe} & \hat{\text{zarraz-a}} & [\text{Lebanese Arabic}] \\
& \text{that} & \text{he} & \text{directed}_{3\text{rd.sg.masc-it}}
\end{align*}
\]

'We met the director that Laila saw the play that he directed it.'

The first consequence of defining \( \hat{\text{illi}} \) in this way is that, with no particular lexical item defined in the language as projecting the required copy, the only way of meeting it is to use the regular anaphoric process of the language, for this by definition involves a form which must be interpreted by some term taken from somewhere else in the context. Hence, there must be some pronoun occurring at some point in the subsequent string, and it must be interpreted as having an interpretation in which its value is token-identical to that of the formula provided by the head node. Any other interpretation of the pronoun (replacing the pronoun’s meta-variable with some independently available term) will leave the LINKed structure with a requirement outstanding, hence not well-formed. Any number of occurrences of a pronoun may occur in the subsequent string: all that matters is that one of them be interpreted as identical with the head from which the relative structure is induced.

The significance of this account is that unlike other characterisations of resumptive pronouns, this makes use of an entirely general account of pronouns. No special resumptive form for the pronoun needs to be posited, and there is no invocation of any “intrusive” pronoun either: the modal requirement does all the work. Despite the emptiness of the locality restriction that this particular form of requirement imposes (using the least constraining \( \langle D \rangle \) operator), the requirement still has the effect of enforcing application of the general process of substitution during the construction process. In order to meet the well-formedness condition that no requirements remain unsatisfied in the resulting logical form, the only possible sequences of transitions, given the non-anaphoric properties of the relativiser \( \hat{\text{illi}} \), will be ones in which at least one anaphoric device is assigned a construal which allows the modal

---

3 Notice again that this remains to be given a proper semantic characterisation, although if the characterisation of definites as involving the construction of a LINKed structure proposed in Cann (forthcoming b) is correct the environment for this operation could be stated directly. We leave this to one side, however.

4 This example is taken from Aoun and Choueiri (1999).
requirement to be satisfied.\footnote{The apparent lack of application of *Adjunction in unfolding the tree structure for a LINKed tree in Arabic following upon the transition ensured through the use of \( \bar{\text{i}} \) as no more than a superficial puzzle, given the analysis of Arabic as a subject pro-drop language, with verbs introducing a full propositional structure from a trigger \( ?Ty(t) \), decorating the introduced subject node with a metavariable. In cases in which an explicit subject expression is present in the string, there may then be an application of *Adjunction – the subject value decorating the unfixed node and merging with that given by the verb.} This pronoun-construal process does not even need to be defined as a grammar-internal device: the pragmatic status of the substitution process which assigns values from context to the metavariables lexically provided by pronouns can remain unmodified.

Recall now that in English, with the strong crossover data, we argued that there was a feeding relation between the decoration of an unfixd node with the value of the head and the existence of some node decorated by a pronoun with a metavariable of the same type \( e \) as the formula decorating the unfixd node. This is because nothing precluded them from merging and so updating the tree, a choice of action which would lead a subsequent node requiring the same type with nothing to provide it with a value. Supposing we have a relative clause sequence introduced by \( \bar{\text{i}} \), will the same distribution result? The predicted answer is no. It could not arise, because \( \bar{\text{i}} \) does not license the introduction of an unfixd node or provide any such node with a copy. All that it does is to license the transition initiating a LINKed structure, imposing on it the requirement for a copy. But this means that no such crossover effects should arise in Arabic relative clauses, as the only way to realise the requirement for a copy of the head in Arabic is through the use of pronouns. This prediction is correct. There are no analogous crossover data involving pronouns in Arabic relatives:\footnote{Demirdache (1991) and others have argued that there are crossover effects involving epithets. However, it has been counter-argued, by Aoun and Choueiri (2000) that such cases constitute a Principle C effect. We leave this issue on one side.}

\begin{enumerate}
\item \textit{ir-rajal} \( \bar{\text{i}} \) \textit{nadya} \textit{ftakkarit} \( \textit{\`inn-u} \) \textit{\`a:l} \( \textit{\`inn} \) Bill
  \textit{man} who Nadya thought that he said that Bill
  \textit{garaH-u}
  \textit{injured him}
  ‘the man who Nadya thought that he said Bill had injured him’
\item \textit{ir-ra:jil} \( \bar{\text{i}} \) \textit{nadya} \textit{ftakkarit} \( \textit{\`inn-u} \) \textit{\`a:l} \( \textit{\`inn-u} \) \textit{aiya:n}
  \textit{the man} who Nadya thought that he said that he was sick
  ‘the man who Nadya thought he said he was sick’
\end{enumerate}

Indeed, the situation presented by the Arabic data is the inverse of that with crossover. The explanation of the strong crossover data requires that a particular value of the pronoun is debarred, any construal of it \textit{other than} that of the head being possible. Here we have the opposite: that \textit{no} interpretation other than that of the head is possible. But in neither case do we have to invoke any structure-specific stipulation to the pronoun itself. The distribution emerges from the interaction of the dynamics of the various tree growth processes, given the different specifications of the relativising elements in the two languages.

It might seem that such a simple account cannot be sustained when more data are taken into account. To begin with, no relative pronoun is possible with an indefinite head. Contrary to the definite head, which requires the presence of \( \bar{\text{i}} \), if a relative clause modifies an indefinite noun phrase then there must not be any complementiser:
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(4.5) a. *mudarris Zili Magdi Darab -u
  teacher who Magdi hit him
  ‘a teacher who Magdi hit him’

b. mudarris Magdi Darab -u
  teacher Magdi hit him
  ‘a teacher who Magdi hit’

However, a simple solution to this problem is to define a highly restricted free-ride mechanism (without phonological input) that licenses the same construction of a LINKed structure with the same requirement: However, a simple solution to this problem is to define a highly restricted free-ride mechanism (without phonological input) that licenses the same construction of a LINKed structure with the same requirement:

\[
\emptyset_{relcomp} \begin{cases} 
  \text{IF} & Fo(x), Ty(e) \\
  \text{THEN} & \text{DEF}(+), Ty(e) & \text{Abort} \\
  \text{ELSE} & \langle \uparrow \rangle Ty(cn) & \text{Abort} \\
  \text{ELSE} & \text{Abort} \\
\end{cases}
\]

The net result is a complementarity of input triggers leading to the same result. However, such data do not in any case constitute a counter-argument to the proposed analysis of resumptive use of pronouns in Arabic, for relatives with either definite or indefinite heads require the presence of such a pronoun. All it shows is that the particular specification of individual actions may vary language by language, or lexical item by lexical item. Such difference of detail does not undermine the common underpinnings of the analysis. The final resulting structure, and the general properties of the individual transitions nevertheless remains constant across languages, as we can see from the tree display in (4.7). The tree in (4.7) is notably identical to the tree resulting from the rather different sequence of intermediate steps of parsing A teacher who Mary hit. No record remains of the fact that in the intermediate steps, the LINK transition has been induced by a sequence of lexical actions (unlike in English); that the verb projects a full template of propositional structure (unlike in English); and that the presence of the variable is guaranteed by introduction and suitable identification of the metavariable projected by a regular pronoun (unlike in English). The resulting semantic structure is identical in both English and Arabic; and, though with minor variations, the syntactic moves allowed are only those which will lead to that same semantic result. So, as we would expect, the two languages display the same assumption about the resulting structure and the general pattern of how such structures are established. They differ only in what is the precise form of computational and lexical actions that give rise to such structures.

\[\text{See Kempson et al. (2001) for a detailed, similar, specification of the required lexical and computational actions.}\]
(4.7) Projection of LINKed trees in Arabic with resumptive pronoun:

\[
\begin{align*}
&T_y(e) \\
&T_y(cn) \quad F_0(\lambda P(e,P)), \\
&T_y(cn \rightarrow e) \\
&T_y(x) \quad F_0(\lambda y.(y,\text{Mudarris}'(y))), \\
&T_y(e \rightarrow cn) \\
&T_y(t) \quad ?(\overline{D})(F_0(x)) \\
&T_y(e \rightarrow t) \quad F_0(e,x,\text{Mudarris}'(x)) \land \text{Darab}'(x)(t,z,\text{Magdi}'(z))).
\end{align*}
\]

It is notable in this regard that the same rule of LINK evaluation for restrictive construals operates identically in both languages, yielding a construal of the noun phrase in (4.5b) as (4.8).

(4.8) \[ F_0(e,x,\text{Mudarris}'(x)) \land \text{Darab}'(x)(t,z,\text{Magdi}'(z))). \]

4.1.2 The interaction of syntax and pragmatics

This account might give us the first beginnings for a principled account of resumption in relative clauses, but a major part of the puzzle remains, because it predicts that resumptive use of pronouns in relative clauses in English should lead to well-formed strings. Indeed, resumptive pronouns do occur frequently in relative clauses in spoken English, as noted in chapter 1, despite the fact that speakers invariably say that they do not use them:

(4.9) a. There was this tawny owl, which it had got its foot caught in the goal netting.

b. That dreadful professor, who I took great care to ensure that I didn’t get HIM as a tutor, is complaining to the head that I do not go to his classes.

c. ...those little potato things that you put ‘em in the oven...

d. There are people who I’ve had lots of ups and downs in my friendships with them.

Some authors comment that resumptive pronouns occur only in non-restrictive relatives, and they are often characterised as rescue devices (Sells 1984 etc.), but as these examples show, all of which except (4.9b) are collected data, their occurrence is very far from being restricted to such uses. Many of the examples quoted here are part of the collection made by Tami Kaplan over a period of six years and we are grateful to her for allowing us to use them. See Cann et al. (forthcoming) for detailed discussion.
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   e. One of my cats had a litter that they were extremely wild.
   f. He’s over Marshall county where flooding is a concern there.
   g. I have three people that I do not know how they are in other classes.
   h. ...he builds this house, which it’s called Pandemonium....

Although such examples are often judged not to be acceptable by native speakers when an acceptability judgement is requested in isolation from any context, they are freely used in conversation, as we noted in chapter 1, where they provided the first example of interaction between long-distance dependency and anaphora construal. They must nevertheless be fully well-formed on our analysis of relative clauses. This follows, because, as we have seen in chapter 3, nothing precludes the applicability of merge unifying the node decorated by a pronoun and the node decorated by a relative pronoun, since neither have internal structure and so no violation of the bottom restriction occurs (see for example the comparison of declarative units in (3.1.4) on page 84). We have now to explain why the status of resumptive pronouns in Arabic and English should be so different.

The puzzle, given this account, is why speakers of English fail to find resumptive pronoun use fully acceptable. To be judged acceptable, it appears that such pronouns need to be associated with markedness effects of one sort or another - being used either for contrastive purposes as in (4.10a), or for a rather slippery notion of easing processing, as possibly in (4.10b):

(4.10)  
   a. Our head of Department, who even he now realises he should be taking a rest, is nevertheless coming to the conference.
   b. The man who Sue says he is no longer coming to the conference has written us an excellent paper.

The answer to this puzzle lies in the availability in the English of two options, either to use a pronoun or not. In Arabic, to the contrary, the use of a resumptive pronoun in all non-subject positions is obligatory. It is only in subject position that a pronoun is optional, but as a dispreferred choice. What is the significance of there being alternatives? In the Dynamic Syntax formalism, as we have seen, there are always alternative means of analysing a string, as all that is licensed are sets of constraints on transition steps across a process of tree growth. All that is required for a string to be well-formed is that there be at least one successful sequence of transitions that incrementally uses the update steps provided by the sequence of words and yields a logical form with no outstanding requirements. The system itself is silent on how one out of a set of alternatives might get chosen and allows multiple analyses just as long as more than one sequence of transitions leads to the same resulting logical form.

This is not the end of the matter however, as there may be, indeed invariably are, system-external constraints. Recall the Principle of Relevance discussed in chapter 1, that all cognitive processing is said to require a balancing of processing cost and inferential effect. So far in the setting out of Dynamic Syntax assumptions, we have had no reason to invoke such restrictions, as we have focused on individual sequences of actions. However, where there are two options leading to exactly the same end result, relevance -theoretic assumptions would lead us to expect that the more otiose route would be avoided unless it served some identifiable ancillary purpose: either to achieve some particular inferential effect; or to ease processing that might otherwise threaten to be beyond what the hearer might be expected to tolerate. And indeed this does appear to provide the beginnings of an answer, even if only informally. Sentences which seem unacceptable at first glance, become
acceptable if said with heavy stress on the pronoun, with the implication of contrast between this term and some other term, which is not made explicit:

\[(4.11)\]

\[\begin{align*}
a. & \text{ John, who had to be the one who said we did very little teaching,} \\
& \text{ was roundly condemned.} \\

b. & \text{ ?John, who he had to be the one who said we did very little} \\
& \text{ teaching, was roundly condemned.} \\

c. & \text{ John, who he had to be the one who said we did very little teaching,} \\
& \text{ was roundly condemned.}
\end{align*}\]

But this is the extra implication which would warrant the use of a pronoun. Put crudely, if you want to say something with contrastive implication, you need to stress it, and you cannot stress silence. Under these circumstances, a pronoun becomes fully acceptable, just as Relevance-theoretic assumptions lead us to expect.

Conversely, when subordinate structures have to be constructed, use of a pronoun seems more acceptable than their use in monoclausal sequences as in \((4.9b)\), \((4.10b)\), and, though there is difficulty in evaluating what constitutes an appropriate level of difficulty that would warrant use of a pronoun, this might be taken to indicate a level of complexity in parsing that makes the use of a pronoun more acceptable because of some clarificatory function. This too is along the lines that Relevance Theory leads us to expect, this time the motivation being the minimisation of effort by which the hearer is expected to establish the intended interpretation.\(^9\)

Various other effects, both pragmatic and processual, may be involved in the parsing of resumptive pronouns in English (see Cann et al. (forthcoming) for discussion). But this still leaves us with the puzzle of why speakers do not uniformly judge them to be well-formed, if sentences such as these can indeed be acceptably used. We address the concepts of well-formedness and production in detail in chapter 9, but in the mean time what is notable about these examples is that the context which motivates a speaker’s use of such data and the context which the hearer is able to bring to bear in interpreting the sentence may not be the same, even though for both the string is processable. For example, a speaker may have a particular entity in mind, hence in her own discourse context, for which the hearer can only construct the appropriate term having gone through the parsing process, so not having the analogous term in his own discourse context. As we shall see in chapter 9, successful communication involves the parser and the producer building structures that are in exact correspondence. This suggests that informants’ judgements of lack of well-formedness are due to a recognition of mismatch between the contexts assumed by speaker and hearer, hence an assessment that the conditions for successful communication are not fulfilled.

Whatever the pragmatic/performance-based explanation of why these data are peripheral in English, confirmation that the restriction on resumptive pronoun use in English is indeed system-external and not a constraint to be encoded in the grammar formalism comes, surprisingly, from construal of pronouns in subject position in Arabic. Despite the obligatory use of pronouns in non-subject position, in subject position pronouns are generally avoided, and dispreferred. However, Arabic displays a restricted freedom exactly similar to that more generally available in

\(^9\)Though we do not address the problem in detail, the fact that definite NPs can be used resumptively is also not unexpected, since definite NPs can be defined, as suggested in chapter 3, as a complex form of anaphoric device (see chapter 8):

(i) John came in. The poor dear was upset.

(ii) That friend of yours who the idiot had to be the one to admit that our teaching loads were low, was roundly condemned.

(iii) John, who Sue tells me the poor dear is suffering dreadfully from overwork, is still at the office.
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English. Though a pronoun is never necessary in subject position, it is in fact fully acceptable to use a strong pronoun here in both relative and main clauses either if the form is stressed, or if it occurs in the presence of a focus particle equivalent to *even/only*, as illustrated in (4.12).

(4.12) a. *irra:gil ʕilli mabsu:T* [Egyptian Arabic]
   *the man who* happy
   ‘the man who is happy’

b. *irra:gil ʕilli HUWWA mabsu:T*
   *the man who* he happy
   ‘the man who he is happy’

c. *irra:gil ʕilli (batta) HUWWA mabsu:T*
   *the man who* (even) he happy
   ‘the man who (even) he is happy’

d. *irra:gil mabsu:T*
   *the man* happy
   ‘The man is happy.’

e. *irra:gil, HUWWA mabsu:T*
   *the man* he happy
   ‘The man, he is happy.’

f. *irra:gil, batta huwwa mabsu:T*
   *the man* even he happy
   ‘The man, even he is happy.’

This is exactly as we would expect on this analysis. Relevance or other pressures on production/processing are general cognitive constraints, entirely independent of the specifics of any one language and the idiosyncracies of its lexicon. Such considerations should therefore apply whenever the system of a language allows two strategies, quite independent of the specifics of the individual structure. So the fact that it applies to determine the markedness of lexical pronouns in subject position in Arabic, and the markedness of resumptive pronouns everywhere in English, buttresses the evidence that including all these data in the system as well-formed is the right step to take. It is only by doing so that their uncertain acceptability can be characterised.

Our analysis leads to one further, and surprising, prediction, which so far as we know, no other account provides. It is the expectation that though relative clauses may license resumptive pronouns in this way, *wh*-questions will not. These are indeed the facts of English. Resumptive pronouns occur regularly in conversational English in relative clauses, but they are never found in *wh* questions. There were no occurrences of resumptive pronouns in *wh* questions in the Tami Kaplan’s collection and native speaker judgements of grammaticality are not affected by contextualising the examples. Compare the strings in (4.13) with those in (4.9).

(4.13) a. *Which house is it called Pandemonium?*

b. *Which town does it look as though it received the brunt of the storm?*

  *cf. That book on evolution, which I have been struggling to understand it for far too long, has been withdrawn from the reading list.*)
d. *Which man does he keep pestering you?

Consider why this should be so. The account that we have given of crossover phenomena in non-restrictive relative clauses in section 3.1.4 depends, in part, on both relative and anaphoric pronouns having a terminal node restriction. This means that merge of the nodes they decorate may occur only if both decorate terminal nodes.\textsuperscript{10} Interrogative pronouns, however, appear not to decorate terminal nodes. In \textit{which} questions, demonstrably, the internal structure of the term is explicitly presented by the sequence of determiner plus nominal, whose structured content we might represent as a disguised epsilon term with a distinguished metavariable \textbf{WH} in place of a real variable as shown in the compiled term in (4.14c).

\begin{equation}
(4.14 \text{a}) \quad \text{Which book have you read?}
\end{equation}
\begin{equation}
(4.14 \text{b}) \quad \text{Which of my books have you read?}
\end{equation}
\begin{equation}
(4.14 \text{c}) \quad \text{Parsing \textit{which} book:}
\end{equation}
\begin{align}
& Ty(e), Fo(e, WH, Book'(WH)) \\
& Ty(cn), Fo(WH, Book'(WH)) & Ty(cn \rightarrow e), Fo(\lambda P. (\epsilon, P)) \\
& Ty(e), Fo(WH) & Ty(e \rightarrow cn), Fo(\lambda y. (\epsilon, Book'(y)))
\end{align}

Given that we are constructing representations of content in Dynamic Syntax, it is possible that all \textit{wh} questions are to be analysed as projecting some form of quantifying term with internal structure. So, even for simple interrogative pronouns such as \textit{who}, we assign them an internal structure like that in (4.14c) in which there is some term-creating operator, a node for the restrictor specification (as \textit{Human'} for \textit{who} or \textit{¬Human'} for \textit{what}), and a node decorated by \textbf{WH}.\textsuperscript{11} With just this assumption, which reflects the fact that there is no necessary one-to-one correspondence between word and associated semantic structure, the asymmetry between questions and relative clauses follows directly. In \textit{wh}-questions, no \textsc{merge} step will unify the unfixed node decorated by the quantifying term and any pronoun-decorated node.

But this still leaves us with the problem of those languages, like Dutch and German, which do not allow resumptive pronouns at all even in relative clauses.

\begin{equation}
(4.15 \text{a}) \quad \text{*das Auto das glaube ich es kaputt ist...}
\end{equation}
\begin{equation}
\text{the car that believe I it dead is}
\end{equation}
\begin{equation}
\text{‘the car that I believe it’s had it...’}
\end{equation}
\begin{equation}
(4.15 \text{b}) \quad \text{das Auto das glaube ich kaputt ist...}
\end{equation}
\begin{equation}
\text{the car that believe I dead is}
\end{equation}
\begin{equation}
\text{‘the car that I believe has had it’}
\end{equation}

\textsuperscript{10}This restriction does not hold of all pronouns, as we shall see in due course, as it does not hold of expletive pronouns.
\textsuperscript{11}We do not go further into questions and the nature of \textbf{WH} here, but see chapter 9 for a discussion of ellipsis and Kempson \textit{et al.} (2001) chapter 5 for a discussion of questions using a slightly different set of assumptions.
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c. *das Auto das ich glaube es kaputt ist...
the car that I believe it dead is...
‘the car that I believe it has had it....’
d. das Auto das ich glaube kaputt ist...
the car that I believe dead is
‘the car that I believe has had it....’

Our response to this is to invoke the idea that, as with question words, in German (and Dutch) the relativiser provides a term of type $e$ with internal structure, reflecting the demonstrative form from which it is derived. On this analysis, it projects full quantificational structure, like names and interrogative words. Since, like English, Germanic personal pronouns display no sign of losing their terminal-node restriction, this assumption is sufficient to ensure that the nodes projected from the relative and personal pronouns will not be able to merge together to yield any well-formed logical form as a result.\(^{12}\)

We do not go further into the analysis of the German data here (pending an account of demonstratives within the framework), but the discussion in this section shows the strength of the anaphoric approach of DS to relative clause construal. The phenomenon of resumption is fully explicable, and indeed predicted. In other frameworks, resumptive pronouns are, contrarily, quite generally taken to be problematic, as they appear to exemplify a situation in which an anaphoric device is apparently hijacked into serving a structural process. They thus require a quite different form of analysis either from other uses of pronouns, or from other characterisations of long-distance dependency. Detailed treatments of resumption using both epithet phrases and pronouns are proposed by Aoun and colleagues (Aoun and Choueiri 2000, Aoun and Li 2003). True resumptive pronouns are distinguished from non-resumptive pronouns, in being a reflex of movement rather than deriving from some form of base generation (see also Anagnostopoulou (1997), Escobar (1997), Torrego (1998) for related phenomena in other languages). But this gives rise to a non-unitary characterisation of even one sub-type of pronoun, with invocation of ambiguity that is a hallmark of an analysis that is failing to capture the appropriate basis of the explanation.

Boeckx (2003) takes up the challenge within Minimalism of reducing this proliferation of lexical ambiguity, purporting to provide a unitary characterisation of resumption, though the challenge is only taken up in the relatively modest form of providing a characterisation that uniformly separates resumptive forms of anaphora from other forms. Within LFG, the more general challenge of providing an account that absorbs resumptive use of pronouns as part of a general account of anaphora is taken up by Asudeh (2004). Both of these accounts, however, are self-confessedly only partial, since they rely on a separation of “true” resumptive and “intrusive” pronouns, dismissing the optional resumptive use of pronouns in English amongst other languages as not properly resumptive and therefore to be set aside.

The distinction between resumptive and intrusive pronouns is of long standing, having been proposed in Chao and Sells (1984), and is based on the assumption that the so-called intrusive pronouns can be analysed in terms of an E-type form of analysis. Yet this account is highly problematic, for both syntactic and semantic reasons. Such “intrusive” pronouns have to be interpreted as bound by the determiner plus noun head for they contribute to the specification of the restrictor for

\(^{12}\)This analysis correctly predicts that crossover effects will arise in German and Dutch, despite the lack of resumptive pronouns in the language. In these, the explanation of the crossover phenomenon will be due solely to the locality constraint imposed on possible values for the pronoun. We are grateful to Gisbert Fanselow and Ad Neeleman for making us aware of these data.
the quantifying determiner. Yet, as we saw in chapters 1 and 3, E-type forms of interpretation, in which the appropriate witness for some set constitutes the denotation of the pronoun, requires a semantic computation over the entire containing clause. Hence, the witness for the term picked out by the subject expression in (4.16) is that individual from history who is said by Sue to be interested in Celtic Studies that is coming to the party.

(4.16) The new guy from history who Sue says he’s interested in Celtic Studies is coming to the party.

But the construction of the term that picks out any such individual is simply unavailable at the level at which an interpretation of the resumptive pronoun is provided, if any concept of compositionality of interpretation is to be preserved. In relying on the Sells analysis, the Boeckx and Asudeh analyses thus turn out to be simply setting aside an entire subset of resumptive pronoun data.\(^{13}\) The challenge of providing an account of anaphora that absorbs resumptive uses of pronouns as merely a subcase of the general phenomenon thus remains entirely open.

4.1.3 Mixed Systems

We now turn to discussion of a further basis for cross-linguistic variation. Having more than one discrete strategy made available for building up relative-clause interpretation by the parsing architecture, we might expect that some languages would use more than one strategy. We look at two languages that display such mixed systems: Irish and Hebrew.

4.1.3.1 Irish relative clauses

Since McCloskey (1979) and subsequently, Irish relatives have been added to the stockpile of data for typological studies of relative clauses cross-linguistically.\(^{14}\) There are two strategies of relative clause formation, both involving partially homonymous complementisers that have different mutation effects on the words that immediately follow them and different strategies for marking the dependency in the relative clause. The direct relative is signalled by a followed by lenition and a gap in the associated position in the relative clause. This strategy is obligatory where the gap is subject, optional when it is direct object and excluded when associated with more oblique functions. Since McCloskey (1979) this is typically represented as aL. The second complementiser, aN, involves nasalisation and a resumptive pronoun in the associated position in the relative clause. This is excluded for subjects, optional for direct objects and obligatory for more oblique functions in the relative clause.

The complementisers have interesting interactions with complementisers that introduce complement clauses. If the verbs after each complementiser show lenition (i.e. after aL) at each level of subordination, there will be no pronoun marking the position of construal for the term corresponding to the relative-clause head (4.17a). If aN is used immediately following the relative-clause head, a pronoun is used to mark the position to be identified with the head (4.17b), with plain subordination.

\(^{13}\)Like others in the same vein, see Sharvit 1999 for an account of resumptive pronouns in Hebrew which excludes a range of data incompatible with a specificity restriction that her analysis purports to explain. She merely notes in a footnote that the specificity restriction holds under conditions of normal stress assignment.

\(^{14}\)As McCloskey reports (1979, 1990, 2001, 2002), to whom all data are due, the distinctions reported here are disappearing in all but the most conservative variants of Modern Irish, as it has in Scots Gaelic, which uses a gap strategy.
marking marked by the complementiser go at all intervening clausal boundaries (4.17c).

(4.17) a. an t-úscaíle a mheadh mé a thuig mé

the novel aL thought I aL understood I

‘the novel that I thought I understood’

b. an scríbhneoir a molann na mic léinn é

the writer aN praise the students him

‘the writer whom the students praise’

c. fir ar shúl Aturnae an Stáit go rabh siad díleas

men aN thought Attorney the State go were they loyal
do’n Rí to-the King

‘men that the Attorney General thought were loyal to the King’

There are also mixed cases. With aN at the highest level of embedding within the relative clause, and aL at some subordinate boundary, there is no pronoun.

(4.18) rud a raibh coinne agam a choinhliónfaidh an aimsir

thing aN was expectation at-me aL fulfil.COND the time

‘something that I expected time would confirm’

Another attested pattern is for aL within the primary structure, but aN across an island boundary, with subsequent required occurrence of the pronominal (4.19).

(4.19) aon duine a cheap sé a raibh ruainne tobac aige

any person aL thought he aN was scrap tobacco at-him

‘anyone that he thought had a scrap of tobacco’

There may also be iterated occurrence of aN at each successive clausal boundary, as with aL, though judgements on these are uncertain at best (4.20).

(4.20) an bhean a raibh mé ag súil a bhfaighinn an

the woman aN was I hope PROG aN get-COND-21sg the

t-airgead uaithi money from-her

‘the woman that I was hoping that I would get the money from (her)’

The first part of the challenge here is to explain how different complementisers contribute to interpretation in a way that matches the fact that only one of these is twinned with occurrence of resumptive use of a pronoun. The second is to express the successive use of these markings at the various intervening boundaries without invoking different sub-specifications for the discrete functions of the embedding device, one of inducing some requirement of binding, the other of passing it down.15

And finally, there is the challenge of characterising how the two forms interact with each other, so that aL following aN removes the need for any subsequent resumptive pronoun, whereas aN following aL apparently introducing that need.

The two discrete patterns are straightforward to express within the DS framework, for they correspond to the English/Germanic form of relativising element on the one hand (with canonical lack of any marking of where the term in the LINKed

15Asudeh (2004) notably provides disjunctive sub-specifications according as the particle occurs locally to the position to be bound or at some intermediate clausal boundary between binder and this position.
structure associated with parsing the relative sequence is to be construed), and to the Arabic form of relativising element on the other (with obligatory resumptive construal of a pronoun). All that is required is to define the complementiser aL as associated with actions of inducing and decorating an unfixed node in the emergent LINKed structure with a copy of the head (along lines suggested for English); and to define aN as associated with the weaker specification of merely imposing a requirement at the appropriate introduction of the LINKed structure for a copy of the head at some subsequent point in the LINKed structure’s development (along the lines suggested for Arabic). Such characterisations would then lead us to expect the mixed case in which aN marking of a relative clause sequence with aL marking some subsequent boundary would not require any further occurrence of a pronoun as the latter complementiser itself would be taken to provide the required copy, rendering any further pronominal superfluous.

If aL marks the point at which the LINK transition is constructed, this involves inducing an unfixed node decorated at this very first step with a copy of the head, so that all that is needed is to identify its subsequent role in the emergent LINKed structure. Any marking of subsequent boundaries by aN, though it might introduce the requirement for a copy of the head, should not need this to be provided by any subsequent pronoun, as the requirement has already been satisfied through a parse of aL. However, it turns out that this aL...aN... ordering is associated with structures for which there are independent reasons why a binder-gap association is not possible, and the subsequent occurrence of aN provides a way of side-stepping these restrictions. It seems that the major challenge is to define aL and aN in such a way that a single specification for each can capture the various environments in which they occur.

Here, it is the ability to express very underspecified conditions on the tree relations which makes such an integrated specification possible. We simply define the actions that each complementiser induces as associated with a condition on their actions that the pointer be at a type-requiring node with no sub-structure already constructed (i.e. they induce the very first step in developing this structure. In addition, there must be arbitrarily above this node there is an inverse LINK relation to a node decorated by some variable. The actions defined for both aL and aN thus take place relative to the condition:

\[
\text{IF } (U)(L^{-1})Fo(x)
\]

recall that (U) is the weak upwards relation that ranges over dominance and LINK relations. So this is a requirement that at some arbitrary previous point in the tree development (even immediately before), a LINK transition has been defined from some head node decorated with Fo(x).

The actions associated with the two complementisers then differ according to whether they induce the construction of some unfixed node and decorate it directly with the formula x, as with aL (4.21), or merely impose a requirement for a copy of that formula at some subsequent point in the tree development, as with aN (4.22).

\[16\text{We do not give here the distinct tense specifications with which these lenition forms are associated, but the lexical definitions are defined with the pointer starting at some node requiring Ty(t) so that the addition of such specifications is unproblematic, at least in principle.}\]
4.1. TOWARDS A RELATIVE CLAUSE TYPOLOGY

\[
\begin{align*}
(4.21) & \quad aL \\
\text{IF} & \quad ?Ty(t) \\
\text{THEN} & \quad \downarrow \top \\
\text{THEN} & \quad \text{Abort} \\
\text{ELSE} & \quad \text{IF} \\
& \quad \langle U \rangle (L^{-1})Fo(x) \\
& \quad \text{THEN} \\
& \quad \text{make}(\downarrow \top); \text{go}(\downarrow \top) \\
& \quad \text{put}(Ty(e),Fo(x)) \\
& \quad \text{ELSE} \\
& \quad \text{Abort} \\
\text{ELSE} & \quad \text{Abort}
\end{align*}
\]

\[
\begin{align*}
(4.22) & \quad aN \\
\text{IF} & \quad ?Ty(t) \\
\text{THEN} & \quad \downarrow \top \\
\text{THEN} & \quad \text{Abort} \\
\text{ELSE} & \quad \text{IF} \\
& \quad \langle U \rangle (L^{-1})Fo(x) \\
& \quad \text{THEN} \\
& \quad \text{put}(?(D)Fo(x)) \\
& \quad \text{ELSE} \\
& \quad \text{Abort} \\
\text{ELSE} & \quad \text{Abort}
\end{align*}
\]

There is a lot more that needs to be said about such specifications. First, the characterisation of \(aL\) does not force its presence at each boundary, although it is compatible with such markings.\(^{17}\) The incorporation of underspecification into the articulation of tree relations, using such expressions as

\[
\langle U \rangle (L^{-1})Fo(x), \text{make}(\downarrow \top)
\]

allows just the right amount of flexibility to be able to express the generalisations needed in a relatively elegant way. Unlike accounts of relative complementisers as providing a predicate-abstraction operator, which enforces a disjunctive specification on all cases of iterated complementisers (since one must not bind, and the other must), an anaphoric account merely needs to define the actions of the complementiser as compatible with the incremental update of the tree on the basis of the earlier specification.

We can assume that the first occurrence of \(aL\) in a sequence of the same complementiser checks the availability of some antecedent term across a LINK relation, and then induces the building of a decorated, unfixed node which then gets passed down the tree. The second occurrence of this complementiser, characterised by the very same underspecified tree description, again checks out the availability of a LINK relation with some provided antecedent head, and then initiates the introduction of a new unfixed node with its own decoration. With the unfixed node from the first instance of \(aL\) getting passed down, the second will initiate a second unfixed node. But this will be token-identical to the first, and the two will harmlessly collapse with each other (indeed they cannot be distinguished). With duplicated \(aN\), on the other hand, no information is percolated down the tree, since what parsing this imposes on the emergent LINKed tree is a requirement for a copy of the head formula. Nevertheless if this requirement is reiterated at a lower node in that subsequent derivation, it will be harmless, as both specifications will be satisfied by the decorations provided by some subsequent parsed pronominal. These requirement specifications are not operators requiring discrete binding domains. So, on the one hand, the problems that arise for predicate-abstraction accounts of these complementisers (McCloskey 2002) do not arise in the anaphoric style of account.

\(^{17}\)McCloskey (2001) notes that the effect of lenition is often not audible, so we leave this underspecified. Forcing its specification would need a definition of locality in terms of there being no closer representation. See chapter 6 where such a characterisation is provided for anaphor-marking in Japanese.
4.1.3.2 Hebrew relative clauses

Hebrew seems to provide another case of multiple complementiser specifications, despite there being just one morphological complementiser with a number of functions (Demirdache 1991). Hebrew allows both a ‘gap’ in relative clause sequences as in English (or German), and also a resumptive pronoun as in Arabic.\(^{18}\) This can be explained as a combination of the two patterns, despite the fact that they involve a single complementiser \(\tilde{\text{\char226}}\). On the one hand, we suggest, the Hebrew relative complementiser acts as a relative pronoun and has a verbal specification consistent with English as not subject pro-drop. On the other hand, it also has a subject pro-drop strategy, and a relativising strategy which requires a resumptive pronoun. With these assumptions, we are led to expect the following mixed effect.

The complementiser \(\tilde{\text{\char226}}\) can project merely the weak form of modal requirement imposed on the top node as in Arabic. Then, on the assumption that the non-pro-drop strategy for projection of clause structure is subsequently followed, *Adjunction may be used to introduce a node that will be decorated by a non-subject expression. The subject expression will then be taken to decorate a fixed position, as introduced by Introduction and Prediction. In such a sequence, it is the unfixled node introduced by *Adjunction which may freely be decorated with the pronominal which is used to satisfy the requirement imposed by the LINK transition. In (4.23) this is the prepositional form of pronominal \(\tilde{\text{\char226}}\)alav:

\[
(4.23) \text{ha-\tilde{i\char226} } \tilde{\text{\char226}} \text{alav } \tilde{\text{\char226}} \text{ani zo\'sev } \tilde{\text{\char226}} \text{amarta } \tilde{\text{\char226}} \text{sara}
\]

\[
\text{the man that about him I think that you said that sara}
\]

\[
\text{katev } \tilde{\text{\char226}} \text{ir}
\]

\[
\text{wrote poem}
\]

\[
\text{‘the man about whom I think you said that Sara wrote a poem’}
\]

Furthermore, the option of using a step of *Adjunction to introduce the node that will subsequently carry the required formula value imposed by LINK introduction is available at the step of processing any new clausal structure. We then expect this option to be available at the outset of any clausal sequence:

\[
(4.24) \text{a. ha-\tilde{i\char226} } \tilde{\text{\char226}} \text{ani zo\'sev } \tilde{\text{\char226}} \text{amarta } \tilde{\text{\char226}} \text{sara}
\]

\[
\text{the man that I think that about him you said that sara}
\]

\[
\text{katev } \tilde{\text{\char226}} \text{ir}
\]

\[
\text{wrote poem}
\]

\[
\text{‘the man about whom I think you said that Sara wrote a poem’}
\]

\[
(4.24) \text{b. ha-\tilde{i\char226} } \tilde{\text{\char226}} \text{ani zo\'sev } \tilde{\text{\char226}} \text{amarta } \tilde{\text{\char226}} \text{sara}
\]

\[
\text{the man that I think that you said that about him sara}
\]

\[
\text{katev } \tilde{\text{\char226}} \text{ir}
\]

\[
\text{wrote poem}
\]

\[
\text{‘the man about whom I think you said that Sara wrote a poem’}
\]

\(^{18}\text{There is a tendency for these options to be taken to be mutually exclusive: with the ‘gap’ strategy being used in simple clauses where there is no further embedding in the relative; the resumptive pronoun strategy being used where the long-distance dependency is across from one propositional structure to another. Defining these strategies to be mutually exclusive is easy enough, but since this appears not to be a hard and fast restriction, we leave these as equally available options. Whether or not the gap-requiring strategy is due to an analysis of \(\tilde{\text{\char226}}\) along German or English lines remains to be established, though, given its morphological simplicity, an analysis along English lines seems preferable.}\)
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Whatever unfixed node is decorated by appropriate construal of the pronoun can then be updated by merging with a fixed node.\textsuperscript{19}

There are two properties held constant in these accounts of Irish, Hebrew, Arabic and English. The first is that in all cases, the term assigned as construal of the head is defined (by the LINK transition rule) to provide the context relative to which the subsequent structure, with its imposed anaphoric dependency, is established. This is quite unlike the bottom-up strategy in most frameworks, in which a binding is established between some (possibly null) operator and some position (possibly identified by a pronoun) to create a predicate on the head. The co-dependency of the head and that predicate is then only established in the light of the determination of that binding relation. To the contrary, on the DS analysis, this co-dependency between some assigned term and the open formula to be constructed is imposed from the outset of the initiation of the structure.

The second property of the account is that whatever pronoun may be taken to be inserted as a means of expressing these various long-distance dependency correlations has not involved any revision in the characterisation of the pronouns themselves. In all cases, the use of a pronoun is assumed to be an unrestricted pragmatic process. It is the modal form of restriction dictating a well-formed completion of the tree which determines why the pronoun must be construed as identical to the formula decorating the head. Indeed, the pragmatic explanation of why such uses of pronouns are marked when optional only carries the force it does because it preserves the analysis of the pronoun unchanged. The pronoun itself remains as a regular lexical item, duly decorating some terminal node in a tree. This is so whether or not the form carried over is complex. However, from the perspective of the copy mechanism as projected either by the English relative pronoun or by the resumptively used pronoun in Arabic and in English, any such complexity is irrelevant. The substitution is simply that of a formula. There is no internal structural complexity at the site of the copy, as opposed to German: what is copied is just a \textit{Formula} decoration on a terminal node in the LINKed tree.

4.1.4 Romance Languages, resumptive pronouns and locality

Let us sum up what we have got so far. We have relativising elements that are fixed anaphoric devices, introducing either simple metavariables or terms with internal structure, and relativising elements that are systematically weaker, imposing only the requirement of such an anaphoric device to appear in a string. We have also seen variation as to whether there is any imposed locality constraint. In English, the provision of the required copy is achieved by applying *\textsc{Adjunction} and decorating that unfixed node by actions of the relative pronoun. This sequence of actions determines that the copy imposed by the LINK transition will be provided within a single tree (and not across a further LINK relation). In Arabic to the contrary, there was no restriction whatever in where the copy of the formula decorating the head should be provided.

The issue of whether or not the relativising element is pronominal-like or not is, however, logically independent of the question of what locality restriction there might be. So what we might now expect as a further point of cross-linguistic variation is the possibility of a language that has a relativiser which like Arabic fails to provide a copy, but which, like English, imposes a locality restriction on

\textsuperscript{19}As (a)-(b) indicate, ˇ\\textit{se} is also the bare subordinating device. The challenge to reduce all uses of ˇ\\textit{se} to a single unambiguous particle remains, postulated ambiguity being a common property of analyses of this element (see Shlonsky 1992). We have not given any lexical characterisation of ˇ\\textit{se} here, so this challenge remains completely open.
where the copy provided by the pronominal should be established. This is indeed what we find in the variation displayed by Romance languages.

The Romance languages, like the Semitic languages, vary as to whether resumptive pronouns are required. On the one hand, there is Italian, which is like English in not requiring the use of a pronoun in establishing relative clause construals, and dispreferring their use. On the other hand, there is Romanian, which patterns exactly like Arabic, except that there is an island restriction constraining the availability of such resumptively used pronouns. Resumptive pronouns, which always take the phonologically-reduced clitic form but are otherwise perfectly regular pronouns, are required in all non-subject positions; but, in addition, the copy of the head required in the process of relative clause construal must be provided within a single propositional tree.

Given that the pattern displayed by Arabic arises in virtue of a relatively loose modal requirement imposed on the top node of the newly introduced LINKed structure, it is straightforward to define a modal requirement with a more stringent locality condition. We simply replace the Arabic form of restriction, \(\langle D \rangle(Fo(\alpha))\), with the restriction \(\langle \downarrow^* \rangle(Fo(\alpha))\), ensuring that the copy will not be found in any LINKed structure. Such a restriction is motivated for Romanian relative clauses as introduced by the particle care, with its accompanying pe, a structure in which, as in Arabic, resumptive pronouns are obligatory in all non-subject positions.

\[
\begin{align*}
\text{(4.25) a.} & \quad \text{biaiatul pe care l'-} \quad \text{am vazut} \quad \text{[Romanian]} \\
& \quad \text{the boy pe which him have$_1$SING seen} \\
& \quad \text{‘the boy that I saw’} \\
\text{b.} & \quad \text{*biaiatul pe care am vazut} \\
& \quad \text{the boy pe which have$_1$SING seen} \\
& \quad \text{‘the boy that I saw’}
\end{align*}
\]

The only difference from Arabic is that such resumptive pronouns are required to occur locally to the complementiser care in the sense that they project a copy of the head formula in the same LINKed tree that the complementiser initiates. So (4.26), unlike (4.25a) is ungrammatical:

\[\text{(4.26)} \quad \text{b\-iaiatul cu care l'-} \quad \text{am venit} \]

\[\quad \text{the boy with whom him I have come} \]

\[\text{We do not give an explicit lexical definition of } pe \text{ care} \]

\[\text{here as there is the issue to sort out as to what information the } pe \text{ and care individually project. The function of } pe \text{ in particular is poorly understood, but it appears to be associated with LINKed structures, inducing the requirement of a copy of the head. What we would expect in both Romanian and Italian is that strong pronouns can be acceptably used if stressed, as in English and Arabic, but this remains to be established.} \]

\[\text{Cinque (1995) reports that resumptive use of pronouns is precluded in standard Italian. However he notes in a footnote that they are used in very informal speech, a comment reported anecdotally by Spanish and Portuguese informants also.}\]

\[\text{Romanian and Italian both have more than one relative pronoun, one of which demands a gap. These can be distinguished according to whether they project an annotation for an unfixed node, possibly like German as an internally structured term of type } e, \text{ or merely a (modal) requirement for the required copy, lexically distinguishing two variants, unlike Hebrew in which a single morphological form has two divergent uses. Udo Klein has suggested (personal communication) that it is } pe \text{ which induces the constraint of requiring a pronoun, as witness:}\]

\[\text{\quad biaiatul cu care am venit} \]

\[\quad \text{the boy with whom I have come} \]

\[\text{\quad *biaiatul cu care l'- am venit} \]

\[\quad \text{the boy with whom him I have come} \]

\[\text{We do not give an explicit lexical definition of } pu \text{ care} \]

\[\text{here as there is the issue to sort out as to what information the } pe \text{ and care individually project. The function of } pe \text{ in particular is poorly understood, but it appears to be associated with LINKed structures, inducing the requirement of a copy of the head. What we would expect in both Romanian and Italian is that strong pronouns can be acceptably used if stressed, as in English and Arabic, but this remains to be established.}\]

\[\text{The preverbal position of the clitic is not what is at issue at this juncture, but the inability of the clitic to have its value established by an antecedent in any structure other than the one currently under construction. Nevertheless, the position of the clitic is not uninteresting, and the processes involved in such placement will be a matter of central concern in chapter 5, and again within a diachronic perspective in chapter 9.} \]
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(4.26)  
\* Omul pe care cunosc femeia care \( \tilde{\text{intilnit}} \) met \( e_j \)  

'\( \text{the man who I know the woman who met him} \)'

The significance of the difference between Arabic and Romanian, and how easy it is to express in Dynamic Syntax terms, should not go unnoticed. The difference is simply an expected variation in the particular form of modality associated with the copy requirement imposed by LINK ADJUNCTION. This is in contrast to the difficulty of capturing this “strong-island” sensitivity in movement terms. The restriction of a long-distance dependency so that it is precluded across a relative clause boundary is taken to be definitive of a movement analysis; but in these examples, embarrassingly, there is a pronoun present, so there is no apparent indication of movement with a self-evident gap. Within the minimalist framework, a strategy to work around this problem is to invoke discrete structural types, so that the structure in which such resumptive pronouns occur is not the same as that involving movement.\(^{23}\) Alternatively, one can postulate different types of pronoun, those that are fully anaphoric and those that are resumptive.\(^{24}\)

Both strategies invoke ambiguity in one domain or another; and the present analysis has a clear advantage in this respect. By expressing discontinuity effects, pronoun construal, and the emergence of fixed tree structure all in terms of constraints on tree growth as expressed through the tree modalities, the resumptive use of pronouns in relative clauses, and the locality restrictions on their appearance, form an expected basis for variation not needing particular stipulation.

4.1.5 Relative clauses: An Intermediate Summary

Stepping back from the detail, we have established the major relative clause types as variants in a system that induces obligatorily anaphorically LINKed structures, the variations being due to: whether or not the relativising element is an anaphoric device; whether or not that anaphoric device has internal structure; and whether or not the LINK transition imposes a locality restriction on the domain within which the copy of the head is to be constructed. The languages in which the relativiser merely introduces a requirement will be those in which a resumptive pronoun will be obligatory unless the node in question is independently projected, e.g. as an argument node introduced as part of the actions of a verb. The languages in which the relativiser annotates a node with the copy which is independently imposed by the LINK transition will be ones in which there may or may not be an associated resumptive use of pronoun, whose role in such a case will solely be to identify the point in the construction process at which the update action of fixing the unfixed node decorated by the relativising element takes place.

\(^{23}\)See Aoun and Li (2003), who posit both movement and base-generation analyses for a range of related phenomena.

\(^{24}\)Asudeh (2004), as noted earlier, purports to incorporate resumptive pronoun use within a general account of anaphora. Yet, his proposal constitutes a quite separate pronoun use. Pronouns are defined as antecedent-seeking operators of logical type \( e \rightarrow e \); and to get the resumptive use, Asudeh defines an abstract higher-type operator which applies to the pronoun in question binding this antecedent-seeking property so that this is removed, leaving the resulting term to be bound by the regular abstraction-operator associated with the relativising complementiser. The formal operation, that is, removes the anaphoric property from the pronoun in these contexts, thereby ensuring that it will be treated as a gap. But this is an ambiguity analysis in all but name, since a distinct binding device removing the antecedent-seeking definitive of pronouns has to be specially introduced.
Given the characterisation of relatives as imposing a modal form of requirement on the emergent structure, we expect there to be further bases for variation in locality. We might expect, for example, LINK transitions which require the copy in the emergent LINKed structure to be met along a subject \( (1_{0}) \) relation. This indeed seems to be the case with participial ‘relatives’, which display obligatory control of the subject position in the LINKed structure by the head.

(4.27) a. The man sneezing is sick.
   b. *The dishes washing are clean.

Alternatively, one might expect a family of relatives where the unfixed relation that is introduced has to be resolved within a single structure, arguably, the property displayed by infinitival relatives in English:

(4.28) a. The man to do the dishes is sick.
   b. The chicken to cook weighs 10 pounds.
   c. The man to sit beside is John.
   d. The man to tell Mary to interview is John.

We expect, that is, the full range of possible modalities to constrain possible anaphoric dependencies set up through a LINK transition.

In this section, we have sketched a cross-linguistic account of relative-clause variation taking restrictive relative clause cases as our basis. This emergent typology is only partial in that non-restrictive forms of construal have not been included, in part because these have not been the subject of such extensive study in the literature. However, given that in the DS framework, the very same account extends to non-restrictive relative construals, differing solely in the point in the parsing process at which the LINK transition is induced, we expect a single means of inducing a LINK transition regularly to give rise to the perceived ambiguity between restrictive and non-restrictive relatives.

There is one far more striking basis for variation still to be considered, which is whether the head precedes or follows the relative clause. The characterisation of relative clause construal as involving paired and anaphorically connected structures imposes no restriction on which of the two trees should come first, and there is nothing in the tree relation of LINK itself to dictate this. So the formalism leads us to expect there to be languages which, in building up relative-clause construal before the head, license the introduction of structure with no commitment as to where in the overall structure it will ultimately fit. So we are at best only part way through a properly general account of relative clauses. We turn to Japanese, as a proto-typical illustration of a head-final language in chapter 6. At present, we have to remain content with having used the various concepts of growth and their interaction to yield the major types of head-initial relative-clause variation.

Reflection on what are the bases for classification gives us some indication of why these various tree-growth mechanisms have proved successful in providing a basis for articulating the various distinct syntactic distributions both in individual languages and across languages, without having to invoke large numbers of syntactic mechanisms or disjunctive specifications in individual lexical entries. The classification is notably not in terms of denotational content associated with complementiser specifications (for example, whether the complementiser is an abstraction device or not). Variation is seen in terms of discrete ways of constructing some representation whose output, once completed, will have some agreed and common denotational content, rather than merely the structural properties of one such complete representation. In focusing on the mechanisms whereby such representations of content
are incrementally built up on a left-to-right basis, we have a fine structure for identifying distinct mechanisms while retaining a common semantic characterisation of all restrictive relative forms of construal. The problems facing syntactic accounts where expressions are directly related to such specifications of content (the syntax providing input to a bottom-up compositionality of semantic content) simply do not arise. Syntactic generalisations, to the contrary, are seen to be grounded in the time linear projection of the requisite logical structure. The heart of syntax thus lies in the meta-level task of building up a semantic representation.

4.2 Towards a left periphery typology

Relative clause construal is not the only structure in which pronouns have what appear to be a resumptive use. They are also used in what might look superficially a quite different type of structure, in left-peripheral topic constructions such as:

(4.29) a. That friend of yours, I found him wandering round the supermarket.
    b. As for that friend of yours, I found him outside.

As we shall see, these display a very similar array of patterns as relative clause constructions. So our next challenge is to see to what extent the defined concepts of tree growth, specifically building paired LINKed trees or building initially unfixed nodes within an individual tree, can be used to characterise the array of variation we find in left-periphery constructions.

It has been standardly recognised over a long period that long-distance dependency effects can be modelled either as a correlation between two discrete positions in a tree through a process such as movement (or feature-passing), or through a process of anaphoric linkage (Ross 1967). There are, that is, languages which show a left-dislocated expression paired with ‘a gap’ (4.30a) and displaying island restrictions (4.30b).

(4.30) a. Mary, John thinks Tom had upset.
    b. *Mary, I dislike the man that married.

There are also languages/structures that display a pairing of a left-dislocated expression with a pronoun with no island restrictions (4.31a)-(4.31b), also perhaps allowing mismatch of the case marking of the peripheral expression and a case-marked pronoun (4.31c). These have been assumed to be induced as independent base-generated structures, associated with each other solely through anaphoric processes.

(4.31) a. il-kita:b da, ẗinta tkallimt maʕa l-walad ʔdli katab
       the book this, you talked with the boy who wrote
       ʕale-y-h. [Egyptian Arabic]
    on it

[25]The terminology in this area is woefully confusing. The concept of topic, which is quite informal, is a general label for some aspect of the information being conveyed which is taken as background, to which other expressions may be anaphorically LINKed. However the term topicalisation is used for long-distance dependency effects, which signal not involve the discourse-based notion of topic, rather inducing a focus effect communicating some type of contrast. To add to the confusion, in LFG the term is used whether or not the foot of the dependency is realised with a pronominal (Dalrymple 2001). In general, in Minimalism, the term refers to movement dependencies, where there is no pronoun signalling the foot of the chain. We shall discuss the concepts of topic and focus in section 5, but in the mean time, in so far as we use the term topic, it will be used only informally, of those strings which are construed as associated with pairs of structures requiring a shared term.
CHAPTER 4. TREE GROWTH AND LANGUAGE TYPOLOGIES

‘You talked with the boy who wrote on this book.’

b. As for Mary, I talked to the boy who said she had cheated.

c. i. Maria, xtes gnorisa ton andra pu

\[\text{the}_{\text{ NOM}} \text{ Maria yesterday met}_{\text{1st.ps.sg}} \text{ the man that} \]

\[\text{tin patreftike} \quad \text{[Greek]} \]

\[\text{her}_{\text{ ACC}} \text{ married} \]

‘Mary, yesterday I met the man that married her.’

Moreover, the devices used to construct such topic-indicating structures are essentially identical to their use in the projection of interpretation for relative clauses, since both give rise to the same long-distance dependency effects (Boeckx 2003). What is less expected, given that way of looking at the dichotomy, are the various intermediate forms, involving some kind of interaction between establishing a long-distance dependency and resolving anaphoric underspecification, with apparent blurring of the distinctiveness in the two processes. There are instances of left-peripheral constituents being paired with a pronoun which display some but not all properties of movement: their properties may include matching case-specification of left-peripheral noun phrase and doubled pronoun (4.32a); sensitivity to strong island effects (4.32b); general exclusion of quantified expressions (indefinites only, and with specific interpretation) (4.33); and realization with a sharp break of intonation following the left-peripheral expression.

\[(4.32) \]

a. ton Petro ton nostalgolo poli \quad \text{[Greek]}

The Peter_{\text{ACC}}, Cl_{\text{ACC}} miss-1sg much

‘I miss Peter a lot.’

b. *tin Maria xtes gnorisa ton andra pu

\[\text{The}_{\text{ACC}} \text{ Maria yesterday met}_{\text{1st.ps.sing}} \text{ the man that} \]

\[\text{tin patreftike} \quad \text{[Greek]} \]

\[\text{her}_{\text{ACC}} \text{ married} \]

‘Mary, yesterday I met the man that her married.’

\[(4.33) \]

a. una secretaria que sabe hablar inglés, Pedro

ACC one secretary that knows speak_{1NF} English, Pedro

la está buscando \quad \text{[Spanish]}

\[\text{proFem.ACC} \text{ is looking-for} \]

‘Pedro is looking for the secretary that speaks English.’

This is the so-called Clitic Left Dislocation effect (Cinque 1990, Dubrovie-Sorin 1991).

There may even be variation between forms within a single language, as in Romanian. This language has one left-dislocation structure associated with one kind of morphological marker, with no preposition but the presence of -pe, which is sensitive to strong-island constraints (4.34a)-(4.34b), and another, with the complex form cît despre, for which there are no island restrictions (4.34c). The echo of relative-clause restrictions is not a coincidence, and we return to this shortly.

\[(4.34) \]

a. pe Maria am crezut ca ai întâlnit -o

pe Maria have_{1st.sg} believed that have_{2.sg} met her

‘Maria, I believed that you met.’
b. *pe Ion n-am întîlnit fata care l- a văzut
   pe John not-I-have met the girl which him has seen
   anul trecut
   year last.
   'The John, I have not met the girl who saw him last year.'

c. cit despre Ion, n-am întîlnit fata care l- a
   As for John, not-I-have met the girl which him has
   văzut ultima dată
   seen the last time.
   'As for John, I have not met the girl that she saw him last time.'

These intermediate effects are problematic for movement accounts in particular, as the paradigm leads one to expect a certain diagnostic set of effects associated with movement: strong island effects; no morphological realisation of the trace position; or if there is a pronoun marking that position, it is treated as some entity distinct from regular pronouns; and a complementary set of effects associated with base generation (no island sensitivity, presence of a pronoun). This range of variation is widespread. For example, Aissen (1992), argues that the Mayan languages differ according to whether they have an external topic which is an independent structure, with pronominal duplication, separated by an intonational break, or have pronominal duplication and no such break and are subject to strong-island sensitivity despite the presence of the pronoun. Indeed, the difficulty in sustaining this dichotomy between movement and base generation is increasingly leading to analyses which depart from it.26

4.2.1 Building LINKed structures at the left periphery

In this section, we survey how the concept of LINKed structures can provide us with an account of so-called ‘hanging topic’ structures like that illustrated for English in (4.35):

\[(4.35) \text{ (As for) that friend of yours, I found him wandering round the}
\text{supermarket.} \]

Chapter 3 provided an account of relative clauses that involved as a core process the projection of propositional structure LINKed to a (partially) constructed term and the imposition of a requirement to find a copy of that term within the LINKed structure. There is nothing, however, in the concept of the LINK relation, to determine the logical type of the nodes to be related, nor the direction of that relation. LINK is just another tree relation, and can, in principle, be constructed between nodes of any type, from any node in a tree. We will see LINK structures being determined between nodes of different types in later sections of the book, but for the purposes of analysing hanging topic constructions we can use a LINK relation projected, as before, from a node of type e onto one of type t with the latter required to carry a copy of the formula decorating the formula. However, in this case the relation is expressed not from some node embedded within some larger propositional tree, but from a top node that is of type e.

So, starting from the axiom:

\[\{Tn(0), Ty(e), \Diamond\}\]

26 For a recent example, see Adger and Ramchand (2003).
we define a transition introducing an inverse LINK relation between this node and a top node decorated by $\text{?Ty}$. The relevant rule is given in (4.36) and its associated tree display in (4.37).

(4.36) **Topic Structure Introduction** (Rule):

\[
\frac{\{\{Tn(0), \text{?Ty}(t), \text{?}\}\}}{\{\{Tn(0), \text{?Ty}(t)\}\}, \{(L)Tn(0), \text{?Ty}(e), \text{?}\}}
\]

(4.37) **Topic Structure Introduction** (Treegrowth):

\[
(L)Tn(0), \text{?Ty}(e), \text{?} \quad Tn(0), \text{?Ty}(t)
\]

Notice that no requirement for a copy is imposed on the propositional tree. This is because at the point at which this rule operates there is (and can be) no formula decorating the type $e$ node. There is, therefore, here a separation of the introduction of the LINK relation from the imposition of a copy. This is done by a separate rule **Topic Structure Requirement** in (4.38) which has the effect shown in (4.39).27

(4.38) **Topic Structure Requirement** (Rule):

\[
\frac{\{\{Tn(0), \text{?Ty}(t)\}, \{(L)Tn(0), \text{Fo}(\alpha), \text{Ty}(e), \text{?}\}\}}{\{\{Tn(0), \text{?Ty}(t), (?D)\text{Fo}(\alpha), \text{?}\}\}, \{(L)Tn(0), \text{Fo}(\alpha), \text{Ty}(e)\}}
\]

(4.39) Parsing *(As for) Mary*:

\[
(L)Tn(0), \text{Ty}(e), \text{Ty}(cn), \text{Ty}(cn \rightarrow e), \text{Fo}(x, \text{Mary}'(x)), \text{Fo}(\lambda P. (i, P'))
\]

The use of the $(D)$ operator encodes the weakest of all tree relations, a requirement that there be a copy of the term just completed on the paired structure somewhere in the development of this newly introduced top node, as required for (4.40a). Coinciding with this separation between the two structures is a characteristic intonation break between the left-peripheral NP in such structures, and the invariable presence of a pronoun or other anaphoric expression. Constructing a LINK transition, that is, is used to construct a tree as context for the subsequent construction of the tree dominated by the root node, as part of the overall information conveyed. Indeed, in English, the complex preposition *as for* arguably induces the building of such a LINK transition from the lexicon, without need of any independently defined computational action. However, the process is a very general one, so we presume that such a set of moves is also licensed by general computational action (4.40b). This is a stipulation in so far as the rules need definition; but the concept of LINK itself as a tree relation associated with anaphorically driven sharing of terms carries over unchanged from the account of relative clause construal, with expectations of linguistic patterning that are immediately confirmed.

(4.40) a. As for Mary, John has met the man who says he’s going to marry her.

---

27 This separation of LINK construction and copy requirement will be the pattern explored in chapter 7 with respect to co-ordination.
4.2. TOWARDS A LEFT PERIPHERY TYPOLOGY

b. MARY, I think she isn’t coming.

Since these structures have no analogue to a relative pronoun, their analysis as projecting LINKed trees would require the construal of the pronoun as identical to the interpretation assigned to the left-peripheral NP. This is because, given the modal form of requirement on the top node of the LINKed structure projected for interpreting the clause following that NP, together with the lack of any morphological expression analogous to an English relative pronoun, some pronoun must be interpreted as identical to the Fo value projected by that NP in order to yield a well-formed result. This is confirmed immediately by English. (4.41) are completely ungrammatical:

(4.41)  a. *As for that friend of yours, I found wandering round the supermarket.

b. *As for Mary, I like.

As in the case of Arabic relative clauses, this does not require any particular stipulation: it is a consequence of the interaction between requirements and the availability of placeholding devices subject to a pragmatic process of substitution. A defined action which imposes a requirement for a copy will have the effect of determining that the only well-formed completions will be ones that get rid of this requirement, and without any analogue of a relative pronoun, this can only be achieved by use of the regular anaphoric device of the language. The pattern is that already set for Arabic relative clause construal and a schematic tree is given in (4.42) showing the parse of As for Mary, Bill dislikes her at the point of substitution.

(4.42) Parsing As for Mary, Bill dislikes her.

\[
\begin{align*}
\langle L \rangle Tn(0), Ty(e), \\
Fo(\iota, x, Mary'(x))
\end{align*}
\]

\[
\begin{align*}
Ty(cn), \\
Fo(x, Mary'(x))
\end{align*}
\]

\[
\begin{align*}
Ty(cn \to e), \\
Fo(\lambda P.(\iota, P))
\end{align*}
\]

\[
\begin{align*}
Tn(0), ?Ty(t), ?(D) Fo(\iota, x, Mary'(x))
\end{align*}
\]

\[
\begin{align*}
Ty(e), \\
Fo(\iota, y, Bill'(y))
\end{align*}
\]

\[
\begin{align*}
?Ty(e \to t)
\end{align*}
\]

\[
\begin{align*}
Ty(e), \\
Fo(\iota, x, Mary'(x))
\end{align*}
\]

The immediate advantage of characterising relative pronoun construal and the so-called hanging-topic structures in the same terms of being associated with independent trees to be anaphorically paired is that whatever parallelisms there may be between relative-clause construal and those topic-forming structures is immediately brought out. This is a bonus for this analysis, since in many other approaches to relative clause formation, the relationship of relativiser to its remainder is that of an operator binding a gap. The essential anaphoricity of the relationship between head and the relativising element is missed. Since such hanging topic constructions are typically not characterised in the same way (Anagnostopoulou et al 1997), the common properties of both types of construction are not captured.28

In particular, we anticipate an asymmetry between those languages which have a full relative pronoun, which in relative clauses provides the appropriate copy;

\[28\text{Though see Boeckx (2003).}\]
and those languages which do not. Where the relativiser does not itself induce
the required copy in the LINKed structure, as in languages such as Arabic and
Romanian, the account so far provided leads us to expect a strong parallelism
between topic structures and relative clauses. Both will require a suitably construed
pronoun in some position within a string, for neither have any expression encoding
the requisite anaphoric link. In languages or structures in which a relative pronoun
secures the presence of the copy of the formula at an unfixed node within the
introduced LINKed structure, there should be no such parallelism.

This asymmetry is indeed reflected in the data. In both Arabic and Romanian
(in relative structures using care), which we have already taken as illustrations
of obligatory resumptive use of pronouns in relative pronouns, the two structures
display parallel effects. In Arabic, for example, a suitably construed pronoun is
obligatory in all non-subject positions, as it is in Romanian:

(4.43) a. l-bint ūlīyī ēntā ēntā bil-ḥa
       the girl that Ali met-her
       ‘the girl who Ali met’

       b. nādja, ūlīyī ēntā bil-ḥa
           Nadia, Ali met her
           ‘As for Nadia, Ali met her.’

(4.44) a. baįalątul pe cāre 1- aįm vāziṭu
       the boy pe which him have1.SING seen
       ‘the boy that I saw’

       b. pe Ion l aįm ėntīlhiṭ ānul trecuṭ.
           John him have1.SING met year last
           ‘John, him I met last year.’

Hebrew, as the mixed case, should, like Arabic, display parallelism between relative
clauses and topic structures, and it does (compare (4.24a,b) with (4.45a,b):

(4.45) a. šaləm, ūlīyī xoşęv śe ūləv ūləmərtə śe sara
       Shalom, I think that about him you said that sara
       katea šir
       wrote poem
       ‘Shalom, I think that about him you said Sara wrote a poem.’

       b. šaləm, ūləv ūlīyī xoşęv śe ūləmərtə śe sara
           Shalom, about him I think that you said that sara
           katea šir
           wrote poem
           ‘Shalom, about him I think you said Sara wrote a poem.’

In English, however, there is no parallelism between hanging topic structures
and relative clause construal, for English has an anaphoric relative-pronoun as its
relative complementiser. So, it is only in topic structures that a suitably construed
pronoun is required, as in (4.35)-(4.41a). In relative clauses it is not, and is merely
an option associated with markedness effects, as we have already seen:

(4.46) ?That friend of yours who I found him wandering round the supermarket
       seemed very upset.

So the exact parallelism of Hebrew and Arabic relative clauses and such topic
structures is, as we would expect, not matched in English.
4.2. TOWARDS A LEFT PERIPHERY TYPOLOGY

4.2.2 Overlapping analyses

What we now find is exactly the same kind of overlapping effects that we saw in the earlier relative clause forms of variation, but here with a new twist. All languages display the two types of strategy for construal at the left periphery: the building of LINKed trees and the building of a single unfixed node. But languages may vary as to whether the locality constraint imposed on the pair of LINKed structures mimics the locality of unfixed node resolution. Languages vary further as to whether or not they have pronominal forms which can freely function either in a pair of LINKed structures or as an update to an unfixed node. In a language which displays all these overlapping effects, we have a prime scenario for an aspect of the language system which is in transition, as indeed the Romance languages are in their emergence from a free word order system, Latin, into the more fixed order of their modern systems.

4.2.2.1 LINKed structures and locality variations

On the one hand, pursuing the parallelism with relative clause construal, if we take a LINK transition as the point of departure for parsing a left peripheral expression, we expect an array of variations in locality associated with the antecedent-anaphor relation imposed by the LINK relation. So we can expect variation as to which modal operator, \( \langle \mu \rangle \), defines the domain within which the constructed copy of the term must be found. ((4.47) leaves open the possibility that there may other relevant modalities.)

\[
(4.47) \text{Locality variations with LINK:}
\]

\[
\langle L \rangle Tn(0), Fo(\alpha) \quad Tn(0), ?T_y(t), ?\langle \mu \rangle Fo(\alpha)
\]

\[
\mu \in \{D, \downarrow^*, \downarrow, \ldots \}
\]

First, there are the cases without any locality constraint on where the copy of the head is established. This is clearly met by the data which allow the left-peripheral expression to be interpreted as picking out the same entity as picked out by a pronoun, possibly inside a relative clause sequence:\(^{29}\)

\[
(4.34c) \text{Căt despre Ion, n-am întâlnit fata care l- a văzut}
\]

As to John, not-I have met the girl which him she has seen

\[
\text{ultima dată.} \quad \text{[Romanian]}
\]

the last time.

‘As for John, I have not met the girl that (she) saw him last time.’

Furthermore, on the assumption that case specifications indicate relative positioning in the resultant tree (see chapter 2), we expect an interaction with case-marking. That is, in languages which display morphological case, we expect, correctly, that in island-insensitive environments, if a pronoun is used, there may well be case mismatching. The use of the pronoun can be taken as indicative of a LINK relation having been established between two separate structures, with only the node decorated by the pronoun meeting the requirement imposed by the case specification, and this pronoun meeting the requirement for a copy of the term constructed from the left-peripheral expression. Hence in the Greek and Malayalam

\(^{29}\)This is in contrast to the restriction on relative clause sequences that the relative pronoun care cannot itself be correlated with a pronoun across such a boundary.
examples below the left dislocated nominal is in the nominative case, but paired with an accusative pronoun in the matrix clause:30

\[(4.48) \quad \text{I the NOM Maria, \textit{xtes gnorisa ton andra pu tin} theNOM Mari\textit{a yesterday met the man who herACC pantreftike married}\] 'As for Maria, yesterday I met the man who married her.'

\[(4.49) \quad \text{Sue the NOM Johninu avale ishtammanu. Sue NOM John\textit{Dat herAcc likes}\] 'Sue, John likes.'

However, given the modal form of the requirement, there is every reason to expect variants of this form of constraint through selection of other modal operators from the range \(\langle D \rangle, \langle \downarrow \rangle, \langle \downarrow 0 \rangle\), again just as in relative clause construal, thereby imposing more severe restrictions on where the copy is to be found in the second tree. The imposition of the requirement using the \(\langle \downarrow \rangle\) operator, where the imposed structural restriction on the antecedent-anaphoric pairing mimics that of an unfixed node, corresponds directly to so-called ‘Clitic Left Dislocation’ (CLLD) structures (Cinque 1990), which we see in all the Romance languages. Despite their strong-island sensitivity, these are obligatorily associated with an attendant pronoun in the second structure, and separated from the remainder of the string by a sharp intonational break. Accounting for such strings in terms of paired LINKed structures would suggest that intonation is playing a role in indicating the separation of the structure to be projected from the first expression from the structure to be assigned to the remainder.31

\[(4.50) \quad \text{el the car coche, \textit{lo compró} Maria it bought} 'The car, Maria bought it.'

Such strings also display a further property, which is a specificity restriction. In general, quantified noun phrases cannot occur at the left periphery with pronoun doubling, with one exception: that of indefinite NPs. And these, if duplicated by a pronoun, must be interpreted as taking wide scope with respect to the remainder of the string, being interpreted quasi-referentially. (4.51) is reported as unacceptable, and (4.33) has to be interpreted as indicating that Pedro is looking for a particular individual:32

\[(4.51) \quad \text{un the Spanish car, coche, \textit{lo compró} Maria it bought}\] 'A car, Maria bought it.'

---

30In Malayalam, as in many other languages, nominative case is associated with null morphological marking.

31In the Romance, Greek and Bantu languages, among others, clitic pronouns may occur either as prefixes (as a form of agreement), or as suffixes. The prefixal form requires a specific lexically induced action licensing the construction of an unfixed node which then merges with the (object/indirect-object) node projected by the actions of the verb. We shall see in chapter 6, in turning to Japanese the need for a localised variant of *Adjunction; and in chapter 9, we shall argue that in the Romance languages the pre-verbal clitic positioning is a calcified lexical reflex of free use of this localised *Adjunction in Latin. For the moment, the preverbal clitic position and the decoration of the argument node which the actions of the clitic pronouns give rise to, will have to be taken on trust.

32In many analyses, such indefinites are analysed indeed as names (Fodor and Sag 1982, and many thereafter: see references in chapter 3), but we have already seen reason to doubt any such analysis of indefinites.
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(4.33) A una secretaria que sabe hablar inglés, Pedro la está buscando.

pro_{Fem, ACC} is looking-for

'Pedro is looking for a particular secretary that speaks English.'

(4.52) qualcuno, lo troveremo

Someone, him we will find

'Someone in particular, we will find him.'

This property buttresses our analysis in terms of LINKed structures. As we saw in chapter 3, unlike all other quantified expressions whose scope is restricted to a particular propositional structure, indefinites can be freely associated with an indefinitely extending scope across independent domains. Analysing the indefinite as projecting an epsilon term, which decorates the top node of a LINKed structure provides the expected distribution. Only indefinites will be able to be associated with nodes identically decorated across a pair of independent structures. As noted, non-indefinites require scope evaluation within an individual tree since they have no lexically idiosyncratic mechanism to dictate any broader scope potential (see chapter 3). What this means is that if a language allows non-indefinite quantified expressions to be pronoun-doubled, i.e. to allow co-construal of the pronoun and the quantified expression, then this must be taken to be an indication, contrarily, that the node which the pronoun has decorated is able to MERGE with the node which the quantifying expression has decorated. That is: the pronoun and the quantified expression must be in the same propositional domain within which the scope of the quantifying expression can be suitably defined. In other words, a left dislocated quantified noun phrase must be treated as decorating an unfixed node, never an independent LINKed term and a co-construed pronoun must be a clitic that is not defined as necessarily decorating a terminal node. This indeed is the property displayed in Spanish datives, a phenomenon we turn to shortly.

So far, so good. We have itemised a basis from which to characterise the mixed status of Clitic Left Dislocation, using the assumption that the locality constraint within which the anaphoric link across a LINK transition may be established as a basis for variation. With this possibility of locality variation, one might expect further that if a language has the morphological means of distinguishing more than one type of such structure, these might differentiate between different forms of locality constraint, and this is what we find in Romanian (4.34c,b). In Romanian, there is the one generalised LINK transition which, like the corresponding transition in relative clause construal in this language, imposes a restriction that the shared term to be introduced must be constructed within the same tree as the LINKed structure (expressed using the ($\downarrow$)); but there is also the richer lexical form involving cit despre (‘as to’), which, like English as for, lexically induces a LINK transition with only the weakest form of locality constraint using the (D) operator that merely has the effect of imposing a requirement for the copy of the term in question during the construction process without any further structural restriction.

