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Redazione e Amministrazione: **Periodici Le Monnier**
Viale Manfredo Fanti, 51-53 - 50137 Firenze
periodici.monnier@lemonnier.it
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GRADIENCE IN SPLIT INTRANSITIVITY: THE END OF THE UNACCUSATIVE HYPOTHESIS?

Riassunto

La selezione dell'ausiliare avere/haben *ed* essere/sein *con i verbi intransitivi in italiano e in tedesco è stata analizzata in numerosi studi come un fenomeno che risponde a condizioni sintattiche, semantiche e lessicali. In particolare, è stata messa in relazione con l'ipotesi della divisione dei verbi intransitivi nelle due classi sintattiche degli inaccusativi e inergativi («Unaccusative Hypothesis», Perlmutter 1978; Burzio 1986). Diversi studi recenti hanno tuttavia dimostrato che la selezione dell'ausiliare, come anche altre manifestazioni sintattiche del'intransitività scissa, è sensibile in modo sistematico alle caratteristiche lessico-semantiche e aspettuali del verbo: i verbi intransitivi si collocano su un gradiente («Split Intransitivity Hierarchy», Sorace 2000, 2004) definito da due fattori – la telicità e l'agentività – la cui interazione influisce sul comportamento sintattico del verbo, rendendolo categorico o man mano piu variabile a seconda del grado di specificazione rispetto a questi fattori. Questo gradiente ha ricevuto riscontri non soltanto dal punto di vista tipologico, ma anche in termini psicologici e sperimentali sulla base di dati su sviluppo linguistico, comprensione e movimenti oculari, e attività elettrica cerebrale. Al tempo stesso, nuovi studi sperimentali confermano l'esistenza della distinzione sintattica tra inaccusativi e inergativi. Il quadro che emerge da questi dati suggerisce la necessità di una revisione dell'ipotesi inaccusativa: l'intuizione originale andrebbe collocata all'interno di un modello dell'interfaccia lessico-sintassi sufficientemente elaborato da spiegare sia la rigidità che la flessibilità dei fenomeni connessi all'intransitività scissa.*

1. Split intransitivity: from the Unaccusative Hypothesis to now

According to the Unaccusative Hypothesis (Perlmutter 1978, Burzio 1986), there are two types of intransitive verbs – unaccusative and unergative – with distinct syntactic properties. The essential in-

sight is that the subject of unaccusative verbs is syntactically comparable to the object of a transitive verb, while the subject of an unergative verb is a true subject. Evidence for the distinction is both syntactic and semantic. For example, in several European languages unaccusative verbs generally select BE as a perfective auxiliary while unergative verbs select HAVE, as shown in (1) and (2):

(1) a. Il treno è arrivato / *ha arrivato in ritardo — ITALIAN
The train is / has arrived late

b. Marie est venue / *a venue à la fête — FRENCH
Marie is / has come to the party

c. De brief is / *heeft vandaag gekomen — DUTCH
The letter is / has today arrived

d. Der Zug ist / *hat spät angekommen — GERMAN
The train is / has late arrived

(2) a. I bambini hanno giocato / *sono giocati tutto il pomeriggio
The children have played / are played whole the afternoon

b. Les policiers ont travaillé / *sont travaillés toute la nuit
The policemen have worked/ are worked whole the night

c. De trompettist heeft / *is met bolle wangen geblazen
The trumpettist has / is with all his might blown

d. Herbert hat / *ist den ganzen Tag gearbeitet
Herbert has / is the whole day worked

Semantically, the subject of unaccusative verbs tends to be a patient or a non-volitional causer while that of unergative verbs tends to be an agent (Dowty 1991; van Valin 1990). However, it has proved difficult to fit many verbs unambiguously into one class or the other. On the one hand, there are verbs that do not satisfy unaccusativity diagnostics in consistent ways, both within and across languages; on the other hand, there are verbs that can display either unaccusative or unergative syntax depending on the characteristics of the predicate (see Levin & Rappaport Hovav 1995; Alexiadou *et al.* 2004; McFadden 2007 for fuller discussions).

