

Structuralist Historical Phonology: Systems in Segmental Change

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Abstract

This chapter continues Murray's survey (this volume) of early work on historical phonology, through structuralism in both narrow and broad senses. We argue that the inheritance from twentieth century structuralists still shapes our contemporary landscape in many ways, whether we are building on structuralist insights, sharpening them, or challenging them.

Keywords

structuralism, split, merger, chain shift, history of historical phonology, lexical diffusion, phonetic analogy, sound law

1. Introduction

Although 'structuralism' is sometimes treated as a finished phase in the historical development of linguistics, the central ideas of structuralist phonology still underlie fundamental thinking in historical phonology to an extent not always recognized; they also shape ideas in the allied areas of formal phonology and language variation and change. In this spirit, we differentiate here between 'classical structuralism' (or 'structuralism in a narrow sense'), by which we mean a group of theoretical frameworks developed in Europe and America, broadly in the first half of the twentieth century, and 'structuralism in a broad sense', which continues in phonology today. Some ideas developed during classical structuralism have been taken into 'basic phonological theory'—concepts sometimes considered theory-neutral, which all phonologically-informed work needs to consider. Kiparsky (2014:81) makes a similar point, calling attention to the 'unexamined structuralist baggage' of historical linguistics, including bottom-up procedures and a focus on mislearning as a, or *the*, source of change.

This chapter focuses on this fundamental and still contemporary substance in structuralist phonology. Section 2 considers these ideas in their historical perspective, taking up where Murray's chapter (this volume) leaves off and finishing at the contemporary period (where this volume's following chapters take off). In some sense, we provide something of an introduction to those other chapters here (and we thank their authors for suggestions, particularly Drescher, Kessler, and Scheer), offering a context for them and a perspective on both how basic structuralist thinking still is to much theorizing about phonological change, and how other work in historical phonology offers some major challenges and reactions to it.

Before continuing, it is worthwhile to clarify the landscape. 'Structuralism' has a bewildering array of associations with particular ideas, approaches and theories in linguistics and other fields, not all of which will be relevant, or discussed, here (see Dosse 1991, Jackson 1991 and Drescher 1999). Jakobson (1929: 11) was perhaps the first to use the term 'structuralism' in linguistics (Percival 2011), writing: 'Any set of phenomena examined by contemporary science is treated not as a mechanical agglomeration but as a structural whole, and the basic task is to reveal the inner,

whether static or developmental, laws of this system'. Jakobson's focus is clearly on the notion of the *system*, which is subject to linguistic 'laws' (what we might call 'principles'). The claim is also that synchronic and diachronic ('static' and 'developmental') analysis can be brought together as a way of understanding the whole.

More recently, Trask's dictionary entry (2000:326) offers a starting point for the application of such thought to diachrony:

structural explanation of change Any proposal to account for language change in terms of the requirements of a linguistic system. Such approaches are most often proposed in connection with phonology; for example, it may be maintained that phoneme systems tend toward symmetry, so that holes in the pattern are filled while phonemes which 'spoil' the symmetry tend to be lost. A standard example is the English fricatives: Old English had only /f θ s ʃ x/, but the acquisition of /v/ and /z/ in loans from French supposedly induced the introduction of /ð/ to partner /θ/, even though the functional load of the contrast is minimal, and /x/ supposedly disappeared because it had no voiced partner.

This highlights central structuralist issues: the role of the *system* itself, *symmetry* within the system (here around a phonological feature), and the fact that the systems involved are systems of *contrasts*. The example illustrates two key mechanisms of change which can create symmetry, split and loss. At the same time, it expressly allows that structural patterns sometimes must be tied to social considerations (although the two are often kept separate), here language contact. Most importantly, as Trask suggests with the repeated use of 'supposedly', careful sifting of the data can show a more nuanced picture: the contrastive voiced fricatives of English, such as /v/, developed from a range of sources, including some with English-internal endogenous origins (see, for example, Minkova 2011), and Trask's illustration highlights some of the nuance of contrast—that it can develop in highly restricted environments first, and then spread to others.

This chapter considers justifications and challenges for the notions just raised, in both historical and contemporary terms, centered on issues of systems, contrast and symmetry. Section 2 links a consideration of the development of structuralist thought on sound change to some of the recent reception of this thinking, Section 3 then reviews the details of some basic diachronic systemic patterns that have been the core of most structuralist thinking, with an eye toward setting up what they mean for theories of sound change, and Section 4 concludes.