With the emergence of a locality constraint imposed on the anaphoric process associated with establishing the requisite pair of terms across a LINK relation, a clear overlap emerges between what are otherwise two discrete strategies: that of

\[ \exists x, \psi(x) \wedge \phi(\epsilon, x, \psi(x)) \models \psi(\epsilon, x, \psi(x)) \wedge \phi(\epsilon, x, \psi(x)) \equiv \psi(a) \wedge \phi(a) \text{ where } a = \epsilon, x. \psi(x) \wedge \phi(x). \]
building paired LINKed trees; and that of building an unfixed node within a single structure. So there will be more than possible analysis for an individual string. And, as we turn to consider *Adjunction, this is what we shall find.

4.2.2.2 The interaction of *Adjunction and anaphora

*Adjunction is the device par excellence for characterising left-periphery effects and was defined to do just that. So with the availability of building an initial LINKed structure to be anaphorically twinned with the subsequently introduced structure, and with *Adjunction, we do indeed have two strategies available for building up interpretation of left-peripheral expressions. To complete the picture of the types of available variation, what we now bring back in to this account is the possibility of a pronoun losing its terminal node restriction (what we have been calling “the bottom restriction”). As we have seen in discussing crossover phenomena and resumptive pronoun construal, a form of update for a node introduced as unfixed is by merging it with the node decorated by that pronoun. In the case of relative clause construal, there is in general no question of there being a constraint precluding such a use of a pronoun, as all that is copied over from one tree to another is the formula itself as a regular anaphoric copy. Even with a bottom restriction, a pronoun can play this role. It is only in the more restrictive Germanic case that the relativising element is claimed to have complex internal structure and it is this property of the relativiser which ensures the lack of resumptive pronouns in German, not any property of the pronoun.

However, when it comes to left-periphery effects, where any type e node of whatever complexity may be taken to decorate an unfixed node, whether or not this subtree can unify with the node decorated by the pronoun will depend on whether the pronoun retains the constraint that it decorate a terminal node. If the pronoun retains this restriction, it will not allow such a process; and indeed retention of the terminal-node restriction is characteristic of English pronouns, and German also.\(^{34}\) This is what prevents resumptive pronouns with interrogative and quantified left dislocated noun phrases:

\[(4.53)\]
\[
\begin{align*}
a. & \text{*Who did Bill say he likes her?} \\
& \text{b. *Every book by Chomsky, I like it/Them.}
\end{align*}
\]

As noted above, for a quantified expression to be paired with a pronominal it must be the case that the latter cannot project the bottom restriction. If a pronoun has lost the terminal node restriction, then the node the pronoun decorates can be unified with any node introduced as unfixed in early stages of the parse process. And under these circumstances, this process will itself provide the update both to the tree position for the hitherto unfixed node and to the metavariable provided by the pronoun.

This provides a basis for characterising the data where a preposed nominal agrees with the case-marking of the pronoun that is construed as doubling it, as in the Greek example (4.32a), repeated below:

\[(4.32a)\]
\[
\begin{align*}
\text{ton Petro, ton nostalgo poli [Greek]} \\
\text{The \textit{Peter}^{ACC}, \textit{him}^{ACC} \text{miss-1sg much}}
\end{align*}
\]

\[\text{‘I miss Peter a lot.’}\]

\(^{34}\)The only exceptions to this restriction on pronominal use are the expletives, for example the English expletive \textit{it}: see chapter 5 where we shall argue that the loss of bottom restriction is what defines expletive pronouns.
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The analysis of this sentence up to the point of merge is shown in the tree in (4.54). (Irrelevant details are omitted and the speaker is taken to be Maria.)

(4.54) Parsing (4.32a):

The effect of the process is shown in (4.55), clearly showing the node originally decorated by the clitic no longer being terminal in the resulting tree. In such cases, the case requirement on the unfixed node is met upon unifying it with the appropriate fixed node.

(4.55) Parsing (4.32a) after MERGE:

As we would expect, these cases need not display specificity effects. Spanish, which unlike Greek does not have case morphology reflected on the noun phrase itself, certainly freely allows quantifiers with clitic doubling in the case of dative clitics:35

(4.56) a nadie le devolvió María su manuscrito [Spanish]

‘To no-one did Maria return his manuscript.’

(4.57) a familias de pocos medios les ofrecieron ques no y leche
to low-income families, they offered cheese and milk.

35Traditionally seen as an animacy marker in accusative cases, for which it does not distinguish between direct and indirect objects, this use of a is extending also to animates (Company 2002). As we shall see in chapter 7, this is a pattern characteristic of Bantu object marking also, where the data provide an application of an operation specific to the introduction of locally unfixed nodes: see chapter 6,7.
We expect this to be so, and without restriction to a particular type of quantifying expression, as the process is simply one of tree update, which is a general computational action applying without restriction to particular sub-types of formula expression. This property distinguishes the Spanish dative from the accusative clitic pronoun. Furthermore, unlike the other clitics, with the dative clitic there is no necessity of any phonological break between the full noun phrase and the remainder of the clause, and in so far as phonological phrasing plays a role in indicating whether discrete structures are or are not to be built, this confirms the present analysis.

4.2.2.3 Processing ambiguities?

There is a consequence to there being such a shift in the set of constraints the pronoun imposes on the substitution of its metavariable. If some pronoun in a language has lost its bottom restriction, then its presence in a string is no longer necessarily indicative of the need to construct a pair of LINKed trees, as we have seen, since the node which it can decorates may nevertheless provide the input to a step of MERGE. Nevertheless, having this less restrictive characterisation will not debar the building of pairs of LINKed structures using this form of anaphoric device either: failing to have a bottom restriction, its distribution will simply be wider than those pronouns upon which such a restriction is imposed. This will give rise to a processing ambiguity without necessary semantic consequences. This, perhaps surprising, result appears however to be correct, in that it enables us to explain differences between dative and accusative doubling in Spanish.

In standard Spanish, the dative clitic pronoun, as we have already seen, can be used to duplicate all forms of NP, quantified and referential: allowing both an interpretation in which the doubled noun phrase is taken as some background context to which the pronoun provides an anaphoric link and there is an intonation break after the left peripheral noun phrase; and an interpretation in which the doubled noun phrase has no such distinctive role and there is no intonational break. This, however, is the only form of clitic for which this is true. The accusative clitic in Spanish can only double referential noun phrases construed as independently fixed in the context, and so requires an analysis in terms of LINKed structures. In support of this conclusion, the object clitic in Standard Spanish is reported always to require intonational indication of a break between the doubled noun phrase and what follows it. Indeed, if no clitic is present in such structures, as in (4.58), the left-dislocated NP must be interpreted non-specifically, and hence by the analysis here as decorating an un fixed node. So (4.33) and (4.58), which differ solely in the presence of the clitic, differ systematically in interpretation:

\[
\begin{align*}
(4.33) & \quad a \quad una \quad secretaria \quad que \quad sabe \quad hablar \quad inglés, \quad Pedro \\
& \quad \text{ACC one secretary that knows speak}_{INF} \quad \text{English, Pedro} \\
& \quad la \quad está \quad buscando \\
& \quad \text{PRO}_{Fem,ACC} \quad \text{is} \quad \text{looking-for} \\
& \quad \text{Pedro is looking for a specific secretary, who speaks English.'}
\end{align*}
\]

\[
\begin{align*}
(4.58) & \quad a \quad una \quad secretaria \quad que \quad sabe \quad hablar \quad inglés, \quad Pedro \quad está \\
& \quad \text{ACC one secretary that knows speak}_{INF} \quad \text{English, Pedro is} \\
& \quad buscando \quad \text{looking-for} \\
& \quad \text{Pedro is looking for some secretary that speaks English.'}
\end{align*}
\]

\[\text{We return to the distribution of Spanish dative clitics and the distinction between clitic (weak) pronoun and strong pronoun in chapter 5.}\]
To achieve this effect, and the asymmetry between dative noun phrases and the rest, we need an analysis which allows two strategies of construal for the one type of case, and one only for the remainder. This is what the analysis of the dative as having lost its bottom restriction provides.

Furthermore, we now expect an ambiguity in the construal of subject pronouns in Spanish. Given the lack of morphological marking of case on the subject, and the pro-drop properties of the verb, we correctly anticipate ambiguity of construal of *María compró un coche* (‘Maria bought a car’) as to whether the subject NP is taken to decorate a LINKed structure (4.59) or an unfixed node (4.60).

(4.59) Parsing *María compró un coche* with LINK:

\[
\text{Parsing } \text{María compró un coche} \text{ with LINK:}
\]

\[
\text{(L) } Tn(0), Ty(e), Tn(0), ?Ty(t), ?(D) F(ite, x, Maria'(x))
\]

(4.60) Parsing *María compró un coche* with *ADJUNCTION:

\[
\text{Parsing } \text{María compró un coche} \text{ with } \text{ADJUNCTION:}
\]

\[
\text{(L) } Tn(0), Ty(e), Tn(0), ?Ty(t), ?(D) F(ite, y, Coche'(y))
\]

Just as in the account of the dative clitic, we do not need to say that, in some sentences, subject agreement requires analysis as some form of indexical, while in other cases an analysis as an agreement device. The account of verbs in pro-drop languages as decorating one or more argument nodes with a metavariable without a bottom restriction gives just the flexibility we need.

Another expected variation is a language which was originally pro-drop, with argument annotations provided by agreement morphology, has changed into one that uses clitics, which have exactly the same properties as the agreement morphology which they replace. This is arguably the case with conversational French, which lost its pro-drop properties early on, and which invariably doubles the subject NP with the presence of a clitic.\(^{39}\)

\(^{37}\)The Porteño Spanish accusative clitic appears to be moving in the same direction in that this intonational patterning of separation between it and its remainder has gone the way of the dative, and got dropped. However it retains a specificity restriction on all doubling of the clitic. See Suñer 1991 and elsewhere.

\(^{38}\)See Zubizarreta (1998) and Belletti (1999) for arguments that in Spanish a lexical specified subject is invariably external to the clause.

\(^{39}\)The same style of analysis arguably applies to the Northern Italian dialects, which share with
Jean, il est malade

‘John is sick.’

Indeed, what are described in the current literature as two discrete processes, Hanging Topic Left Dislocation, and Clitic Left Dislocation (Anagnostopoulou 1997), are argued by de Cat (2002) to be indistinguishable in modern conversational French. On this analysis, it is exactly analogous to Spanish, except that in French the richness of decoration of the agreement morphology is taken over by the clitic.

So, with the use of two discrete forms of structure-building, both allowing variants which overlap, we expect the range of intermediate effects which the phenomena display. There is one pattern, however, for which we do not have a structural explanation to offer. This is where a left-peripheral noun phrase is case-marked, and shows island-sensitivity with respect to its ultimate position in the emergent structure, but nevertheless which excludes all quantified expressions except those that can be interpreted as specific. The former properties of case-marking and island sensitivity, we characterise in terms of *Adjunction, while the latter property, the exclusion of quantified terms, we characterise in terms of a LINK relation and so would expect to be incompatible. Such a distribution is, however, observed of Greek accusative clitic pronouns, and of Rio-Platense Spanish accusative clitics:

(4.62) mia kokini blouza tin psaxno edo ki ena mina

a red blouse _FEM.ACC_ her _ACC_ look-for _1.sg_ for _1.sg_ a month now

[Greek]

‘I have been looking for a particular red blouse for a whole month now.’

How can we square this with our analysis, without weakening the diagnostics for the account of other data? The first thing to note about these data, is that, in careful accounts of the Greek phenomenon, they are accompanied by a footnote pointing out that the data are not entirely clearcut, as in the subjunctive where an intensional context is being described, the pronoun may be obligatory without any indication of referentiality:

(4.63) a. psachni mia fousta pu na ti thavmazoun

looks-for _3.sg_ a skirt that _SUBJ_ her _ACC_ admire _3.pl_

oli

all _NOM_

‘She is looking for a skirt that everyone will be jealous of.’

b. *psachni mia fousta pu na thavmazoun oli

looks-for _3.sg_ a skirt that _SUBJ_ admire _3.pl_ all _NOM_

‘She is looking for a skirt that everyone will be jealous of.’

This situation suggests that the phenomenon is not a clearcut reflection of structure, so we prefer to advocate a pragmatic explanation of the specificity effect in examples such as (4.62), and assume an analysis of such data using the unfixed node strategy. The account turns on explaining the well-known constraint that expressions occurring at the left periphery tend to get interpreted as “given”, expressions at the right periphery as “new”. This is a universal pressure found in

French the property of being in contact with neighbouring speakers of (Swiss) German, a non pro-drop language.

41 The observation about Greek specificity effects is attributed to Philippaki-Warburton (1985), as the first to observe this. The example is taken from Alexopoulou and Kalliakou (2002).

42 The same phenomenon is noted in passing for Hebrew in Sharvit (1999) which pursues an analysis which is incompatible with such data.
all languages wherever there is freedom of choice in constituent ordering and the distribution can be seen to be founded in relevance-related constraints operating on speakers in the production task of choosing words in a particular order. As we shall see in chapter 9, a major difficulty in the production task is to choose appropriate words to express some selected representation of content, and do so incrementally. Using context-dependent expressions is a major means of reducing this task to manageable proportions, as the very fact that such expressions are context-dependent means that some matching term, and the words already used to express it, will be available in the context, so there will not be any need for a speaker to search in their general lexicon store to find them. Furthermore, if such words are placed at the initial edge of what the speaker is trying to say, they will be temporally as close to that established context as possible, so that even within that context, the search for the appropriate term will have been made as small as possible. We shall leave this here as a promissory note to which we shall return when we consider the DS modelling of production, where this kind of constraint will play an important role. But what this account suggests is that while some specificity effects have led to encoded instructions to build LINK structures, others have not, an apparent indication of a language system in transition.

4.2.3 Towards an explanation of topic and focus effects

In developing this typology of left periphery phenomena, there has been no invocation of primitive concepts of either topic or focus: no features or projections encoding any information as having either of these functions. We now test the extent to which the DS constructs can be used to reflect these informal notions. First, we turn to the concept of topic, which we take to constitute some minimal form of context relative to which some update is constructed. From the perspective of this framework, given that all parsing takes place in a context, we take this to include at least some (minimal) sequence of partial trees immediately available to the parser. The context, simply, is the point of departure for the current processing, with a record of what has just been processed. However, the speaker is able to construct a point of departure as part of the utterance sequence, and in this lies the function of building a LINKed structure at the outset of an utterance. The speaker may decide to create on-line the context for the main substance of what he has to say, either establishing anaphorically a relationship to the larger context in which the utterance takes place, or to constitute a departure from it. And so it is that structures constructed as independent from the remainder, and LINKed to it, may be construed as providing background, contrastive, or topic shift information.

Second, there is the concept of focus, a slippery notion which some have argued is incoherent.43 The other form of decision about the presentation of information within the time-linear dynamics of an utterance is the need to separate off some term from the remainder in order to allow it to serve as a specific form of update relative to some proposition to be taken as context. However, as with the concept of topic, this separation of what is the new update may be achieved in one of two ways. Either the construction process can itself present both the update and the structure to which the update is provided: this is the function of *ADJUNCTION with later application of MERGE, unifying the two nodes. On the other hand, what is the presented context may itself provide the structure to which the string provides an update. Question-answer pairs such as (4.64) illustrate cases of this sort. In (4.64), the parse process of the fragment can be seen as starting from the subject node

43See Buering 1997 who argues that it is no more than that which is left over once all expressions which match up with some term in context have been identified.
presented in the context structure, to which the presented utterance provides an update:

(4.64) Who annoyed his mother? John.

There is no need to postulate the silent utterance of a full sentence; all that is needed is to presume that the relation of context to its update transcends sentence boundaries. In (4.64) the context is used directly and we have elliptical forms of focus. Where the context plus update are constructed together, we have syntactic focus.

There is much more to be said here, and we return to a proper formulation of context in chapter 9. All we can hope to have indicated is that there are grounds for being optimistic that, with the formal tools of building partial structures with an unfixed node, or paired LINKed structures, we have the basis for explaining topic and focus effects without having to invoke these concepts themselves as primitives in the explanation. And, as we shall see when we turn to right-periphery phenomena, the same mechanisms of tree growth can be used to characterise somewhat different topic and focus effects in the latter stages of the interpretation process.

4.3 Summary

Overall, this account of clitic-duplicated left-dislocation structures matches the more familiar accounts which invoke a dichotomy between anaphoric and dislocation bases for characterising the data. However, it brings out the parallelism between left-periphery effects and processes of relative clause construal, distinguishing those languages where there is full parallelism from those where the parallelism is only partial. The intermediate cases also emerge as expected variants, either from the interaction of independently motivated processes, or as expected variations along a locality spectrum. In particular, the various anaphoric effects that are achieved do not need to be formalised with mechanisms distinct from regular processes.

The only difference between pronouns which do allow update by node-merging processes and those which do not, is in the loss of the terminal-node restriction. Strong pronouns invariably retain such a restriction, behaving in all respect as regular lexical items. Clitic pronouns may have lost this restriction, though by no means all have done so. In all other respects, these pronouns function as regular anaphoric expressions, the loss of the restriction merely ensuring that they have a wider distribution. So despite the complexity of the data, the various options available emerge from the interplay of general principles of tree growth, and the minimum of lexical stipulation.

As with the characterisation of relatives, this left-periphery typology is only partial in that there is no hint of how a LINK relation might be induced in the latter stages of the construal process, a right-periphery effect, a matter which we turn to in the next chapter.

44 See Kiaer in preparation for detailed exploration of this view.
45 An account which purports to unify anaphora and long-distance dependency is that of Hornstein (2000), but with the opposite move of making anaphora resolution be modelled as a form of movement.
Chapter 5

On the Right Periphery

5.1 Right Dislocation

In previous chapters, we have looked at a range of phenomena in the pre-verbal, or left-peripheral, domain of the clause. In particular, a range of constructions associated with topic and focus effects has been provided with analyses using concepts of unfixed nodes and LINK structures. In this chapter, we explore certain constructions on the less commonly studied right periphery (postverbal) domain (though see Beerman et al 1997). As we shall see, essentially the same concepts of *ADJUNCTION and the building of LINKed structures used in analysing the left periphery can be used in analyses of right periphery phenomena. The result is a more unitary account of the two peripheral boundaries of the clause than is possible within Minimalism accounts or those based on Kayne (1994)’s antisymmetry thesis. However, as we shall also see, constructions on the left and right peripheries are not fully symmetrical and we will show how the time-linear parsing approach of Dynamic Syntax provides an elegant and straightforward way of accounting for these.

We cannot, of course, explore the whole range of right periphery phenomena here. In particular, we do not provide accounts of true afterthought and other elliptical constructions.1 Such fragments display rather different properties from those generally discussed in this book, as they do not appear on the left periphery (5.1b) and involve a non-monotonic process of re-using processed structure, as illustrated in (5.1a) where only part of the content of the preceding utterance is used to derive the interpretation ‘Harry was not having a good time’: it notably cannot mean ‘I was relieved that Harry was not having a good time’.

(5.1) a. I was relieved to see that everyone was having a good time. Except Harry/ But not Harry.

b. *Except Harry/But not Harry. I was relieved to see that everyone was having a good time.

The constructions we do analyse all involve pronominal elements, either explicitly as in Pronoun Doubling (5.2) and sentential Extraposition (5.3) or covertly as in Subject Inversion (5.4) and (we shall argue) Right Node Raising (5.5).

(5.2) a. He talks too fast, the new secretary.

---

1But see chapter 9 for further discussion of certain types of ellipsis.
b. *lo conosco, Giovanni* [Italian]
   him I know Giovanni
   ‘I know him, Giovanni.’

(5.3) a. It is surprising that the Principal left so soon.
b. I have proved it to my satisfaction that the analysis is watertight

(5.4) a. *ha telefonato Beatrice* [Italian]
   has telephoned Beatrice
   ‘Beatrice has telephoned.’
b. *e’ arrivato uno studente*
   Is arrived one student.
   ‘A student has arrived.’

(5.5) a. Mary wrote, and I reviewed, several papers on resumptive pronouns.
b. Every overseas student could answer, but most home students couldn’t even understand, some questions on formal semantics.

The question of whether the tools of Dynamic Syntax can capture the near, but not perfect, symmetries between right and left periphery effects is a non-trivial one. In movement accounts, the close correspondence between c-command explanations and explanations based on linear order of left-periphery phenomena threatens to break down in addressing those on the right-periphery. The correspondence can only be re-established by positing an array of movement processes and a number of additional projections whose sole motivation is to sustain a c-command analysis in the face of apparent counter-evidence (see Ordonez 1997, Cecchetto 1999, for example). If the DS approach is to be shown to be superior to movement analyses, the theory must be able to account for the common properties of left and right dislocation phenomena in the same terms. It is to a demonstration of the theory’s ability to achieve just this that we now turn.

5.2 LINKed structures and recapitulation effects

The primary attribute of right-periphery phenomena is that they occur as part of the process of completing the decoration on a tree structure already set; and at this point, the monotonic compositionality of the tree construction process imposes tight constraints on how the tree must be compiled. The concept of well-formedness turns on the availability of a derivation which yields a complete logical form using all the words, with no requirements outstanding. The building of such logical forms involves two phases: (i) setting out the structure, (ii) compiling up decorations on nonterminal nodes of that structure. We have so far seen how there may be a considerable amount of leeway in lexical actions in what pointer movements from node to node are possible in how such structure is set out. For example, the sequence of actions of a verb allows the pointer to go to some local topnode, add a decoration there of some tense specification and return to the predicate-requiring node, which constituted the point of departure. However, to preserve the monotonicity of accumulating content of the tree, once some structure is set and its terminal nodes decorated in a way that satisfies all their requirements, there must be strict movement of the pointer during the evaluation stage in which rules of Completion and Elimination apply to determine how some total tree is successfully decorated. In particular, once some mother node is decorated on the basis of these rules, there can
be no return to any of its daughter nodes: the addition of any further decorations on these nodes would lead to the modification of the decorations on the mother node in the light of any such changes which is incompatible with the monotonicity of the tree growth process, the centre pin of the concept of tree growth. We now see this constraint applying in a number of different ways.

The first case we take up in the light of this is a recapitulation effect. All languages permit a pronoun to double some NP on the right periphery of the clause, the effect being a backgrounding of the postposed constituent, sometimes described as a “background topic” (Herring 1994). It is even possible in some languages for the right peripheral noun phrase to be an emphatic pronoun (5.6c).

(5.6) a. I think you should realise that it’s an impossible topic, right dislocation.
    b. He’s not very good, that new administrator.
    c. I’m not happy, me.

In these structures, an anaphoric expression is necessarily identified as co-referential with the formula annotating the right-peripheral structure, which is itself optional and definite (5.7). Since it re-identifies the same element identified in the main clause by the pronoun, we may refer to the right peripheral expression as a recapitulation.

(5.7) a. She’s a fool, my mother.
    b. She’s a fool.
    c. *She’s a fool, my brother.
    d. ??She’s a fool, a woman I saw yesterday.

This construction may be considered to be the analogue of Hanging Topic constructions on the left periphery, discussed in chapter 4. In left-dislocation structures, we postulated the construction of a LINK relation between a node of type $e$, projected for the analysis of an initial noun phrase, and a node requiring type $t$, providing the main proposition. The recapitulation case is naturally interpreted in DS analogously, but inversely, with a transition from the rootnode of the propositional tree to some following structure requiring type $e$. The term decorating this LINKed tree is required to be identical to some subterm of the just constructed propositional structure, which must itself provide a complete formula of type $t$. We thus have the construction rule in (5.8) which licenses the transition shown in (5.9).\(^2\)

(5.8) **Recapitulation (Rule):**

$$\{\ldots, T_n(0)\ldots T_y(t), Fo(\phi), \ldots, \{\perp, T_n(0), T_n(n), T_y(e), Fo(\alpha)\}, \ldots, \perp\} \ldots \}
\{\ldots, \{T_n(0)\ldots T_y(t), Fo(\phi), \ldots, \{\perp, T_n(0), T_n(n), T_y(e), Fo(\alpha)\}, \ldots, \perp\}, \ldots \}
\{(L^{-1})T_n(0), ?T_y(e), ?Fo(\alpha), \perp\}$$

---

\(^2\)Note the use of the external underspecified modality $\perp$. This indicates that the node decorated by $Fo(\alpha)$ is dominated by node $T_n(0)$ but at a possibly fixed position. See the discussion in chapter 2 on page 53.
**CHAPTER 5. ON THE RIGHT PERIPHERY**

(5.9) Licensing Recapitulation

\[ T_n(0), T_y(t), F_o(\phi) \]  \[ \mapsto \]  \[ T_n(0), T_y(t), F_o(\phi) \]

\[ \uparrow T_n(0), T_y(e), F_o(\alpha) \]  \[ \mapsto \]  \[ T_n(0), T_y(e), F_o(\alpha) \]

The fact that this rule projects from a completed tree of type \( t \) accounts directly for optionality (5.7b) while the requirement imposed on the LINK structure accounts for co-referentiality (5.7a), (5.7c). The restriction of these right dislocated expressions to referring expressions (5.7d) follows from the fact that the pronoun in the preceding clause cannot be truly cataphoric. This is precluded by the constraint that a mother node cannot be completed and eliminated unless both daughters carry no outstanding requirements. Since a pronoun projects a metavariable with its associated formula requirement, the propositional tree cannot be completed until substitution has occurred. It is the assigned value derived from substitution that is carried across as a requirement on the development of the LINKed structure. This can then only be satisfied by some referential term which itself identifies the same value in context (i.e. a proper name or a definite noun phrase). Thus, in parsing (5.2a) *He talks too fast, the new secretary*, the metavariable projected by the pronoun is substituted in context with the term picking out the new secretary, some individual named *Bill*, which is carried across the LINK relation as a requirement to be satisfied by the formula value of the postverbal definite NP.

(5.10) Parsing *He talks too fast.* in (5.2a):

\[T_n(0), T_y(t), F_o(Talk-Fast'(i, x, Bill'(x)))\]

\[\uparrow T_y(e), F_o(U)\]

\[\uparrow T_y(e \rightarrow t), F_o(i, x, Bill'(x))\]

\[F_o(Talk-Fast')\]

A bonus for this analysis, in contrast to the problematic apparent violation of principle C which these data pose for binding theory accounts, is the naturalness with which it reflects the fact that a right dislocation structure with this type of construal, like the analogous left dislocation structure, is a root structure phenomenon, unavailable within the confines of an individual tree.\(^3\)

Despite the mirror-image of Hanging Topic Left Dislocation that this analysis presents, there is nevertheless an asymmetry between right and left periphery effects, which is a consequence of the dynamics of time-linear processing. A left peripheral expression that is used to introduce a LINKed structure projected at the outset (as a topic) cannot rely for its interpretation on any information projected by the following clausal sequence. However, the projection of a pronoun within the subsequent clausal string can, indeed must, take the preceding LINKed structure as its context.

(5.11) **Italian**

Giovanni, lui/si 'apprezzavamo

‘Giovanni, we appreciate him.’

\(^3\)The naturalness of this explanation is in sharp contrast to the setting aside of these data by Cechetto (1999) as problematic for all.
5.2. LINKED STRUCTURES AND RECAPITULATION EFFECTS

With a right-peripheral NP ‘topic’, however, the pronoun in the clausal sequence must be interpreted relative to the context in which it is processed to establish a logical form. The right-peripheral NP must then be interpreted as referring to the same individual in order to ensure that there is a shared term in the two structures: hence, the invariably reported reminder effect in such pronoun doubling structures (Herring 1994, Kural 1997). The backgrounding topic effect in this framework emerges as an immediate consequence of the analysis. There is nothing in the process displayed in (5.9) (and the corresponding rule in (5.8)) stopping the right dislocated expression from being a pronoun. Examples can be found at least in some dialects of spoken British English, as in (5.12):

(5.12)  a. He’s a pain, him.
       b. We don’t start teaching next week, us.

In both these cases, acceptability depends on there being inferential effects derivable from the recapitulation of a term through a second pronoun. In (5.12), the effect in context is usually of (potential) contrastive focus. So in (5.12a), the contrast might be with other people who are not pains while the spontaneously produced example in (5.12b) indicated possible contrast with the hearer (i.e. the hearer might be starting teaching in the following week).

A further consequence of the rule in (5.8) is that it freely allows recapitulation of a full noun phrase within the main clause. Such examples generally, however, show varying degrees of unacceptability. Recapitulation of quantified noun phrases is completely unacceptable (5.13a),(5.13b) and, without intonational cues, recapitulation of proper nouns is very marginal (5.13c).

(5.13)  a. *Most students liked John’s lectures, most students.
       b. ??A tv presenter visited my garden, a tv presenter.
       c. ???Jane likes my book, Jane.

However, independent constraints determine the range of well-formedness effects we find. Recall that quantifying expressions, or rather their accompanying noun, introduce a new variable; and the scope of the constructed term has to be determined in the most local propositional domain. In (5.13a), therefore, the scopes of the quantified expressions in the right peripheral domain cannot be resolved and so the outstanding requirement (to determine a scope relation) ensures the ungrammaticality of these strings, as discussed in chapters 3 and 4.

There is a somewhat different effect with indefinite noun phrases, since in this case, as with names, repetition simply seems to be otiose. Indefinites can, however, be successively asserted of a given individual, as in apposition structures such as A friend of mine, a famous opera singer, is coming to stay, a phenomenon that we can ascribe to the scope-extending properties of indefinites. Thus, despite the double projection of the quantifying expression, such a process is applicable, licensing a well-formed interpretation of the string. Note in this regard that (5.13b) becomes fully acceptable if the repeated indefinite is replaced by a distinct indefinite.

(5.14)  A TV presenter visited my garden, a well-known garden journalist.

The unacceptability of (5.13b)-(5.13c) is thus merely due to lack of informativeness, and can, unlike repeated quantifying expressions, be improved by use of contrastive

4The second of these examples was spontaneously uttered by the second author in a telephone conversation with the first.
stress, yielding a focus effect, as in (5.15a):\(^5\)

(5.15)  
\begin{enumerate}
  \item Harry came to my party, \textbf{HARRY}!
  \item A tv presenter visited my garden, a \textbf{TV presenter}.
\end{enumerate}

This is a balancing of parsing effort with added inferential effect that Relevance-theoretic assumptions would lead one to expect. However, this amelioration of the effects of repetition by construing it to be for contrastive purposes is not available with non-indefinite quantifying expressions, as we would expect:

(5.16) *Most students liked John’s lectures, \textbf{MOST STUDENTS}.

\section*{5.3 Late*Adjunction}

Having seen how a right peripheral expression can be analysed using the same \textsc{link} analysis as for \textsc{hanging topic} constructions at the left periphery, we now turn to an exploration of the applicability of using some form of \textquote{\textsc{adjunction}} at a late stage in a parse to analyse some right peripheral expression.

It might seem that this could not be motivated in Dynamic Syntax, since the later stages of processing a string do not provide the same sort of underspecification so manifestly provided at the left periphery. Once some structure has been introduced, and all its terminal nodes decorated, it would appear that there could be no node introduced later into the structure whose position was underspecified. Such a view is forced in frameworks which do not allow for left/right asymmetry, yet such a conclusion is too hasty for Dynamic Syntax. Indeed, the conclusion would entail that left and right periphery processes are radically asymmetric, when it is precisely their symmetry that is more commonly observed (see, for example, Steedman (2000) for whom the symmetry is definitional). In any case, we have left a margin of flexibility open through the analysis of anaphoric expressions as projecting metavariables as their formula value, leaving a requirement for a fixed formula value yet to be provided. Nothing forces substitution to apply at any point. Like all other rules \textsc{substitution} is optional, and with the provision of a type specification, \textsc{completion} can apply, and hence the parse process can proceed, leaving that requirement unfilled. Should substitution not have taken place as the pronoun is parsed, however, the pointer will have to return to that node at a later juncture if a successful derivation is to be achieved.

Consider, now, what the parse process involves in general terms. Structure is progressively introduced in a top-down, goal-directed way, introducing either unfixed nodes to be updated or a skeletal propositional structure, to which lexical actions provide further update for terminal and nonterminal nodes. The tree is then evaluated bottom-up by functional application applying only if all requirements on the daughter nodes are satisfied. Pointer movement does no more than reflect incremental development, moving first down the tree driven by computational and lexical actions, and then successively back up it driven by functional application over types to complete the tree, as shown in detail in chapter 2. In the closing stages of interpreting a clausal string, once the requisite structure is introduced and all words are parsed, successive steps of evaluation then determine the values of nonterminal nodes on the tree whose value is not yet established.

\(^5\)It is notable that in English, such repetitions may occur in such examples as (i)-(ii) with the combination of NP plus auxiliary at the right periphery acting as a backgrounding device:

(i) He’s always a pain, he is.
(ii) He always says nice things, Donovan does.

We take up the anaphoric properties of expressions occurring with verbs such as \textsc{be} in chapter 8.
There is nevertheless a potential role for *Adjunction even at this late stage. Consider the situation in which there is some node in the tree whose characterisation during the construction process has been partial, leaving some unfulfilled requirement. In such a situation, a late application of *Adjunction might be invoked to satisfy the outstanding requirement through Merge. This would be the case, for example, if a metavariable failed to get a fixed value through Substitution from the context (all rules being optional). In such circumstances, while the node decorated by the metavariable is type-complete, it is still formula incomplete and there remains an outstanding requirement. Satisfying a type requirement allows the pointer to move on in the construction process, but the open formula requirement causes a problem in the tree evaluation process, as the mother node cannot be evaluated by Elimination. Steps must therefore be taken to allow this requirement to be met in order to allow the tree to be completed. To accomplish this the pointer must be able to move back down to the relevant daughter node in order to further specify it. In such a situation, we have a scenario in which late application of *Adjunction can lead to a successful update of the tree, by creating an unfixed node whose formula annotations will provide the satisfaction of the outstanding requirement through the Merge process.

In order to make this type of analysis more concrete we will explore a number of constructions in which the hypothetical situation sketched above occurs: a metavariable is projected by some pronominal element (overt or covert) but its content is only identified at some later stage of the parse.

### 5.3.1 Extraposition

We begin by looking at a construction in English which may not be obviously associated with the right periphery, but which involves a pronoun that allows a contentive expression to appear post-verbally: sentence extraposition. In this construction, the subject argument of a predicate is propositional and so we find clausal strings appearing pre-verbally as syntactic subject (5.17a). We also find the clausal expression in post-verbal position just in case there is an expletive pronoun before the verb (5.17b).

(5.17)  
\[ \begin{align*} 
  a. & \text{ That we are wrong is possible (but not likely).} \\
  b. & \text{ It’s possible that we are wrong (but it’s not likely).} 
\end{align*} \]

The pronoun it in (5.17b) is not ‘referential’, taking its value from the context in which the string is uttered, but expletive in that it takes its content from the postverbal expression.

In nonpro-drop languages such as the Germanic languages, lexicalised expletives are essential in this position. Without them, the parsing sequence breaks down and cannot proceed because the verb does not decorate its subject position with a metavariable, unlike Japanese (Chapter 6) and some of the Romance languages (see chapter 2 and below). Thus, the string in (5.18) is simply unparsable as the pointer cannot move on from the subject node without lexical input.

(5.18)  *Is likely that Bill is confused.

The function of an expletive use of a pronoun, accordingly, is to keep the parsing process alive: it first provides a metavariable as an interim value to some type requirement associated with one node and then moves the pointer on to another node. Because the pointer is moved on as part of the actions determined by parsing the expletive pronoun, no substitution can take place and an open formula requirement necessarily remains on the node decorated by the metavariable.
The (provisional) definition of these actions is given in (5.19) which assumes that \( Ty(t) \) can decorate a subject node, and that certain predicates project a formula of type \( t \to t \).\(^6\) Note the extra condition, \( \langle \uparrow \rangle \bot \), which checks whether the current node is the topnode in a tree and aborts the parse if it is, thus preventing \( it \) from being the sole expression in a sentence.

\[
\begin{array}{c|c}
\text{IF} & \ ?Ty(t) \\
\text{THEN IF} & \langle \uparrow \rangle \bot \\
\text{THEN} & \text{Abort} \\
\text{ELSE} & \text{put}(Fo(U), Ty(t), ?\exists xFo(x)); \text{go}(\langle 10 \rangle \langle 11 \rangle) \\
\text{ELSE} & \text{Abort}
\end{array}
\]

The effect of these lexical actions is to license the transition in (5.20).

\[
(5.20) \quad \text{Parsing expletive } it : \quad Tn(0), Ty(t) \quad \mapsto \quad Tn(0), Ty(t)
\]

Once the predicate node is decorated, the pointer moves to the mother node in order to complete the propositional type requirement. However, because the subject node still carries an unsatisfied formula requirement no evaluation can proceed; and the pointer must move back down to the subject daughter in order to complete the requirements on this node. Since the node is type-complete, however, it looks as if the parse is doomed to failure. But it is at this point that a variant of \( \ast \text{Adjunction}, \) which we dub \( \ast \text{Late Adjunction}, \) can apply to provide an open type requirement allowing the parse of new material to take place.

Unlike the versions of \( \ast \text{Adjunction} \) discussed in earlier chapters, \( \ast \text{Late Adjunction} \) projects an unfixed node with a requirement for the same type as the node from which it is projected. Since no further direct development of the fixed node is possible, this version of \( \ast \text{Adjunction} \) thus defines directly the structural context to which \( \text{Merge} \) applies, i.e. the unfixed node and the fixed node from which it is projected. We define this rule in (5.21) and show the effects from some arbitrary node in (5.22).\(^7\)

\[
(5.21) \quad \text{Late Adjunction (Rule)}:
\]

\[
\frac{Tn(n), \ldots, \{\ldots, Tn(n), Tn(a), \ldots, Ty(X), \diamond \}, \ldots}{\{Tn(n), \ldots, \{\ldots, Tn(n), Tn(a), \ldots, Ty(X) \}, \langle \langle \uparrow \rangle Tn(a), ?Ty(X), \diamond \rangle, \ldots\}}
\]

\(^6\)Noting the possibility of (i)-(ii), we do not provide any tense restriction on the propositional tree to be constructed in subject position:
(i) It’s nice being drunk.
(ii) It would be nice to be drunk.

\(^7\)Note again the use of the external dominance relation \( \uparrow _* \), allowing the node from which the unfixed node is projected to be fixed.
5.3. LATE*ADJUNCTION

(5.22) LATE*ADJUNCTION (Treegrowth):

\[ Tn(n), ?Ty(t) \mapsto Tn(n), ?Ty(t) \]

\[ \uparrow, Tn(n), Tn(a), Ty(X), \ldots, \Diamond \]

\[ \rightarrow \]

\[ \langle \uparrow \rangle Tn(a), ?Ty(X), \Diamond \]

This is the only form the rule could take, on the assumption that downward unfolding rules have provided a complete skeletal propositional structure; as it is only a development of one of these already introduced nodes which remains to be completed.

Applying LATE*ADJUNCTION to the subject node in a parse of *It is possible* yields the configuration in (5.23).\(^8\) This permits the parse of the post-verbal string and the completion of the unfixed propositional tree immediately feeds an application of MERGE, as shown in (5.24), which yields a complete subject node and a final formula value \( Fo(\text{Possible}'(\text{Wrong}'(\text{CKM}'))) \) as desired.

(5.23) Parsing *It is possible* :

\[ Tn(0), ?Ty(t) \]

\[ Tn(00), Ty(t), Fo(U), ?\exists x. Fo(x) \]

\[ Ty(t \rightarrow t), Fo(\text{Possible}') \]

\[ \langle \uparrow \rangle Tn(00), ?\exists x. Tn(x), ?Ty(t), \Diamond \]

(5.24) Parsing *It is possible that we are wrong* :

\[ Tn(0), ?Ty(t) \]

\[ Tn(00), Ty(t), Fo(U), ?\exists x. Fo(x), \Diamond \]

\[ Ty(t \rightarrow t), Fo(\text{Possible}') \]

\[ \langle \uparrow \rangle Tn(00), ?\exists x. Tn(x), Ty(t), Fo(\text{Wrong}'(\text{CKM}')) \]

\[ Fo(\text{CKM}') \]

\[ Fo(\text{Wrong}') \]

This analysis has the bonus of providing a much tighter restriction on late applications of adjunction characteristic of all rightward dependencies, encapsulating

---

\(^8\)Ignoring the contribution of the copula, including tense. See Chapter 8.
the Right Roof Constraint. The application of \textsc{Late}*\textsc{Adjunction} can only arise in a context in which one of two daughter nodes lacks a \textit{Formula} value, so no successful annotation of the mother node is as yet possible. The string in (5.25a) will never emerge as well-formed, as the projection of an annotation for the embedded subject cannot be successfully achieved without some later addition of a node providing the necessary update for the metavariable projected by the expletive pronoun \textit{it}. (5.25b), on the other hand, is fully well-formed, precisely because such a value is provided prior to the construction of the main predicate.

(5.25) a. *That it is certain is unfortunate that we are wrong.
    b. That it is certain that we are wrong is unfortunate.

Note further that the effect of parsing the expletive pronoun in moving the pointer straight to a sister node means that examples like (5.26a) are precluded, given the lexical definition of the expletive. The predicate must be established before the pointer can return to the subject node. At the same time, left dislocation of a clause is awkward, if not ungrammatical, in the presence of the expletive (5.26b). Here, the fixing of the adjoined tree should occur as soon as the pointer is on the subject node (see chapter 2) which prevents the parsing of the expletive.

(5.26) a. *It that I’m wrong is possible.
    b. ??That we are wrong, it is possible.

An important thing to notice at this point is that for \textsc{Merge} to successfully take place in (5.24) the node decorated by the expletive pronoun must not project a terminal-node restriction, \([\bot]_\bot\). This is because any node initially decorated by a pronoun whose final formula value is only successfully provided by a step of \textsc{Late}*\textsc{Adjunction} and subsequent \textsc{Merge} will, in the end result, be a nonterminal node. Indeed, we take the lack of this restriction to be a definitive property of expletive expressions of all kinds, as discussed at the end of the last chapter. Despite the fact that \textsc{Late}*\textsc{Adjunction} and subsequent \textsc{Merge} only lead to a successful outcome if the formula which decorates the node which is input to \textsc{Late}*\textsc{Adjunction} contains a metavariable, no special provision needs to be made to reflect this. This is a consequence of the fact that conflicting formula values on a single node lead to ill-formedness, unless one of those values is a metavariable. Hence, the restriction follows without stipulation from the definition of well-formedness for a node.

We return to a further discussion of expletive expressions in English in Chapter 8, but for now what we have established is that the analysis of expletive pronouns may require a late application of \textsc{*Adjunction} to determine their content.

5.3.2 Subject Inversion

Certain languages do not use lexical expletive pronouns in cases of extraposition and such languages also do not require overt referential subject pronouns, either, as illustrated in the Italian examples in (5.27).

(5.27) a. \textit{sembra che Giovanni ha telefonato Maria}
    seems that Giovanni has phoned Maria
    ‘It seems that Giovanni phoned Maria.’ [Italian]

\footnote{The term is due to Ross (1967), who first observed the phenomenon. As we shall see, Right Node Raising, though an apparent exception to the Right Roof Constraint, in the event, is subject to it also.}

\footnote{As a lexical restriction, however, this might be subject to cross-linguistic variation; and stein Nilssen reports to us that the analogue of (5.26a) is well-formed in Norwegian.}
5.3. LATE*-ADJUNCTION

b. ha telefonato Maria
   has phoned Maria
   ‘S/he phoned Maria.’

Given that an overt subject expression is optional in Italian and similar languages, parsing the verb must construct a subject node which is decorated by a metavariable, exactly as though a pronoun were present, as we saw for Greek in chapter 2. This is unlike English where subject nodes are constructed by general transition rules and are initially decorated only with a type requirement. It is, furthermore, unlike Japanese in that it is only the subject node which the verb annotates with a metavariable: non-subject argument nodes are specified as open type requirement, as in English. A verb such as sembra ‘seems’ will, therefore, project a full propositional template, decorating its propositional subject node with a metavariable as illustrated in (5.28).

(5.28) Parsing sembra:

\[
\begin{array}{c}
T_n(0), ?T_y(t), □ \\
\end{array}
\]

\[
\begin{array}{c}
T_n(0), T_y(t), Ty(t \rightarrow t), \\
F_o(U), ?\exists x. F_o(x) \\
\end{array}
\]

\[
\begin{array}{c}
F_o(Sembra) \\
\end{array}
\]

Since the verb is intransitive, the pointer moves to the topnode via COMPLETION from the predicate node, as shown. ELIMINATION cannot, however, apply until the formula requirement on the subject node is satisfied, which can be done by an application of LATE*-ADJUNCTION, exactly as in English (5.29). The only difference between English and Italian in this respect is thus the actions associated with parsing verbs. There is nothing at all mysterious about the lack of expletive pronouns in such constructions in pro-drop languages: it follows as a consequence of the analysis.

(5.29) Parsing sembra che

\[
\begin{array}{c}
T_n(0), ?T_y(t) \\
\end{array}
\]

\[
\begin{array}{c}
T_n(0), T_y(t), Ty(t \rightarrow t), \\
F_o(U), ?\exists x. F_o(x) \\
\end{array}
\]

\[
\begin{array}{c}
F_o(Sembra) \\
\end{array}
\]

\[
\begin{array}{c}
\langle \ast \rangle T_n(00), ?\exists x. T_n(x), \\
?T_y(t), □ \\
\end{array}
\]

Such subject pro-drop languages also permit the inversion of a subject to the end of the clause (in simple clauses) as exemplified by the examples in (5.4) repeated below.

(5.4) a. ha telefonato Beatrice
       has telephoned Beatrice
       ‘Beatrice has telephoned.’

b. e’ arrivato uno studente
       is arrived one student.
       ‘A student has arrived.’
Again this property is not strange from the DS perspective and again follows from the actions associated with parsing verbs. We saw, in chapter 2, two cases where the parsing of verbs result in the projection in full propositional structure. In Irish and Greek, we assumed, at the end of the lexical actions associated with verbs, the pointer is at the open subject node, in Irish decorated merely with a type requirement and in Greek with a metavariable and completed type. The effect in Irish is to force VSO ordering: the subject must be parsed immediately after the verb (at least in finite contexts). Greek, also, shows VSO properties (although not fully) and Late*Adjunction gives us the means for explaining this and at the same time accounting for inversion in Italian.

Consider first the Greek example in (5.30), in which the subject occurs immediately after the verb:

\[(5.30)\]
\[
kseri\稃 Stavros ti Maria he knows [Greek]
'\text{Stavros knows Maria.}'
\]

We associate a parse of the verb kseri ‘knows’ with the actions in (5.31).

\[(5.31)\]
\[
\begin{align*}
\text{IF} & \quad ?Ty(t) \\
\text{THEN} & \quad \text{put}(\text{Ty}(	ext{PRES})); \\
& \quad \text{make}((\langle 1 \rangle_1)); \text{go}((\langle 1 \rangle_1)); \text{put}(?Ty(e \rightarrow t)); \\
& \quad \text{make}((\langle 1 \rangle_1)); \text{go}((\langle 1 \rangle_1)); \\
& \quad \text{put}(\text{Ty}(\text{Kser}'), Ty(e \rightarrow (e \rightarrow t)), [\perp]) \\
& \quad \text{go}((\langle 1 \rangle_1)); \text{make}((\langle 1 \rangle_0)); \text{go}(?Ty(e)); \\
& \quad \text{go}((\langle 1 \rangle_0)\langle 1 \rangle_1)); \text{make}((\langle 1 \rangle_0)); \text{go}((\langle 1 \rangle_0)); \\
& \quad \text{put}(Ty(e), \text{Fo}(U), \exists x.\text{Fo}(x)) \\
\text{ELSE} & \quad \text{Abort}
\end{align*}
\]

As noted, the pointer is left at the subject node and the metavariable can either be substituted by some accessible term from the context (as in kseri ti Maria ‘S/he knows Maria’), merged with some previously projected unfixed node (as in o Stavros kseri ti Maria, see (2.75) on page 67) or give rise to an application of Late*Adjunction, as illustrated in (5.32) which provides a means of parsing the first three words in (5.30) (irrelevant detail omitted).

\[(5.32)\] Parsing kseri o Stavros:

\[
\begin{align*}
& \text{Tn}(0), ?Ty(t) \\
& \quad \text{Tn}(00), Ty(e), \text{Fo}(U), \exists x.\text{Fo}(x), \phi \\
& \quad (1, \text{Tn}(00), Ty(e), \exists x.\text{Tn}(x), \text{Fo}(\epsilon, x, \text{Stavros}'(x)) \\
& \quad \text{Ty}(cn), \text{Ty}(cn \rightarrow e), \text{Fo}(x, \text{Stavros}'(x)) \text{Fo}(\lambda P.(\epsilon, P)) \\
\end{align*}
\]

Applications of Merge, Completion and Anticipation apply as normal to (5.30) to place the pointer onto the open internal argument node, allowing the object to be parsed, so yielding the SVO order.
The same processes apply in parsing the intransitive Italian examples in (5.4),\(^1\) but in transitive contexts things are not the same. Italian does not show VSO ordering and Subject Inversion with transitive verbs has the subject following the object, as in (5.33).

\[(5.33)\] \textit{parla inglese} Giovanni

speaks English Giovanni

‘Giovanni speaks English.’

The difference between Italian and Greek in this respect is that the macro of lexical actions associated with parsing an Italian finite verb leaves the pointer on the object node, not the subject node, giving rise to VOS orders. A finite verb form like \textit{parla} ‘s/he speaks’ (transitive) is thus associated with a set of actions like those in (5.34) (ignoring tense and agreement information).

\[(5.34)\] \textit{parla} [Italian]

\[
\text{IF } \neg Ty(t) \text{ THEN make}(\langle 1 \rangle_0); \text{ go}(\langle 1 \rangle_0); \text{ put}(Ty(e), Fo(U), ?x.Fo(x));
\]

\[
\text{go}(\langle 1 \rangle_0); \text{ make}(\langle 1 \rangle_1); \text{ go}(\langle 1 \rangle_1); \text{ put}(Ty(e \rightarrow t));
\]

\[
\text{make}(\langle 1 \rangle_1); \text{ go}(\langle 1 \rangle_1); \text{ put}(Ty(e \rightarrow (e \rightarrow t)), Fo(Parl'), [1] \bot);
\]

\[
\text{go}(\langle 1 \rangle_1); \text{ make}(\langle 1 \rangle_0); \text{ go}(\langle 1 \rangle_0); \text{ put}(?Ty(t))
\]

\[
\text{ELSE } \text{Abort}
\]

The effect of these actions triggered by processing the verb is that the pointer will not return to the subject node until the entire verb-phrase sequence has been processed, as illustrated in (5.35).

\[(5.35)\] Parsing \textit{parla inglese} :

\[
\begin{array}{c}
?Ty(t) \\
Ty(e), Fo(U), \neg \exists x.Fo(x), \Diamond \\
Ty(e \rightarrow t), Fo(Parl'(Inglese'))
\end{array}
\]

\[
\begin{array}{c}
Ty(e), [1] \bot, Fo(Inglese') \\
Ty(e \rightarrow (e \rightarrow t)), Fo(Parl'), [1] \bot
\end{array}
\]

At this point, \textsc{Substitution} could occur from context\(^1\) or \textsc{Late*Adjunction} may be used to further develop the node within the string. The effect of this is shown by the structure derived from the parse of \textit{Parla inglese Giovanni} ‘Giovanni speaks English’ in (5.36).

---

\(^1\) Although it should be noted that (5.4a) is, in fact, ambiguous between an intransitive ‘Beatrice has telephoned’ and transitive reading ‘S/he has telephoned Beatrice’.

\(^1\) As it may with expletive \textit{it}:

(i) Kim thinks that the Vice Principal is insane. It’s possible.
(5.36) Parsing _parla inglese Giovanni_:

```
?T(y(t))
```

```
Ty(e), Fo(U), ∃x Fo(x), ⊤
```

```
Ty(e → t), Fo(Parl′(Inglese′))
```

```
Ty(e), Fo(t, x, Giovanni′(x))
```

```
Ty(e → (e → t)), Fo(Parl′), [[ ]]⊥
```

```
Ty(e), [[ ]]⊥, Ty(e → (e → t)), Fo(Inglese′)
```

**5.3.3 Clitics in Porteño Spanish**

This account of pro drop structures, and expletive pronouns, as decorating nodes with metavariables, but without a bottom restriction, gets confirmation from the fact that a natural explanation of the clitic doubling puzzle of (Porteño) Spanish datives at the right periphery emerges from the analysis. In Porteño Spanish, as in other dialects, full noun phrases in postverbal position can be doubled by a preverbal clitic (5.37).

(5.37) a. (les) ofrecieron queso y leche a familias de pocos medios

‘They offered cheese and milk to low-income families.’ [Spanish]

b. (la) oían a Paca

‘They listened to Paca.’

As Suñer (1991) observes, this clitic doubling in Porteño Spanish affects both accusative and dative pronouns, but not in the same way. The optional doubling by a clitic of some following full dative-marked noun phrase imposes no restriction on the noun phrase in question (notice the nonspecific construal of the right-peripheral NP in (5.37a)). Doubling of an accusative noun phrase, on the other hand, imposes a restriction on the right peripheral NP, that it be restricted to a referential construal.

We have already seen in chapter 4 that there is reason to analyse the Spanish dative clitic as having lost its bottom restriction, in this sense becoming expletive. This analysis now comes into its own, as it leads us to expect these facts. In this chapter, we have seen that a pronoun may be interpreted as indexical with a following NP interpreted as coreferential with that contextually assigned value, a distribution we have analysed as involving a LINK relation between two structures, the second decorated with a node of of type e. In English, because pronouns retain their bottom restriction, they can only be recapitulated by referential noun phrases through the construction of a such structure, and this is so of the Spanish accusative clitic too. And because this is a domain in which quantified noun phrases cannot be used to provide a well-formed result, only definite noun phrases are acceptable here.

The dative clitic, on the other hand, is not so restricted and can double a quantified noun phrase. Under such a use, the right peripheral noun phrase could not be analysed in terms of a LINK projection. Instead, to accommodate doubling
of a quantified expression with a clitic, the clitic needs to be analysed as able to be
updated by some unfixed node derived through application of Late*Adjunction.

Schematically, the situations with respect to the two clitics are shown in (5.38) and
(5.39) which relate to the parsing of the sentences in (5.37b) and (5.37a), respectively.13
The co-occurrence of the dative pronoun with a subsequent quantified expression is expected: once Late*Adjunction and Merge have taken place, the introduced quantified term will be able to enter a scope statement into the
set of scope statements associated with interpreting the resulting logical form in a
completely regular way.

(5.38) Parsing (5.37b) with the accusative clitic:

\[ Tn(0), Ty(t), Fo(Oi'(i, x, Paca'(x)))(p22) \]

(5.39) Parsing (5.37a) with the dative clitic and quantifying expression:

There is a further puzzling fact concerning the Porteno Spanish clitics: when
a strong pronoun is used instead of a full form of NP, clitic doubling becomes
obligatory, as shown by the dative examples in (5.40) and the accusative ones in
(5.42).

(5.40) le hablaron a ella
to her spoke3pl. to her
‘They spoke to her.’

(5.41) *hablaron a ella
spoke3pl. to her

13\(p_{22}\) is some arbitrary constant picking out an individual identified from a term in context.
‘They spoke to her.’

(5.42)  
la llamaron a ella  
her call3pl. her  
‘They called her.’

(5.43)  
*llamaron a ella  
call3pl her  
‘They called her.’

These data may seem bizarre as they show that the weak clitics may appear without
the buttressing effect of a pronoun or full noun phrase; while the strong pronouns
need the help of a clitic when they appear in the apparently normal postverbal
position.

However, there is an alternative way of looking at these data. Suppose we
assume that it is not full pronouns or noun phrases which provide the decoration
of the fixed argument nodes in tree structures, as we find in English, but clitics.
Clitics in Spanish we define as decorating the requisite predicate-internal argument
node, doing so from a preverbal position by lexically defining the introduction and
decoration of a (locally) unfixed node that merges with the argument node provided
by the actions of the verb.\(^{14}\) This will have the effect of ensuring that no regular
noun phrase occurs in that string position, as such a node will be introduced only by
the lexical actions particular to these clitics. All we have to stipulate of the strong
pronouns, then, is that they are restricted to decorating nodes in a tree structure
that are in some sense non-canonical (i.e. either at a node LINKed to the primary
structure or at an unfixed node within it). This is ensured by the set of actions in
(5.44), because the trigger \(\uparrow \langle \top \rangle\) that induces the \texttt{Abort} action holds of any node
that has a mother node.\(^{15}\)

\[\begin{align*}
(5.44) & \quad \text{\texttt{ella}} \\
& \quad \text{IF } ?Ty(e) \\
& \quad \text{THEN } \text{IF } \langle \uparrow \langle \top \rangle \rangle \\
& \quad \text{THEN } \texttt{Abort} \\
& \quad \text{ELSE } \texttt{put}(\texttt{Fo(U)}, Ty(e), ?\exists x \texttt{Fo}(x)) \\
& \quad \text{ELSE } \texttt{Abort}
\end{align*}\]

Accusative and dative clitic doubling with strong pronouns thus turns out to be
obligatory because Spanish is only subject (and not object) pro-drop. Hence, by
virtue of the actions in (5.44), the strong pronoun (in the dialects which display such
obligatory doubling) never decorates the fixed argument position in the emergent
tree directly and relies on the clitic to do so.

The restriction of strong pronouns to unfixed nodes and LINKed structures as
encoded in the lexical characterisation of \textit{ella} is a stipulation; but this is nothing
more than a codification of their exceptional pragmatic properties (conveying more
than just the anaphoric construal conveyed by the clitic form of pronoun, such as
focus or background topic effects). It is thus a direct reflex of its communicative
function, encoded as a particular, distinct form of anaphoric expression.

We have now seen that the concepts of formula underspecification, LINKed struc-
tures and positional underspecification do operate in the analysis of right peripheral

\(^{14}\)We do not provide an account of the requisite actions here. See chapter 9 section 9 for
discussion of the diachronic underpinnings to these actions.

\(^{15}\)We ignore the gender specification here and the prepositional marker \textit{a} which we assume to
be a kind of case-marker that does not project its own structure.
effects, as well as those on the left. They allow analyses to be given of apparently quite disparate constructions such as pronoun doubling, sentence extraposition, subject postposing and clitic doubling. The fact that the same concepts apply to both the left and right peripheries provide striking support for the form of grammar proposed in this book, while the time-linearity of the parsing process accounts nicely for observed asymmetries between the two peripheries. A particular bonus is the explanation of the Right Roof Constraint as a consequence of compositionality of the tree growth process: in other frameworks, this restriction remains a mystery - able to be expressed by some form of stipulation, but not subject to a principled explanation.

5.4 Right Node Raising

We now take up the challenge posed by Right Node Raising (RNR). This is a construction in which the building of one structure may be "temporarily set on one side" in a parsing sequence while a second is introduced, both then being completed by a single right-most expression as in the examples in (5.5) repeated below.

(5.5) a. Mary wrote, and I reviewed, several papers on resumptive pronouns.
    b. Every overseas student could answer, but most home students couldn’t even understand, some questions on formal semantics.

Such examples show paired clauses in which a first clause is left incomplete while a second is introduced, with an expression at the right periphery doing double duty by providing an interpretation that completes the construal of both conjuncts. This is a challenge for the strict time-linearity of Dynamic Syntax, because it appears that an initial structure depends on a subsequent expression in order to be completed, a reverse of the normal case. This process is invariably signalled by intonation, and constituents of various types can be presented right-peripherally in this way (NP in (5.45), complement clause in (5.46), a non-finite structure in (5.47)). It is generally also observed that more than one constituent can be dislocated, as in (5.48). Although characteristically indicative of some constituent missing from a final position in both clauses from which it appears to have been dislocated, Right Node Raising does not (pace Levine 2001) appear to impose any constraint that the constituent in question be final in the string, as witness (5.49).

(5.45) John criticised, and then Mary reassured, that woman from Birmingham.

(5.46) John believed, but Harry doubted, that Mary was being deliberately obtuse.

(5.47) John wanted, but Harry was determined, to get to the first night of Traviata.

(5.48) John passed on, and Harry distributed, the notes from Ruth’s course to any student that asked for them.

(5.49) John showed to Mary, and subsequently Harry copied from her, the solution to the semantics exercise.

The non-standard constituents displayed in RNR might appear to be best expressed in terms of string-movement (or string-deletion at PF, see Hartmann 1998),
hence outside the remit of the grammar formalism, strictly speaking.\[^{16}\] If this is the right stance, such data would be intransigent also for a framework like DS, since processes of update are exclusively defined over partial semantic structures, and not over (structure defined over) strings. The challenge for Dynamic Syntax is whether the combination of building independent but anaphorically LINKed structures and introducing unfixed nodes within an individual tree are sufficient to reflect these notoriously problematic properties.

We have so far seen the separate applicability of projecting LINKed structures and unfixed nodes in characterising right peripheral constituents. Nothing precludes the interaction of these processes, and we expect there to be strings whose well-formedness turns on an analysis requiring projection of both LINK relations and Late*Adjunction. More specifically, we might expect the occurrence of strings whose interpretation is induced as a pair of LINKed structures of which the projection of the second involves application of Late*Adjunction, yielding a composite right-dislocation effect. This, we suggest, is what underpins the analysis of Right Node Raising.

5.4.1 Characterising Co-ordination

We begin by presenting a brief characterisation of co-ordinate constructions (a topic that will be pursued in more detail in Chapter 7). It is well known that conjunctions typically connect expressions of the same type (but not necessarily the same syntactic category) as long as they can appear in the same structural environment, as exemplified in (5.50).

\[
\begin{align*}
(5.50) & \quad a. \text{ John came in and Mary fainted.} \\
& \quad b. \text{ John and Mary went to the party.} \\
& \quad c. \text{ The keys are lost or in your study.} \\
& \quad d. \text{ Kim sang well and often.} \\
& \quad e. \text{ The man came in and sat down.}
\end{align*}
\]

The optionality and independence of co-ordinate expressions points to an analysis within DS using LINK structures. While relative clauses, Hanging Topic Left Dislocation constructions and after-thought constructions all achieve their somewhat different effect through the construction of a shared term, the LINK relation is a tree relation, and so its construction is in principle independent of the requirement of any shared term. We can use this to good effect in characterising co-ordination, while preserving in the account of Right Node Raising the general property of LINK structures of sharing a term in the end result. As an initial attempt at characterising the effect of parsing a conjunction like and, consider (5.51), where the actions induced by parsing the word simply launch a LINK relation with a requirement to construct an expression of the same type as the triggering node (in this regard being like Late*Adjunction). The effect of (5.51) is illustrated in (5.52), which results from parsing the first four words of John came in and Mary started shouting.

\[
\begin{align*}
(5.51) \quad & \text{IF } Ty(X) \\
& \quad \text{ THEN } \text{make}((L)); \text{go}((L)); \text{put}(?Ty(X)) \\
& \quad \text{ ELSE } \text{Abort}
\end{align*}
\]

\[^{16}\]There are two major alternative types of characterisation of RNR, one involving dislocation, moving an expression rightwards out of both conjuncts, the other a copying of the term from one structure to the other, then deleting the first copy. Given the severe criticisms of Postal’s (1998) variant of the movement account by Levine (2001), and also by Phillips (1996), Hartmann (1998), the in situ account is now the more widespread. See also Steedman (2000) for a CCG account.
5.4. RIGHT NODE RAISING

(5.52) Parsing *John came in and*:

\[
\begin{align*}
Tn(0), Ty(t), \\
Fo&(\text{Come-in}'(t, x, John'(x))) \\
&\langle L^{-1}\rangle Tn(0), Ty(t) \\
\end{align*}
\]

\[
\begin{align*}
Ty(e), \\
Fo&(\iota, x, John'(x)) \\
Ty&(e \rightarrow t), \\
Fo&(\text{Come-in}') \\
\end{align*}
\]

Completing the parse of *John came in and Mary fainted* yields two LINKed propositional trees, the first with formula value \(\text{Come-in}'(\iota, x, John'(x))\) and the second with \(\text{Faint}'(\iota, y, Mary'(y))\). In chapter 3, we have presumed on the relation between LINK structures being assigned the weakest possible interpretation, that of conjunction; and the process of LINK Evaluation defined there for non-restrictive relative clause evaluation (3.13) on page 79 applies equally to the evaluation of a pair of LINKed structures constructed in the construal of sentence co-ordination. The completion of the construction process from parsing *Jane came in and Mary fainted* will thus yield a propositional formula for the whole structure:\(^{17}\)

\[
\text{Come-in}'(\iota, x, John'(x)) \land \text{Faint}'(\iota, y, Mary'(y))
\]

In addition to this basic type of co-ordinate construction, we also need to assume that *and*, like the relative pronoun, can also be associated with a LINK transition from a node of any type introducing a node to be developed into a structure decorated by a type \(t\) formula. Evidence for such a process comes from parenthetical constructions such as those in (5.53).

(5.53)  

a. John, and he’s clever, didn’t get an award.

b. The woman next door, but she’s a bit conventional, might be a possible judge.

c. That John is insane, while it’s obvious to everyone else, is entirely ignored by Mary.

These examples all show an instance of the pronoun in the parenthetical conjunct, thus indicating that a copy of the formula that decorates the node from which the LINKed structure is launched is required to be found in the propositional structure. This is supported by the fact that without a pronoun the examples are considerably worse. Compare (5.54) and the postverbal conjoined clauses in (5.55) which necessarily involve conjunction of propositional structures.

(5.54)  

a. ??John, or Mary’s wrong, didn’t get an award.

b. ??The woman next door, but John’s a bit conventional, might be a possible judge.

c. ??That John is insane, although nobody has any proof, is believed by everybody.

(5.55)  

a. John didn’t get an award, or Mary’s wrong.

b. The woman next door might be a possible judge, but John’s a bit conventional.

\(^{17}\)This is an appropriate interpretation for clauses conjoined by *and*, but other conjunctions, such as *or* require different means of interpreting the two LINK structures. In Cann et al. (2005), we generalise the process of interpreting LINKed structures, introducing an \(\text{EVAL}\) predicate which takes as value some (possibly logical) connective which determines the appropriate semantic relation between the two linked trees. We do not pursue this elaboration here, as it is not directly relevant to the task of characterising RNR.
c. That John is insane is believed by everybody, while nobody has any proof.

Given these data, we modify the lexical actions induced by *and* given above as (5.51) to include the disjunction shown in (5.56).

\[
\begin{array}{ll}
\text{IF} & (Ty(X) \land Fo(\alpha)) \\
\text{THEN} & \text{make}(\langle L \rangle); \text{go}(\langle L \rangle); \text{put}(?Ty(X)) \\
\text{OR} & \text{make}(\langle L \rangle); \text{go}(\langle L \rangle); \text{put}(?Ty(t), ?\langle D \rangle Fo(\alpha)) \\
\text{ELSE} & \text{Abort}
\end{array}
\]

This induces a structure like that in (5.57) after a parse of the first two words in (5.53a) with the tree that results after the parse of the conjunct shown in (5.58). The completed tree (not shown) is evaluated to give the formula value:

\[Fo(\neg \text{Get}'(\epsilon, x, \text{Award}'(x))(\iota, y, \text{John}'(y)) \land \text{Clever}'(\iota, y, \text{John}'(y)))\]

(5.57) Parsing *John*, *and*:

\[
\begin{array}{c}
Tn(0), ?Ty(t) \\
\quad \begin{array}{c}
Tn(00), Ty(e), Fo(\iota, y, \text{John}'(y)) \\
?Ty(e \rightarrow t)
\end{array}
\end{array}
\]

(5.58) Parsing *John*, *and he’s clever*:

\[
\begin{array}{c}
Tn(0), ?Ty(t) \\
\quad \begin{array}{c}
Tn(00), Ty(e), Fo(\iota, y, \text{John}'(y)) \\
?Ty(e \rightarrow t)
\end{array}
\begin{array}{c}
\langle L^{-1} \rangle Tn(00), Ty(t), ?\langle D \rangle Fo(\iota, y, \text{John}'(y)) \\
Ty(e, Fo(U), ||)}
\end{array}
\end{array}
\]

5.4.2 **An Example**

We are still not quite at the point where we can provide a full characterisation of Right Node Raising. The DS account of this construction requires one assumption additional to the mechanisms already in place: we allow there to be lexically defined updates without any overt morphological form, for which only intonation provides the clue as to what structure is to be built. Specifics of the acoustic stream is
one aspect of the input which we have so far ignored altogether, and indeed the analysis of prosodic information within the DS system remains an open question. However, in such a system, with an explicit parsing-oriented perspective, sensitivity to intonation is entirely expected: intonation forms part of the phonetic signal and is thus available to induce procedures of interpretation during the course of a parse.

We suppose, then, that intonation can have the effect of signalling the ad hoc construction of a metavariable as an interim \textit{Formula} value, indicating that the containing structure is left incomplete at the current stage of the interpretation process. This is not sufficient, however, as strings like those in (5.59a,b) are ill-formed even with RNR-style intonation: the intonation apparently signals that the string is incomplete and requires completion by some other expression.

\begin{enumerate}
  \item [a.] *John eagerly anticipated.
  \item [b.] *John eagerly anticipated, but Mary dreaded.
  \item [c.] John eagerly anticipated, but Mary dreaded, meeting the new ambassador.
\end{enumerate}

The insertion of the metavariable by the proposed rule must thus trigger one of two distinct types of action: either to induce the building of a LINK transition, or the building of an unfixed node which completes the structure. Such actions both cut short the construction of the current node and prevent pragmatic substitution of the metavariable, thus ensuring the incompleteness effect of the prosodic signal and further development of the tree.

With these assumptions concerning co-ordination and the possibility of a metavariable being inserted without a morphological trigger,\textsuperscript{18} we are now in a position to show how Right Node Raising may be characterised within Dynamic Syntax. To illustrate, we take the example in (5.5a) and show informally how the incremental processing of this string leads to a well-formed propositional structure with the expected interpretation.

\begin{enumerate}
  \item [5.5a] Mary wrote, and I reviewed, a paper on resumptive pronouns.
\end{enumerate}

The parse of the first two words proceeds as we would expect. The subject and predicate nodes are introduced by \textit{Introduction} and \textit{Prediction} in the normal way, with the initial noun phrase being parsed to provide the content of the former, and the verb providing a formula annotation for a two-place predicate and an internal argument node awaiting development. Given the signal of incompleteness by intonation (or punctuation), a metavariable is provided as annotation to this node, satisfying its type requirement while at the same time projecting additional structure, in this case a LINK structure with a requirement to find within it a copy of the metavariable decorating the host node, as illustrated in (5.60).\textsuperscript{19}

\textsuperscript{18}We discuss the properties of this trigger below.
\textsuperscript{19}In this and the following trees, irrelevant details such as completed requirements are omitted.
The analysis then proceeds with the parse of the subject and verb of the second conjunct as usual until the pointer rests at the internal argument node of the predicate. At this point, again signalled by intonation, a further metavariable may be introduced. This variable is taken to be identical to that used to construct the structure for the first conjunct, anticipating a means of securing the fulfilment of the requirement imposed by the LINK transition. It is then LATE*ADJUNCTION which, this time, provides a node with an open requirement of type \( e \) and allows the parse of the right dislocated expression, as shown in (5.61).

Once the unfixed node is decorated and completed, it can MERGE with the argument node in the structure assigned to the second conjunct, and the interpretation of the whole is duly compiled. In the construal of (5.5a), this yields an interpretation for the second conjunct as (5.62).\(^\text{20}\)

\[(5.62) \quad \text{Fo(Review'}(\epsilon, z, \text{Paper'}(z))(t, y, \text{John'}(y))), Ty(t)).\]

\(^{20}\)The term constructed from a paper on resumptive pronouns is represented as \( \epsilon, z, \text{Paper'}(x) \) for convenience, and scope statements are omitted.
5.4. **RIGHT NODE RAISING**

With the propositional formula established for the LINKed structure, the pointer moves back along the LINK relation to the terminal node with its provisional metavariable characterisation, which it updates with the value to the variable that was established in interpreting the second conjunct; and the interpretation for the first conjunct can at last be completed and finally combined with that of the second. The resulting formula value is given in (5.5a')

\[
(5.5a') \quad F_o(Write'(\epsilon, z, Paper'(z))(i, x, Mary'(x)) \land Review'(\epsilon, z, Paper'(z))(i, y, John'(y)))
\]

5.4.3 **A Lexical ‘Free Ride’**

The controversial aspect of this analysis from the point of view of DS is that there is no associated morphological trigger for the lexical free ride.\(^{21}\) Despite this, the introduction of this move is not a license for overgeneration. In the first place, we restrict the update to applying within the construction of a predicate node, thus disallowing such strings as those in (5.63).

\[(5.63) \quad \begin{align*}
& a. \quad *\text{was angry, and Kim annoyed, the man at the cashdesk.} \\
& b. \quad *\text{John liked, but disliked him, his new teacher.}
\end{align*}\]

This is achieved in the statement of what we call *Lexical Metavariable Insertion* (LMVI) in (5.64) where the modality \(\langle \uparrow^0 \langle \uparrow^1 \ast \rangle ?Ty(e \rightarrow t)\rangle\) requires the trigger node to be developed within a predicate context.

\[
(5.64) \quad \text{LEXICAL METAVARIABLE INSERTION}
\]

\[
\begin{align*}
\text{IF} & \quad ?Ty(X) \\
\text{THEN} & \quad \begin{align*}
& \langle \uparrow^0 \langle \uparrow^1 \ast \rangle ?Ty(e \rightarrow t)\rangle, \\
& \text{THEN put}(Fo(U), Ty(X), \exists x.Fo(x)) \\
& \text{AND (make}(\langle L \rangle); \text{go}(\langle L \rangle); \text{put}(?Ty(t); ?(D)Fo(U)))) \\
& \quad \vee (\text{make}(\langle 1, \ast \rangle); \text{go}(\langle 1, \ast \rangle); \text{put}(?Ty(X))))
\end{align*} \\
\text{ELSE} & \quad \text{Abort}
\end{align*}
\]

There are a number of things to note further about LMVI. In the first place, the actions envisaged are those that have counterparts elsewhere in the system, i.e. parenthetical conjunction and Late*Adjunction, and so involve no novel types of transition. Secondly, by moving the pointer on from the node decorated by the metavariable, these actions ensure that pragmatic Substitution cannot occur, so we do not get an effect of illicit pro-drop in languages like English: the formula requirement associated with the metavariable cannot be satisfied without further tree development, either through LINK or *Adjunction. Strings like those in (5.65) are thus correctly rejected.

\[(5.65) \quad \begin{align*}
& a. \quad *\text{The man anticipated.} \\
& b. \quad *\text{Mary wrote, and I submitted.}
\end{align*}\]

Notice that a step of *Adjunction on the left periphery cannot satisfy the tree-growth requirement associated with LMVI.

\[(5.66) \quad *\text{Mary likes and that woman, John dislikes.}\]

\(^{21}\)Equally, there is no morphological trigger for the null relative complementiser in English in chapter 3, (3.46) on p.98. However, this set of actions is associated with very restricted contexts and does not satisfy an open type requirement.
(5.66) is precluded on two counts. On the one hand, in the processing of the second conjunct, obligatory movement of the pointer away from the node decorated by the meta-variable precludes application of Merge directly. Equally, Merge cannot apply to the output of Late*Adjunction unifying the node decorated by that woman with the object node of the predicate Fo(Dislike'), because the node introduced by Late*Adjunction is not itself fixed. On the other hand, if no application of variable insertion takes place in parsing the second conjunct, Merge will apply directly to the object node, leaving the requirement for an update to the variable from the first structure imposed by the LINK transition unsatisfied, and no provision for it provided by the construction process as initially indicated. With no possible derivation of a logical form, (5.66) is not well-formed.