One of the main challenges posed by the Unaccusative Hypothesis is therefore to account for the variable behaviour of verbs. Theoretical linguistic research in the last 10 years – expressed in both 'projectionist' and 'constructional' approaches – has focused on the

complex mappings between a lexical-semantic level of representation and the level of syntactic structure (Levin & Rappaport Hovav 2005; Ramchand 2008). Projectionist approaches enrich the lexical entry of verbs with fine-grained semantic specifications, which project to the syntax via a complex system of linking rules. Constructional approaches, on the other hand, assume 'bare' lexical entries that are free to project onto enriched syntactic configurations, which in turn determine interpretation (Borer 1994, 2005). However, the projectionist view allows for too little variation, because of the deterministic nature of its linking rules, whereas the constructionist view allows too much variation, because it lacks a mechanism that rules out impossible mappings. These limitations have been highlighted in particular by work by Sorace and colleagues (see e.g. Sorace 2000, 2004), which has shown that there is systematic variation that cannot be explained by either approach. Instead, her proposal is that intransitive verbs are organized in a Split Intransitivity Hierarchy (henceforth: SIH), defined primarily by aspectual notions (telicity/atelicity), and secondarily by the degree of agentivity of the verb (Figure 1).

CHANGE OF LOCATION >	categorically unaccusative
CHANGE OF STATE >	
CONTINUATION OF STATE >	
EXISTENCE OF STATE >	
UNCONTROLLED PROCESS >	
CONTROLLED MOTIONAL PROCESS >	
CONTROLLED NON-MOTIONAL PROCESS	categorically unergative

Figure 1. The Split Intransitivity Hierarchy (SIH)

The array of verb classes represented on the SIH reduces to two key factors – telicity and agentivity – whose interaction affects the syntax of split intransitivity and creates gradient satisfaction of morphosyntactic diagnostics of split intransitivity: 'telic change' at the core of unaccusativity and 'agentive atelic non motional activity' at the core of unergativity. The closer to the core a verb is, the more determinate its syntactic status as either unaccusative or unergative. Sensitivity to contextual or compositional factors also correlates with the distance of a verb from the core: verbs that are stative and non-agentive are the

most indeterminate and therefore the most susceptible to syntactic alternations and variation across languages.

What kind of gradience is represented by the SIH? It is important to distinguish *gradience* from the more general meaning of *variation*. Variation refers to the existence of linguistic structures that may alternate freely or randomly (albeit within limits); in contrast, gradience refers to alternations that obey tighter constraints and result in *degrees* of variation (in the sense of graded likelihood to alternate) and graded perception of (un)acceptability. It is gradience – rather than simply variation – that has been the object of investigation in studies on the SIH. Gradience is a property of speakers' mentally represented grammar because individual speakers agree on intermediate degrees of unacceptability (see e.g. Fanselow *et al.* 2006 for recent theoretical treatments). In this respect, the gradience embodied by the SIH is also different from Creissels's (2008, this volume) concept of *fluid intransitivity*: this is defined as 'fluctuation' in the behaviour of intransitive verbs leading to 'vacillations' in their assignment to the unaccusative or unergative class which are inevitably 'exceptions' if a strictly syntactic split is maintained. In contrast, gradience on the SIH, as part of speakers' linguistic knowledge, is much more systematic and far from being exceptional. Importantly, it affects only certain verbs and coexists with the categorical behaviour of other verbs. Gradience in this sense is typically left unaccounted for by traditional linguistic models of the syntax-lexicon interface. For example, Optimality-theoretic accounts (e.g. Legendre's 2007 work on auxiliary selection) address the issue of variation, but not the phenomenon of gradience. Similarly, projectionist accounts such as Levin & Rappaport Hovav (1995) could not explain the fact that in English verbs of (sound) emission exhibit more variation than verbs of change, or that in Italian *durare* 'last' can take both auxiliary *essere* 'be' and *avere* 'have' but *partire* 'leave' can take only *essere*.

While effects of the SIH have been found on a variety of manifestations of split intransitivity (e.g. *ne*-cliticization in Italian, Sorace 1995; quantifier floating in Japanese, Sorace & Shomura 2000), the most detailed demonstrations of the SIH have focused on auxiliary selection.