2. A History of Structuralist Historical Phonology

Pace Lass's qualifications (this volume) and Minkova's discussion (this volume), alphabetic writing can be seen as a kind of recognition of the role of contrast in segmental inventories, such that the development of alphabets or similar writing systems were acts of structural phonological analysis in some preliminary sense. This is a far cry from articulated phonology, however, which fully developed as an autonomous discipline only in the twentieth century (Fischer-Jørgensen 1975, Anderson 1985). Before the twentieth century there was mostly a unified 'phonetics-phonology' which at certain times and places was well developed, and certainly involved the consideration of phonological ideas, but largely offered unconnected precursors for structuralist thought.

Some late nineteenth century work by the Neogrammarians would now be viewed as sophisticated phonetic description, but other aspects of their work was clearly phonological, considering syllable structure, sonority and some aspects of contrast, for instance. As Murray (this volume) shows, there was also a nascent recognition during that century of the role that phonological systems can play in the organization of language (and in the patterning of change). Fully-fledged 'autonomous' phonology (autonomous, that is, from phonetics) grew out of the context of this nineteenth-century historical work (for which see Murray, this volume, and especially Morpurgo Davies 1997). The end of this century also saw the earliest signs (in the modern era) of work which focused on synchronic phonological structure, such as Kruszewski (1881) and Baudouin de Courtenay (1895), or which at least recognized the role of contrast in transcription, such as Sweet (1877).

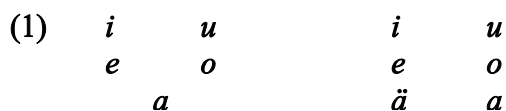
Saussure (1916) emphasized the possibility of a linguistic focus on the synchronic organization of language, as well as a diachronic approach. Both he and the two writers typically seen as true founders of autonomous phonology—Trubetzkoy and Jakobson, who in part saw themselves as followers of Saussure—had been trained in Neogrammarian ideas. Such early structuralist thinkers were immersed in historical data, but were seeking synchronic linguistic principles. It is thus no surprise that the ideas developed in this period have become central in general historical phonology.

Trubetzkoy (e.g., 1939), Jakobson (e.g., 1931, 1941), and others connected with the Prague Linguistic Circle in the 1920s and 1930s thus maintained and developed ideas on contrast and systematicity which had been implicit or gradually developing in earlier work. While there were continuities, there were also breaks with the past: Anderson (1985: 173) writes that the 'real innovation in structuralist phonemic theory [...] was the notion that the set of phonemes [...] in a given language form a system with an important internal organisation.' These early structuralists were revolutionary in devising a research programme which made these ideas the focus of sustained investigation. This formed the European Structuralism of the first half of the twentieth century, which both influenced and was influenced by those who developed American Structuralism, such as Bloomfield (e.g. 1933). These structuralisms differed, but also shared many similarities: they both worked with an overt distinction between what is now known as underlying and surface phonology ('phonemic' and 'allophonic' levels, along with a recognition of morphophonological analysis), and they both explicitly developed the notion that languages comprised segmental systems. This allowed the classical structuralists to focus explicitly on the extent to which phonological changes affect the number and nature of the contrasts which exist in a phonological system, and to consider the inter-relatedness of both contemporaneous and successive changes, leading to the recognition that segmental changes can (but need not) involve segmental/phonemic splits or mergers. Fox (this volume) and Gordon (this volume) show how important an understanding of splits and mergers can be and Kiparsky (this volume) explores some complications with the notion of split (see also below).

Work from the 1940s until the 1960s elaborated these basic insights in paradigms that can be described as structuralist in both the broad and narrow sense. For example, Martinet (e.g., 1955) was instrumental in recognizing ways in which the maintenance of contrast can be seen to play a role in phonological change in the patterning of chain shifts (see Gordon, this volume, and Section 3.3, below), Hockett (1955) focused in detail on symmetry and organizational principles in segmental systems, and Hoenigswald (1960) condensed and codified ideas on diachronic merger

and split, distinguishing between split with merger (which he called ‘primary split’) and without (‘secondary split’), among other ideas (see Section 3.2, below).

European structuralists ‘discovered’ symmetry as a principle of systemic organization. As Fischer-Jørgensen (1975: 33) notes, there is an implicit assumption of symmetry in Trubetzkoy’s (1939) discussion of vowel systems, and the idea is made explicit in later structuralist work, perhaps reaching its zenith in Martinet (1955). Trubetzkoy (1939) argues, for example, that vowel systems tend to have equal numbers of segments at a small number of levels, with equivalent degrees of distance in phonological space between them. Vowel systems are typically either triangular or quadrangular, and ‘by far the majority of languages has three-degree vowels systems’ (1939: 107), of the type shown in (1). These observations are based on early typological investigations (see Kümmel, this volume, for more on the role of typology in phonology). The spacing of symbols is slightly adapted here and the vowel diagrams are inverted to fit in with current practice, retaining Trubetzkoy’s symbols (and some of this discussion borrows from Honeybone 2010).