This characterisation of LMVI, as it stands, has two unwanted effects. In the first place, since it constructs a LINK structure, it will permit examples like that in (5.67), where no conjunction occurs.

(5.67) *Mary criticised, John consoled, the weeping student.

This could be rectified using the EVAL predicate, which was proposed in Cann et al. (2005) as a basis for generalising over connectives that there must be at least one occurrence of the connective in some sequence of LINKed structures in order to trigger the appropriate evaluation (see footnote 17). By adding a requirement to the node to which the LINK structure is identified that specifies that some \( \exists x. \text{EVAL}(x) \), the apparent need for a conjunction will be ensured.

The second, possibly unwanted, effect of this version of LMVI is that conjunctions will also need to be effectively ‘expletive’ in certain contexts. In other words, instead of projecting LINK structures directly as indicated in (5.56), a conjunction may be parsed in a context in which a LINK structure is already defined, simply adding an EVAL value to the structure. As we wish to keep the characterisation of co-ordination as simple as possible at this point for the discussion in Chapter 7, we will not go into this further. What is important at this point is that the rule of LMVI directly encodes what the intonational cue intuitively signals, which is that the string is not yet complete, hence the projection of structure that needs to be determined.

Although not problematic from the point of view of the grammaticality of the output, postulating such “free-ride” processes in the lexicon without phonological input does pose problems for the psychological parsing process as it substantially increases the set of choices at any point during the parse. We have simply stipulated in our analysis what it means to break off from a routine parse process, lexically enforcing applications of the procedures of LINK-construction and Late*Adjunction which, as computational actions, are optional. This is where the characteristic prosody of Right Node Raising becomes significant: by its use, the speaker signals to the hearer the incompleteness of the proposition under construction, through the modification of the normal prosodic contour. In other words, the speaker makes manifest to the hearer the possibility that a non-canonical operation must be performed to yield a well-formed final representation. It is in this sense that we consider the intonation to license the introduction of a metavariable without lexical input. We assume, that is, that prosody does not give rise to specific parsing actions, and that intonational contours are not directly associated with lexical actions (following Ladd 1996: 98 ff. amongst others). However, intonation may nevertheless be used to bring out parsing information which might otherwise not be recoverable.

\[ 22 \] Values of this predicate are, at least, the logical conjunctions \( \land \) and \( \lor \), there may be others.
5.4. RIGHT NODE RAISING

5.4.4 Some Consequences

With this use of intonation to signal that a hearer must do something extra to establish propositional content, Right Node Raising can be analysed using the same sorts of operation as are found in the analysis of left periphery phenomena: LINK and *Adjunction. The hypothesis that left and right dislocation effects are basically symmetrical is thus strongly supported within the framework, despite systematic divergence between the two. We now turn to a consideration of the consequences of our analysis.

The theory differs from all other accounts of which we are aware, but incorporates some insights from apparently irreconcilable theoretical approaches. Given that *Adjunction is the DS analogue of Move $\alpha$, the fact that the right peripheral expression is analysed with respect to an unfixed node gives the analysis some commonality with right raising accounts such as proposed in Postal (1993, 1998). In particular, the ‘extraction’ is subject to locality conditions (the Right Roof Constraint), which is here determined by the fact that partial trees cannot be completed until all requirements on daughter nodes are satisfied. This forces Late$\star$Adjunction to operate very locally within a propositional tree (see also below).

There are also important common properties with in situ analyses such as those of Hartmann (1998) and McCawley (1982, 1988). Since the right dislocated constituent is necessarily merged with a node within the second conjunct, constraints that operate within non-dislocated structures automatically apply to the right dislocated structure. For example, the construal of a pronominal anaphor in a right dislocated constituent is subject to the same constraints as if it were in situ (see (5.68) based on 5b, 5b‘ in McCawley (1988: 187)).

(5.68) a. I know that Bill said, and Mary$_i$ happens to agree, that she$_{i/j}$ needs a new car.

b. I know that Bill said, and she$_i$ happens to agree, that Mary$_{i'}$ needs a new car.

There are two striking differences between our analysis and all others, however, despite the fact that we are constructing two copies of the same term, as it were, in situ. First, we are building semantic trees, and not trees defined over the string. Secondly, the construction process is time-linear, and the order of processing is significant. In particular, and against the left to right presentation of the words, the construal of the second conjunct is completed before that of the first structure. The right-peripheral constituent is constructed as unfixed locally within the structure projected from the second conjunct, and then merged with it, this unification step providing the update fixed value for the metavariable. To the contrary, however, the occurrence of the same formula decorating a node within the structure projected from the first conjunct is not secured through Merge, but through the anaphoric properties of the metavariable, identifying with the value already provided to the other token of this variable. So though the analysis superficially looks like an in situ analysis of RNR, the structure built is not inhabited by words of the string, and it is not symmetrical.

5.4.4.1 Left-Right Asymmetries

The analysis, indeed, leads us to expect a number of asymmetries not predicted by any other analysis. First, we expect that context-sensitive conditions may be satisfied in the second conjunct without requiring satisfaction also in the first. This
will arise in any case where a lexical item has conditions which trigger the update actions that it provides that are not reflected in that output. In all such cases, it is only in the second conjunct that the triggering condition will be met. This property is met by a negative polarity item such as *any*:

(5.69) John has read, but he hasn’t understood, any of my books.

By hypothesis, we assume that *any* is a negative polarity item which projects into the structure a regular indefinite (epsilon) term as Fo value, but it does so only in the presence of a negative (or ‘affective’) feature decorating its locally dominating propositional type node.

\[
(5.70) \begin{array}{c|c|c|c}
\text{IF} & \text{THEN} & \text{ELSE} \\
?\text{Ty}(e) & \text{IF} & \text{ELSE} \\
\text{THEN} & \uparrow \ast \text{NEG} & \text{Abort} \\
\text{THEN} & \text{make}(\langle \downarrow 1 \rangle); \text{go}(\langle \downarrow 1 \rangle); \text{put}(\langle F_o(\lambda \text{P}..(\langle \downarrow 1 \rangle), \text{Ty}(\text{cn} \rightarrow e)); \text{go}(\langle \uparrow 1 \rangle); \\
\text{ELSE} & \text{Abort} & \text{make}(\langle \downarrow 0 \rangle); \text{go}(\langle \downarrow 0 \rangle); \text{put}(\langle ?\text{Ty}(\text{cn}) \rangle \\
\end{array}
\]

The negative polarity condition must be met by the structure projected from the second conjunct in (5.69), hence the update is licensed, and a successful action of Merge takes place. The object node associated with the first conjunct of (5.69), on the other hand, being decorated with the same metavariable as in the second conjunct, then gets updated with whatever value is assigned to that second occurrence, this being the indefinite term projected by *any*. The presence of this term is thus duly licensed in the structure projected from the first conjunct despite the lack of negation.

Sensitivity to the presence of negation is not required for the indefinite term itself: it is merely a condition on the tree in which the lexical item *any* is to provide an update. The analysis leads immediately to a second prediction of asymmetry. We expect correctly that negation only in the first conjunct will lead to ungrammaticality, as is indeed the case.

(5.71) *John hasn’t understood, but he has read, any of my books.

This observation is generalisable to other clashes in the selectional properties between the predicates in the two conjuncts. Such clashes will be more tolerated if resolved solely with respect to the second conjunct but not if resolved solely with the first. Hence, (5.72a) is preferable to (5.72b), as (5.73a) is preferable to (5.73b).

(5.72) \[\begin{array}{l}
\text{a. } ?\text{John prefers but Sue would rather not eat meat.} \\
\text{b. } *\text{John prefers but Sue would rather not to eat meat.}
\end{array}\]

(5.73) \[\begin{array}{l}
\text{a. } ?\text{John intended to, but Sue prevented him from, submitting a paper to Linguistic Inquiry.}
\end{array}\]

---

23This feature is shown as NEG. Again this is a promissory note for an account of downward entailing contexts in which NPI’s are typically licensed (Ladusaw 1983).

24The phenomenon here is similar to the vehicle-change effects of ellipsis (Fiengo and May 1994). Not all speakers judge (5.72) and (5.73) to be fully well-formed. What is at issue, in the analysis, is whether the action induced by the verbs includes some reflex of their particular non-finite form in the required logical-form output, or whether they merely contribute different triggers for the required update action. Leaving this issue unresolved, the difference in acceptability between (5.72a) and (5.72b) on the one hand and between (5.73a) and (5.73b) on the other is nevertheless uniformly agreed upon by all speakers.
b. *John intended to, but Sue prevented him from, submit a paper to *Linguistic Inquiry.*

These data showing asymmetry translate straightforwardly into many other languages, and we cite here comparable negative polarity data from Hindi and Malayalam:

(5.74) a. John-ne parhaa lekin voh samjhaa nahi meri koi kitaab\-e
John\textsubscript{ERG} read but he understand-past not my any
books

‘John read but hasn’t understood any of my books.’

b. *John-ne samjhaa nahi lekin voh parhaa meri koi kitaab\-e
John\textsubscript{ERG} understood not but he read-past my any
books

‘John has not understood but has read any of my books.’

c. John vaayiccu pakshe avanu manasillay-illa ente oru
John read but he\textsubscript{NOM} understood not my one
pusthakavam

[Malayalam]

book-npi

‘John read but he hasn’t understood any of my books.’

b. *John-inu manasillay-illa pakshe vaayiccu ente oru
John\textsubscript{DAT} understood not but read my one
pusthakam

[Malayalam]

book

‘John hasn’t understood but he has read any of my books.’

c. John-inu manasillay-illa pakshe vaayiccu ente oru
John\textsubscript{DAT} understood not but read my one
pusthakam

[Malayalam]

book

‘John hasn’t understood but he has read one of my books.’

5.4.4.2 Hindi Case Marking

There is new evidence from Hindi of an entirely different sort that buttresses the analysis nicely.\textsuperscript{25} Hindi has case-marking that varies according to the type and form of the verb. Transitive verbs require the subject noun phrase to be in the ergative case in the past tense, but otherwise in the nominative. This includes the plain future, but if the future is modal in form, then the case form required is dative. This is a relatively low-level morphological property, without any reflex in the resulting logical form, so we expect it to be characterised as a set of idiosyncratic triggers for update. This then provides us with a test for the analysis of Right-Node Raising.

On the account provided, we expect asymmetry between the case marking for a subject which is postposed out of both conjuncts, i.e. a subject interpreted relative to the second conjunct with a null form in the first conjunct interpreted as identical to the right dislocated noun phrase.\textsuperscript{26} Such a subject noun phrase is,  

\textsuperscript{25}We are grateful to Anili George for bringing these data to our attention, and for the discussion that led to their analysis.

\textsuperscript{26}Note that LMVI is not invoked here. As Hindi is pro-drop we expect subject postposing to be licit in RNR constructions. See also the next subsection.
under our analysis, required to match the case requirement of the verb in the second conjunct, while licensing a mismatch with the case requirement of the verb in the first. Contrarily, a subject noun phrase marked to match the verb in the first, but to mismatch with that of the second, should not be well-formed. This is exactly what we find, as illustrated in (5.75).

(5.75) a. us aurat-ko ignore kiyaa aur abhi usko samadhan that woman$\text{DAT}$ ignore did and now she$\text{DAT}$ reassure karnaa parhega John-ko do will have to John$\text{DAT}$

‘John ignored that woman and will now have to reassure her.’

b. *us aurat-ko ignore kiyaa aur abhi usko samadhan that woman$\text{DAT}$ ignore did and now she$\text{DAT}$ reassure karnaa parhega John-ne do will have to John$\text{ERG}$

‘John ignored that woman and will now have to reassure her.’

c. us aurat-ko samaadhan kiyaa aur abhi usko ignore that woman$\text{DAT}$ reassure did and now she$\text{DAT}$ ignore kareega John will do John$\text{NOM}$

‘John reassured that woman and will now ignore her.’

d. *us aurat-ko samaadhan kiyaa aur abhi usko ignore that woman$\text{DAT}$ reassure did and now she$\text{DAT}$ ignore kareega John-ne will do John$\text{ERG}$

‘John reassured that woman and will now ignore her.’

Exactly comparable data occur in German.

We thus have welcome independent evidence of an analysis initially proposed solely on the basis of the English data. In striking contrast to the way in which the data match the DS style of analysis, it is not at all clear how in situ, CCG, or movement analyses of RNR could be extended to these data. In particular, the in situ style of analysis is committed to there being copies of the dislocated expression in the two sites, with whatever restrictions the expression imposes being matched symmetrically in both contexts (see e.g. Hartmann 1998). It is therefore far from obvious how the wide-ranging asymmetries observed here between first and second conjuncts can be expressed.

5.4.4.3 Expletives and Right Node Raising

Interesting support for our hypothesis that RNR involves what is essentially a null pronominal in the first (strictly non-final) conjunct which is signalled by intonation comes from a type of Right Node Raising construction that does not need any superimposed intonational contour. These are structures containing twinned expletives as in (5.76).

(5.76) It is likely and it is not unreasonable that our analysis will fail.

Again our analysis directly achieves this result.

No break-off intonation needs to be used in these structures, because there is no need to invoke an un-morphologically triggered sequence of actions. The presence of an expletive in the first conjunct has the effect of inducing pointer
movement back to its subject node once the predicate node is constructed and decorated, which will already be decorated with a metavariable as Formula value. A LINK transition is an available option and will, if applied to the metavariable, project a new LINKed structure, which must be developed to have a copy of that variable, which is provided by the second expletive. In the second structure, too, there is no need to invoke any special device, other than the fact that the choice of metavariable in the second conjunct must determine that the imposed LINK requirement is met. Late*Adjunction can apply in a way that is standard for all expletive constructions, applying at the late stage of the construction process. Thereafter, all the processes are entirely regular. The result of processing (5.76) is shown schematically in (5.78) with an interpretation equivalent to (5.4.4.3).

(5.77) That our analysis will fail is likely, and that our analysis will fail is not unreasonable.

(5.78) Parsing (5.76):

\[ Tn(0), Ty(t) \]

\[ Tn(00), Ty(t), Fo(U), ?\exists x. Fo(x) \]

\[ Ty(t \rightarrow t), Fo(Likely') \]

\[ \langle L^{-1} \rangle Tn(00), ?Ty(t), ?(D) Fo(U) \]

\[ Ty(t), Fo(U), ?\exists x. Fo(x), \emptyset \]

\[ Ty(t \rightarrow t), Fo(\lambda p. \neg Unreasonable'(p)) \]

\[ Ty(t), Fo(Fail'(\epsilon, x, Analysis'(CM')'(x)))) \]

\[ Ty(e), Ty(e \rightarrow t), Fo(\epsilon, x, Analysis'(CM')'(x)) \]

\[ Fo(Fail') \]

5.4.4.4 Right Node Raising and Island Insensitivity

There is a further puzzle about Right Node Raising in that it differs from all other instances of rightward dependency in apparently not displaying the Right Roof Constraint. Indeed the process appears to be insensitive even to strong islands, a property that is problematic for any movement analysis (5.79).

(5.79) a. John wants to buy, and Harry knows the man who is willing to sell, a van Gogh.

   b. Bill likes the man who sells, but Sue detests the woman who buys, obscene photographs of British politicians.

This property is straightforwardly explained in our analysis, where our analogue of the Right Roof Constraint is satisfied. The analysis we have posited for RNR is a two stage process: the construction of a LINK structure from some node in an initial propositional structure with a requirement to find a copy of the metavariable that provides the formula value of that node. Then, in the second (or subsequent)
conjunction that copy is established through a second application of LMVI. The lack of restriction on where in the LINKed structure the copy of the constructed variable should occur is determined by the weakness of the modality of the requirement \(\langle D \rangle_{Fo(U)} \) which ranges over both dominance and LINK relations.

An unfixed node is then projected from the node decorated with the copy of the metavariable in the first conjunct to provide the means of identifying the content of that copy. As we have seen, because the unfixed node is projected locally to the node in the LINK structure that is decorated with the copy, it is necessarily the case that the right dislocated expression is interpreted as local to the propositional structure containing the metavariable. There can thus be no dependency into a non-local propositional structure. Compare (5.80a) with (5.80b) (with the intonational breaks indicated by the commas).

(5.80)  
a. *Kim likes, and everyone who knows is bound to like Sue, the new secretary.

b. Kim likes, and Sandy thinks that everyone who knows her is bound to like, the new secretary.

Thus, such apparent constraint-free long-distance dependencies are in fact licensed by Merge applying locally within some \(Ty(t)\) subtree. The DS analogue of the Right Roof Constraint is maintained and dependencies into islands are licensed by the pronominal nature of the analysis.

We have now established that RNR can be given an analysis in terms of LINK and *Adjunction that accounts for observed asymmetries between left and right dislocation structures in terms of the time linearity of the parsing process.  

5.5 Summary

In this chapter, we have provided an account of a number of right peripheral constructions, largely focusing on English data. Pronoun Doubling (Recapitulation) constructions have been analysed as involving a LINK transition from a completed \(Ty(t)\) to a type e tree, an analysis of which the backgrounding topic construction is a consequence. It Extrapolation and Subject Inversion have been analysed in terms of an unfixed node introduced late in the parsing process whose resulting formula replaces the metavariable projected by the subject anaphoric expression. The obligatory clitic doubling of Spanish has been analysed in terms of the potential availability of both LINK transitions and the late construction of an unfixed node. Finally, Right Node Raising has been modelled using a combination of building LINKed structures and unfixed nodes.

There are a number of problematic properties of the construction that we have not touched on, however. One in particular is the observation that the right peripheral sequence may comprise more than one constituent:

(i) ?John criticised and Mary refused to employ a friend of mine for drinking too much.

This has been denied in Postal (1998), with a critique in Levine (2000) providing a wealth of apparently conflicting data. In fact such sequences are relatively straightforward to handle in this framework, but they involve defining subvariants of *Adjunction, licensed relative to a range of locality constraints, then justifying an analysis of Heavy NP Shift as an application of the locally-restricted form of *Adjunction, which applies within the predicate sub-structure. We take up these variants of *Adjunction in chapter 6. Here we leave these data on one side, merely noting that they are analogous to the multiple scrambling phenomena of verb-final languages in which more than one constituent appears to be able to occur at the left periphery, external to its own clause (see Kempson and Kiaer (2004) and Kiaer (in preparation) for an account of such multiple long-distance scrambling).
Almost all these data are intransigent for most frameworks. The characterisation of expletives in Minimalism involves special stipulation, with the insertion of expletive pronouns often taken to be an operation of Last Resort to save an otherwise irredeemable derivation. While there are notable attempts to provide substance to such accounts (see, for example, Lasnik 1995, Holmberg 2000), they remain both theoretically problematic (with respect to concepts of economy) and singularly unexplanatory.

The analysis of right dislocation effects of any sort is problematic for most theories of syntax. Within minimalist approaches which adopt Kayne (1994)’s Linear Correspondence Axiom or some analogue thereof, all such constructions must be accounted for in terms of leftward movement of any material which is normally linearised to the right of the dislocated expression. Such movement requires the proliferation of otherwise unmotivated functional projections (such as Topic and Focus projections below the VP projection), and is required solely to preserve the asymmetry hypothesis of no rightward movement, resulting in an account which is little more than a description of the data with a great deal of movement machinery (see Buering and Hartmann 1997).

Furthermore such analyses singularly fail to provide any account of the Right Roof Constraint. This mysterious condition is quite generally problematic for all, LFG, HPSG and CCG included, as it does not follow from any configurational principle associating the source site with the discontinuous sequence that provides its interpretation: it simply has to be defined as a property of these particular structural dependencies. The DS account, however, provides a straightforward and intuitively satisfying account of this difference between left and right dislocation, as it is based solely on differences in the opening stages of a tree-construction process, where trees are partial and incomplete, and later stages of the process when the outline propositional structure is complete and its nonterminal decorations are being compiled.

Right Node Raising has long been recognised as problematic for movement explanations. Its combination of the display of total insensitivity to islands but nevertheless locality of the right-peripheral expression(s) with respect to the right conjunct is particularly hard to express. Though categorial grammar formalisms often laud the type-lifting mechanisms defined for the ease with which they allow the ad-hoc constituents needed to analyse Right Node Raising as a form of constituent co-ordination (Steedman 1996, 2000), in practice the left-right asymmetry effects we have observed in Right Node Raising are extremely problematic for such accounts. This is because, given that left and right implication are basic connectives, for any type-lifting operation that can be defined to license left-extraction, the formalism will equally allow the analogous operation licensing right-extraction.

There is then also the anaphoric doubling processes at the right periphery, with the particular twist of obligatory strong-pronoun doubling. These remain problematic in minimalist accounts, often set aside (see Cecchetto 1999); and, in categorial grammar formalisms too, this type of interaction between anaphora and structural processes remains unaddressed. So far as we know, no current analyses of these data can offer principled explanations of the various asymmetries set out, in Right Node Raising, or more generally between left and right periphery effects. In Dynamic Syntax terms however, the systematic variation between left- and right-periphery effects is expressible through application of the same tree-growth processes with the differences seen as a consequence of early vs late stages in the interpretation process.
CHAPTER 5. ON THE RIGHT PERIPHERY

5.6 Dynamic Syntax: some comparisons

At this mid-point of the book, with this clutch of Dynamic Syntax accounts in hand, it is worth stepping back, and seeing just to what extent DS does indeed differ from other frameworks. The first thing, and in many ways most significant, difference is the lack of any syntactic vocabulary distinct from that of the semantic representations under construction.\(^28\) There are no multiple levels of syntactic structure expressing different forms of generalisation: there is only the progressive building of logical forms. This immediately distinguishes it from Discourse Representation Theory. In DRT, the inter-level of discourse representation structure is posited as a sub-part of the semantic interpretation of the string, presuming on an independent characterisation of syntax: DRT does not make a bid to constitute a grammar formalism as such at all.

The presumption of only one level of representation is certainly a difference in architecture between DS and the multi-level frameworks of Lexical Functional Grammar (LFG) (Dalrymple 2001), and Head-driven Phrase-Structure Grammar (HPSG) (Sag et al. 2003)\(^29\) and Jackendoff’s conception of a grammar formalism (Jackendoff 2002). Nevertheless, there remain similarities between these formalisms. Dynamic Syntax, LFG and HPSG are all constraint-based, for example, so they imply no commitment to determining a fixed set containing all and only the well-formed strings of the language (see Pullum and Scholz 2002). All three systems are thus able to be relatively liberal with the data, allowing other, e.g. pragmatic, constraints to be operative in determining judgements of acceptability. In terms of the formal machinery of the three systems, there is also much in common. Perhaps the most striking of these is the common underpinnings to long-distance dependency in DS and LFG. The concept of underspecified domination that is used to define the concept of an unfixed node of DS is predated in LFG by at least twenty years, realised as the concept of functional uncertainty (Kaplan and Zaenen 1989). The concept of ‘dominate’ is formally identical in the two accounts: both are defined through a Kleene*-defined concept of dominate, as in tree logics (see Blackburn and Meyer-Viol 1994, Rogers 1994). The aim in the two frameworks is similar too: to address the specific contribution made by language in a broadly inferential perspective.

The DS account of left dislocation and unbounded dependencies shares some similarities with HPSG (and GPSG before it). *Adjunction has as its analogue the Head-Filler phrase (or rule) and like HPSG the information associated with the left dislocated structure is carried down the tree before being ‘discharged’ in some argument position. Unlike HPSG, however, there is no analogue of the SLASH mechanism, so no duplication of the relevant information and no Inheritance Principle or Amalgamation constraint to control the way the dependency is discharged. Ultimately, of course, there is also no record of the fact that some expression was initially dislocated, the output tree in DS not providing a record of the process by which it was established.

What makes the DS framework distinctive is its intrinsic dynamics, as the various analyses have brought out. The LFG characterisation of long-distance dependency has no updating of one relatively weak structure to another of the same kind. The f-structure configuration onto which the functional-uncertainty c-structure con-

\(^28\)Even the schematic predicates such as *Indef, Def, NEG, etc., all have semantic bases and are there as promissory notes pending proper semantic characterisation (possibly in terms of some form of evaluation).

\(^29\)Although HPSG is not explicitly multi-level, its use of discrete attributes for syntax, semantics and pragmatics, with different principles applying to the way the information in these structures is encoded, makes it implicitly multi-level.
5.6. Dynamic Syntax: Some Comparisons

figuration is mapped is not a tree configuration as is its c-structure counterpart, so it cannot be an update of that tree. Quite generally, there is nothing reflecting the dynamics of parsing in the way the constraint-based principles of either LFG or HPSG apply within the formalism. As a result, there is nothing in either LFG or HPSG to predict asymmetries of the type displayed by left and right periphery effects. And any case where the explanation turns on intermediate steps in the construction process will not receive the type of explanation which DS can offer either. Given the richness of the vocabulary of these systems, the various discrete contexts in which expressions may occur can invariably be defined in such static systems; these will have to be defined construction by construction, and item by item, without any principle underpinning their distribution. One illustration of this is the Right Roof constraint where, given that the constraint on the dependency is essentially local, the structures can simply be listed as a disjoint set of alternatives (see Dipper 2003). But the DS account clearly wins out, in that it purports to explain these phenomena as a consequence of more general principles.

Another illustration, though this time a lexical specification, is the Irish relative pronoun, where the relatively conservative variable-binding mechanism of Asudeh (2004) necessitates a disjunctive specification, one of which merely passes the specification onto some later (higher) variable-binding mechanism which constitutes the other half of the disjunction. This is a problem which McCloskey (2002) registers as highly problematic, as the semantics of such complementisers as abstraction operators, if misapplied to the case of a complementiser intervening between the head and the foot of the chain, would inappropriately bind off the variable associated with the foot of the chain. The DS account, in being both anaphoric and involving structural underspecification, does not face either of these problems. The account is defined as contributing to the progressive growth of an incomplete LINKed tree to which the complementiser lenition simply adds additional node specifications compatible with the overall emergent partial tree. So the facts may be capturable in systems with no left-right incrementality built in to the formalism, but the explanations fall short of the more explanatory accounts which DS can provide.

There are also similarities between DS and categorial formalisms, again at least at the level of the tools used. There is of course the shared use of type-deduction, although used much more restrictively in DS. Here, the major difference lies in the fact that categorial systems, at least type-logical categorial systems, are proof systems: DS, to the contrary, in being a specification of growth, is not even an inference system. Indeed, the reason why DS makes much less use of type deduction is that much of the construction process is driven by enrichment to the logical structure from very partial specifications, unlike categorial formalisms where the entire burden of explanation falls on appropriate assignment of types. In being a proof system, categorial grammar in principle does not provide a framework for articulating concepts of underspecification plus update. The formalism may allow relatively weak specifications, for example allowing permutation to reflect lack of constraints on word order, but this is because specification is not needed (by assumption), not because it is not available at some fixed juncture but will be at some later juncture. Moreover, in using left and right elimination operators as a central inferential tool, categorial grammar formalisms preclude asymmetry between left and right periphery effects, as whatever mechanism is available for leftward modes of combination, will in principle also be available for rightward combination. Not surprisingly, given the lack of emphasis on underspecification, the challenge of providing a unitary characterisation of anaphora is, with the honourable exception of type-theoretic grammar formalisms (Ranta 1994, Piwek 1998, Fernando 2002) ignored by categorialists, and the characterisation of anaphora is in terms equivalent
to assumption-construction and abstraction creating resumptive pronoun binding
within relative clauses or other such structures. As we saw in the characterisa-
tion of relative clauses, such an analysis precludes a unitary characterisation of the
different forms of relative clause construal; and without an articulated account of
anaphora, the account of relatives will remain, at best, incomplete.

Finally, we turn to Minimalism, or the various movement theories which precede
it, which we have taken as the point of departure for most comparisons. Superfici-
ally, Minimalist systems may seem the furthest from the DS system in being
explicitly generative, articulated without explicit reference to semantic properties,
and, at least in most variants, making very considerable use of permutations of the
input structure in the form of movement operations. Certainly the DS system not
merely has no overt movement, it has no covert movement either, as the account
of quantification is built on the proof system of predicate logic, rather than on the
language itself. Yet, despite the fact that the DS system differs with regard to these
properties, conceptually the two paradigms are surprisingly similar. Both advocate
a purely syntactic form of explanation in which syntax is no more than the pro-
gressive building of structures at the interface with semantic interpretation. And
there is a sense in which the Minimalist claim to articulate the core computational
system of language as irreducibly syntactic is mirrored in the DS characterisation
of language as not reducible simply to properties of complete logical structures, but
requiring characterisation in terms of growth of this level of representation. The sig-
nificance of the move to replace orthodox characterisations of discontinuity effects
by explanations in terms of underspecification and update is that we are replac-
ing what by definition are irreducible syntactic computations entirely lacking any
grounding in any more generalised cognitive activity with a concept of structural
growth which has a grounding in the general property of input devices to the gen-
eral cognitive system that they involve underspecification plus processes of update.
Moreover, in all cases, we are suggesting, the DS explanations are simpler. Indeed,
in any one individual case, the DS form of analysis risks being dubbed naively over
simple, but as these various accounts accumulate into a harmonious whole, the
explanatory force of the overall DS account increasingly gains in momentum.

This momentum is not about to dissipate either. To the contrary, we are now
about to see a very nice bonus for the DS framework: the naturalness with which it
extends to the notorious puzzles posed by Japanese.
The main thrust of our story so far has been that the dynamics of parsing is the basis for everything there is to say about structural properties of languages. The partial typologies established in chapters 4 and 5 provide some preliminary confirmation of this, with their sketches of cross-linguistic similarities in relative clause and left and right periphery effects across a broad range of languages as illustration of this. However, there are singular gaps in these typologies; and despite the cross-linguistic similarities we have so far drawn attention to, there are nevertheless major differences between different language families which seem to threaten the extremely strong claims made. In verb-final languages, in particular, from the starting point provided by English, everything seems to be the other way round. First the verb generally appears last in the clause. So while in English the canonical order is subject–verb–direct-object–indirect-object (6.1), in Japanese it is subject–indirect-object–direct-object–verb (6.2).

(6.1) John peeled an apple for Mary.

(6.2) Hiroto-ga Akiko-ni ringo-o muita
Hiroto\textsubscript{NOM} Akiko\textsubscript{DAT} apple\textsubscript{ACC} peeled
‘Hiroto peeled an apple for Mary.’

In addition, unlike in English, the relative ordering within any sequence of NPs in an individual clause is very free. Any order will do:

(6.3) a. Hiroto-ga Akiko-ni ringo-o muita
Hiroto\textsubscript{NOM} Akiko\textsubscript{DAT} apple\textsubscript{ACC} peeled
‘Hiroto peeled an apple for Akiko.’

b. Ringo-o Hiroto-ga Akiko-ni muita
apple\textsubscript{ACC} Hiroto\textsubscript{NOM} Akiko\textsubscript{DAT} peeled
‘Hiroto peeled an apple for Akiko.’

c. Akiko-ni Ringo-o Hiroto-ga muita
Akiko\textsubscript{DAT} apple\textsubscript{ACC} Hiroto\textsubscript{NOM} peeled
‘Hiroto peeled an apple for Akiko.’

1 None of these sentences is the most natural way of expressing their shared content, as there is overwhelming preference to use the topic marker -wa to indicate surface subject. But with appropriate intonation, these are fully well-formed (and if embedded in a nominal, e.g. preceding koto (‘fact’) i.e. as presenting a translation of a factive nominal the fact that these are perfectly normal. So we follow the convention of recent discussions of Japanese scrambling in which, following Saito (1985), all sequences are given with -ga, except where discussion of properties of -wa are directly relevant (see section 6.4).
When it comes to embedding one clause within another, the freedom of noun phrases within the clause repeats itself (though with some constraints as we shall see later), but the verb now must be final in its clause, for both clauses, and the effect is of one verb following the other. So the ordering can be any one of:

\[
\begin{align*}
\text{subject}_1 & \quad \text{subject}_2 & \quad \text{object}_2 & \quad \text{verb}_2 & \quad \text{verb}_1 \quad (6.4a) \\
\text{subject}_1 & \quad \text{object}_2 & \quad \text{subject}_2 & \quad \text{verb}_2 & \quad \text{verb}_1 \quad (6.4b) \\
\text{object}_2 & \quad \text{subject}_1 & \quad \text{subject}_2 & \quad \text{verb}_2 & \quad \text{verb}_1 \quad (6.4c)
\end{align*}
\]

(6.4) a. Hiroto-ga Masa-ga ringo-o tabeta to itta
    Hiroto_{NOM} Masa_{NOM} apple_{ACC} ate COMP said
    ‘Hiroto said Masa ate an apple.’

b. Hiroto-ga ringo-o Masa-ga tabeta to itta
    Hiroto_{NOM} apple_{ACC} Masa_{NOM} ate COMP said
    ‘Hiroto said Masa ate an apple.’

c. ringo-o Hiroto-ga Masa-ga tabeta to itta
    apple_{ACC} Hiroto_{NOM} Masa_{NOM} ate COMP said
    ‘An apple, Hiroto said Masa ate.’

But there is no possible order:

\[
\begin{align*}
*\text{subject}_1 & \quad \text{subject}_2 & \quad \text{object}_2 & \quad \text{verb}_1 & \quad \text{verb}_2 \quad (6.5)
\end{align*}
\]

(6.5) *Hiroto-ga Masa-ga ringo-o itta tabeta to
    Hiroto_{NOM} Masa_{NOM} apple_{ACC} said ate COMP
    ‘Hiroto said Masa ate an apple.’

In short, a common pattern in Japanese is for there to be a sequence of noun phrases followed by a sequence of verbs.

However, it is not only verbs which occur last in the structure they induce. So too, canonically do nouns. That is, in relative clauses, the sense of everything being the other way round repeats itself, for in Japanese the head noun always follows the relative. What is said in English as (6.6) is said in Japanese as (6.7) with its literal English construal in (6.8).

(6.6) An apple that Mary peeled was tasty.
(6.7) Hiroto-ga muita ringo-ga oisikatta
    Hiroto_{NOM} peeled apple_{NOM} tasty_{PAST}
    ‘An apple which Hiroto peeled was tasty.’
(6.8) ‘Mary peeled apple tasty.’

There is no relative pronoun. It is simply that the clause to be interpreted as a relative normally has one argument missing, which is provided by the head of the relative, which follows.\(^3\) There is also an added complication that Japanese has no determiner (notice the single word ringo translated as ‘an apple’).

The problem that this ordering poses is that in parsing a sequence of noun phrases followed by a verb, a choice has to be made at some point as to which of the noun phrases in the sequence are part of the relative clause, and which are not. In (6.9), all the noun phrases are part of the relative clause:

\[^2\]Case-marked left-peripheral noun phrases that precede the expression taken to be the matrix subject but yet are interpreted as in some subordinate structure are of uncertain status. See section 6.3.

\[^3\]One of these arguments might be expressed with the topic marker -wa to avoid repetition, but this is not necessary.
(6.9) Hiroto-ga Akiko-ni muita ringo-ga oisikatta
HirotoNOM AkikoDAT peeled appleNOM tastyPAST
‘An apple that Hiroto peeled for Akiko was tasty.’

But this is not so in (6.10):

(6.10) Hiroto-ga Akiko-ga Halimah-ni muita ringo-o tabeta
HirotoNOM AkikoNOM HalimahDAT peeled appleACC ate
‘Hiroto ate the apple which Akiko peeled for Halimah.’

Nor need it be in (6.11) where, with no competing overt specification of an alternative subject for the relative clause, Hiroto can nevertheless be interpreted either as subject of the relative or, simply, as the subject of the main clause:

(6.11) Hiroto-ga Halimah-ni muita ringo-o tabeta
HirotoNOM HalimahDAT peeled appleACC ate
‘Hiroto/Tom/Yuki ate the apple which Hiroto/Tom/Yuki.... peeled for Halimah.’

The effect of this is that in parsing a Japanese sentence, one may not know even whether one is constructing a structure which will turn out to be part of the main clause or a relative clause modifying some head, until one gets past the verb to the immediately following noun: it is only the sequence verb-noun which unambiguously determines that the sequence immediately preceding the noun has to be used to construct a relative clause.

To make matters worse, all argument expressions in Japanese are optional, this being a full pro-drop language, so subject, object and indirect object can all be recovered from the context. This makes it seem that the ambiguity in parsing Japanese sentences presents an acute burden on the parser. Is it really the case that Japanese speakers, and indeed speakers of about half the world’s languages, are doing something so very different in talking to each other from speakers of English? And is the relationship between a grammar of Japanese and a corresponding parser essentially different from the correspondence that we have observed in the English case? If that really is so, then the claims of Dynamic Syntax are seriously threatened; for, if the grammar formalism constitutes an architecture for parsing, this architecture is presumably going to have to be said to be universal, possibly hard-wired, and hence not subject to more than minor variations across all languages. Just how, one might ask, can such minor variations give rise to this almost totally inverted effect? The goal of this chapter is to answer these questions by looking at the process of projecting structure in Japanese in some detail, first in relation to scrambling and then in relation to relative clause construal. And we shall see that, though more needs to be said, the additions are natural to an inferentially driven system; and we shall find that the dynamics of projecting structure in an incremental, time-linear way can be sustained without modification.4

6.0.1 Preliminaries: Basic Lexical Templates

The first thing to sort out is how the basic templates of structure are provided; and this at least is straightforward. Because Japanese is a fully pro-drop language, all arguments are optional, and it is the verbs which project a full predicate-argument whose argument values can be identified directly from context. In the case of

4Recent work on parsing shows how incremental the parsing of Japanese is. To see how these resu(1995), Fodor and Hirose (2003), Aoshima et al (2004).
the verbal form *tabeta* (‘ate’), this takes the form of projecting a full propositional
template with argument nodes decorated with metavariables. This indicates a more
radical form of pro-drop than is found in the Greek, Spanish and Italian examples
in previous chapters where only the subject node is type-complete. Otherwise, the
lexical entry for the verb *tabe* is very similar for that given for the Italian verb *parla*
in (5.34) on page 171.\(^5\)

(6.12) \[tabe\]

\[
\text{IF } \ ?Ty(t) \\
\text{THEN } \make((1o)); \go((1o)); \put(Fo(U), Ty(e), ?\exists x. Fo(x)); \go((1o)); \\
\make((1i)); \go((1i)); \put(\forall Ty(e \rightarrow t)); \\
\make((1i)); \go((1i)); \\
\put(Fo(Tabe), Ty(e \rightarrow (e \rightarrow t)), [1] \perp); \go((1i)); \\
\make((1o)); \go((1o)); \put(Fo(V), Ty(e), ?\exists x. Fo(x))
\]

ELSE Abort

Noun phrases also are frequently composed of just one word, e.g. *ringo-o* in (6.2)
and many other examples. So, in like manner, nouns in Japanese are taken to
project a full term of type \(e\), introducing a new variable, and an operator to bind
it. A noun like *ringo* will thus be associated with (at least) the set of actions
shown in (6.13) which effectively combine the actions associated with parsing the
two words *an apple* in English (see also section 6.5.1).\(^6\)

(6.13) \[ringo\]

\[
\text{IF } \ ?Ty(e) \\
\text{THEN } \make((1i)); \go((1i)); \put(Ty(cn \rightarrow e), Fo(\lambda P.(e, P)), [1] \perp); \\
\go((1i)); \make((1i)); \go((1i)); \put(\forall Ty(cn)); \\
\make((1i)); \go((1i)); \put(Ty(e \rightarrow cn), Fo(Ringo'), [1] \perp); \\
\go((1i)); \make((1i)); \go((1o)); \freshput(x, Fo(x))
\]

ELSE Abort

So from a minimal sequence of words, (6.14) has just three, a full propositional
template may be induced complete with quantificational terms:

(6.14) \[Hiroto-ga \ ringo-o \ tabeta\]

\[Hiroto_{NOM} \ apple_{ACC} \ ate\]

‘Hiroto ate an apple.’

This means that there is a considerable gap between richness of morphological
information and richness of structural information; but this separation of surface form
and decoration on the semantic tree is unproblematic in DS, given that the concept
of lexical content is not just the provision of some Formula value but a macro of
actions for building up emergent semantic structure. Indeed it is at least in part
the richness of information provided by individual words which underpins the very
great flexibility in the NP sequences allowed. The actions that lead to the requisite
logical structure do not turn on the subject and object-denoting expressions being
in any particular order, for full predicate-argument structure is provided by just
one word – the verb.

\(^5\)We return to the tense specification directly.

\(^6\)This analysis is inconsistent with Chierchia (1998), who analyses quantification in languages
such as Japanese as semantically distinct from the basis for quantification in languages such as
English. In this framework, both types of analyses are expressible (see chapter 8), but in the
Japanese case we presume that the difference is merely one of how much of the containing logical
structure is projected by the word itself.
6.0.2 Scrambling

The flexibility in ordering of noun phrases is however very far from unproblematic, and this phenomenon, called Scrambling (Ross 1967), has been the focus of a great deal of attention over an extended period, at least within transformational frameworks. Despite all this attention however, scrambling remains resistant to a unified form of analysis in all current frameworks.

One of the cross-theoretic debates has been whether these languages are as configurational in their structural properties as more familiar languages such as English. The apparently flat sequence of noun phrases preceding the verb with their multiple possible orders may be taken as evidence for the lack of any verb phrase constituent. Can they, that is, be taken to project a VP node in any regular sense, if the noun phrases can occur in an order which makes the assignment of such a constituent impossible? LFG analyses propose that scrambled sentences are analysed with a non-binary flat structure at the level of c-structure, while other semantically related levels encode their thematic and semantic predicate-argument properties (Bresnan 2001, Dalrymple 2001, Nordlinger 1998). HPSG analyses too project such sequences as flat at the level of the string, separating out configurational principles from linearity, with superimposed linearisation principles. For example, Reape (1994) defines discrete domains with relations between domains defined hierarchically, order internal to any one domain (roughly that of a clause) being unspecified. Kathol (2000), in addition, defines a topological concept of fields, based on the concepts of vorfeld and mittelfeld in traditional German grammar, internal to which idiosyncratic ordering statements are definable. Combinatory Categorial Grammar might seem best suited to languages with such free permutation, since it allows very great flexibility in the creation of constituents (Hoffman 1995), but this turns out to provide too great a flexibility, and the restriction on possible permutations is very hard to state (Baldrige 2002). The optionality of all arguments provides an additional problem, as given that expressions are typed as to the number and type of expressions they combine with to form a clausal sequence, all verbs will have to be assigned multiple types to match the full range of arguments expressible.

Even within a movement-based framework, in which most work on Japanese scrambling has been done, the analysis of these data remains controversial. Amongst movement analyses, see Hale (1983), Saito (1985, 1992), Speas (1990), Diesing (1992), Boškovič and Takahashi (1998), Saito and Fukui (1998), Karimi(ed.) (2003) and many others. See Kempson and Kiaer (2004) for an account of just why scrambling is so problematic for CCG, using the phenomenon of multiple long-distance scrambling. See Saito (1985, 1992, 2003), Fukui (1993), Boškovič and Takahashi (1998), Saito and Fukui (1998), Bailyn (2001, 2003), Miyagawa (2003), Nemoto (1999). The problem of optionality can be side-stepped of course, by invoking features specific to the task of enforcing the requisite movement (Kiss 2003, Miyagawa 2003, Maki and Ochi 1998). But invoking such features solely in order to trigger scrambling equally threatens the content of the Minimalist claim; and analyses are also proposed in terms of base generation of the scrambled strings, with LF lowering (Boškovič and Takahashi 1998). Yet others invoke concepts of information-restructuring (Bailyn 2003) (though the status of such discourse-based explanations within a grammar formalism which eschews all reference to phenomena of use is unclear).
CHAPTER 6. THE CHALLENGE OF JAPANESE

In the original *wh* data cited by Saito (1992), in which the *wh* expression can be construed in the subordinate structure suitably marked by the -ka Q-marker, there is no change of meaning and the correspondence between the two is said to involve “radical reconstruction”, but in mixed quantification sentences, the order in which expressions occur does matter. (6.15) is said to be unambiguous, but (6.16) is ambiguous:\(^{11}\)

(6.15)  
\[
\text{dareka-ga hotondo-no uta-o utatta}  
\text{someone}_{\text{NOM}} \text{most}_{\text{GEN}} \text{song}_{\text{ACC}} \text{sang}  
\]

‘Someone sang most of the songs.’ (unambiguous: some < most)

(6.16)  
\[
\text{hotondo-no uta-o dareka-ga utatta}  
\text{most}_{\text{GEN}} \text{song}_{\text{ACC}} \text{someone}_{\text{NOM}} \text{sang}  
\]

‘Most of the songs, someone sang.’

(ambiguous: some < most/most < some)

The idiosyncratic property of indefinites in allowing wide scope effects that we saw in chapter 3 repeats itself in Japanese, except that when the indefinite precedes another quantifying expression, it appears that linear order is providing an additional constraint.

A problem that scrambling poses for all movement accounts (as noted by Saito 1992) has turned out to be particularly troublesome for a Minimalist account. The problem is the feeding relation between rules. In principle a complement noun phrase can be dislocated out of some embedded clause, as in (6.17), and, equally, a complement clause itself can be moved to the left of the matrix subject as in (6.18):

(6.17)  
\[
\text{?Sooru-ni Taro-ga Hanako-ga iru to omotteiru}  
\text{Seoul}_{\text{LOC}} \text{Taro}_{\text{NOM}} \text{Hanako}_{\text{NOM}} \text{be}_{} \text{COMP} \text{thinks}  
\]

‘In Seoul, Taro thinks Hanako is.’

(6.18)  
\[
\text{Hanako-ga Sooru-ni iru to Taro-ga omotteiru}  
\text{Hanako}_{\text{NOM}} \text{Seoul}_{\text{LOC}} \text{be}_{} \text{COMP} \text{Taro}_{\text{NOM}} \text{thinks}  
\]

‘Hanako is in Seoul, Taro thinks.’

These two processes must not be allowed to combine to yield (6.19):\(^{12}\)

(6.19)  
\[
\text{*[Hanako-ga} \text{t}_i \text{iru to}\text{t}_j \text{Sooru-ni} \text{Taro-ga} \text{t}_j \text{omotteiru}  
\text{Hanako}_{\text{NOM}} \text{be}_{} \text{COMP} \text{Seoul-in Taro}_{\text{NOM}} \text{thinks}  
\]

‘[That Hanako is \text{t}_i]_j \text{in Seoul, Taro thinks} \text{t}_j.’

Yet the Proper Binding constraint, defined in Saito (1992) to prevent one such movement process from feeding another, is an s-structure condition; and, with the level of s-structure having been jettisoned in minimalism, this form of explanation is no longer available.\(^{13}\) So the challenge for a dynamic perspective, committed as it is to taking seriously the linearity of how interpretation is built up, is whether it can capture this apparently heterogeneous set of facts in a more illuminating way.

\(^{11}\)The standard analysis of such reversed scope effects invokes covert A′ movement to induce the appropriate LF configuration (Saito 1985), rather than any radical reconstruction.

\(^{12}\)In this example, we provide indication of traces, as in movement analyses, in order to bring out the problem for analyses of this type. There is no commitment to any such movement in the DS account.

\(^{13}\)Saito (2003) defines a particular restriction on Merge to state the facts appropriately relative to Minimalist assumptions, but this is no more than a description of the phenomenon.
6.1. LOCAL *ADJUNCTION

What we have to hand is the concept of having unfixed nodes early on in the parse process; but it is far from obvious that this provides sufficient expressive power to express this heterogeneous set of facts. As so far defined, with the process of *ADJUNCTION introducing one unfixed node within an individual tree, the answer is pretty clearly “No”. The phenomenon of very free ordering without any necessary substantive difference in interpretation is not adequately reflected in the distinction between the building of linked structures vs the characterisation of one unfixed node within an individual tree. A linked-structure analysis reflects an anaphorically established relation between otherwise distinct structures; and *Adjunction reflects the isolatability of one constituent across an indefinite structure within an individual tree from its point of construal. The phenomenon of locally free constituent ordering is something else again. Yet, as it turns out, there is a natural extension of the vocabulary we have already set up which does reflect the data very naturally. This is to extend the concept of varying locality constraints on the resolution of Formula underspecification (familiar from the Binding Principles distinguishing reflexives, pronouns and names (Chomsky 1981)) to the resolution of underspecification of structure, defining an analogue of the binding principles for structural underspecification. Dynamic Syntax is uniquely set up to explore this particular form of parallelism between anaphora and long-distance dependency effects, as it is only in this framework that such effects are expressed as a form of underspecification. These in combination will make possible an account of scrambling. We start from the regular process of *Adjunction, and modify it in two directions, one more local, one less local.

6.1 Local *Adjunction

We begin by looking at a more restricted form of *ADJUNCTION, which we call LOCAL*ADJUNCTION, and which expresses what it means to be an argument node that is introduced locally relative to some node, \( T_n(a) \), decorated with \(?T_y(t)\), but without yet the projection of the tree within which its position is fully determined. Such a form of *ADJUNCTION seems to be just what we need for capturing Japanese local scrambling.

This new rule of LOCAL*ADJUNCTION creates unfixed nodes relative to a local type-t-requiring node. It will need to be distinct from *ADJUNCTION, because it must allow repeated application for an apparent sequence of nodes:

(6.14) Hiroto-ga ringo-o tabeta

\( \text{Hiroto}_{\text{NOM}} \text{ apple}_{\text{ACC}} \text{ ate} \)

‘Hiroto ate an apple.’

(6.20) ringo-o Hiroto-ga tabeta

\( \text{apple}_{\text{ACC}} \text{ Hiroto}_{\text{NOM}} \text{ ate} \)

‘Hiroto ate an apple.’

We define such a rule by first defining a distinct composite operator so that different underspecified tree relations will be associated with different tree construction processes. This operator defines a relation:

\[ (\langle t_0 \rangle t_1) X \]

which holds at a node in an underspecified dominated relation to some node X, whose possible values range only over one dominance relation defined from an argument daughter plus zero or more dominance relations defined from functor nodes:

\[ (\langle t_0 \rangle X, (\langle t_0 \rangle (\langle t_1 \rangle X), (\langle t_0 \rangle (\langle t_1 \rangle (\langle t_1 \rangle X), \text{ etc.} \right] \]
Notice why a separate operator needs to be established, even though it might seem that its effect could in principle be captured by allowing *Adjunction to apply more than once to yield more than one unfixed node. What might seem the natural solution of allowing more than one application of *Adjunction is however debarred by the theory: it is impossible for there to be more than one unfixed node of a type at a time within any partial tree.\footnote{We are grateful to Wilfried Meyer-Viol for pointing this out to us.}

To see why this is so, consider the effect of an application of *Adjunction. This rule introduces a new node from a node identified as $Tn(a)$, identifying it as $\langle \uparrow^* \rangle Tn(a)$. For this relation to hold between two nodes in a partial tree in the model, there must be at least one extension leading to a fixed relation between these two nodes. By definition, any further application of this process will introduce the very same assigned tree relation in the partial tree in which it is introduced, one which is characterised in exactly the same way, and which is satisfied in the model in the very same way. But this means any two such putatively distinct nodes cannot in fact be distinguished: there is immediate collapse of the two nodes so described. The effect of any two such construction steps will be exactly as though two subject relations had been constructed from a node. Moreover, this consequence cannot be side-stepped by attempting to define a distinct construction step which uses the same operator $\langle \uparrow^* \rangle Tn(a)$ imposing on the constructed node an additional locality resolution on its resolution, for the second node so introduced will be indistinguishable from the first: additional decorations will not make any difference to the outcome. By defining a separate operator $\langle \uparrow_0^* \uparrow^*_1 \rangle$, however, this problem goes away. The second, more narrowly defined operator will enable a discrete construction step to be defined which introduces a node with a distinct treenode identifier, $\langle \uparrow_0^* \uparrow^*_1 \rangle Tn(a)$. This underspecified tree relation will have a distinct set of possible extensions from a relation introduced using the more general operator, $\langle \uparrow^* \rangle Tn(a)$. Accordingly, having a distinct operator enables a distinct relation to be introduced into the tree, met in the model by a distinct set of partial trees (albeit a subset of the set satisfying the more general operator).

So, with this operator, we now define a construction step from a node $Tn(a)$ decorated by $\uparrow Ty(t)$ to a locally unfixed one decorated by $\uparrow Ty(e)$, as shown in the rule in (6.21) and the treegrowth display in (6.22).

\begin{equation}
(6.21) \text{Local}^* \text{Adjunction (Rule)} \nonumber
\end{equation}

\begin{align*}
\{ \ldots \{ Tn(a), \ldots, Ty(t), \Diamond \} \ldots \} \\
\{ \ldots \{ Tn(a), Ty(t) \ldots \ldots \{ \langle \uparrow_0^* \uparrow^*_1 \rangle Tn(a), Ty(e), ?\exists x. Tn(x), \Diamond \} \ldots \} 
\end{align*}

\begin{equation}
(6.22) \text{Local}^* \text{Adjunction (Treegrowth):} \nonumber
\end{equation}

\begin{align*}
Tn(a), Ty(t) & \quad \mapsto \quad Tn(a), Ty(t) \\
\langle \uparrow_0^* \uparrow^*_1 \rangle Tn(a), Ty(e), ?\exists x. Tn(x), \Diamond
\end{align*}

This process enables us to characterise the actions of each individual noun phrase in a locally scrambled NP-sequence as decorating an unfixed node whose position will be resolved within the domain given by the propositional template induced by the lexical actions of a verb.

### 6.1.1 Case and Locality Effects

Defining a discrete operator does not quite solve the problem. Even with a separate rule of Local*Adjunction, we appear to need multiple applications of this rule.
But this is what the framework disallows, for exactly the reasons stated above for *adjunction. There is, fortunately, a simple solution to this problem, provided by overt case marking. Case can be seen as fulfilling two distinct roles. On the one hand, it can be used to define filters on output (see chapter 2), imposing requirements on a node which constrain subsequent development. This means imposing a requirement, say for object marking, of decorating a node whose position in the resulting tree is with a mother of predicate type, i.e. imposing on a term node the requirement \( ?(\langle 0 \rangle Ty(e \rightarrow t)) \). The object-marking suffix -o could accordingly be defined as in (6.23).15

\[
\begin{array}{c|c}
\text{IF} & Ty(e) \\
\text{THEN} & \langle \ast \rangle (Tn(a) \land ?Ty(t)) \\
(6.23) & \text{THEN} & \text{put}(?\langle 0 \rangle Ty(e \rightarrow t)) \\
\text{ELSE} & \text{Abort} \\
\end{array}
\]

Nothing forces this requirement to be met at any particular stage in the construction process: hence its use in earlier chapters in connection with long-distance dependency. An unfixed node, in particular, can be decorated with such a case specification to constrain where the node is to be merged. This case specification does not have any encoded pointer-return process. This is instead ensured by completion, suitably generalised to cover the introduction of locally unfixed nodes.16

On the other hand, case can also serve a more constructive role, in some sense inducing a structure-building action as part of the incremental structure-building process, as it appears to in these local scrambling structures. This is indeed the form of analysis proposed in several different frameworks.17 It might seem in this framework that such a move would have to be defined as a quite separate form of action invoking distinct lexical ambiguity, but, as it turns out, these two roles of case-marking, as a constraint on output and as structure building, can both be served by the one output filter mechanism, given the particular locality restriction defined by local *adjunction. Like the other adjunction processes, this is defined using the Kleene * operator which covers a disjunction of possibilities, but because the underspecified relation is defined as \( \langle 0 \rangle \langle 1 \rangle Tn(a) \), it makes available only three possible subsequent forms of development given the restricted adicity of verbs in natural-language.18 There is \( \langle 0 \rangle Tn(a) \) (subject) where \( \langle 1 \rangle \) is satisfied by the empty set of such relations,19 \( \langle 0 \rangle \langle 1 \rangle Tn(a) \) (direct object), and \( \langle 0 \rangle \langle 1 \rangle \langle 1 \rangle Tn(a) \) (indirect object). This is where the role of the case specification comes in: the effect of processing the case marker will automatically rule out all but one of these possible developments. For example, the parsing of the accusative case-suffix -o, having decorated a node introduced by local *adjunction immediately rules out all further tree developments except those in which the relation of this node is

15 As noted in chapter 2 footnote 10, we do not in this book provide a full theory of case-marking. In particular, we do not account for the so-called semantic uses of case and have nothing to say about case alternations or quirky case. These are significant issues, but whatever solution is found for them within DS, it should remain the case that case-marking of subjects and objects will provide a means of linking arguments with their relevant argument slots, represented in DS in terms of hierarchical tree relations. So, even if the precise characterisation of case given for -o (and other case-markers) turns out not to be ultimately tenable, nevertheless what we say about its use in the analysis Japanese scrambling should not be significantly affected.

16 I.e. with \( \mu \) allowed to range over \( \downarrow 0 \) and \( \mu^{-1} \) over \( \uparrow 0 \) in (3.12) on page 78.


18 If adjuncts constitute optional arguments, this list would be increased, but would still constitute a restricted set. See Marten (2002b).

19 Remember that the Kleene * operator includes the empty set.
fixed as object, despite the case specification itself being only a filter on the output tree. Hence the constructive effect of case in short-scrumbling environments. The process of parsing *ringo-o* in (6.20), repeated here, is shown in (6.24) (ignoring the internal structure of the term projected by *ringo*):

(6.20)  *ringo-o*  *Hiroto-ga*  *tabeta*

apple*ACC*  *Hiroto*NOM  ate

‘Hiroto ate an apple.’

This sequence of actions in effect solves the problem of apparently needing the debarred multiple occurrences of unfixed nodes introduced by more than one application of local*Adjunction*.

Once having parsed *Ringo-o* as in the third tree in (6.24) in the construal of (6.20), *Hiroto* can be processed in exactly the same way, leading to (6.25) and to (6.26) once the subject case-marker -ga has been parsed (again ignoring the internal structure of the terms which play no role in subsequent tree development).

(6.25)  Parsing *Ringo-o* *Hiroto*:

We are grateful to Wilfried Meyer-Viol for pointing this out to us, and for the discussions that led to this analysis.

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20*We are grateful to Wilfried Meyer-Viol for pointing this out to us, and for the discussions that led to this analysis.*
6.1. LOCAL *ADJUNCTION

(6.26) Parsing Ringo-o Hiroto-ga:

\[
T_n(0), \exists T_y(t), \Diamond
\]

\[
\text{Fo}(i, y, \text{Hiroto}'(y)), \\
(\{1\}T_n(0), T_y(e)), \\
?\{1\}T_y(t)
\]

\[
T_y(e), \text{Fo}(e, x, \text{Ringo}'(x)), \\
(\{1\}T_n(0), \\
?\{1\}T_y(e \rightarrow t)
\]

Nothing in the characterisation of any case suffix forces the node it decorates to be introduced in a particular order; and, as the display in (6.26) shows, there is no record on the tree of which node was constructed first. In every case, according to this derivation, the node is introduced by constructing an unfixed node, and the local relation to the dominating type \( t \)-requiring node is fixed following the action dictated by the case specification. The subsequent projection by the verb of a full propositional template of predicate node and array of argument nodes is unproblematic. If any of the argument nodes of this template have already been introduced, they will simply vacuously be duplicated by the associated argument node of the predicate. Indeed it could not be otherwise, as two nodes with the same tree-node address decorate one and the same node. This is the same phenomenon as the problem of multiple unfixed nodes. Once the verb is introduced, each argument node has an assigned fixed tree-node address (see chapter 2).\(^{21}\)

No application of \textit{merge} is required to be externally imposed. The two sets of actions, the fixing of position through case markers and projecting a full propositional template by the verb, simply create one and the same tree-relation. Thus in the parsing of (6.20), the tree-update actions provided by the verb induce a propositional template of structure, essentially introducing the functor node which it decorates with the formula \( \text{Fo}(\text{Tabe}') \), the other argument nodes having already been constructed: notice in (6.27) the \( \text{Fo}(\text{U}) \), \( \text{Fo}(\text{Hiroto}') \) decorating the subject node and \( \text{Fo}(\text{V}) \), \( \text{Fo}(e, x, \text{Ringo}'(x)) \) decorating the object node.

(6.27) Parsing Ringo-o Hiroto-ga tabe:

\[
T_n(0), \exists T_y(t)
\]

\[
\text{Fo}(i, y, \text{Hiroto}'(y)), \\
\text{Fo}(\text{U}), T_y(e), \\
(\{1\}T_n(0), \\
?\{1\}T_y(t)
\]

\[
\text{Fo}(e, x, \text{Ringo}'(x)), \\
(\{1\}T_n(0), \\
?\{1\}T_y(e \rightarrow t), \\
\text{Fo}(\text{V}), T_y(e)
\]

\[
\text{Fo}(\text{Tabe}'), \\
T_y(e \rightarrow (e \rightarrow t)), \\
\exists \bot
\]

With these actions completing the outline of structure, decoration of all nonterminal nodes duly takes place.

\(^{21}\)The case suffixes in Japanese are optional, and, if omitted, necessitate other ways of determining construed. One strategy is to use computational actions to induce subject predicate structure (see Kempson et al. 2001), as SVO ordering, in any case generally taken as the canonical ordering, will match such top down actions. Any variation from this without case-marking will rely solely on pragmatic considerations or contingent knowledge of individuals and events described.
As we shall see in addressing long-distance scrambling, things are not quite this simple, as long-distance scrambling is apparently precluded for -ga-marked subject expressions. Some additional specification of what -ga contributes is needed to reflect this asymmetry. Nonetheless, the essential dynamics of short scrambling is to introduce an unfixed node, decorate it, and then fix its tree relation to the locally dominating type t-requiring node, all as a consequence of Local*Adjunction.

6.1.2 Suffixes and Constituency Boundary Marking

One important property of all case suffixes needs to be brought out at this point, and it is a property shared by both case and tense suffixes, possibly a property definitive of suffixes in general. What the case suffixes ensure, as (6.14) and (6.20) show, is the progressive build-up of interpretation for the constituent that it marks. Each suffix indicates that all that is needed to interpret the constituent whose end it marks is already given. The action defined by a suffix, that is, takes some decorated node, with type-requirements satisfied, and adds some additional specification. It is this form of the input condition that is critical, as it is the simple mechanism of fixing a type specification as the input condition which ensures that all non-terminal nodes dominated by the node in question must have already been decorated with a type and formula specification. Hence, the effect of case is to determine the completed assignment of interpretation to the noun phrase sequence, what we might call its "sealing-off" function.

This suffixal property extends directly to tense. The processing of a tense suffix in Japanese indicates that all elements needed to establish a propositional structure are already in hand. The specification of its lexical actions as taking place in the presence of a formula of type t drives the compilation of all non-terminal nodes in a propositional structure. Reflecting this, the lexical actions of the suffix -ta is given in (6.28), where, as before, Si is some temporal variable giving the index of evaluation and SU a meta-variable over such temporal variables. Japanese tense-marking is explicitly anaphoric, and the past tense construal may be relative to some point in time established in the discourse, not necessarily related to some time indexically fixed as prior to the time of utterance. Here, as elsewhere, everything we say about temporal specification is provisional.

This account, notably, requires the tense suffix to be processed last in a clausal sequence. This is because it is defined to take as trigger a completed propositional formula of type t, with no requirements. Furthermore, the propositional formula which it projects, with temporal specification added, signals the end of the scope evaluation process. Buttressing this account, the tense particles are projected as suffixes on the verb; and verb-final ordering is a consequence.

---

22The dynamics of this is identical to the parser of Schneider (1999), here construed as intrinsic to the grammar formalism itself.

23We take following and preceding quantifiers to be a “quantifier-float” phenomenon. The details of all floating quantifiers, either preceding or following a constructed term, remain to be explored, as does plural quantification in general.


25The scope evaluation algorithm dictates that the term indicating the index of evaluation is evaluated last in the sequence of evaluation steps.

26This property of the tense suffix is a very general characteristic of verb-final languages and
6.1.3 Local Scrambling, and quantifier construal

We have now defined the effect of case-marking as a tree-update action. Together with the suffixal property of both case and tense as completing construal of structural boundaries that they mark, we have to hand an account of how local scrambling interacts with quantifier construal. For example, quantifier scoping is generally fixed in a way that reflects linear order (see chapter 3). This is so in simple clauses, because with case-marking determining first the completion of all decorations for the type e node and then the fixing of its tree relation within the local tree, all aspects of interpretation must be completed because the pointer will not return to any argument node within that structure to further develop it. Hence (6.29) is unambiguous:

(6.29) dareka-ga hotondo-no uta-o utatta
someone NOM most GEN song ACC sang

‘Someone sang most of the songs.’ (unambiguous: some < most)

Only an indefinite following some other quantifying expression can be an exception to this direct reflection of linear order within simple clauses, because it has the property of lexically assigning an underspecified scope relation to be fixed by pragmatic choice, allowing greater freedom (see chapter 3):

(6.30) hotondo-no uta-o dareka-ga utatta
most GEN song ACC someone NOM sang

‘Most of the songs, someone sang.’
(ambiguous: some < most/most < some)

Even in such cases, the choice of term on which it is to be construed as dependent has to be made from other terms already constructed at that point in the interpretation process. So there may be ambiguity, but it is not unrestricted.

These linearity restrictions on quantifier-scoping, when the term in questiondecorates a fixed node, do not require special stipulation. They are a consequence of the fact that once a node has all its decorations completed and all requirements met including the specification of tree-node position, the pointer will not subsequently return to further develop that node. In particular, given the encoding of the tense particle as providing the very next lexical action to follow the building of the template of predicate-argument structure, there will be no grounds, unlike in non-verb-final languages, for any expletive pronoun which might license return of the pointer following the processing of the verb to further develop any argument nodes. Hence, from a hierarchically fixed position in the configuration, all aspects of underspecification for the construal of the argument term must be resolved.

6.2 Generalised Adjunction

In the last section, we provided an account of local scrambling in Japanese by defining a distinct adjunction process, more locally restricted than *Adjunction. The next step in developing a full account of scrambling is to see in more detail how the structure induced from simple clausal sequences is nested in some larger structure and to do this, we invoke a weaker concept of adjunction than *Adjunction.
This expresses what it means to be contained within an overall configuration, possibly containing LINKed trees, without further itemisation of the particular relation involved. This relation to some node with address $Tn(a)$ is shown as:

$\langle U \rangle Tn(a), ?\exists x. Tn(x)$

Recall from chapter 3 that $\langle U \rangle$ is defined as the reflexive transitive closure of the union of the inverse-LINK ($\langle L^{-1} \rangle$) and mother ($\langle \uparrow \rangle$) relations, so $\langle U \rangle X$ holds at some node $n$ if somewhere along a sequence of relations, including either $\langle \uparrow \rangle$ or $\langle L^{-1} \rangle$, $X$ holds. Like the relation between $\langle \uparrow \rangle Tn(a)$ and $\langle \uparrow^1 \rangle Tn(a)$, there is an entailment relation between $\langle \uparrow \rangle Tn(a)$ and $\langle U \rangle Tn(a)$, though this time $\langle \uparrow \rangle Tn(a)$ is the more restricted relation. But, again, because a discrete operator is defined, the two relations can be distinguished in partial trees containing both relations.

To introduce such a node, we define a process of Generalised Adjunction whereby a node can be introduced that matches in type the node from which the relation is induced, but which can hold across any arbitrary relation to the input node. The rule is given in (6.31) and its associated display in (6.32). In tree-diagrams representing this tree relation, we use a dotted line, distinguishing it from the dashed line indicating application of *Adjunction.

(6.31) Generalised Adjunction (Rule):

\[
\begin{array}{c}
\{ \ldots \{ Tn(a), \ldots, ?Ty(t), \hat{\diamond} \} \ldots \} \\
\{ \ldots \{ Tn(a), \ldots, ?Ty(t) \}, \{ \langle U \rangle Tn(a), ?\exists x. Tn(x), \ldots, ?Ty(t), \hat{\diamond} \} \ldots \}
\end{array}
\]

(6.32) Generalised Adjunction (Treegrowth):

\[
Tn(a), ?Ty(t)
\]

\[
Tn(n), \langle U \rangle Tn(a), ?Ty(t), ?\exists x. Tn(x), \hat{\diamond}
\]

This process is one which allows a node to be, as it were, pulled apart from the place in the tree from which it was introduced for further modification. There are at least two structure types in English which appear to motivate such a process, the so-called preposed clausal adjuncts, and genitive constructions:

(6.33) a. Having once had a fright by drinking too much, I am sure Tom will be careful not to do so at his party this time.

b. The King of England’s mother’s brother’s wife has disappeared.

Though these are very different constructions, they both pose the problem that the local projection of structure apparently needs to be nested at arbitrary levels of embedding with respect to the root.

In Japanese, as we shall see, structure is quite generally developed without any indication of its contribution to the overall structure:27

(6.34) a. Hiroto-ga muita to itta

Hiroto NOM peeled COMP said

‘Hiroto (or someone else) said that he peeled it.’

27Given the full pro-drop nature of the language, in these and subsequent examples, other interpretations may be possible when identification from the context is possible.
b. Hiroto-ga muita ringo-o tabeta
   Hiroto\textsubscript{NOM} peeled apple\textsubscript{ACC} ate
   ‘Hiroto (or someone else) ate an apple he peeled.’

So once having introduced the general goal-driven requirement that Japanese, as every other language, is driven by the overall goal of establishing a propositional structure, we shall need to make use of some step of Generalised Adjunction in all cases where subordination needs to be induced. The effect of this step is that subordinate structure can be locally constructed without any prior identification of whether in the end result it will turn out to be that of a complement structure or as part of some relative-clause construal.\(^{28}\)

### 6.2.1 Complement clause construal

In setting out putative variations in the building of nodes without a fixed position in the resulting structure, we have now distinguished Generalised Adjunction from *Adjunction and Local*Adjunction, the first being a much more general process with no constraint at all imposed on the relation of the local structure to be developed to the whole. Hence it can be used for all forms of embedding, being neutral between relative clause and subordinate clause construal. We now see the individual steps involved in building up complement structures, on the assumption that it is Generalised Adjunction which, in anticipation of nested structure, may be taken as an option at the first initial step in parsing either (6.35) or (6.36):\(^{29}\)

(6.35) 
Hiroto-ga muita to itta
   Hiroto\textsubscript{NOM} peeled COMP said
   ‘Hiroto (or someone else) said Hiroto peeled it.’

(6.36) 
Hiroto-ga muita ringo-o tabeta
   Hiroto\textsubscript{NOM} peeled apple\textsubscript{ACC} ate
   ‘Hiroto (or someone else) ate the apple Hiroto peeled.’

Following through on such an initial step, we will take the simplest form of subordinating sequence, (6.37), in order to set out the process in more detail:

(6.37) 
Hiroto-ga ringo-o tabeta to itta
   Hiroto\textsubscript{NOM} apple\textsubscript{ACC} ate COMP said
   ‘Hiroto said he ate an apple.’

The first thing to note is that, building on this assumption of an early step of Generalised Adjunction, the sequence Hiroto-ga ringo-o tabeta in (6.37) can be parsed as though it were a single simple clausal sequence. The subordinate structure is exactly that of the simple clausal sequence, the only difference being the initial step of Generalised Adjunction.\(^{30}\)

\(^{28}\)If it were not for the existence of topic structures, which we shall see in section 6.4 we model as a LINKed structure, the safe option at the outset of every parse would be to presume on a step of Generalised Adjunction. However, again as we shall see, the existence of the option of building a LINKed structure is paired with the very general use of topic-marking to indicate surface subject, so, as things turn out, Japanese processing does not require any such default assumption of complexity.

\(^{29}\)As we shall see in due course, the topic marker -wa is proto-typically used to indicate the matrix subject, so without such marking a common assumption is that the structure under construction is subordinate, an assumed strategy for analysis which would be confirmed by the -ga marking.

\(^{30}\)In this and subsequent trees, the internal structure of the terms will not be shown where this is not relevant to the discussion. Types are also omitted where not relevant.
(6.38) Parsing *Hiroto-ga ringo-o tabeta*:

\[
T_n(0), \diamond\\
(U)T_n(0), Fo(Tabe(\epsilon, x, Ringo(x))(\iota, y, Hiroto(y))), Ty(t)\\
Fo(\iota, y, Hiroto(y)) \\
Fo(Tabe(\epsilon, x, Ringo(x))) \\
Fo(\epsilon, x, Ringo(x)) \\
Fo(Tabe')
\]

With no use of *-wa* to mark a surface subject, the first morphological sign of anything other than that this string is a matrix clause comes with the parsing of the suffix *-to*. In the construction of the requisite structure, the complementiser has a clear role to play as the next step needed to induce structure for (6.35): it marks the completion of a propositional sub-structure. The nesting it creates can be achieved in one of two ways, as reflected in the disjunctive set of lexical actions (6.39): either by making use of structure already induced and returning the pointer there, or by adding a further intermediate node locally dominating the node just completed:\(^{31}\)

\[
\text{IF} \quad \langle U \rangle T_n(a), Fo(\alpha), Ty(t) \\
\text{THEN} \quad \text{put}(\langle \iota_0 \rangle \langle \iota_1 \rangle T_n(a)); \\
\text{go}(\langle \iota_0 \rangle \langle \iota_1 \rangle) \\
\lor \\
\text{ELSE} \quad \text{Abort}
\]

The actions of *-to*, that is, dictate how or whether the pointer returns from the completed propositional structure in (6.38) to the root.