The typological predictions made possible by the SIH can therefore be best illustrated by a comparison of auxiliary selection in different languages. The SIH predicts that, across languages, telicity is the primary factor, separating BE verbs from HAVE verbs and distinguishing subclasses of BE verbs; agentivity further differentiates among atelic verbs of process, identifying verb subclasses that require HAVE to different degrees (see Sorace 2000 for details). The SIH makes it possible to account for cross-linguistic variation in auxiliary selection systems. Not all languages are predicted to make the same differentiations among verb classes, but core verbs are predicted to select the auxiliary BE or HAVE across all languages, while intermediate verbs are predicted to exhibit cross-linguistic variation: an intermediate verb class could select BE in one language and HAVE in another, and exhibit auxiliary alternations within the same language. These predictions have been borne out in several auxiliary-selecting languages (Cennamo & Sorace 2007; Legendre & Sorace 2003; Legendre 2007; Sorace 2000; Sorace, to appear).

How do these concepts apply to an analysis of two auxiliary-selecting languages like Italian and German? The literature on German split intransitivity and auxiliary selection has focused on the syntactic bases of the distinction (Grewendorf 1989 and on its semantic bases (Seibert 1993; Kaufmann 1995). Among the researchers working on argument structure and the syntax-semantics interface, van Hout, Randall & Weissenborn 1993, emphasize the centrality of the concept of *change* for unaccusativity in German (equivalent terms are Brinkmann's 1992 'transition', and 'locomotion' used by Randall, van Hout, Weissenborn & Baayen 2004 and Randall 2010), as opposed to the more restricted notion of telic change which has been found to determine unaccusativity in other languages, such as Italian and Dutch. This parametric difference is necessary, in these authors' view, to account for the fact that Dutch and German select different auxiliaries for verbs denoting displacement without a specific endpoint, as shown in (3):

(3) (a) Paul und Rita sind stundenlang durch den Saal getanzt
Paul and Rita are for-hours though the room danced
'Paul and Rita have been dancing around in the room for hours'

(b) Paul en Rita hebben urenlang door de zaal gedanst
Paul and Rita have for-hours though the room danced
'Paul and Rita have been dancing around in the room for hours'

Keller & Sorace (2003) set out to assess the validity of the SIH for German by testing (a) auxiliary choice and impersonal passivization, (b) the extent of the correlation between auxiliary selection and impersonal passivization in German, i.e., whether the two tests broadly identify the same syntactic classes of verbs and whether they display variation with respect to the same semantic verb classes, and (c) the correlation between dialectal variation in auxiliary choice and the position of verbs in the SIH. Based on Magnitude Estimation acceptability judgment data (Bard, Robertson & Sorace 1996), Keller and Sorace were able to confirm that auxiliary selection in German, as in other languages, is sensitive to telicity and agentivity. Native speakers' intuitions are most determinate for core verb types (e.g. *ankommen* 'arrive', *abreisen* 'depart' which are strongly preferred with *sein*; *reden* 'talk', *arbeiten* 'work' which are strongly preferred with *haben*). Nevertheless, native German intuitions do not differentiate between verbs of change of location and verb of change of state with a telicity-inducing prefix (e.g. *verrosten* 'rust', *verwelken* 'wilt'), but exhibit indeterminacy in auxiliary selection with unprefixed indefinite change verbs, which are not inherently specified for telicity (see Sorace 2000 for examples in other languages). The class of motional process verbs (e.g. *schwimmen* 'swim', *rennen* 'run') elicit a strong preference for *sein* in German, unlike many other languages in which these verbs select HAVE when they are not accompanied by prepositional phrase indicating the endpoint of the process. Taken together, these results indicate that telicity is a crucial determinant of *sein*-selection, but not the only one: the factor 'locomotion' or 'spatial transition' also underpins the choice of *sein*. The factor 'transition' by itself (i.e. not specifically spatial) is not sufficient to guarantee the selection of *sein*, as indicated by the indeterminate behavior of verbs of indefinite change.

Intermediate verbs on the SIH are more variable, as predicted, but do not exhibit precisely the same pattern in German as in oth-

er languages. Auxiliary selection is most indeterminate with stative verbs denoting position (e.g. *baumeln* 'dangle', *liegen* 'lie') Verbs of uncontrolled non-motional process (e.g. *schaudern* 'shudder', *zittern* 'shiver') and uncontrolled emission (e.g. *rumpeln* 'rumble', *klappern* 'rattle') show a weaker preference for *haben* than verbs of controlled, non-motional process – also in line with the SIH. Verbs of continuation of state (e.g. *überleben* 'survive', *verharren* 'persist'), however, show a definite preference for *haben* and no sensitivity to other factors, such as subject agentivity. As Keller and Sorace suggest, it is possible that these verbs are conceptualized as processes rather than continuations of a pre-existing state: the underspecified event structure of these verbs makes them potentially compatible with different conceptualizations.