This means that symmetry is most widespread on the vertical axis in vowels systems—as it exists in both triangular and quadrangular systems—and only quadrangular systems feature symmetry on the horizontal axis. The basic expectation of symmetry in segmental systems thus requires symmetrical units in each phonological slot provided by the language’s system (in terms of height and backness for vowels, and laryngeal and place of articulation features for obstruents, for example). Structuralists also worked to explain *why* symmetry should guide the structure of segmental inventories; in part these ideas fit with the notion of markedness, discussed below.

From here it is no real leap to assume that a striving for symmetry in languages is relevant in diachrony as well as synchrony, a basic assumption in the Trask quotation above. Symmetry provided what were argued to be purely phonological descriptions and, even, *explanations* of phonological change. This type of explanation focuses directly on systemic considerations and it is thus ‘asocial’—ignoring any social motivation for change—so it should be noted that the ideas considered here are directed at understanding endogenously-innovated change, ignoring exogeny. It gives synchronic phonological structure a role in understanding phonological change in a manner described as ‘amphichronic’ by Kiparsky (2006, and Bermúdez-Otero, this volume).

The period in which these ideas were developed formed the peak of classical, narrow-sense structuralism. These ideas, and the notion that phonological *correlations* can change—not (just) sounds or phonemes—formed the basis of the standard understanding of how phonology worked, linked to a number of other assumptions; for some, these included the notions that phonological units should be understood as elements that were characterized by the *differences* that existed between them and other units in a system, or that the relationship between phonological levels must be one-to-one, forbidding phonemic overlap. The same physical item could have strongly diverging phonological characteristics and behavior according to the nature of other items present in a phonological system, and modifications of an item could be caused by the segmental environment or by systemic properties. There were differences between European and American structuralisms (Fischer-Jørgensen 1975, Anderson 1985), but

the basic thrust—that a focus on phonological contrast and phonological systems is crucial in order to understand phonology—was central to the development of contemporary understandings of phonology, and of phonological change.

It is widely claimed (Bromberger & Halle 1989, Anderson 1985) that the rise of generative phonology, following Halle (1959) and Chomsky & Halle (1968), involved a fundamental paradigm shift. There *were* major breaks with classical structuralism, such as the explicit attention paid to the relationship between morphophonology and low-level/postlexical phonology, the embracing of lengthy derivations, and a major focus on the linear phonological environment in which segments occur, rather than chiefly on their place in a system, but there was also non-negligible continuity (Goldsmith 2008, Scheer 2011). The most-often cited fatal flaws of structuralism are typically less aimed directly at its phonological machinery (much of which can still be seen in use by some today), than its connection to behaviourist psychology, taxonomic orientation and lack of full engagement with syntax.

While the role of segmental systems in driving phonology was taken out of centre focus, contrast remained crucial (if modified to recognize that surface contrast does not necessarily imply underlying contrast), and analyses of languages in generative materials still made the assumption that a language had defined inventories of segments. Diachronic work of the period, even if influenced by generative ideas, could still consider the effect of changes on segmental systems, such as mergers and splits. Furthermore, the notion that marked structures are dispreferred due to deep-rooted phonological machinery has anchored itself in generative theory. For example, Chomsky & Halle (1968: 401–2) argue that a vowel system such as that in (2) is ‘more natural, in some significant sense, than one such as’ the one in (3), which conflicts with markedness expectations (for example, that no system may have front rounded vowels if it does not also have front unrounded vowels).

(2) i u
 e o
 a

(3) ü i
 ʌ
 œ a

This connects generative thought with the structuralist expectations of unmarkedness and of order and symmetry in segmental systems. Goldsmith and Laks (to appear) argue against this, quite rightly, that ‘new’ segments could be lightly assumed in this model without much worry about their consequences for the phonological system, thus Chomsky and Halle could consider proposing /k^w/ for English in order to account for some morphophonological alternations, without immediately worrying if this also implied a need for /g^w/. But this did not imply a total rejection of structuralist concerns: on the same page (p.150) that they consider /k^w/, Chomsky and Halle also write that ‘[w]ith the postulation of doubled consonants . . . we fill a gap in underlying structures (a ‘phonological gap’) and extend the symmetry of the system of lexical entries’.