Following the regular pattern of suffixes, a completed type specification, here a type \( t \) formula, is the condition necessary for the update given by *-to* to be carried out. What *-to* imposes, as a result, is obligatory local subordination. Thus, pursuing the parse of (6.37), we need only the first alternative of returning to the root, in so doing determining the local relation between it and the node initially introduced by **Generalised Adjunction** as shown in (6.40):\(^{32}\)

---

\(^{31}\) Though a stipulation, the disjunctive characterisation provides a straightforward way of expressing dialectal variation in the use of *-to*. In some dialects, e.g. the Osaka dialect, use of *-to*, like case, is optional. On this analysis, the dialect difference lies in whether the updating of the tree is by lexical or computational action. In standard Japanese, there is no generalised convention of return of the pointer from any node: such a computational action is only applicable to nodes of \( Ty(e) \). In the Osaka dialect, this is generalised to apply to nodes with formulae of type \( t \). In fact, as we shall see shortly the action of using a node already introduced and enriching the relation in question is very general in Japanese, but here we keep the disjunction, as with *-to*, like *-ga*, the effects are strictly encoded.

\(^{32}\) We leave the propositional formula here in its unevaluated form for simplicity, ignoring the scope statement \( S_i < x \) with which it must be evaluated.
(6.40) Parsing  *Hiroto-ga ringo-o tabeta to*:

\[
\begin{align*}
& T_n(0), \Diamond \\
& \langle \downarrow_1 \rangle T_n(0) \\
& \langle \downarrow_0 \rangle \langle \downarrow_1 \rangle T_n(0), \\
& F_o(Tabe'(\epsilon, x, Ringo'(x))(t, y, Hiroto'(y))), T_y(t) \\
& F_o(t, y, Hiroto'(y)) \\
& F_o(Tabe'(\epsilon, x, Ringo'(x))))) \\
& F_o(\epsilon, x, Ringo'(x)) \\
& F_o(Tabe') \\
& F_o(U), \\
& ?\exists x. F_o(x), \\
& T_y(\epsilon) \\
& \langle ÷ \rangle T_y(t) \\
& F_o(Tabe'(\epsilon, x, Ringo'(x))(t, y, Hiroto'(y))), \\
& F_o(V), T_y(t) \\
& F_o(Iu') \\
& F_o(t, y, Hiroto'(y)) \\
& F_o(Tabe'(\epsilon, x, Ringo'(x))))) \\
& F_o(\epsilon, x, Ringo'(x)) \\
& F_o(Tabe')
\end{align*}
\]

The result of carrying out the actions induced by  *-to*, on either alternative, is that the pointer will be at a node from which the subsequent verb  *itta* will be able to project its propositional template. From this node, the propositional template of structure provided by the verb  *itta* is constructed (with metavariables  $F_o(U), F_o(V)$ decorating its argument nodes), in the way we have already seen. In this derivation, the already partially constructed propositional structure induced from the parsing of the initial clausal sequence will collapse with its object argument, the two nodes being non-distinct, as shown in (6.41).

(6.41) Parsing  *Hiroto-ga ringo-o tabeta to itta*:

\[
\begin{align*}
& T_n(0), T_y(t) \\
& F_o(U), \\
& ?\exists x. F_o(x), \\
& T_y(\epsilon) \\
& \langle ÷ \rangle T_y(t) \\
& F_o(Tabe'(\epsilon, x, Ringo'(x))(t, y, Hiroto'(y))), \\
& F_o(V), T_y(t) \\
& F_o(Iu') \\
& F_o(t, y, Hiroto'(y)) \\
& F_o(Tabe'(\epsilon, x, Ringo'(x))))) \\
& F_o(\epsilon, x, Ringo'(x)) \\
& F_o(Tabe')
\end{align*}
\]

With the predicate-requiring node duly decorated with a formula requirement by Elimination, the pointer will arrive at the subject node projected by  *itta*, and up to that point decorated with a metavariable. This node can then be identified anaphorically on the basis of having already parsed the expression  *Hiroto* in the building of propositional structure from  *Hiroto-ga ringo-o tabeta*. Note that this choice is not any reflection of some analogue to any c-command relation: it is solely a consequence of linear order.\footnote{A constraint analogous to the Binding Principle C filtering out putative occurrences of the term $F_o(t, y, Hiroto'(y))$ on the tree once constructed would not be appropriate. The DS analogue} And, with this last requirement on the various
non-root nodes completed, the topnode of the tree can finally be decorated with
the formula (suppressing tense specifications):

$$Fo(Iu'(Tabe'(e, x, Ringo'(x)))(e, y, Hiroto'(y)))(e, y, Hiroto'(y)))$$

Notice that we are building up semantic structure, subpart by subpart, with each
suffix, whether case, tense, or complementiser, determining the full compilation of
semantic interpretation that is possible at that stage in the interpretation process
prior to the subsequent structure-building step.

This derivation, though providing a natural interpretation, is by no means the
only possible interpretation that can be assigned to (6.37). An analysis closer to
that assumed in current syntactic accounts might be to assume as a first hypothesis
that the subject-marked noun phrase is to be projected as the matrix subject at
the early stage at which the noun phrase itself is parsed. Such choices are always
available. At each step, there is choice as to whether to interpret all noun phrases
in the sequence as arguments of the subordinate clause, or whether to interpret the
presented expressions as providing arguments of the matrix predicate, by making
alternative selections of the nested arguments from some independent context. In
Japanese, any argument of a predicate may be identifiable from context. (6.42) in
a context of identifying who has eaten some cake might well mean that Akiko said
to Halimah that some contextually identified person had eaten the cake:

(6.42) Akiko-ga Halimah-ni tabeta to itta
      Akiko_{NOM} Halimah_{DAT} ate COMP said
      ‘Akiko said to Halimah that Tom ate the cake.’

If Generalised Adjunction is taken to have applied following the processing of
the first -ga marked expression in (6.37), the following object-marked node would
then be constructed relative to a lower level of embedding, and the subordinate
subject be identified anaphorically. Given that -wa is characteristically used to
indicate which expression is to be construed as matrix subject, this is not the
natural interpretation. Nevertheless, this possibility gives a glimpse of the large
numbers of sequences of actions available for an individual string, with variability
even for one possible outcome.

Before we turn to a discussion of locality constraints involved in construing noun
phrases within scrambled embedded contexts, we briefly show how more complex
levels of embedding can be handled in this analysis. In examples with more than
one level of embedding, as in (6.43), the second form of action provided in the
specification of -to will be required. One analysis of the initial string in this example
would thus require the construction of the tree in (6.44) from that in (6.38), licensed
by the second set of actions in (6.39).

(6.43) Hiroto-ga ringo-o tabeta to itta to omotteiru
      Hiroto_{NOM} apple_{ACC} ate COMP said COMP thinks
      ‘Hiroto ate an apple, he said, he thinks.’

of the binding constraints are filters on choosing values in constructing interpretations for the
natural language expressions, e.g. the name Hiroto. They do not apply to the terms in the
formula language; and so do not apply to any logical term decorating a node in the output
structure.
6.2. GENERALISED ADJUNCTION

(6.44) Parsing Hiroto-ga ringo-o tabeta to in (6.43):

\[ T_n(0), ?T_y(t) \]

\[ (U)T_n(0), ?T_y(t), \triangle \]

\[ \langle \uparrow 1 \rangle \langle U \rangle T_n(0) \]

\[ Fo(\text{Tabe}'(\epsilon, x, \text{Ringo}'(x))(\epsilon, y, \text{Hiroto}'(y))), \]

\[ \langle \uparrow 0 \rangle \langle \uparrow 1 \rangle \langle U \rangle T_n(0), T_y(t) \]

\[ Fo(\epsilon, y, \text{Hiroto}'(y)) \]

\[ Fo(\epsilon, x, \text{Ringo}'(x)) \]

\[ Fo(\epsilon, x, \text{Ringo}'(x)) \]

\[ Fo(\epsilon, x, \text{Ringo}'(x)) \]

From this point the second verb *itta* projects a full propositional template from the node labelled \( (U)T_n(0) \) in (6.44), whose object node collapses with the toplevel of the first propositional tree to have been completed, in the way that we saw in the analysis of (6.37). The actions on parsing an instance of *to* for the second time, then fixes this complex propositional tree as an internal argument which becomes the object of the matrix verb *omotteiru*. By starting in this radically unfixed way, we can build structure that is itself unfixed, thus allowing the parse of pre-verbal propositional material, even though at the point at which the proposition is completed the depth of embedding at which it is to be found is as yet unknown. This illustrates the general pattern of Japanese parsing: given that the parser may have no indication of where in the overall tree some emergent structure is to fit, propositional structure is locally induced, and then put together sub-structure by sub-structure. This will be explored further in section 6.5 when we turn to an account of head-final relative clauses.

6.2.2 Locality Constraints on Noun Phrase Construal

Confirmation of the style of analysis that we are advocating comes from its immediate application to providing an account of the variability in construing dative noun phrases in scrambling. Though scrambling of pre-verbal, non-quantified, non-anaphoric noun phrases is noted to be relatively unconstrained, a dative-marked noun phrase sometimes gives rise to ambiguous construals, sometimes not. When the dative-marked noun phrase occurs between two subject-marked phrases, it is ambiguous:

(6.45) Hiroto-ga Masa-ni Akiko-ga ringo-o multa to itta

\[ \text{Hiroto}_{\text{NOM}} \] \[ \text{Masa}_{\text{DAT}} \] \[ \text{Akiko}_{\text{NOM}} \] \[ \text{apple}_{\text{ACC}} \] \[ \text{peeled} \] \[ \text{COMP} \] \[ \text{said} \]

‘Hiroto said that Akiko peeled an apple for Masa.’

‘Hiroto said to Masa that Akiko peeled an apple.’

However what is not possible is the interpretation of a dative relative to some superordinate node in the structure once a certain level of embedding has been introduced. (6.46), in which there are two -*ga* marked phrases is unambiguous:
(6.46) Hiroto-ga Akiko-ga Masa-ni ringo-o muita to itta
Hiroto NOM Akiko NOM Masa DAT apple ACC peeled comp said
‘Hiroto said that Akiko peeled an apple for Masa.’
≠ ‘Hiroto said to Masa that Akiko peeled an apple.’

Assuming an application of Generalised Adjunction intermediate between the processing of Hiroto-ga and the processing of Akiko-ga, this is as we would expect, as can be seen in (6.47) which shows the state of the tree prior to parsing Masa.

(6.47) Parsing Hiroto-ga Akiko-ga:

\[ T_n(0), ?T_y(t), \]

\[ F_0(i, y, Hiroto'(y)) \quad (U)T_n(0), ?T_y(t), \cap \]

\[ F_0(i, x, Akiko'(x)) \]

Notice what has happened here. Given that two NPs both marked with -ga as in (6.46) cannot be resolved in the same local domain,\(^{34}\) the only possible sequence of transitions which allows the parse of Akiko-ga is one in which Generalised Adjunction applies following the parsing of the first subject expression, Hiroto-ga.\(^{35}\) But on such a transition, the propositional domain now under construction is the radically unfixed one. The expression Masa-ni following Akiko-ga can only lead to interpretations in which either the two NPs are interpreted as co-arguments of some lower predicate (as indicated in the display provided), or where Masa-ni is interpreted as contributing to some structure at a further level of embedding (following yet a further step of Generalised Adjunction). What is excluded is its projection as co-argument with the node decorated by the actions of Hiroto-ga, for there is no possibility of pointer movement back across completely unrestricted tree relations to arbitrary nodes already introduced. Parsing the dative can yield a tree (something) like that in (6.48), which is developed through a parse of the first verb muita to yield a tree in which Masa is the beneficiary of Akiko’s peeling an apple.\(^{36}\)

---

34 Apart from the pairs of -ga marked expressions which dictate a more abstract subject-predication relation. See footnote 39.

35 There cannot be a step of *Adjunction as the type-t-requiring node already has one node that it immediately dominates.

36 Assuming, for convenience, that a beneficiary is treated as an argument of the verb. Nothing hinges on this assumption.
So far the predictions match those of other frameworks. However, with the occurrence of the matrix subject after the embedded clausal sequence, this analysis leads to predictions which depart from movement analyses, in particular. On the present analysis, the occurrence of the dative-marked NP following *to* as in (6.49)-(6.50), must be interpreted relative to the matrix subject, and not as contributing a term in the subordinate structure:

(6.49)  
Akiko-ga ringo-o muita to Hiroto-ga Masa-ni itta  
Akiko\textsubscript{NOM} apple\textsubscript{ACC} peeled COMP Hiroto\textsubscript{NOM} Masa\textsubscript{DAT} said  
‘Hiroto said to Masa that Akiko peeled an apple.’  
\# ‘Hiroto said that Akiko peeled an apple for Masa.’

(6.50)  
Akiko-ga ringo-o muita to Masa-ni Hiroto-ga itta  
Akiko\textsubscript{NOM} apple\textsubscript{ACC} peeled COMP Masa\textsubscript{DAT} Hiroto\textsubscript{NOM} said  
‘Hiroto said to Masa that Akiko peeled an apple.’  
\# ‘Hiroto said that Akiko peeled an apple for Masa.’

As we have already seen, once the pointer has moved down to some subordinate structure, there is no return to a higher point in the tree across a relation constructed using Generalised Adjunction, until that intermediate tree is completed. Yet once that intermediate tree is completed, the pointer moves on to a dominating node, with the complementiser having imposed the completion of that subordinate structure. The pointer is at that later point placed at whatever node locally dominates the node decorated by Hiroto-ga. Hence the only interpretation for either (6.49) or (6.50) is one in which the term decorated by Masa-ni modifies the predicate applied to $Fo(t, y, Hiroto'(y))$ (either as third argument, or as adjunct, depending on the analysis attributed to the dative).\footnote{In all of (6.46)-(6.50), the fixing of the subject relation in processing *-ga means that the construction of the full template of structure projected by the verb will involve constructing the subject relation non-distinctly, as in the simpler cases, assigning the subject node a metavariable as Formula decoration emptily, given the presence of an already determined Formula value.}

This result is not predicted by movement accounts. To the contrary, on those accounts, (6.50) ought on the face of it to allow an interpretation in which the dative-marked noun phrase, Masa-ni, is understood as an argument in the subordinate structure. This is because there is a possible sequence of steps that first moves the dative NP from the complement clause to left-adjoint to the containing
structure, followed by a second extraction step moving the complement structure itself from its subordinate position to a left-adjoined one. Such cases constitute the problematic Proper Binding Constraint (Saito 1985), which has to be superimposed on a movement analysis, as an additional constraint. It is these data further which remain problematic for Minimalist accounts, since the level at which the Proper Binding Constraint was defined, s-structure, cannot be invoked. The pattern repeats itself across a broad range of constructions:

(6.19) *[Hanako-ga t_i iri toj_i Seoul-ni, Taro-ga t_j omotteiru]

Hanako\textit{NOM} be that Seoul\textit{LOC} Taro\textit{NOM} thinks

‘[That Hanako is t_i] in Seoul, Taro thinks t_j.’

(6.18) Hanako-ga Seoul-ni t\_iri to Taro-ga omotteiru

Hanako\textit{NOM} Seoul\textit{LOC} be that Taro\textit{NOM} thinks

‘Hanako is in Seoul, Taro thinks.’

On the Dynamic Syntax account, however, there is simply no question of any such sequence of operations. All such cases are automatically precluded. The parsing of the sequence ending with -to in (6.19) has to have been construed as a completed propositional formula in order to license the update provided by -to, so would have to have the argument of \textit{iri} provided in context. The provision of \textit{Seoul-ni} following the parsing of \textit{to} but to be understood as modifying the embedded structure, is precluded. There is no going back into a structure once it is completed. Hence, the only possibility would be to construe \textit{Seoul-ni} as a dative argument to \textit{omotteiru} but this is independently excluded (since the verb cannot take this sort of argument). In (6.18), by way of contrast, the full sequence of expressions needed to interpret the clausal sequence ending with -to allows a propositional structure to be routinely completed, and this then serves as the internal argument of \textit{omotteiru}, all exactly as expected.

The explanation follows directly from general properties of tree growth as driven by the suffixes which “close off” and complete the expressions that they terminate. The processing of \textit{to} requires the prior completion of a propositional structure and an associated formula of type \textit{t}. No expression contributing to that structure can occur after it:

(6.51) *Mary-ga yonda to sono hon-o John-ga itta

Mary\textit{NOM} read \textit{comp} that book\textit{ACC} John\textit{NOM} said

‘Mary read that book, John said.’

We can see how the data which provide such a problem for the movement accounts melt away in the the DS analysis. The problem arises in frameworks in which the projection of structure is defined exclusively bottom up, with chains or coindexing being said to provide the basis for defining relations between some propositional template of structure and some left-dislocated expression. In the present framework, the dynamics is the other way about. Partial structures are induced in a time-linear fashion as various forms of underspecification with subsequent enrichment, with the morphological suffixes indicating when any substructure is completed. The analogue of a leftward movement process from out of some overall structure, from which the remainder must not also be allowed to move, simply never arises.\textsuperscript{38}

\textsuperscript{38}The apparent mirror image effect in (i), which is well-formed, can perhaps be explained by introducing either LINKed structures or unfixed nodes in the latter stages of the interpretation process, analogous to (ii):
6.3 Long-distance scrambling

Despite the simplicity of the account so far, the sensitivity to linear order appears to be jeopardised by the so-called reconstruction effects in which, contrary to the general linearity pressures, the construal of an anaphoric expression occurring in a left-peripheral expression may be, in some sense, delayed:

(6.52) \( \overline{?zibunzisin-o \ Taro-ga \ semeta} \)

\( \text{self}_{\text{ACC}} \ Taro_{\text{NOM}} \) blamed

‘Himself, Taro blamed.’

The first problem about these is how case specifications can allow any such delay, for the subject action, defined as fixing a tree relation, certainly does not. A sequence of two -\( \text{ga} \)-marked expressions completely precludes any inversion in Japanese:

(6.53) \( \overline{sono \ kodomo-ga \ kouchou \ sensei-ga \ jugyou-ni \ sankashite-ua} \)

\( \text{the-child} \ \text{head teacher}_{\text{NOM}} \ \text{class}_{\text{DAT}} \) participating

\( \text{ikenai-to \ kimeta} \)

\( \text{not allowed \ comp \ decided} \)

‘The head-teacher, the child decided should not attend class.’

\( \neq \) ‘The child, the head-teacher decided should not attend class.’

There is a further problem. Long-distance scrambling data are commonly reported by informants not to occur in normal Japanese usage, no matter how formal the style:

(6.54) \( \overline{?Ringo-o \ Hiroto-ga \ Akiko-ga \ tabeta \ to \ itta} \)

\( \text{Apple}_{\text{ACC}} \ Hiroto_{\text{NOM}} \ Akiko_{\text{NOM}} \) ate \( \text{comp} \) said

‘An apple, Hiroto said that Akiko ate.’

Given the central status of \( \text{*Adjunction} \) in the grammar formalism as the primary parsing tool for introducing unfixed nodes, such non-occurrence of long-distance dependency, if this is what it is, would seem an extraordinary source of cross-linguistic variation, apparently varying in the central sources of underspecification which the grammar makes available.

The processing perspective can provide a basis for explaining both of these problems. The very first step is to note that in principle we expect long-distance scrambling as a general option. There is no reason to preclude the applicability of \( \text{*Adjunction} \) in Japanese. To the contrary, given that the constructive use of case is, by analysis, determined by the interaction of the case specification with the constraint imposed by \( \text{Local*Adjunction} \), we expect that in decorating a node introduced by \( \text{*Adjunction} \), which does not impose any such locality restriction, the case specification functions as a constraint on the relative position of that node when its position is subsequently determined. But this gives us the clue as to how to define -\( \text{ga} \) so that it precludes long-distance scrambling. All we have to do to distinguish the subject-marking -\( \text{ga} \) from other case-marking suffixes is to give it the

(i) \( \overline{Taro-ga \ omotteiru-(yo) \ Hanako-ga \ iru \ to \ Seoul-\text{LOC}} \).

‘Taro\( \text{NOM} \) thinks Hanako\( \text{NOM} \) be \text{comp} Seoul\text{LOC}.’

(ii) She talks too fast, Ruth Kempson.

If that analysis were appropriate, (i) would arguably involve two such processes: one to parse the sequence after \( \text{omotteiru} \) as a LINKed structure with what follows as anaphorically LINKed to the primary structure, a second to parse the sequence after \( \text{iru-to} \) analogously. However, see Sells (1999) for arguments that all constituents occurring after the verb in a clausal sequence are instances of ellipsis (note the presence of -\( \text{yo} \)). Thanks to Hiroto Hoshi for pointing out these data.
CHAPTER 6. THE CHALLENGE OF JAPANESE

distinguishing feature of not merely imposing the requirement for relative position in a tree, but also of making that node relation and moving the pointer back up to what is now the immediately dominating type-t-requiring node as in (6.55). 39

\[
\begin{align*}
\text{IF} & \quad Ty(c) \\
\text{THEN} & \quad (\exists t) (Tn(a) \wedge Ty(t)) \\
\text{THEN} & \quad \text{put}((\{1\})Tn(a)); \quad \text{make}((\{1\}); \quad \text{go}((\{1\})) \\
\text{ELSE} & \quad \text{Abort}
\end{align*}
\]

(6.55) -ga

What we have done in defining -ga in this way is to lexically encode the very actions which otherwise would emerge as a mere consequence of the interaction of the output filter which the case specification might impose (?((\{1\})Ty(t))) and the locality constraint imposed by LOCAL*ADJUNCTION. This encoding of what is otherwise a consequence of interaction between case-marking and a computational process will force the fixing of an immediate dominance relation to the node from which it was constructed in all environments, whether introduced by LOCAL*ADJUNCTION or by *ADJUNCTION. So *ADJUNCTION will be applicable as input to the parsing of a -ga marked expression, but it will never give rise to long-distance dependency effects.

In pursuing the applicability of *ADJUNCTION for the other case-specifications, what we now find is that, despite its availability in principle in Japanese, the implementation of *ADJUNCTION in well-formed derivations is far from unproblematic. This is because, in a language such as Japanese, fixed subordination relations are only established by the complementisers after some propositional structure is induced. The step that initiates such embedded structures gives no indication at all of the level of embedding, as we saw above. The problem with examples such as (6.54) is that in pursuing the parse beyond the identification of the matrix subject, *ADJUNCTION cannot be used to introduce the subordinate structure, because there is already an unfixed node whose update has not yet been provided, and only one such unfixed node can be introduced at a time. But this means that the transition from main clause structure to subordinate structure between the parsing of Hiroto-ga and the parsing of Akiko-ga has to be constructed by application of GENERALISED ADJUNCTION, as we saw earlier in section 6.2.2. This in its turn creates a further

39 There are uses of -ga which appear not to mark subject position. They fall into two classes, those which involve a concept of subject at a suitable level of abstraction, indicating predication on the first -ga marked term to be constructed from the remaining string, (i), and particular stative verbs which appear to have to be itemised as taking an idiosyncratic use of ga-marking, (ii):

(i) usagi-ga mimi-ga nagai
\text{rabbit}_{\text{NOM}} \text{ear}_{\text{NOM}} \text{long}
‘Rabbits’ ears are long.’

(ii) John-ga nihongo-ga wakaru
\text{John}_{\text{NOM}} \text{Japanese}_{\text{NOM}} \text{understands}
‘John understands Japanese.’

It is arguable that the first type can be expressed while retaining the characterisation of -ga suggested here, by presuming on variable adicity of nominal-internal predicates (mimi (‘ear’) in (i) functioning as a two-place predicate ‘ear-of’), following the direction of Marten 2002b. Takano 2003 also has arguments for a bi-clausal analysis even in the case of verbs such as wakaru, as in (ii), which turn on difference in scope effects for -ga and -o marking, the former giving rise to wide scope effects, the latter not. Since scope is defined over propositional domains, we would take such arguments to apply in this framework to motivate assigning structure with more than one type t-requiring node. If such an account can be substantiated, the amount of lexical stipulation specific to -ga then reduces to those stative verbs that cannot be analysed in terms of projecting more abstract structure involving nesting of one propositional structure within another, a very restricted set.
hurdle, as the resulting structure is too weak to license MERGE of the unfixed node originally introduced by \*-ADJUNCTION:

\[(6.56)\] Parsing (6.54):

\[\text{Tn}(0), ?Ty(t)\]

\[\text{Fo}(\epsilon, x, \text{Ringo}'(x)), \langle\text{U}\rangle\text{Tn}(0)\]

\[\boldsymbol{Tn}(0), ?Ty(t)\]

\[\text{Fo}(t, y, \text{Hiroto}'(y)), \langle\text{U}\rangle\text{Tn}(0)\]

\[\langle\text{U}\rangle\text{Tn}(0), ?Ty(t)\]

\[\text{Fo}(t, x, \text{Akiko}'(x)), \langle\text{U}\rangle\text{Tn}(0)\]

\[\langle\text{U}\rangle\text{Tn}(0), ?Ty(t)\]

\[\text{Fo}(W), \Diamond\text{Fo}(\text{Tabe}')\]

A step of MERGE cannot be applied to unify the node decorated with \(\text{Fo}(\epsilon, x, \text{Ringo}'(x))\) and the object node for \text{tabe}, because the application of MERGE depends on a process of evaluating the unfixed node successively down some tree under construction across a succession of daughter relations, as discussed in chapter 2. GENERALISED ADJUNCTION does not, however, provide the appropriate structural environment to allow this, since what it defines is a transition which is a disjunction across LINK or daughter relations.

This may seem to enforce a characterisation of all such strings as incapable of yielding a logical form as a result, hence ungrammatical. Yet there is a simple and monotonic repair process. Given that the formal system allows interspersing of pragmatic enrichment processes with the mechanisms which encode the building of partial structures, all that is required to achieve a parsable string is to assume that pragmatic enrichment, as a generally available cognitive process, can apply not only to formula enrichment as in anaphora resolution, but also to structural enrichment. This is hardly contentious, since enrichment of stimuli is a general cognitive phenomenon, not one specific to a certain mode of representation. On the contrary, given the extension of the concepts of underspecification plus update from anaphora to these more general structural processes, such an enrichment step is exactly what we should expect. So, suppose we assume that a hearer, when faced with an overly weak tree relation such as constructed by GENERALISED ADJUNCTION, has the option of enriching it from \(\langle\text{U}\rangle\text{Tn}(a)\) to a fixed relation \(\langle\text{U}\rangle\langle\text{U}\rangle\text{Tn}(0)\). The required step of MERGE is now licensed to identify \text{ringo-o} as providing the required object argument for \text{tabe}, as shown in (6.57). The significance of such a step is that it is not morphologically triggered: it is a step of abduction, and what is required here is a meta-level process of reasoning. Being a pragmatic and system-external process, any such choice should be expected to be associated with general cognitive constraints; and it is notable that such strings, often initially rejected by speakers, are judged to be acceptable when the context relative to which the string is interpreted has already set up the type of structure which constitutes the enrichment step that has to be made, i.e. when the required structural relation is available from the immediate context. This is the structural analogue of identifying the appropriate substituend for interpreting a pronoun from the immediate context.
As pragmatic considerations lead one to expect, informants also find sentences of this type more acceptable in circumstances where failure to use such a strategy would cause other, arguably worse, processing difficulties:

(6.58) *watashi-ga muita ringo-o Hiroto-ga Akiko-ga tabeta to itta*

*I NOM peeled apple ACC Hiroto NOM Akiko NOM ate COMP said*

'The apple which I peeled, Hiroto said Akiko ate.'

It is notable that with a minor ordering change from (6.54), in which the matrix subject occurs immediately before the main verb *itta*, the acceptability of the string is transformed into perfect, idiomatic Japanese, as all Japanese speakers report:

(6.59) *ringo-o Akiko-ga tabeta to Hiroto-ga itta*

*apple ACC Akiko NOM ate COMP Hiroto NOM said*

'Akiko ate an apple, Hiroto said.'

In this latter case, though a step of Generalised Adjunction has to be presumed to take place, this occurs initially, and all structure is progressively built, with no abduction step being required.

It should not go unnoticed that assigning separate lexical specifications for a verb and its tense suffix is essential to the analysis. Application of Merge has to take place subsequent to the processing of the verb (which introduces the template of propositional structure), and prior to the steps of compiling up the decorations on non-terminal nodes of this structure as required by the update given by *-ta*. The need for such a Merge step (together with the attendant structural enrichment to enable it to take place) is thus driven by the presence of the verbal suffix and the condition it imposes that a completed propositional structure be established.\(^{40}\)

Though construal of long-distance scrambling is constructed via application of Generalised Adjunction, the account nevertheless explains the observed sensitivity of long-distance scrambling to strong island restrictions, which constituted an argument for its syntactic status (Saito 1985).

\(^{40}\)This result should extend to all verb-final languages; and casual but persistent enquiries indicate that this is overwhelmingly the general pattern in Turkic, Polynesian, Japanese and Korean.
6.3. LONG-DISTANCE SCRAMBLING

(6.60) *ano hon-o John-ga katta hito-ni aitagatteiru rasii
That book ACC John NOM bought person DAT want-to-see seems

*It seems that that book, John wants to meet the person who bought it.’

The first presumed step is one of *Adjunction, providing the node decorated by the left-peripheral expression (*ano hon-o in (6.60)). The use of Generalised Adjunction prior to the projection of structure for the relative clause sequence is essential to the characterisation of relative clause construal (see section 6.3.5). Enriching that relation to one of domination at an intermediate step in the construction process in the presence of a node to be construed as unfixed is however licensed, and is essential if Merge is to unify the node associated with the left-peripheral expression and an argument node for the verb katta. But making this move would then debar the resulting structure from functioning as a LINKed structure to some subsequent head, despite the use of Generalised Adjunction: hence, the islandhood restriction.

On this account then, long-distance scrambling is available for non-subject-marked expressions through an intermediate step of abduction which fixes a weak, grammar-induced, level of subordination into an appropriately enriched structural relation. It is only the non-subject-marked case-markers which can give rise to this sequence of steps, as, unlike -ga marking, their update actions do not fix the tree relation of the node they decorate. But the border-line status of these examples reflects the grammar-external enrichment step which has to be taken to secure a successful derivation.

6.3.1 Case Marking Reviewed

It might be suggested that this account of case as differentiating between subject-marking and the rest cannot be sustained, because it is only when there are two -ga marked expressions at the left periphery that there is any such constraint on long-distance scrambling. If either the second subject-indicated NP is marked with wa, which is a canonical indication of matrix-subject, or if the subject is marked with -ni which is the standard way of marking subordinate subjects in non-finite constructions, then occurrence of an expression to be construed as a subordinate subject at the left periphery is perfectly possible (in the latter case together with some other argument expression), so that (6.61) is ambiguous:

(6.61) Saito-ga Chomsky-wa totemo ii riron-o motteiru to
Saito NOM Chomsky TOP very good theory ACC has COMP

motteiru

thinks

‘Saito, Chomsky thinks has a very good theory.’

‘Saito thinks that Chomsky has a very good theory.’

41 Examples such as (6.62) are of interest in their own right. The constituents preceding what is construed as the matrix subject constitute what have been labelled ‘surprising constituents’ (Takano 2002). They have to be construed as local to each other, as an incomplete propositional structure. In these non-finite constructions, analysing them as forming a partial propositional structure, hence a constituent, is not essential since the case-marking allows an analysis in which the causative sase, by a word-formation process in the lexicon, increases the adicity of the predicate to which it is suffixed, with -ni being defined to range over both nested subjects and the more regular indirect object construal, as in many languages. However such pairs of expressions functioning as co-arguments of some embedded predicate may also occur in finite constructions, and in these they require analysis as a partial propositional structure containing only argument nodes. Given the DS perspective, these can be straightforwardly characterised in virtue of the licensed feeding relation between *Adjunction and Local*Adjunction. See Kempson and Kiaer (2004) and Kiaer (in preparation) for analysis of such data in these terms.
Moreover, in the closely related language of Korean, speakers report that inversion of case-marked subjects is perfectly acceptable if suitably triggered, again, one might argue, showing that the data in Japanese apparently to the contrary are not robust. However, these arguments do not stand up to scrutiny.

First, the occurrence of what were called “displaced subjects” by Saito (1985), as in (6.61), conform, strictly, to what this analysis leads us to expect, despite first appearances. All we need is to anticipate the DS analysis of -wa marking (which we look at in more detail in section 6.4).\(^{42}\) -Wa is perhaps the most often cited example of topic marking in languages, and we are going to analyse -wa as inducing the construction of a LINK relation, we did with respect to hanging left topic dislocation in chapter 3. Such a LINK construction induces no island constraints but requires the sharing of a term in the two structures. Now, recall from chapter 3 that LINK transitions can in principle be built from any node. If we posit such a transition from the parsing of the initially placed Saito ga to the parsing of the wa-marked Chomsky-wa in the construal of (6.61), then we have an analysis of such data that follows from the theory unproblematically.

We assume that, as in the cases so far considered, the -ga marked expression is taken to decorate and fix the subject node for a proposition-reaching node at an arbitrary, but unspecified, level of embedding which has been introduced by an opening step of Generalised Adjunction. With the license of a step of building a LINK transition, which the processing of the suffix -wa confirms, we expect that otherwise, the effect of the -ga marking is to enforce the local construction (by Local*Adjunction) of any other argument node. This is because it fixes the node it decorates as in a subject relation to the local propositional substructure, and this precludes subsequent application of *Adjunction within that structure. The distributions that this analysis then lead us to expect turn out to be matched by the data in a surprising way. The addition of a dative-marked expression either before or after the -wa marked expression completely precludes an interpretation in which it is interpreted as a co-argument with the -wa marked expression, despite the obvious pragmatic plausibility:

\[(6.63)\] Saito-na Lasnik-ni Chomsky-wa totemo ii riron-o
\[Saito_{\text{NOM}} \text{ Lasnik}_{\text{DAT}} \text{ Chomsky}_{\text{TOP}} \] very good theory_{\text{ACC}}
\[\text{motteiru to itta} \]
\[\text{\textquoteleft Saito said to Lasnik that Chomsky has a very good theory.\textquoteright} \]
\[\neq \text{\textquoteleft Chomsky said to Lasnik that Saito has a very good theory.\textquoteright} \]

\[(6.64)\] Saito-na Chomsky-wa Lasnik-ni totemo ii riron-o
\[Saito_{\text{NOM}} \text{ Chomsky}_{\text{TOP}} \text{ Lasnik}_{\text{DAT}} \] very good theory_{\text{ACC}}
\[\text{motteiru to itta} \]
\[\text{\textquoteleft Saito said to Lasnik that Chomsky has a very good theory.\textquoteright} \]
\[\neq \text{\textquoteleft Chomsky said to Lasnik that Saito has a very good theory.\textquoteright} \]

On the analysis in which Chomsky-wa is associated with an independent structure, for which a LINK transition from the primary structure has to be induced, this

\(^{42}\)We are very grateful to Hiroto Hoshi for pointing out these data, and for help in establishing their significance.
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Locality of all other expressions to the structure immediately containing the subject node decorated by the actions of Saito-ga is exactly as we expect. In marked contrast, on an analysis of (6.61) as involving left-peripheral separation of the -ga marked phrase from the remainder (by *Adjunction), with -wa taken to initiate the construction of the surface subject, this is exactly what would not be expected. So these facts strongly buttress the proposed account of -ga as locally fixing the relation of the node it decorates.

Secondly, the construal of left-peripherally placed -ni marked expressions as subordinate equally buttresses the proposed analysis of -ga. For a pair of -ni-marked expressions, it is indeed pragmatic considerations that are operative, as in (6.62). Speakers report that (6.65)-(6.66) are both ambiguous, though with the first -ni marked expression much preferred as the understood embedded subject in both cases:

(6.65) Akiko-ni Taro-ni John-ga kisu-saseta
Akiko\textsubscript{DAT} Taro\textsubscript{DAT} John\textsubscript{NOM} kiss-caused
\begin{itemize}
  \item ‘John caused/let Akiko kiss Taro.’ (preferred)
  \item ‘John caused/let Taro kiss Akiko.’
\end{itemize}

(6.66) John-ga Akiko-ni Taro-ni kisu-saseta
John\textsubscript{NOM} Akiko\textsubscript{DAT} Taro\textsubscript{DAT} kiss-caused
\begin{itemize}
  \item ‘John caused/let Akiko kiss Taro.’ (preferred)
  \item ‘John caused/let Taro kiss Akiko.’
\end{itemize}

This availability of inverted subject interpretations extends to Korean, where subject-marking freely allows inverted scope interpretation as long as the context makes this plausible. So, it appears to be only with contiguous sequences of -ga-marking that general cognitive considerations have no impact, as notably displayed with (6.53). But this suggests that it is indeed an encoded property of -ga that prevents such displacement: because only in this case does the morphological specification induce structure and move the pointer on to the immediately dominating node just created with its requirement \textsuperscript{?}\textit{Ty}(t), hence precluding return of the pointer to the higher node for further development. (Completion, recall, applies only to type-completed nodes.) If the constraint were pragmatic only, exactly the same constraints should operate to determine construal of expressions, whether -ga marked, -ni marked, or as in Korean subject-case-marking too: all should be alike.

Thus we take these data to confirm that the correct analysis does not involve the construction of one isolated node by application of *Adjunction for the -ga marked expression to decorate.

6.3.2 Long-Distance Scrambling and Binding effects

Confirmation of all three processes of adjunction, *Adjunction, Local*Adjunction and Generalised Adjunction, comes from the interaction of these processes with anaphor construal, with which we opened this section.\textsuperscript{43}

First, we expect “reconstruction” effects for non-ga marked anaphoric expressions occurring left-peripherally in any clausal sequence, whereby they can be construed as picking up their interpretation from some following expression. On the analysis of these expressions as decorating an unfixed node, these data are licensed

\textsuperscript{43}We do not take up the distribution of the reciprocal anaphor otagei, despite its prominence in the scrambling literature, as without a full account of plurals, let alone reciprocals, any such discussion would be premature in a system committed to formally characterising both syntactic and semantic properties. (But see chapter 7 for an initial characterisation of plurality.)
because any node whose tree node relation is not fixed will be associated with a subsequent update process. The fact that there has to be such a subsequent process means that there will be a distinct point in the construction process at which any aspects of underspecification left without update at the earlier step of constructing the unfixed node can be resolved at this second stage:

(6.52) \text{zibunzisin-o Taro-ga semeta}

\text{self}_{\text{ACC}} Taro_{\text{NOM}} \text{ blamed}

‘Himself, Taro blamed.’

Because all rules are optional, nothing forces the substitution of a term to update the meta-variable projected by the anaphor in (6.52) at the point at which the unfixed node is decorated. The pointer can be moved on from this node without any such move, given the provision of a type specification for the meta-variable projected by the anaphor, as it is only fixed type-assignment that is critical to successful processing of the case-marker -o. COMPLETION thus licenses the tree in (6.67) from a parse of zibunzisin-o, despite the incomplete formula specification on the unfixed node.

\[ Tn(a), \exists Ty, \Diamond \]

At a later stage, once this incompletely decorated node has merged with the internal argument node projected by the verb semeta, the substitution of this meta-variable will however become essential, as otherwise with an open requirement remaining, its immediately dominating predicate node will fail to be decorated with formula by Elimination, and so there will be no well-formed outcome overall.

It might seem from (6.52) that the identification of appropriate construal for zibunzisin is identified off the fixed structure, once the initially unfixed node is updated. Such an analysis would be in agreement with accounts in which the associated predicate-argument structure has to be established before the construal of the antecedent can be established (effectively a radical reconstruction analysis, as in Saito 1985 and others following him). But things are not quite this simple (as Saito 2003 discusses). As is well-known, \text{zibun} is a subject-controlled anaphoric device, restricting identification of its antecedents to terms that decorate a subject node. \text{zibunzisin} is the local analogue of this, requiring as its antecedent a suitably local subject node, that is the closest subject in some sense to be made precise. However, it is not sufficient to define locality either off the predicate relative to which the anaphor has to be construed, or off the subject expression closest to it in the linear sequence, for it turns out that in a more extended sequence of embeddings, the anaphor can be identified from any subject along the route, as it were, between antecedent and anaphor, so that the further the distance between antecedent and anaphor, the more interpretations become available:

(6.68) \text{Taro-ga, Hanako-ga, Jiro-ga_k zibunzisin-o_{\star i, \star j, k} hihansita to}

\text{Hanako}_{\text{NOM}} Jiro_{\text{NOM}} \text{ self}_{\text{ACC}} \text{ criticised COMP itta to omotteiru (koto)}

\text{criticised COMP thinks fact}

‘Taro, thinks that Hanako said that Jiro criticised self_{\star i, \star j, k}.’
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(6.69) \[ \begin{align*}
\text{Taro-ga} & \text{ Hanako-ga} \ zibunzisin-o_{i,j,k} \ Jiro-ga \ \text{hihansita to} \\
\text{Taro} & \text{ Hanako} \ \text{self}_{ACC} \ Jiro & \text{criticised COMP} \\
\text{itta} & \text{to omotteiru (koto)} \ \\
\text{said COMP thinks fact} \\
\text{’Taro} & \text{thinks that Hanako said that Jiro criticised self}.^{*} \\
\end{align*} \]

There is a notable left-right asymmetry in these examples. If the anaphor immediately follows the expression to be construed as the most subordinate subject (i.e. is last in the sequence of noun phrases, as in (6.68)), it will only have one interpretation. If it precedes that most subordinate subject, it will have two interpretations - (6.69). And if it precedes all but the expression to be construed as the matrix subject, despite the reduced acceptability of essential long-distance dependency, it will be able to take as antecedent not only the preceding matrix subject, but also all subject expressions between it and the verb whose object argument it is to be construed as providing.

The lexical specification of \textit{zibunzisin} is simple and is analysed as project an itemised meta-variable, $U_{anaph}$, defined to be associated with a local substitution process:

(6.71) \[ \text{zibunzisin} \begin{cases} 
\text{IF } ?Ty(e) \\
\text{THEN } \text{put}(Fo(U_{anaph}, Ty(e))) \\
\text{ELSE } \text{Abort} 
\end{cases} \]

The restriction on this local substitution process then has to refer to some closest subject relative to some point in the construction process (i.e. one for which there is no closer subject dominated by an intervening ?Ty(t)-requiring node):

(6.72) \[ \text{Local Substitution:} \begin{cases} 
\text{IF } (Fo(U_{anaph}) \land Ty(e)) \\
\text{THEN } \text{IF } (U)(Tn(a), ?Ty(t), \langle l_0 \rangle Fo(\alpha)) \\
\text{THEN } \text{IF } (U)(Tn(b), ?Ty(t), \langle l_0 \rangle Tn(a), \\
\text{b} \neq a, \\
\text{l}_0 \top) \\
\text{THEN } \text{Abort} \\
\text{ELSE } \text{Abort} 
\end{cases} \]

The characterisation of locality may look cumbersome, but all it does is to preclude the selection of any antecedent in which selection of subject is not the one most local to the node which the anaphor decorates. The sort of situation that is precluded by (6.72) is shown in (6.73), where some proposition-requiring node intervenes between the position decorated by the anaphoric metavariable and the targeted subject antecedent.

\[ ^{44} a, b, \text{ and } \alpha \text{ are variables in the DU language that describes the treenode decorations, instantiated by arbitrary values of treenode identifiers and lambda terms respectively. } \]
There is more to this characterisation of locality than merely defining its domain. Its significance lies in the fact that it is defined to apply to any closest subject-decorated node at some arbitrary point in the construction process, so it is not specific to a fixed position in a tree. First, the substitution defined will trivially apply in the case of (6.68) since the node which zibunzisin decorates is a node which is locally dominated by a type-t-requiring node with a fixed term as subject. This can function as its antecedent as there is no intervening type-t-requiring node. Indeed, because it has this antecedent, no other potential antecedent will do.

However, the substitution process can also apply in a derivation in which, following the parsing of some ga marked expression to serve as antecedent, a presumed step of Generalised Adjunction introduces an intermediate type-t-requiring node across a very weak structural relation and then a new unfixed node is introduced for the anaphor to decorate, as in (6.74), which gives the case of (6.69).

(6.74) Parsing Taro-ga Hanako-ga zibunzisin-o Jiro-ga hihansita:

As long as there is no intervening subject between the unfixed node decorated by zibunzisin and that of the putative antecedent, the ga marked expression immediately preceding the anaphor in the string will remain the closest subject as defined on the tree even though it is not structurally local. So in (6.69), $Fo(t, y, Hanako'(y))$ will be available as an antecedent for zibunzisin at the point at which the anaphor is processed; and, because it is, the higher subject formula $Fo(t, x, Taro'(x))$, is not. Since the node which the anaphor decorates is unfixed, this choice of substituend allows Hanako to be interpreted as the object of hihansita following Merge of the
unfixed node with the internal argument position decorated by $Fo(W)$ in (6.74). This gives the interpretation for (6.69) of ‘Taro thinks that Hanako said that Jiro criticised Hanako’.

But this is not the only possible interpretation of the string. Nothing forces $zibunzisin$ to select Hanako as antecedent, as the process of substitution is a computational action, and hence optional. So, should the option of substituting $Fo(i, y, Hanako'(y))$ not be taken up at the point at which $zibunzisin$ is parsed and decorates the unfixed node, its metavariable remains uninstantiated until the point at which it can be merged as the object of $hihansita$. At this point, the closest available subject antecedent is Jiro. Since substitution must now take place to allow the propositional tree to be completed, the anaphoric metavariable is identified as $Fo(i, z, Jiro'(z))$, giving the interpretation for (6.69) of ‘Taro thinks that Hanako said that Jiro criticised himself’. As we would expect, these two interpretations are reported to be equally natural, since no step of structural abduction was necessary in the derivation of either interpretation.

Finally we get to (6.70), and here, with its three possible interpretations, an intervening step of abduction becomes essential. As in (6.69), a step of Generalised Adjunction can be presumed to apply following the parsing of the matrix subject, and the immediately succeeding anaphor can be construed as sharing the $Fo$ value of that matrix subject, i.e. as $Fo(i, x, Taro'(x))$, as shown in (6.75).

(6.75) Parsing Taro-ga zibunzisin-o Hanako-ga Jiro-ga hihansita:

There is also the interpretation of (6.70) in which the metavariable projected by the anaphor is not identified until the node it decorates is merged with the object argument node of $hihansita$ at which point it can be identified relative to the most deeply embedded subject, hence as $Fo(i, z, Jiro'(z))$. However, there is, in addition, the possibility of identifying $zibunzisin$ as picking out Hanako-ga, which follows it in the string. This is because in the evaluation of the unfixed node decorated by the anaphor down through the tree, there is an interim transition step in which the structural description provided by the locality specification will pick out Hanako-ga as the “closest” subject. This occurs once the decoration of the node associated with construal of Hanako-ga has been completed, allowing evaluation of the unfixed node relative to that fixed node, prior to construction of any more subordinate structure, hence prior to evaluating it relative to the node decorated by $Fo(i, z, Jiro'(z))$, as shown in (6.76):
In all three of these interpretations, structural abduction will be essential: without such an enrichment step, exactly as in the cases of long-distance scrambling already seen, the unfixed node which zibunzisin decorates will not be able to be merged with the object node of the complement structure provided by hihansita. So we get some basis for anticipating both the left-right asymmetry displayed in (6.68)-(6.70), and the reported reduced acceptability of (6.70).

It is notable that this analysis emerges from the dynamics of introducing a left-dislocated term as decorating a node without a fixed tree node which itself has an underspecified Formula value. The distribution of the different forms of construal of zibunzisin is simply a reflex of the interaction between the resolutions of the structural underspecification intrinsic to GENERALISED ADJUNCTION and *ADJUNCTION, on the one hand, and the content underspecification expressed with a meta-variable as Formula on the other.\textsuperscript{45} Moreover, we have retained the essentially local character of zibunzisin while capturing what look like thoroughly non-local antecedent-anaphor relations: in particular, we have had no need to postulate the existence of a separate logophoric pronoun.

Finally, in our analysis of scrambling in Japanese, we come to the surprisingly restricted potential of a quantifying expression to bind a pronoun that follows it in the linear order. From a left-peripheral position, quantifying expressions can only be taken to bind a pronoun in some immediately following subject position if they are construed as in the same clause as that subject, and not if they are construed in a subordinate clause. Again we have a constraint in construal across two intervening subject expressions:\textsuperscript{46}

\begin{itemize}
  \item (6.77) \textit{dono hon-ni-mo sono tyosya-ga keti-o tuketa} which book\textit{DAT}-even its author\textit{NOM} criticism\textit{ACC} gave
    
    \textit{‘Every book its author criticised.’}
  \item (6.78) \textit{dono hon-ni-mo sono tyosya-ga Hanako-ga keti-o tuketa to itta} which book\textit{DAT}-even its author\textit{NOM} Hanako\textit{NOM} criticism\textit{ACC} gave COMP said
    
    \textit{‘Every book its author said that Hanako criticised.’}
\end{itemize}

\textsuperscript{45}This is in contrast to the Saito form of analysis, for which an additional A feature needs to be defined just in order to allow the facts to be expressible within the general movement account. The feature may seem reasonably well motivated, but it is a stipulation none the less.

\textsuperscript{46}These examples and translation are from Saito (2003).
6.4. **TOPIC-MARKING AND LINK**

As promised above, we now turn to seeing how the concept of building linked structures applies in the analysis of the Japanese topic marker *-wa*.

The first and obvious application is to topic marking. Verb-final languages characteristically have so-called topic markers, generally left-peripheral in the sequence:

(6.79) *Ringo*-wa *Akiko*-ga *muita* to *itta*

Apple_{TOP} Akiko_{NOM} peeled COMP said

‘The apple, Akiko said she peeled it.’

(6.80) *Akiko*-wa *ringo*-o *muita* to *itta*

Akiko_{TOPIC} apple_{ACC} peeled COMP said

‘Akiko, she said she peeled the apple.’

Such topic-marked expressions project some structure that is quasi-independent of the string that immediately follows, individuating one term in the structure that is to be projected as to be in some sense the term about which the following assertion is made. Structurally, as already hinted, this strategy is exactly that of hanging topic left-dislocation structures that we have seen in head-initial languages. The topic-marked expressions do not have to be construed within the same local structure.
as given by the verb whose argument they provide; and there is no sensitivity to island restrictions:

(6.81) \( \text{Masa-wa Akiko-ga muita to itta ringo-o tabeta} \)
Masa_{TOPIC} Akiko_{NOM} peeled COMP said apple_{ACC} ate

‘As for Masa, he ate the apple which Akiko said she peeled (for him).’

(6.82) \( \text{Tanaka kyooju-wa kaita ronbun-o koosei shiteita} \)
Tanaka Prof_{TOP} wrote paper_{ACC} correction did

‘Speaking of Professor Tanaka, the student who was correcting the paper that he wrote had disappeared.’

Notice how in these cases, the anaphoric dependence of the argument of the most nested verb and the topic-marked expression is entirely natural: because of its linear positioning, it is closest to the left-peripheral topic marker.

The only difference from the analogous construction in head-initial languages is that the topic-marking suffix itself imposes the requirement of the copy to be constructed, so the action is lexically driven as given in (6.83).

\[
\begin{align*}
\text{IF} & \quad F o(\alpha), T y(\epsilon) \\
\text{THEN} & \quad \langle L \rangle T n(\alpha) \\
(6.83) & \quad -w a \quad \text{THEN} \quad g o(\langle L \rangle); p u t(\langle U \rangle (D) F o(\alpha)) \\
\text{ELSE} & \quad A b o r t \\
\text{ELSE} & \quad A b o r t
\end{align*}
\]

-\( wa \) is thus defined as requiring a completed node to which some additional structure is built as to be LINKed, from which it imposes a requirement on some node of the tree under construction that it be developed so as to contain a copy of the term just constructed. In other words, it is much like the complex preposition \textit{as for} in English, except that it is defined as a suffix, and so does not itself induce the construction of the LINKed node. Moreover, unlike English, Japanese is fully pro-drop so a pronoun is not required to establish the copy in the tree of the constructed term. (6.84), which is the translation-equivalent of (6.82), involves essential use of the pronoun:

(6.84) As for Professor Tanaka, the student who had corrected his paper had disappeared.

Once having introduced such a LINKed structure, with its imposition of a requirement for the copy, a pronoun may be used, but it is not necessary:

(6.85) \( \text{Masa-wa Akiko-ga soitu-ni muita to itta ringo-o} \)
Masa_{TOP} Akiko_{NOM} that guy_{DAT} peeled COMP said apple_{ACC}

\( \text{Mamoru-ga tabeta} \)
Mamoru_{NOM} ate

‘As for Masa, Mamoru ate the apple which Akiko said she peeled for Masa.’

Because no case marking is involved (indicating some particular hierarchical position in the configuration), the tree decorated by the \( -w a \)-marked expression and the tree projected from the remainder of the string do not need to \textsc{merge}, and the two structures remain in the output structure sharing a common term. This is all exactly as we expect from an analysis of a LINK relation holding between the term
projected from the left-peripheral expression and the remainder string. We then expect no island constraints, as the relation between the term and the remainder of the string is established solely through anaphora resolution.

Since, furthermore, the left-peripheral expression is in a quasi-independent structure, with no dominating node requiring $?Ty(t)$ at which scope statements might be collected, we do not expect any accompanying scope actions, and so we do not expect quantified expressions to occur in that position. This is indeed a well-known restriction on topic structures. We also expect the displacement data discussed in section 6.3.1, where a -wa-marked expression intervenes between a -ga-marked expression and its co-arguments, with just the extension of the requirement imposed by the processing of -wa that the required copy which the LINK transition imposes can occur anywhere at all in the structure under construction, hence the restriction takes the form $?\langle U \rangle \langle D \rangle \text{Fo}(\alpha)$.\(^{47}\)

There is much more to be said here. First, there is a very strong preference to use -wa as indicating which is the matrix subject argument, counter-balancing the effect otherwise of building up interpretation from the most subordinate structure first. Secondly, -wa, as a topic marker, is used both for contrastive purposes, and to set a background topic. These are standardly analysed as two discrete uses of wa: “contrastive” wa and “topic” wa. However, as we already saw briefly in section 4.2.3, the projection of an initial linked structure can be used either as a basis for setting up an anaphoric link with some larger context, or for introducing a context specifically for the subsequent tree construction process, hence in contrast to the larger context. There is thus reason, to the contrary, to think the contrastive use of -wa is sufficiently well-characterised by the LINK analysis. So the general pattern of left-peripheral topic effects repeats itself in verb-final languages, buttressing the analysis of chapter 4 in terms of building up such structures as paired anaphorically connected structures.

### 6.5 Relative Clause Construal

Relative clause construal is the central phenomenon for which the building of LINKed structures is motivated; and its application to Japanese is essential to our larger objective, which is to round out the account set out in chapter 3 with its associated relative-clause typology set up in chapter 4. It is in verb-final languages that an anaphora-style analysis of relative clauses is regularly invoked (Dayal 1996); and the commitment to this style of analysis as a cross-linguistic basis for all forms of relative clause construal yields the striking bonus of anticipating in detail the phenomenon of so-called head-internal relatives, as we shall shortly see. But, to get there, we need to proceed in an orderly fashion by taking stock of the general picture of relative clause construal, as we now envisage it, and then proceed through presentation of the more familiar head-final relatives.

In discussing relative clause construal for head-initial languages in chapter 3, we presumed that the LINK relation is constructed in an essentially asymmetric way, and, furthermore that the antecedent term which provides the basis for the encoded anaphoric connection between the paired structures provides the input to the transition which leads to the construction of the appropriate LINK relation. However, as we have seen throughout the preceding chapters, the trees themselves are a representation of semantic content, with no reflex of linear order. Equally, the

\(^{47}\) It is these cases which lead us to define the requirement which -wa imposes as $?\langle U \rangle \langle D \rangle \text{Fo}(\alpha)$. Otherwise, the transition might be seen as occurring only at the rootnode and imposing a requirement on a node requiring $?Ty(t)$ of the form $?\langle D \rangle \text{Fo}(\alpha)$, constraining all downward development.
LINKed structure could be projected first and an anaphoric connection established from that structure onto some following structure; and it is this inverse ordering that Japanese relative clause construal displays. What we now have to do is see to what extent the mechanisms we have introduced apply in the characterisation of Japanese relative clause construal without further modification.

In shifting into exploring such a use of LINKed structures, we face what is for other frameworks another major hurdle. There are the two major forms of relative clauses in Japanese. On the one hand, there is the regular reverse pattern of English-like languages, in which the relative clause sequence precedes the head:

(6.86) *Hiroto-ga muita ringo-o Akiko-ga tabeta*

   Hiroto\textit{NOM} peeled apple\textit{ACC} Akiko\textit{NOM} ate

   ‘Akiko ate the apple Hiroto peeled.’

There are also the head-internal relatives in which what constitutes the head is presented \textit{within} the relative sequence while nevertheless also functioning as an argument in the main clause:

(6.87) *Hiroto-ga sanko-no ringo-o muita no-o Akiko-ga tabeta*

   Hiroto\textit{NOM} three\textit{GEN} apple\textit{ACC} peeled no\textit{ACC} Akiko\textit{NOM} ate

   ‘Akiko ate the three apples Hiroto peeled.’

In (6.87) the expression \textit{sanko no ringo-o} serves to provide the object argument for the predicate projected by the verb \textit{tabeta} (‘ate’); but, in addition, this expression projects the object argument of \textit{muita} (‘peeled’) which it precedes, and the whole is construed as a form of relative.

This second form of relative is extraordinarily problematic for standard assumptions about relative clauses and the structure to be assigned them, for instead of the head being in some dominating position, it is, to the contrary, contained within it. The supposed relation of domination (actually c-command) between the head and the modifying relative is not displayed at all; and the expression which has to be construed as satisfying whatever selectional restriction are imposed by the clause within which it is construed as an argument (i.e. the higher clause) in fact occurs in the middle of a quite separate (subordinate) clausal sequence.

### 6.5.1 Head-final Relatives

As we have already noted, the general problem posed by Japanese, and by relative clauses in particular, is the multiple ambiguity presented by strings. Yet one aspect of interpretation of relative clauses about which there is no under-determinacy is the indication of the point at which the LINK relation has to be constructed: this is completely fixed. The sequence verb-nominal unambiguously indicates that some sequence of expressions preceding the nominal \textit{must} be used to construct a relative clause construal modifying that nominal.\[48\]

\[48\]In modern Japanese head-final relatives, the indication of the relative clause boundary is provided solely by the positioning of the noun immediately following the verb. It is invariably indicated by lack of intonational break between verb and head; see Kurosawa (2003). Indication of such a LINKed structure relation may be provided earlier. See Yoshida \textit{et al.} (2004) for evidence from quantifier float data that a quantifying determiner agreeing with the head may precede the whole relative-clause sequence, by its very mismatch between the classifier it bears and the NPs that follow indicating the upcoming LINK transition.
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(6.88) Hiroto-ga muita ringo-o tabeta
Hiroto\textsubscript{NOM} peeled apple\textsubscript{ACC} ate

‘Hiroto ate an apple he peeled.’
‘Sue (or someone else) ate an apple Hiroto peeled.’
‘Hiroto ate an apple Sue (or someone else) peeled.’

In order to bring out exactly what is needed, we give a step-by-step construction of (6.89):

(6.89) Hiroto-ga muita ringo-ga oisikatta
Hiroto\textsubscript{NOM} peeled apple\textsubscript{NOM} tasty\textsubscript{PAST}

‘The apple which Hiroto peeled was tasty.’

As with construal of complement clauses, the first action is to introduce the intermediate type $t$-requiring node by \textsc{Generalised Adjunction}. Going step by step through a parse of (6.89) from such a node, the noun phrase \textit{Hiroto} decorates an unfixed node of type $e$ annotated with $\text{Fo}(\iota, x, \text{Hiroto}'(x)), Ty(e)$, for which the suffix -\textit{ga} adds the fixed relation $\langle \uparrow 0 \rangle \langle U \rangle Tn(0)$. These steps are shown in (6.90).

(6.90) Parsing Hiroto-ga in (6.89):

\begin{align*}
\text{Axiom Generalised Adjunction} \\
Tn(0), ?Ty(t), \Diamond &\quad \mapsto \quad Tn(0), ?Ty(t) \\
\quad &\quad \mapsto \quad \langle U \rangle Tn(0), ?x. Tn(x), ?Ty(t), \Diamond \\
\text{*Adjunction} \\
Tn(0), ?Ty(t) &\quad \mapsto \quad Tn(0), ?Ty(t) \\
\quad &\quad \mapsto \quad \langle U \rangle Tn(0), ?x. Tn(x), ?Ty(t), \Diamond \\
\quad &\quad \mapsto \quad \langle \uparrow 0 \rangle \langle U \rangle Tn(0), ?x. Tn(x), Ty(e), ?Tn(x), \Diamond
\end{align*}

Then, having the pointer back at the top node of this intermediate type-$t$-requiring node, the lexical specification of \textit{muia} in (6.91) leads to the construction of a tree whose nodes of type $e$ are annotated with meta-variables that require identification as shown in (6.92), where the subject node decorated collapses with the first of these, just as in the characterisation of subordinate clauses.
CHAPTER 6. THE CHALLENGE OF JAPANESE

(6.91) mui

\[
\begin{align*}
\text{IF} & \quad \{?T y(t)\} \\
\text{THEN} & \quad \text{make}((\downarrow 0)); \text{go}(\downarrow 0); \text{put}(F o(U), T y(e), ? \exists x. F o(x)); \text{go}(\downarrow 1); \\
& \quad \text{make}(\downarrow 1); \text{go}(\downarrow 1); \text{put}(?T y(e \rightarrow t)); \\
& \quad \text{make}(\downarrow 1); \text{go}(\downarrow 1); \\
& \quad \text{put}(F o(M u', T y(c \rightarrow (e \rightarrow t)), [\downarrow \bot]); \text{go}(\uparrow 1); \\
\text{ELSE} & \quad \text{Abort}
\end{align*}
\]

(6.92) Parsing Hiroto-ga mui:

\[
\begin{array}{c}
\begin{array}{c}
T n(0), ? T y(t) \\
\vdots \\
(U) T n(0), ? \exists x. T n(x), ? T y(t)
\end{array}
\end{array}
\]

\[
\begin{array}{c}
\begin{array}{c}
F o(i, x, Hiroto'(x)), \\
F o(U)
\end{array}
\end{array}
\]

\[
\begin{array}{c}
\begin{array}{c}
? T y(e \rightarrow t) \\
F o(V), \exists x. F o(x) \\
T y(e), \Diamond
\end{array}
\end{array}
\]

\[
\begin{array}{c}
\begin{array}{c}
? T y(e \rightarrow t) \\
F o(M u')
\end{array}
\end{array}
\]

What now of the object node, with its metavariable decoration? One of the verb’s arguments has to be kept in some sense open in order to be identified as an argument of the predicate of the head noun once that is introduced subsequently. Yet we need to presume that Completion and Elimination will all successfully apply to yield a propositional structure in order that the tense suffix can be parsed. In order for these rules to take place, all requirements must have been satisfied. This is the heart of how a compositionality constraint applies to the compilation of interpretation on the resulting tree structure, and was critical to the account of expletives in chapter 5.

It might look as though we have a number of choices, but in fact they reduce to effectively the same one. If the metavariable is a decoration provided for an unfixed node we might allow that metavariables are not always identified on line, as long as the process of substitution can apply at the subsequent point at which the node in question is assigned a fixed value. But if the node is projected by the verb’s template, as it is in these structures, then, since it is the verbs that provide fixed templates of structure, this argument node will be at least fixed relative to the predicate that introduced it. So, in order to compile an interpretation for this structure, there is really only one course of action: to enrich the metavariable by a step of abduction. In this case, the step of abduction is to construct a fresh variable that instantiates the metavariable and satisfies its formula requirement. Without such an assumption, no completed decoration can be provided for the LINKed structure, so the abduction process is effectively obligatory, just as in the enrichment of the subordination relation in establishing long-distance dependency construals. Such a move has the effect of making possible the projection of a propositional formula, from which a LINK transition can indeed be licensed, see (6.93).
6.5. RELATIVE CLAUSE CONSTRAUL

(6.93) Parsing *Hiroto-ga mui* after abduction:

\[
\begin{align*}
&T_n(0), ?T_y(t) \\
&(U) T_n(0), ?\exists x T_n(x), T_y(t), F_o(Mui'(v)(e, x, Hiroto'(x))), \Diamond \\
&F_o(t, x, Hiroto'(x)) & T_y(e \rightarrow t), F_o(Mui'(v)) \\
&F_o(v), F_o(e), T_y(e) & F_o(Mui')
\end{align*}
\]

A LINK adjunction transition for relative construal is then induced by a computational action which is the mirror-image of the head-initial transition in a language such as English. For this, we define a rule whose input is some complete decorated formula of type \( t \), containing some formula of type \( e \). A node is created to which the propositional node is LINKed; and this node gets decorated with \( T_y(e) \) and a copy of the selected term. From this node, a further new node, decorated with \( ?T_y(e) \), is created that locally dominates this node. The complex of actions shown in the LINK ADJUNCTION rule for Japanese in (6.94) is, in fact, an amalgamation of an inverse of the rule for English plus the construction of a node decorated by \( T_y(e) \) that dominates the internal type \( e \) node. The latter is a remnant of the lexical actions which we assume were associated with the relativising particle in classical Japanese which immediately followed the verb, as in present-day Korean. This is lost in modern Japanese which uses just the order itself to provide this structural information.

(6.94) LINK ADJUNCTION (Japanese):

\[
\begin{align*}
&\{\ldots \{T_n(n), T_y(t), \ldots, \Diamond \} \ldots \{|\ast\} T_n(n), F_o(x), T_y(e) \ldots\}\} \\
&\{\ldots \{T_n(n), T_y(t), \ldots\} \ldots \{|\ast\} T_n(n), T_n(a), F_o(x), T_y(e) \ldots\}, \\
&\{\{|\ast\} L T_n(n), F_o(x), T_y(e)\}, \\
&\{\{|\ast\} L T_n(n)\}, \\
&\{\{|\ast\} L T_n(n), (U) T_n(0), ?\exists x T_n(x), \Diamond\}\}
\end{align*}
\]

The effect is displayed in the tree in (6.95). In the parsing of (6.89), having constructed a formula \( F_o(Mui(v)(e, y, Hiroto'(y))) \) and parsed the tense suffix, what is copied over to the new structure is the variable \( v \) embedded within another type \( e \) structure. Notice in (6.95) how this composite tree contains the subpart of a LINKed structure as projected for English construal (see chapter 3), but with a ‘containing’ structure that is itself entirely unfixed with respect to the root. Notice, too, how each of the steps to get to this juncture is in effect driven by the tense and the imposition of a LINK transition by the adjacency of verb plus noun, for at each step the next update relies on the previous update having taken place. We can set this out through a chain of reasoning as follows.
The metavariable decorating the object argument node cannot be left without any formula replacing it, as otherwise, with one requirement remaining open, the propositional structure could not be compiled. Hence a fresh variable is constructed by assumption (being a variable, it has no attendant scope statement). The necessity of applying Completion and Elimination to provide Formula values for the non-terminal nodes in the structure is driven by the tense specification with its trigger condition that a type $t$ tree is completed. And the LINK transition, much like the specification of -to, closes off the decoration of that LINKed structure by requiring the top formula of that structure to be compiled, carrying over a copy of the variable left in the propositional formula and with its place in some term under construction determined, despite not yet being fixed in the overall structure.\footnote{There are issues to be explored as to how the construal of head-final relative clauses interacts with the evaluation of quantifying terms, which we entirely leave on one side.}

The rule in (6.94) does not itself determine that what is copied over into the new structure is a variable, since it turns out that variables are the only formula values which can decorate this node. This is because, as a result of the transition defined by the rule, the pointer is now at an open type-$e$-requiring node which necessarily immediately triggers the parse of some noun (rather than allowing, for example, the parsing of a case suffix). Recall from the lexical actions associated with ringo in (6.13) on page 196 that nouns project full quantifier structure in Japanese. This means that a parse of some noun after the construction of the tree in (6.95) will give rise to a quantifier structure with a fresh variable decorating the internal $Ty(e)$ node, as shown in (6.96) (with any nodes with the same treenode identifier constructed twice collapsing immediately, as in other derivations).

(6.96) Parsing Hiroto-ga muita ringo:
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Because this internal term structure is induced, nothing other than a variable will
be possible as a decoration on the node containing the copy of the term from the
LINKed structure. Moreover, this variable can only be identical to the variable
already abduced to allow completion of the newly LINKed tree. Even this does
not need particular stipulation in either the rule itself, or in the particular up-
date actions induced by the noun. The checking action associated with putting a
fresh variable, which is part of the actions induced by the noun, checks only those
variables already used in scope statements;\(^{50}\) and the copied variable is merely an
assumption without any associated scope statement. So nothing prevents selecting
the copied variable, and indeed choice of this variable is the only possible selection
to obtain a consistent set of decorations at this node. It therefore follows that only
a variable can be copied over from the completed propositional tree onto the head,
and only that variable will then be bound by the epsilon operator introduced in the
parsing of the noun.\(^{51}\)

As can be seen from (6.96), the parsing of (6.89) leads to a structure which is
exactly that of the relative clause construal set out in chapter 3 except for the tree
node identifiers, which bear record of the fact that the structure is being induced
upwards. The topnode of this structure is additionally characterised as being below
whatever node the propositional formula providing the restrictor (from the relative
clause) is below: i.e. below the starting point of the whole subroutine of processing
the relative. This is formulated in the LINK adjunction rule as the declaration
that given the construction of a LINK relation from a node within a structure of
topnode \(T_n(a)\), the newly introduced containing node of type \(e\) across that LINK
relation is also below \(T_n(a)\).

Once this structure is projected in the construal of (6.89), the evaluation of this
subtree together with its LINKed tree can take place, exactly as in English. Recall
that the sequence of words so far parsed in setting out the derivation of (6.89)
is \(\text{Hiroto-ga muita ringo}\), a sequence of ‘relative clause plus head’. The formulae
projected by the common noun and by the LINKed propositional structure are
combined together exactly as in head-initial languages through an application of
LINK EVALUATION 1 (see (3.13) on page 79), to yield a type \(cn\) term:\(^{52}\)

\[
Fo(x, \text{Ringo}'(x) \land S_i : \text{Mui}^2(x)(i, y, \text{Hiroto}'(y)))
\]

‘apple that Hiroto peeled’

The whole term can now be compiled to give a substructure consisting of a term
with a propositional structure LINKed to its internal variable, that is exactly as in
English. The only difference at this point in the parse is the fact that the structure
is radically unfixed within the unfolding tree, as shown in (6.97).

\(^{50}\)For the details of the checking procedure for determining what constitutes a fresh variable,
see Kempson et al. (2001: ch.7).

\(^{51}\)An alternative analysis, as was pointed out to us by Masayuki Otsuka, is to assume that the
relative clause structure contains a (weakly specified) epsilon term to be copied onto the head in
the primary structure for development, rather than a variable. However this analysis remains to
be set out in detail, so we do not adopt it here.

\(^{52}\)See Kurosawa (2003) for detailed justification of this analysis and the interaction of structural
and pragmatic factors in determining relative clause construal in Japanese.
Compiling *Hiroto-ga muita ringo*:

This presents us with an apparently new problem. The parse routine has induced a structure from the bottom up without having determined the role of that structure within the overall structure currently under construction. Without this being determined, a scope relation for the constructed term cannot be defined in the locally containing structure. This underspecification must therefore be resolved. It is again a suffix, the case suffix, that induces the requisite structure, not merely closing off the structure just completed, but constructing a relation in the tree from that now completed node. Indeed as we have already seen, this is how case suffixes function in short scrambling environments, providing the necessary enrichment. But in the current situation, where there is no introduced superstructure, other than the original starting point, we have two possibilities.

One is to take the term constructed as decorating a node which is assigned a relation relative to that point of departure, in (6.89) the root node, by a direct step of enrichment as in complement clause construal. By this route, given a *-ga* marked expression, we would have:

\[
\langle U \rangle Tn(a) \leadsto \langle 1_0 \rangle Tn(a)
\]

and similarly for the other case-markers, though in these other cases this update will need to be an abductive step. The other alternative, which will have to be invoked in cases where relative clauses are modifying terms in subordinate structures, is to allow the construction of an arbitrary intermediate node to allow for the development of further levels of embedding. To allow for this latter possibility, what we now need in order to preserve the same analysis is to presume on a general characterisation of a rule that is the inverse of LOCAL*ADJUNCTION. The rule is given in (6.98) and the tree growth effect in (6.99).
6.5. Relative Clause Construal

(6.98) Inverse Local*Adjunction (Rule):

\[
\{\ldots \{T_n(n), ?T_y(t), \ldots \}\ldots \{T_n(b), (U)\mathcal{X}, ?\exists x. T_n(x), F_0(a), T_y(e)\ldots, \diamond\}\} \]

(6.99) Inverse Local*Adjunction (Treegrowth):

\[
T_n(n), ?T_y(t) \quad \rightarrow \quad T_n(n), ?T_y(t)
\]

\[
T_n(b), (U)T_n(a), F_0(a), T_y(e), \diamond \quad (\downarrow_{10})T_n(b), (U)T_n(a), ?T_y(t), \diamond
\]

\[
T_n(b), (U)T_n(a), F_0(a), T_y(e)
\]

This rule constructs a dominating node as an intermediate type-\(T\)-requiring node from which the subsequent structure will be developed: it is the simple inverse of Local*Adjunction. While it is a stipulation, it is no more than the assumption that propositional structure is always induced locally in Japanese; and in the Osaka dialect, the rule has to be freely available since embedding complementisers are optional. With this rule, the case specifications remain as before with one minor modification – the concept of some independently introduced locally dominating node is generalised to be any node higher than the current node of which there is no closer node of appropriate decorations. The lexical actions associated with the subject marker -\(ga\) are shown in (6.100).

(6.100) -\(ga\)

| IF \(T_y(e)\) THEN IF \((U)(T_n(a))\) THEN IF \((U)(T_n(b))\wedge ?T_y(t)\wedge \)
| \((U)T_n(a) \wedge a \neq b)\) THEN \text{Abort} ELSE \text{Abort}
| ELSE \text{Abort}

What this characterisation of -\(ga\) specifies is that given some dominating node decorated with ?\(T_y(t)\) of which there is no closer node with the same properties, a fixed subject relation is defined, hence a boundary marker for the introduction of proposition-requiring structure. It has to be stated in these relatively abstract terms, rather than in terms of an output filter, because it has to be stated as a condition on action, and the pertinent tree-relations are not yet in place. So the statement of locality follows instead the pattern of the locality constraint of zibunzisin construal.