2. Beyond the Unaccusative Hypothesis: some open questions

There is now evidence for gradience in split intransitivity in more than a dozen typologically diverse languages, including Basque, French, Catalan, Chinese, Croatian, Dutch, German, Italian, Japanese, Paduan, Sardinian, Spanish, Turkish and, in addition, some sign languages (Sorace, to appear). The SIH has also received support in the literature on diachronic change. Variable verbs in terms of the SIH are diachronically unstable and prone to change, as is well attested in the pan-Romance BE → HAVE shift: change starts from non-core verbs and affects core verbs last (Tuttle 1986 on Italian; Benzing 1931, Aranovich 2003 on Spanish; Legendre & Knipe 2003 on French; Sankoff & Thibault 1977 on Canadian French; Rohlfs 1969 on Italian; Cennamo 2008 on Old Neapolitan).

The SIH is, by itself, a generalization and not a theory. This generalization appears to substantiate the intuition that, within their respective classes, some verbs are 'more unaccusative' and 'more unergative' than others (Legendre, Miyata & Smolensky 1991). But the unaccusative/unergative split is a binary *syntactic* distinction, and therefore is not compatible with the idea that unaccusativity and unergativity

are inherently gradient notions. Does this mean that the Unaccusative Hypothesis should be abandoned after 33 years of service? The key issue, recently re-proposed by Perlmutter (2010) himself, is whether the relevant phenomena can be accounted for in semantic terms without invoking a syntactic representation of unaccusativity (as in e.g. Bentley and Eythórsson 2003; Bentley 2006).

The thesis defended here is that the fundamental intuition underlying the Unaccusative Hypothesis can be maintained (although not the details of the original syntactic analysis – see Alexiadou *et al.* 2004), but needs to be re-conceptualized within a model of the lexicon-syntax interface that explains how a multi-dimensional lexical-semantic level maps onto a binary syntactic level. Depending on the interplay of the lexical semantics of the verb and the aspectual composition of the predicate, some verbs allow only one type of syntactic projection whereas other verbs are compatible with different projections to variable degrees. This is the reason why any 'syntactocentric' or 'semanticocentric' approaches that focus exclusively either on the syntactic or on the semantic side of split intransitivity at the exclusion of the other are ultimately bound to provide only a partial picture of this phenomenon. One important limitation of these approaches is the fact that they are either based on purely theoretical argumentations, or on corpora and/or offline data. On the one hand, linguistic theories cannot determine exactly when syntactic, lexical, and aspectual factors are computed and how they become integrated in the comprehension and production of intransitive verbs appearing in the typical constructions that have served as diagnostics of unaccusativity/unergativity. On the other hand, acceptability judgment data, which have been the main source of evidence for the SIH, do not capture the relative weight of syntactic and semantic factors, and their interplay, in real-time processing of auxiliaries with intransitive verbs. For example, Keller & Sorace's study (2003) raises some intriguing questions about the role of telicity and agentivity in processing German auxiliary selection that are difficult to address on the basis of their off-line judgmental data. In particular, the difference between telicity inherently encoded in the verb's argument structure (as in *ankommen*)

and telicity morphologically induced by the presence of a prefix (as in *verwelken*) is one of compositionality: is one type of telicity more complex than the other? Is compositional telicity computed at a later stage than inherent telicity?

3. Learning, losing and processing split intransitivity

In order to appreciate why both syntactocentric and semanticocentric approaches are inadequate, it is crucial to consider some of the more recent experimental evidence supporting the SIH, distinguishing between studies supporting the gradience in verb behaviour and studies supporting the binary distinction between unaccusative and unergative verbs. It is the existence of evidence for both sides – briefly summarized in the next section – that represents a strong argument in favour of modelling their interface.

