Cambridge Books Online

The Contrastive Hierarchy in Phonology

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Chapter

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3 *Contrast in structuralist phonology*

3.1 Introduction

In the preceding chapter, I identified two basic approaches to contrastive specification in phonology, and discussed their status from a logical point of view. I argued that pairwise comparison based on full specifications has severe logical problems, whereas contrastive specification by feature ordering is logically sound. I showed that Martinet's (1960) analysis of Standard French bilabial stops is an example of the former approach, and that Jakobson and Lotz's (1949) analysis of the same phonemes exemplifies the latter approach.

In this chapter I will review some work in structuralist phonology that bears on this issue. This chapter has three main aims. First, I wish to show the extent to which contrastive specification was central to the project of phonological theory in its formative years, roughly the period 1925–50. Though the authors I will survey are central figures in the field whose work has been widely read, I believe that this work has been misconstrued in various ways. There are several reasons for this. First, the authors sometimes use terminology that is unfamiliar to contemporary readers. Second, they are not always very explicit about how their theory is supposed to work, and in some cases, their writings do not add up to a consistent theory. Third, we tend to read these works through the prism of our own preoccupations.

The second aim of this chapter is to investigate in detail the narrower question of how these phonologists determined which features of a phoneme are contrastive in a given language; that is, how they arrived at contrastive specifications. One might come away from the previous chapter with the impression that Martinet and Jakobson represented two different theoretical positions (pairwise comparison versus feature ordering), and one might expect to see arguments for and against these positions. However, this impression would be incorrect. I will show on the contrary that explicit procedures for determining contrasts were not formulated, and the authors I survey did not adopt clear-cut or even

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consistent positions on this issue. Nevertheless, it is possible to see the two basic approaches to contrast throughout this period.

This review of early work in phonology proceeds not just from a historical interest. The third and most important aim is to recover fundamental insights into the nature of contrast and its role in phonology that should form a part of contemporary phonological theory. To this end, I will show the existence of what appears to be a recurring pattern: when these theorists were thinking abstractly about contrast, they tended to assume something like pairwise comparison; but when they had empirical reasons for proposing contrastive specifications, they tended to apply something like feature ordering. This result supports the finding in the previous chapter that feature ordering is the only viable approach to contrastive specification. Moreover, we will see that it is indispensable in accounting for phonological patterning.

3.2   Sapir: phonetics versus phonological patterning

A central theme in the work of Edward Sapir is the distinction between a phonetic description of the sounds of a language and the way these sounds 'pattern' in the phonology (Sapir 1925, 1933). Sapir emphasizes that the phonological patterning, or 'pattern alignment', of a speech sound can be different from what we might expect from the phonetics. But what does Sapir mean by 'sound pattern'? Through the prism of generative phonology, this term is usually understood, in a wide sense, to be the collective set of rules and representations that make up the phonology of a language, and, in a narrower sense, to refer to the underlying representation of a sound. It can be argued, however, that the 'pattern alignment' of a phoneme refers most specifically to the set of its contrastive properties.

Sapir (1925) presents interesting examples of how systems that appear to be phonetically similar pattern very differently (his languages A and B), and, conversely, how languages that may appear to be phonetically quite different can be very similar in their phonemic patterning (languages C and D). The languages are constructs of Sapir's, though they are based on cases with which he was familiar. Sapir's languages C and D are shown in (1).[1]

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1 I have changed Sapir's phonetic symbols to accord with current usage. Next to q, Sapir writes '(velar k)', and similarly for all the obstruents in the fourth column. I assume he means uvular rather than velar. Similarly, I represent his 'h (laryngeal ḥ)' as ħ. In this book, I transcribe italicized *a* in my sources as ɑ, except where something like IPA *a* is intended.

(1)   Different phonetics, similar patterning (Sapir 1925)
     a. Pattern of C

a		ɛ		i			u	
aː		ɛː						
	h		w	j		l	m	n
p		t	k		q			
b		d	g		ɢ			
f		s	x		χ			

     b. Pattern of D

æ		e		i			y	
æː		eː						
	h		v	ʒ		r	m	ŋ
pʰ		tʰ	kʰ		qʰ			
β		ð	ɣ		ʁ			
f		ʃ	ç		ħ			

Sapir points out that, if one were to be guided only by phonetics, one might suppose that [ʒ] in Language D should be listed under [ʃ] as its voiced counterpart, just as [b] is placed under [p] in system C. Similarly, we might expect that [v] in D should be placed under [f] as its voiced counterpart. Sapir allows that the 'natural phonetic arrangement' of sounds is a useful guide to how they pattern, but he goes on: 'And yet it is most important to emphasize the fact, strange but indubitable, that a pattern alignment does not need to correspond exactly to the more obvious phonetic one.'