Since the intervening rule of Inverse Local*Adjunction is optional, the effect is that either \(ga\)-marking has the effect of fixing a subject relation relative to the point of departure (there being no closer node), or with some intervening node having been introduced (by Inverse Local*Adjunction), -\(ga\) marking has the effect of fixing a subject relation to that node. In the case of the derivation of (6.89), we have the former strategy, since the -\(ga\) marking is taken to fix a relation to the rootnode as shown in (6.101).
(6.101) Parsing Hiroto-ga muita ringo-ga:

\[ T_n(0), T_y(t) \]
\[ \langle \uparrow \rangle T_n(0), T_y(e), T_y(t) \]
\[ F_0(\epsilon, v, \text{Ringo}'(v)) \land S_i : \text{Mui}'(v)(\iota, x, \text{Hiroto}'(x)) \]
\[ F_0(v, \text{Ringo}'(v)) \land S_i : \text{Mui}'(v)(\iota, y, \text{Hiroto}'(y)) \]
\[ F_0(\iota, y, \text{Hiroto}'(y)) \]
\[ Mui'(v) \]
\[ F_0(v) \]
\[ F_0(\text{Mui}') \]

With this fixing of an immediate domination relation by the root node, the interpretation of (6.89) can now be completed in a straightforward way. The adjective oisikatta (‘tasty’) projects a subject node decorated with a metavari able that collapses with the subject node already constructed. The tense suffix drives the completion of the propositional structure, and all requirements are finally satisfied. Any accompanying scope statement, which will have to have been constructed during the construction process, will be evaluated to yield a completed logical form. The result is a predicate-argument structure with just the one argument, the result of building the LINKed structure compiled into the restrictor of the term contributing that argument. The final formula is:

\[ \langle S_j < v \rangle F_0(\text{S}_j : \text{Oisika}'(\epsilon, v, \text{Ringo}'(v)) \land S_i : (\text{Mui}'(v)(\iota, x, \text{Hiroto}'(x)))) \]

which is evaluated as:

\[ F_0(\text{Ringo}'(a) \land S_i : (\text{Mui}'(a)(\iota, x, \text{Hiroto}'(x))) \land S_j : \text{Oisika}'(a)) \]

\[ a = (\epsilon, v, \text{Ringo}'(v) \land S_i : (\text{Mui}'(v)(\text{Hiroto}'(v))) \land S_j : \text{Oisika}'(v)) \]

The construction of relative clauses on nouns with other case suffixes, as in (6.102) equally follows the pattern already set up for simple clauses, though, as with -ga we have to generalise the form of decoration to apply to some closest dominating node, as shown in (6.103).

(6.102) Hiroto-ga muita ringo-o tabeta
Hiroto\text{NOM} peeled apple\text{ACC} ate
‘Hiroto ate an apple he peeled.’
‘Sue (or someone else) ate an apple Hiroto peeled.’
‘Hiroto ate an apple Sue (or someone else) peeled.’
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The only difference from the subject-marked nouns, again as before, is to assume that the step which enriches the weak tree relation between the node decorated by the case suffix and some higher node is an abduction step rather than being encoded in the specification of the case marker. Just as with possible derivations involving -ga marking, a step of INVERSE LOCAL*ADJUNCTION is an option, so the case marking update will either fix the relation to the point of departure (if INVERSE LOCAL*ADJUNCTION does not apply) or to some sub-structure node (if it does).

In the projection of (6.89) and (6.102), we have still kept things relatively simple by projecting the LINKed structure for the relative clause sequence initially in the string, and not assuming more levels of embedding than is dictated by the string under consideration. But these strategies may apply at arbitrary depths of embedding, and in all such cases INVERSE LOCAL*ADJUNCTION will become essential.53

(6.104) shujutsu-o okonatta isha-ga byooki-o shinpaisita
operation_ACC did doctor NOM disease_ACC worried

kanja-o hagemashita
patient NOM encouraged

‘The doctor who did the operation encouraged the patient who worried about his disease.’

The LINKed structure may involve a transition to a head which is subordinate to some finally added verb as in (6.105), or across a further link relation:

(6.105) Masa-wa Yuki-ga muita ringo-ga oisikatta to itta
Masa TOP Yuki NOM peeled apple NOM delicious COMP said

‘Masa said that the apple Yuki peeled was delicious.’
‘The apple Yuki peeled, Masa said was delicious.’

(6.106) Tanaka kyooju-wa kaita ronbun-o koosei shiteita
Tanaka Prof TOP wrote paper NOM correction did
gakusei-ga inakatte shimatta
student NOM had disappeared

‘Speaking of Professor Tanaka, the student who corrected the paper that he wrote had disappeared.’

We do not give the full sequence of transitions for any such derivations, because the examples already set out have established the individual patterns.54 There is, transparently, a whole field of research to be done on the interaction of linear ordering, scope choices and depths of embedding. For our purposes, it is sufficient to have given a sense of the overall dynamics.

53This example is from Nakayama (1995).
54And keeping one’s head down in the explicit details of a construction process is hard work on the reader!
6.5.2 Head-Internal Relatives

At last we get to a discussion of head-internal relatives, and these come as a reward for having worked through all the details of the previous sections. This is because, with head-internal relatives, the distribution and form of construal emerge as consequences of independently motivated details of the formalism. This result is a real bonus, because these structures are so highly problematic for all other frameworks, with the head-variable binding relation all entirely contrary to the expected c-command relation taken otherwise to hold between head and position in the relative to be bound. This structure is generally presumed to be idiosyncratic to head-final languages, and, given the anaphoric character of the process of building LINKed structures, we can now see why it occurs in this type of language.55 Pairs of LINKed structures are built up by a serial strategy of inducing one structure and then ensuring that the second structure that is induced shares a term with the structure already (partially) completed.56 This analysis leads us to expect that languages such as Japanese in which the relative clause precedes the head should also display relative clauses in which the antecedent for the head is contained within that clause, with the head following and projected by a pronominal device. Such a sequence follows the natural direction of anaphoric construal: the antecedent precedes, the anaphoric expression follows. And this is, indeed, what we find in the head-internal relatives:

\[(6.107) \text{John-wa [Mary-ga sanko-no ringo-o muita-no]-o tabeta} \]
\[
\begin{align*}
\text{John} & \quad \text{TOP} \\
\text{Mary} & \quad \text{NOM} \\
\text{three} & \quad \text{GEN} \\
\text{apple} & \quad \text{ACC} \\
\text{peeled} & \quad \text{ACC} \\
\text{ate} &
\end{align*}
\]

‘John ate three apples Mary peeled.’

The interpretation is that of a relative; but the only marker of it being a relative is the case-marking and the nominaliser -no (which morphologically is also a genitive marker, also used for preposed quantifiers).

These sequences are interpreted as relative clauses modifying some argument in the primary structure, the two structures sharing some term just like other relatives. A distinctive property is their interpretation. It is not simply the term sanko no ringo o (‘three apples’) which is interpreted as the head of the relative in \(6.107\). The interpretation of the head has to be the more fully specified ‘the three apples which Mary peeled’ (Hoshi 1995). This is directly analogous to the so-called E-type effect of pronouns (see chapter 1). These are pronouns whose antecedent is in some sense computed by taking the entire clause containing that antecedent term, and reflecting the content of the whole within that term:

\[(6.108) \text{Most people left the party. They were tired.} \]

The interpretation of the subject of the predicate ‘tired’ is not simply some large proportion of the indicated set of people. It is those people who left the party. In exactly parallel fashion, the interpretation of the head of head-internal relatives is not simply that of the noun phrase sequence itself, but of the term projected from the noun phrase sequence as construed within the context of the containing propositional structure.

A definitive property of these clauses, as strings, is that they invariably present a full sentential sequence, within their containing context. Unlike the head-final

\[^{55}\text{Contrary to general expectation, it is in fact displayed in restricted form in head-initial languages, as headless relatives of the type What we ate upset us.}\]

\[^{56}\text{A more abstract analysis is proposed in Otsuka (1999), in which the building of a LINK transition is taken to be logically independent of the imposition of an anaphoric connection between pairs of trees. In this connection, see chapter 7, and the account of co-ordination proposed there.}\]
relative in which one argument is canonically absent.\footnote{Japanese also displays so-called headless relatives, which we do not take up here. See Kurosawa (2003) for a DS account of this construction.} in these clauses, to the contrary, nothing is missing. So for example in (6.107), leaving John wa on one side as an independent tree to which what follows is LINKed, the sequence Mary-ga sanko no ringo-o muita (‘Mary peeled three apples’) constitutes a perfectly well-formed sentence of Japanese, the words presenting everything necessary to complete a propositional formula together, given general principles for compiling an interpretation for the sequence. It is this fact which provides the clue to their analysis.\footnote{See Otsuka (1999) for an account of head-internal relatives within the DS framework, and also Kempson et al. (2003).}

Recall how the analysis of quantification involves the construction of terms which are representations of an arbitrary witness which guarantees the truth of the formula constructed. The construction of terms, that is, reflects the predicate-argument array directly; and the semantic algorithm which dictates how such terms are to be construed packs the entire content of the propositional formula, including all information about scope-dependency, into the terms themselves (see (3.76) on page 112 in chapter 3).

This analysis now comes into its own, for the DS framework, given the account of quantification as terms of type $e$, might have been defined to match the semantic particularity displayed by head-internal relatives. Consider the substring Hiroto-ga sanko-no ringo-o muita of the sentence in (6.109).

\begin{align*}
(6.109) & \quad \text{Hiroto-ga sanko-no ringo-o muita} \\
\quad & \quad \text{Hiroto}_{\text{NOM}} \quad \text{three}_{\text{GEN}} \quad \text{apple}_{\text{ACC}} \quad \text{peeled}_{\text{NO-ACC}} \quad \text{ate} \\
\quad & \quad \text{‘Hiroto (or someone else) ate the three apples Mary peeled.’}
\end{align*}

This is a complete clausal string that can stand independently as a sentence in Japanese meaning ‘Hiroto peeled three apples’. As we have seen, the method of scope evaluation takes a clausal sequence containing a full array of quantified noun phrases and evaluates this relative to some accompanying scope statement to yield fully evaluated terms of type $e$. It is this process of evaluation that enables our account of head internal relative clauses.

To see why this is so, we give a partial specification of the steps involved. In parsing the sequence Hiroto-ga sanko-no ringo-o muita, all the information necessary to complete and evaluate a propositional structure is provided, as illustrated in the tree in (6.110) which is constructed exactly as we have seen before with progressive fixing of initially unfixed nodes.\footnote{We make no pretence to provide an account of plurality here, merely giving the information associated with sanko (‘three’) as a suffix on the quantifying term-operator.} The rules for evaluating quantified formulae will apply to (6.110), so the scope statements introduced in the parsing of any quantifier expression plus the attendant tense specification will be evaluated together to yield a fully determined propositional formula and completed epsilon terms.
(6.110) Parsing *Hiroto-ga sanko-no ringo-o muita*:

\[ Tn(0), ?Ty(t) \quad \vdots \quad \langle U \rangle Tn(0), Ty(t), \text{Scope}(S, < x), Fo(S_i : \text{Mui}'(\epsilon_3, x, \text{Ringo}'(x))(t, y, \text{Hiroto}'(y))), \diamond \]

\[
\begin{array}{c}
Fo(t, y, \text{Hiroto}'(y)) \\
Fo(Mui'(\epsilon_3, x, \text{Ringo}'(x))) \\
Fo(\epsilon_3, \text{Ringo}'(x)) \\
Fo(Mui')
\end{array}
\]

The interpretation of the clause within (6.110) is shown in the evaluation of (6.111a) as (6.111b).

(6.111) 

a. \( \langle S_i < x \rangle \ Fo(Mui'(\epsilon_3, x, \text{Ringo}'(x))(t, y, \text{Hiroto}'(y))) \)

b. \( Fo(S_i : \text{Ringo}'(a) \land \text{Mui}'(a)(t, y, \text{Hiroto}'(y))) \)

where \( a = (\epsilon_3, x, (\text{Ringo}'(x) \land \text{Mui}'(x)(t, y, \text{Hiroto}'(y)))) \)

The critical difference from head-final relatives and their construal is that there is no free variable in the formula that decorates the propositional tree to be carried across a LINK relation to provide the appropriate term to be shared. However, what can be carried across such a relation is the completed epsilon term shown in (6.111b), i.e.

\( (\epsilon_3, x, (\text{Ringo}'(x) \land \text{Mui}'(x)(t, y, \text{Hiroto}'(y)))) \)

The relevant LINK relation is projected by the nominalising element *no* as a specified LINK-inducing pronominal (6.112).\[ \text{IF} \quad Ty(t) \quad \text{THEN} \quad \text{IF} \quad Fo(\psi[a]) \quad \text{THEN} \quad \text{make}(\langle L^{-1} \rangle); \text{go}(\langle L^{-1} \rangle); \quad \text{put}(Fo(a), Ty(e)) \quad \text{ELSE} \quad \text{Abort} \]

These lexical actions apply to some node decorated with a completed formula of type \( t \) and targets some completed term contained within the evaluated formula that decorates that node. This is the intention behind the use of the notation \( Fo(\psi[a]) \), where \( \psi \) is a complete formula making reference to some complete term \( a \). The nominalising suffix then builds an inverse LINK transition to create a node to function as argument in some new structure, and then uses the targeted term to decorate this newly created node.

\[ ^{60} \text{The suffix } -\text{no expresses a range of functions; and the challenge of providing a unitary account remains open. See Otsuka (1999) for the outline of an analysis which goes at least some way towards achieving this.} \]
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The effect of this is shown in (6.113).

(6.113) Parsing Hiroto-ga sanko-no ringo-o muita-no:

\[
\begin{align*}
T_n(0), & T_y(t) \\
\langle L \rangle T_n(0), T_y(e), & F_o(a), \Diamond \\
\langle U \rangle T_n(0), T_y(t), & F_o(S, : Mui^i(a)(t, y, Hiroto^i(y))), \Diamond \\
F_o(t, y, Hiroto^i(y)) & F_o(Mui^i(\epsilon_3, x, Ringo^i(x))) \\
F_o(\epsilon_3, x, Ringo^i(x)) & F_o(Mui^i) \\
a = (\epsilon_3, x, (Ringo^i(x) \land Mui^i(x)(t, y, Hiroto^i(y))))
\end{align*}
\]

From this point on, the procedures we have already seen apply to complete the construal of (6.109). The case particle -o identifies this newly introduced node as a node immediately dominated by a predicate node, and by abduction fixes the relation to be that of object to the root node.\footnote{In a more complex structure, \((\text{progressive steps of})\) \textsc{Inverse Local\(^*\text{Adjunction}}\) could of course apply to yield some appropriate level of embedding.}

The verb tabeta is then duly processed as projecting a propositional template from that node, and its object argument node, decorated with a metavariable \((F_o(V))\) as part of the lexical actions of tabe, collapses with the node decorated by \((\epsilon, x, Ringo^i(x) \land Mui^i(x)(t, y, Hiroto^i(y)))\) as non-distinct, as illustrated in (6.114).

(6.114) Parsing Hiroto-ga sanko-no ringo-o muita-no-o tabe:

\[
\begin{align*}
\ldots & T_n(0), T_y(t) \\
F_o(U), & \exists x F_o(x) \\
T_y(e \rightarrow t), & F_o(a), F_o(V), F_o(\text{tabe}') \\
\langle L^{-1}\rangle \langle t_0 \rangle\langle l_1 \rangle T_n(0), T_y(t), & F_o(S, : Mui^i(a)(t, y, Hiroto^i(y))), \Diamond \\
F_o(t, y, Hiroto^i(y)) & F_o(Mui^i(\epsilon_3, x, Ringo^i(x))) \\
F_o(\epsilon_3, x, Ringo^i(x)) & F_o(Mui^i) \\
a = (\epsilon_3, x, (Ringo^i(x) \land Mui^i(x)(t, y, Hiroto^i(y))))
\end{align*}
\]
allowing any choice of dependency, an associated scope statement gets added to the sequence of scope statements for its locally dominating $T_y(t)$-requiring node in a regular way.\[^{62}\] As in the parsing of (6.37), the subject node remains to be identified; but this can be identified as $F_0(t, y, Hiroto' (y))$ as a value taken from the immediate context at this stage in the interpretation process. This anaphoric process parallels the identification of antecedent in the construal of some unexpressed matrix subject following the construction of a complement structure: it is the context from which the formula value is selected, irrespective of the tree relation between the two.

The result will be the logical form in (6.115a) which yields (6.115b) once the scope evaluation algorithm applies, hence the resulting interpretation of (6.109) as ‘Hiroto ate the three apples that Hiroto peeled’. The E-type effect arises because the object term in the primary structure is construed as identical to a term derived from the full process of constructing an interpretation for the relative clause and its containing expressions (ignoring the internal structure of $i, x, Hiroto' (x)$).

(6.115) a. $\langle S_j, x \rangle F_0(\text{Tabe}'(\epsilon_3, x, (\text{Ringo}'(x) \wedge Mui' (x)(i, y, Hiroto' (y)))(i, y, Hiroto' (y))$

b. $F_0(S_j)$

\[ a = (\epsilon_3, x, (\text{Ringo}'(x) \wedge Mui' (x)(i, y, Hiroto' (y)) \wedge \text{Tabe}'(x)(i, y, Hiroto' (y))) \]

In these examples, the pattern of Japanese parsing repeats itself yet again. Without early commitment to precise structural relations between the imposed axiom node and the remainder, composite propositional structure is built up, propositional unit by propositional unit, each subpart, as it is compiled, being used as the context for what follows.

We can now see why it is that head-internal relatives are so problematic for other frameworks, yet straightforward for the DS perspective. In other frameworks, syntax is defined over natural language strings (or some abstraction from them). It is not defined over representations of meaning for that string, as this is the burden of semantics. Syntax in those frameworks merely provides the vehicle over which principles of semantic interpretation are articulated. In Dynamic Syntax to the contrary, syntax is nothing more than the progressive compilation of representations of semantic content. In the head-internal relatives, where everything is available to project a final interpretation of the sub-string comprising the relative before constructing the structure to be associated with the string following the relative, it is precisely the completed interpretation which provides the input to that construction process. That a full lexical noun phrase serving as antecedent might occur within the relative sequence is expected: indeed it is essential to this form of interpretation. The E-type construal is expected: it is the consequence of copying over an evaluated term whose restrictor contains a full record of the scope dependency in the evaluated formula and the resulting interpretation of the antecedent expression. Even the coincidence of head-internal relatives with head-final languages is expected, for it is only if some clause in its entirety precedes the head that such an interpretation (with all scope statements evaluated) will be available. In short, the entire explanation emerges as a consequence of general principles of the dynamics of tree growth for relative clauses and quantified expressions and their interaction.\[^{63}\]

---

\[^{62}\]With no metavariable from some lexical projection and no other quantifying term in this structure, the only possibility is for the copied epsilon term to take narrow scope with respect to the index of evaluation (see chapter 3).

\[^{63}\]Kuroda (1999) identifies five different “look-alike” constructions to head-internal relatives. It remains to be established whether all these construction types can be reduced to the single form.
6.6 Summary

We began this chapter by setting out the perplexing properties of Japanese as illustrative of verb-final languages, and posing the challenge of finding a grammar formalism which expresses the properties of these languages in the same terms as the more familiar head-initial languages and without undue complexity in the analysis. We seem to be close to realising our goal. The dynamics of setting out partial tree structures incrementally and building up propositional structure as further information becomes available has applied in exactly the same terms, and with essentially the same mechanisms as in those languages. The superficial flatness of the languages has been expressed through building underspecified structural relations whenever the lexical actions do not themselves induce the requisite structure. The asymmetry between morpheme simplicity and complexity of structure projected has been straightforwardly definable. And, because the only level of structure that is represented is that of the emergent representation of content, there is no complex mapping from some structure inhabited by the words onto this semantically transparent structure. It is notably the abandoning of the assumption that natural language strings induce a level of structure defined over those strings which has enabled a characterisation of verb-final languages which is commensurate with languages with more fixed word order.

Of course, we have only scratched the surface of Japanese syntax and semantics in setting out this sketch. But what is notable in the account, as indeed all other phenomena we have looked at, is how analyses have invariably taken the form of a direct, even simple-minded, reflection of the way in which interpretation is built up bit by bit. Moreover, we now have our various typologies rounded out. We have relative clause construal involving the building of paired LINKed structures with the propositional structure either constructed after the head or before it, with asymmetry in the different kinds of anaphoric relations between the items in these LINKed structures according as the head or the LINKed structure precede. And we have left versus right periphery effects of the much the same sort across all languages. As we have seen, there is cross-linguistic variation according as left-periphery effects are more or less locally constrained. And, although we have not taken up right-periphery effects in any detail in Japanese, we also anticipate, for example, that the Right Roof Constraint would hold universally, being a constraint on compositionality of content for the resultant structure.

There is, as a coda, the challenge of explaining where Generalised Adjunction and Local* Adjunction might be needed in English, or if not, why not. Motivation for application of Generalised Adjunction is not difficult to find: we arguably need it for modelling attributive adjectives and their construal, exactly as in Japanese but defined as a lexically induced sequence of actions. Many languages allow adjectives both before and after the noun they modify, with singularly little difference, except that the pre-head adjectives invariably lack any tense marking: the tattered book vs. the book that is tattered. Moreover, Japanese is highly exceptional in having fully tense-marked head-final relatives (the standard cross-linguistic pattern is for such head-final relatives to be non-finite), the parallelism suggesting that this is indeed an appropriate parallel to draw. For Local* Adjunction, we suggest that it is only a case of knowing where to look. With structurally fixed subject relations in language such as English, its application would seem to have to be internal to the verb phrase, and indeed many subject-verb-object ordering

\[\text{of analysis provided here.}\]

\[\text{\textsuperscript{64}We would now confidently anticipate, for example, that resumptive pronouns would not occur in head-final languages.}\]
languages display much freer constituent order after the verb, redolent of short scrambling. Another candidate application, as we have already seen in passing, is to allow application of LOCAL*ADJUNCTION in introducing a predicate node, thereby allowing VP adjuncts to be introduced as predicate modifiers directly. Yet another candidate is the type-c-internal application, to express the identity of construal of John’s picture and the picture of John. There are also local permutation processes, of which passive might be a candidate. We do not follow up on these here, but GENERALISED ADJUNCTION and LOCAL*ADJUNCTION certainly give us tools with which to address these further phenomena.
Chapter 7

Swahili agreement and conjunction

In the previous chapters we have seen how the dynamic perspective on natural language adopted by DS provides new and, we think, more insightful analyses of cross-linguistically recurrent patterns of complex syntactic structures such as relative clauses, left and right periphery effects, and word-order variation. In this chapter, we look at yet another language group, and at a new topic, namely at the relation between agreement and conjunction in Swahili, a Bantu language spoken in East Africa.

Bantu languages are known for their noun class systems, and for their morphologically complex verb forms. The morphologically marked relationship between NPs and verbs in Bantu is often analysed as agreement, but we will see in the course of this chapter that, from a dynamic perspective, Bantu verbal agreement markers are more appropriately analysed as pronominal elements, which share a number of characteristics with the pronominal clitics found in Romance languages, and, indeed, with expletive pronouns in English (see Chapter 5). After introducing the relevant background, we concentrate on our analysis of the relation between agreement and conjoined NPs, as this is a topic which has received attention more widely in the literature, and because some aspects of this complex topic provide a good example of the importance of linear order for syntactic analysis.

We begin by reviewing the agreement system of Swahili shows the relation of different parts of the sentence:

\[(7.1)\]
\[
\begin{align*}
\text{a. } & \text{wa-toto } \text{wa-wili } \text{wa-zuri } \text{me-} \text{anguk-a} \\
& \text{2-children } \text{2-two } \text{2-beautiful } \text{2-SUBJ} \text{PERF fall-FIN} \\
& \text{‘Two beautiful children have fallen.’}
\end{align*}
\]

\[
\begin{align*}
\text{b. } & \text{m-iti } \text{mi-wili } \text{mi-zuri } \text{i-} \text{me-} \text{anguk-a} \\
& \text{4-tree } \text{4-two } \text{4-beautiful } \text{4-SUBJ} \text{PERF fall-FIN} \\
& \text{‘Two beautiful trees have fallen.’}
\end{align*}
\]

The examples in (7.1a) and (7.1b) show how the relation between the subject noun and the numeral, adjective and verb to which it is related is marked with agreement prefixes. In (7.1a), the subject noun *watoto*, ‘children’, belongs to Class 2 (the

---

1The prefixed numbers indicate the noun-class, and singular/plural distinctions are presented as subscripted suffixes. In this chapter we use SUBJ, OBJ as annotations, rather than *NOM, ACC* as Swahili lacks a morphological case system, and the information as to whether the prefix marks subject or object comes from the position in the verbal template.
numbering of different noun classes is arbitrary, and we are following here the system used by Bantu linguists), indicated by the nominal prefix wa-. The same prefix is used for numeral and adjectival stems, so we have wa-wili and wa-zuri. The relation between subject nouns and verbs is marked with the subject concord, which in the example in (7.1a) is identical to the nominal prefix. In (7.1b), we see that the nominal prefix for class 4 is mi-, and that the subject concord for class 4 is i-.

Noun class systems like that in Swahili can be regarded as half-way between gender systems such as found in German or French, and classifier systems, as for example in Thai. As in gender systems, each Swahili noun belongs to a particular class which is morphologically marked and determines agreement patterns. On the other hand, Swahili noun classes have, in contrast to most gender systems, a fairly discernable semantic base. For example, classes 1 and 2 contain only humans, classes 3 and 4 contain a lot of words for natural features like trees, mountains and rivers, classes 7 and 8 contain many words for concrete physical things like chairs, and class 9 and 10 contain words for animals, but also many loan-words. In general, the classes show a pairing of singular and plural. However, in many cases the relation is more subtle, so that for example the word for ‘lion’, simba, is in class 9, and ‘many lions’ are in class 10, but there is also ma-simba, in class 6, meaning ‘a pride of lions’. In fact, quite generally, nouns can be shifted from one class to another to achieve a change in meaning. For example, shifting a noun into class 7 often gives a diminutive interpretation, so that ki-toto, from the stem -toto which we have seen already in wa-toto, ‘children’, means ‘small child’. So, Bantu noun class systems such as the one in Swahili have a morphological dimension, in that the noun class system determines the morphological shape of nouns and other words, but also a semantic dimension in that class membership and class shifting often reflect semantic distinction. In addition, there is a syntactic dimension because noun classes are important for the agreement system.

7.1 Strategies for resolving agreement

One rather obvious question in relation to the agreement system sketched above is: what is the verbal agreement for conjoined subjects, either of conjoined NPs of the same class, or of different classes? In other words, given that the subject concord in (7.2a) is u- (i.e. class 3) because the subject noun phrase m-kate is a class 3 noun, what should the subject concord for the verb in (7.2b) be, where the subject is a conjoined NP of a class 3 and a class 7 noun?

(7.2) a. m-kate u- me- anguk-a
    3-bread 3-SUBJ PERF fall-FIN
‘The bread has fallen.’

b. m-kate na ki-ti ??- me- anguk-a
    3-bread and 7-chair ?? PERF fall-FIN
Int.: ‘The bread and the butter have fallen.’

The answer to this question has been discussed in a number of works. There appear to be three strategies which Swahili speakers use when deciding on agreement with conjoined noun phrases. Some of them, or a variation of them, are found in most Bantu languages, and indeed in other languages where similar structures are found.\(^2\) It is also worth pointing out that in many cases the problem is avoided by

using a conjunction of two clauses, rather than two noun phrases. However, examples of all strategies we describe here are readily found in discourse and in ‘natural’ Swahili texts (Marten 2000 has a number of examples taken from a Swahili novel).

7.1.1 Plural marking

Conjunctions of two (or more) noun phrases of the same class may show agreement with the corresponding plural class, exploiting the singular-plural pairing of the noun classes. However, as pointed out above, the relation between the different noun classes is only partly based on real number distinctions, as it also includes more conceptual semantic distinctions. The only two classes which seem to encode a real number distinction are in fact the ‘human’ classes, class 1 and class 2. This difference between nouns denoting humans and all other nouns is a wide-spread feature in Bantu grammar, and shows up in a number of contexts, some of which we will see further below. For the problem of agreement with conjoined noun phrases, the ‘plural’ strategy is the most common strategy for class 1/2 nouns, but it is very rare for nouns belonging to other classes:³

(7.3) mw-alimu na mw-anafunzi w-ake wa-li- kuj-a
1-teacher and 1-student 1-his 2-SUBJ3rd.pl PAST come-FIN
‘The teacher and his student came.’

The example in (7.3) shows the plural strategy, where two class 1 nouns are conjoined, and the verb shows class 2 agreement. Except for cases of word-order variation, which we discuss below, this strategy is the only available strategy for nouns denoting humans. The most common strategy for nouns denoting non-humans is described in the next section.

7.1.2 Default class agreement marking

Agreement with conjoined noun phrases of classes higher than 1/2 most commonly exploits semantic features of the noun class system, in particular that some noun classes, such as classes 6, 8, and 10 denote a plurality of ‘things’. Thus conjoined noun phrases denoting non-animates often show verbal agreement of class 8, irrespective of the noun classes of the nouns in the conjoined phrase:

(7.4) Sabuni na ma-ji vi- ta- ku- saidi-a
9-soap and 6-water 8-SUBJ FUT 1-OBJ2nd.sg help-FIN
‘Soap and water will help you.’
(Krifka 1995: 1400)

(7.5) ki-su na m-kono w-ake Amanullah vy-ote vi- me-
7-knife and 3-arm 3-his Amanullah 8-all 8-SUBJ PERF
lo-a damu ...
soak-FIN 9-blood...
‘...(the) knife and Amanullah’s arm were all soaked in blood...’
(Abdulla 1976: 74)

³The sequences of numbers, e.g. [9 + 6 >> 8] indicates that the conjunction of a class 9 noun and a class 6 noun, in that order, can take agreement marking on the verb of class 8.
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(7.6) mi-saada na mi-kopo vi- ta- hatarish-a u-huru
4-gifts and 4-loans 8-SUBJ FUT endanger-FIN 11-freedom
w-etu 11-our
‘Gifts and loans will endanger our independence.’
(Schadeberg 1992: 22)
[4 + 4 \(\gg\) 8]

The examples show that a conjoined (non-animate denoting) subject can have verbal class 8 agreement. This holds in cases where the two conjuncts are from different classes: in (7.4) from class 9 and class 6, and in (7.5) (which is taken from a novel), class 7 and class 3. Finally, the example in (7.6) shows that also a conjunction of two conjuncts from the same class, here class 4, is fine with a class 8 agreeing verb.

The ‘default’ strategy with class 8 agreement is also available for conjunctions of more than two conjuncts:

(7.7) ... mede, mede; makochi; viti, viti; meza, meza;
... 10-seat 10-seat 6-couch 8-chair 8-chair 10-table 10-table
makabati na mataa ya mathurea yenye vigae
6-cupboard and 6-lamp 6-GEN 6-chandelier 6-with 8-droplet
vi- na- vyo- to-a mwanga wa rangi
8-SUBJ PRES 3-REL take-out-FIN 3-GEN 10-colour
nanna kwa namna mithili ya almasi vy-ote hi-vyo
kind of kind 9-likeness 9-GEN 9-diamond 8-all DEM-8
vi- li- ene-a katika chumba kile. ...
8-SUBJ PAST spread-FIN in 7-room 7-DEM ...
‘....seats, seats, couches, chairs, chairs, tables, tables, cupboards, and chandelier lamps with droplets giving light of different colours like a diamond – all these were spread across the room.’
(Abdulla 1976: 61)
[10, 10, 6, 8, 8, 10, 10, 6 + 6 \(\gg\) 8]

In (7.7), there are nine conjuncts from different classes, and the verb shows class 8 agreement. Again, much as in (7.5), there are dependent nominals, the quantifying adjective vy-ote and the demonstrative hi-vyo showing class 8 agreement. We will return to default agreement later in this chapter. Before doing so, however, we will look at one more agreement possibility to complete our survey of agreement strategies.

7.1.3 One conjunct agreement

Another possibility to resolve agreement with conjoined noun phrases are cases where the verb agrees only with one conjunct. This strategy is only available for conjoined NPs which follow the verb, in which case the verb agrees with the first conjunct.\(^4\) In other words, the possibility of ‘partial agreement’ depends on

\(^4\)Note also that in (7.5) not only the verb, but also the quantifier vy-ote has class 8 agreement. Given its morphological structure, this is arguably a pronominal element with internal quantification, but we ignore this here.

\(^5\)This holds for animate NPs. The situation for non-animate NPs is less clear. Bokamba (1985) has examples showing agreement with the first conjunct of a conjoined NP preceding the verb, but these examples were not confirmed by our informants, which may be due to dialectal variation; all examples used here are from the Kiungua dialect of Swahili, spoken on Zanzibar island. Other examples of this kind reported in the literature (including the cases discussed in Marten (2000)) can be analysed as cases of default agreement further discussed in section 7.4.1.
7.1. STRATEGIES FOR RESOLVING AGREEMENT

word-order. Agreement with the first conjunct is possible in subject-inversion constructions, where the subject follows the verb, which often express presentational focus, as well as with conjoined objects following the verb. While this strategy can be found with non-animate NPs, it is most common with animate NPs showing agreement with class 1/2:

(7.8) Bwana Msa ... a- li- mw- omba Bibie
Shali na jamaa wote ruhusa ya ku-ach-iw-a
Shali and 9-company 2-all 9-permission 9-GEN 15-left-PASS-FIN
huru ku-vut-a kiko chake
9-liberty 15-smoke-FIN 7-pipe 7-his
‘Bwana Msa... asked of Bibie Shali and the whole company the permission to be left at liberty to smoke his pipe.’
(Abdulla 1976: 103)

The examples in (7.8) and (7.9) show partial object agreement. In (7.8) the verb alimwomba shows singular (class 1) agreement with the first conjunct Bibie Shali, while the second conjunct is the plural (class 2) NP jamaa wote (‘whole company’). In (7.9), the object agreement on the verb nilipokukuta is 2nd person singular, agreeing with the overt pronoun wewe (‘you’). Note that the immediately following verb nikakwambieni shows 2nd person plural agreement. The examples show that when a conjoined object follows the verb, the verb may show agreement with the first conjunct only. The following example shows a similar effect with a conjoined subject:

(7.10) a- li- kuja Haroub na Nayla
1-SUBJ3rd.sg PAST come Haroub and Nayla
‘Haroub and Nayla came.’

Here the subject follows the verb, and the verb shows agreement with the first conjunct. As (7.11) shows, the verb may also show plural agreement:

(7.11) wa- li- kuja Haroub na Nayla
1-SUBJ3rd.pl PAST come Haroub and Nayla
‘Haroub and Nayla came.’

On the other hand, when the subject precedes the verb, verbal agreement behaves differently: only plural agreement is possible as in (7.12a), while singular agreement is precluded (7.12b):

[6] The noun itself is in fact a class 9 noun, but as it refers to a human referent, it takes class 2 agreement, as can be seen from the class 2 agreement in wote.
CHAPTER 7. SWAHILI AGREEMENT AND CONJUNCTION

(7.12) a. Haroub na Nayla wa- li- kuja
Haroub and Nayla 1-SUBJ$_{3rd.pl}$ PAST come
‘Haroub and Nayla came.’

b. *Haroub na Nayla a-
Haroub and Nayla 1-SUBJ$_{3rd.sg}$ PAST come
Int.: Haroub and Nayla came.’
Int.: [1 + 1 $\gg$ 1]

What is possible is to have only the first conjunct as subject, and the second conjunct following the verb, in which case the verb shows singular agreement:

(7.13) Haroub a-
Haroub 1-SUBJ$_{3rd.sg}$ PAST come and Nayla
‘Haroub came with Nayla.’

In view of (7.13), one might be tempted to propose an analysis which involves ambiguity of the conjunction na, which could be thought of as functioning as true conjunction (‘and’) in some cases, and as a subordinating conjunction (‘with’) in others, as indeed we have done in translating (7.13).

However, as an analysis, this would be somewhat dissatisfying, as it would have nothing to say about the word-order dependency of full versus partial agreement. Rather, we propose to analyse na in the following sections as inducing a LINK structure between what is projected from the first and second conjunct, which semantically is interpreted as ordinary conjunction. This analysis, in addition to the dynamics of the construction process leads to a uniform account of na, while at the same time providing a structural correlate to the intuition that sentences like (7.10) and (7.13) are in some sense ‘about’ Haroub, while sentences like (7.11) and (7.12a) are ‘about’ Haroub and Nayla.

In order to see the relation between partial agreement and word-order more clearly, let us have another look at object expressions. As shown above, objects following verbs may have full (plural) and partial (singular) agreement:

(7.14) Asha a-
Asha 1-SUBJ$_{3rd.sg}$ PAST 2-OBJ$_{3rd.pl}$ see-FIN Haroub and Nayla
‘Asha saw Haroub and Nayla.’

(7.15) Asha a-
Asha 1-SUBJ$_{3rd.sg}$ PAST 1-OBJ$_{3rd.sg}$ see Haroub and Nayla
‘Asha saw Haroub and Nayla.’

However, when the objects are fronted, only plural agreement is possible (7.16). Singular agreement is possible if only the first conjunct is fronted (7.18):

(7.16) Haroub na Nayla, Asha a-
Haroub and Nayla Asha 1-SUBJ$_{3rd.sg}$ PAST 2-OBJ$_{3rd.pl}$ see-FIN
‘Haroub and Nayla, Asha saw him.’

(7.17) *Haroub na Nayla Asha a-
Haroub and Nayla Asha 1-SUBJ$_{3rd.sg}$ PAST 1-OBJ$_{3rd.sg}$
see-FIN

---

7 The distribution of na is in fact wider than these two translation possibilities indicate, the form is also used, for example, to indicate the agent of a passive verb (cf. Mous and Mreta (forthcoming) for discussion of a similar situation in Chasu). Without going into details, we take this to indicate a more fundamental semantic underspecification than an ‘and/with’ ambiguity.
7.2. AGREEMENT MARKING

*‘Haroub and Nayla, Asha saw him.’

(7.18) Haroub, Asha a-li-mw- on-a na Nayla
Haroub Asha 1-SUBJ3rd.sg PAST 1-OBJ3rd.sg see-FIN and Nayla
‘Haroub, Asha saw (him) with Nayla.’

These examples show that it is linear surface word-order which matters for agreement, and not the grammatical status as subject or object of the conjoined NP. And given the emphasis we have placed so far on the dynamics of structure building in natural language, we take these examples as an indication of the importance of linear order for natural language syntax and its correlation with interpretation, rather than as an example of lexical ambiguity of na.

This is contrary to other approaches, addressing similar phenomena in other, unrelated languages, which have been analysed from a number of perspectives. For example Munn (1999) and Johanesson (1996, 1998) propose that partial agreement cases result from different structures of, essentially asymmetric, conjunction phrases, while Aoun et al. (1994, 1999) and Camacho (2003) propose that partial agreement is an indication of right node raising, that is of sentence conjunction, rather than NP conjunction. Doron (2000), on the other hand, points out the relation between verb-initial structures and presentational focus, which we have noted above, and relates her analysis of partial agreement in Hebrew to this observation. Finally, Sadler (2002) relates partial agreement to different feature-matching operations within LFG. However, in all of these analyses the relation between partial agreement and word-order is captured only indirectly. The challenge we thus take up in this chapter is to show that it is word-order, and pretty much only word-order, which explains the idiosyncratic nature of partial agreement with conjoined NPs, at least in Swahili, and, hopefully, by extension, in other languages, and that associated facts of this construction type follow from the general analysis as a by-product of the way hearers build semantic interpretations in context.

7.2 Agreement Marking

Before getting into any characterisation of partial agreement, we have to establish a Dynamic Syntax base for analysing the Swahili agreement forms. There is both subject and object agreement, separated by tense-marking, all prefixed on the verb:

(7.19) ni-li-zi-nunua
1-SUBJ1st.sg PAST 10-OBJ buy
‘I bought them.’

Of this sequence, subject marking is obligatory on the verb, even in the presence of a full subject expression; object marking is optional with non-animates, the presence of the object marking indicating a specificity effect; and, as an apparently extra puzzle, object marking for animates is obligatory. Like all clitics or agreement markers, they come in a rigid order - subject-marking (which is obligatory), tense-marking (which requires the presence of the subject marker), object or indirect object marking. But there is an additional puzzle. In general, these agreement markers remain the same irrespective of whether they are used to indicate a subject, object or indirect object: in general, that is, they are a marker of noun class and not of case. The only exceptions are class 1 markers (marking humans) which differentiate between subject and object marking. In consequence, class 1 marking apart, the only indication of whether they are subject or object, is whether or not
the tense marking follows. If it follows the agreement marker, then the marker indicates the subject; if the tense marker precedes the agreement marker, then the marker indicates the object. This then leaves the problem that there is never more than one object marker, either indirect or direct object marking, and this underspecification remains unresolved by the agreement system, and is determined only by the verb and the general context.

Looked at broadly, we have two choices as to how to analyse this phenomenon. Either we analyse Swahili, as classically, as having a highly complex verbal morphology with idiosyncratically defined mappings onto the required semantic representation, demanding subclassifications of an entirely language-particular sort. Alternatively, we take the linear ordering in the processing strictly, and analyse these forms as sequences of reduced pronominal elements that themselves induce the requisite semantic representation before the verb is processed. There is good reason to think that attending to the time-linear dynamics of parsing is the right route to go; and, considered in this light, Swahili shows interesting parallels with Spanish, and the other Romance languages. First there is the obvious similarity, that in both languages, as indeed many others, the choice of subject expression is obligatorily reflected by marking on the verb, whether or not there is an explicit subject:

(7.20) \[ \text{llamaron a Paca} \]
\[ \text{call}_{\text{PAST,3ps.pl}} \text{ a Paca} \]
‘They called Paca.’

But remember too how in Spanish, strong pronouns obligatorily required the presence of a clitic:

(7.21) a. \[ \text{la llamaron a ella} \]
\[ \text{her call}_{3pl} \text{ a her} \]
‘They called her.’

b. \[ *\text{llamaron a ella} \]
\[ \text{call}_{3pl} \text{ a her} \]
‘They called her.’

In Swahili, we have a similar phenomenon. A subset of NPs obligatorily requires the presence of a marker on the verb, morphologically transparently a reduced anaphoric element, in its function just like the Spanish clitic; but in this language it is the subset of animate-marked NPs that imposes this requirement.

(7.22) a. \[ \text{ni- li- mw- on-a Juma} \]
\[ 1\text{-SUBJ}_{1\text{st.sg}} \text{ PAST 1-OBJ}_{3\text{rd.sg}} \text{ see-FIN Juma} \]
‘I saw him, Juma.’

b. \[ *\text{ni- li- on-a Juma} \]
\[ 1\text{-SUBJ}_{1\text{st.sg}} \text{ PAST see-FIN Juma} \]
Intd.: ‘I saw Juma.’

This suggests that, despite differences between the phenomena in the two language families, in terms of their role in building up interpretation, they should be analysed along the same lines. For Spanish, we defined strong pronouns as decorating only unfixed or linked nodes, encoded as not decorating fixed nodes in the

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Footnote 8: For the slightly different cases of infinitive, habitual and subjunctive marking, see footnote 12.
7.2. AGREEMENT MARKING

emergent tree directly. In Swahili, this restriction is apparently generalised to all animate NPs, making it closer to Japanese, in which all NPs decorate nodes which are initially either unfixed or on a linked structure. This leaves non-animate object marking, which is largely optional. But this is not a puzzle at all. It is the general pattern of object-marking: the presence of a pronoun duplicating a postposed full noun phrase induces a background topic effect, in Spanish, in Swahili and many other languages:

(7.23)  
a. \text{nì-} \text{li-} \text{n-a} \text{ki-tabu}  
\hspace{1cm} \text{1-SUBJ}\text{1st.sg} \text{PAST} \text{see-FIN} \text{7-book}  
'I saw a/the book.'

b. \text{nì-} \text{li-} \text{ki-} \text{n-a} \text{ki-tabu}  
\hspace{1cm} \text{1-SUBJ}\text{1st.sg} \text{PAST} \text{7-OBJ} \text{see-FIN} \text{7-book}  
'I saw it the book.'

(7.24)  
a. \text{lo} \text{cono-} \text{sco, Giovanni}  
\hspace{1cm} \text{he} \text{I know} \text{Giovanni}  
'I know him, Giovanni.'

b. \text{Maria lo compró, el coche}  
\hspace{1cm} \text{Maria it she bought} \text{the car}  
'Maria bought it, the car.'

The analysis of this phenomenon, we suggest, is that non-animate-marking object pronouns retain their full anaphoric status, always functioning to pick out some term already presented in context, then to be interpreted as coreferential to the term constructed from the subsequent duplicated NP.

Of course there are differences between the languages. In Spanish the clitic pronouns precede the entire verbal complex: only the subject affix is incorporated into the verbal morphology. In the Bantu languages, contrarily, both subject and object positions can be projected through the so-called agreement prefixes on the verb. There is also the general lack of differentiation between subject and object marking for the Bantu agreement markers. Then there is the fact that Bantu languages, like Japanese, do not require determiners: nouns can project either a new or a contextually fixed term, so the presence of the object marking, by having an anaphoric function, can be exploited to determine which of these interpretations is intended. But the parallelisms between the two languages (and their containing families of Romance and Bantu) are striking nonetheless. It seems that Swahili morphology becomes a much more transient problem if we analyse the various prefixes in the mode adopted for other languages, as projecting metavariable placeholders which behave as though they were pronominals.

This will give rise to the following expectations. On the one hand, if the affix enforces a construal of coreference of its term with some other constructed term (whether preceding or subsequent), then this suggests that the affix corresponds to a pronoun, projecting a metavariable formula; and a LINK relation is constructed between the structure projected from the string containing the affix and the duplicated NP. This analysis would impose a requirement of identity between the term projected from the affix and that projected from the NP, along lines developed in the left- and right-periphery typologies of chapters 4-5. We thus expect these structures to give rise to a specificity effect, since the pair of trees will constitute two independent domains for quantifier construal, with only indefinites apparently able to be construed across them. The specificity effect would be a consequence of copying over the constructed epsilon term and then re-compiling it, as displayed for
indefinites in chapter 3 (see section 3.3.5). On the other hand, if the behaviour of the affix under conditions of duplication does not impose any specificity implication on the doubled expression, then this suggests an analysis in terms of the metavariable projected from the affix having lost the bottom restriction definitive of full lexical status. This would allow derivations in which the node decorated by the affix could unify with that decorated by some co-construed noun phrase. On this analysis, there would be only one articulated tree, hence no reason to preclude any subclass of quantifying expressions. As things turn out, whether a specificity restriction holds or not appears to play a relatively small role in Swahili, arguably no more than a pragmatic constraint, as in Greek (see chapter 4 section 4.2.2.3). However, it has been argued to play a larger role in Chichewa (Bresnan and Mchombo 1987), and the framework certainly makes available a range of lexical effects which enables such variation to be naturally expressed.

To follow through on this general form of analysis, we have to assume that the affixes together with the verb induce a full template of structure, the verb inducing whatever structure is not provided by the clitics themselves, as in Japanese.\(^9\) The one puzzle that appears not to be reducible to the distinction between the building of linked structures vs the building of an unfixed node is the lack of information conveyed by the morphological marking as to whether the relation encoded is subject, object or indirect object. This property is unlike the Romance clitics. However, it is directly redolent of Local*Adjunction and can be expressed very straightforwardly as a lexical action corresponding to this general computational process. So, as it turns out, all the principal patterns can be straightforwardly expressed by analysing the distribution in terms of the two strategies of either building a pair of linked structures or building an unfixed node within a single structure.

To flesh out these analyses now with lexical specifications of some of the agreement markers, we take first the most weakly specified form, an agreement marker (not a class 1 marker) which has an identical form whether subject or object or indirect object. The analysis involves using the Local*Adjunction operator, the disjunction across these various relations. We take the class 10 marker zi- by way of illustration which we treat as projecting a metavariable with a presuppositional constraint restricting substituends to those that have the semantic properties associated with class 10 nominals.\(^10\)

\[
\begin{align*}
\text{zi} & \quad \text{IF} \quad ?T_{y}(t) \\
& \quad \text{THEN} \quad \text{IF} \quad ?(\{1\}) \exists x.T_{y}(x) \\
& \quad \text{THEN} \quad \text{Abort} \\
& \quad \text{ELSE} \quad \text{make}(\{(1|0|0)\}); \quad \text{go}(\{(1|0|0)\}); \\
& \quad \quad \text{put}(F_{o}(U_{10}), T_{y}(e), ?\exists x.F_{o}(x), ?\exists x.T_{n}(x)) \\
& \quad \text{ELSE} \quad \text{Abort}
\end{align*}
\]

The effect of parsing the prefix zi- is shown in the tree display in (7.27) considered as part of a parse of the verb complex in (7.26). (We ignore the noun phrases for the time being.)

\[
\begin{align*}
\text{(7.26)} \quad \text{(sabuni kizi) zi-li-zi-harib-u} & \quad \text{(ngoma)} \\
10.\text{soaps these 10SUBJ-PAST-10OBJ-destroy-FV 10.drums} & \quad \text{‘These soaps destroyed the drums.’}
\end{align*}
\]

\(^9\)As in Japanese, nouns induce a full complex of term structure projecting an argument; and because this structure is projected directly from the lexicon, the specification of additional restrictions induced by some semantic constraint is straightforward. Nouns denoting animate objects, for example, can be defined as invariably decorating an unfixed or linked node. Inanimate nouns can be defined as doing so only if they precede the verb, or in the presence of the object marker, in which case they decorate a linked structure.

\(^{10}\)For more discussion of the content of the class-marking, see section 7.4.
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(7.27) Parsing zi:

\[
T_n(0), ?T_y(t)
\]

\[
⟨\uparrow^0 \uparrow^1 \ast⟩ T_n(0), T_y(e), F_o(U_{10}), ?∃_x F_o(x), ?∃_x T_n(x)
\]

Notice how the construction of the locally unfixed node directly reflects the underspecification of its semantic role in the resulting structure: this sequence of actions can apply whenever the pointer is at a type-\(t\)-requiring node, as long as the predicate node is not already decorated: in other words, it is obligatorily a prefix to the verb. But, because all such underspecified relations must be unique within any partial tree, there is a consequence: no further application of such action will be possible until the underspecified relation is updated. In the present analysis, we propose that it is the tense marker which provides the fixed subject node. This can be seen as a reflex of the verbal origin of tense markers in Swahili: this is most transparent in comparatively recently grammaticalised tense markers such as the future tense marker \(ta\)- from -\(taka\), 'want', or perfect \(me\)- from -\(mala\), 'finish'; and also in the auxiliary-like status of Bantu tense-aspect markers, of which the Swahili tense marking is an atrophied reflex.\(^{11}\) Accordingly, we define the tense marker as marking a type-\(t\)-requiring node with the appropriate tense specification, and inducing a subject relation in the presence of one such locally unfixed node, see (7.28). The action for this affix aborts if any fixed structure is already introduced, guaranteeing also its pre-fixal status.

\[
(7.28) \text{li-}:
\]

\[
\begin{align*}
\text{IF} & \quad T_n(a), ?T_y(t) \\
\text{THEN} & \quad \langle\uparrow^1\rangle \top \\
\text{THEN} & \quad \text{Abort} \\
\text{ELSE} & \quad \text{Abort}
\end{align*}
\]

\[
\begin{align*}
\text{ELSE} & \quad \text{Abort}
\end{align*}
\]

The effect of parsing \(li\)- is shown in (7.29) assuming an appropriate substituend for the metavariable and THINNING of all satisfied requirements (\(?T_y(e), ?∃_x T_n(x), ?∃_x F_o(x)\)).

(7.29) Parsing zi-li-:

\[
T_n(0), ?T_y(t), T_{ns}(PAST), \downarrow
\]

\[
⟨\downarrow^1⟩ T_n(0), T_y(e), F_o(e, x, \text{Sabuni}′(x)), ⟨\uparrow^0⟩ T_n(0)
\]

Once the tense marker has served to fix the subject relation, the lexical actions of zi- can apply again to yield another unfixed node (all the condition precludes is that a fixed predicate relation already be introduced), as in (7.30).\(^{12}\)

\(^{11}\)As we shall see in ch.8, there is also reason to analyse auxiliary verbs in English as projecting a propositional template.

\(^{12}\)This analysis can be extended to the (verb-initial) habitual marker, \(hu\)-, and the infinitival marker \(ku\). These can be defined as inducing the construction and decoration of a fixed subject node (which they invariably replace), thereby licensing the presence of the immediately following
Whatever the cluster of argument nodes so far constructed, the verb then induces a full template of structure, as in other languages, the nodes which have already been constructed by the affixes harmlessly collapsing with them as not distinct. As in the Romance languages, the subject node projected by the verb is decorated with a metavariable, but the object node decorated solely with a requirement. In other words, we analyse Swahili as a subject pro-drop but not object pro-drop language. (The fact that the subject affix is obligatory as a prefix is a consequence of the lexical conditioning for the update action of the subject and tense markers jointly, and not an intrinsic difference between subject and object marking.) The lexical actions associated with the verb stem -haribu are given in (7.31) and are very similar for those given for verbs in Italian in chapter 5 (see (5.34) on page 171).

(7.31) -haribu

<table>
<thead>
<tr>
<th>IF</th>
<th>THEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>?Ty(e)</td>
<td>make(⟨↓0⟩); go(⟨↓0⟩);</td>
</tr>
<tr>
<td></td>
<td>put(Ty(e), Fo(U), ?∃x.Fo(x)); go(⟨↓0⟩);</td>
</tr>
<tr>
<td></td>
<td>make(⟨↓1⟩); go(⟨↓1⟩);</td>
</tr>
<tr>
<td></td>
<td>put(Ty(e → t), Fo(Haribu'), [↓⊥];</td>
</tr>
<tr>
<td></td>
<td>go(⟨↓1⟩); make(⟨↓0⟩);</td>
</tr>
<tr>
<td></td>
<td>put(⟨↑1⟩); make(⟨↓0⟩);</td>
</tr>
<tr>
<td></td>
<td>go(⟨↓0⟩); put(⟨↑1⟩);</td>
</tr>
<tr>
<td></td>
<td>make(⟨↓0⟩); put(⟨↑0⟩);</td>
</tr>
</tbody>
</table>

In continuing the parse of the verbal complex in (7.26), the subject node collapses with that introduced by the verb and the locally unfixed node then must MERGE with the internal argument node. This is shown in (7.32) where again a suitable substituend has been selected to instantiate the metavariable on the unfixed node.

(7.32) Parsing zi-li-ziharibu:

```
Tn(0), ?Ty(t), Tns(PAST)

Ty(e),
Fo(ε, x, Sabuni′(x))

⟨[1]⟩Tn(0), Ty(e),
Fo(ε, y, Ngoma′(y))

?∃x.Tn(x)

?Ty(e → t)

?Ty(e), Fo(Haribu′)
```

We put to one side a characterisation of the status of the final vowel of inflected verbs which is usually -a but lexically determined with some loan-words like haribu.
Although for most noun classes, there is no difference in form between subject and object agreement markers, class 1 markers do differ according to subject or object function, as do the markers for second person. So class 1 agreement has a- marking for subject, and m- marking for object marking, but even in this case the m- marking does not differentiate between direct and indirect object marking. Since this is a lexical differentiation, it is straightforward to define the second person subject marker u-, for example, as having exactly the case marking properties familiar from other languages, an output filter of decorating an immediate dominating type t node:

\[
\text{(7.33) } u- \begin{array}{l}
\text{IF } ?T_y(t) \\
\text{THEN IF } \downarrow \top \\
\text{THEN Abort} \\
\text{ELSE make}(\langle \downarrow 1 \rangle); \text{go}(\langle \downarrow 1 \mid a \rangle); \\
\text{put}(F_o(U_{\text{Addressee}}), ?(a)T_y(t)) \text{ ELSE Abort}
\end{array}
\]

As with all other case agreement markers, the subject marker induces a locally unfixed node and the tense-marking updates it. But this time, the agreement marking itself is sufficient to rule out all other developments, with its output filter of immediate domination by a node of type t. The 2nd person singular object marker, ku-, on the other hand, following the tense marker retains its underspecification vis a vis whether the node it decorates will in the end result serve as an object or as an indirect object (7.34).

\[
\text{(7.34) } ku- \begin{array}{l}
\text{IF } ?T_y(t) \\
\text{THEN IF } \downarrow \top \\
\text{THEN make}(\langle \downarrow 1 \rangle); \text{go}(\langle \downarrow 1 \rangle); \\
\text{make}(\langle \downarrow 1 \mid o \rangle); \text{go}(\langle \downarrow 1 \mid o \rangle); \\
\text{put}(F_o(U_{\text{Addressee}}), T_y(e), ?(x).F_o(x)) \text{ ELSE Abort}
\end{array}
\]

As this variation between individual agreement markers shows, the framework allows a range of variation within a language. There is a question of whether these Swahili agreement markers should include specification of a bottom restriction, but to retain the neutrality of the marker with respect to subject and object marking, we do not impose any such restriction. Nonetheless, the agreement marker, if it precedes the duplicated NP invariably serves as a pronominal device identified in context so that the effect is to pick out some term in context with which the duplicated NP also has to be construed as identifying, suggesting possible motivation for assuming that a bottom restriction is invariably in place. In the absence of case-marking on the NPs, unlike Greek, there is no definitive evidence of whether the specificity effect obtained by using such agreement markers is or is not a consequence of an encoded restriction; but it is notable that this is again a parallelism with the Romance languages, in the availability for these clitic doubling phenomena of an analysis for the doubled NP as either decorating an independent LINKed structure and an unfixed node. On this basis also, we expect there to be a considerable degree of variation across related languages. In particular, the reported greater discrimination between subject and object marking in Chichewa (Bresnan and Mchombo 1987) is straightforward to express, since we can analyse the subject marker as having no bottom restriction hence not giving rise to a specificity effect, the object marker, contrarily, having an associated bottom restriction and invariably so doing.

There is a further bonus to this style of analysis. From the perspective of frameworks which make a sharp distinction between grammar-internal agreement
devices, and pragmatically constrained anaphoric devices, it might seem to be at
best surprising that of two agreement devices, it should be the most nested affix,
the object marker, which is associated with a free anaphoric device, displaying
behaviour most like an independent pronominal, while the least nested affix, the
subject marker, displays behaviour more like an agreement marker. However, on the
present analysis, this puzzle simply disappears. Nothing in the characterisation of
agreement devices as instructions on updating an emergent propositional structure
requires one form of affix to be more or less peripheral in the morphological cluster
in virtue of the status of its metavariable characterisation of the formula projected.
Indeed, the only factor dictating ordering of such construction inducing clusters
would be pointer movement, and this indeed dictates that it is the subject-marking
affix which is most peripheral, since it is this which is unfolded first from the type-
t-requiring node.

Despite these sketches being no more than an indication of a definitive working
analysis, it is worth emphasising the explanatory role which is played by the re-
striction of uniqueness holding of the construction of unfixed nodes. In Swahili, as
in other Bantu languages, either the direct or the indirect object may in principle
induce agreement marking on the verb, but not both, as illustrated in (7.35).

\[(7.35)\]
\[\begin{align*}
a. & \text{ ni-} \quad \text{li-} \quad m- \quad \text{pa} \quad Juma \quad ngoma \\
& \text{1-SUBJ\textsubscript{1st.sg} PAST 1-OBJ give 1.Juma 10.drums} \\
& \text{‘I gave the drums to Juma.’} \\

b. & \text{ ni-} \quad \text{li-} \quad m- \quad \text{pa} \quad ngoma \\
& \text{1-SUBJ\textsubscript{1st.sg} PAST 1-OBJ give 10.drums} \\
& \text{‘I gave the drums to him.’} \\

c. & \text{ ni-} \quad \text{li-} \quad zî- \quad \text{pa} \\
& \text{1-SUBJ\textsubscript{1st.sg} PAST 10-OBJ give} \\
& \text{‘I gave them (to him).’} \\

d. & *\text{ ni-} \quad \text{li-} \quad zî- \quad m- \quad \text{pa} \\
& \text{1-SUBJ\textsubscript{1st.sg} PAST 10-OBJ 1-OBJ\textsubscript{3rd.sg} give} \\
& \text{Intended.: ‘I gave them (to) him.’} \\

e. & *\text{ ni-} \quad \text{li-} \quad m- \quad zî- \quad \text{pa} \\
& \text{1-SUBJ\textsubscript{1st.sg} PAST 1-OBJ\textsubscript{3rd.sg} 10-OBJ give} \\
& \text{Intended.: ‘I gave him them.’} \\
\end{align*}\]

This follows in our analysis because once an object marker has been parsed, there
is no further tense-marking to update its weak structural relation with the root.
The node must remain unfixed until a suitable fixed node is projected by the parse
of a verb with which it can \textsc{merge}. Since no more than one such unfixed node can
be constructed at a time, it follows that only one occurrence of any object marker
will be possible, hence the mutual exclusion of indirect-object and direct-object
marking.

Despite their provisional nature, these characterisations directly reflect the con-
structive role of these prefixes. They induce structural relations rather than defining
filters on relative tree position; and accordingly they have none of the flexibility we
expect of case-marking devices that project an output filter. In this, we suggest,
lies their agreement status.

Aside from these lexical encodings of argument and predicate nodes, other pro-
cesses remain in force as expected. Without any object marking clitic, as we would
now prefer to call them, the canonical position for an object noun phrase will be
after the verb (Bresnan and Mchombo 1987): the pointer following the parse of
7.3 Agreement and Co-ordination: animates

Characterising the various agreement patterns between co-ordinated NPs and the pronominal agreement prefixes involves bringing together the various strands which we have individually introduced in previous chapters. We put together the account of the prefixes as inducing the introduction of metavariables decorating independent nodes in the semantic tree, an account of co-ordination as involving the construction of a LINKed structure, and the various construction processes both at the left and right periphery.

Following observations about Swahili in the literature (most clearly made in Schadeberg (2001)), we assume that the agreement system involving nouns which denote sets of animate objects differs from the one involving terms denoting non-animates, and that the category of number is only relevant to the former system, while the system of non-animates is more semantically motivated, with semantic restrictions on the process of building up interpretation. We are formalising this here as restrictions on substitutions of metavariables (see Chapter 2), similar to the restrictions on gendered pronouns in English, where we analysed, for example, she as lexically encoding a restriction on the substitution of the formula value to representations which can be construed as female. That was glossed there as $F_0(U_{FEM})$, but it is now time to take this up in more detail.

In the case of apparent agreement in Swahili of animacy marking, we take this to be founded in singularity versus plurality (where the distinction between one individual and a group is significant); and neither animacy or non-animacy is encoded as such. In contrast, non-animate agreement markers encode presuppositions about the nature of the objects denoted, ensuring that they can be thought of as objects which could be grouped as, for example, “ki-” type objects, where the knowledge of what constitutes a ki- object is part of native speakers’ knowledge (see e.g. Demuth 2000 for supporting evidence for this view from language acquisition). Such presuppositions about non-animate entities serve to restrict the range of substituends for the pronominal metavariables for which we use here the relevant class prefix as a label for entities which can semantically be construed as falling in that class of objects. Animacy is not encoded either. This is because we claim that only noun phrases describing animate objects have linguistically relevant singularity (or plurality): a predicate expressing singularity is invariably also one that denotes animate objects, leaving the specification of animacy redundant. There is no concept of non-animacy in pronominal substitution either, and for the same reason: pronouns denoting non-animates are used irrespective of any singular or plural distinction, triggering instead simply the presupposition relating to the various classes of object given by the class-marker.

Another difference correlated with the animate vs. non-animate split is the role of agreement for these two types of NPs. While subject agreement is mandatory in
most tense forms for all NPs, there is in Swahili, a difference in object agreement between animate and non-animate denoting NPs. As mentioned above, with NPs denoting animate objects, object agreement is mandatory (at least in the majority of contexts), while for non-animates, object agreement is related to specificity:

\[
\begin{align*}
\text{(7.36) } & \text{a. } \text{ni-} \text{li-} \text{mwa-} \text{on-a} \text{ Juma} \\
& \text{1-SUBJ}^{1st.sg} \text{ PAST} \text{ 1-OBJ}^{3rd.sg} \text{ see-FIN} \text{ Juma} \\
& \text{‘I saw him Juma.’} \\
& \text{b. } *\text{ni-} \text{li-} \text{on-a} \text{ Juma} \\
& \text{1-SUBJ}^{1st.sg} \text{ PAST} \text{ see-FIN} \text{ Juma} \\
& \text{‘I saw Juma.’} \\
& \text{c. } \text{ni-} \text{li-} \text{on-a} \text{ ki-tabu} \\
& \text{1-SUBJ}^{1st.sg} \text{ PAST} \text{ see-FIN} \text{ 7-book} \\
& \text{‘I saw a/the book.’} \\
& \text{d. } \text{ni-} \text{li-} \text{ki-} \text{on-a} \text{ ki-tabu} \\
& \text{1-SUBJ}^{1st.sg} \text{ PAST} \text{ 7-OBJ} \text{ see-FIN} \text{ 7-book} \\
& \text{‘I saw it, the book.’}
\end{align*}
\]

From (7.36b), it appears that an animate-denoting NP like \textit{Juma}, which is a name for a man, cannot be used to decorate directly the object node provided by the verb: the pronominal prefix is obligatory. As already sketched, this should be analysed in parallel with Spanish strong pronouns, decorating unfixed or LINKed nodes.

With these preliminary assumptions in place, we concentrate first on the class of nouns denoting animate objects, and see how the partial agreement patterns illustrated above result from the dynamics of our system.

### 7.3.1 Agreement with Preposed Subjects

Recall that the basic asymmetry of agreement with conjoined NPs denoting animate objects in Swahili is that, in subject-verb order, only full agreement is possible, while in verb-subject order, both full and partial agreement are possible. The relevant examples for subject-verb order are repeated below as (7.37) and (7.38):

\[
\begin{align*}
\text{(7.37) } & \text{Haroub na Nayla wa-} \text{li-} \text{kuj-a} \\
& \text{Haroub and Nayla 2-SUBJ}^{3rd.pl} \text{ PAST come-FIN} \\
& \text{‘Haroub and Nayla came.’} \\
& \text{[1 + 1 \(\gg\) 2]} \\
\text{(7.38) } & *\text{Haroub na Nayla a-} \text{li-} \text{kuj-a} \\
& \text{Haroub and Nayla 1-SUBJ}^{3rd.sg} \text{ PAST come-FIN} \\
& \text{Intd.: ‘Haroub and Nayla came.’} \\
& \text{[1 + 1 \(\gg\) 1]}
\end{align*}
\]

As we have discussed earlier, we analyse animate-denoting NPs as providing decorations to unfixed nodes or to the top node of a linked structure, and, correspondingly, subject clitics can be taken as having lost the bottom restriction, allowing them to be freely further developed by either unfixed node or across a LINK relation. The question of whether, in a given example, an animate-denoting subject NP is taken to decorate an unfixed node or a LINK structure corresponds broadly with the discourse status of the NP. If the term is constructed by the building of a linked structure of which it is the \textit{formula} decoration, we would anticipate that it would be construed as a background topic, providing the context
anaphorically for what follows. If however the term introduced is taken to be a
decoration on an unfixed node which merges with the subject position decorated
by the pronominal clitic after the verb is processed, then we would expect that it
might be associated with material which provides an update to some constructed
structure, and is not merely a term already established in context. For the examples
in (7.37) and (7.38), we will assume that the subject NPs decorate unfixed nodes,
since by assumption these names, lacking any paired pronominal clitic, introduce
terms denoting the individuals in question into the discourse. For our analysis of
the agreement asymmetries, this decision is of no great importance, as the analysis
is independent of whether a linked structure is built for the subject NP to deco-
drate, or an unfixed node. We will come back to the possibility of linked subjects in
section 7.4, when discussing non-animates.

We thus here assume that a Dynamic Syntax derivation of the grammatical
(7.37) proceeds as follows. At the initial sequence of steps as displayed in (7.39),
the first conjunct is taken to decorate an unfixed node, dominated by the root node
without fixing that relation. Moreover we assume, as in chapter 5, that all names
project quantifying terms with internal structure; and, for reasons that will emerge
very shortly, we wish to assume also an explicit indication that such a name denotes
an atomic entity marked with the predicate SING.\textsuperscript{14}

(7.39) Parsing Haroub in (7.37):

\[
Tn(0), \?Ty(t), \downarrow \\
\mid \\
Fo(t, x, Haroub′(x) \land SING(x)), Ty(e), \\
(\uparrow)Tn(0), \exists x.Tn(x)
\]

At this point, the pointer could return to the root node; but, given the presence of
the connective na, a LINK relation is constructed between two nodes of type e. The
connective is defined as the reflex in this system of what in categorial systems would
involve typing as \(Ty(X \rightarrow (X \rightarrow X))\): the connective induces the introduction
of the linked tree that is to provide the modification of the first constructed term.
This is defined in the lexical entry for na in (7.40).

(7.40) \(na\)

\[
\begin{array}{l}
\text{IF } Ty(X), \exists x.Fo(x) \\
\quad \text{THEN } \text{make}(\{L\}); \text{put}(?Ty(X)) \\
\text{ELSE } \text{Abort}
\end{array}
\]

Note that this lexical entry for conjunction is in relevant respects identical to the
one used for English and in Chapter 5. The additional condition, that there exist
a full formula value at the node from which the LINK relation is launched, reflects
the fact that the LINK relation from the conjunction is built only from formula-
complete nodes, and not from nodes with metavariables as formulas. This seems
fairly straightforward, and we will make use of this condition for the analysis of
extraposed conjuncts later on. Parsing \(na\) leads to the partial tree in (7.41).

\textsuperscript{14}The information SING(x) might, assuming Link (1983), be taken as shorthand for Atom(x),
or, equivalently SING(x) \equiv (|x| = 1). It would clearly be preferable if such an additional
specification were seen as the result of application of a step of inference expressed as some general
inference schema, such as a meaning postulate. However, we have not entered at all into issues of
content for predicative terms decorating the trees in this book, so here we take the information
to be projected directly onto the tree by the lexical actions of the nouns. Nothing turns on this.
(7.41) Parsing Haroub na in (7.37):

\[
T_n(0), T_y(t)
\]

\[
\langle \downarrow \rangle T_n(0), ?\exists x T_n(x)
\]

\[
\langle L^{-1} \rangle \langle \downarrow \rangle T_n(0), T_y(e), \diamond
\]

The information provided by the lexical entry given by Nayla, the next word in the string, then leads to the decoration of this newly introduced LINKed node, as normal. The way we have used the LINK relation here differs from the use of LINK in chapters 3 and 4, and, like that in chapter 5, does not impose any sharing of information across the LINK relation. This is in principle possible: the LINK relation is defined as a relation between nodes in two separate partial trees, and as such is independent from the requirement of shared information. Nevertheless, in co-ordination, as it turns out, the shared term results from a process of evaluation; so the substance of LINKed structures in the final completed tree as involving sharing of terms is preserved. The evaluation step needed is that which creates a term out of two distinct individual-denoting terms, forming a new term denoting the group.

We, therefore, introduce a new rule for LINK evaluation in addition to those introduced in chapter 3 for relative clause construal.\(^{15}\) This version is a process which takes two terms constructed across a LINK relation, and from them defines a term out of the join of the two, giving rise to a plural interpretation (as in the English Tom and an administrator control the timetable).

(7.42) LINK Evaluation (Conjunction):

\[
\begin{align*}
\{ \ldots \{ T_n(a), \ldots , Fo(e, x, P(x)), T_y(e), \ldots \} , \\
\{ ((L^{-1}) T_n(a), \ldots , Fo(e, x, Q(x)), T_y(e), \ldots , \diamond \} \ldots \\
\{ \ldots \{ T_n(a), \ldots , Fo(e, x, (P \land Q)(x)), T_y(e), \diamond \} , \\
\{ ((L^{-1}) T_n(a), \ldots , Fo(e, x, Q(x)), T_y(e) \} \ldots 
\end{align*}
\]

Notice how in this rule, the predicates \( P \) and \( Q \) which serve as the restrictors of the two terms (and which could equivalently be written as \( \lambda y. P(y) \) and \( \lambda z. Q(z) \)) are each bound by the quantifier of the two separate epsilon terms in the input, but in the output these predicates are not distributed over the same individual variable.

What this means is that the application of the rule constructs a term which denotes

\(^{15}\)Although it seems that we are building up an array of LINK evaluation rules that are independent of each other, this is not, in fact, the case. All the evaluation rules specify a means of copying the content provided by a LINK structure onto the matrix tree. The rules all involve some form of co-ordination of formula values (typically, as here, as conjunction) but they differ as to which node in the matrix tree at which this co-ordination is to occur: for restrictive relative construal it is the \( T_y(cn) \) node that dominates the node decorated by a variable; for non-restrictive construal, it is the topnode in the propositional tree. The rule in (7.42) copies the information onto the term from which the LINK relation is projected. In all these cases, it is arguably the types that are involved that induces the various forms of evaluation and the possibility is open that LINK evaluation is always semantically co-ordination of formulae, possibly reducible to a single characterisation, while pragmatic inference over the tree under construction determines the actual output. See also footnote 31 on page 312.
7.3. AGREEMENT AND CO-ORDINATION: ANIMATES

the union of the two sets which the predicates define, a complex term denoting a group.

(7.42) thus allows the construal of the two epsilon/iota terms as giving rise to a complex term where the properties of the two terms as input do not distribute over the variable. In the analysis of Haroub na Nayla in (7.37), evaluation of the two LINKed nodes of type \(e\) in provides the formula value:

\[
Fo(\iota, z, ((\lambda x.\text{Haroub}'(x) \land SING(x)) \land (\lambda y.\text{Nayla}'(y) \land SING(y)))(z))
\]

This does not reduce any further because of the joining of the two properties of being Haroub and being Nayla, so the term picks out ‘the plural entity consisting of (the join of) Haroub and Nayla’. Notice that through this process of evaluation the sharing of formula values across the LINK relation is established, as illustrated in (7.43) afterCompletion.