In these senses, we see a continuation of fundamental structuralist ideas after the demise of classical structuralism in the 1960s and 1970s. While narrow-sense

structuralism declined, broad-sense structuralism continued, and generative approaches can be seen as structuralist in the broadest sense of the notion.

Dresher (this volume) considers a current rule-based approach to phonological change, of a type fundamentally compatible with classical generative phonology. He shows how such ideas can be overtly mixed with more clearly structuralist ideas—placing considerable explanatory importance on the contrastive hierarchy of phonological features. Features are a clear inheritance from narrow-sense structuralism. Trubetzkoy (1939) considered ‘oppositions’ between segments, invoking the idea that they are characterized by the relationships that they enter into in languages, tying in with the notion that phonological units should be understood as the set of differences between them and other units in a system. Jakobson developed these ideas (e.g. Jakobson, Fant & Halle 1952) to provide the basis of contemporary distinctive feature theory, developing a small language-universal set of features which exist independently of the segments that they make up, as segmental ‘building blocks’. The use of features and contemporary work in subsegmental phonology can thus also be seen as a continuation of structuralist ideas in a broad sense (see Purnell & Raimy, this volume, on the application of theories of features to the interpretation of phonological change).

There were objections to generative ideas when they were proposed (some discussed by Scheer, this volume, along with some defence; see also Donegan & Nathan, this volume and Mailhammer, Restle & Vennemann, this volume), and a new round of anti-generative work in phonological theory arose in the late 1990s and 2000s, often of a radical purely usage-based or exemplar-based type, as in Bybee (2001, this volume) and Phillips (this volume); other work still allows for the possibility of a formal grammar, such as Blevins (2004, this volume). Such work discards much of the structural machinery of formal phonology, but need not always reject the broad structuralist importance placed on the role of contrast and system (Sóskuthy, 2013, for example, explicitly links exemplar-type modeling with systemic concerns in phonological change). Some such work does make this rejection, however, arguing that complementary distribution does not imply that two phones derive from one underlying segment, and that similar segments occurring in different environments need not count as phonologically the same. A general push-back against phonology, especially formal phonology, has come from work like Ohala’s (see Yu, this volume). While answers vary about how much abstract (phonological) structure and computation actually exists, this tradition eliminates most or potentially all of it. Of all challenges to structuralist principles, this is the most fundamental. Such ideas do represent the end of structuralism in phonology, but are minority positions in the contemporary phonological world.

Less inimical to formal approaches, but still challenging to the idea that purely phonological structure accounts for change is the branch of work which can be described as ‘dispersion theory’. Dispersion is ‘the idea that segments are subject to a pressure to be maximally dispersed in the available phonetic space’ (Mielke 2009: 707). Vaux & Samuels (2006), themselves critical of the enterprise, describe ways in which this has been developed into ‘Dispersion Theory’, on the basis that ‘consonant inventories tend to evolve so as to achieve maximal perceptual distinctiveness at minimum articulatory cost’ (Lindblom & Maddieson 1988), by balancing the impetus to disperse with the impetus to minimize effort. Some work in Optimality Theory (e.g. Flemming 1995/2002, Ní Chiosáin & Padgett 2010) or in frameworks which assume that phonological inventories are subject to the principles of self-organizing systems

(e.g. de Boer 2001) argues that such reductionist pressures account for the tendency towards symmetry, and Holt (this volume) considers how dispersion has been integrated into OT. In a sense, this work links to structuralist ideas, aiming to motivate symmetry in systems; it is perhaps the phonetically-based mechanisms adopted to do this that are non-structuralist.

We can also see the influence of broad-sense structuralism in other developments in synchronic and diachronic phonology which have emerged since narrow-sense structuralism faded. In addition to generativism, the other main paradigm has been Labovian variationist sociolinguistic work (Labov 1972 et seq., D'Arcy, this volume). This is hardly a challenge to structuralism per se, though see Chambers' (1995: ch. 1) critique of 'categoricity' in formal linguistics. Indeed, Labov's work on chain shifting (most importantly 1994; Gordon, this volume) is itself classically structuralist. More importantly, Labov's trilogy on language change—almost entirely on SOUND change, in fact—aims to integrate the structural (or 'internal') with the social and the cognitive. Indeed, Labov (1994: ch. 21) posits a set of principles embracing and integrating phonetic, phonological and 'external' factors, and can be seen as broadly structuralist. As laid out in D'Arcy (*this volume), patterns of acquisition correlate with patterns of social behavior and change in response to them, or as she says 'linguistic and social factors are closely interrelated in the development of a change'.