It is worth inquiring a bit more closely into the significance of Sapir's inventory charts. We observe first that he specifies no features or other substantive specifications of the listed sounds (except for the parenthetical comments about the obstruents in the fourth column). Therefore, the basis of the similarities in the patterns of C and D is, in the first place, in the typographical arrangement of the sounds. C and D have isomorphic patterns because each segment in one corresponds to a unique segment in the other, and the relative position of each segment in the pattern is the same as that of its correspondent.

But what is the meaning of these typographical layouts? They surely imply some phonological feature specifications, though these are not listed explicitly. Moreover, by arranging the systems of C and D isomorphically, Sapir is suggesting that the specifications for the two languages are parallel, if not identical. He writes that the reasons for placing [ʒ] (which he represents as *j*) in D where it is may have to do with the alternations it enters into (it might alternate with /i/

but never with /ʃ/), or the phonotactic combinations it enters into (for instance, that *v*- and *ʒ*- are possible initials, like /r, m, ŋ/, but that /β, ð, ɣ, ʁ/ are not). He continues, 'In other words, it "feels" like the y [= IPA *j*] of many other languages, and as y itself is absent in D, we can go so far as to say that j [=[ʒ]] occupies a "place in the pattern" that belongs to y elsewhere.'

The notion of 'place in the pattern' can be interpreted in a number of ways. One interpretation in terms of generative theory is that the corresponding segments in C and D have the same underlying specifications, which, in classical generative phonology, are full, not contrastive, feature specifications. Thus, we could understand Sapir to be suggesting that the lexical (underlying) phonological specifications of the phonemes /v/ and /ʒ/, that appear to be in the wrong place in the pattern of D, are to some extent at odds with their phonetics. In derivational generative terms, we can justify their positions in the pattern of D by assuming that they are specified as sonorants rather than obstruents, just like /w/ and /j/ in C, and assume their phonetic forms by late rules that alter some of their specifications. On this interpretation, /v/ and /ʒ/ in D correspond to /w/ and /j/ in C because they *are* those sounds at an abstract level of analysis.

While such an analysis is tenable in these cases, it does not extend to the rest of the phonemes whose phonetics do not deviate so spectacularly from their positioning in the phonological pattern. According to Sapir, /b/ occupies a place in the pattern of C that corresponds to the place of /β/ in D. In this case we have no reason to suppose that one of these sounds derives from the other. Looking at their fully specified lexical representations would not show us in what way they can be said to occupy the same position in the pattern of their respective languages. Rather, in this case, we must understand the notion of 'place in the pattern' to refer to the contrastive role of speech sounds. What /b/ in C and /β/ in D have in common is that they are both the only voiced labial obstruents in their respective languages; no further specifications are required to distinguish them from every other phoneme. That /b/ is also a stop whereas /β/ is a fricative is not relevant to their contrastive positioning, in this analysis.

Similarly, /l/ in C corresponds to /r/ in D because each is the only liquid in the language, and /n/ in C corresponds to /ŋ/ in D by being a non-labial nasal consonant. There is no suggestion that the underlying forms of the corresponding phonemes must be identical.

More generally, both languages C and D can be said to have a series of contrastively voiceless stops (with redundant aspiration in D), a series of contrastively voiced obstruents (which are redundantly stops in C and spirants in D), and a series of contrastively voiceless spirants. Both languages contrast four places of articulation for each obstruent series: labial, coronal, palato-dorsal

and post-dorsal; further specification within these broad place categories is not important to the phonological patterning of the system.

Similar considerations hold for the vowels. Both languages have two high vowels, one unrounded and the other rounded; whether the latter is front or back is not significant. Each language also has one mid vowel and one low vowel, the exact tonality of which is not important phonologically. Each language also has long vowels corresponding to the non-high short vowels.

The contrastive patterning common to these languages is shown in (2). In each cell, the first phoneme is from C, and the second is from D. Phonemes that share a cell have the same contrastive specifications.