(7.43) Parsing Haroub na Nayla:

\[
Tn(0), ?Ty(t), \emptyset
\]

\[
Fo(\iota, z, ((\lambda x.\text{Haroub}'(x) \land SING(x)) \land \lambda y.\text{Nayla}'(y) \land SING(y))(z)),
\]

\[
Ty(e), \langle L^{-1} \rangle Tn(0), ?\exists x. Tn(x)
\]

\[
\langle L^{-1} \rangle \langle \ast \rangle Tn(0), Ty(e), Fo(\iota, y, \text{Nayla}'(y) \land SING(y))
\]

The result of the steps of parsing so far is a representation of a compound type-\(e\) term denoting a pair of animate objects as a decoration on an unfixed node with an associated linked structure. In the absence of case information in Swahili, the unfixed node may end up as the subject or the object node, depending on further lexical input to be parsed. For the problem at hand, it is important to note that in this example, the information from the conjoined NP has been scanned and the corresponding structure has been built before the actions obtained in parsing the verb have been used to extend the tree under construction.

The next step in the derivation is the parsing of the verb complex \(wa-li-kuj-a\) (‘They came’). As we have seen, this form is morphologically complex, consisting of the subject pronominal marker, the \(wa\)-, which is the plural agreement marker, \(li\)-, a past tense marker, the verb root \(-kuj-\), and an inflectional final vowel \(-a\).

Given the discussion about the structure of Bantu verbs in section 7.2, we assume that \(wa\)-projects a locally unfixed node decorated with a metavariable. In this case, because \(wa\)-marked nouns are all plural, the class marker does not induce a presuppositional constraint on potential substituends, but adds an underspecified epsilon term, determining the plurality of any substituend, as we shall see below. The tense prefix fixes this locally unfixed node as subject and the verb projects subject and predicate nodes, the former decorated by a metavariable which falls together with the already constructed subject node and the latter decorated with the annotation \(Fo(\text{Kuj}')\), as in (7.44).

---

16Iota terms are by definition epsilon terms, so the rule is defined over epsilon terms. In a more complete characterisation of plural quantification this rule needs to articulate in a fully general way the relationship between quantification over individuals and quantification over groups.

17In fact, even the verb root here can be analysed as being complex, as the syllable -\(ku\)- is a dummy morpheme, historically related to an infinitival marker, which is used with, among others, monosyllabic verbal roots such as -\(j\)-, ‘come’ (Marten 2002a).
(7.44) Parsing Haroub na Nayla wa-li-kuja:

\[
T_n(0), ?Ty(t), Tns(PAST)
\]

\[
\begin{align*}
&\text{Fo}(t, z, ((\lambda x.\text{Haroub}'(x) \land \text{SING}(x)) \land \lambda y.\text{Nayla}'(y) \land \text{SING}(y))(z)) \\
&\land Ty(e), Fo(U), \\
&Ty(e, x, \text{PLUR}(x)), \exists x.Fo(x), \Diamond \\
&Ty(e \rightarrow t), Fo(Kuj')
\end{align*}
\]

\[
\langle L^{-1}\rangle\langle L^{-1}\rangle T_n(0), Ty(e), \text{Fo}(t, y, \text{Nayla}'(y) \land \text{SING}(y))
\]

Structurally, this is by now a familiar situation: an unfixed node with some formula value and a requirement for a tree position, and a fixed node, here the subject node, with a requirement for some formula value. In addition, we here have a plural entity at the unfixed node imposing a restriction on the update of the metavariable at the subject node that the value to be provided be a plural entity. These various requirements can be fulfilled by merging the unfixed node with the subject node, leading to the tree in (7.45).

(7.45) Parsing Haroub na Nayla wa-li-kuja:

\[
T_n(0), ?Ty(t), Tns(PAST)
\]

\[
\begin{align*}
&\text{Fo}(t, z, ((\lambda x.\text{Haroub}'(x) \land \text{SING}(x)) \land \lambda y.\text{Nayla}'(y) \land \text{SING}(y))(z)) \\
&Ty(e, \exists x.Tn(x), ?x.Fo(x)) \\
&Ty(e \rightarrow t), Fo(Kuj')
\end{align*}
\]

\[
\langle L^{-1}\rangle\langle L^{-1}\rangle T_n(0), Ty(e), \text{Fo}(t, y, \text{Nayla}'(y) \land \text{SING}(y))
\]

We now arrive at a parse state in which there are two terms decorating a single tree node. This is not precluded, recall, as long as one of these formulae entails the other (this property holds on the tree after every application of substitution updates a metavariable). Here, the requisite entailment transparently holds in the semantics because, with Nayla and Haroub being distinct individuals, the complex term that conjoins their properties must be taken to pick out a group entity, which is precisely what the underspecified plural epsilon term does:

\[
\text{Fo}(t, z, ((\lambda x.\text{Haroub}'(x) \land \text{SING}(x)) \land \lambda y.\text{Nayla}'(y) \land \text{SING}(y))(z)) \\
\supseteq \text{Fo}(\epsilon, z, \text{PLUR}(z))
\]

MERGE is thus licensed in the semantics and we might construct a composite term in which the plurality is expressed in the representation language:18

\[
\text{Fo}(t, z, ((\lambda x.\text{Haroub}'(x) \land \text{SING}(x)) \land \lambda y.\text{Nayla}'(y) \land \text{SING}(y))(z) \land \text{PLUR}(z))
\]

Notice that here the predicates distribute over the same variable \(z\), so that the property of constituting the set of individuals made up of Haroub and Nayla and the property of being a plural entity are indeed both predicated of the same (plural)

---

18Formal rules for achieving this through rules of Appositive LINK EVALUATION and Term Resolution are discussed in chapter 8. See section 8.4.2.
individual. By familiar application of COMPLETION and ELIMINATION, the tree in (7.45) can then be completed, and the final tree derived: with a subject term denoting a plural entity, contributing to the assertion that it is these individuals that came.\footnote{\textit{There is of course a great deal to spell out here to do the semantics of plurals properly as an extension of the epsilon calculus, which we cannot possibly take on here. However, plurality is a quite general problem, not specific to Swahili; and what we have here will suffice for expressing the variation available in agreement phenomena.}}

The next question, given our analysis so far, is: why is singular agreement here not possible, as indicated in (7.38), repeated from above:

\[(7.38) \quad \text{*Haroub na Nayla a-li-kuj-a} \quad \text{Intd.: ‘Haroub and Nayla, they came.’} \]

The initial stages for an attempt to derive (7.38) are as in the previous example, resulting in the building of a representation of the content of the initial conjoined noun phrase. However, the information from the verb complex now is slightly different: the subject concord a- leads to a predicate of singularity at the subject node, and, as before, we specify this as an additional predicate on an underspecified epsilon term.

In this situation, as in the previous example, MERGE is a possible option. However, since the formula at the unfixed node denotes a plural entity, it does not provide a possible value for the metavariable holding at the subject node, since the metavariable is restricted to singular entities. The formula decorating the unfixed node shown in (7.46a) now clearly does not semantically entail that decorating the fixed subject position (7.46b), so MERGE will lead to incoherence and is, therefore, excluded.

\[(7.46) \quad \begin{align*}
\text{a. } & Fo(t, z, ((\lambda x. \text{Haroub}'(x) \land SING(x)) \land \lambda y. \text{Nayla}'(y) \land SING(y))(z)) \\
\text{b. } & Fo(U), Fo(t, z, SING(z))
\end{align*} \]

While the formula value decorating the subject node can, of course, be interpreted as some pragmatically supplied singular term, as might be the situation, for example, where the unfixed node ends up in object position. But if this strategy is adopted in parsing an intransitive example like (7.38) the requirement for a fixed tree-node address for the unfixed node cannot be fulfilled, as the only fixed node provided in this example is the subject position. Thus, the unfixed node cannot MERGE with any position in the tree, and the derivation fails. The ungrammaticality of (7.38) thus follows from the restriction on the process of updating the metavariable at the subject node to singular-denoting terms. In part, this reflects the pre-theoretic intuition that a plural subject cannot be combined with singular agreement: here we have reconstructed this as the provision of an additional predicate of singularity, this being inconsistent with a plural predicate attributed to the term filling the subject role.

### 7.3.2 Agreement with Postposed Subjects

As we have seen above, such a pre-theoretic intuition is only partially true. The more correct intuition is that plural terms, once introduced into a derivation, cannot combine with singular predication provided by the pronominal agreement marking, a transparent truth. However, as we will show next, singular agreement is possible
with plural subjects as long as the term constructed from that subject has not yet been built at the time when the verb is introduced. The relevant data for this second case are repeated below:

(7.47)  a. wa-
        li-
        kuj-a Haroub na Nayla
2-SUBJ\text{3rd.pl} PAST come-FIN Haroub and Nayla
‘Haroub and Nayla came.’

b. a-
        li-
        kuj-a Haroub na Nayla
1-SUBJ\text{3rd.sg} PAST come-FIN Haroub and Nayla
‘Haroub and Nayla came.’

The pattern here, mixed agreement apart, is remarkably like that of the Romance languages, particularly Spanish. Subject-inversion structures as in these examples are more marked than subject-verb order, and often convey a presentational focus interpretation. In addition, as pointed out above, intuitively, while (7.47a) is an assertion about both Haroub and Nayla, (7.47b) seems to be more an assertion about Haroub. On the other hand, in terms of denotational content, strictly, both sentences assert the same proposition, namely that Haroub and Nayla came. We are going to show now how the two agreement possibilities, and the slightly different readings, result from the process of structure building.

We take first the cases where there is matching agreement. These are the inverse of the preposed matching agreement cases. In these examples, following the Romance pattern, the verb is parsed first, hence the construction of the propositional template with its predicate \text{kuj} as shown in (7.48).

(7.48) Parsing \text{wa-li-kuja}:

\[ Tn(0), Ty(t) \]

\[ \begin{array}{c}
Tn(0), Ty(e), \\
\text{Fo(}U\text{)}, ?\exists x.\text{Fo}(x), \\
\text{Fo}(e, x, \text{PLUR}(x))), \Diamond \\
\end{array} \]

\[ Ty(e \to t), \text{Fo}(Kuj) \]

Given the agreement properties of Swahili, the formula value can of course be substituted from context, in which case no further input would be necessary. However, in (7.47a) there is further input, the post-posed subject, and prototypically these examples are used in contexts where the subject cannot be identified in context, for example at the beginning of texts, as is common for presentational structures like these. There is no restriction on the type of NP in these structures, indicating that pronominal subject-agreement markers in Swahili have lost their bottom-restriction, and post-posed subjects allow introduction of their lexical actions into the parse tree by means of LATE \*ADJUNCTION (see Chapter 5), as in (7.49). Notice that it is the first conjunct of the conjoined subject whose lexical specification decorates the node introduced by LATE \*ADJUNCTION, before the conjunction \text{na} is scanned.
(7.49) Parsing \textit{wa-li-kuja} Haroub:

\[
T_n(0), ?T_y(t)
\]

\[
\begin{align*}
& T_n(00), ?F_o(U), ?\exists x F_o(x), \\
& F_o(e, x, \text{PLUR}(x)), \varnothing
\end{align*}
\]

\[
T_y(e \rightarrow t), \quad F_o(Kuj')
\]

\[
\langle \uparrow \ast \rangle T_n(00), ?F_o(x), ?\exists x F_n(x), \\
F_o(e, x, \text{Haroub}'(x) \land \text{SING}(x))
\]

This is a trivial observation; but, at this juncture, there are two options, and these are not trivial at all. The first is to continue scanning lexical input and to develop the unfixed node by introducing a LINKed structure and using that to build up a compound formula. The second option is to \textsc{Merge} the unfixed node with the subject node, and only after that, to introduce some linked structure to build up the appropriate compound term with whatever further words are provided. It is the availability of these two options which explains the different agreement options. The first option reflects plural agreement: the second option reflects singular agreement. Furthermore, in the second option, there is a stage in the derivation where the representation of \textit{Haroub} is the only subject of the assertion, and it is this (intermediate) stage which accounts for the intuition that (7.47b) is an assertion about Haroub.

To see these points more clearly, let us continue with the derivation of (7.47a), with plural agreement. Here, the first option is relevant, that is, the unfixed node is not yet merged, and the lexical information from \textit{na} and \textit{Nayla} induces the building of a linked structure, whose top node the actions of \textit{Nayla} decorate, exactly as we saw in the example with preposed subject. The step that then follows is the evaluation of the linked structure, to form a compound group-denoting term at the unfixed node, which combines two singular terms as a formula decoration for the unfixed node, again as we saw before. At this point with the LINK structure complete and evaluated, the unfixed node can (indeed must) validly \textsc{Merge} with the subject node as shown in (7.50).

(7.50) Parsing \textit{wa-li-kuja} Haroub \textit{na} Nayla:

\[
T_n(0), ?T_y(t)
\]

\[
\begin{align*}
& T_n(00), ?F_o(U), ?\exists x F_o(x), \\
& F_o(e, x, \text{PLUR}(x)), \varnothing
\end{align*}
\]

\[
T_y(e \rightarrow t), \quad F_o(Kuj')
\]

\[
\langle \uparrow \ast \rangle T_n(00), ?F_o(x), ?\exists x F_n(x), \\
F_o(e, z, (\lambda x. \text{Haroub}'(x) \land \text{SING}(x)) \\
\land (\lambda y. \text{Nayla}'(y) \land \text{SING}(y))(z))
\]

\[
\langle L^{-1} \rangle \langle \uparrow \ast \rangle T_n(0), ?F_o(e), ?F_o(t, y, \text{Nayla}'(y) \land \text{SING}(y))
\]
7.3.3 Postposed subjects with agreement mismatch

Now we get to the mismatch case of agreement, (7.47b), displaying subject inversion with singular agreement. The initial steps of parsing the verb and introducing and decorating an unfixed node in the progressive construal of (7.47b), are exactly as set out in the displays in (7.48) and (7.49), except that the subject node is specified as singular, not plural. At this point, instead of proceeding with the parse of *na* and the construction of a LINK relation, the choice is taken to MERGE the unfixed node with the subject position, as shown in (7.51).

(7.51) Parsing *a-li-kuja Haroub*:

![Diagram](image)

The two quantified terms decorating the subject node as a result of this merge step collapse trivially to:

\[ \text{Fo}(t, x, \text{Haroub}'(x) \land \text{SING}(x)) \]

Since Haroub is a singular entity, the update of the metavariable \( \text{Fo}(U) \) by the term denoting Haroub is unproblematic, with the result that at this stage, the subject node is decorated with a term denoting a singular entity as subject, signally matching the singular specification of the verb’s pronominal-subject-agreement marking. It is now only after this step that the conjunction, and the second conjunct are parsed, introducing and decorating a linked structure to give the tree in (7.52).

(7.52) Parsing *a-li-kuja Haroub*:

![Diagram](image)

From this step on, the sequence of actions is all familiar. By LINK evaluation (CONJUNCTION), this can be developed into a tree whose subject node is decorated by:

\[ \text{Fo}(t, x((\lambda y.\text{Haroub}'(y) \land \text{SING}(y)) \land \lambda z.\text{Nayla}'(z) \land \text{SING}(z))(x)) \]
And so with this compound formula as subject of the verb *kuja* we again derive the same resulting formula:\(^{20}\)

\[
\text{Fo}(\text{Ku'}(t, x((\lambda y.\text{Haroub'}(y) \land \text{SING}(y)) \land \lambda z.\text{Nayla'}(z) \land \text{SING}(z))(x)))
\]

The final trees of all examples discussed so far are effectively identical, reflecting correctly the fact that the denotational content expressed by these examples is the same, namely that Haroub and Nayla came. The bonus is that the specific pragmatic interpretations associated with the different sequences result correctly, not from differences in the final tree, but from the differences in the sequence of building up the structure. The availability of a presentational focus construal with postposed subjects results from the presumed unavailability of a contextual interpretation of the metavariable associated and the late construction of the formula value only once the structural template is provided by the verb. The intuition about the aboutness of verb-subject structures with singular agreement, namely that the assertion is about the individual itemised by the first conjunct, and not about the group of individuals picked out by the whole conjunction, is directly reflected in the availability of an intermediate tree in which only the information from the first conjunction is projected at the subject node.

A final addition to the analysis so far in this context is to assume that the LINK structure introduced by *na* can be constructed from a position in the string not adjacent to the head:\(^{21}\)

\[(7.53) \text{Haroub } a-\text{ SUBJ} \text{3rd.sg} \text{ li- PAST kuj-a na Nayla}
\]

\`Haroub came with Nayla.'

In order to explain examples like these, we assume that the pointer may move back to the subject node after the verb has been scanned and that a LINK relation from the subject may be projected so as to accommodate the lexical actions defined by *Nayla*. This would lead to an analysis where (7.53) results in the same final tree as all examples discussed so far, but, again, crucially differing in the way these final trees are derived. For the derivation of (7.53), it is necessary that the unfixed node decorated with the information from *Haroub* merges with the fixed subject node projected from the verb before the LINK relation is built. This is because, firstly, according to our lexical definition of *na*, the LINK relation can only be built from a node with a fixed formula value, so that the LINK construction process cannot carry over the metavariable decoration provided by the verb. Secondly, the pointer can only move to the fixed subject node, but not to the unfixed node, so the LINK construction process cannot be built from the unfixed node. The result is that, in order to build a LINK relation, the subject node has to have been decorated with the formula value from *Haroub*. In consequence, end-placed conjunctions with *na* can only occur with singular agreement, the plural agreement marking is precluded:\(^{22}\)

\[(7.54) \text{*Haroub } wa-\text{ SUBJ} \text{3rd.pl} \text{ li- PAST kuj-a na Nayla}
\]

\`Haroub came with Nayla.'

---

\(^{20}\)This is a formula differing only from earlier formulations in lacking an explicit predicate of plurality, in any case an immediate step of lexical inference.

\(^{21}\)The problem is analogous to relative clause extraposition, as in the English A man left, who I like.

\(^{22}\)The return of the pointer to a completed subject node assumed here is used in chapter 8 to provide accounts of equative and specification copula clauses.
CHAPTER 7. SWAHILI AGREEMENT AND CONJUNCTION

The examples discussed so far show how the interaction between agreement and word-order receives a natural explanation from a dynamic perspective. What we have developed are analyses for sets of well-formed strings, all with the same semantic interpretation, whose syntactic explanation, in particular the distribution of agreement morphology, as well as their discourse-pragmatic status have been shown to be crucially dependent on the transitions from initial to final tree.

7.3.4 Object agreement

As we shall now see, the availability of partial object agreement, which is much less studied, can be explained without any further modification of the analysis outlined so far. While the relation between word-order, agreement and conjunction has attracted reasonable attention in the literature, most previous analyses have been exclusively concerned with subject agreement. However, there is a similar relation between word-order and the pronominal doubling called object agreement. The DS analysis of conjunction and agreement developed so far can easily be extended to these cases, because the agreement facts with object agreement depend, like subject agreement, on temporally specified word-order.\(^\text{23}\)

To begin with, consider the following examples where the conjoined object follows the verb:

\[\text{(7.55)}\]

\(\begin{array}{ll}
\text{a. } & \text{Asha } \text{a-} \text{li-} \text{wa-} \text{ona } \text{Haroub } \text{na} \\
& \text{Asha } 1\text{-SUBJ}_{3\text{rd.sg}} \text{ PAST } 1\text{-OBJ}_{3\text{rd.pl}} \text{ see } \text{Haroub } \text{and} \\
& \text{Nayla} \\
& \text{Nayla} \\
& \text{‘Asha saw Haroub and Nayla.’} \\
\text{b. } & \text{Asha } \text{a-} \text{li-} \text{mw-} \text{ona } \text{Haroub } \text{na} \\
& \text{Asha } 1\text{-SUBJ}_{3\text{rd.sg}} \text{ PAST } 1\text{-OBJ}_{3\text{rd.sg}} \text{ see } \text{Haroub } \text{and} \\
& \text{Nayla} \\
& \text{Nayla} \\
& \text{‘Asha saw Haroub and Nayla.’} \\
\end{array}\)

In these cases, object marking is obligatory, as we have animate-denoting NPs, which, like their Spanish strong-pronoun counterparts, are defined as decorating only an unfixd node or a LINKed structure. However, the object marking can either be plural (using the object concord \textit{wa}- or singular (with the object concord \textit{mw}-). The reason for this is similar to the reason given for verb-subject sequences. In both cases, the initial noun is introduced as decorating an unfixd node and then the verb complex, including the object concord marker, is scanned. This gives rise to the introduction of a full propositional template, with metavariables decorating both subject and object nodes, courtesy of the subject and object agreement markers. The conjoined object sequence is processed only after this sequence of actions, via an application of \textsc{Late *Adjunction} at the object node. Because of this, as in the case of verb-subject sequences, there are two different routes for parsing \textit{na Nayla}, depending on whether the object marker is singular or plural.

If the object marker is plural, as in (7.55a), the parse proceeds through scanning the conjunction and deriving the semantically plural term which can \textsc{Merge} without conflict with the object node, as shown in (7.56).\(^\text{24}\)

\(\text{\underline{23}}\)While the DS analysis extends naturally to these object agreement cases, it is less clear how alternative analyses based on hierarchical configuration such as spec-head agreement could be extended to object agreement.

\(\text{\underline{24}}\)A further property that allows \textsc{Merge} to take place is that these object personal pronouns markers must, like their subject counterparts, lack any bottom restriction.
With both conjuncts parsed, the information from the LINKed structure can, at the next step, be evaluated as part of a compound term compiled on the unfixed node in order to provide the appropriate plural entity that can be consistently merged with the decorations on the object node. Finally, the unfixed node decorated by Asha is merged with the subject node and the tree can be completed coherently, leaving no outstanding requirements.

In contrast, (7.57) shows a snapshot of the parse of the string in (7.55b) with singular object marker. Here, as before with subject post-posing, the unfixed node decorated by Haroub merges with the object node prior to parsing of the conjunction.

Different object agreement, like different subject agreement, thus results in the projection of identical final trees, with differences in the construction process, namely whether Merge occurs before or after the LINK structure induced from na is built.

A further parallelism between subject and object agreement can be seen with fronted objects. Objects in Swahili can freely be fronted, as the following examples show. However, for fronted conjoined objects, verbal agreement has to be plural:
It is clear from these examples that the relevant parameter determining agreement possibilities is word-order, and that object and subject agreement behave exactly alike in this respect: If the conjoined NP precedes the verb, only plural agreement is possible, while if the conjoined NP follows the verb either plural or singular agreement is possible.

The relevant DS analysis follows from the analysis developed so far, again on the assumption that the fronted objects are projected unto unfixed nodes at the outset of the parse (though here, as in other cases, a LINK analysis would, equally, be appropriate).

7.4 Agreement across Linked Structures

Throughout the discussion so far we have developed the account of animate-denoting NPs as decorating an unfixed node that merges with a fixed node. Yet this is only half the story for, equally, these NPs could be taken to decorate a LINKed structure with only an anaphoric connection to the main structure. It is in particular with conjoined terms denoting non-animates that the relation between the compound term resulting from a conjoined NP and the remainder is relevant. This
relation is in some sense often less structural than with the animate NP cases we have discussed so far, and is better characterised as an anaphoric relation satisfied across a LINK relation. This can be seen at least partly as a function of the difference between animate and non-animate agreement markers. Animate agreement markers encode singularity and plurality as a restriction on the substitution of the metavariable they project, and this is provided by other terms presented in the same structure, hence indicating a construction process involving a step of *ADJUNCTION to introduce an unfixed node with MERGE with the node decorated by the agreement marker. Non-animate agreement markers, on the other hand, encode a restriction with no structural reflex, which is merely that the substituend provided by the antecedent can be construed as fitting into the same set as that indicated by the class of the agreement marker. We will thus use examples with non-animate NPs in the following section to illustrate agreement possibilities across a LINK relation.

7.4.1 Subject agreement: non-animates

The most common agreement strategy with a conjunction of non-animate denoting NPs is to have verbal agreement of a default class, that is, the conjunction of two (or more) NPs of any non-animate class can be used with a subject (or object) clitic of any class which can suitably be construed as referring to the assortment of entities identified by the compound term:

\[(7.61) \text{sabuni na maji vi-} \text{ta-} \text{ku-} \text{saidi-a} \]
\[9\text{-soap and 6-water 8-SUBJ FUTURE 1-OBJ}_{2nd\text{.sg}} \text{ help-FIN} \]
\[\text{‘Soap and water will help you.’} \]
\[[9 + 6 \gg 8] \]
\[(Krifka 1995: 1400)\]

\[(7.62) \text{pambo la nyumba, vi-faa, zana na} \]
\[5\text{-ornaments 5-GEN 9-house 8-fittings 9-furniture and} \]
\[\text{samani mbalimbali zi-} \text{li-} \text{wez-a} \text{ ku-} \]
\[10\text{-decorations various 10-SUBJ PAST be able-FIN 15} \]
\[\text{u-} \text{mez-a} \text{ ... u-tupu wa nafasi kubwa} \]
\[11\text{-OBJ swallow-FIN ... 11-emptiness 11-GEN 9-space big} \]
\[\text{ile} \text{ ...} \]
\[9\text{-DEM} \]
\[\text{‘The ornaments of the house, fittings, furniture, and various decorations were able to swallow ... the emptiness of this big space.’} \]
\[(Abdulla 1976: 61)\]
\[[5, 8, 9/10 + 9/10 \gg 10]\]

In the first example, a conjunction of a class 9 and a class 6 noun is used with a verb showing class 8 subject agreement. The second example, which is somewhat similar in content and structure to example (7.7) at the outset of the chapter with class 8 agreement, shows a conjunction of nouns from several classes and class 10 verb agreement. Other examples of this strategy employ class 6 and sometimes class 11 agreement. What all these classes have in common is that they prototypically denote an assortment of more or less abstract entities. The relation between the conjoined NP and the agreeing verb in these cases is, we propose, not so much one of number, with the term the NP projects as an update to the term projected by the pronominal marker, but a looser anaphoric relation, where the verbal agreement functions as a pronoun to be interpreted as referring to the entity denoted by the
conjoined NP without the need to absorb the created term and its associated structure into the propositional structure. Since the category of number is not relevant in these cases, we assume, in line with Schadeberg (2001), that pronominal prefixes with a noun class indicating a non-animacy restriction project a metavariable with a presupposition, not relating to number, but to the set membership of this class. Thus, in (7.61), the question in constructing a representation for the string is whether the concept associated with the formula value constructed from sabuni and maji, i.e. an assortment of soap and water, provides an appropriate substituend for the metavariable projected as the formula value of vi- which we analyse as $\text{Fo}(U_8)$.

The answer to this is yes, as the grammaticality of (7.61) shows. The choice of agreement morpheme for conjunctions of non-animates in Swahili is then to some extent pragmatically determined, reflecting contingent properties of the objects denoted. We would expect speakers to vary in their acceptance of one or more of those pronominal forms (i.e. those found in the examples above, with vi-, zi-, or ni-, and possibly others) which plausibly in a given context can serve as anaphoric element for a given antecedent. A schematic tree display showing how (7.61) is parsed is shown in (7.63), using rules for constructing topic structures in chapter 4 (see section 4.2.1).

(7.63) Parsing (7.61):

\[
\begin{align*}
\langle L \rangle T_n(0), Ty(e), & \quad \text{Fo}(\epsilon, x, (\lambda y. \text{Sabuni}'(z) \land \lambda z. \text{Maji}'(y))(x)) \\
\langle D \rangle T_n(0), Ty(t), & \quad \text{Fo}(\epsilon, x, (\lambda y. \text{Sabuni}'(y) \land \lambda z. \text{Maji}'(z))(y))) \\
T_y(e), & \quad \text{Fo}(U_8), \quad \text{Fo}(Saidi}'(i, y, Juma'(y))) \\
T_y(e), & \quad T_y(e \rightarrow (e \rightarrow t)), \quad \text{Fo}(i, y, Juma'(y)) \quad \text{Fo}(\text{Saidi}') \\
\langle L^{-1} \rangle T_n(0), Ty(e), & \quad \text{Fo}(\epsilon, z, \text{Maji}'(z)) \\
\langle L^{-1} \rangle T_n(0), Ty(e), & \quad \text{Fo}(\epsilon, z, \text{Maji}'(z)) \\
\end{align*}
\]

The tree in (7.63) shows that the whole term constructed from the conjoined NP is LINKed to the remaining structure. It is thus not merged with the subject node, but rather, as in other cases of LINK which we have encountered before, there is a requirement at the root node $T_n(0)$ that a copy of the formula value of the LINKed node be part of the eventual tree. This requirement can be fulfilled by a suitably construed anaphoric pronominal element such as the formula value projected by the subject marker. Because the (non-animate) subject marker does not encode a number restriction, agreement with non-animate conjoined NPs is more subject to pragmatic constraints than agreement with animate conjoined NPs.\(^{25}\)

\(^{25}\)In the light of this analysis, we propose that examples in the literature which have been analysed as agreement with the last conjunct of a pre-verbal conjoined NP are in fact instances of anaphoric agreement across a LINK relation to a compound term, of which the first conjunct is used to decorate a structure LINKed to the node decorated by the second conjunct (see Ashton (1947: 311), Schadeberg (1992: 22), Marten (2000)):

(i) wema huu na hisani hii ha-i-nenekan-i

11-goodness 11-this and 9-kindness 9-this NEG-9SUBJ-sayable-NEG

‘This goodness and this kindness cannot be expressed (in words) ...’

It is worth noting that examples like this are only ever reported with non-animate NPs.
7.4. AGREEMENT ACROSS LINKED STRUCTURES

7.4.2 Object Agreement: non-animates

The examples with non-animate denoting NPs given so far have shown subject agreement. Object agreement with non-animate conjoined NPs is also possible, but it is not obligatory. One possibility is to have a default object clitic similar to the subject cases. However, partial agreement of the kind discussed in the previous section is also found with non-animate NPs, as in the following example, which shows a post-verbal conjunction of two class 9 nouns and class 9 object agreement:

(7.64)  
\[\text{a-} \text{li-} \text{i-} \text{tia fremu na picha ya} \]
1-SUBJ3rd.sg PAST 9-OBJ push-into 9-frame and 9-picture of
Muhammad Ali chini ya godoro
Muhammad Ali under of mattress

“She pushed the frame and the picture of Muhammad Ali under the mattress.”

(Abdulla 1976: 70)  
\([9 \ll 9 + 9]\]

In this example, the object clitic shows class 9 agreement, and the object NP is a conjunction of two class 9 nouns. The fact that both conjuncts are of the same class here is accidental, and we assume that the object clitic is construed as picking out the term provided by the first conjunct. The analysis of this type of example parallels our analysis for the animate cases above, except that we assume that the post-verbal object serves to decorate a node at the top of a linked structure. The term constructed indeed functions as a background topic here, presumed to have been independently identified in the context in some form (we assume that the subject is identified from context as Asha). Such LINKed structures can be constructed in two ways. The first is via the construction of a LINK relation from the top of the propositional structure, analogous to She talks too fast, that woman, as we saw in chapter 5. Upon this construal, the metavariable provided by the agreement marker must be already identified as some term identified from the context to allow compilation of the full propositional structure. Here, the context provides the group denoting term (see footnote 26):

\[Fo(\epsilon, x, (\text{Fremu'} \land \text{Picha'})(x))\]

The constructed anaphorically-constrained LINK relation must then involve an anaphoric relation to a term denoting a class of objects, a term which is imposed as a requirement on the way the linked structure is completed. Given that the expression to be treated as the value of a formula decorating the linked structure is itself a group-denoting entity, the term identified in context must already have been identified as a group-denoting entity also. This analysis is illustrated in (7.65), where the step of SUBSTITUTION for the metavariable projected by the object marker i- is displayed to bring out the process by which the tree is constructed.

---

26 Indeed the picture and the frame are mentioned in the previous section of the novel, from which this example is taken, so the analysis accurately matches the rhetorical effect intended by the writer.
There is a second option which is to construct a LINK relation directly from the object node to a structure of type $e$. We postpone the formal description of the rule that achieves this transition until chapter 8 where it will form the backbone of our analysis of equative and specificational copula clauses. However, the intuition behind the rule is straightforward. Most, if not all, natural languages permit NP apposition, i.e. the stacking of noun phrases each denoting the same object, but providing further specification of that object, as in (7.66).

(7.66) Ruth, a colleague from London, a well-known professor of Linguistics, is giving a talk here next week.

This piling up of noun phrases can easily be accounted for by a rule that projects a LINK structure from one type $e$ node to another and compiles up the information on the LINKed tree onto its host to get the effect of specifying a single entity. In the current example, the APPOSITIVE LINK construction rule can be used to build a LINK relation to a type-$e$-requiring node, permitting the parse of the first post-verbal conjunct, fremu in (7.64) as shown in (7.67).

(7.67) Parsing (7.64):

On this construal, the final NP is taken to be in apposition to the pronoun. Conjunction of further noun phrases can take place in the now familiar way and evaluation takes place up the LINK relations to provide a new, complex compound term decorating the compound structure. At this point, evaluation of the APPOSITIVE LINK structure occurs, in this case essentially copying this constructed formula value onto the node decorated by the metavariable (see section 8.4.2). In the case

\[27\] See chapter 8, section 8.4.1, for details.
7.4. AGREEMENT ACROSS LINKED STRUCTURES

of (7.64), the metavariable provided by the agreement marking is restricted to concepts which can be classified as being of class 9. By such a move, the class of the first NP can be taken to satisfy the predicate specification of the verb, imposing such a classification on any further NP that follows.

7.4.3 Non-animate Concord: Cross-Linguistic Variation

Interestingly, there is cross-linguistic variation as to these possibilities in different Bantu languages. On the one hand, in many Bantu languages, only one agreement morpheme is acceptable for pronominal reference with conjoined non-animates, most commonly a cognate form of the Swahili agreement marker \( vi-\):

(7.68) \( ici-puna \ ne \ tebulo \ na- fi- \ pon-a \) [Bemba]  
7-chair and 9-table PAST 8-SUBJ fall-FIN  
‘The chair and the table fell down.’  
\([7 + 9 \gg 8]\)

(7.69) \( ulu-kasu \ ne \ nganda \ fi- \ lee- \ y-a \ kuli \ Chomba \)  
11-hoe and 9-house 8-SUBJ PRES go-FIN to Chomba  
‘The hoe and the house are going to (e.g. are inherited by) Chomba.’  
\([3 + 7 \gg 8]\)

In Bemba, one of the national languages of Zambia, only \( fi-\) is possible in this context as verbal agreement marker. The system in Bemba seems to have grammaticalised the more pragmatic system found in Swahili. It is possible that the notion of singularity plays a role in Bemba also for nouns denoting non-animates, in contrast to Swahili, where we have claimed it is only relevant to animates, and that the only appropriate anaphoric plural is the class 8 marker \( fi-\) as illustrated in the examples above.

In contrast, the non-animate agreement system in Luguru, a North-East coast Bantu languages spoken in Tanzania, is, in a sense, more pragmatically driven than the Swahili system. Luguru has pragmatic partial agreement with conjunctions of non-animate NPs (the agreement possibilities for animate NPs are the same as in Swahili; see Marten and Ramadhani (2001), Marten (2003)), whereby a verb may show subject agreement with only one conjunct of a non-animate conjoined subject or object, as long as the conjoined NP - subject or object - precedes the verb.

(7.70) \( chi-ti \ na \ ghumu-biki \ pfi- \ ghu-liw-a \) [Luguru]  
7-chair and 3-tree 8-SUBJ buy-PASS-FIN  
‘The chair and the tree were bought.’  
\([7 + 3 \gg 8]\)

(7.71) \( ghumu-biki \ ne-chi-kapu \ pfi- \ ghu-li-w-a \)  
3-tree and 7-basket 8-SUBJ buy-PASS-FIN  
‘The tree and the basket were bought.’  
\([3 + 7 \gg 8]\)

(7.72) \( chi-ti \ na \ ghumu-biki \ chi- \ ghu-liw-a \)  
7-chair and 3-tree 7-SUBJ buy-PASS-FIN  
‘The CHAIR and the tree were bought.’  
\([7 + 3 \gg 7]\)
The examples show a conjunction of a class 7 and a class 3 noun, and the different verbal agreement markers possible with it. The first two examples show default agreement with class 8 pﬁ-, similar to Swahili class 8 agreement with vi-. However, the second two examples show instances of 'pragmatic' agreement not found in Swahili. In (7.72), the verb has a class 7 agreement marker, and in (7.73) a class 3 agreement marker corresponding to the first and the second conjunct respectively. The point here is that the conjunct which triggers verbal agreement provides information which is pragmatically prominent, and emphasised (represented in the English translation by the use of small capitals). Pragmatic agreement is sensitive to word-order as in the Swahili cases. The following examples show pragmatic agreement with one conjunct of a fronted object, but the unavailability of agreement with the second conjunct if the object follows the verb:

(7.74)  ichi-ti na ghamu-biki wanzhe wa- chi- ghal-a
        7-chair and 3-tree elders 2-SUBJ 7-OBJ buy-FIN
      ‘A chair and a tree the elders bought.’
    [7 + 3 ≫ 7]

(7.75)  ichi-ti na ghamu-biki wanzhe wa- u- ghal-a
        7-chair and 3-tree elders 2-SUBJ 3-OBJ buy-FIN
      ‘A chair and a tree the elders bought.’
    [7 + 3 ≫ 3]

(7.76)  *wanzhe wa- gha- ghal-a li-banzi na ma-bwe
        elders 2-SUBJ 6-OBJ buy-FIN 5-wood and 6-stone
      Intd.: ‘The elders bought a wooden board and stones.’
    [∗6 ≪ 5 + 6]

While we do not develop a full analysis of the Luguru facts here, they do not seem particularly intransigent. Given that all processes are optional, the unfixed node decorated by the subject may be left unmerged and the LINK evaluation process in setting out the subject also left unevaluated, both forms of underspecification being delayed until after the verb is parsed. This would allow the match between agreement markings between the first provided term and the pronominal agreement marking. Alternatively, given the pragmatic nature of antecedent selection, the choice of antecedent might be made from the smallest possible context, that being deemed to pick out the set of properties most recently added to the context, that of the second term. On either strategy, the way in which interpretation would be being built is analogous to the two-stage construal of expletives, with an initial partial specification and a later update. Such a delay is not available to the parsing of the object since pointer return to the object node, given that the sequence of object NPs is in any case after the verb, would be precluded. Of course, any such account would need rounding out in detail, but it would seem very much within the general spirit of the explanation, and furthermore an appropriate reflex of a phenomenon undergoing change.28

28 Analogously, in Spanish, Rio-Platense Spanish object clitics are shifting into having the freedom of the dative expletives, and in so doing, losing the bottom restriction, which, in standard Spanish, distinguishes the two forms of clitic.
7.5 Summary

Our main topic in this chapter was the analysis of agreement with conjoined NPs in Swahili, and how this relation can be analysed from a dynamic perspective. This also provided a welcome opportunity to look more closely at two of the defining features of Bantu languages, namely the systems of verbal agreement and nominal classification in the noun class system. We have seen that agreement in Swahili shares a number of characteristics with the pronominal clitic system of Romance languages, and we have proposed an analysis of Swahili subject and object agreement markers along the lines sketched earlier for Spanish. The difference between the systems of these two language groups is, from this perspective, mainly one of relative freedom of positioning. The Romance clitic system is slightly more free, with cross-linguistic variation in clitic ordering, while in the Bantu system the pronominal markers are in a fixed position with respect to the verb stem and tense morphemes. However, both systems share essential pronominal features which allow for both cataphoric and anaphoric uses of the pronominal elements. Our analysis of the noun class system was based on the observation, made by several researchers, that there is a considerable semantic core to nominal classification in Bantu, and that speakers can exploit this semantic information in the construal of pronominal, underspecified elements. This analysis explains the agreement facts solely with recourse to the dynamics in which semantic structure unfolds, and so doing explaining both the denotational equivalent, and yet the pragmatic differences of structures with different agreement properties. It goes without saying that more empirical and theoretical work in this area is necessary, but we take the dynamics of the parsing-oriented system to have illuminated a complex morphological area.
Chapter 8

Copula Constructions in English

In the last two chapters, we have been exploiting the ability of Dynamic Syntax to allow steps of inference to interact with the syntactic process of establishing representations of content to provide explanations of problematic linguistic data. The use of various kinds of underspecification permit these explanations through processes of update, either derived from computational actions (*ADJUNCTION and MERGE) or through pragmatic reasoning (abduction and substitution). In this chapter, we push these ideas a bit further, and develop the analysis of expletives put forward in chapter 5 and developed for Swahili in chapter 7 into a (partial) account of the copula in English that utilises semantic underspecification and pragmatic enrichment. In particular, we present an account of the predicative construction, and show how an analysis of the ‘double expletive’ construction involving forms of the string there be can be given. We end the chapter with a brief account of equative and specifical copular clauses which exploits the properties of the LINK mechanism. In all these constructions, we argue, the interpretation of the string crucially depends on the properties of the expressions that appear with the copula, the context in which the string is uttered and the parsing process itself. This will require us to look a bit more closely at the syntax/pragmatics interface and the discussion in this chapter is thus inevitably more speculative than previously. We believe, however, that it provides enough substance to give the reader an idea of the explanatory potential of Dynamic Syntax for constructions whose interpretation varies with local and non-local context.

8.1 Analysing ‘Be’

The copula appears in a whole range of constructions which apparently involve complements of different sorts and which show a variety of interpretations. For example, in English we find be inducing an interpretation of identity with a noun phrase complement in equatives (8.1a); as doing little more than hosting tense and agreement information with adjective, prepositional and nominal phrases in predicatives (8.1b); giving rise to existential interpretation in construction with there (8.1c); as some sort of presentational marker with an expletive subject (8.1d); as part of a construction determining focus in cleft (8.1e), and pseudo-cleft (8.1f) constructions; and (rarely) as providing ‘existential focus’ in certain intransitive
constructions (8.1g).\(^1\)

(8.1)  
\begin{itemize}
  \item a. Mary is the dancer.
  \item b. John is silly.
  \item c. There is a riot on Princes Street.
  \item d. It’s me.
  \item e. It is Mary who is the dancer.
  \item f. What we want is a good review.
  \item g. Neuroses just are (they don’t need a cause)
\end{itemize}

The variability in the interpretation of be in (8.1) is further compounded by the subtle differences in meaning exhibited by very similar sentences. For example, copular clauses involving a definite noun phrase give rise to slightly different interpretations according to whether the definite NP precedes or follows the copula. Equative clauses, as in (8.2a), involve a post-copular definite which appears to be fully referential, while specification clauses, as in (8.2b) involve an initial definite which appears to provide a description of an unknown entity, rather than to pick out some specific object.\(^2\)

(8.2)  
\begin{itemize}
  \item a. John is the culprit.
  \item b. The culprit is John.
\end{itemize}

Whether a string consisting of two noun phrases and a form of the copula is interpreted as predicative or equative thus depends largely on the definiteness of the post-copular term: an equative reading is only possible if this is definite.\(^3\) Furthermore, if both noun phrases are definite, then either an equative or a specification reading may result, depending on whether the post-copular term may (or must) be interpreted as fully referential in context and whether the initial term need not be. A sentence such as that in (8.3) where both noun phrases contain the definite article may be interpreted as equative or specification according to the context of utterance.

(8.3)  
The culprit is the teacher.

Such variation in interpretation according to the definiteness of a noun phrase is found also in constructions of the copula with the expletive pronoun there. So, for example, when the post-copular noun phrase (the associate) has a weak (or intersective, Keenan and Stavi (1986), Keenan (2001)) determiner, this gives rise to the ‘standard’ existential construction illustrated in (8.4a). With post-copular definites, however, we have presentational or locative readings as in (8.4b)-(8.4c), while numerals may give rise to existential, presentational or locative interpretations as in (8.4d).

(8.4)  
\begin{itemize}
  \item a. There’s a riot on Princes Street.
  \item b. There is the student that you wanted to see in the corridor.
  \item c. There’s that cat again.
  \item d. There are three students in the common room.
\end{itemize}

\(^{1}\)We leave on one side the ‘grammaticalised’ constructions of passive and progressive in English.  
\(^{2}\)See Heycock (1994), Heycock and Kroch (1999), Mikkelsen (2004), etc.  
\(^{3}\)The interpretation of specific indefinites seem to be able to induce quasi-equative readings:

i. Mary is a student I’ve been waiting for for twenty years.
Reconciling these different interpretations of copular clauses in English is not straightforward. There is little apparent semantic similarity between existence, equation, presentation and predication, let alone the progressive and passive. Yet treating *be* as multiply homonymous is not an attractive option, neglecting as it does the interaction of whatever meaning the copula has with the semantics of the expressions with which it combines. Hence, most discussions of the copula in the linguistic literature try to reconcile the different interpretations as far as possible. Such accounts tend to be restricted to reconciling predicate and equative (and specification) readings which minimally seem to require two homonyms with distinct semantic structures. Montague (1973) treats the copula as equative, giving it a translation $\lambda P \lambda x \forall \{ \hat{y} \mid x =^? y \}$. This permits an account of predicational uses with indefinite post-copular expressions, but does not treat adjectival predicative constructions. Other semantic attempts to resolve this ambiguity, such as those in Williams (1983) and Partee (1986) favor treating the copula as ‘essentially’ predicative. Partee’s account, for example, provides the copula with a semantic type ($e \to t$) $\to$ ($e \to (e \to t)$) with the semantic structure: $\lambda P \lambda x. P(x)^4$. The difference between predicative and equative readings is derived through a type shifting operation (Ident) on a post-copular term to turn it into an identity predicate, thus shifting the homonymy to the term rather than the copula.

The details of Partee’s analysis (and other similar ones) are not important here but one of the things such an analysis fails to account for is the existential effect of *be* exhibited not only in the *there be* construction in (8.1c) but also in the intransitive usages in (8.1g) and the more common (although quasi-idiomatic) strings in (8.5).

(8.5)  
\begin{enumerate}
  \item I think therefore I am.
  \item To be or not to be.
\end{enumerate}

But we now get us back to an apparently irreconcilable homonymy for the copular verb between denoting existence and providing no semantic content at all. Such analyses also signal fail to account for the context sensitivity of the interpretation of *be* in various constructions.

8.1.1 *There be*

There have, of course, been a number of interesting and elegant attempts to deal with this problem semantically (see in particular Heycock and Kroch 1999). However, the problem of context dependence reasserts itself, more strongly, with respect to constructions involving *there be*. This construction gives rise to a range of different interpretations, depending on the properties of the post-copular noun phrase (often called the ‘associate’) and the rest of the clause (often referred to as the ‘coda’ or the ‘extension’ in Huddleston and Pullum 2002)). In the examples in (8.6) below, we have existential, presentational and locative readings associated with minimally different syntactic contexts.

(8.6)  
\begin{enumerate}
  \item There’s a chemist shop on Princes Street.
  \item There is the chemist shop on Princes Street that you wanted to go to.
  \item There’s that chemist shop again.
\end{enumerate}

The existential/presentational distinction seems to correlate with the definiteness of the post-copular noun phrase. Clauses with definite associates are thus

\footnote{Partee, in fact, allows a variable type with the arguments of the expression appearing in either order, i.e. $\lambda x \lambda P. P(x) : e \to ((e \to t) \to t)$.}
typically interpreted as locative or ‘presentational’.\footnote{The latter being a catchall term that we use for interpretations that are neither existential nor locative.} The differences between existential, locative and presentational readings might be taken to indicate differences in the meaning of there be. This cannot be the case, however, because definite and indefinite associates can be conjoined, giving rise to apparently mixed readings. Consider the examples in (8.7).

(8.7) a. There’s a crow on the lawn.
    b. There’s that bloody cat fighting on the lawn.
    c. There’s a crow and that bloody cat fighting it out on the lawn.

While (8.7a)-(8.7b) seem to be indisputably existential and presentational, respectively, (8.7c) may be interpreted variously: as existential (there is a fight on the lawn between the cat and a crow); presentational (the cat is fighting on the lawn with a crow); or with a mixed reading (there is a fight on the lawn and the cat is fighting with a crow on the lawn). Such a mixed reading is more obvious in the example in (8.8) and this should be impossible if the constructional subtypes are semantically discrete.

(8.8) There’s/are a student and the lecturer (you wanted to see) outside.

The context-dependence of there be constructions is further shown in examples with associates with non-definite strong quantifiers. Although not particularly frequent and often quite marked, universally and other quantified NPs can appear after there be, but the interpretation of such sentences depends strongly on context. Compare the acceptable example in (8.9a) with the odd, but minimally different, example in (8.9b).

(8.9) a. There’s every PhD student of mine coming to my inaugural.
    b. ??There’s every student in the garden.

The example in (8.9a) is likely to be acceptable only in a context which supports the open proposition There are n students coming to y’s inaugural, the determiner providing the value for n (and the pronoun providing that of y). This would give rise to a focus effect, which might be considered to be precluded by the universal quantifier every. The example in (8.9b), peculiar out of context, would seem similarly to require some context such as There are n students in the garden to be acceptable, and indeed the exchange in (8.10) appears to be well-formed. In a null context, however, the sentence is odd, if interpretable at all.

(8.10) I think there are only one or two students in the garden.
    No, there’s every student in the garden.

Another example in (8.11a),\footnote{From http://www.24hoursofadrenalin.com/sched\_mass.cfm, October 2002} is interpretable without further contextualisation but requires inference over every chain restaurant to every type of chain restaurant. The example in (8.11b), on the other hand, while it could be interpreted in a similar fashion requires more effort and a more elaborated context to achieve a similar result, because it is pragmatically unlikely that every type of restaurant (tout court) could be found on a single street.

(8.11) a. Within 15 minutes there is every chain restaurant in the USA.
    b. ??Within 15 minutes there is every restaurant in the USA.
Again this construction does not seem to involve different interpretations for *there be*, as illustrated in (8.12) where a definite or an indefinite may be conjoined with a universal to give possible mixed readings.

(8.12) There’s the Chancellor/a lord of the realm and every student of mine coming to my inaugural.

If it is true that the phrase *there be* itself does not have different interpretations directly, then the interpretation of the various constructions involving this string must result from inference over whatever single meaning it has and the meanings of its associates and codas. Analyses of the existential construction typically concentrate on properties of the associate and mostly on the existential reading. As already noted, in one of the most influential semantic accounts, Keenan (1987) identifies associates as needing to be intersective DPs in order to give rise to an existential reading. Musan (1995), on the other hand, analyses the construction in terms of a temporal variable indicating stage level predication, while McNally (1998) interprets the construction in terms of the properties of non-particulars. In a more pragmatic account, Zucchi (1995) argues that the existential reading occurs just in case the associate presupposes neither the existence nor the non-existence of some entity. Ward and Birner (1995), concentrating on definite associates, again adopt a pragmatic approach to the felicity of such constructions, attributing acceptability to the possibility of construing the post-copular definite as providing ‘hearer-new’ information.

We do not go into a discussion of these various accounts, but it is notable that in none of them is there an analysis of the string *there be*. The following statement by Louise McNally sums up the apparent attitude of most researchers in this area (although very few even acknowledge this lacuna in their discussion):^7

‘I treat *there be* as an unanalyzed unit; I do this ... partly because there is no decisive evidence concerning the individual semantic contributions of the individual words’ (McNally 1998:354).

The existential force of the construction is hypothesised to come from the way that associates and codas are interpreted or it is just assumed. Little attempt is made to derive the interpretations compositionally or to explore how (and indeed why) definiteness interacts with *there be* to give rise to different interpretations.

The interpretation of a *there be* sentences as presentational or existential is attributable to the definiteness of the post-copular associate, and existence is not (necessarily) predicated of definite associates (see also Mikkelsen (2002), Geist (2002), *inter alia*). The opposite, however, seems to be true in the case of the existential focus construction where an existential reading appears to be licensed only if the subject can be construed as generic, otherwise the clause must be interpreted as elliptical (or at least that ‘true’ indefinites seem not to give rise to an existential interpretation, e.g. A woman just is, OK?). This difference in interpretation according to definiteness also gives rise to differences in interpretation between equative and specificational clauses, as we have seen above. An equative reading with two noun phrases is only possible if the post-copular phrase is not indefinite, while specificational sentences differ only in terms of the order of the two noun phrases and are for their interpretation dependent on contextual information. The fact that the interpretation of a clause containing *be* may alter according to the expressions with which it appears in this way indicates that it is dependent on context.

^7See, however, Rooryck and Barbiers (1999) for a notable exception within a theory that utilises multiple Topic projections at the left periphery.
for its interpretation. With variability in acceptability also being dependent on the context of utterance, we have strong reasons for preferring an analysis of be that is inferential rather than semantic, with interpretation determined through pragmatic negotiation between the associates of the copula and non-local context. This is the approach that we take in this chapter: the interpretation of be is context-dependent and not ambiguous.

### 8.1.2 Intransitive Be

One of the problems of trying to treat the copula as non-homonymous, however, is the fact that it appears to be able to take complements of various numbers and types. So, for example, the constructions illustrated in (8.1) imply a number of different types that could be ascribed to the copula amongst which are \( e \rightarrow (e \rightarrow t) \) (equative), \( (e \rightarrow t) \rightarrow (e \rightarrow t) \) (predicative), and \( e \rightarrow t \) (existential focus). This flexibility of complement type is not matched by other auxiliary verbs, including have, compare (8.13) with (8.14) and (8.15).

\[
\begin{align*}
\text{(8.13)} & \quad A: \text{Kim is} \\
& \quad \quad \quad \text{a friend of yours.} \\
& \quad \quad \quad \text{the teacher.} \\
& \quad \quad \quad \text{playing football.} \\
& \quad \quad \quad \text{disliked by Hannibal.} \\
& \quad \quad \quad \text{happy.} \\
& \quad \quad \quad \text{misunderstood.} \\
& \quad \quad \quad \text{*play cricket.}
\end{align*}
\]

\[
\begin{align*}
\text{(8.14)} & \quad A: \text{Kim can} \\
& \quad \quad \quad \text{a friend of yours.} \\
& \quad \quad \quad \text{the teacher.} \\
& \quad \quad \quad \text{in the garden (ellipsis).} \\
& \quad \quad \quad \text{playing football.} \\
& \quad \quad \quad \text{disliked by Hannibal.} \\
& \quad \quad \quad \text{happy.} \\
& \quad \quad \quad \text{misunderstood.} \\
& \quad \quad \quad \text{play cricket.}
\end{align*}
\]

\[
\begin{align*}
\text{(8.15)} & \quad A: \text{Kim has} \\
& \quad \quad \quad \text{a friend of yours.} \\
& \quad \quad \quad \text{the teacher.} \\
& \quad \quad \quad \text{in the garden (ellipsis).} \\
& \quad \quad \quad \text{playing football.} \\
& \quad \quad \quad \text{disliked by Hannibal.} \\
& \quad \quad \quad \text{happy.} \\
& \quad \quad \quad \text{misunderstood.} \\
& \quad \quad \quad \text{play cricket.}
\end{align*}
\]

This variability in apparent complement type presents quite a serious problem in trying to establish the syntactic properties of the copula, leading in frameworks like GPSG (and HPSG) to the postulation of *syntactic* homonymy for be (Gazdar et al. 1982, Warner 1993). If be is semantically non-homonymous, however, syntactic homonymy should also be excluded. Of course, we could take the view that the type of the copula is simply underspecified and assign it a type \( Ty(U \rightarrow t) \) where the
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metavariable ranges not only over different types, but also over strings of types. However, such a move does not really solve the problem, as it gets us back to the quandary of how different complement types lead to different interpretations. Instead, we take a more restricted view of the adicity of be than is normally taken: that it projects one and only one argument. In other words, the copula is a verb that has a subject but no complements.

This position is supported by the data in (8.16) below, which reveal a further difference between the copula and the modals. The former allows construal of existence in a null context, while the latter, such as may and can, do not license interpretations where the general modality, such as possibility and ability, are ascribed to the subject. Without a complement VP, modals can only be interpreted elliptically, whereas, as we have already seen, be can give rise to a non-elliptical interpretation of existence in intransitive contexts.

(8.16) a. Neuroses just are. (= Neuroses exist)
    b. Neuroses just may. (≠ Neuroses are possible)
    c. The students just can. (≠ The students are able)

These differences from the auxiliaries, the variability in apparent complement type and non-elliptical interpretation in intransitive contexts, all lead to the same conclusion: that be uniformly projects a one-place predicate of type e → t.

8.2 Representing the Content of the Copula

We adopt, therefore, the hypothesis that be uniformly projects a one-place predicate whose content is underspecified and determined by context. As we have seen in previous chapters, such underspecified content when associated with a pronoun is represented by a metavariable of type e whose actual content is determined either by a pragmatic process of substitution or, if the pronoun is expletive, through an update provided by the parse of later material (i.e. through Late*Adjunction). This is exactly what we need in order to analyse the copula, except that the metavariable in this case is of predicate type. We may assume then that the lexical entries for the various forms of be all contain an instruction to annotate a predicate node with the appropriate type label and a metavariable, together with an associated requirement to find some contentful predicate to act as substituend.

It is not the case that just any predicate can associate with be, however, but only stative predicates that are associated with non-verbal expressions.

(8.17) a. *Kim knows the answer and Lou is, too.
    b. *Kim is knows the answer.

Maienborn (2002) argues for a differentiation between Davidsonian states (or D-states) and states that she refers to as K-states following Kim (1969, 1976)’s notion

---

8This must be true, at least with respect to e, t, and possibly e → t:
(i) Kim is mad.
(ii) That Kim is mad is obvious.
(iii) To run is fun.

9Such an account would be like the e* notation of Marten (2002b).

10Lamarche (2003) comes to essentially the same conclusion, though for very different reasons.

11As noted in footnote 8 above, it may be that this has to be modified to allow for propositional and property subjects. We do not explore such constructions here, but they do not undermine the essence of the current analysis. The important point here is that be does not project an internal argument, whatever the properties of its subject argument may be.
of temporally bounded property exemplifications. She suggests that such states are not eventualities, but form a separate class of abstract object (in the sense of Asher (1993)) somewhere between world bound facts and spatio-temporally defined eventualities. We do not go into her arguments here or discuss how she attempts to implement this concept within DRT, but adopt the hypothesis that copula clauses denote some sort of state that differs from the classic Davidsonian notion. This requires the lexical definition of the copula to project an annotation to ensure that any predicate that substitutes for the metavariable projected by \( \text{be} \) is restricted to K-states. This may be done by labelling the metavariable with a presuppositional condition on substitution, restricting substituends to K-states. So we may represent the content of \( \text{be} \) as \( \text{Fo}(U_S K) \). However, in order to keep clear that we are dealing with a predicate metavariable with a restriction on the types of predicate that can substitute for it, we will actually write the content of \( \text{be} \) as \( \text{Fo(BE)} \) in the hope that this will be clearer. It should nevertheless be borne in mind that technically \( \text{Fo(BE)} \) is shorthand for \( \text{Fo}(U_S K) \).

Before we can give a sample lexical entry, we need first to consider, albeit briefly, the behaviour of auxiliary verbs in English. Auxiliaries are differentiated from main verbs in English in terms of their behaviour with respect to negation (8.18a), inversion in question formation (8.18b), their acceptability as ‘code’ in ellipsis (8.18c), and emphasis (8.18d), the so-called NICE properties (Huddleston and Pullum (2002: 93), \textit{inter alia}):

\begin{align*}
(8.18) & \quad \text{a. She isn’t happy.} & \text{Negation} \\
 & \quad \text{They didn’t sing.} \\
 & \quad *\text{They sang not.} \\
 & \quad \text{b. Is she happy?} & \text{Inversion} \\
 & \quad \text{Did they sing?} \\
 & \quad *\text{Sang they?} \\
 & \quad \text{c. Jane is unhappy, and Bill is, too.} & \text{Code} \\
 & \quad \text{They saw Jane, and Bill did, too.} \\
 & \quad *\text{They saw Jane, and Bill saw, too.} \\
 & \quad \text{d. Jane seemed to be unhappy, but she wasn’t.} & \text{Emphasis} \\
 & \quad \text{John doesn’t think they sang, but they did.} \\
 & \quad *\text{John doesn’t think they sang, but they sang.}
\end{align*}

The fact that auxiliaries occur in inverted constructions, preceding the subject, indicates that they should be treated as projecting a propositional template from a \( ?T_y(t) \) trigger, in the same way that we have seen for Irish, Greek, Spanish, Italian, Swahili and Japanese in earlier chapters. This is unlike main verbs in English which we have treated throughout as being triggered by a predicate requirement. Since such a trigger can only be derived from \textit{Introduction} and \textit{Prediction}, the subject has also necessarily been projected by the time the verb is parsed: hence, they do not appear initially in a finite clause and cannot invert around a subject. Auxiliaries, however, have a propositional requirement as trigger and then project and decorate a predicate node and then build the subject node which is decorated with \( ?T_y(e) \).

With this in mind, we define the lexical actions associated with forms of \( \text{be} \) such as \( \text{is} \) as in (8.19).\footnote{The second condition is to prevent strings such as \( *\text{John singing is} \). In fact, this condition is likely to be too strong for a full analysis of the auxiliary system in English, as it would prevent multiple occurrences of the verb \( \text{be} \) itself, thus rendering ungrammatical strings like \( \text{John has been singing} \). However, we leave the necessary refinements for future research.} The result of parsing this verb initially in a string is shown in (8.20).
8.2. REPRESENTING THE CONTENT OF THE COPULA

(8.19) is

\[
\begin{aligned}
\text{IF} & \quad ?T_y(t) \\
\text{THEN} & \quad \text{IF} \quad \langle \downarrow 1 \rangle T_y(e \rightarrow t) \\
& \quad \text{THEN} \quad \text{Abort} \\
& \quad \text{ELSE} \quad \text{put}(T_{ns}(PRES)); \text{make}(\langle \downarrow 1 \rangle); \\
& \quad \text{go}(\langle \downarrow 1 \rangle); \text{put}(?T_y(e)) \\
& \quad \text{ELSE} \quad \text{Abort}
\end{aligned}
\]

(8.20) Parsing is \((Kim)\) :

\[
\begin{aligned}
?T_y(t) & \\
?T_y(e), \Diamond & T_y(e \rightarrow t), \text{Fo}(\text{BE}), ?\exists x.\text{Fo}(x)
\end{aligned}
\]

From the tree in (8.20), the parse of a following subject noun phrase can proceed straightforwardly. But what of non-initial is? Again, this is straightforward to account for, in what should now be a familiar fashion. Should INTRODUCTION and PREDICTION create subject and predicate nodes, an initial subject NP can be parsed and after COMPLETION the pointer will be at the open propositional node, as shown in the first tree in (8.21). This allows the parse of the copula to give the second tree in (8.21). The fact that the pointer is again at the subject node is not a problem, as COMPLETION can move the pointer back again to the topnode (although not necessarily immediately as we shall see below).

(8.21) Parsing Kim is :

\[
\begin{aligned}
?T_y(t) & \\
?T_y(e), \Diamond & T_y(e \rightarrow t), \text{Fo}(\text{BE}), ?\exists x.\text{Fo}(x)
\end{aligned}
\]

The analysis of be as a predicate underspecified for content allows us to tackle the bewildering variety of copular constructions in English in a uniform manner, the burden of explanation shifting from considerations of the core ‘meaning’ of be as denoting existence or identity to an account of inference in context that derives the correct interpretations of sentences. Assuming that the copula does project underspecified content, the value of the metavariable, \(\text{BE}\), that it projects must be established. This, like all other values for metavariables, may be freely identified in context which gives us a direct way to account for ellipsis involving the copula, as illustrated in (8.22).

(8.22) a. John’s really happy, John is.

b. A. Who was at the meeting?
B. Mary was.

Under the assumption that be projects a metavariable, the elliptical utterances in (8.22) will be well-formed, because the preceding utterance includes an accessible (and relevant) one-place predicate which can substitute for the metavariable in the normal way. The situation resulting from parsing the second clause in (8.22b) is shown in (8.23) up to the point of SUBSTITUTION. The resulting formula is, as
CHAPTER 8. COPULA CONSTRUCTIONS IN ENGLISH

required, that shown in (8.24), where the predicate satisfies the presuppositional constraint.\(^{13}\)

(8.23) Parsing *Mary was*:

\[
\begin{array}{c}
\text{\(Ty(t)\)} \\
\text{\(Ty(e)\),} \\
\text{\(Fo(\epsilon, x, \text{Mary}'(x))\)} \\
\text{\(Fo(\lambda x. \text{Att}'(x, (\epsilon, y, \text{Meeting}'(y))))\)} \\
\end{array}
\]

(8.24) \(Fo(\text{Att}'((\epsilon, x, \text{Mary}'(x)), (\epsilon, y, \text{Meeting}'(y))))\)

So, we can account straightforwardly for two of the NICE properties: inversion, and code. Emphasis is also easily accounted for (see section 8.2.2 for emphatic forms of *do*). We do not tackle negation in this book, but our characterisation does allow us to suggest how the fourth NICE property can be expressed. Any analysis of sentential *not* simply requires a specification of a completed predicate node that still lacks a full formula value. The triggering environment shown in (8.25) ensures that negation must come after some underspecified verb like *is* or *did*, but before any contentful predicate.\(^{14}\)

(8.25) \(n't\)

\[
\begin{array}{c}
\text{IF} \\
\text{THEN} \\
\text{IF} \\
\text{ELSE} \\
\text{THEN} \\
\text{Abort} \\
\ldots
\end{array}
\]

Interestingly enough, the current analysis also directly accounts for the possible interpretation of *be* as existential in the existential focus constructions illustrated in (8.1h) repeated below:

(8.26) Neuroses just are.

In identifying the potential substituends for the predicate metavariable *BE*, the context also includes predicates derivable from the tree currently under construction. Thus, instead of identifying a predicate from the previous discourse, a hearer may construct one from the immediate context (the tree currently under construction) and substitute that for the predicate metavariable. In the tree constructed to parse (8.1h), the only available predicate is that derived from the common noun in the subject position, as illustrated in (8.27) (using the plural notation from chapter 7).

(8.27) Parsing *Neuroses (just)* are:

\[
\begin{array}{c}
\text{\(Ty(t)\)} \\
\text{\(Ty(e)\),} \\
\text{\(Fo(\epsilon, x, \text{Neurosis}'(x) \land \text{PLUR}(x))\)} \\
\text{\(Ty(cn)\),} \\
\text{\(Fo(x, \text{Neurosis}'(x) \land \text{PLUR}(x))\)} \\
\text{\(Ty(cn \rightarrow e)\),} \\
\text{\(Fo(\lambda P. (\epsilon, P))\)} \\
\end{array}
\]

\(^{13}\)We show prepositional predicates as projecting a one-place predicate, but do not further explore their syntactic or semantic properties.

\(^{14}\)We do not further specify what other actions parsing *n't* entails, pending a theory of negation in DS.
8.2. REPRESENTING THE CONTENT OF THE COPULA

Making this substitution gives rise to the output formula in (8.28a) which, by the established equivalence in the epsilon calculus shown in (8.28b), gives rise to the existential statement in (8.28c).

(8.28)  
a. $F\epsilon(Neurosis'(\epsilon, x, Neurosis'(x) \land PLUR(x)))$

b. $P(\epsilon, x, P(x)) \leftrightarrow \exists x. P(x)$

c. $\exists x. Neurosis'(x) \land PLUR(x)$

What is interesting here is that the existential interpretation is provided directly without any reference to Scope Evaluation. Indeed, the output in (8.28a) is exactly what such evaluation would derive, given the scope statement Scope($S_i < x$). We take this to give rise to further pragmatic effects, buttressing the existential interpretation.

While more needs to be said about the existential focus construction, especially with respect to the possibility of quantified subjects and the interaction with tense, it should be clear from this discussion that the treatment of be as projecting semantically underspecified content that may be pragmatically enriched provides a basis of a unified account of both ellipsis in copula clauses and existential focus readings, an unexpected result.

8.2.1 The Predicative Construction

In the elliptical case discussed above, the update for the predicate metavariable projected by be is determined through pragmatic Substitution. However, there is a construction in which the appropriate predicate is supplied syntactically without the intervention of pragmatics. This is the basic predicative construction where a non-verbal predicate appears in post-copular position and be appears to be entirely meaningless.15

(8.29)  
a. John is happy.

b. Robert was on a train.

c. Mary is a teacher.

We already have the machinery to analyse this construction straightforwardly.

The lexical entry for the copula in (8.19) does not write a bottom restriction to the predicate node, giving it one of the characteristic properties of an expletive. This allows us to use the same mechanism, Late*Adjunction, that we used to account for it-extrapolation in Chapter 5, except that the unfixed node is projected from the predicate, and not the subject, node.

To see how the analysis works, consider the parse of (8.29a). Parsing the first two words projects a subject-predicate structure and the actions associated with parsing the copula leave the pointer on the subject node. As this is already complete, the pointer moves back up to the topnode by Completion and then down to the predicate node by Anticipation as this has an open requirement, preventing the application of Elimination. To satisfy the open formula requirement, Late*Adjunction can apply to provide an unfixed node with type requirement $\forall y(e \rightarrow t)$ (the rule is free with respect to the type of node). This permits the parse of any one-place predicate, in this case the simple adjective happy. The node decorated by the adjective then merges with the underspecified main predicate expression, satisfying both the requirement of the unfixed node to find a fixed position

15 Apart for constraints on event type, see Rothstein (2001), Maienborn (2002), inter alia, captured here by the presuppositional constraint on substitution, discussed above.
within the tree and the requirement that \textbf{BE} be replaced by some contentful concept. Note that \textsc{merge} is licensed only if the unfixed predicate is of the right sort, i.e. not something that denotes an eventuality. This correctly excludes *John is run, etc. \footnote{More, of course, needs to be said about the status of participles in English, but this we leave for another time.} This process is illustrated in (8.30), from the parse of the initial word \textit{John}, through the parsing of the copula, the unfolding of the unfixed node and the parse of the predicate to give the result in the final tree.

(8.30) Parsing \textit{John} is \textit{happy}:

a. Parsing \textit{John}:

\[
T_n(0), \ ?Ty(t) \\
\quad Ty(e), \\
\quad Fo(i, x, John'(x)), \Diamond \\
\quad T_n(01), \ ?T_y(e \rightarrow t)
\]

b. Parsing \textit{John} is:

\[
T_n(0), \ ?Ty(t), Tns(PRES) \\
\quad Ty(e), \\
\quad T_n(01), \ ?Ty(e \rightarrow t), Fo(BE) \\
\quad Fo(i, x, John'(x)), \Diamond \\
\quad ?\exists x. Fo(x)
\]

c. Parsing \textit{John} is with Completion, Anticipation and \textsc{late}^\textsc{adjunction}:

\[
T_n(0), \ ?Ty(t), Tns(PRES) \\
\quad Ty(e), \\
\quad T_n(01), \ ?Ty(e \rightarrow t), Fo(BE) \\
\quad ?\exists x. Fo(x) \\
\quad ⟨↑⟩T_n(01), \ ?Ty(e \rightarrow t), ?\exists x. T_n(x), \Diamond
\]

d. Parsing \textit{John} is \textit{happy}:

\[
T_n(0), \ ?Ty(t), Tns(PRES) \\
\quad Ty(e), \\
\quad T_n(01), \ ?Ty(e \rightarrow t), Fo(BE), ?\exists x. Fo(x) \\
\quad ⟨↑⟩T_n(01), \ ?Ty(e \rightarrow t), Fo(Happy'), ?\exists x. T_n(x)
\]

e. Completing a parse of \textit{John} is \textit{happy}:

\[
Ty(t), Fo(Happy'(i, x, John'(x))), \Diamond
\]

\[
Ty(e), \\
\quad Fo(i, x, John'(x)) \\
\quad Ty(e \rightarrow t), \\
\quad Fo(Happy')
\]
8.2. REPRESENTING THE CONTENT OF THE COPULA

Prepositional predicates may be treated in the same way, under the (natural) assumption that such expressions may be of predicate type. So, a sentence like that in (8.31a) gets the formula value in (8.31b).