3.1 Evidence for the syntactic distinction

Some of the most telling evidence for the 'psychological reality' of the unaccusative/unergative distinction comes from studies of second language acquisition and first language attrition. Developmental studies generally show a split between the syntactic distinction underlying split intransitivity, which is acquired early and remains stable, and the interface conditions determining gradience, which display more variation and instability. Sorace (1993a, b), for example, demonstrated that the linguistic intuitions of non-native Italian speakers initially are most determinate for core verbs and then gradually approximate the SIH, without reaching the determinacy shown by native Italian speakers even at the highest proficiency level. Adult second language learners of languages that do not have overt and consistent morphosyntactic markers of split intransitivity go through a transitional stage in which they introduce these markers in the language (Zobl 1989; Balcom 1997; Hirakawa 2001; Oshita 2001). For example, learners of English from various language backgrounds overextend the passive constructions with core unaccusative verbs:

(4) a. My mother was died when I was a baby
b. People are fallen in love
c. What is happened?

Overpassivization with unaccusative verbs is a strong indication that learners expect to find overt markers of unaccusativity/unergativity in the second language. When these are not found, learners apply markers typically available in other languages (such as auxiliary selection) even if they are not instantiated in either their native language or the target language.

Montrul's (2005) study of native language attrition in second-generation Spanish speakers in the US ('heritage speakers') shows that these speakers maintain robust knowledge of the syntactic reflexes of unaccusativity in Spanish, since they correctly discriminated syntactically between unaccusative and unergative verbs in contexts requiring postverbal subjects, the absolutive construction, and postverbal bare plural subjects. However, these speakers do lose sensitivity to the gradient distinctions along the SIH. Attrition therefore appears to affect the lexicon-syntax interface mappings but not the unaccusative/unergative syntactic distinction itself.

A number of psycholinguistic studies of native language processing offer evidence of the syntactic distinction underlying the Unaccusative Hypothesis. Friedmann *et al.* 2008 used a cross-modal lexical priming technique, which tests whether or not the subject NP is reactivated after unergatives and unaccusatives verbs during the online processing of a sentence. The experiments revealed that only subjects of unaccusatives reactivate after the verb, but subjects of unergatives do not. The fact that sentences with unaccusative and unergative verbs are processed differently directly supports the Unaccusative Hypothesis and the underlying analysis based on the different structural status of the single argument of unaccusative and unergative verbs. Interestingly, some verbs that enter transitive-unaccusative alternations do not show a consistent pattern of trace reactivation, a fact that as the authors themselves suggest might be related to their intermediate position on the SIH.

The psychological reality of abstract semantic features, such as telicity and agentivity, is addressed in a study of a Semantic Dementia

patient by Romagno *et al.* (2010). This patient showed a dissociation between impaired access to the referential semantic features of verbs (*dying*, for example, refers to stopping living or existing), and the lexical-semantic features, such as telicity, affecting the syntactic behaviour of verbs, including auxiliary selection. Impairment selectively affected referential semantic features but not abstract lexical semantic features. A body of neurolinguistic studies of aphasia (e.g. Thomson 2003, among others) also supports the reality of the Unaccusative Hypothesis in processing terms.

Finally, neurological evidence for the Unaccusative Hypothesis comes from a study by Shetreet, Friedmann & Hadar (2009). These authors show that the brain distinguishes between unaccusative and unergative verbs, even when they appear in identical structures. Furthermore, different patterns of brain activation were found for syntactic and lexical operations: the inferior frontal gyrus appears to be involved with the execution of the syntactic operation of moving the argument from an object to a subject position, whereas the middle temporal gyrus may be responsible for other lexical operations that are associated with unaccusative verbs in particular languages.

In sum, a range of studies offers processing and neurological arguments in support of the syntactic split originally assumed by the Unaccusative Hypothesis. This evidence complements the linguistic arguments for maintaining a syntactic characterization of split intransitivity as a way of accounting for generalizations that unify transitive and intransitive clauses (Levin & Rappaport Hovav 1995; Perlmutter 2010).

3.2 Evidence for gradience

Is there real-time processing evidence for the gradient variation of the SIH? Recent studies have begun to provide a perspective on gradience that is complementary to that resulting from earlier acceptability judgment studies.

In eye-tracking experiments with native Italian speakers, Bard, Frenck-Mestre & Sorace (2010) explored the processing correlates of the SIH by using real-time measures of eye movements in sentence reading.