(2)   Contrastive patterning of languages C and D
   a. Short vowels   b. Long vowels

unrounded	rounded
i/i	u/y
ε/e	
a/æ	

high	
mid	εː/eː
low	aː/æː

c. Consonants

			labial	coronal	palato-dorsal	post-dorsal
obstruent	voiceless	stop	p/pʰ	t/tʰ	k/kʰ	q/qʰ
		spirant	f/f	s/ʃ	x/ç	χ/ħ
	voiced		b/β	d/ð	g/ɣ	ɢ/ʁ
sonorant	nasal		m/m	n/ŋ		
	liquid		l/r			
	glide		w/v	j/ʒ		h/h

Sapir's discussion lacks formal rigour and a system of features, but we can recognize in it some seminal ideas that I would like to build on later. First is the notion that not all properties of a sound are equally important, but that certain ones – the contrastive ones – are particularly relevant to the phonology. Second, the contrastive status of a phoneme may differ from what its phonetics might lead us to think; that is, the phonetics of a segment is a

guide to its distinctive properties, but is not sufficient to indicate what these are, and may sometimes even be at odds with its phonological status. Finally, we determine what the contrastive properties of a phoneme are by the phonetics in combination with its phonological *behaviour*. This behaviour could consist of its phonotactic restrictions, or the way it alternates, or the effects it has on other phonemes.

3.3   Trubetzkoy: a theory of oppositions

The phonologist who did the most to develop the principle of contrast as an organizing principle of phonology was N. S. Trubetzkoy. His *Grundzüge der Phonologie*, written in the 1930s, is a major statement of the Prague School approach to phonology. In this work, Trubetzkoy's aim is to present an exhaustive account of the various types of contrastive oppositions that can exist in a phonological system. The influence of his approach can be found in many subsequent schools of linguistics. Therefore, Trubetzkoy's approach to contrast is central to our investigation.

Trubetzkoy made major contributions to our understanding of how contrast functions in phonological systems. One of his key insights is that the determination of contrastive features in an inventory is not self-evident but must be established by the analyst on the basis of the patterning of the phonological system. I will also show that the notion of feature hierarchy as a way to depict contrastive relations makes an appearance – perhaps its earliest appearance – in the *Grundzüge*. However, his account of contrastive relations is crucially incomplete, because it is not explicit with respect to how contrasts are assigned. More than that, I will show that Trubetzkoy (1939) does not follow a consistent approach to contrast, but varies between the pairwise approach and feature ordering. The former predominates in the earlier parts of the book, where the discussion tends to be abstract and mainly theoretical, with no direct empirical consequences. In later sections, where Trubetzkoy has empirical evidence for proposing certain contrastive relations, he uses an approach consistent with feature ordering.[2]

3.3.1   *Phonologically relevant features and phonemic content*
Every phoneme of a language enters into an *opposition* with every other phoneme. It is important to bear in mind that an opposition is a relation between

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2 I am grateful to William Sullivan for reminding me that Trubetzkoy died before he was able to complete his book, a fact that may account for some of the inconsistencies noted here.

a *pair* of phonemes. It is not just the number of oppositions, but their particular characters that give structure to a phonological system.

From the outset, Trubetzkoy distinguishes between *phonologically relevant* and *phonologically irrelevant* features of speech sounds: 'every sound contains several acoustic-articulatory properties and is differentiated from every other sound not by all but only by a few of these properties' (p. 35).[3] As an example he adduces the German phonemes *k* (/k/) and *ch* (/x/). The latter has two allophones, [x] (what Trubetzkoy calls the '*ach* sound') and [ç] (the '*ich* sound'). The sounds that belong to the /k/ phoneme are distinguished in manner of articulation from /x/ by forming a complete closure, whereas /x/ sounds form a stricture; that is, /k/ is distinctively a stop, whereas /x/ is a fricative. As to place of articulation, the fact that the opposition between [x] and [ç] is nondistinctive 'presents evidence that for *ch* the occurrence of a stricture between dorsum and palate is *phonologically relevant*, while the position of stricture in the back or central dorsal-palatal region is *phonologically irrelevant*' (p. 36).

From this example we can also see Trubetzkoy's approach to determining what the distinctive marks of a phoneme are. These are the marks that abstract away from the variation of the surface allophones. Thus, in the case above, variation in the place of articulation of the allophones of German /x/ provides evidence that its place must be specified only as generally dorsal. Similarly, the more radical variation in the place of articulation of German /r/, which is sometimes alveolar and sometimes uvular, reveals that place is a completely irrelevant property of this phoneme.

This diagnostic does not apply in cases of neutralization of underlying distinctive contrasts.[4] For example, in certain positions German voiced obstruents become voiceless, causing /g/ to become [k], which is identical to [k] that derives from phoneme /k/. Since the contrast between /g/ and /k/ is suspended in these positions, it is not possible to define the contrastive features of /g/ in such a way that they abstract away from the variation between [g] and [k]. Allophonic variation is not a necessary condition for determining the phonologically relevant features of a phoneme. We will see below that Trubetzkoy also appeals to other aspects of a sound's phonological behaviour in discovering its relevant distinctive features.