As we have seen, symmetry within systems is one of the most important themes in structuralist historical phonology. Fischer-Jørgensen (1975: 45) explains:

Trubetzkoy, Jakobson, de Groot and van Wijk all emphasize the tendency towards harmonious systems. Martinet's contribution consists in a reinterpretation of the somewhat vague concept as something more concrete: harmony is a manifestation of economy (a view which was suggested earlier by de Groot (1931)). A system which utilizes a limited number of distinctive features in several pairs is more economical than one with many different distinctive features none of which are put to much work.

Thus, for example, if [\pm back] is used to make a contrast at one level of vowel height in a system, it is expected that it will be used at other levels, too, so three-level and four-level systems have two vowels at all heights (apart from at the lowest level, which can be central in triangular systems).

The idea that phonological systems are organized symmetrically has been picked up and developed in recent work in formal phonological theory, often with relevance to diachrony. Clements (2003, 2009), for example, argues that the impetus towards symmetry need not be seen as a system-organizing principle in its own right—rather, symmetry is the result of a more fundamental phonological principle. For Clements (picking up the idea that we have just seen discussed in narrow-sense structuralist work), 'the typical 'symmetry' of vowel systems reflects Feature Economy' (2009: 56). Clements (2003) is at pains to explain that the simple requirement for symmetry and the formal expectation of Feature Economy do not make exactly the same predictions: systems can be perfectly symmetrical but not fully economical, for example. This does not mean that an impetus towards economy does not lead towards symmetry, however.

The notion of markedness has also played a major role in formal phonology of various stripes. Theories of markedness asymmetries, such as the fact that if a language has only one set of front vowels, they are always unrounded, developed in narrow-sense

structuralism, hand in hand with the development of phonological features, as an attempt to explain patterns in phonology. The notion has been fundamental in Optimality Theory (see Holt, this volume, and the comparative discussion in Kiparsky, this volume) as the basis for many of the constraints assumed in the model. It has also been developed in frameworks which have placed importance on expanded models of segmental structure, working with only privative/unary subsegmental units to account for markedness asymmetries in a theoretical model. Such approaches, often referred to (e.g. Carr, Durand & Ewen 2005) as the ‘Dependency/Government’ approach to segmental structure, offer another explanation for the tendencies in vowel systems, deriving the most common patterns in vowel inventories from the set of subsegmental primitives that it allows. The approach is found in Dependency Phonology (e.g. Anderson & Jones 1974, Anderson & Ewen 1987), Particle Phonology (e.g. Schane 1984, 2005) and Government Phonology (e.g. Kaye, Lowenstamm & Vergnaud 1985, 1990), in part through independent development, and latterly through cross-fertilization (see, e.g. Harris 1994, Botma 2004, Purnell & Raimy, this volume).

These approaches assume that subsegmental phonological representations involve a set of privative primes which are not many in number and which are each used in several ways in the structure of segments. These primes are typically called ‘elements’ and are fully interpretable in their own right, thus the most common vowels (the only ones found in the smallest triangular system) are composed of one element each, as shown in (4), where the second column represents the most prominent characteristic of the three elements involved.

(4)	vowel		element
	/i/	=	palatality = I
	/a/	=	openness = A
	/u/	=	labiality = U

Other vowels are composed of combinations of these elements, thus /y/ is made up of **I** and **U**, as a palatal vowel with labiality (i.e. rounding). In Government Phonology (other approaches differ in the precise implementation) one element is assumed to be the ‘head’ of an expression (underlined below), which means that any other elements in it are ‘dependents’. Thus the three and four-degree triangular systems can be represented as in (5).

(5)	Vowel system		Elemental makeup	
	i	u	<u>I</u>	<u>U</u>
	e	o	<u>I, A</u>	<u>U, A</u>
	a		<u>A</u>	
	i	u	<u>I</u>	<u>U</u>
	e	o	<u>I, A</u>	<u>U, A</u>
	ɛ	ɔ	<u>I, A</u>	<u>U, A</u>
	a		<u>A</u>	

This approach builds markedness directly into the set of features assumed, as a front high unrounded vowel has a simple representation, comprising only **I**, whereas a front high rounded vowel is more complex, as it is comprised of **I** and **U** together.

The model fits well with triangular systems, but less obviously with quadrangular systems, as Durand (2005: 83) explains: ‘[i]f we came across a system like /i e æ, a o u/, it would be modeled as inherently symmetrical in the *SPE* tradition’.