Effects of the SIH were found on second pass reading times, although not on first pass reading times: participants took longer to read sentences with core unaccusative or unergative verbs (as in 5a, b) than those with non-core verbs (as in 6a, b) when presented with the wrong auxiliary:

(5) a. Dopo l'assedio l'allarme ha/è rientrato in tutte le zone della città
b. Dopo l'assedio*l'allarme*ha/è durato*in tutte *le zone della città*
(6) a. A quella vista il codardo ha/è urlato per lo spavento
b. A quella vista il codardo ha/è trasalito per lo spavento

The effect was replicated in an eye-tracking experiment by Sorace, Ferreira, Bard, Vernice & Badino (2008), who found longer reading times in first pass as well as second pass reading measures. In both studies, another signature of the SIH was a 'spill-over' effect for non-core verbs, (especially for non-core unergatives) in the words immediately following the past participle, which is interpretable as non-commitment of the processor on auxiliaries with underspecified verbs until the rest of the sentence is encountered.

The eye-tracking data overall suggest that auxiliary selection violations with verbs fully specified for telicity cause more processing disruption than violations with underspecified verbs. Moreover, auxiliary violations with underspecified verbs cause more extended processing disruption than those to core verbs because non-core verbs depend on compositional factors beyond the auxiliary-verb combination. Although the data, at first sight, do not seem to support a model of auxiliary selection as an operation involving two independent and sequential stages (i.e. the syntactic computation of unaccusativity/unergativity followed by the integration of aspectual and semantic information from the context), the results are open to multiple interpretations, including one that assumes the parallel (late) processing of the syntax and the semantics of split intransitivity (see Bard *et al.* 2010 for discussion).

Event-related brain potentials (ERPs) provide a different and potentially more direct measure of cognitive processing. Because of the high sensitivity and multidimensionality of this measure in combination with the method's high temporal resolution, ERPs are very well

suited to an examination of the rapid and complex integration of information in language processing. With respect to language comprehension, research within the ERP paradigm has revealed a number of distinct ERP components that have been functionally classified as arising from semantic or syntactic processes. First, the N400, a centro-parietal negativity with a peak latency of approximately 400 ms post-stimulus onset, was firstly described by Kutas & Hillyard 1980 in response to the processing of a semantically anomalous word and has since been regarded as a correlate of lexical-semantic processing. In addition, the amplitude of the N400 is modulated by a variety of lexical-semantic parameters such as word frequency or semantic relatedness (see Kutas & Federmeier 2000, for an overview). Second, the P600, a late positivity with a peak latency of approximately 600 ms after stimulus onset has been regarded as a correlate of syntactic processing (as for example in response to the processing of a syntactically incongruous word; Osterhout & Holcomb 1992; Hagoort *et al.* 1993). Although recent research has shown that a strict one-to-one mapping between ERP components and functions cannot be maintained (see Bornkessel-Schlesewsky & Schlesewsky 2008, for a discussion), ERPs not only allow to distinguish precisely the time course of processing but still provide an insight into qualitative differentiations of processing different information types. In an ERP study of auxiliary selection in German, Roehm & Sorace 2008 and Roehm, Bornkessel-Schlesewsky & Sorace (submitted) found that violations to auxiliary selection with core verbs engendered a biphasic N400-P600 pattern. This pattern was engendered by core unergative verbs (verbs of controlled non-motional process such as *reden* 'talk) and core unaccusative verbs (verbs of change of location such as *ankommen* 'arrive'), i.e. verbs with an inherent positive or negative lexical specification of the key semantic feature of *telicity*, and for lexically indeterminate verbs with a telicity-inducing prefix (prefixed change of state verbs, such as *verrosten* 'rust'). The onset latency of the N400 was delayed for sentences with prefixed verbs in comparison to sentences with inherently telic verbs, which suggests that auxiliary selection is computationally more demanding when it is compositional rather than lexically specified. However, sentences with unprefixed change of state verbs (e.g. *rosten*) did not show

any differences between BE and HAVE in grand average ERPs. Acceptability judgment data were also collected, and additional analyses of data for individual participants revealed that some indeterminate verbs were associated with a P600 component, the amplitude of which was proportional to the acceptability scores given to the sentence by the participants. One interpretation of these correlations is that participants apply aspectual coercion in order to render an indeterminate verb compatible with a particular auxiliary choice.

Finally, McKoon & Macfarland (2002) in a series of experiments support the hypothesis that syntactically relevant information about verbs is encoded in the lexicon in semantic event templates. The experiments show a significant difference in lexical decision times between verbs with more complex event templates (such as externally caused change of state verbs of the *break* type) and verbs with less complex event templates (such as internally caused change of state verbs of the *bloom* type). Intriguingly, verbs with more complex templates were found to take longer to process in these experiment – a result that does not completely match the psycholinguistic evidence mentioned above of longer reading times for verbs that are less specified for telicity or agentivity. Nevertheless, this study provides clear evidence of differential processing of intransitive verbs depending on their degree of aspectual and semantic specification.