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3 All quotes drawn from the English translation by Baltaxe, cited as Trubetzkoy (1969).
4 As we shall see, neutralization itself is Trubetzkoy's primary diagnostic for bilateral oppositions, and hence for the structuring of contrasts in an inventory.

The phonologically relevant marks of a phoneme make up its *phonemic content*. 'By phonemic content we understand all phonologically distinctive properties of a phoneme, that is, those properties which are common to all variants of a phoneme and which distinguish it from all other phonemes of the same language, especially from those that are most closely related' (p. 66). Again, this must exclude neutralized variants of phonemes. More important, the phonemic content of a phoneme is a function of the contrastive oppositions it enters into: 'The definition of the content of a phoneme depends on what position this phoneme takes in the given phonemic system, that is, in final analysis, with which other phonemes it is in opposition . . . Each phoneme has a definable phonemic content only because the system of distinctive oppositions shows a definite order or structure' (Trubetzkoy 1969: 67–8).

The above remarks suggest that the phonemic content of a phoneme, that is, the set of its distinctive (contrastive) properties, ought to *derive* from its position in the system of distinctive oppositions. Therefore, we need a way to determine a phoneme's position in the system of oppositions *before* we have determined its distinctive properties. But Trubetzkoy does not explicitly show us how to do this.

Consider again his comments on the German phoneme /r/, cited above in section 1.2. Trubetzkoy (1969: 73) observes that the phonemic content of German *r* is 'very poor, actually purely negative: it is not a vowel, not a specific obstruent, not a nasal, nor an *l*.' How did Trubetzkoy arrive at this conclusion? First, he is assuming a theory of *markedness* wherein one value of a feature is marked (positive) and the other is unmarked (negative). His discussion assumes the markedness values in (3); the feature names are not Trubetzkoy's, but I have chosen them so that the marked value is the positive (+) one.

(3)   Markedness of features of German /r/

Feature	Marked	Unmarked
[obstruent]	obstruents	sonorants
[nasal]	nasals	liquids
[lateral]	laterals	rhotics

Markedness is one ingredient we require to reconstruct Trubetzkoy's analysis, but we need to answer a further question: how did he pick these particular features, and only these, to distinctively characterize German *r*? One way we can arrive at this result is by successively dividing up the German consonantal inventory, by features, following the order given in (3). The phonemes shown in (4) are those listed by Trubetzkoy, and the layout of the chart is based on his remarks.

(4)   German consonantal phonemes

p	pf	t		ts			k	
b		d					g	
	f			s	ʃ		x	h
	v			z				

m		n					ŋ

ⓛ   r

We can distinguish /r/ from every other phoneme by this procedure:

1. First, divide the inventory by the feature [obstruent], which distinguishes between obstruents (above the line in (4)) and sonorants (below the line). Since *r* is a sonorant, this feature distinguishes it from all obstruents, which no longer need be considered with respect to uniquely characterizing /r/.
2. Among the sonorants the feature [nasal] distinguishes the nasal consonants (in the box) from the non-nasal sonorants, leaving *r* in contrast only with *l*.
3. The final feature, [lateral], distinguishes between *l* (circled) and *r*, and leaves them both with a unique set of features.

The above procedure meets the requirement that the phonemic content of a phoneme, that is, the set of its distinctive (contrastive) properties, follows from its position in the system of distinctive oppositions. Moreover, in this procedure, 'the system of distinctive oppositions shows a definite order or structure'. The order in question is the order of the features, which gives structure to the inventory.

It follows that feature ordering gives us a way to reconstruct what Trubetzkoy may have meant by the statements cited above. However, it is not possible to state definitively that this is indeed what he intended, for he does not give any explicit procedure for how he arrived at his analysis of German *r*. Moreover, some of the other examples he discusses do not appear to work the same way, and other statements are inconsistent with feature ordering.

In the following sections I will first give some examples consistent with the assumption that Trubetzkoy determined contrasts by means of pairwise comparisons. I will then review other examples that are more consistent with contrast through feature ordering.

3.3.2   *Some examples that imply the pairwise method*

In chapter 3, Trubetzkoy presents what he calls a 'logical classification' of distinctive oppositions. He makes clear that he intends the principles presented in this chapter to be applicable to any systems with contrastive elements made up of features, though his examples are almost all drawn from phonology.

Oppositions are characterized by the properties that distinguish the opposition members, as well as by the properties the members have in common. In a *bilateral* opposition, the sum of the properties common to both opposition members is common to them alone. In a *multilateral* opposition, the basis of comparison is not limited exclusively to the two opposition members.