(6)		-back	+back
	+high, -low	i	u
	-high, -low	e	o
	-high, +low	æ	ɑ

‘By contrast, it would be inherently skewed in a D[ependency] P[honology] approach’:

(7)	i	u	<u>I</u>	<u>U</u>
	e	o	<u>I, A</u>	<u>U, A</u>
	æ		<u>I, A</u>	
	ɑ		<u>A</u>	

This issue for the Dependency/Government tradition may just be an advantage, in fact, as quadrangular systems are rarer than triangular ones. As the Dependency/Government approach represents such systems as subsegmentally aberrant, it provides a phonological rationale for the observation.

These formal approaches, like dispersion, assume that phonological systems strive to fit a particular form, due to the pressures that they presume (although there is no intention to predict *when* a particular change will occur—surely a fool’s errand). All this raises the issue of teleology in sound change. If the structure of a system, including considerations like symmetry in segmental oppositions, is considered a motivation, broadly structuralist approaches see language change as language improvement in some sense, e.g. by improving the systematicity of featural contrasts. The idea that language change improves anything, that it is in some sense teleological, is controversial, although teleology is also present in functionalist approaches to change. Luraghi (2010:364–6) reviews key literature on the issue, showing that little common ground exists among the broader community of historical linguists on this point; we note also that symmetrical patterns can often be motivated ateleologically (and, of course, any model needs also to recognize and deal with the fact that not all changes move phonologies in the direction of improved symmetry, or dispersion).

Many structuralist ideas have proven very hardy. While the full (narrow-sense structuralist) frameworks that they emerged from have faded from phonological focus, many of the basic ideas are still important in diachronic phonology, in part because they are still important in (synchronic or amphichronic) phonological theory. To the extent that they are relevant to phonological change, basic structuralist ideas at least provide a taxonomy for describing changes in terms of their impact of systems of contrasts (see below); some argue that they should be expected to intervene in phonological change, determining what is possible in (endogenously innovated) change.

3. Structural Patterns: Some Basic Segmental Differences in Diachrony

This section considers selected fundamental concepts of broad-sense structuralist phonology as they play out in diachronic phonology: mergers, splits, chain shifts, and how gaps get or don’t get filled. A fuller taxonomy is sketched in Salmons (2010), on which this draws. In each case, we note ways in which current discussion treats the

issue. The fundamental issue of phonologization remains actively debated, including by Hale, Kissock & Reiss (this volume), Kiparsky (this volume) and Bermúdez-Otero (this volume) along with related discussion in Fox (this volume). The issues are crucial as they relate to the development of contrasts (often through splits of the sort considered here), and hence of the underlying segments which form systems of the type under consideration here; the debate about when phonologization occurs and how it patterns is so heated and long-lasting that we refer readers to those chapters rather than discussing it here. Our simple goal is to fully (if briefly) introduce the notions, with exemplification, to foreshadow the substantive discussions of foundational and theoretical issues coming in later chapters. Given the focus on the system, structuralist ideas typically begin with mergers and splits, which change the set of contrasts within a system, to which we now turn.

3.1 Merger

Contrasts between segments can be lost by sound change. This can remove phonemes from a system, as in the currently advancing collapse of /a/ and /ɔ/ in North American English, so that pairs like *cot* and *caught* or *don* and *dawn* are no longer distinguished (Di Paolo 1988 and much work since). Or it can eliminate contrast positionally, as in final laryngeal neutralization in many obstruents, such as in the disappearance of an earlier contrast between syllable- or word-final /s ~ z, t ~ d/, etc. (Iverson & Salmons 2007, 2011). Classic structuralist work was naturally less concerned with the ‘mere alteration in the physical properties of phones’ (Hoenigswald 1960:72) and more in the loss of contrasts. Hoenigswald writes (1960:72–3, see also Bloomfield on the observation of change, 1933:346–7):

in this view, sound change proceeds in small ‘imperceptible’ steps so long as no contrasts are imperiled or other structural changes are called for. When these things do happen, gradual subphonemic alterations ‘become’ phonemic. In the almost total absence of large-scale, questionnaire-supported observation of speakers in a community, such a picture can be only guesswork.