4. Linguistic models of split intransitivity: the way forward

The challenge for linguistic models of split intransitivity is to make sense of the vast array of types of evidence that has emerged from studies carried out in different research areas and from different theoretical orientations. The most promising models proposed so far are enriched variants of the constructional approach that – unlike the 'bare entries' constructional models – attribute a restricted set of aspectual features to lexical entries of verbs, thus constraining their association with syntactic representations, and allow the compositional construction of event structure in the syntax.

Elements of this approach can be found in earlier proposals. Rappaport Hovav & Levin (1998), for example, propose Template Augmentation as a lexical operation that builds ('augments') event structure templates up to other possible templates from less complex to more complex, within a basic inventory of event structure templates (see also McClure 1995). More recently, Ramchand's 'first-phase syntax' (Ramchand 2008; Mateu 2005, 2009; see also Folli & Harley 2006) assumes a set of features ('combinatorial primitives') with different levels of specification that define a verb and the building of the event structure(s) in which that verb can participate. These models are more flexible than projectionist approaches: instead of exhaustively stating syntactically relevant semantic features at the level of lexical entries, they allow degrees of featural un(der)specification to determine degrees of freedom in the syntactic projection of verbs and thus the extent of their interfacing with compositional semantics and with encyclopaedic knowledge. One of the current limitations of these models, however, is there inability to distinguish between variability in verb behaviour that can be explained structurally or configurationally (e.g. by the licensing of an additional argument, as in the causative alternation *the wind broke the window/the window broke*) and variability that depends on the integration of semantic or world knowledge (such as auxiliary alternations with verbs like *durare* 'last', or *atterrare* 'land', which prefer BE or HAVE depending on subject agentivity). As a consequence, these models are also not well suited to explain gradient effects in acceptability judgments and in psycholinguistic measures, such as the ones found by Sorace 2000, 2004 or by McKoon & Macfarland 2000.

Clearly, more theoretical and experimental research is needed to account for the multiple mappings between the multidimensional lexical-semantic level and the syntactic level of split intransitivity. A useful observation is that this particular lexicon-syntax interface does not seem to be different in principle from other interfaces between syntax and extra-syntactic cognitive systems that have been recently studied. The developmental patterns that have been discovered for the lexicon-syntax interface appears to share properties with

those observed at other interfaces, such as the syntax-pragmatics interface (Sorace 2006; Sorace & Keller 2005 for discussion). For example, the robustness of the unaccusative-unergative distinction in acquisition, attrition and impairment compared to the vulnerability of lexical-semantic gradience on the SIH resembles a parallel split between syntactic properties of null subject languages, which are developmentally stable, and the pragmatic-contextual conditions on the distribution of pronominal forms, which display developmental optionality (Sorace 2011).

Once developmental data are taken into account, a theory of learning also becomes necessary in order to account for the acquisition of interface principles in addition to syntactic and lexical knowledge. Following Yang 2002, ideally what is needed is a theory-neutral variational model that incorporates both language-specific and domain general mechanisms of learning. More generally, what is needed is commitment to a model of *competent gradience* as the target of learning (Duffield 2003), recognizing that grammatical competence includes knowledge of both grammatical invariance and interface conditions on grammatical realization.

5. Conclusions

Linguistic and psycholinguistic experimental research on split intransitivity over the last fifteen years has considerably expanded our understanding of phenomena related to split intransitivity. It has allowed generalizations about variable verb behaviour that were not possible when the original Unaccusative Hypothesis was proposed. These developments have raised the question of whether the syntactic characterization at the basis of the Unaccusative Hypothesis should be rejected in favour of purely semantic accounts of split intransitivity. All in all, it seems that at the moment this move would not be appropriate in the light of the existing evidence. A more promising avenue is to continue to explore the interface between the syntactic and lexical-semantic levels of split intransitivity, both theoretically and experimentally, and to

aim at an explanatory model of how gradient variance and categorical invariance can co-exist in languages and in the human mind.

Antonella Sorace
antonell@ling.ed.ac.uk

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