A question immediately arises: in comparing the opposition members, do we consider *all* their properties, or only their *distinctive* properties? Trubetzkoy's initial answer is decisive (1969: 68): 'Of course, only the phonologically distinctive properties are to be considered.' But he goes on: 'However, some nondistinctive properties may be taken into consideration as well if, on the basis of these properties, the members of the opposition in question are placed in opposition with other phonemes of the same system.' This latter qualification muddies the waters considerably. In this case, Trubetzkoy (1969: 69) presents an example to illustrate why he wants to allow nondistinctive features to play a role: '[T]he opposition *d-n* (as in French) is to be considered bilateral because its members are the only voiced dental occlusives. Yet neither voicing nor occlusion is distinctive for *n*, as neither voiceless nor spirantal *n* occur as independent phonemes.'

The only way to make sense of Trubetzkoy's remarks is to assume that he looked for minimal pairs in order to determine which features are contrastive. In particular, we can make the pairwise comparisons in (5).

(5)   French consonants: pairwise comparisons
      a. $n \sim m$ are distinguished by [dental] (or another place feature).
      b. $n \sim d$ are distinguished by [nasal].
      c. These two features suffice to distinguish *n* from every other phoneme as well, regardless of any other distinctions that may exist.
      d. The only way *n* could be contrastively [voiced] in a pairwise procedure is for there to exist a voiceless segment with the same full feature specifications as *n* except for [voiced] – that is, a voiceless *n*.
      e. Similarly, *n* could be contrastively [non-continuant] if there existed a fricative *n*, identical to *n* in all other features.

To confirm that Trubetzkoy must be (tacitly) following the pairwise method here, it suffices to observe that feature ordering does not give this result. If we used that procedure here, we could, for example, order the feature [voiced] first, distinguishing between voiced (boxed in (6)) and voiceless consonants.

(6)   French consonantal phonemes

p	t			k

b	d			g

f		s	ʃ	

v		z	ʒ	
m	n			ɲ
		l		r
				j

Since both *d* and *n* are voiced, following this division we would only have to subsequently distinguish among the voiced consonants. Continuing to use Trubetzkoy's terms, the next feature could be [occlusive] (horizontal boxes in (7)), which we apply to the set of voiced consonants (voiceless consonants are no longer relevant to distinguishing *n*). Finally, the feature [dental] (vertical box in (7)) narrows the set to just *d* and *n*.

(7)   French voiced consonantal phonemes

b	d			g
v		z	ʒ	
m	n			ɲ
		l		r
				j

Note that under this procedure the features for voicing and occlusion *are* distinctive for *n*; in fact, together with [dental], they are the *only* distinctive features so far assigned to *n*. Since Trubetzkoy does not consider the possibility that these features are contrastive in *n*, it must be that he was not thinking of the feature ordering method in this discussion of French.[5]

Further examples of what appears to be extraction of contrasts based on pairwise comparisons can be shown to occur in Trubetzkoy (1939), particularly from the front of the book. To mention just one more here, his analysis of bilateral oppositions in German vowels (Trubetzkoy 1969: 69–70) can be shown to be based on pairwise comparisons applied to fully specified

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5 We will see below that Trubetzkoy argues that occlusion does not play any contrastive role in French; rather, he argues that stops and fricatives are distinguished by place, not manner.

representations, and are inconsistent with any feature ordering approach to contrastive specification.

It should be noted that Trubetzkoy adduces no empirical evidence in support of these analyses; thus, it is unclear what consequences, if any, flow from them. This is in striking contrast to the examples to be discussed in the following section, which are all accompanied by empirical justifications.

3.3.3   *Examples of hierarchy in Trubetzkoy*

One might conclude from the above examples that our earlier interpretation of Trubetzkoy's theory of contrast is simply wrong. Nevertheless, I do not believe that this position can be consistently maintained. For one thing, the notion of 'relevant contrast' is central to Trubetzkoy's entire exposition. If, as he writes in connection with the $d \sim n$ opposition, oppositions must normally be established using only contrastive features, the implication is that the contrastive status of a specification is established *before* oppositions are classified as bilateral or multilateral. But such a notion is incompatible with deriving bilateral pairs from full (noncontrastive) specifications.

Second, as we have seen, pairwise comparisons do not yield a result for oppositions that differ by *more* than a single feature: for such cases, which make up the majority of oppositions, the procedure does not decide which feature is the contrastive one and which are redundant.