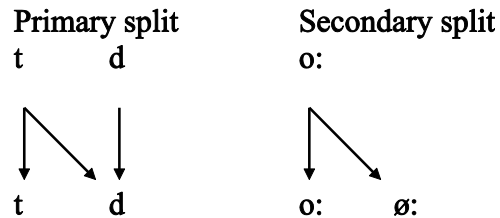
Since the rise of quantitative variationist work on sound change, a whole field has been dedicated to answering this challenge, and with tools Hoenigswald may not have imagined when he wrote that. Leaving aside issues of lexical effects (see Phillips, this volume) and frequency effects (see Wedel, this volume, Bybee, this volume), we today have a clearer sense of the fine-grained conditioning involved in changes like mergers. Even today, for instance, much work treats vowels as single points in a two-dimensional (F1xF2) space, while in fact vowel distinctions may be maintained by vowel dynamics (e.g. Purnell 2008) or phonation differences (Di Paolo & Faber 1990), leading to the rise of the notion of a ‘near-merger’, which must be further distinguished in terms of production versus perception. Within consonant systems, questions of synchronic ‘incomplete neutralization’ rage today for production and perception (Iverson & Salmons 2011:§3), though Kharlamov (2012) demonstrates the challenges involved in rigorous laboratory testing of this question.

3.2 Split

In contrast to mergers, splits redistribute some occurrences of a sound to another existing sound (primary) or increase the number of sounds in the inventory

(secondary), as shown below, when conditioning is lost. (With regard to splits in general, our empirical dataset has grown much richer since classical structuralist times, see Ratliff, this volume, on tonal splits.)

(8) Primary vs. secondary split



As illustrated, primary split is traditionally seen as rearranging existing distributions rather than changing the overall set of contrasts in a language, though Blust (2012) presents a case for how primary split could reduce an inventory.

A classic secondary split was given in the discussion of Trask at the beginning of this chapter and perhaps the most famous is Germanic *i*-umlaut. As discussed by Kiparsky (this volume) for Old High German, secondary split raises critical problems of how phonologization proceeds, and in particular how it interacts with opacity (see also Iverson & Salmons 2012 on Old Norse *i*-umlaut).

3.3 Chain Shifts

Chain shifts involve an interlocking series of changes, where an individual segment takes on some feature or other characteristics of a related one, which in turn interacts in similar fashion with a further segment, famously exemplified by Grimm's Law in obstruent systems and the Great Vowel Shift or the Northern Cities Shift in vowels (see Gordon, this volume). Their treatment goes back to well before structuralism (Sievers 1881, originally 1876, and see Murray, this volume), but was a central phonological concern for Martinet and Hoenigswald, before becoming the focus on phonetic work in variationist circles, where Labov's work stands out for its balance of phonetics and phonology. Building on Sievers, Labov (1994, elsewhere) posited three principles of chain shifting (later refined further), namely that long/tense vowels rise (Principle I), short/lax ones lower (II) and back vowels front (III). That these types of shifts are well attested is laid out in detail by Gordon (this volume), but we note here a couple of difficulties in the mechanisms by which they proceed and in their motivations.

To the first point, chain shifts are widely seen as an alternative to merger (Labov 1994, many others). Yet where low back merger (*cot* ~ *caught*, as above) and the Northern Cities Shift (NCS involving /æ, a, ɔ/ among other vowels, Gordon this volume) meet, Benson et al. (2011) find speakers who show /æ/ raising, the suspected trigger of the NCS, and merger. Other 'chains' lack interlocking links, like back vowel fronting (Principle III), which are also called 'solidarity chains'. While /u:/ and /o:/ fronting co-occur closely in American English, nothing about the chronologically earlier fronting of /u:/ forces the movement of /o:/.

Stockwell (1978, see also Labov 1994) identified a potentially more perplexing problem, 'the perseverance problem', or how it is that vocalic chain shifts are so chronic that they appear to be 'a pervasive and persevering characteristic of vowel systems of a certain type' (1978: 337). Simple social motivations seem unlikely to account for this, and some seek structural factors which might prime the pump for these changes, like

Salmons et al. (2012) and earlier work which provides evidence that the progress of chain shifts over time follow the patterns of prosodic prominence in the same dialect. The link here is in Child-Directed Speech, where adults appear to use particularly clear realizations of vowels in talking to small children, so that children may systematically acquire slightly different starting points for vowel realizations from those of earlier generations in their own families.

3.4 Filling Gaps in Systems

Trubetzkoy's observations on symmetry in phonological systems have largely been confirmed by more recent work. Maddieson (1984: 136), generalizing over the 317 languages that he reviews the sound systems of, writes that '[t]he most prevalent patterns seem to be the so-called 'triangular' systems, particularly those of average size, and notably the 5-vowel systems. For example, over a quarter of the 209 languages in the Stanford Phonology Archive have a triangular 5-vowel system consisting of /i, ε, a, ɔ, u/, while less than 5 per cent have any of the other 5-vowel configurations; the 'square' 4-vowel and 6-vowel systems combined total less than 10 per cent.' And, further, that '[t]he great majority of vowel systems in our sample assume configurations which are predictable from a theory of vowel dispersion . . . About 86 per cent of the languages have vowel systems that are built on a basic framework of evenly dispersed peripheral vowels' (Maddieson 1984: 153–4). While by no means *all* languages have symmetrical vowel systems, a large majority do ('dispersion', connects closely with symmetry, as above). This returns us to how and why symmetry exists (or doesn't).