(8.31)  
\[ \lambda x.\text{On}^\prime(x,\epsilon,y,\text{Train}^\prime(y))\epsilon(y,\text{Robert}^\prime(y)). \]

For common noun predicates, in some languages such as Classical (and Modern) Greek, the nominal predicate may be treated directly as a predicate just like an adjective or a prepositional phrase and be analysed accordingly, the expression in (8.32a) giving rise to the formula value in (8.32b) through Merge of the nominal predicate with the metavariable projected by the copula.\footnote{We discuss how nominal predicates in English may be analysed in Section 8.5 below.}

(8.32)  
\[ \begin{array}{ll}
\text{a.} & \text{ho s̄okr̄ates } \epsilon n \text{ philos̄ophos.} \\
\text{the.nom.sg} & \text{Socrates.nom.sg} \text{ be.3.sg.impf philosopher.nom.sg} \\
\text{‘Socrates was a philosopher.’} \\
\text{b.} & \text{Philosoph}'(\epsilon,\text{Socrates}'(\epsilon)).
\end{array} \]

8.2.2 Do

Before further exploring other copular constructions, we pause here to look at the other very underspecified auxiliary verb in English, do. The behaviour of this verb is very similar to that of the copula, except that it associates with predicates that denote true eventualities, i.e. those expressed by verbs in English. So we have the pattern shown in (8.33).\footnote{Note that (8.33e) can only be interpreted as something like ‘Mary is engaged in actions that can be construed as deriving from her being happy’, not that she is happy.}

(8.33)  
\[ \begin{array}{ll}
\text{a.} & \text{Does Mary like beans?} \\
\text{b.} & \text{Mary does.} \\
\text{c.} & \text{Mary does like beans.} \\
\text{d.} & \text{Mary likes beans, Mary does.} \\
\text{e.} & \% \text{Mary does happy.}
\end{array} \]

We, therefore, treat do as projecting an underspecified predicate just like the copula, only this time the metavariable is constrained only to be substituted by eventuality-denoting predicates. As with be, we write this metavariable in mnemonic form:

\[ Fo(\text{DO}) \overset{\text{def}}{=} Fo(\text{U}_{\text{Eventuality}}) \]

Since do shows the NICE properties just like be, its associated lexical actions construct a propositional template, as shown in the set of actions shown in (8.34).\footnote{Unlike the copula, do might be best treated as ambiguous between a main verb and an auxiliary in order to account for its transitive uses:}

(i) Mary did the supper last night.

\[ \begin{array}{ll}
\text{IF} & \text{?Ty}(t) \\
\text{THEN} & \text{put}(\text{Tns}(\text{PAST}));\text{make}((\langle 1 \rangle));\text{go}((\langle 1 \rangle)); \\
& \text{put}(\text{Ty}(e \rightarrow t),\text{Fo}(\text{DO}));\?\exists x.\text{Fo}(x)); \\
& \text{go}((\langle 1 \rangle));\text{make}((\langle 1 \rangle));\text{go}((\langle 1 \rangle)); \\
& \text{put}(\text{?Ty}(e)) \\
\text{ELSE} & \text{Abort}
\end{array} \]

\[ \text{For common noun predicates, in some languages such as Classical (and Modern) Greek, the nominal predicate may be treated directly as a predicate just like an adjective or a prepositional phrase and be analysed accordingly, the expression in (8.32a) giving rise to the formula value in (8.32b) through Merge of the nominal predicate with the metavariable projected by the copula.} \]

\[ (8.32) \]
\[ \begin{array}{ll}
\text{a.} & \text{ho s̄okr̄ates } \epsilon n \text{ philos̄ophos.} \\
\text{the.nom.sg} & \text{Socrates.nom.sg} \text{ be.3.sg.impf philosopher.nom.sg} \\
\text{‘Socrates was a philosopher.’} \\
\text{b.} & \text{Philosoph}'(\epsilon,\text{Socrates}'(\epsilon)).
\end{array} \]

\[ \text{(8.33)} \]
\[ \begin{array}{ll}
\text{a.} & \text{Does Mary like beans?} \\
\text{b.} & \text{Mary does.} \\
\text{c.} & \text{Mary does like beans.} \\
\text{d.} & \text{Mary likes beans, Mary does.} \\
\text{e.} & \% \text{Mary does happy.}
\end{array} \]

\[ \text{We, therefore, treat do as projecting an underspecified predicate just like the copula, only this time the metavariable is constrained only to be substituted by eventuality-denoting predicates. As with be, we write this metavariable in mnemonic form:} \]

\[ Fo(\text{DO}) \overset{\text{def}}{=} Fo(\text{U}_{\text{Eventuality}}) \]

\[ \text{Since do shows the NICE properties just like be, its associated lexical actions construct a propositional template, as shown in the set of actions shown in (8.34).} \]

\[ \text{(8.34)} \]
\[ \begin{array}{ll}
\text{IF} & \text{?Ty}(t) \\
\text{THEN} & \text{put}(\text{Tns}(\text{PAST}));\text{make}((\langle 1 \rangle));\text{go}((\langle 1 \rangle)); \\
& \text{put}(\text{Ty}(e \rightarrow t),\text{Fo}(\text{DO}));\?\exists x.\text{Fo}(x)); \\
& \text{go}((\langle 1 \rangle));\text{make}((\langle 1 \rangle));\text{go}((\langle 1 \rangle)); \\
& \text{put}(\text{?Ty}(e)) \\
\text{ELSE} & \text{Abort}
\end{array} \]
The analysis of an emphatic sentence like *Mary did eat some beans* proceeds in exactly the same way as an analysis of the predicative copular construction shown above, with an unfixed node providing the value of the eventuality metavariable.

(8.35) Parsing *Mary did eat some beans*:

\[
\begin{array}{c}
T_n(0), ?T_y(t), T_{ns}(PAST) \\
T_y(e), \\
F_o(t, x, Mary'(x)) \\
\end{array}
\]

\[
\begin{array}{c}
T_n(01), T_y(e \to t), F_o(DO) \\
?\exists x. F_o(x), \Diamond \\
\end{array}
\]

\[
\begin{array}{c}
\langle \uparrow \rangle T_n(01), T_y(e \to t), \\
F_o(Eat'(\epsilon, y, Beans'(y))), ?\exists x. T_n(x) \\
\end{array}
\]

\[
\begin{array}{c}
T_y(e), \\
F_o(\epsilon, y, Beans'(y)) \\
\end{array}
\]

\[
\begin{array}{c}
T_y(e \to t), \\
F_o(\epsilon, y, Beans'(y)) \\
F_o(Eat') \\
\end{array}
\]

There is, of course, more to be said about *do* and we say a bit more in chapter 9 with respect to ellipsis. But we hope to have shown how auxiliaries can be incorporated into DS without undue problems.

### 8.3 Towards an account of ‘There be’

In this section, we provide a (partial) account of another construction involving the copula whose analysis is controversial: the ‘there be’ construction. As we have noted above, this construction gives rise to a range of different interpretations, depending on the properties of the post-copular noun phrase (the ‘associate’) and the rest of the clause (the ‘coda’, or the ‘extension’ in Huddleston and Pullum (2002)).

We already have an account of the copula, as projecting an underspecified predicate, but how best to characterise the contribution of *there*? Clearly, in its adverbial use, the expression is a locative pronoun standing for a place where something is, used demonstratively as in (8.36a) or anaphorically as in (8.36b).

(8.36) a. Your keys are there.

b. Did you see Bill at the clubhouse? I meet him there all the time.

Generally, *there* may be interpreted as projecting an underspecified locative relation involving an object and a location: \( LOC(THING, PLACE) \) (see Jackendoff 1983, etc.). In the predicative example in (8.36a) the expression will project a predicate version of this \( \lambda x. LOC(x, PLACE) \) which can be substituted by a specific locative predicate that locates the keys (such as, for example, being on the table), as illustrated schematically in (8.37), where the output propositional formula is:

\[
F_o(On'(\epsilon, x, Keys'(z, Bertie'(z))))(\epsilon, y, Table'(y)))
\]

---

20We assume here that parsing finite forms of verbs abort if a local tense specification has already been constructed, thus excluding *Mary did ate the beans, at least in standard British and American English.

21We assume here for convenience that once parsed, the genitive constitutes an argument of the predicative-term Keys'. Nothing hangs on this.
8.3. TOWARDS AN ACCOUNT OF ‘THERE BE’

(8.37) Parsing Your keys are there:

\[ \text{Ty}(t) \]
\[ \text{Ty}(e), \quad \text{Fo}(e, x, \text{Keys'}(t, z, \text{Bertie'}(z))(x)) \]
\[ \text{Ty}(e \to t), \text{Fo}(\text{BE}), \quad ?\exists x.\text{Fo}(x) \]
\[ | \]
\[ | \]
\[ \text{Ty}(e \to t), \text{Fo}(\lambda y.\text{LOC}(x, V)), \quad ?\exists x.\text{Fo}(x), \quad ?\exists x.\text{On}(x) \]
\[ \uparrow \]
\[ \text{Fo}(\lambda x.\text{On'}(x, y, \text{Table'}(y))) \]

As a locative anaphor operating as an adjunct, the locativity of there may be treated not as projecting an underspecified locative predicate, but as an underspecified term, i.e. a metavariable, but with the locative content of the adverbial being a ‘presupposition’. In the case of a locative anaphor, the presupposition constrains substitution of the metavariable to a PLACE: U_{LOC(U_{THING},U)}. We do not pursue a discussion of adjuncts in this book, but Marten (2002b) suggests that such expressions should be analysed as optional arguments of type \( e \). In interpreting (8.36b), therefore, the metavariable projected by there could appear as an argument of the verb meet and be substituted with the content of the clubhouse with a presupposition that something (in this context, I or Bill) is at that place:

\[ \text{Fo}(\epsilon, x, \text{Clubhouse'}(x)_{LOC((\epsilon, y, \text{John'}(y)), (\epsilon, x, \text{Clubhouse'}(x))))} \]

We thus get an interpretation in which John often meets Bill at the clubhouse (when John is at the clubhouse). Notice here that we are now taking annotations to metavariables more seriously that we have done so far.

What of the expletive uses of there? The most common assumption is that it has become a full expletive without any remaining trace of its locative usage. However, we find the assumption that there is fully bleached of all meaning to be incompatible with an analysis that tries to account for the meanings of different there be constructions. In particular, such a hypothesis seems to provide no basis for an account of presentational uses. Consider again example (8.4c), repeated below.

(8.4) c. There is the student that you wanted to see in the corridor.

This sentence might be used locatively to tell the hearer that some specified student is here (in the corridor) or ‘presentationally’ to bring the situation as a whole to the hearer’s attention, perhaps reminding her that her afternoon appointments are not completed yet. Interestingly enough, the simple copula clause without there (the student you wanted to see is in the corridor) can be used to express the locative reading but not the presentational one. The former reading follows from the explicit locative, but the latter has to do with something more abstract, as we show below.

We therefore maintain that some remnant of the locative presupposition does remain with the expletive, but that the projected metavariable satisfies not the place of the locative relation, but the thing: U_{LOC(U_{PLACE}). In other words, part of

---

\(^{22}\) We do not provide a full analysis of this example, as the discussion would take us too far from the current topic, nor do we address the question of the variability in type associated with PPs.

\(^{23}\) Diachronically, this could arise from a locative inversion construction being interpreted as providing a subject predicate relation directly and the initial locative being interpreted as entity-
the grammaticalisation of the locative proform into an expletive subject involves a shift in perspective from the place where something is to the thing itself. This shift has the effect of associating the expletive with the associate (the post-copular DP) rather than directly with any locative expression. (8.38) below provides the relevant part for the lexical entry for there.\textsuperscript{24}

\begin{equation}
\begin{array}{ll}
\text{IF} & \exists y (\epsilon y (e)) \\
\text{THEN} & \exists y (\epsilon y (t)) \\
\text{THEN} & \text{put}(\epsilon y (e), F_o(U_{LOC(U,V)}), ?x.F_o(x)) \\
\text{ELSE} & \text{put}(\epsilon y (e), F_o(U_{LOC(V,U)}), ?x.F_o(x)) \\
\text{ELSE} & \text{Abort}
\end{array}
\end{equation}

We introduced them in chapter 2 as restrictions on Substitution for metavariables introduced by pronouns. Then in chapter 7, we introduced the idea with respect to the class markers in Swahili that they might have more content. In this chapter, we develop this further and treat such annotations as more than just constraints on what sort of expression can substitute for a metavariable, giving them semantic, as well as pragmatic, content.

Our analysis of there be thus involves the projection of a radically underspecified propositional structure, where both subject and predicate are decorated by metavariables, as shown in (8.39). The account we propose of the interpretation of clauses containing some form of this string then rests on how the content of these two nodes is established in context, given the other material provided by the string.

\begin{equation}
\begin{array}{l}
\epsilon y (e) \\
\epsilon y (t), F_o(U_{LOC(U,V)}), ?x.F_o(x), \because \\
\epsilon y (e \rightarrow t), ?x.F_o(x), F_o(BE)
\end{array}
\end{equation}

\subsection{The existential construction}

We proceed to show how an analysis of the existential example in There’s a riot on Princes Street is provided. The tree display in (8.39) above shows the structure after parsing there’s with metavariables in both subject and predicate position, requiring completion. The pointer is on the subject node where Substitution or Late*Adjunction may apply, as we have seen now many times. As the node decorated by there does not have a bottom restriction, Late*Adjunction may apply, yielding the tree in (8.40).

\textsuperscript{24}Note that the pointer remains on the decorated subject node after parsing, allowing substitution by Merge or through the pragmatic process of substitution. So we allow A cat, there is in the garden, inter alia.
8.3. TOWARDS AN ACCOUNT OF ‘THERE BE’

(8.40) Parsing There’s after Late*ADJUNCTION:

\[
\begin{align*}
&\text{Ty}(t) \\
&\quad \Rightarrow T_n(00), T_y(e), \\
&\quad Fo(U_{LOC(U,V)}), ?\exists x.Fo(x) \\
&\quad T_n(01), Ty(e \rightarrow t), \\
&\quad ?\exists x.Fo(x), Fo(BE)
\end{align*}
\]

\[
\begin{align*}
&\langle \_\rangle T_n(00), Ty(e), ?\exists x. T_n(x) \triangleright
\end{align*}
\]

This allows the parse of the post-copular indefinite noun phrase, a riot, which merges with the subject node to provide the content of the metavariable as illustrated in (8.41).

(8.41) Parsing There’s a riot:

\[
\begin{align*}
&\text{Ty}(t) \\
&\quad \Rightarrow T_n(00), T_y(e), \\
&\quad Fo(U_{LOC(U,V)}), ?\exists x.Fo(x) \\
&\quad T_n(01), Ty(e \rightarrow t), \\
&\quad ?\exists x.Fo(x), Fo(BE)
\end{align*}
\]

\[
\begin{align*}
&\langle \_\rangle T_n(00), Ty(e), ?\exists x. T_n(x) \triangleright
\end{align*}
\]

At this point, the subject node is complete and the pointer moves to the predicate node which provides a means of analysing the coda, on Princes Street, as a straightforward prepositional predicate phrase. Just as with normal predicative constructions, this is achieved through an application of Late*ADJUNCTION and MERGE, as shown in (8.42).

(8.42) Parsing There’s a riot on Princes Street:

\[
\begin{align*}
&\text{Ty}(t) \\
&\quad \Rightarrow T_n(00), Ty(e), \\
&\quad Fo(U_{LOC(U,V)}), ?\exists x.Fo(x) \\
&\quad T_n(01), Ty(e \rightarrow t), \\
&\quad ?\exists x.Fo(x), Fo(BE)
\end{align*}
\]

\[
\begin{align*}
&\langle \_\rangle T_n(00), Ty(e), ?\exists x. T_n(x) \triangleright
\end{align*}
\]

The outcome of this structure is the formula:

\[
\text{On}^\prime((e, x, \text{Riot}'(x))_{LOC(e,x,\text{Riot}'(x),V)}, \text{PrincesSt}')
\]

There remains an uninstantiated metavariable, V which needs to be instantiated for interpretation to take place. Clearly, the most obvious assumption would be that it should be identified with the content of Princes Street, inducing a straightforward

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25 The internal structure of the prepositional predicate is not shown.
CHAPTER 8. COPULA CONSTRUCTIONS IN ENGLISH

interpretation of the underspecified relation \( LOC \) as \( On' \) and so giving rise to a formula value that is equivalent to predicating the locative phrase of the subject:

\[
On'((\epsilon, x, Riot'(x)), PrincesSt')
\]

However, the process by which such a substitution of the metavariable can take place is somewhat mysterious under the assumptions we have been making throughout this book, since the process can only take place when the pointer is at the node decorated by a metavariable. This constraint is necessary to ensure that substitution is not randomly applied so that, for example, construing it with an apple in (8.43) is excluded.

(8.43) ??Every student who brought it to school gave Mary an apple.

We have not elaborated on the representation of the substitutonal presuppositions associated with definites and lexical expressions such as proforms so far in this book. However, the most natural way to treat these within DS is to take the presupposition as a LINKed structure. This would mean the parsing there’s should more properly give rise to the tree display in (8.44) rather than that in (8.39).

(8.44) Parsing There’s with LINK:

\[
\begin{align*}
&Ty(t) \\
&Tn(00), Ty(t), Fo(U) & Tn(01), Ty(e \rightarrow t), \\
&\land x. Fo(x), \diamond & \land x. Fo(x), Fo(BE) \\
\langle L^{-1}\rangle Tn(00), Ty(t) & \\
Ty(e), Fo(U) & Ty(e \rightarrow t) \\
&Ty(e), Fo(V) & Ty(e \rightarrow (e \rightarrow t)), \\
&\land x. Fo(x), \diamond & Fo(\lambda y x. LOC(x, y))
\end{align*}
\]

The value of the subject metavariable, \( U \), in the LINKed structure need not be associated with a formula requirement, since it is a copy of the formula value on the head node of the LINK structure whose value may therefore be identified at a later point in the parse process. However, that on the internal argument node must be satisfied before elimination can apply, otherwise no substituend will ever be forthcoming. What could possibly substitute at this point? Of course, the context could provide an appropriate substituend (a place), but there is a more accessible potential substituend given within the domain of the matrix proposition. This is provided by the axiom and is the index of evaluation, \( S_i \), which we introduced in chapter 3. In keeping with the general Relevance-theoretic assumptions of Dynamic Syntax, we adopt the perspective on pragmatic processes such as substitution whereby there is a tradeoff between processing cost and informativeness, as we have seen elsewhere in this book. Since Optimal Relevance is defined to be determined by a trade-off between cognitive effort and informativeness (the more effort required to access an interpretation the more informative it should be), a
hearer will be constrained to take as substituend the most accessible formula that is likely to yield significant inferential effects. The pragmatic process of substitution occurs within the construction of a propositional representation, however, and so will tend to prefer substituends which are provided by the immediate discourse because the domain over which other inferences are to be carried out may not yet be complete. So we assume that, in order to compile the LINK structure and return to parsing the rest of the string, the index of evaluation is indeed chosen as the appropriate substituend. This is a valid move, given that the index of evaluation, picking out some world-time-place, following Montague (1974), Lewis (1970) etc., can be construed as a place for the purposes of the locative predication.

The interpretation of the structure in (8.42), with $S_i$, duly substituted for $V$, is then straightforward. In chapter 3, a rule of evaluation for non-restrictive relative clauses is provided in which the content of a LINKed tree projecting the content of such a clause (such as who I like) is ‘cashed out’ at the topnode as a proposition conjoined to the proposition expressed by the matrix clause. This rule of LINK Evaluation is given in (3.13) and repeated below:

\[(3.13)\] LINK Evaluation (Non-restrictive construal):

\[
\begin{align*}
\{\ldots \{Tn(a), \ldots, Fo(\phi), Ty(t), \diamond \}\}, \{\langle L^{-1}\rangle\text{MOD}(Tn(a)), \ldots, Fo(\psi), Ty(t)\} \\
\{\ldots \{Tn(a), \ldots, Fo(\phi \land \psi), Ty(t), \diamond \}\}, \{\langle L^{-1}\rangle\text{MOD}(Tn(a)), \ldots, Fo(\psi), Ty(t)\}
\end{align*}
\]

\[MOD \in \{(1_a), (1_i)\}^*\]

The rule is entirely neutral with respect to whatever determines the LINKed structure (i.e. whether a relative clause or not) and we can thus derive for (8.42) the conjoined expression in (8.45a) which is evaluated as in (8.45b) and is equivalent to (8.45c).

\[(8.45)\]

a. $S_i < x$ On'$(x, x, \text{Riot'}(x), \text{PrincesSt}') \land \text{LOC'}(x, x, \text{Riot'}(x), S_i)$$

b. $S_i : \text{On'}(a, \text{PrincesSt}') \land \text{LOC}(a, S_i)$

where $a = (x, x, \text{Riot'}(x) \land \text{On'}(x, \text{PrincesSt}') \land \text{LOC}(x, S_i))$

c. $\exists x. \text{Riot'}(x) \land \text{On'}(x, \text{PrincesSt}') \land \text{LOC}(x, S_i)$

The interpretation we derive for the existential construction is effectively equivalent to a small clause analysis: the content of the proposition being provided by the associate and the locative coda. However, there are two differences. In the first place, the informational effect of asserting the existential is different from an assertion of \textit{A riot is (happening) on Princes Street}. This is because in the process of interpreting \textit{There is a riot on Princes Street} the hearer is initially presented with the information that some term needs to be identified that is associated with some locative presupposition. The content of this term is then presented by the associate which introduces a new variable, as discussed in Chapter 3, indicating new information. The coda then provides an appropriate predicate, hence completing the proposition, but in two stages instead of one, thus giving rise to different informational effect as discussed in chapters 4, 5 and elsewhere.

The second difference, of course, is that the presuppositional information associated with \textit{there} may be projected as part of the content of the string. This explicit location of the content of the associate at the index of evaluation buttresses the existential interpretation derived from the process of scope evaluation. In effect, by using the \textit{there be} construction to convey the information that a riot is happening on Princes Street, a speaker emphasises the fact the riot exists at the place and time chosen as the index of evaluation of the proposition.
This buttressing of existence by the use of the locative presupposition associated with the expletive turns out to be important in the consideration of existential clauses without codas. Consider the exchange in (8.46) and the analysis of the answer in (8.47):

(8.46) Q: Do we have any fruit?
A: There are some apples.

(8.47) Parsing There are some apples:

\[
\begin{align*}
\text{Scope}(S_i, < x), T_y(t) & \\
T_n(00), T_y(e), F_0(U), ?\exists x. F_0(x), \emptyset & \quad T_n(01), T_y(e \rightarrow t), ?\exists x. F_0(x), F_0(\text{BE}) \\
\langle \uparrow \rangle T_n(00), T_y(e), ?\exists x. T_n(x), F_0(e, x, \text{Apples'}(x)) & \quad \langle L^{-1} \rangle T_n(00), F_0(\text{LOC}(U, S_i)) \\
F_0(U) & \quad F_0(\lambda x. \text{LOC}(x, S_i)) \\
F_0(S_i) & \quad F_0(\lambda y \lambda x. \text{LOC}(x, y))
\end{align*}
\]

After Merge, the pointer moves onto the predicate node, but here there is no substituend for BE provided by the string so one needs to be chosen from context. At this point there are two possible instantiations of the metavariable, one, given by the locative predicate in the LINKed structure, within the current tree and one associated with parsing the common noun fruit, provided by the preceding question. Substituting either predicate would be fine, but in keeping with assumptions set out above, we take the most accessible predicate, \( F_0(\lambda x. \text{LOC}(x, S_i)) \), to be the most relevant. Since LINK evaluation does nothing more than restate the formula already derived for the matrix proposition, this yields the final formula value in (8.48) after scope evaluation.

(8.48) \( S_i : \text{LOC}(a, S_i) \)
where \( a = (e, x, \text{Apples'}(x) \land \text{LOC}(x, S_i)) \)
\[ \equiv \exists x. \text{Apples'}(x) \land \text{LOC}(x, S_i) \]

In interpreting the answer in (8.46), the locative presupposition is crucial in determining the content. It explicitly provides the information that apples exist at the appropriate time and place and hence conveys relevant information.

### 8.3.2 Definite Associates

The apparent focus on existence in our account of the existential construction thus derives from the scope evaluation of the indefinite associate and the proposition that it is located at the index of evaluation. The informational effect that the associate provides new information is treated as a result of the new metavariable introduced into the subject position of the emergent propositional structure and by the consequent process of deferring the presentation of a value for that form to a postverbal position induced by there be. Given that definites do not introduce
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new variables, but select terms from context, we might expect some differences in pragmatic interpretation of there be clauses with definite associates, but possibly not in the way such examples are analysed. In this section, we look briefly at definite associates and

sketch how the properties they have in DS gives rise to greater reliance on pragmatics for interpretation than indefinite ones.

As we saw in passing in chapter 2 but have not so far made use of, the metavariables projected by pronouns are sortally restricted to determine the range of terms of which Substitution can apply, $\text{Fo}(\text{U}_{\text{Male}})$ for a pronoun such as him, $\text{Fo}(\text{U}_{\text{Speaker}})$ for first person pronoun, etc. However the use of anaphoric determiners such as the, this, that serve to ensure that the descriptive condition that controls such selection of terms as substituend can be arbitrarily complex. In this, they play a dual role: they project a requirement that their value be independently found, but nevertheless also project a predicate which is itself not in the immediate context, hence triggering an extension of the context to provide a term that matches that predicate. Consider for example, the dialogue (8.49), in the context of A’s function of interviewing students who fail, cheat, or are otherwise in disgrace:

(8.49) A: Who’s seeing me today?
B: That student who cheated.
A: Oh yes, the student who downloaded stuff from the web.

Notice as a first informal observation that wh questions in a conversation between administrator and assistant at the beginning of the day are characteristically a request to be reminded as to what is the immediate context for the coming activities of the day (one’s head otherwise being full of much more interesting matters). Here, the first sentence sets out such a question as the context relative to which the definite in the second has to be interpreted, this being the structure whose topnode has as formula value:

$$\text{Fo}(\text{Seeing}'(A)(\text{WH}))$$

The reply provides as substituend for the metavariable provided by the wh expression a partially specified term $(U, \text{Student}'(U) \land \text{Cheat}'(U))$, computed by building a LINKed structure and compiling its content into the restrictor of the presented nominal, the verb cheated apparently proffered as providing a predicate sufficient for A to identify a term from A’s context. In the event, it does indeed lead to the expansion of the minimal context provided by the wh question; but it does so by using that information together with further general information. What A has stored in some accessible context, given this trigger, is that some student had downloaded information from the web, this being, let us assume, a premise of the form,

$$\text{Student}'(a) \land \text{Download}'(a)$$

Indeed his reply confirms this, equally presented via the presentation of a relative clause. By the addition of one assumption, (8.50), and a step of deduction this

[26] Here for simplicity, we present the wh expression as a simple metavariable.
can provide the necessary term to serve as a substituend for \((U, \text{Student}'(U) \land \text{Cheat}'(U))\):\(^{27}\)

\[(8.50)\quad (\text{Student}'(a) \land \text{Download}'(a)) \rightarrow \text{Cheat}'(a)\]

Given that the term \((\epsilon, x, \text{Student}'(x) \land \text{Download}'(x))\) can be substituted in the input to this inference-step, the derived conclusion is:

\[
\text{Cheat}'(\epsilon, x, \text{Student}'(x) \land \text{Download}'(x))
\]

At this point a general epsilon-calculus equivalence dictates the next step:

\[
\psi(\epsilon, x, \phi(x)) \iff \phi(\epsilon, x, \psi(x) \land \phi(x)) \land \psi(\epsilon, x, \psi(x) \land \phi(x))
\]

This equivalence yields:

\[
\text{Student}'(a) \land \text{Download}'(a) \land \text{Cheat}(a)
\]

where \(a = \epsilon, x, \text{Student}'(x) \land \text{Download}'(x) \land \text{Cheat}(x)\)

Substitution of this term in the open structure provided by the \(\text{wh}\) question will indeed yield an answer from which regular inferential effects may be derived, given A’s administrative function.

Consider now a minor variant of (8.49):

\[(8.51)\quad \text{A: Who’s seeing me today?}
\]

\[
\text{B: There’s that student who cheated.}
\]

\[
\text{A: Oh yes, the student who downloaded stuff from the web.}
\]

The parsing of there’s proceeds as above and Late*Adjunction provides a means of analysing the definite associate, as before with an intermediate step of inference. Reasoning over what it means to have downloaded stuff from the web yields the existential term \(\epsilon, x, \text{Student}'(x) \land \text{Download}'(x) \land \text{Cheat}'(x)\) exactly as in the simpler case, replacing the metavariable projected from the demonstrative.\(^{28}\)

\[(8.52)\quad \text{Parsing There’s that student who cheated:}
\]

\[
\text{Scope}(S_i), ?T_y(t)
\]

\[
\begin{align*}
T_y(\epsilon), \text{Fo}(U_{\text{LOC}(U,S_i)}), ?\exists x.\text{Fo}(x) & \quad T_y(\epsilon \rightarrow t), \text{Fo}(\text{BE}), ?\exists x.\text{Fo}(x) \\
\text{Fo}(U, \text{Student}'(U) \land \text{Cheat}'(U)), ?\exists x.\text{Tn}(x), \Diamond & \quad T_y(\epsilon), \text{Fo}(\epsilon, x, \text{Student}'(x) \land \text{Download}'(x) \land \text{Cheat}'(x))
\end{align*}
\]

\(^{27}\)There are two ways this information might be modelled, presuming a step of deduction is required. Either it involves a separate lexicon, a lexicon for the language of thought, a storage of postulates associated with the concepts expressed in LOT, or it is listed as a subpart of the lexical specification of the word used, here cheat. Since we have not discussed lexically based reasoning in this book at all, we leave this as an entirely open issue.

\(^{28}\)(8.52) omits the LINKed structure from which the restrictor on the metavariable for the demonstrative is computed.
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Merge applies at this point, leaving the subject node with a decoration:

$$\text{Fo}(\epsilon, x, \text{Student}'(x) \land \text{Download}'(x) \land \text{Cheat}'(x))$$

$$\text{LOC}(\epsilon, x, \text{Student}'(x) \land \text{Download}'(x) \land \text{Cheat}(x)), S_i)$$

The content of the predicate metavariable still needs to be identified, and by the assumptions presented above this will need to be supplied by some local predicate as far as possible. There are a number of potential predicate substituends in (8.52), one from the restrictor for the metavariable projected by the demonstrative article, one from the restrictor associated with the definite article, one from the locative presupposition, and one from the preceding linguistic context.

(8.53)  
\begin{align*}
&\text{a. } \lambda x. \text{Student}'(x) \land \text{Download}'(x) \\
&\text{b. } \lambda y. \text{Student}'(y) \land \text{Cheat}'(y) \\
&\text{c. } \lambda z. \text{LOC}(x, S_i) \\
&\text{d. } \lambda x. \text{Seeing}'(A)(x)
\end{align*}

(8.53b) has been used to identify the substituend for the definite associate and so its informativeness is weak. Under the natural assumption that information directly represented within the current tree is more accessible than information derived from the context, (8.53a) is less accessible than (8.53b) in not being part of the parse of the existential sentence, and so would need to potentially lead to a more informative proposition. However, by assumption this term identifies the entity for the hearer so again the information associated with its restrictor is unlikely to have any informational effect at all, leaving the locative predicate in (8.53c) as the most accessible predicate to choose. However, given the fact that the addressee has just asked about her day’s appointments, it is the predicate in (8.53c) which will directly yield the requisite inferential effects in the context, so will be particularly salient to the hearer. Making the appropriate substitution and compiling up the tree yields the formula value in (8.54):

(8.54)  
$$\langle S_i \rangle \text{ Seeing}'(A)(\epsilon, x, \text{Student}'(x) \land \text{Download}'(x) \land \text{Cheat}'(x)) \land \text{LOC}(\epsilon, x, \text{Student}'(x) \land \text{Download}'(x) \land \text{Cheat}(x)), S_i)$$

Notice the importance of context here. The need to construe something informative to substitute for the predicate metavariable associated with the copula means that certain examples involving *there be* will be difficult to interpret except in rich contexts. For example, it is usually held that *there be* constructions involving a definite associate and a locative coda are ungrammatical.

(8.55)  
??There’s the student in the garden.

It is true that (8.55) is difficult to interpret in a null context. The explanation for this provided by the current pragmatic approach is that the predicate projected by the associate (*Student*) is not informative, having been used to identify some accessible individual. Additionally, a locative interpretation for *BE* is not obviously informative because the coda provides an explicit location for the referent of the associate. Hence, some other predicate must be construed from a wider context to deduce a relevant substituend for the predicate metavariable. In a null or restricted context, therefore, it is difficult if not impossible to identify an appropriate interpretation for the string in (8.55). But in a context in which (for example) there has been a prior utterance by the hearer of the question *Who’s missing?*, the utterance of (8.55) provides an instantiation of the predicate $\lambda x. \text{Missing}'(x)$ derived from the question and being salient in the discourse. The actual content of (8.55) in such a context would be something like that in (8.56), where *Mary* is the student identified in the context.
Further evidence in favour of a pragmatic approach to the interpretation of such clauses comes from the fact that extra information contained in modifier constructions can sufficiently enrich the context so that the hearer can extract sufficient information to identify the relevant object (something often noted but rarely explored). Hence, the predicate modifier again in (8.55a) provides a context in which the relevant rabbit is persistently in the garden, while the modifier and relative clause in (8.57b) indicates that where the student is now is relevant to the hearer.

(8.57) a. There’s the rabbit in the garden again.
   b. There’s the student you wanted to see in the corridor.

In the latter case, the interpretation is locational and this is easily derivable. In a situation in which previous linguistic context is lacking or does not provide an obviously relevant substituend for the predicate metavariable, the locative presupposition is likely to be chosen as the most accessible predicate which is also, by virtue of the lack of context, likely to be the most informative. So we derive for (8.57a) the formula in (8.58a), on the assumption that Mary is the relevant student, which supports the inference that she is here (now).

(8.58) a. \( S_i : LOC((\iota, x, Mary'(x)), S_i) \)
   b. \( \models S_i : At'(\iota, x, Mary'(x)), S_i \)
   c. \( \models S_i : Here'(\iota, x, Mary'(x)) \)

Notice that the analysis presented here says nothing directly about definite associates having to be ‘hearer new’ (Ward and Birner 1995). As with indefinite associates, such an interpretation results from the process by which the interpretation of the string is ultimately derived. By uttering there be, the speaker induces the hearer to construct a skeletal propositional tree as a promissory note for following information. The associate (and any coda) provide the requisite updating of this structure and, by virtue of the fact that a nominal update of a propositional structure is interpreted as some sort of focus (see Kempson et al. 2004), the associate gets construed as new information, even though the definite form requires the hearer to process its content as old (given) information. Given a dynamic system, the discourse properties of these sentences do not have to be directly encoded, but derive from the parsing process itself.

We have here presented a brief sketch of the there be construction in English that, by treating both words in the string as expletives, provides a means of accounting for variations in interpretation in terms of contextual effect and the properties of definite and indefinite expressions. Much more could, of course, be said about the construction and the pragmatic effects it induces, but it is, we hope, clear that it is precisely the underspecified properties of the string there be that induces the various interpretations in conjunction with the properties of its associates.

8.4 The Equative and Specificational Constructions

We turn now to a consideration of equative and specificational clauses to show how the approach to the copula introduced above can provide an explanatory analysis. Unlike predicative and existential constructions, both types of clause necessarily involve a definite noun phrase, either before or after the copula (or both) and a copular clause without a definite cannot be easily interpreted as equative or specificational (e.g. (8.59f)).
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\[ (8.59) \]
\begin{align*}
\text{a. John is the teacher.} \\
\text{b. That student over there is the best in the class.} \\
\text{c. The best in the class is that student over there.} \\
\text{d. A PhD student is the lecturer for this course.} \\
\text{e. The culprit is John.} \\
\text{f. A plant is a gift for life.}
\end{align*}

Again we can exploit the differences in the properties of definites and indefinites and of the process of parsing a clause to provide analyses that account for the variation in interpretation illustrated above.

8.4.1 Equative Clauses

Equative clauses are typically described as involving the identification of the referents of two definite, referential, noun phrases that appear with the copula. This equating function may be viewed as deriving from the copula (Montague 1973, Dowty et al. 1981, *inter alia*) or through some operation on the term expressed by the post-copular noun phrase (e.g. Partee 1986, Williams 1983). In both cases the effect is the same: the copula is treated as a two-place predicate of some sort and the output is a statement of identification between the two terms, \( \alpha = \beta \). If the assumption put forward above is correct, that the copula is an expletive one-place predicate without explicit semantic content, the question arises as to whether and how a relation of identity relation can be derived.

An obvious way of accounting for equatives would be to adapt the approach of Partee (1986) in terms of an essentially predicative copula which takes a term as subject and a predicate as object (or vice versa) which relies on a type shifting operation over terms (Ident) to account for equative interpretations (i.e. deriving from a term \( \alpha \) a predicate that picks out all those things that are identical to \( \alpha \) i.e. \( \lambda x. x = \alpha \)). Within the current framework one could allow referential noun phrases to be homonymous between a term and an identity predicate founded on an epsilon term constructed from the common noun phrase (e.g. *the culprit* could be realised either as \( U_{\text{culprit}}(U) \) in a context requiring a term or \( \lambda x. x = \epsilon, x, \text{Culprit}'(x) \) in a predicate context). The analysis could then follow that given for predicative expressions above, deriving equative expressions directly.

A more interesting approach suggests itself, however, that exploits the machinery of Dynamic Syntax presented above and derives the equative interpretation without recourse to assuming that either the copular or the definite article (or other definite determiners) are homonymous. There must on this view be something specific to definite expressions which allows equative/specificational readings that is not available to other types of noun phrase. To see what this might be, consider the short text in (8.4.1).

\[ (8.60) \]
\begin{align*}
\text{A: Oh no, someone has drunk the last of the milk again.} \\
\text{B: John is the culprit.}
\end{align*}

In interpreting the equative clause in B’s utterance, the hearer, A, assumes the existence of someone who drank the last of the milk and then identifies this person with John through the semantics of the concept \( Fo(\text{Culprit}') \). Analysing *John is the culprit*, we begin by establishing the structure in (8.61) through the parsing of the first two words (ignoring tense as usual and the internal structure of the term projected by the proper name).
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(8.61) Parsing John is:

\[
\begin{align*}
T_n(0), T_y(t) \\
T_n(00), T_y(e), F_o(u, x, John'(x)), \diamond \\
T_y(cn), F_o(x, John'(x)), [1]| \downarrow \\
\langle L^{-1} \rangle T_n(00), ?x. F_o(x)
\end{align*}
\]

At this point the pointer is at the subject node and one might assume that it would move straight on to the predicate node to satisfy its outstanding formula requirement. However, nothing stops further specification of the node, provided that no established conditions are contradicted. As the subject term has structure with terminal nodes decorated by the bottom restriction, Late*Adjunction cannot apply. But some LINK relation could be projected from this position. As mentioned in Chapter 7, appositive constructions such as illustrated in (8.62) can be analysed through a construction rule that induces a LINKed structure from a completed node of type e to a node requiring an expression of the same type. This rule is given in (8.63) and its effect on tree growth is shown in (8.64).

(8.62) Professor Kempson, Ruth, a colleague from London is giving a talk next week.

(8.63) LINK Apposition (Rule):

\[
\{ \ldots \{ T_n(a), \ldots, T_y(e), \ldots, \diamond \} \ldots \} \\
\{ \ldots \{ T_n(a), \ldots, T_y(e), \ldots \} \ldots \} \langle L^{-1} \rangle T_n(a), ?T_y(e), \diamond
\]

(8.64) LINK Apposition (Treegrowth):

\[
T_n(a), F_o(a), T_y(X), \diamond \quad \mapsto \quad T_n(a), F_o(a), T_y(e), \diamond
\]

\[
\langle L^{-1} \rangle T_n(a), ?T_y(e), \diamond
\]

Applying LINK apposition to the tree in (8.61) yields the tree shown in (8.65) after parsing the culprit.

(8.65) Parsing John is the culprit via LINK Apposition:

\[
\begin{align*}
T_n(0), T_y(t) \\
T_n(00), T_y(e), F_o(u, x, John'(x)) \\
\langle L^{-1} \rangle T_n(00), ?x. F_o(x), F_o(U_{Culprit'(U)}), \diamond
\end{align*}
\]
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There is now a requirement to identify the content of the metavariable in the LINKed tree provided by the definite noun phrase. The substitution is constrained by the presuppositional information that the substituting term must be describable as a culprit. Such a substituend is provided by the content of the previous utterance by A, which was A’s talking about someone having drunk the milk. Formally this contains an epsilon term that picks out the witness for the act of drinking the last of the milk, i.e. \( \langle \varepsilon, x, \text{Drink}'(m)(x) \rangle \) (where \( m \) is a term denoting the last of the milk that was drunk). Under the assumptions that someone who drinks the last of the milk (without getting more) is guilty of wrongdoing and that someone who is guilty of wrongdoing is describable as a culprit, the substitution of this term for the metavariable projected by the definite is licensed (through abduction on the semantics of culprit) and the presupposition discharged. These steps of reasoning are summarised in (8.66).

\[(8.66)\]
\[
a. \text{Given Context: } \exists x. \text{Drink}'(m)(x).
\]
\[
b. \text{Arbitrary term satisfying a: } \langle \varepsilon, x, \text{Drink}'(m)(x) \rangle.
\]
\[
c. \text{Assumption: } \text{Drink}'(m)(x) \rightarrow \text{Wrongdoer}'(x)
\]
\[
d. \text{Semantics of Culprit: } \text{Culprit}'(x) \rightarrow \text{Wrongdoer}'(x)
\]
\[
e. \text{Substitution: } \text{Fo}(\text{U} \text{Culprit}'(x)) \Leftarrow \text{Fo}(\varepsilon, x, \text{Drink}'(m)(x))
\]

If we use the term \( \varepsilon, x, \text{Drink}'(m)(x) \) as the value of the metavariable provided by the parse of the culprit, we may evaluate the LINK structure with respect to the node from which it is projected. This is achieved through the use of an inference rule that combines the two epsilon terms into one which was mentioned in the last chapter as the rule of Appositive LINK Evaluation and which is (initially) defined in (8.67) below.

\[(8.67)\] Appositive LINK Evaluation:

\[
\begin{align*}
\langle \text{L}^{-1} \rangle Tn(a) & \ldots F \alpha(x, P(x)), Ty(e) \ldots \rangle \rightarrow \\
\{ \{ (L^{-1})Tn(a) \ldots F \alpha(x, Q(x)), Ty(e) \ldots \} \ldots \}
\end{align*}
\]

Applying Substitution and Appositive LINK Evaluation to the relevant nodes in the tree in (8.65) gives rise to the decorations in (8.68).

\[(8.68)\] Evaluating John is the Culprit:

\[
a. \text{Node } \langle \text{L}^{-1} \rangle Tn(00): \text{Fo}(\text{U} \text{Culprit}'(U)) \mapsto \text{Substitution}
\]
\[
\text{Fo}(\varepsilon, y, \text{Drink}'(m)(y) \text{Culprit}'(e, y, \text{Drink}'(m)(y)))
\]
\[
b. \text{Node } Tn(00): \text{Fo}(\varepsilon, x, \text{John}'(x)) \mapsto \text{LINK Evaluation}
\]
\[
\text{Fo}(\varepsilon, x, \text{John}'(x) \land \text{Drink}'(m)(x))
\]

The information on the subject node in (8.65) is thus resolved as in (8.68b) to the arbitrary term that picks out that person, John, who drank the last of the milk.\(^{29}\)

Notice that the rule in (8.67) effectively determines the identity of two terms by picking out the witness for both internal predicates: it captures identity without the need for any type-raising operation or even the use of the identity relation. Hence, the equative reading is neither particular to the content of the copula nor

\(^{29}\)The formula retains the iota operator as defining a more restricted type of epsilon term, one with a unique value in any context.
derived from some operation on the denotation of a noun phrase. Instead, the identity of the two terms in an equative clause is derived through an independently required inference rule operating on the output of grammatical operations (LINK Apposition and Evaluation) that are themselves independently required.

The analysis has not yet finished, however, as the value for the predicate still needs to be identified. In substituting for the predicate metavariable in (8.65), the context given in (8.4.1) provides the three candidate predicates in (8.69), the most informative of which should be chosen as the substituend, according to the relevance theoretic stance taken in this book.

(8.69) Possible Predicate Substituends:

a. From the culprit: \( \lambda y. \text{Culprit}'(y) \).

b. From substituend (and main predicate of A's utterance):

\( \lambda y. \text{Drink}'(m)(y) \)

c. From the (last of the) milk: \( \lambda x. \text{Milk}'(x) \)

Of the predicates in (8.69), (8.69c), picking out the property of being milk, is least likely to be chosen because of the (likely) processing cost needed to derive useful inferential effect from the proposition that \( \text{John is milk} \). Of the remaining two predicates, that of being a culprit has been used to identify the appropriateness of substituting \( x, \text{Drink}'(m)(x) \) for \( U_{\text{Culprit}}'(U) \) and so is less informative than (8.69b), the property of drinking the last of the milk, leaving the latter as the apparently most informative potential substituend in the context. However, this is of the wrong sort to substitute for \( \text{BE} \), being something that denotes an eventuality. So, even though the predicate \( \lambda y. \text{Culprit}'(y) \) is not fully informative, it is nevertheless the only candidate for an appropriate substituend in the context, and so must be chosen.\(^{30}\) The result of this substitution yields (8.70a) which is evaluated as (8.70b), a statement asserting that someone did steal the last of the milk (a confirmation of A's initial assertion in (8.4.1)) and that that someone is John, as required.

(8.70) a. \( \text{Fo(\text{Culprit}'(t, x, \text{John}'(x) \wedge \text{Drink}'(m)(x)))} \)

b. \( \text{S: Culprit}'(a) \)

\( \text{where } a = (t, x, \text{John}'(x) \wedge \text{Drink}'(m)(x) \wedge \text{Culprit}'(x)) \)

There exists someone who is a culprit and drank the last of the milk and that person is John.

Notice that the result is almost equivalent to the predicative assertion that \( \text{John is a culprit} \). However, because of the use of the definite, an inference is induced to identify possible things that could truthfully be called a culprit. The step of substituting an appropriate term for the metavariable projected by the definite leads to an interpretation where John is said not just to be a culprit but in fact the one who drank the last of the milk. By exploiting underspecification of various sorts and the inferential process of substitution, we have thus provided an account of the interpretation of equative clauses without the use of the logical identity operator, leaving open the intriguing possibility that the logical relation of identity does not form part of the semantic representation system of natural languages (although it does form part of the interpretation language of that system), but simply from the notion of content underspecification as applied to the copula.

\(^{30}\)Note that this result is arrived at without actually undertaking any further inference at this point: milk not being a property semantically predicable of a human being and culprit (under assumptions already made) subsumes drinking the last of the milk.
8.4.2 Specificational Clauses

We turn now to specificational clauses, which as mentioned above, like equatives, involve two definite noun phrases. However, unlike true equatives, specificational sentences involve a definite in pre-copular position which can be construed as a description rather than as picking out some specific entity. In other words, the subject definite provides a description whose referent is assumed to be unknown to the hearer, and whose value is supplied by a referential post-copular noun phrase. An analysis of such clauses is straightforward under the assumptions made here.

Consider the text in (8.71).

(8.71) A: Where are my socks?
   B: The culprit is John.

The analysis of B’s utterance begins with the parse of the definite noun phrase projecting a metavariable with presupposition as before and shown in the first tree in (8.72). The current context, however, does not provide an obvious substituend for the metavariable and, substitution being an optional process, the pointer moves to the predicate node, licensing the parse of the copula which leaves the pointer on the subject node, as before, giving the second tree in (8.72).

(8.72) Parsing The culprit is:

\[
\begin{array}{ll}
T_n(00), Ty(e), & Ty(e \rightarrow t), \\
Fo(U_{Culprit}(\epsilon)) & F_o(BE), \exists x.F_o(x)
\end{array}
\]

The pointer now returns to the incomplete subject node. As with the analysis of equatives discussed above, Late*Adjunction cannot apply to develop this node, in this case because definites are not expletive and so project a bottom restriction on the node decorated by the metavariable. However, as before, Appositive LINK formation may provide an open type e requirement permitting the parse of John, yielding the tree in (8.73).

(8.73) Parsing The culprit is John:

\[
\begin{array}{ll}
?Ty(t) \\
T_n(00), Ty(e), [\bot], Ty(e \rightarrow t), \\
Fo(U_{Culprit}(\epsilon)), \exists x.F_o(x)
\end{array}
\]

Unfortunately, at this point, because the host node for the appositive LINK structure is decorated by a metavariable rather than an epsilon term, Appositive LINK Evaluation in (8.67) on page 309 will not work here. However, we might consider splitting the evaluation rule into a two stage process, one that first writes the formula on the LINKed structure onto its host node (8.74) and then tries to resolve the apparent contradictory result. One such resolution rule is shown in...
(8.75) which combines two epsilon terms into one, as we have already seen in the analysis of equatives.\footnote{It may be, as envisaged in footnote 15 of chapter 7 that this is the only evaluation rule needed (with types suitably left unrestricted). The information copied onto the host node then being passed up the tree resolved as locally as possible according to the type of the copied formula and that of the host node. We leave this refinement for formulation at some other time.}

(8.74) **LINK Evaluation (revised)**

\[
\{\ldots (\lambda x. Culprit(x), π, x), \ldots \} \vdash \{\ldots (\lambda x. Culprit(x), π, x), \ldots \} \\
\{\ldots (\lambda x. Culprit(x), π, x), \ldots \} \\
\{\ldots (\lambda x. Culprit(x), π, x), \ldots \}
\]

(8.75) **TERM Resolution**

\[
\{\ldots (\lambda x. Culprit(x), π, x, P(x)), \ldots \} \vdash \{\ldots (\lambda x. Culprit(x), π, x, P(x)), \ldots \}
\]

How does this help in the analysis of The culprit is John? The answer is straightforward. An application of the revised LINK evaluation rule gives rise to the DU shown in (8.76a). Since a metavariable subsumes any formula value at all, this is equivalent to that shown in (8.76b) which contains no contradictory information, with the content of the metavariable thus being supplied by the LINK structure. In this way, we model the intuition that the initial definite provides a description of some entity while the postcopular expression identifies it.

(8.76) a. \(Tn(00), Ty(e), Fo(U_{\text{Culprit}}(U),Fo(t, x, John'(x)), [\perp]) \downarrow \diamondsuit\)

b. \(\models Tn(00), Ty(e), Fo(t, x, John'(x))_{\text{Culprit}}(t, x, John'(x)), [\perp]) \downarrow \diamondsuit\)

As before, we still need a value for BE. In the current context, the most accessible predicate is that of being a culprit: \(\lambda x. Culprit'(x)\). This has not been used to identify any substituend and there is no other accessible predicate which it subsumes. It, therefore, must be chosen as substituend as shown in (8.77a) with the formula in (8.77b) resulting as that for the propositional tree. From which some further inference must be made between John’s culpability and A’s inability to find socks.

(8.77) a. BE \(\Leftarrow \lambda x. Culprit'(x)\)

b. \(Fo(\text{Culprit}'(t, x, John'(x))) = (\text{John is a culprit})\)

Specificalional clauses thus may, as in this case, end up being truth-conditionally equivalent to predicative clauses, but notice that the process by which the interpretation is obtained is distinct. In parsing John is a culprit, a term is identified, \(t, x, John'(x)\), and a property, \(\lambda x. Culprit'(x)\), is predicated of this without need of inference. In parsing The culprit is John, on the other hand, the possibility that there is someone who is a culprit is presented to the hearer and this someone is identified as John through a process of LINK Evaluation. The informational effects are thus distinct, with the latter providing focus on John, and at the same time (in the current context) providing information that may enable the hearer to find their socks by indicating that somebody may be responsible for wrongdoing with respect to those socks. Process is central to Dynamic Syntax and forms part of the procedural ‘meaning’ of an utterance without the need to define different representations or layers of information to specifically encode differences in meaning between different constructions.\footnote{See Cann (forthcoming b) for further discussion.}
8.5 Nominal Predicates

In this last section, we take a brief look at nominal predicates in English. Unlike many languages, English does not permit singular bare count common nouns in post-copular position. Instead, the indefinite article must accompany the relevant predicate.

\[(8.78) \quad \text{a. } *\text{Mary is teacher.} \]
\[(8.78) \quad \text{b. Mary is a teacher.} \]
\[(8.78) \quad \text{c. Tom and Mary are teachers.} \]
\[(8.78) \quad \text{d. Tom and Mary are some teachers.} \]

To account for this distribution in DS, it must be the case that common nouns cannot have a \( ?T y(e \rightarrow t) \) trigger (at least in the singular)\(^{33}\). A trivial way of analysing this construction, then, would be to treat the indefinite article as being ambiguous between something that constructs an epsilon term in the context of a requirement to construct an expression of type \( e \) and one that makes a common noun into a one-place predicate in a context in which such an expression is required. A sentence like \textit{Mary is a teacher} may then be parsed in the same way as other post-copular predicate constructions, as illustrated in (8.79). The indefinite article then provides some binder for the distinguished variable in the common noun, an epsilon operator in the context of a requirement for a term and a lambda operator in the context of the requirement for a one-place predicate. The output formula is simply \( Fo(\text{Teacher'}(t, x, \text{Mary'}(x))) \) as required.

\[(8.79) \quad \text{Parsing Mary is a teacher (ambiguous article):} \]

\[
\begin{array}{c}
?T y(t) \\
\quad T y(e), Fo(t, x, \text{Mary'}(x)) \\
\quad T y(e \rightarrow t), Fo[\text{BE}], ?\exists x. Fo(x) \\
\quad T y(e \rightarrow t), Fo(\lambda y. \text{Teacher'}(y)), \\
\quad T y(cn), Fo(y, \text{Teacher'}(y)) \\
\quad T y(cn \rightarrow (e \rightarrow t)) \\
\quad Fo(\lambda P. (\lambda, P)) \\
\end{array}
\]

A more interesting approach suggests itself, however, based on the appositional analyses of equative and specificational constructions presented above: the post-copular noun phrase projects an epsilon term that decorates a node LINKed to the subject. Nothing in the discussion above requires a LINKed term expression to be definite, so we should expect post-copular indefinites. Taking this approach, which is more in keeping with the general eschewing of homonymy followed in this book, we may alternatively analyse \textit{Mary is a teacher} as in (8.80), with a transition involving both LINK Evaluation and Term Resolution.

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\(^{33}\)We leave on one side an account of plural common nouns.
Chapter 8. Copula Constructions in English

(8.80) Parsing *Mary is a teacher* with LINK Evaluation and Term Resolution:

\[
\begin{align*}
\text{Scope}(S, < x), T y(t) \\
T n(00), T y(e), \\
F o(i, x, Mary'(m)(x)) \land Teacher'(x), \diamondsuit \ 
T y(e \rightarrow t), \\
F o(e \rightarrow t), \ 
\exists x. F o(x)
\end{align*}
\]

There are two local (and potentially relevant) predicates available for substituting the predicate metavariable: \(\lambda x. Mary'(x)\) and \(\lambda x. Teacher'(x)\). The substitution of either predicate in fact yields what we require, i.e. an existential statement. This is shown in (8.81) where both substitutional possibilities are given first with the existential statement with which they are truth conditionally equivalent shown in (8.81c).

(8.81)

a. \(Mary'(i, x, Mary'(x) \land Teacher'(x))\)

b. \(Teacher'(i, x, Mary'(x) \land Teacher'(x))\)

c. \(\exists x. Mary'(x) \land Teacher'(x)\)

This account automatically excludes quantified expressions other than indefinites from post-copular position. As discussed in chapter 3, scope resolution for fully quantified expressions must be determined within the local propositional structure. However, appositional LINK formation is not propositional and there is no means to resolve the scope requirement and so such expressions are ungrammatical, just as with the right peripheral background topics discussed in Chapter 5. The examples in (8.82) are thus straightforwardly excluded.

(8.82)

a. *Tom and Mary are every teacher.

b. *Those people are most students in my class.

c. *Many rabbits are many rabbits.

However, what of quantified subjects? These are fully grammatical with post-copular indefinites and yet, while the LINK mechanism enables the post-copular noun phrase to be analysed, there is no resolution rule providing an integrated interpretation for the expression. Thus, while the tree in (8.83) is well-formed, applying LINK evaluation would yield a DU on the subject node involving both a tau and an epsilon term whose content cannot be reconciled.

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34 Note that this effect is achieved without Scope Evaluation.

35 The analysis also explains why post-copular quantifier determiners like *many* must be interpreted as a cardinality expression rather than a full quantifier:

(i) The arrows that hit the target were many.
(ii) *The arrows that hit the target were many arrows.*
8.6. **SUMMARY**

In this chapter, we have presented an analysis of the English copular verb, *be*, that treats it uniformly as a one-place predicate with underspecified content. Within the framework of Dynamic Syntax, this underspecification is represented as the projection of a metavariable whose actual value must be derived pragmatically from the context in which the copular clause is uttered. This context involves both external and local linguistic content and the latter determines to a large degree whether the copular clause is interpreted as a predicative or equative construction, no distinction being made between predicative and equative *be*. It is also shown how the existential *there be* construction fits into the general pattern and how the pragmatic process of substitution can, within an overall Relevance Theoretic framework, explain how different interpretations are given to different *there* clauses and why certain combinations of expressions are difficult to interpret. The processes specified for the analyses of the different constructions are needed elsewhere in the grammar and do not constitute an ad hoc set of assumptions to account for constructions involving the copula. While there is much more to say about all these constructions, the apparent success of this style of analysis in covering a wide range of data with very different interpretive effects supports the dynamic view of utterance interpretation and the need to move away from static models of autonomous syntax.
Chapter 9

General Perspectives

As an exercise in showing how cross-linguistic similarities and differences can be explained by shifting into a parsing-oriented perspective, this book is in one sense complete. We have taken the dynamics of language processing and used it to demonstrate how syntactic properties of language become explicable through the dynamics of building up representations of the content of strings in context. Though our emphasis has been on defending the hypothesis of a parsing-directed grammar formalism by setting out these empirical cross-linguistic results, the shift in assumptions is radical, and we have now to step back and consider the perspective itself. What does it tell us about the interface between syntactic and semantic properties of language? What does it tell us about the relationship between parsing and production? Or about the relationship between knowledge of language and the general cognitive system? In short, how does it contribute to our understanding of the nature of language?

Before we turn to these questions, first we have to be honest, and admit that there are a lot of things that we have not done, any one of which might render this entire enterprise problematic. To take one obvious example, as we have noted a couple of times, our account of case is incomplete: there is, in particular, no characterisation of any semantic contribution case markers may give. We have not addressed the problems of passive, or the question of whether the subject of a passive structure does, or does not, involve the same concept of subject as the one of immediate domination by some propositional node in a semantic structure. Nor have we explored other constructions typically used as starting points for the development of most generative formalisms, such as control and raising. More generally, we have not addressed the complexities of derivational morphology at all and a theory of the lexicon remains to be developed. All we have done is to adopt a simple-minded Fodorian one-to-one word-concept correspondence, knowing that this is not adequate,\(^1\) and knowing that attributing underspecification of contextually provided content to pronouns only scratches the surface. Then there is the problem of expressing tense and related phenomena. We have not addressed any of the problems induced by tense specifications and the construal of events in time which aspect and tense morphology give rise to. But this is known to parallel anaphora, and to display properties of context-dependence, which must lie at the heart of any formal characterisation.\(^2\)

There is also adjunction, which we have only addressed in so far as we have anal-

\(^1\)See Carston 2002 for the challenge that faces any serious modelling of the under-determinacy and enrichment required for lexical items.

\(^2\)See Perrett (2000), and Gregoromichelaki (in preparation).
ysed relative clauses and co-ordination through the concept of LINKed structures. But there remains the whole debate about the relation between argument and adjunct. Marten (2002b) provides arguments that these constitute yet another case where there is an alternative analysis in terms of underspecification. According to this view, VP adjuncts are optional arguments, and it is the verb which is lexically not assigned a specific type: this is fixed only in the light of the itemisation of the arguments. With \textsc{Local Adjunction} now motivated within the panoply of operations available, an alternative account is that \textsc{Local Adjunction} licenses the building of a locally unfixed predicate node, so that additional predicate-functor nodes can be added to yield back a predicate node. Yet another alternative is that all true VP adjuncts are built up as LINKed structures of identical type, as a form of predicate apposition, analogous to \textit{John, the idiot} (see chapters 7 and 8).

Detailed investigation of any of these phenomena might simply show that we were wrong: the sceptic is entitled to think we have only taken data which happen to fit our case. But, with the wide range of linguistic phenomena that we have provided explanations for in this book, we remain optimistic that answers to these problems lie, as above, in concepts of underspecification and their resolution in context.

In this chapter, we mostly put aside analyses of specific linguistic phenomena (apart from ellipsis) and address some wider issues. Throughout this book we have stated that the grammar formalism is context-dependent. Indeed, without appropriate substituends being contextually provided, many examples containing pronouns simply cannot give rise to well-formed logical forms. So we need a theory of context and, specifically, a theory of well-formedness with respect to context. Given also that our theory is unapologetically parsing-oriented, it is not unreasonable to ask questions about production (although, of course, such questions are rarely asked of the more standard formalisms) and about the relation between parsing, production and dialogue. Then, further on the horizon, questions arise with respect to language acquisition and diachronic change, even about language evolution. This chapter touches on these questions in order to provide some initial, but certainly not definitive, answers. We begin, however, by addressing the issue of the relation between syntax and semantics.

### 9.1 The Syntax-Semantics Correspondence

Despite using the word \textit{semantics} sporadically throughout the book, we have not actually set out any semantics in the model-theoretic sense. Yet, we have set out a method for constructing epsilon and tau terms; and even gone on to rely on some intuitive concept of what it means to have a partially specified epsilon/tau term which can provide some input to pragmatic processes of \textsc{Substitution}, giving rise to one or more copies of these incomplete terms. One might well argue that without an accompanying semantics, it is quite unclear what these claims amount to.

Our response is that this complaint simply misses the point. This book has not been an essay in semantics, where that term is construed in terms of specifying what it means to be a denotation. It is, instead, an exercise in showing how semantic representationalism can act as the basis of a theory of natural-language syntax. Our claims about quantification are certainly partial, in that the basis of the account needs to be extended to the full range of quantifying expressions in natural language, and all we have given is a subset, characterisable in terms of epsilon and tau terms, which correspond to predicate logic expressions. But, in so far as we have chosen to

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See Wu (forthcoming) for an analysis of Chinese adjuncts along these lines.
stick to this restriction, formal articulation of the semantics is not an urgent task, without which the claims made cannot even be judged. The expressive power of the epsilon calculus is identical to that of predicate logic, constituting the explication of arbitrary names in natural deduction systems of predicate logic. Its semantics is, by definition, non-distinct from that of predicate logic, and this semantics is formally very well understood. Even the very bald sketch of tense construal in chapter 3 and references to groups and plurality in chapter 7 have well-known and well understood semantics. (see Prior (1967), Link (1983), Lasersohn (1995), etc.).

What we have done, however, is not unrelated to semantic issues, for the demonstrations of the complexity of the syntax-semantics correspondence in the literature often take the form of showing that a given string has more than one truth-denotational content, associated with which are distinct structural properties, hence justifying the invocation of ambiguity. Examples that we have considered include restrictive and non-restrictive construal of relative clauses, E-type vs bound-variable construal of pronouns, different interpretations of the verb *be*, for all of which we too have suggested analyses. As with these phenomena, whenever ambiguity occurs on a broad cross-linguistic basis, we have however taken this as requiring explanation in terms of some relatively weak intrinsic characterisation of the individual items, with mappings from that uniform input specification onto divergent outputs via the interactions between different processes of update. The result has been that we simultaneously capture the heterogeneity and diversity of natural language interpretation, while nevertheless capturing the underlying systematicity of the natural language expressions in question. This methodology has been applied throughout the book. The wealth of apparent structural and semantic diversity which natural languages may display is analysed in terms of the way relatively simple forms of input interact with general principles that determine how information is built up relative to context.

Of course, the ambiguity or under-specification of individual items is not flagged by the expressions themselves, and has to be argued case by case. Nevertheless, this emphasis on reducing apparent ambiguity to relatively weak specifications is not simply an application of Occam’s Razor in terms of a preference for fewer, and more general explanations (although we do believe this is ultimately the criterion for choosing between competing analyses). We take the wealth of such data to vindicate our claim about natural language that underspecification and the dynamics of update constitutes the heart of natural-language structure and is a direct reflection of the dynamics of language processing, this in its turn being a reflection of the general cognitive human capacity for information retrieval.

At this point, it is worth looking back to how we set out on the enterprise of this book. What we set out, by way of introduction, were the two apparently independent problems: the context-dependence of natural language, and the apparent imperfection of natural language in displaying long-distance dependency effects. What we have argued for is the novel view that the concepts of underspecification which are familiar in semantic explanations apply also to the central syntactic core of language as well. And, in extending this concept of underspecification into the arena of syntax, the dichotomy between what should be explained in syntactic terms and what in semantic terms collapses. The phenomenon of context-dependence is, on this view, largely resolved (following the lead of Kamp (1981)) within the construction algorithm that induces representations of semantic content.

It is this construction algorithm for building propositional forms relative to context which through the rest of this book has been shown to be a vehicle for expressing syntactic generalisations about natural languages. So the thirty-year-old question of the relation between syntax and semantics, as raised by theoretical
linguists, is transformed into the question of how structural representations of content are progressively built up. There are no independent concepts of syntactic and semantic representation, one associated with a string, the other associated with some denotational content. There are no multiple levels of syntactic structure expressing different forms of generalisation. There is only the progressive building of logical forms. The conclusion is the same as reached elsewhere, now expressible at the meta-level of constructing grammar formalisms. The dynamics of parsing from a phonological sequence onto representations of content along a time-linear perspective is the driving force which determines the formal properties of natural language grammars.

With the concept of syntax expressed in terms of growth of logical form, this stance stands in an easily traceable line to the Montague tradition in which syntactic and semantic properties of natural language are taken to correspond in a one-to-one fashion. The shift away from the direct syntax-semantics correspondence assumed in that paradigm is as small as could be envisaged while licensing what we take to be the necessary liberalisation from compositionality of denotational content defined over the surface string. Since the 1960’s, when in virtue of island constraints in particular, semanticists in the Montague tradition granted that there were structural properties of language which could not be reduced to model-theoretic underpinnings, there has been general recognition of the need for independent vocabularies for expressing structural and semantic generalisations. A number of very liberal systems were defined at that time in which an open-ended number of levels of representation were set up, merely requiring forms of correspondence between the levels. Despite the neutral format of the AVM notation, HPSG falls into the same class of formalisms, in principle allowing an open-ended set of types of information, with the AVM notation providing the basis for stating appropriate forms of correspondence. This book reverses that trend in so far as it argues for a position much closer to the earlier, tighter, Montague position.

The structural properties of a natural language string are to be explained solely in terms of the combination of (i) properties of representations of denotational content attributable in a given context to the expressions in the string and (ii) the incremental process of building up a representation of that content as defined over the partial information which each word in sequence provides, relative to that context. Put more simply, the syntax of a natural language sentence is given by setting out the properties of its semantic interpretation as defined relative to some context plus the process of getting there across the parsing dynamics of taking the words in sequence. And compositionality for a natural language string is achieved by the constraint that each word in a well-formed sequence contributes a sequence of actions to the monotonic tree growth process of establishing a complete logical form.

In one sense at least, this is not such a drastic departure from the Montague stance after all, merely a shifting of the level over which denotational content is defined from the string itself to the logical form that is constructed from parsing it. Like the Montague system, the explanation of structural properties of language is reduced to what is required for articulating the way in which structural representations of content which the sentence is taken to provide are built up: the primary departure from that view is the incorporation of real-time dynamics into the way in which such representations are built up. And coming round full circle to where we set out in writing this book, we can now see in what sense languages are imperfect (Chomsky 1995). This judgement of Chomsky’s stems from the Montague-style

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4See e.g. Jackendoff (2002), Dalrymple (2001), Muysken (2002) for recent exemplars of such systems.
assumption that compositionality of denotational content has to be defined over natural language strings. Shifting the perspective to one in which natural language syntax is defined in terms of progressive building up of structures representing content as established in context, natural languages turn out to be a perfect reflection of what they enable humans to do, which is to progressively build up information from very partial beginnings in the activity of parsing in real time.

9.2 Context and Parsing

There is however a major difference between Dynamic Syntax and other systems in virtue of this shift: the system is not encapsulated. That is, at any point, there may be interaction with context-dependent processes such as substitution which are defined over terms in the context, hence ranging over more than the constructs which the construction process itself provides. With the formal recognition of the wide-spread nature of this interaction, we need now to be more precise about what it means to have defined grammar-internal operations that interact with context-dependent processes which are, in some sense, external to the grammar formalism. We begin by being explicit about the concept of context itself.

9.2.1 Defining Context

Recapitulating what we have been presuming throughout the book, the context, to put it at its most neutral, constitutes the point of departure for whatever is the current task. We take the context used in understanding and producing language by humans to be a mental state of some sort, informed by the physical context in which a communicative act takes place, any preceding utterances and perhaps knowledge about the interlocutors engaged in that act. Given our adoption of a Fodorian language of thought \( (\text{LOT}) \), such representations must be in terms of that language. For our purposes, we choose the epsilon calculus as our \( \text{LOT} \), so that contexts for us consist of expressions in that calculus. Further, since any such representation of content can be represented in a tree format, we take the actual objects that make up the \( \text{LOT} \) to be labelled trees. Our contexts, therefore, are made up of sequences of such trees, including, minimally, the (partial) tree which constitutes the input to the task to hand. Even at the beginning of a parsing task, then, the context consists of some non-empty sequence of labelled trees. So we might provisionally define the context, \( \mathcal{C} \), as:

\[
\mathcal{C} = \text{def} \langle T_1, \ldots, T_n, T \rangle
\]

where each of \( T_i \) (\( 1 \leq i \leq n \)) is an arbitrary, (complete) tree, and \( T \) is some partial pointed tree under construction. An important property of this characterisation is that the concept of context itself is language-general. The context is solely made up of \( \text{LOT} \) objects, and not natural-language expressions. It does not comprise strings, prosodies, or anything external to the interlocutor. However, we do not impose a type restriction; so these context trees may, at least, range over trees decorated at their rootnode with type \( t \), \( e \), \( (e \rightarrow t) \), or \( (e \rightarrow (e \rightarrow t)) \) formulae. In fact, there is no need to stipulate that only the last tree in the sequence is partial. Unless the tree under development is linked to the preceding tree, itself also under construction, there will be no license for the pointer to return to that tree. So, unless the tree under construction is a LINKed tree, all previous trees will necessarily be complete.

\footnote{And, to keep things simple, we assume a single such language.}
This concept of context, ranging over both information that may be independent of the immediate parsing task and information constructed during the parse task, is sufficient to cover the major types of pronoun resolution. For example, it covers both intra-sentential and inter-sentential anaphora, because both the partial tree under construction and the structure obtained by parsing the previous utterance are taken as part of the context relative to which the string under construal is interpreted.\(^6\)

\begin{enumerate}
  \item a. John said he was upset.
  \item b. John left. He was upset.
\end{enumerate}

It applies equally to LINKed structures in which the tree may not be of type \(t\), but of type \(e\):\(^7\)

\begin{enumerate}
  \item a. As for John, he was upset.
  \item b. If John left, he was upset.
\end{enumerate}

It applies in the projection of LINKed structures, irrespective of whether the propositional structure is processed first, or subsequently. In either case, it is that which is processed first which constitutes part of the context for the building of the LINK transition and the construction of the copy. This was the basis of our account of Japanese head-internal relatives, accounting for the way in which both the matrix arguments are identified in (9.3), despite the structural configuration:

\begin{align*}
\text{(9.3) } & \begin{array}{llll}
  \text{John-ga} & \text{sanko-no} & \text{ringo-o} & \text{maita-no-o} \\
  \text{NOM} & \text{GEN} & \text{ACC} & \text{NO-ACC} \\
  \text{ate} \\
  \text{John ate the three apples which he peeled.}'
\end{array}
\end{align*}

It was also the basis of the account of right-dislocation effects such as:

\begin{enumerate}
  \item a. A man left. He was upset.
  \item b. Two men left. They were upset.
  \item c. Every parrot sang a song, which it didn’t understand.
\end{enumerate}

With the characterisation of context as a sequence of trees, of which the last may be some tree under construction, it might appear that there is a left-right asymmetry in context construction, which would not apply to cases where the context may not literally always be prior to the update being carried out, as in cases of Right-Node Raising:

\(^6\)In principle, the characterisation is neutral enough to allow for system-external inferences, given that any expression of the language of inference can be expressed as a tree. It is well-known that there is a feeding relation from general steps of inference onto tree structures, since anaphora resolution may involved bridging cross-reference effects:

(i) If I fainted outside the hospital. They operated right away.
(ii) The wedding pair looked miserable. He had just come from a hospital appointment, and she had been fretting that he would be late.

However, at the current stage of development, there are no mechanisms for expressing these, as the feeding relation necessary between decorations on tree-nodes, general forms of inference, and the process of tree growth, remains to be defined.

\(^7\)See Gregoromichelaki (in preparation), where an account of conditionals is developed in which the antecedent of a conditional is taken to project a linked structure providing the restriction on a world variable.
(9.6) John ignored, but Bill consoled, the woman from Birmingham.

In these, what is imposed as a requirement on the development of the second structure is a copy of the metavariable used to decorate a node in the first, incomplete, structure. The right-peripheral expression decorating an unfixed node provides a value for that copy of the metavariable in the second structure, enabling it to be completed. Hence, the structure that was started second happens to be completed before the first structure is completed. Despite this, the concept of context remains time-linear, remaining that of a sequence of trees minimally including the tree resulting from the task just completed.

There is however one type of anaphora resolution which is not so far covered by our concept of context: the “sloppy” uses of pronouns (Karttunen 1976). This case requires an extension of the notion of context to include an online lexicon, which, anticipating the discussion of dialogue, we might call the “dialogue lexicon”.

(9.7) John keeps his receipts very systematically, but Tom just throws them into a drawer.

To analyse these sloppy uses of pronouns, the pronoun is interpreted as having as antecedent some term which carries the information that it itself contains a metavariable. Thus, in the sloppy reading of (9.7) what substitutes for the metavariable is not the term previously constructed from parsing his receipts, which we might represent as:

\[ Fo(\epsilon_{pt}, x, \text{Receipt}'(t, y, \text{John}'(y))(x)) \]

but a new term that is constructed using the actions by which the earlier term was itself constructed. These actions include a point at which substitution takes place of the metavariable projected by the possessive pronoun, his. Given the optionality inherent in the system, a different choice of substituend may now be taken, yielding a new term, with \((t, z, \text{Bill}'(z))\) in place of \((t, y, \text{John}'(y))\), as required.

Taking actions, both computational and lexical, as part of the linguistic context, plays a much bigger role in ellipsis, where all three different concepts which the process of tree growth makes available are brought into play – terms, structure, and actions.

### 9.2.2 Ellipsis and Context-dependence

Ellipsis provides us with a particularly good window on what constitutes context, as, by definition, it constitutes nothing other than re-use of what context makes available and it does so in different ways.\(^8\)

First, there is the ability to pick up on terms as made available in some context tree, simply reusing a predicate formula just established. This is illustrated with the so-called strict readings of ellipsis, the exact analogue of pronominal construal.

(9.8) Q: Who upset Mary?

Ans: John did.

As the display in (9.9) illustrates, once having parsed the string *Who upset Mary?* a term of appropriate type is available from the context to substitute for the metavariable projected by the auxiliary verb *did*.\(^9\)

---

\(^8\)This section reflects a number of helpful discussions with Matthew Purver.

\(^9\)Recall from chapter 8, that \(Fo(\text{DO})\) is a metavariable whose substituends are restricted to denoting eventualities, i.e. \(Fo(U_{\text{Eventuality}})\). In these and subsequent tree displays, we do not show the internal structure of the terms projected by names, or *wh* expressions for ease of reading.
(9.9) Parsing *John did*:

**CONTEXT:**

\[ Ty(t), \text{Fo}(\text{Upset}'(\text{Mary}'))(\text{WH}) \]

**TREE UNDER CONSTRUCTION:**

\[ ?Ty(t) \]

\[ \text{Fo}(\text{WH}) \rightarrow Ty(e \rightarrow t), \]

\[ \text{Fo}(\text{Upset}'(\text{Mary}')) \]

\[ \text{Fo}(\text{John}') \]

\[ \exists x. \text{Fo}(x), \Diamond \]

\[ \Uparrow \text{Fo}(\text{Upset}'(\text{Mary}')) \]

Of course, in this case, we do not need to assume that context is presented in tree format, as long as we can assume that context makes available both some propositional form and the subterms that make it up. However, presuming that the full structure is available certainly ensures the isolatability of the various subparts constructed during the process of establishing that form; and the use of the auxiliary *did*, with its formula metavariable of type \( e \rightarrow t \) and a requirement for a fixed formula value (see chapter 8), will determine that a formula of that type must be identified as part of the interpretation process.