Consider again Trubetzkoy's analysis of German r (see (4)). Recall that Trubetzkoy assigns German r the distinctive (negative) features [non-lateral], [non-nasal] and [non-obstruent]. We have seen that $l \sim r$ are distinguished by the feature [lateral]. But, except for this pair, the pairwise method yields unclear results.[6] What feature distinguishes r from $ŋ$, for example? It could be [nasal], as in Trubetzkoy's analysis; but it could also be an occlusion feature (nasals are stops, in contrast to r), or a place feature. Similarly, r may be distinguished from z by [obstruent], as in Trubetzkoy's analysis, but this is not the only feature that distinguishes these phonemes; other candidates are [strident], or place of articulation. Such choices arise with respect to almost every opposition.

Third, there are places where Trubetzkoy makes crucial use of the notion that bilateral oppositions are a function of the system of contrasts, and that the same inventory can be viewed in different ways, depending on what contrasts have been established. These examples can all be easily reconstructed in terms of a contrastive hierarchy, but not in terms of pairwise comparisons. It is to these cases that we now turn.

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6 Even for this pair there are other possible contrasts, such as [continuant].

3.3.3.1 Consonant systems: place versus manner and voicing

Many examples come from Trubetzkoy's discussion of consonant systems. We frequently find two consonants that differ slightly in place of articulation (e.g. bilabial vs labiodental, or dorsal vs laryngeal) as well as in another dimension such as manner (stop vs fricative) or voicing. It is a recurring question whether the contrast is primarily one of place of articulation, from which the other differences are derived, or whether the other dimension is the determining difference. Trubetzkoy resolves these oppositions differently, depending on how the particular opposition fits into the overall system, in a way that implies some hierarchical organization of the relevant features.

Trubetzkoy recognizes a basic series of place contrasts that includes the gutturals (or dorsals), the apicals (dentals) and the labials. To these he adds the sibilants. Some languages have other basic series. He lists the lateral, labiovelar, palatal and laryngeal series.[7] The key point is that 'the phonological concept of series of localization must not be confused with the phonetic one of position of articulation' (p. 124).

German and Czech h Consider, for example, Trubetzkoy's treatment of German and Czech *h*. According to Trubetzkoy (1969: 69), German *h* does not take part in any bilateral oppositions. In particular, it is not in a bilateral opposition with *x*: *h* is laryngeal and *x* is dorsal, so there is no set of features that the two share exclusively. Looking at the Czech consonant inventory in (8),[8] one might suppose that Czech *h* (more properly, *ɦ*) is similarly isolated.

(8)   Czech consonant phonemes: *h* in a separate laryngeal series

p	t	c	k	
b	d	ɟ	ɡ	
	ts	tʃ		
f	s	ʃ	x	
v	z	ʒ		ɦ
m	n	ɲ		
	r	r̝		
	l			
		j		

However, Trubetzkoy (1969: 124) proposes that *ɦ* forms a bilateral opposition with *x*. His reason is that the distinction between these phonemes can be

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7 In contemporary feature theory, the features [sibilant] and [lateral] are not typically considered to be places of articulation.

8 Trubetzkoy does not provide an explicit account of the Czech phoneme inventory; the charts in (8) and (9) are based on D. C. Hall (2007: 38).

neutralized, for they behave phonologically like a voiced–voiceless pair, like the other such pairs in Czech: 'The *h* in Czech thus does not belong to a special laryngeal series, which does not even exist in that language. It belongs to the guttural series, for which, from the standpoint of the Czech phonological system, only the fact that lips and tip of tongue do not participate is relevant.' That is, we should diagram the Czech consonants as in (9) rather than as in (8).

(9)   Czech consonantal phonemes: *h* part of the guttural series

p	t	c	k
b	d	ɟ	ɡ
	ts	tʃ	
f	s	ʃ	x
v	z	ʒ	ɦ
m	n	ɲ	
	r	r̝	
	l		
		j	

The difference in the contrastive status of German *h* and Czech *ɦ* does not emerge from pairwise comparisons of the phonetic properties of these phonemes with other phonemes in the system. Rather, it is the *phonological behaviour* of these phonemes that is the key to the analysis of their phonological content. Whereas pairwise comparison tells us nothing about the difference between the German $h \sim x$ opposition and the Czech $ɦ \sim x$ opposition, we can use feature ordering to implement Trubetzkoy's analysis and capture this distinction. In German, if the feature [laryngeal] is ordered relatively high in the list, it will distinguish *h* from every other consonant, including *x*; therefore, *h* participates in no bilateral oppositions. In Czech, [laryngeal] would be lower in the order; instead, a feature [guttural] (perhaps characterized negatively as [non-coronal] and [non-labial]) and the voicing feature are ordered higher. As there are no distinctive place differences between *ɦ* and *x*, their opposition is bilateral.