While vowel systems are in a sense 'dispersed', Ohala (1980, also Hall 2011:36–7) proposes a principle of 'maximum utilization' of features; this links to the work of Clements, discussed above. Not all gaps get filled, for a variety of reasons—some systems simply don't show full symmetry, even if no system shows the hypothetical seven-consonant system Ohala (1980:185, Hall 2011: 36) sketches with seven manner features and five place features:

(9) Hypothetical (unattested) asymmetrical consonant system

	labial	dental	alveolar	retroflex	velar
stop				ɖ	
affricate			ts		
ejective					k'
click		ɓ			
fricative			ʈ		
nasal	m				
liquid			r		

Hall (2011) resolves this apparent conundrum by making a rigorous distinction between contrast and enhancement of contrast, 'representational economy' on the one hand and redundant properties which enhance those contrasts.

In fact, gaps in systems can escape conscious notice to a surprising extent. Iverson & Salmons (2005) call attention to a near-complete phonotactic gap traditionally found in English, namely the absence of tense vowel plus coda /j/. The gap was created by an earlier phonotactic restriction in English (f[i]sk but *f/i:/sk), whereby long vowels didn't occur with coda clusters of the /sk/ type, followed by a change of *sk into [ʃ], leaving the absence of (synchronically expectable) long vowel or

diphthong plus the single segment /ʃ/. We leave aside when the shibilant can be considered phonemic, if at all, but the similar phonotactic distribution—viz. a gap with long/tense vowel of diphthong—has figured in the extensive literature about the phonemic status of the velar nasal in languages like English and German. Over the ensuing millennium the gap has been filled by a variety of loanwords from various sources (*gauche* and *quiche* from French, *hashish* from Arabic, etc.). Nonetheless, we can suspect that speakers are aware of the marginal status of this structure given how productive it is in affective or onomatopoeic words like *swoosh* and *sheesh*.

3.5 Summary on Structural Patterns

The issues just described—mergers, splits, chain shifts, and the filling of gaps—are key ways of organizing discussions of sound change in classic structuralism and they all remain at the centre of significant debates today, although the ground has shifted. Earlier discussions often focus on the phonology or occasionally on the phonetics. Today, some of the most intriguing work seeks to integrate the phonetics and phonology, such as Hall (2011) from within theoretical phonology and Labov within variation and change.

One further relevant type of diachronic change should be acknowledged. It is implicit in a narrow-sense structuralist viewpoint, although it has not been pursued or even fully recognized until recently. This is ‘contrast shift’; that is, a shift in the contrastive structure of an inventory—in the contrastive representation of one or more segments in terms of their featural make-up. Dresher (2009, this volume) traces the idea to Jakobson (1931), and shows that it can fit into contemporary broad-sense structuralist models (see also Purnell & Raimy, this volume). In contrast shift, a shift is recognized in the contrastive status of phonemes, whether or not this is accompanied by mergers, splits, additions or overt shifts in segmental realization.

4. Conclusion

This chapter introduced and reviewed some history of structuralist historical phonology to contextualize it in two distinct ways: first in terms of some of the central issues that narrow-sense structuralist work on sound change dealt with (and in terms of how those issues are conceived of today) and second in terms of some particularly salient theoretical issues. This brief survey highlights both historical continuities and discontinuities in all this.

The notion of abstract systems of contrasting segments, and a role for such systems in phonological change is a central inheritance from our intellectual forebears. Contemporary work includes much straightforward continuation of those traditions with new tools and frameworks (Hale et al., Kiparsky, Clements, Dresher). Others, like Labov (see D’Arcy, this volume) are working to integrate structural considerations into socially informed work on change, while Eckman and Iverson (this volume) argue that L1 structure shapes L2 acquisition and change in contact. Yet others, like Bybee and Ohala, are pushing the boundaries in an effort to minimize the amount of structure and computation that needs to be posited. Whether or not they so actively engage in the battle, almost every chapter in this book builds on or contests the structuralist heritage, and the following discussions will show just how vital structuralist concerns (in the broad and narrow senses) remain to the field.

Structuralist concerns are certainly alive, if still fraught, in contemporary research.

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