However, structure may be used more directly in the construal of fragments, where a tree established by a parse in context may be directly extended, with one speaker using the structure provided by her interlocutor. Question and fragment answers illustrate this: the expression which constitutes the answer is construed as providing an update to the very structure provided by the parse of the question.

(9.10) Q: Who did John upset?

Ans: Himself.

The well-formedness and interpretability of the elliptical answer, *himself*, depends on there being available the structure which provides the antecedent whereby the reflexive can be locally identified.\(^{10}\) While we might postulate some complex abstraction process that enables the context to be reconstructed as part of the single sentence, of which there is only one word overtly expressed, there is no need for such complexity if we simply assume that the process of construal can make use of structure which the context makes available directly, since the speaker will have just parsed the question. All that is required to flesh out this account is to analyse the *wh* expression as providing some partial specification of a term needing to be replaced, with an added stipulated license to move the pointer back to that node once the construction of the tree is incomplete (as displayed in (9.11)).

---

\(^{10}\)See chapter 2, footnote 38 for a characterisation of the domain in which substitution is restricted for this sort of reflexive.
Kempson et al. 2001 argue that *wh* expressions project a particular form of metavariable, with detailed demonstration that *wh* expressions are not scope-taking expressions in the manner of regular quantified expressions. There are various forms this very weak term might take: (i) a specialised metavariable, projected like a demonstrative with a restrictor predicate provided either by the nominal or as some encoded predicate \( \text{Fo(\text{Human}')(John')} \) in the case of *who*; (ii) an epsilon term with a metavariable for its restrictor nominal; or (iii) as a variable in an epsilon term, as suggested in chapter 4. In any case, the term projected remains a term under construction, so it cannot be assigned a scope statement until the restrictor specification is provided in the form of some substituend. The need for a substituend, i.e. an answer, thus follows from such a characterisation and does not itself need special stipulation.

This analysis naturally applies to so-called functional questions. In these a pronoun has to be construed relative to some quantifier introduced within the question. Standardly these are analysed as questions quite distinct from regular *wh* questions, since if the *wh* expression is construed as a scope-taking expression, it needs to be analysed as some higher functional type which itself may have wide scope with respect to the quantifier but nevertheless allows an interpretation which makes possible a narrow scope interpretation of the answer with respect to that quantifier:

\[(9.12)\] Q: Who did everyone ignore?  
Ans: Their husband.

No such complexity is needed if we assume that *wh* expressions project a radically underspecified term. With the context itself containing the structure provided by the parse of that question, and the pointer back at the node decorated by that term, the fragment can be seen as directly providing a substituend, through Late *Adjunction*. Any metavariables contained in the term that the fragment provides, such as *their* in *their husband* in (9.12), can then be updated by substituting terms made available in that structure. In (9.12), with the *wh* expression providing such a radically incomplete term, the set of scope statements of the question is essentially incomplete, and the quantifying term provided by the subject expression can therefore not be evaluated. The fragment answer provides the object term; and with the object argument of the predicate Ignore* now available, the metavariable
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contained within that term can be identified as the tau term under construction.
This is shown very schematically in (9.13):

\[(9.13) \quad \text{Fo}(\text{Ignore}'(\text{WH})(\tau, x, \text{Person}'(x)))\]

The genitive by definition projects a dependent epsilon term - i.e. one in which
the introduced term takes narrow scope with respect to the term contained in the
determiner specification. In the case of their husband, this means that an epsilon
term is projected of the form \(\epsilon, y, \text{Husband}'(\text{U})(y)\) (see Kempson et al. (2001:144-
148) for a variant of this analysis). Parsing their husband and a logical form with
attendant scope statements can then be completed, to yield:

\[S < x < y \quad \text{Fo}(\text{Ignore}'(\epsilon, y, \text{Husband}'(\tau, x, \text{Person}'(x))(y))(\tau, x, \text{Person}'(x)))\]

The resulting interpretation, once the logical form is evaluated, is:\footnote{This dependency could be spelled out in full following the pattern set out in chapter 3, but here we leave these names in their shorthand form where the dependence is graphically displayed.}

\[\text{Person}'(a) \rightarrow \text{Husband}'(a)(b_a) \land \text{Ignore}'(b_a)(a)\]

Finally, what might, on the face of it, seem to be data that are problematic for
the current analysis turn out to be commensurate with the account, as long as we
assume, as above, that actions just used in some context can be re-used as part
of the information provided by the context. The relevant data are the so-called
sloppy ellipsis construals, where, apparently, some linguistic form is re-used with a
modified interpretation:

\[(9.14) \quad \text{Q: Who upset his mother?} \quad \text{Ans: John.}\]

In these cases, the fragmentary reply appears to require some retraction from the full
specification of the context to establish a predicate \(\lambda x.\text{Upset}'(\epsilon, y, \text{Mother}'(x)(y))\)
and reinterpret that predicate with respect to the term presented by the fragment. Since Dalrymple et al. (1991), it has been assumed that such a process of abstraction applies on what is provided in the context to create the relevant predicate. This is then applied to the new term. In DS, this would have to be defined as a special operation on contexts. While this is formally a reasonably well-understood possibility, it is unattractive in this framework as it would be incompatible with the upwardly monotonic tree-growth process of construal: some aspect of the content of the formula in context has apparently to be removed in order to yield what is required for the next update.

An alternative is simply to presume that the actions used in establishing that construal of the first utterance are themselves available in the context, and so can be re-used just as terms or structure can be. The actions that have to be applied in the construal of John in (9.14) as ‘John upset John’s mother’ are identical to what the context makes available. The sloppy ellipsis construal arises because amongst the actions so reiterated from the context is the projection of a metavariable to be identified as before from the subject argument, which in the new context provided by the just parsed subject expression John will give rise to the new predicate ‘upset John’s mother’. The display in (9.15) shows the analysis of the question in (9.14) while (9.16) recapitulates the actions undertaken to build the predicate node from a parse of upset his mother (ignoring tense).

(9.15) Parsing Who upset his mother?

IF

THEN

\[
\begin{align*}
\text{make}((\{1\})); \text{go}((\{1\})); \text{put}(\text{Fo(Upset')}); \\
\text{go}((\{1\})); \text{make}((\{0\})); \text{go}((\{0\})); \text{put}(\text{Ty}(e)); \\
\text{make}((\{1\})); \text{go}((\{1\})); \\
\text{put}(\lambda P.\epsilon, P); \text{go}((\{1\})); \\
\text{make}((\{0\})); \text{go}((\{0\})); \text{freshput}(x); \text{go}((\{0\})); \\
\text{make}((\{1\})); \text{go}((\{1\})); \\
\text{put}(\text{Fo(Mother')}); \\
\text{SUBSTITUTE}(\alpha, \alpha \in T_{\text{Context}}); \text{go}((\{1\})); \\
\text{make}((\{1\})); \text{go}((\{1\})); \\
\text{put}(\text{Fo(Mother'), Ty}(e \rightarrow (e \rightarrow \text{cn})))
\end{align*}
\]

The fragmentary reply John then decorates the subject node of a propositional tree and the actions in (9.16) build the rest of the tree. Crucially, at the point where
Substitution applies \( Fo(\text{John}') \) is selected to yield ultimately the formula:

\[
Fo(\text{Upset}'(\epsilon, x, \text{Mother}'(\text{John}')(x))(\text{John}'))
\]

Hence the sloppy construal of the elliptical form, on this account, retains a concept of identical re-use of some context-provided construct.

This style of analysis is particularly well-suited to an account of antecedent-contained ellipsis:

(9.17) Bill interviewed everyone John did

This construction is problematic for many accounts, as the elliptical fragment is apparently contained within the expression from which its interpretation has to be built up, threatening circularity (Fiengo and May 1994). On an analysis in which the context provides not only terms and their structure but also the actions used in building up the resulting structure and terms, antecedent-contained ellipsis falls into place, without anything special having to be said. This is illustrated in (9.18).

(9.18) Parsing (9.2.2):

\[
\begin{array}{c}
Tn(0), ?Ty(t) \\
\quad \downarrow \quad \downarrow \\
Fo(\text{Bill}') \quad ?Ty(e \rightarrow t) \\
\quad \downarrow \quad \downarrow \\
Tn(010), ?Ty(e) \quad Fo(\text{Interview}') \\
\downarrow \quad \downarrow \\
?Ty(cn) \quad Fo(\lambda P(\tau, x, P(x))) \\
\downarrow \quad \downarrow \\
Fo(x), Ty(e) \quad Fo(\text{Person}') \\
\quad \downarrow \quad \downarrow \\
(L^{-1})Tn(010), ?Ty(t), ?(\downarrow \ast)Fo(x) \\
\quad \downarrow \quad \downarrow \\
Fo(x), ?\exists x.Tn(x) \quad Fo(\text{John}') \\
\quad \downarrow \quad \downarrow \\
Ty(e \rightarrow t), \quad Fo(\text{DO}), \quad ?\exists x.Fo(x), \checkmark
\end{array}
\]

What the parsing of everyone John did in (9.2.2) has provided is, in sequence: the partial term under construction got by parsing everyone, with its fresh variable \( x \); the induction of a LINKed structure with a copy of that variable \( x \) at an unfixed node; a subject node decorated by \( Fo(\text{John}') \), and then a predicate node decorated by a place-holding metavariable, \( \text{DO} \). The tree cannot at this point cannot be completed, as there is no node with which the unfixed variable can \text{MERGE}. However, \text{LATE *ADJUNCTION} may apply to the predicate node and this provides the right context for the sequence of actions in (9.19) to be triggered, these actions being derived already from the earlier parse of the verb \text{interviewed}.

(9.19)

\[
\begin{array}{c}
\text{IF} \quad ?Ty(e \rightarrow t) \\
\text{THEN} \quad \text{make}(\downarrow \downarrow); \quad \text{go}(\downarrow \downarrow); \\
\quad \text{put}(Fo(\text{Interview}'), Ty(e \rightarrow (e \rightarrow t))) \\
\quad \text{go}(\downarrow \downarrow); \quad \text{make}(\downarrow \downarrow) \\
\quad \text{put}(?Ty(e))
\end{array}
\]
These actions provide all that is needed to complete the LINKed structure and build up a composite restrictor for the tau term already introduced, since the unfixed node decorated the variable can now MERGE with the internal object node. The final result is, as required:

$$S < x \text{ Fo(Interview}′(\tau, x, (\text{Person}′(x) \land \text{Interview}′(x)(\text{John}′)))(\text{Bill}′))$$

\[
\begin{align*}
\text{(Person}′(a) \land \text{Interview}′(a)(\text{John}′)) & \longrightarrow \text{Interview}′(a)(\text{Bill}′)
\end{align*}
\]

The whole process of construal is monotonic: nothing needs to be removed by any process of abstraction.

The analysis has the bonus of extending to other forms of ellipsis which are problematic for abstraction accounts, since they appear to involve abstraction of some expression other than the subject, indeed abstraction over an expression within a relative clause, standardly a strong island:

(9.20) The man who saw John told him his rights, but the one who saw Bill didn’t.

Again, on the assumption that actions may be re-used, these are quite unproblematic, as the actions that are re-used in setting up the interpretation of the second define an update relative to the extended context which the newly introduced second subject expression makes available.

While a lot more needs to be said about ellipsis, we nevertheless take these preliminary considerations as indicative that the concept of context for the purposes of the construction process has not only to contain sequences of representations of content, but also sequences of actions, as implemented in the parsing process. This however does not disturb the concept of context as needing to be defined over LOT constructs, for these actions are all defined as updates in a tree-growth process. Context, as now revised, is a record of what information has been constructed to date, and how it has been presented. Notice that ellipsis is very restricted in its distribution and is not fully anaphoric in the same sense in which pronouns are. In general, ellipsis is licensed only with respect to an immediately preceding sentential utterance. Thus in (9.21a), the ellipsis in the second string is licit and a sloppy reading can be construed, giving the reading ‘John didn’t love John’s mother’. However, in (9.21b), the ellipsis is awkward and, if it is construable at all, can only mean that John did not love Bill’s mother.


b. Bill loved his mother. He was very distressed when she died. ??John didn’t (and held a big party).

We take this to indicate that it is only the set of actions associated with constructing the immediately preceding propositional tree that forms part of the context. In effect, we may hypothesize that this reflects short-term memory and the well-known way that recall of actual preceding utterances quickly degenerates. The definition of the contexts we suppose to be relevant with respect to parsing a string $\phi$ is given in (9.22) as an ordered list of complete trees and a partial tree constructed over the current string (which may just be a tree determined by the Axiom). The actions of the current and immediately preceding trees also form part of the context.

(9.22) $C \overset{\text{def}}{=} < T_0, \ldots, T_{n-1}, < T_n, A_n >, < T_\phi, A_\phi >>$

where $0 \leq i$; every $T_j$, $i \leq j \leq n$, is a complete tree without requirements; $T_\phi$ is a partial tree constructed as part of the parse of $\phi$; and $A_\phi$ is the set of lexical, computational and pragmatic actions used in constructing $T_\phi$. 
9.3 Dialogue as a Window on Production

The analyses of context and its role in building up a structural basis for interpretation has buttressed our view that the syntactic system, designed as an architecture for parsing, is not encapsulated. What may be more surprising is that the concept of context is just as central to an account of production.

The question of the relation between parsing and production is one which is not raised in other theoretical frameworks. According to standard methodologies, it simply makes no sense to articulate either parsing or production as primary—both are different applications of the use-neutral grammar formalism. Indeed, this question is not especially interesting since the assumptions made do not suggest answers, the matter is purely contingent. From the Dynamic Syntax perspective, however, things are quite different. Parsing has to be seen as the more basic of the two activities, as the articulation of the licensed parse moves constitutes the grammar formalism. But more than this, production has to involve establishing a possible parse for that is what the rules of grammar provide; it has to be an incremental task; and it also has to be context-dependent. The one major difference is that, unlike the blind and trusting parser, the producer has the foresight of knowing what they want to say, at least in part. So the producer starts with some (possibly partial) representation of content which guides the construction process. Otherwise, the two tasks go hand in hand.

This may seem a surprising twist; and to set this proposal in context, we need to see what relations there are between the roles of producer and parser. And for this we turn to dialogue, which is proposed in Pickering and Garrod (2004) as the major new challenge facing both linguistic and psycholinguistic theorising.

9.3.1 Data from Dialogue

The most striking property of everyday dialogue is how easily we shift between the roles of producer and parser. We ask and answer questions in rapid succession:

(9.23) A: Who did you see?
    B: I saw Mary.
    A: Mary?
    B: Yes, with Eliot.

We extend what the other person has said:

(9.24) A and B talking to C:
    A: We are going to London.
    B: Tomorrow. Because Mary wants to.

We may even interrupt, and finish each other’s utterances:

(9.25) A: What shall I give...
    B: Eliot? A toy.

As these data show, all such completions involve the assumption of a shared partial structure. Yet, our reliance on a concept of shared context is not always successful, as what constitutes the context for the speaker may not always match that of their hearer:

(9.26) A (having come off the phone): I’m worried about him.
    B: Who?
    A: Jim. That was his supervisor.
At any such point, where the context turns out not to be shared by the hearer, the negotiation between speaker and hearer may become momentarily explicit. In the more usual case, however, there is presumed identity of context, and it is on their own individually established context upon which speaker and hearer individually rely.

Further co-ordination between speaker and hearer roles is displayed by what Pickering and Garrod label ‘alignment’ between speakers. If one interlocutor has used a certain structure, word or choice of interpretation, then the respondent is much more likely to use the same structure as in (9.27), rather than a switch of structure as in (9.28):

\[(9.27)\]  
A: Who has Mary given the book?  
B: She has given Tom the book.

\[(9.28)\]  
A: Who has Mary given the book?  
B: ??She has given the book to Tom.

\[(9.29)\]  
A: Who was at the bank yesterday?  
B: Sue was at the bank until lunchtime, and Harry stayed at the bank all afternoon.

So there is tight co-ordination between speaker and hearer activities at syntactic, semantic and lexical levels.

These informal observations about dialogue and the observed interplay between shifting speaker and hearer roles may seem obvious, even trivial, but, as Pickering and Garrod (2004) point out, dialogue presents a major hurdle for most theoretical frameworks. The separation of competence from performance, with the articulation of the former as logically prior, has meant that the data for linguistic modelling have been sentences taken in isolation. The presumption has been that study of performance, whether processing or production, can only be couched in terms of how the principles encoded in such a cognitively neutral body of knowledge is put to use in the various language-related tasks the cognitive system may engage in. This separation of the articulation of the system itself from considerations of these activities means that the formal properties of the system provide no clue as to what such parsing and production systems might look like, other than dictating that they must make reference at various points to the system: there is certainly no reason to anticipate that these various applications might have anything to do with each other. Reflecting this, models of parsing and production have been quite generally studied in psycholinguistics as quite separate research enterprises with very little to do with each other.\[12\]

9.3.2 Production: The Dynamic Syntax Account

It might seem that Dynamic Syntax is in an even worse position than other frameworks for modelling production, since production so obviously is not the same as parsing. To the contrary, production is in some sense surely the reverse activity? Where the goal of parsing is to progressively establish some logical form, surely

\[\text{\textsuperscript{12}}\text{Computational models of parsing and generation have explored the relationship between parsing and generation over a number of years (following Shieber (1988): see e.g. Neumann (1994)), but nonetheless, with a direction-neutral grammar formalism, the two systems are defined as different applications of the shared grammar-formalism. One such difference lies in the fact that, while strictly incremental parsing systems can be defined, generation systems remain head-driven despite increasing psycholinguistic evidence to the contrary (see Ferreira (1996), Branigan et al (2000), Pickering and Branigan (1999), Pickering and Garrod (2004), see Shieber et al (1990), Stone (1998), Shieber and Johnson (1993), Stone and Doran (1997), Webber et al (2003).}\]
what the task of the producer has to be is to start from some assumed representation of content and select some string of words from which a parser can recreate that same representation of content?

Certainly, what is needed is a mapping from a decorated tree (or more abstractly some logical representation)\textsuperscript{13} onto a linearised string from which the tree in question could be constructed by a parsing system. However, the surprise is that we can model this task using the very same rules, following possible parse routines, with the goal tree merely serving as the filter against which all possible actions by the generation system have to be matched, despite the fact that neither selection of words nor their order are uniquely correlated with a given content. All that is required in addition to the parse routine is that the choice of words to be selected by the generation device must meet the requirement that they progress the building of the goal tree. Reflecting these informal statements, we assume that in generation, the very same computational actions initiate the development of some tree, but this time, each update step has to meet the restriction of not merely being an enrichment as in parsing, but of being a precise form of enrichment – a sequence of progressive enrichments towards yielding a particular tree, the selected goal tree representing the interpretation to be conveyed.\textsuperscript{14}

Though this is in principle straightforward, given that the parsing steps themselves are defined to be progressive enrichments, the search through the lexicon for appropriate words becomes a major task. Seen overall, production involves a sequence of triples: a partial string, a partial tree, and a complete tree. The first step comprises an empty string, the Axiom step (or some other partial tree), and the goal tree; the last step comprises some complete string, and two occurrences of the goal tree.\textsuperscript{15} All steps in between these two involve updating the previous partial tree, commensurate with the goal tree filter. For any update that passes the filter, the selected word can be uttered, or, in writing systems, added to the output partial string. Even in a simple case such as uttering *John snores*, given a binary branching semantic structure, there is in principle two successive searches of the lexicon to find words that provide the appropriate update to the opening partial tree. And this is only the beginning, as for any one tree, there may be several linearisation strategies. Even in such a simple case as this, there are two, since the noun *John* could have been taken to decorate an unfixed node which then merges with the subject node once that is subsequently constructed. So, with two such parsing strategies, there would equally be at least two production strategies, against each of which appropriate searches of the lexicon have to be set up, even for this simple goal tree. This poses a substantial computational problem, particularly for a theory committed to the account being incremental.

### 9.3.3 The context-sensitivity of production

The clue to solving the problem, we suggest, lies, as before, in modelling what goes on in real-time as closely as possible.\textsuperscript{16} Since production, on this account, is

\textsuperscript{13}Following Otsuka and Purver (2003), Purver and Otsuka (2003), we call this representation of content the goal tree. A goal tree is a tree with all requirements on nodes satisfied, and with Ty and Fo decorations at each node.

\textsuperscript{14}The suggestion for this design of a generation system relative to DS assumptions was suggested to Kempson, Otsuka and Purver by Matthew Stone (personal communication), and subsequently developed by Otsuka and Purver.

\textsuperscript{15}In principle, a production task might start from any partial tree, but, to give the general architecture initially we start from the simplest case, a string which constitutes a complete sentence.

\textsuperscript{16}One suggested solution to this problem in Otsuka and Purver (2003), Purver and Otsuka (2003) involves restricting solutions to words representing terms that decorate terminal nodes in three, selected from the lexicon as a first pass. This account has the disadvantage of not being
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a proper subpart of a theory of performance, we expect this to be restricted by whatever general cognitive constraints apply to processing in real time: we would thus expect that production choices are sensitive to whatever is provided by the immediate context; and this is what we propose (as reflected in the current DS implementation (Purver and Kempson 2004 a,b,c)).

To stick with our simple cases, recall how parsing a sequence such as (9.30) takes place:

(9.30) John ignored Mary. He upset her.

Having established a tree representation decorated with the formula: $Fo(Ignore'(Mary')(John'))$, the task of parsing He upset her involves manipulating the process of Substitution to establish the value of the subject argument as $Fo(John')$ and the object argument as $Fo(Mary')$, given that particular minimal context. Recall that the constraint of minimising processing cost which is central to the constraint of relevance posited by Sperber and Wilson (1995) was in response to Fodor’s counsel of despair that no theory of the central cognitive system is possible, because of the complexity of the selection task, with unrestricted multitude of connections a reasoning agent can bring to bear in determining interpretation. But the producer of that same sentence also has as the immediate context the tree with topnode decorated with $Fo(Ignore'(Mary')(John'))$. The production of He upset her thus, analogously, allows choice of the word he, on the basis that in the immediate context is an appropriate occurrence of $Fo(John')$ a copy of which, substituting the metavariable lexically associated with the actions of the pronoun, will indeed meet the subsumption requirement with the goal tree. The only difference between parsing and production is the subsumption requirement specific to production.\footnote{In principle, the production of a pronoun, given its lexical specification as providing a metavariable as Fo value will trivially satisfy the subsumption constraint, apparently without any reflex of the parsing step whereby it might be interpreted. If this were the correct analysis, pronouns would not be good evidence of the context-dependency of natural-language production: to the contrary, pronouns would constitute a trivial production step, always licensed no matter what is being talked about. However the presence of the requirement $\exists x. Fo(x)$ in the lexical specification of the pronoun forces the provision of a value in the building up of a logical form in all well-formed strings containing a pronoun, hence also forcing the contextual provision of a value in production on the assumption that production steps incrementally match the corresponding parse steps.}

Notice the immediate advantage of pronouns in language for the production task. The search in the lexicon is reduced to finding the pronoun. There does not have to be a search for a particular unique word, matching the term decorating the node in the tree. The pronoun will do just as well, as long as the context contains the term in question. Indeed, the pronoun itself, by definition, provides an update which relies on context for its determination. So, as long as pronouns are presumed themselves to be easily available as lexical expressions, their selection bypasses the general lexicon search, replacing it with search in the immediate context, a very much smaller and more tractable task.\footnote{This account of pronoun generation has as a consequence that the utterance of a pronoun in the context of a preceding sentence containing two possible antecedents will be ambiguous, a problem which extends also to ellipsis. We take this to be correct. The process of SUBSTITUTION which provides interpretations of pronouns is taken to select a value out of some arbitrary minimal context, and where two antecedents are provided in any such context, two logical forms are derived and the resulting ambiguity has to be resolved by evaluation of inferential potential (minimally passing a consistency check).} And, given that in both parsing and production, the same tree is being constructed by both speaker and hearer, the selection of appropriate minimal context will in general be taken from the sequence of trees both speaker and hearer know each other to have constructed, i.e. as discourse-anaphoric. No calculation of mutual manifestness, or hypothesis about
the hearer’s mental lexicon is needed to ensure this: it is a simple consequence of the fact that production follows the same process as parsing. Both involve the construction of tree representations of content; and presumed values of minimal context are thereby shared. Cases of pronouns which are unsuccessful in enabling their hearer to establish the appropriate term are when a speaker chooses a pronoun on the basis of his own minimal context, but this structure is not available to the hearer (as in (9.26)). So, as in the case of parsing, though in principle there is nondeterminism and a wide range of possibilities, in practice this is narrowed down to a single choice; or, where not, the threat of breakdown in communication is immediately opened up.

The context-dependent characterisation of the production of pronouns applies immediately to the generation of ellipsis - indeed even more strikingly, in that no lexical form needs to be retrieved at all. All that is required is the license for ellipsis which the parsing strategy must define: but with that provided the contextually available actions can be re-used without more ado. Ellipsis, that is, constitutes a total by-pass of the general lexicon in favour of re-using actions accessible from the immediate context (Purver and Kempson 2004c). We immediately expect liberal use of actions giving rise to the range of sloppy interpretations of ellipsis, invariably judged to be natural.

Such presumed use of actions extends straightforwardly to the alignment patterns displayed in dialogue. Each form of alignment involves a re-use of actions from context. No higher-level hypotheses about the hearer’s mental state are needed to justify such a move. Given that a parse step licenses recovery of actions from context, the producer can manipulate a sequence of actions from her own immediate context, subject only to the subsumption constraint definitive of the production task. Take for example the widespread occurrence of repetitions in dialogue, so-called lexical alignment. If in engaging in the task of searching for an appropriate word, the first search is through those actions that have so far been accessed, one will have a strategy which avoids full lexical search altogether. Repetitions are not essential for the hearer, though assuming a dialogue lexicon helps reduce the hearer’s lexicon search space. But for the producer, cutting down on lexical search is essential to the realisability of the task. Lexical repetition makes an important contribution to this, as long as we assume that lexical specifications, once used, themselves become part of the context. There is simply no need to access the dictionary if one’s context provides an appropriate set of lexical actions.

Syntactic alignment goes hand in hand with lexical and semantic alignment. A putative example of syntactic alignment is provided by a word such as give, since this is said to have discrete syntactic properties for a single semantic content: the subcategorisation either for a double object construction or for the indirect object construction. This turns out to be straightforwardly reflected in a DS analysis in virtue of the procedural nature of lexical content. All that is exceptional about a word such as give is that it has two closely related sequences of actions, which are reflected in two discrete lexical specifications, as partially shown in (9.31).  

19This specification ignores the requirement for the preposition to in the indirect object construction, pending a theory of such expressions.
9.3. DIALOGUE AS A WINDOW ON PRODUCTION

\[ (9.31) \]

\begin{align*}
\text{IF} & \quad ?Ty(e \rightarrow t) \\
\text{THEN} & \quad \text{(Double Object)} \\
& \quad \text{make}((\langle \; \rangle_0)); \text{go}((\langle \; \rangle_0)); \text{put}(?Ty(e)); \\
& \quad \text{go}((\langle \; \rangle_0)); \text{make}((\langle \; \rangle_1)); \\
& \quad \text{put}(?Ty(e \rightarrow (e \rightarrow t))); \text{make}((\langle \; \rangle_1)); \text{go}((\langle \; \rangle_1)); \\
& \quad \text{put}(Ty(e \rightarrow (e \rightarrow t))), \text{Fo}(\text{Give}), \text{[|]} \perp; \\
& \quad \text{go}((\langle \; \rangle_1)); \text{make}((\langle \; \rangle_0)); \text{go}((\langle \; \rangle_0)); \text{put}(?Ty(e)) \\
\text{OR} & \quad \text{(Indirect Object)} \\
& \quad \text{make}((\langle \; \rangle_1)); \text{go}((\langle \; \rangle_1)); \text{put}(?Ty(e \rightarrow (e \rightarrow t))); \\
& \quad \text{make}((\langle \; \rangle_1)); \text{go}((\langle \; \rangle_1)); \\
& \quad \text{put}(Ty(e \rightarrow (e \rightarrow t))), \text{Fo}(\text{Give}), \text{[|]} \perp; \\
& \quad \text{go}((\langle \; \rangle_1)); \text{make}((\langle \; \rangle_0)); \text{go}((\langle \; \rangle_0)); \text{put}(?Ty(e)) \\
\text{ELSE} & \quad \text{Abort} \\
\end{align*}

This is all we need to account for such so-called syntactic alignment, given that it is the macro of update actions for a word which, once retrieved for parsing (or production), gets added to the context. For once either of these specifications gets selected, it is that pairing of word and update-specification that will get entered into the context, to be retrieved by the second occurrence of the word. As with instances of repetition, it is the stack of lexical actions that gets searched first to see whether there are items that can project the required subsumption relation to the goal tree; and in all cases, as long as one sub-case of the lexical specification is selected, it is that pairing of word and update-specification that will get entered into the context, to be retrieved by the second occurrence of the word. As with instances of repetition, it is the stack of lexical actions that gets searched first to see whether there are items that can project the required subsumption relation to the goal tree; and in all cases, as long as one sub-case of the lexical specification is selected, it is the pairing of word and update-specification that will get entered into the context, to be retrieved by the second occurrence of the word.

Such a recall of actions might, indeed, be made use of for a whole sequence of words, giving rise to what Pickering and Garrod call ‘routinization’, so that an extended sequence of actions may still be stored and retrieved as a unit. The perspective in which the speaker has no choice but to manipulate the same actions as the hearer yields the alignment facts directly. The additional significance of this result is that the multi-level alignment of apparently discrete levels of syntax, semantics and lexicon, which are indeed taken by Pickering and Garrod as evidence that these constitute independent levels, is here transformed into a single phenomenon. The very success of the account thus confirms the contrary assumption that syntactic, semantic, and lexical forms of specification do not constitute discrete forms of representation.

Finally, and perhaps most significantly, given the problem it poses for other frameworks, we expect that utterances can be shared. Both in parsing and producing an utterance, a single tree is constructed. If before completion, the hearer can leap to the conclusion of what is being said, she can complete the partial tree she has up till then constructed as a parser, and so shift into being a producer where the task is to complete that tree against an already completed goal tree. Equally, the speaker can shift into being a parser, as she, too, has a partial construction of that tree. On this view, this is merely a shift from providing the input for updating some partial structure, to analysing some provided input with which to update that very same partial structure. There is no major shift from one performance mechanism to some entirely distinct mechanism. Unlike in other frameworks, the...
phenomenon of shared utterances is expected to be strikingly natural. Apart from the abduction step of anticipation made by the interrupting interlocutor, nothing new needs to be added.\textsuperscript{21}

Overall, therefore, dialogue patterns buttress the DS account of production as an incremental task following the pattern of parsing.\textsuperscript{22} It is notable that this account (despite similarities with e.g. Clark (1996) in taking language use to be a collaborative activity) does not require the definition of either parsing or production in terms of having to construct higher-level hypotheses about the other interlocutor’s belief system. The production steps simply follow a parse routine because this is the form of the grammar. The use of context by the speaker to identify the usability of a pronoun, and the widespread use of repetition occurs for the same reason as in parsing: it is because the task of production by the speaker is context-dependent, dependent, that is, on the speaker’s own context. There is no necessary Gricean construction of what the other believes about what the speaker might believe, etc.

9.3.4 Parsing as basic

We can now see why parsing is basic, with production defined in terms of parsing, rather than the reverse. Here we diverge from Phillips (1996, 2003), despite a great deal in common in our joint commitment with him to arguing for the intrinsic dynamics of language processing within the grammar formalism itself. Phillips sets out a grammar formalism which reflects left-right incrementality within the Minimalist framework, by assuming copy-and-delete mechanisms of movement, generating strings through a top-down mechanism from the head of the chain to its foot. This is taken to reflect an incremental production system, and involves an assignment of constituency at each stage of the derivation, with revisions wherever this is incompatible with subsequent input. There is, in particular, no concept of structural underspecification and its enrichment. To the contrary, there is fixed structural assignment at each step, and subsequent revision.

Implicitly, the evidence against such a production-oriented perspective has been set out with each individual analysis we have presented. As we have seen, syntactic explanations have been transformed by the central assumption of a parser that information projected early on in the projection of structure from the initial edge of a string projects some partial representation to be subsequently updated in interaction with whatever other general cognitive constraints may be operative. An immediate disadvantage of the alternative production-based account of language, with parsing seen as the dependent activity, is the loss of this embedding relation within a general cognitive capacity for information processing. We would be defining a process that takes as input some rich notion of content, suitably represented, and for which some choice of output has to be selected whose content may be systematically weaker than the input specification, in contra-distinction to those other cognitive systems displaying underspecification of initially retrieved information and subsequent enrichment. Immediately, the entire concept of context dependence returns as an unsolved mystery: why should there be natural-language expressions whose content is systematically bleached as an intermediate step in the mapping onto the string itself? The puzzle of the apparent imperfection of natural languages also returns. We are back to the problem of why some term associated

\textsuperscript{21}Kempson and Purver (2004b) provide a formal characterisation of these informal reflections and report on an implementation of them.

\textsuperscript{22}This DS account of production, implemented as reported in Purver and Kempson (2004 a,b,c) is notably confirmed by current research on production, both in outline and in detail: see the ongoing work of V.Ferreira and colleagues, and also Pickering and Branigan (1999), Branigan et al (2000).
with a given position in a hierarchical semantic structure should ever occur at some initial (or final) edge, from which its interpretation is not optimally projected. We would then have to return to some equivalent of the movement account, with a heterogeneous listing of different types of anaphoric expression, different types of relative clause, and different left and right periphery effects. We would, in fact, be back at our point of departure, with no reason to expect interaction of anaphoric and structural processes. On the DS view, as we have seen, these various phenomena emerge as by-products of the adopted stance.

This relative success of the parsing-oriented perspective reflects a deeper difference between the two approaches. On the Phillips view, there is no concept of compositionality definable for natural language strings. With no concept of structural underspecification to hand, constituency on his view is not a property retainable at the output level of logical form (LF). Assignments of constituency are established immediately upon their left-to-right projection on the basis of the partial string under analysis; but these are then revised, with no necessary trace of that constituent at the output LF. On the DS view, to the contrary, there is a well-defined concept of compositionality, albeit distinct from the traditional one (see section 9.1). It is the cumulative contribution to the building up of a logical form over a left-to-right sequence to a result in which no requirements as introduced during the derivation of the remain outstanding. And so, as promised at the outset, we take the arguments presented here to demonstrate to the contrary that parsing is the basic mechanism.

9.4 Context and Well-formedness

We have now seen how the concept of context is crucial to both parsing (9.2) and production (9.3). In this section, we take up the challenge that this poses in defining the well-formedness of expressions in a language (Purver and Kempson 2004 (a,b,c)). The first, most important, task is to reflect on the challenge of defining concepts of well-formedness for a system that is non-encapsulated. The second task is to evaluate such results by the basis they provide for explaining phenomena where speakers systematically make judgements of well-formedness which fly in the face of what they actually do.

The only objects that we can properly describe in terms of grammaticality in the generative sense are the representation trees that are the output of the parsing process, the expressions of the epsilon calculus as our language of thought ($\text{LOT}$). These constitute a language which is fully describable given the set of construction rules, conditions on declarative units, and some lexicon acting as a filter on output. A formal definition of this language can be stated without reference to context or anything external to the cognitive system. This is as we would expect, as all underspecification is resolved during the construction process, and a tree all of whose nodes are decorated with such $\text{LOT}$ formulae has no requirements outstanding. To define well-formedness of strings of words in some natural language, we must consider the process by which such $\text{LOT}$ trees are constructed as a string is parsed and the role of context in that process.

It is important first to note that the grammar formalism itself provides a basis for determining what are licensed SUB-strings of the language, quite independent of any utterance context. All licensed strings are updates from one partial tree to another, using computational, lexical and pragmatic actions following the sequence of words. So the strings in (9.32) are all well-formed bits of English, albeit incomplete in the sense that any analysis of them will fail to yield complete propositional trees.
(9.32)  

a. is a man  
b. Wendy is thinking of  
c. reviewing a chapter on those  
d. is to be too

These strings all provide mappings from some appropriately defined partial tree to an output partial tree; and the sequence of words provides the appropriate lexical update actions that make such a tree update process possible. So, relative to some partial tree as context, they can contribute as a sub-part of a well-formed sequence of words.

This characterisation of a well-formed sub-string already distinguishes these from impossible strings.

(9.33)  

a. *Man the died.  
b. *Died man.  
c. *is the often man.

In (9.33a), the computational actions of the system do not provide the appropriate trigger for parsing man, and the lexical actions induced by the parsing of man do not provide as output the appropriate node specification for parsing of the. So there is no partial tree with a pointer at an appropriate node to provide appropriate input for the parsing of died. A similar basis underpins the lack of well-formedness of (9.33b,c). No general discourse-based concept of context is needed to distinguish such strings such as those in (9.33) from those in (9.32): all that is required is the mapping from one partial tree to another.

9.4.1 Utterance Well-formedness

However, we need a concept of well-formedness for sentences in some language, even though the concept of ‘sentence’ itself is epiphenomenal and plays no role at all in the specification of the grammar formalism: there is no output that says ‘this is a sentence’. What we need is some concept of ‘complete string’ and to define what constitutes such a thing, so that we can get some sort of handle on what people are doing when they produce judgements of grammaticality and acceptability. It is important at this juncture to remind ourselves that we are not really here dealing with strings but utterances. So that what we looking for is a concept of ‘complete utterance’ rather than complete string. Utterances being concrete things (spoken or written tokens) necessarily appear in a context, a context that is updated continually as the utterance progresses (since the act of uttering some string necessarily changes the context). From the hearer’s perspective, therefore, the time-linear parse of an utterance incrementally updates the context within which the utterance is interpreted. The output tree of the parse of an uttered string must then be part of the context with respect to which the well-formedness of that utterance is evaluated. This is essential to preserve the dynamic spirit of the parsing underpinnings which the system provides, and the unitary concept of anaphora.

We may take the concept of ‘complete utterance’ in some language $L$ to be one for which it is possible to construct a propositional tree of type $t$ from an uttered string of words using the lexical, computational and pragmatic actions licensed in $L$. Propositional trees have a special status in the larger general cognitive system as, with inference as a core activity of that containing system, it is well-formed formulae which must be constructed in order to feed appropriate inference actions, necessary for the retrieving of information. The required output we have so far
9.4. CONTEXT AND WELL-FORMEDNESS

defined is a tree with a rootnode decorated with a propositional formula of type \( t \), without requirements on any node (see also Kempson et al (2001)). An uttered string is, then, well-formed if there is a mapping defined over the sequence of words such that a complete tree representing a propositional formula of type \( t \) is derivable using computational, lexical and pragmatic actions, with no requirements outstanding on any node.\(^{23}\) We might represent this notion of well-formedness in terms of the development from the Axiom to a well-formed complete propositional tree using lexical and computational actions on a time linear parse of some string:

(9.34) A string \( \phi \) is well-formed iff:

\[
\{ \text{Ty}(t) \} \xrightarrow{\phi_{\mathcal{L}, \mathcal{K}}} \mathcal{T}_{\phi}
\]

where \( \phi_{\mathcal{L}, \mathcal{K}} \) is the transition from Axiom to some tree using lexical \((\mathcal{L})\) and computational \((\mathcal{K})\) actions used in parsing \( \phi \) and \( \mathcal{T}_{\phi} \) is a complete tree in \( \text{LOT} \).

This strict interpretation of the relationship between requirements and well-formedness is a reasonable point of departure, but it is under-informative, in that it fails to express any concept of context-dependence, which as we have seen above and throughout this book is crucial to the successful parsing and production. So we may take the definition of well-formedness given in (9.34), and extend it to include reference to some context \( C \), where \( C \) is defined as in (9.22) on page 329, and repeated below.

(9.22) \( C = \text{def} < T_1, ..., T_n, A_n >, < T_{\phi}, A_{\phi} > > \)

where \( 0 \leq i \); every \( T_j, i \leq j \leq n \), is a complete tree without requirements; \( T_{\phi} \) is a partial tree constructed as part of the parse of \( \phi \); and \( A_{\alpha} \) is the set of lexical, computational and pragmatic actions used in constructing \( T_{\alpha} \).

Making explicit the fact that the utterance itself is a function from context to context, we now define a concept of well-formedness which makes reference to both the input and the output of such a composite update process: a string constitutes a well-formed utterance if it licenses a transition from one (tree-complete) context to another.

(9.35) A string \( \phi \) of language \( L \) uttered with respect to a context \( C \) is a well-formed complete utterance just in case:

\[
C \cup \mathcal{T}_{\text{Ty}(t)} \xrightarrow{\phi_{\mathcal{L}, \mathcal{C}, \mathcal{P}}} C' \cup \mathcal{T}_{\phi}
\]

where \( C, C' \) are contexts; \( \phi_{\mathcal{L}, \mathcal{C}, \mathcal{P}} \) is the transition from \( C \) to \( C' \cup \mathcal{T}_{\phi} \) licensed by a parse of \( \phi \) using computational, lexical and pragmatic actions of \( L \); and \( \mathcal{T}_{\phi} \) is complete.

In other words, a string is well-formed just in case the parsing of it using rules of the system gives rise to a (tree-complete) update as the output context. Notice, however, that in the definition the context may itself be enriched independently of the parse of the current string. This is the import of having the context \( C' \) in the output rather than just \( C \). This is to allow inferential update of the context, adding new trees (or possibly subtracting them) to enable a parse to proceed. Thus, an analysis of (9.36) arguably requires the context to be updated with a tree that represents the content of A pair of newlyweds consist of a man and a woman.

\(^{23}\)To reflect this latter condition, we have sought to retain a strict reflection of compositionality in the application of Elimination. This rule is subject to the constraint that no mother node can have \( \text{Formula} \) decorations attributed at that node unless all requirements on the daughter nodes are complete (see the discussion of the Right Roof Constraint, chapter 5, section 5.4).
The well-formedness of each of these strings can be established as follows. We begin with a null context (an impossibility but a simplifying assumption) and derive the context \( \{ T_{(9.37a)} \} \) consisting solely of the tree derived from parsing the string in (9.37a). This forms the input context to the parsing of (9.37b):

\[
\emptyset \rightarrow \{ T_{(9.37a)} \} \rightarrow Axion \rightarrow \{ T_{(9.37a)}, T_{Ty(t)} \} \rightarrow he \rightarrow \{ T_{(9.37a)}, T_{he} \}
\]

Substitution operates to replace the metavariable projected by the pronoun from this new context to give: \( \{ T_{(9.37a)}, T_{John} \} \). Parsing the rest of string derives the context \( \{ T_{(9.37a)}, T_{(9.37b)} \} \) in which both trees are complete and so (9.37b) can be considered well-formed relative to having parsed (9.37a).

For a text like (9.39(a,b)) in which the anaphor identifies its substituend internally, the reasoning goes analogously.

We begin with the null context again and progressively induce some context \( \{ T_{(9.39a)} \} \) through the parse of the string in (9.39a). We then progress through the parse of the second string incrementally building up the context: \( \{ T_{(9.39a)}, T_{Janet \ thinks \ he} \} \). At this point the only suitable substituend is derived internally to the current tree being developed to give \( \{ T_{(9.39a)}, T_{Janet \ thinks \ Janet} \} \). The rest of the string is parsed to give a context \( \{ T_1, T_{(9.39b)} \} \) in which both trees are complete. (9.39b) is thus well-formed as a string. Notice that for this characterisation of well-formedness to hold, the string must be complete, and a fully specified interpretation assigned; hence at the juncture of its evaluation, the tree \( T \) which constitutes its interpretation is itself part of the derived context.

On this characterisation we are not saying that she is pregnant is a well-formed utterance relative to the context provided by the parsing of the incomplete sentence Jane thinks that, even though the parsing of this substring provides the context structure whereby the metavariable provided by she is identified, for she is pregnant is a substring of Jane thinks that she is pregnant. Well-formedness of complete strings is a property of utterances relative to a particular kind of context, one where the trees are complete. This restriction to complete trees correctly yields the result that right-node raising conjuncts cannot be uttered in isolation from some string that provides the requisite structure.

Neither A’s nor B’s utterances are well-formed as complete utterances, even though they are well-formed as substrings. In A’s utterance, the result is not a complete tree. In B’s utterance, the context upon which its interpretation depends is not a complete tree. (9.40) is only interpretable as a collaborative utterance, as we would expect (see section 9.3 for discussion of such shared utterances). Similarly in the phenomenon of mixed utterances:

\[24T_X \] is a diagrammatic shorthand for a partial pointed tree, where \( X \) indicates how far the parse has proceeded through the string from which \( T \) is being constructed.
(9.41) A: I'm worrying about..
  B: your chapter on the..
  A: Split-Identity puzzle.

Though each sub-string of this exchange involves a well-formed sequence of actions licensing an update from partial tree to partial tree, none of these utterances as an individual action is itself a complete well-formed utterance, since they all involve incomplete trees; and, as in this case, they may not add up to a single uttered string, even though a single proposition is constructed as a result. This result is important as, without it, we risk failing to provide a sufficiently rich concept of well-formedness, since collaborative construction of utterances may not, as here, respect constituent boundaries at the change-over of the speaker and addressee roles.

9.4.2 Grammaticality, Acceptability and Felicity

Once having made this shift to a concept of well-formedness explicitly in terms of context update, we get different concepts of well-formedness. In the first place, we have utterances that are not well-formed in any context. A sentence is ungrammatical with respect to all contexts if there is no context relative to which a string is derivable. This includes sentences whose substrings are not licensed sequences of actions, as in (9.33) above. But it also includes sentences which contain sub-strings that constitute licensed sequences of actions, but with no overall resulting output logical form:

(9.42) a. *Which man did you interview the man from London?
  b. *The man from London emerged that he is sick.
  c. *The man John saw whom is outside.
  d. *Who did you see the man who came in with?

In each of these, some requirement on either computational or lexical action fails to be satisfied; the appropriate update cannot take place; and the result is a failure to derive an output tree with all requirements satisfied. So no logical form is derived to yield a context update from any one context to another.

The concept of ungrammaticality is thus treated as categorical. However, the definition of grammaticality is not so straightforward. There is a concept of full grammaticality for sentences that are well-formed in all contexts (or none). These pick out a heterogeneous set:

(9.43) a. No man is mortal.
  b. A woman likes mustard though it makes her hot.
  c. If John is a teacher, he will have a degree.
  d. As for John, he is sick.

These are either sentences in which no specific context is required, or they are sentences in which the context required for the latter part of the string is provided by the first part. We may say that say that such strings are fully grammatical since they require no context to support their interpretation. However, it does not follow that in being well-formed with respect to all contexts that such strings are displaying no element of context-dependence. To the contrary, every uttered string displays some element of context-dependence: minimally that of the context of the act of utterance. Even conditional sentences, whose antecedent if-marked clause presents a recursively complex specification of some context relative to which the consequent
is to be evaluated, have to be evaluated relative to the index of the world/time of utterance, albeit while constructing some alternative index of evaluation.\footnote{See Gregoromichelaki in preparation, to whom this observation is due.}

Thus, our notion of grammaticality is in one sense somewhat restricted. However, it is also quite weak in that (9.35) defines a very general concept of well-formedness, one in which a string is well-formed as long as there is at least one context with respect to which it is uttered that can lead to a well-formed, complete propositional tree. We might express this more informally as:

A string is well-formed just in case there is some context where the parse of an utterance of that string gives rise to an updated context that contains only complete trees including the one derived from the parse of (an utterance of) the string itself.

This definition means that \textit{Janet thinks she is pregnant} is well-formed (since the transition $\emptyset \mapsto \{T_{\text{Janet thinks she is pregnant}}\}$ is licensed through the parse of the string), while \textit{He was in tears} is well-formed because $\{T_{\text{John came in}}\} \mapsto \{T_{\text{he was in tears}}\}$ is licensed.

Such strings may be referred to in terms of acceptability, since their felicity will change from context to context. Thus, we can express the distinction between (9.45) and (9.44):

\begin{enumerate}
\item[(9.44)] John upset Mary. He ignored her.
\item[(9.45)] A book fell. *He ignored her.
\end{enumerate}

The utterance of the string \textit{He ignored her} with respect to a context obtained from having parsed \textit{John upset Mary} is well-formed. In contrast, the utterance of the second string in (9.45) is not well-formed with respect to the context provided by having just parsed \textit{A book fell}, with no further expansion of the given context. The step of expanding the minimal context which would be necessary to determine the acceptability of \textit{He ignored her} in the context of an utterance of \textit{A book fell} is often taken as trivial, but on the characterisation of well-formedness for context-string pairs provided here, this sideways move would have the effect of substituting the pair under characterisation with a different pair of objects. It is no coincidence that this concept of well-formedness with respect to a fixed context is exactly that of felicitous utterance, as put forward by Heim (1982) (and the very similar concept of proper DRS of Kamp and Reyle).\footnote{Heim notes, with regret, that her concept of felicitous use can only be defined over whole sequences of utterances, given her rule of existential closure over a discourse as a whole. We are grateful to Eleni Gregoromichelaki for reminding us of this discussion and the concept of proper DRS.} Indeed, given the claimed conflation of syntactic structure and level of semantic representation that we are putting forward, the concepts of well-formedness and felicitous use are bound to come together.

Given the characterisation of well-formedness in terms of context update, gapping, pseudo-gapping cases and other elliptical utterances emerge as well-formed complete utterances, because contexts, as we have defined them, contain the lexical actions associated with the current and previously constructed trees. This means that all the right peripheral strings are well-formed, given the context presented.

\begin{enumerate}
\item[(9.46)] a. John ignored Mary. And Bill Sue.
\item b. John ignored Mary. And Bill did Sue.
\item c. Who saw Mary? Bill.
\end{enumerate}
Is this a problem? We do not think so, given that what we are characterising are well-formed *utterances* and not well-formed *strings*. Such utterances may not be canonical and have a very restricted distribution, but once the concept of context is taken seriously such a conclusion is unavoidable. Furthermore, since such strings are only acceptable in very restricted contexts, it is possible in principle to capture this by specifying that any tree that results from using the actions used in constructing some other tree involves a non-canonical string. Nothing, however, follows from this. Our definition of well-formedness allows an utterance to be well-formed whether or not the number of contexts within which it is well-formed is very small. It may be possible to provide a notion of degree of acceptability according to the nature of the contexts with respect to which some string is uttered. However, it is not clear that such a move is either possible or, indeed, necessary.

Through all this exploration of different concepts of well-formedness, one property has remained constant. The concept of well-formedness does not express appropriacy of uttering one sentence after another: there is no attempt to express what is an appropriate answer to a question, or what is a cohesive sequence of dialogue. We are concerned solely to articulate what is intrinsic to ability in a language, independent of any such constraints. It is in this respect that the framework is *not* providing a model of pragmatics. Accordingly, the concept of well-formedness is expressed solely in terms of being able to derive a complete propositional formula, with no requirements outstanding. Despite its context-dependence, it does not incorporate any implementation of pragmatic constraints, nor any reflection of such constraints.

Thus the decision to define a concept of what it means for a utterance to be well-formed relative to some fixed context has led to a richer overall account of well-formedness for natural languages.

### 9.4.3 On Judgements of Well-formedness

With this set of relatively abstract concepts of well-formedness, one might well wonder what the relationship is between the defined concepts and speakers’ judgements of well-formedness, given that the grammar formalism is said to turn on such judgements. And in this connection, particularly interesting cases are sentences which informants uniformly judge as *not* well-formed despite their widespread use and total lack of recognition by either speaker or hearer that the sentence used is in any way exceptionable. Resumptive pronouns in English, which we came across in chapter 4, are one such case:

(9.47) There was this owl, which it was trapped in the goal-netting.

How is it that, if these strings are indeed successfully produced and parsed in context, that informants could ever judge them not to be well-formed? Indeed, given this, such data might be taken as evidence that our characterisation of well-formedness with respect to context is not the appropriate basis on which to characterise the notion?.

We think, to the contrary, that such data show just how sensitive informants are to the context-relativity of interpretation; for what these data display are cases where the context relative to which a speaker may make a choice of words, and the context relative to which a hearer may construct an interpretation can come apart. These structures are characteristically used when a speaker may well have in mind an individual on the basis of which she uses a pronoun, which the hearer, not being party to any such mind-internal representation, cannot construct. Nevertheless, the
hearer can certainly derive a well-formed sequence of tree-updates to yield an interpretation; and she might do so by using the pronoun to construct a metavariable at the appropriate argument node, which then through a step of Merge will yield a LINKed structure, thereby providing an addition to the restrictor of the term to be constructed. In (9.47), this might be represented as the term:

\[(\epsilon, x, \text{Owl}'(x) \land \text{Trapped-in-Netting}'(x))\]

What differs in the two types of derivation that the speaker and hearer might construct is the context that they severally bring to the communication task: the speaker has much richer information about the individual in question than the hearer. In the event, neither speaker nor hearer cares, because each, by analysis, is making decisions relative to their own context; and in both cases a successful result is derived. In being asked to make judgements in isolation, on the other hand, informants are generally asked to do so without any context provided. In evaluating such a sentence, they can nevertheless see that as speaker they might have one context, which as hearer they would not. Now, as competent speakers of the language, they “know” that the overwhelmingly general pattern in successful dialogue is for speaker and hearer to share a common context in virtue of parsing or producing by the same mechanisms.\(^{27}\) Accordingly, informants assume that the sentence will give rise to problems in any utterance situation, and hence not be fully well-formed. And so it is that when the speaker’s and hearer’s contexts for the actions that they take are judged to come apart, judgements of well-formedness become less secure. Notice how our characterisations of parsing and production in terms of constructing partial representations relative to the individual’s own context are providing a basis both for expressing both the successful use of such strings, and yet nevertheless the judgement by informants that these strings are not acceptable. Furthermore, given that what we require our concepts of well-formedness to reflect is successful use of language, we take the characterisation of such strings as well-formed to be correct.

### 9.5 Grammar and Parsing

There is one final question to which in setting out a parsing-driven architecture, we need an answer; and that is the relation between the grammar formalism as so presented and its application in a model of parsing as part of an account of performance itself. Given that we have been committed to the view that there is no articulation within the grammar formalism of how individual choices are made between alternative strategies, we are faced with the consequence that a model of the grammar formalism is a proper subpart of a model of the parsing mechanism. Minimally, we need some reconstruction of a filter, say reflecting relevance-theory assumptions.\(^{28}\)

While this remains an avenue for future research of which we can do no more than give a hint, we can get a sense of what the problem and its resolution should be. In the opening stages of any parse, and from then on, the choices available to the hearer multiply. (The problem arises for the producer too of course; but

\(^{27}\)This knowledge is of course not conscious knowledge.

\(^{28}\)See Dekker and van Rooy (2000) for a remodelling of the Levinson Q and I implicatures (Levinson 2000) as strategies in a decision-resolution game-theoretic model which at all stages determines which out of the presented alternatives is to be selected within the space provided by the grammar architecture. As van Rooy (2004) notes, the formulation of these strategies correspond broadly with considerations of cognitive effect and cognitive effort, along relevance-theoretic lines.
at this juncture it is the threat of a gap between on-line parser and the grammar formalism which is of concern.) Even in parsing some first constituent, say that receptionist, from what we have set out in previous chapters, the parser has at least three alternatives, to parse the noun phrase as decorating a fixed subject node, as in That receptionist distrusts me, to parse it as some unfixed node to be updated to a fixed position later, as in That receptionist, I distrust, or to parse it as decorating the toponode of some structure, to be treated as linked to what is constructed as some remainder, as in That receptionist, I distrust her. Because there is no lexical basis for differentiating the choices to be made at this first step, it might look as though we have to posit the construction not just of one, but at least three structures in tandem, progressively decorating each one of them until such time later in the parse at which all but one of them will have been rejected as putative candidates by some filtering process yet to be formally modelled. Unless the window in which parallel structures are sustained is very small, it looks as though we will have a gap opening up between parsing on-line and the grammar formalism which threatens to undermine the central claim of the theory. But it turns out that contributory factors determine swiftly the selection to be made, for the implementation of pragmatic constraints is not applied to the output of what is provided by the grammar (as in other frameworks), but at each step in the construction process as provided by the system.

Consider the difference in uttering that receptionist as subject and as a displaced object. These are immediately distinguished by intonation: if an unfixed node is to be built, as in That receptionist, I distrust, there will be a marked intonational effect distributed across the entire expression indicating, at the very least, that the process by which the resulting tree is to be built is not a canonical one. Moreover, intonation is a para-linguistic feature, distributed right across a constituent and identifiable from the outset of the parse. By contrast an utterance of That receptionist distrusts me with neutral intonation will induce the canonical strategy (for English) of INTRODUCTION and PREDICTION. Consider also the difference between uttering that receptionist to be construed as subject, and uttering that receptionist to be construed as decorating a structure related to the remainder only through anaphora (That receptionist, I distrust her). Such Hanging Topic Left Dislocation Structures are invariably reported as requiring a distinctive intonation pattern. Whether the intonation itself is sufficient to distinguish the effect of building an unfixed node from that of building and decorating a linked structure is surely uncertain, but this is not necessary, given that all utterances are interpreted relative to context. The hallmark of unfixed nodes is that they are constructed in order to provide some update to what may be independently identifiable as in context, a distinctiveness from the remaining structure to be constructed which their assigned intonation buttresses. The characteristic use of sentence-initial LINKed structures, on the other hand, is to provide the context relative to which what follows is the update. The relation of these two to the context in which they are uttered is not the same. Hence the combination of intonation and their distinct relation to how they add to their context is sufficient to determine that, even at the first step in constructing a representation of content, the hearer has either one, or maximally two alternative strategies to construct. And with each next presented word, it can be expected that this choice of alternatives will get narrowed down to the limit.

29See Steedman (2000) for exploration of effects of intonation within CCG; and also Kiaer (in preparation), where this account of topic and focus is substantiated in detail. Kiaer (in preparation) argues that intonation plays a critical role in enabling a fully incremental account of Korean. See also Kurosawa (2003) for a discussion of the role of intonation in parsing certain constructions in Japanese.

30Of course it might be argued that what this disjunction of strategies shows is that we have
The claim we are making, then, is that the choice mechanism, however it is formalised, does not apply to the output of the grammar. Indeed, the output of the grammar is the output of the parser also. Rather, it applies to each individual action of tree growth licensed by the grammar. It has to be granted, however, that the challenge of modelling any such choice mechanism within Dynamic Syntax remains entirely to be done.\textsuperscript{31}

9.6 Coda: Acquisition, Change and Evolution

We have so far in this chapter provided initial answers to important questions, questions that arise immediately one abandons the jigsaw-puzzle view of language discussed in chapter 1 and replaces it with a view of syntax as the process of parsing strings of words in order to extract their content. We have thus provided an initial characterisation of context and shown how concepts of well-formedness can be defined with respect to such contexts. We have discussed the relation between parsing and production and the interaction between the two in dialogue. We have also briefly discussed the relation between parsing as a psycholinguistic process and parsing as the basis of a grammar formalism. Such matters are rarely touched on in books that are written primarily to present syntactic analyses of specific linguistic phenomena. However, the change in perspective that we advocate brings such questions to the fore and, indeed, provides the means to begin to address them. To finish this chapter, and indeed this book, we look briefly at three areas of concern to theoretical linguistics, language acquisition, language change and language evolution, and show how the view of syntax we present brings out new perspectives and gives rise to new sorts of questions. The discussion here is necessarily speculative, but nonetheless, we hope, sets out fruitful areas of further research.

Turning first to language acquisition, the long-standing issue of whether or not the linguistic system is encapsulated is here resolved in favour of non-encapsulation (Fodor 1981, Marslen-Wilson and Tyler 1980). On this view, the language system is not some independent self-contained device, the application of which in parsing, production or acquisition has to be independent of other more general cognitive considerations. To the contrary, interaction between structural and more general mechanisms of construal is essential to explaining intrinsic properties of the parsing device which constitutes natural language. Nevertheless, the system can be studied independently, as we hope this book has shown.

This lack of encapsulation and the primacy of parsing have consequences for how we view language acquisition. Given language processing as the primary task, we expect language processing to emerge first, followed shortly thereafter by speech. Moreover, we expect the process to be buttressed by dialogue alignment patterning.\textsuperscript{32} Indeed, as soon as the parsing device is sufficiently rich to establish a structural representation from a phonological sequence, then in principle we would expect that the task of production could also successfully take place, with the use of structural representations from the immediate context as an essential strategy until

the wrong analysis and that we should have provided a more integrated account with but a single input specification. One alternative would be to analyse verbs in all languages as projecting a propositional template, differing only in the decorations on their attendant argument nodes, thereby reducing the number of alternative strategies by one.

\textsuperscript{31}Prototype implementations of Dynamic Syntax have been defined by Kibble and Purver (Kibble et al. 1997, Otsuka and Purver 2003, Purver and Otsuka 2003, Purver and Kempson 2004 a,b,c); but, in all cases, these have focused on testing the framework as a grammar formalism, setting aside the disambiguation challenge.

\textsuperscript{32}See Tomasello (1999) for the role of imitation in joint attentional activities in language acquisition.
the child’s own lexicon stock is securely in place. So the phenomenon of apparent mimicry is not so much the child copying whoever is talking to them, as using the immediate context, given what they have just parsed. As we have already seen, there is no need to construct higher-order hypotheses about the mental state of either hearer or producer in successful dialogue, and this means that the child’s system does not need the facility for representing such complex structures to be in place before the child can be said to demonstrably have acquired language. These can emerge later in more sophisticated types of communication, inducing indirect pragmatic effects.

What is it that the child has to learn, on this view? Like every other formalism, the answer is, at least in part, a lexicon. Given the commitment to a grammar formalism that reflects general parsing capacity, one thing is certain. No procedure for developing semantic representations along a growth dimension can be available to one language but not to another. As a parsing architecture, such principles of growth are arguably hard-wired, and certainly available by definition. For the analyst, it is only a matter of knowing where to look in each individual language to find a strategy which is generally applicable in one language, and apparently not available in another. For the child, what is required is to learn the relative weighting of the devices the system makes available, the particular balance between computational and lexical actions as expressed in the language to which he/she is exposed. But, because of the ability to manipulate the immediate context, this stock of information does not need to be securely in place before any production activity whatever can get started, and we allow that the process of establishing this appropriate balance can be gradual.

When it comes to the possibility of parameter settings determining language acquisition in an individual language (see Chomsky 1986), these have no place in this framework. The property of tree growth, construed as the basis of both computational and lexical actions, delimits the range of cross-linguistic variation. Strategies for establishing interpretation may vary across languages only with respect to whether they are defined as a general computational action (relative to some range of constraints), or as a lexical action, triggered only by specific forms. No general strategy is excluded in a language. Put bluntly, there are no parameter switches that get established early on in language acquisition. In other respects, however, with its broadly lexicalist stance, the assumptions to be made about language acquisition by DS are not so very far from those of more orthodox frameworks.

When it comes to language change, the difference in perspective dictated by Dynamic Syntax is more radical, at least in comparison with approaches to language change articulated within current syntactic frameworks. It is perhaps not surprising that the problem of language change has not had more attention from syntacticians. Diachronic explanations, like performance phenomena, depend, according to the orthodoxy, on the viability of an independently provided synchronic account of a language system, which means turning to one’s favourite syntactic theory; but the well-known formal linguistic frameworks are not well set up to explain language change. The problem with language change is that it is obviously gradual, and equally obviously involves a complex interaction between system-internal and pragmatic, hence system-external, considerations. Neither of these properties is

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33 As is widely known, such higher-order hypotheses do not emerge until about the age of 6 (see Tomasello (1999) for discussion). However, what the dialogue patterns suggest is that, even in adult language use, such higher-order hypotheses are constructed only as required, and not invariably. This point is made in Pickering and Garrod (2004).

34 Most work on syntactic change has been done within the Principles and Parameters or, more recently, the Minimalist frameworks.
naturally expressible within orthodox formalisms. But with the shift into a system which articulates linguistic phenomena in terms of alternative strategies for construction of semantic structure within a non-encapsulated system, we have a real chance to explain language change in a way that is commensurate with psycholinguistic considerations.

On the one hand, from a system-internal stand-point, we can see the flexibility of alternative strategies which the framework makes available in any individual language as an advantage in language change: these allow alternative ways for either interlocutor to recover the same content without necessarily noticing any difference in the strategies they have severally employed. We posited just such a case to account for the Greek specificity effects with clitic doubling in chapter 4. Flexibility such as this provides a basis for gradual change in a system over time, without any damage to the effectiveness of an individual system.

However, it is the bringing of dialogue considerations into the type of data which the grammar can characterise that really opens up the spectrum of possibilities for providing a formal basis to processes of language change. We can now explore ways in which dialogue pressures on production choices can trigger syntactic change. To take the shift from Latin to the modern Romance languages as a case study, we suggested in passing in chapter 4 that the preposing of clitic pronouns might be analysed as a lexical calcification of what had been earlier a free process of LOCAL *ADJUNCTION. We can now substantiate this somewhat. It is a very well-known observation that in Latin, the strong forms *ille and *ipse regularly occurred early on in a sequence of noun phrases preceding the primarily final position of the verb; and this positioning is taken to be the point of departure for what came to be the clitic pronouns’ pre-verbal position. What was previously a puzzle was how this relatively left-peripheral positioning could be explained, other than by the general apparent desideratum that items which are in some sense ‘given’ in the discourse occur before items which have not, which are ‘new’. But we can now see that this is due to the alignment pressures on lexicalisation choices in production. Strong pronouns are prototypical examples of context-dependent items, and it is these, as argued above, which can be used by the speaker to minimise his production costs by using them to be construed as an item already presented in the dialogue context, saving himself the task of having to find the precise word. If the context against which the search for this item is made as small as possible, the speaker has the possibility of further minimising his production costs, by placing the anaphoric expression he has elected to use as close to that context as possible. For if he were to do anything else and place some expression indicating a term new to the discourse before the a context-dependent expression, the context relative to which this expression is licensed would no longer be minimal: it would contain not merely the structure containing the antecedent from which the anaphoric expression is to pick up its interpretation, but also the new term. So with this constraint of minimising production costs, directly consonant with relevance constraints, we expect that context-dependent items will be placed at the left periphery of any clausal sequence. The result is that there does not have to be a rule or convention determining the positioning of these strong pronouns, or indeed other anaphoric expressions: it is simply performance pressures of a regular sort. Such pressures apply to all speakers in every utterance.

\footnote{It is independently attested as an advantage in the production task (Ferreira 1996).}

\footnote{This is of course a well-established view of clines of grammaticalisation (Hopper and Traugott 1993), but it has to date lacked an overall grammar formalism which provides the background for sustaining it.}

\footnote{The phenomenon of ‘given’ where ordering is not otherwise determined is reported on a broad cross-linguistic basis. See Uszkoreit (1987) for the same observation in German, Kiss (1987) in Hungarian, etc.}
exchange. The worry as to how to provide the diachronically needed explanation of how such pressures might provide the trigger for such change generalising from one idiosyncratic utterance context across a community simply vanishes. We all “do” dialogue, all the time.

This is not just a pretty post-hoc story that happens to be plausible. We can see evidence for this from the form of the shift. If a shift has taken place from some dialogue-induced pressure into a system-internal encoding, then there should be evidence of this shift in the form of clear reconstructibility of the dialogue-based pressure. Indeed, one might expect the encoded distribution to be characterisable in a natural way only in terms of the claimed dialogue pressures either at, or shortly after, the point in time at which it is encoded in the language. In any case in which this is so, there should then be subsequent shifts across successive generations of language learners towards whatever constitutes optimum learnability.\(^{38}\) This is exactly the situation in the shift from Latin to medieval Spanish (and early Romance more generally), and from there to the modern Spanish variants. From the structural perspective, the distribution of medieval Spanish clitics is, bluntly, a mess. They can be found preceding and following a finite verb, subject to an extremely heterogeneous set of restrictions.\(^{39}\) They had to occur before the verb in the presence of a negative element, in the presence of a questioned element, in the presence of an emphatic element, in the presence of a relative pronoun or complementiser. They always occurred after the verb if the verb was initial,\(^{40}\) in an imperative, in non-finite constructions, in yes-no questions, but also in the presence of vocatives. In the presence of subjects, they could either occur before the verb or after, depending on whether the subject was construed emphatically; and in some clausal adjuncts there was also an element of optionality. This distribution is currently close to a total mystery.

However if we recall the dialogue pressures on the earlier Latin stage, we can see an immediate explanation. Like the strong pronouns of Latin before them, the clitics immediately follow any first indication that a discrete propositional structure is to be built. Proclisis occurs because an array of non-verbal elements provide this indication. Negation and a complementizer self-evidently indicate a discrete propositional domain. Syntactically focused items, wh-expressions, emphasised subject expressions, and relative pronouns all also provide such indication, given that they all involve decorating an unfixed node which by \(^{*}\text{ADJUNCTION}\) is only licensed if the dominating node, prior to the construction, dominates no other nodes.\(^{41}\) Even enclisis falls within the characterisation, since if the verb occurs first in a clausal sequence, it will certainly define a new emergent propositional structure. So nothing special needs to be said to distinguish enclisis and proclisis, to yield this functional explanation. Apparent exceptions such as vocatives and non-emphasised subjects are cases where, by analysis, a pair of independent structures is projected, the first constituting a LINKed tree, a separate domain from the propositional structure to which it is LINKed; but with such analyses, it is the verb which provides the needed

\(^{38}\)An optimal learning state for an encoded specification is presumably a single non-disjunctive specification constituting either a single computational action or a unified class of lexical items invoking the same action.

\(^{39}\)The phenomenon of clitic pronouns occurring before the verb are called proclisis. The phenomenon of clitics occurring after the verb is called enclisis. See Bouzouita (2001) for a setting out of the change in the distribution of object clitic pronouns from medieval to modern Spanish in Dynamic Syntax terms.

\(^{40}\)Though see Fischer (2002) for recorded occurrences of initial clitics in interrogatives in Old French and Old Italian and a devastating critique of current Minimalist phonological and syntactic accounts.

\(^{41}\)Relative clauses are taken to project an independent LINKed structure, so relative pronouns fall into this set as the first structure-building operation in that structure.
first identification within the structure to which the enclitic pronoun contributes its update actions.

Despite the functional motivation of placing ‘given’ items before items which are ‘new’, there is a benefit to the learner in such distribution becoming encoded, for, in so doing, it becomes deterministic, hence learnable by successive generations without any of the hit and miss property of general dialogue pressures. From a system-internal perspective, the resultant situation is nevertheless non-optimal. A complex disjunction has to be learned as a list by each succeeding generation. We would therefore expect that simplification would take place, and quite rapidly. This is exactly what has happened. The shift from Medieval to Renaissance Spanish and the shift from there to modern Spanish can both be analysed in DS terms as instances of progressive loss of lexically stipulated restrictions. The optimal state would be a fully determined single position, as an agreement device, syntactically adjacent to the verb, and phonologically defined as allowing nothing intermediate. The current Romance languages are not quite there, but, in having clitics in finite clauses invariably preverbal and invariably cliticising onto the verb, they are getting a lot closer.

This account effectively reconstructs the well-known grammaticalisation cline from anaphora to agreement, but with the new twist of being from a formal basis. Lack of reversibility, which is a current point of controversy in diachronic syntax (Campbell 2001, Hopper and Traugott 1993), is expected on this view: syntactic change is expected to be progressively towards some optimum state relative to a learnability criterion, on the assumption that such an optimum will act as an attractor for shift from an earlier more complex specification to a finally transparent one. There is a lot more to be said: indeed this gives little more than a hint of a new way one might formally model syntactic change, but it is notably directly in line with traditional informal views of language change.

Finally, and most broadly, this takes us to language evolution. With the transformation of syntax into the progressive construction of semantic representation following time-linear dynamics of parsing, with production essentially the same device, the evolution of language begins to have the air of inevitability. Of course this is a vast area to explore, and some questions remain the same: how the capacity to recognise and produce signals emerged, how and whether the construction of complex concepts is independent of language itself; and so on. Other questions, though, are new. In particular there is the role of alignment in the co-emergence of production and parsing skills. And a number of other questions melt away. In particular, there is no question to answer about how a capacity independent of parsing and production comes to be in place. There is no longer any need to explain how the separate and mismatching properties of syntactic and semantic mechanisms of such a capacity could have emerged, and whether the requisite sub-systems could have been acquired by a general reasoning device in the first place and then become innate. Even the issue of how some encapsulated vocabulary for syntax constitutive of the language faculty could be in place prior to any language emergence evaporates, and, too, the question, for the alternative inferentialist view, of how specialised vocabulary for syntax could have emerged from some general inferential mechanism. On the new view, the vocabulary in terms of which structural proper-

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42 As Bouzouita (2001) demonstrates, given the DS form of lexical specification, these forms of simplification involve successive loss of disjunctions internal to the lexical characterisation.

43 In order to substantiate a functional explanation over a random-drift form of explanation, there needs to be evidence of movement towards some justified optimum (see Sober 1991).

44 See Arbib forthcoming for the exploration of how mirror-neurone properties of the brain led, in humans, to the development of language.
ties of natural language are expressed is simply that required to express structural properties of the language of thought (LOT), with the added dimension of defining properties of growth of such structures, a dimension which is in any case general to the interpretation of all forms of input, not merely language. And this means of representing LOT formulae and their structure would be part of the representational device for any inferential mechanism, whether general or specialised. And, if the recursive complexity of thought is not contentious,\textsuperscript{45} then it follows that the emergence of a language capacity reflecting this property is much less of a surprise. On this view, all that has to evolve is the manipulation of sound-sequences, and what systematic clusters of such sequences represent.\textsuperscript{46} At this point we leave all these issues entirely open. All we can say – but with confidence – is that a new story of language evolution is begging to be told.

\textsuperscript{45}See Hauser et al. (2002) for arguments that it is the recursive complexity of natural language syntax which is the sole irreducible characteristic of the human capacity for language.

\textsuperscript{46}There are many points of contact between this view of language evolution and that proposed by Kirby and colleagues (Christiansen and Kirby 2003).
Chapter 10

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