As Trubetzkoy (2001 [1936]: 20) remarked in his 1936 article addressed to psychologists and philosophers, the correct classification of an opposition 'depends on one's point of view'; but 'it is neither subjective nor arbitrary, for the point of view is implied by the system'. Feature ordering is a way to incorporate 'point of view' into the procedure of determining contrastive properties. Different orders result in different contrastive features, as is the case with German *h* and Czech *ɦ*.

Greek and French labials   In German and Czech, different feature orderings resolve whether the laryngeal consonant makes up a distinct place of articulation, or whether it is to be regarded as part of a more general guttural series. There are other differences between German and Czech that illustrate the same point. For example, Trubetzkoy (1969: 125) proposes that the German bilabials *p*, *b* and *m* form a series distinct from the labiodentals *v*, *f* and *pf*; he makes no such claim for Czech, where the labial consonants presumably make up a single series.

This issue arises explicitly in Trubetzkoy's discussion of Greek and French labial consonants. In Greek, labial and apical stops and fricatives differ in place as well as in occlusion: the fricatives /f, v/ are labiodental in contrast to the bilabial stop /p/, and fricatives /θ, ð/ are interdental in contrast to the stop /t/. The major contrast between these stops and fricatives could thus be based either on place or on occlusion. Trubetzkoy appeals to 'parallel' relations between stops and fricatives at different places of articulation. In the sibilant and dorsal series, /ts, s, z/ and /k, x, ɣ/, respectively, the contrast is unambiguously one of stop versus fricative, since stops and fricatives occur at exactly the same place of articulation. By parallelism, Trubetzkoy proposes that the same contrast should apply to the ambiguous cases, which leads to the conclusion that the minor place splits are phonologically irrelevant. The Greek consonant contrasts can thus be represented as in (10).[9]

(10)   Greek: major place, voicing, occlusion > minor place

	Labial	Apical	Sibilant	Dorsal
voiceless stops	p	t	ts	k
voiceless fricatives	f	θ	s	x
voiced fricatives	v	ð	z	ɣ

The criterion employed here by Trubetzkoy can also be viewed in terms of symmetry, or economy. Since the feature [continuant] is required in any case to distinguish between /k/ and /x/, using it also for /p/ ~ /f/ and /t/ ~ /θ/ results in a minimal feature set and a more symmetrical inventory.

In French, however, Trubetzkoy argues for a split labial series: 'For in the entire French consonant system there is not a single phoneme pair in which the relation "spirant : occlusive" would occur in its pure form' (p. 126). Trubetzkoy argues that place should take priority over occlusion in this type of case. Indeed,

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9 I substitute phonetic transcription for Trubetzkoy's Greek letters.

he follows this analysis to its logical conclusion that there is no opposition between occlusives and spirants in French, because degree of occlusion cannot be regarded independently of position of articulation (n. 93). As Trubetzkoy does not give a chart, I adapt the one in (11) from Martinet (1964: 65), whose analysis is clearly influenced by Trubetzkoy.

(11)   French: minor place, voicing > occlusion

	bilabial	labiodental	apical	alveolar	pre-palatal	dorso-velar
voiceless	p	f	t	s	ʃ	k
voiced	b	v	d	z	ʒ	g

We can express the above analyses formally if Greek and French have different orderings of the occlusion feature, which we can call [continuant], relative to the minor place features that distinguish bilabial from labiodental place:

(12)   Variable feature ordering
     French: minor place features > [continuant]
     Greek: [continuant] > minor place features

Moreover, Trubetzkoy's discussion of these cases suggests a principle that guides the choice of ordering: minor place features take scope over occlusion (German *h*, French labials) *unless* an occlusion contrast is needed as evidenced by neutralization (Czech ɦ) or by the principle of parallelism (Greek labials).

3.3.3.2   Vowel systems

     Polabian   In his discussion of the Polabian (Lechitic West Slavic, extinct) vowel system, Trubetzkoy (1969: 102–3) observes that a 'certain hierarchy existed' whereby the back ∼ front contrast is higher than the rounded ∼ unrounded one, the latter being a subclassification of the front vowels. Trubetzkoy's analysis suggests that the features are ordered into the (partial) hierarchy: [low] > [back] > [round]; under this analysis, the vowel system is as in (13).[10]

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10 Because the point here is to present Trubetzkoy's analysis of Polabian, the vowels in (13) are as presented by Trubetzkoy. See Polański (1993) for a more recent account. According to Polański, the Polabian non-nasal, non-reduced monophthongs are: high vowels /i, ü, u/; 'closed

(13)   Polabian vowel system (based on Trubetzkoy 1969)

[−back]		[+back]
[−round] [+round]		
i ü		u
ê ö		o
[−low] e		α
[+low]		ɑ

Trubetzkoy's rationale for this analysis is that, in Polabian, palatalization in consonants is neutralized before all front vowels and before 'the maximally open vowel *ɑ* which stood outside the classes of timbre' (p. 102). The chart in (13) captures the notion that *ɑ* 'stood outside the classes of timbre' by ordering [low] before [back]: thus, *ɑ* has no contrastive value for [back] or [round]. Trubetzkoy cites, as further evidence, the fact that the oppositions between back and front vowels are constant, but those between rounded and unrounded vowels of the same height are neutralizable after *v* and *j* to the unrounded vowels *i* and *ê*. Because [back] is ordered ahead of [round], 'The properties of lip participation were phonologically irrelevant for the back vowels'. That is, they have no contrastive value for [round].

Though Trubetzkoy does not say so explicitly, it is clear that the vowels /ü/ and /u/ do not form a bilateral opposition in this analysis of Polabian. Since /u/ is not contrastively round, the two vowels have in common only the feature [high], which they share with /i/. The phonemes /i/ and /ü/, however, do form a bilateral opposition based on the shared features [–back] and [+high].

Triangular vowel systems with an 'indeterminate vowel'   In the case of Polabian, Trubetzkoy explicitly refers to a hierarchy of contrasts. In other cases, he makes clear that different bilateral oppositions may be assigned to inventories that look the same. This notion is not compatible with pairwise comparisons, which would yield the same result for such inventories.

Consider first triangular vowel systems that have a central 'indeterminate vowel', as in (14). If we assume that the relevant distinctive features are [low],

é /ė/; mid vowels /e, ö, o/; and low vowels /a, å/. The vowel written α in (13) may correspond to Polański's å, which he characterizes as the rounded counterpart of *a*.

[high], [round] and [front], then the fully specified specifications of the vowels in (14) are as in (15).

(14)   Triangular system with schwa

```
i                         u
            ə
      e           o
            a
```
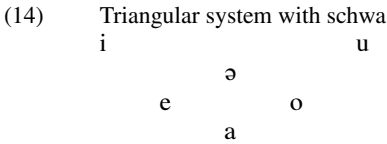
(15)   Distinctive features of vowels in (14)

	i	e	ə	a	o	u
front	+	+	–	–	–	–
round	–	–	–	–	+	+
low	–	–	–	+	–	–
high	+	–	–	–	–	+

Reading the feature values off the chart in (15), we can see that /a/ and /ə/ are a (potential) minimal pair. However, Trubetzkoy (1969: 113) explicitly states that 'the "indeterminate vowel" does not stand in a bilateral opposition relation with any other phoneme of the vowel system' in the usual case, but is 'characterized only negatively'. We can instantiate this idea in terms of a contrastive hierarchy ordered [low] > [round] > [front] > [high] (among other possibilities), as in (16).

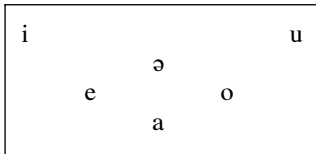(16)   Triangular system with schwa: [low] > [round] > [front] > [high]
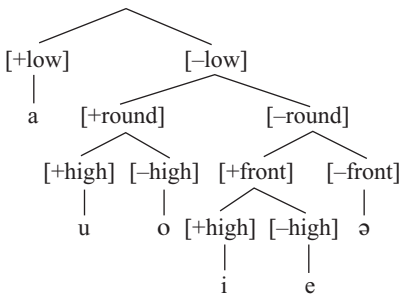
In the contrastive specifications that result from the hierarchy in (16), /a/ is specified only as [+low], and so shares no other feature(s) exclusively with /ə/. Therefore, there is no bilateral opposition between /a/ and /ə/.

Though Trubetzkoy considers the above to be the usual analysis for vowel systems like (14), he also allows for other analyses. Because the indeterminate /ə/ vowel is 'outside the system of timbre', it can enter into a relation with the maximally sonorous vowel in a triangular system, which is

also outside the timbre system (1969: 114). An example of such a system is Bulgarian (17).

(17)   Bulgarian (Trubetzkoy 1969)
   a. Stressed syllables   b. Unstressed syllables

An opposition is *proportional* if the relation between its members is identical to the relation between the members of another opposition. Otherwise, it is *isolated*. With respect to Bulgarian, Trubetzkoy writes (1969: 114), 'It would hardly be possible to assume a pure opposition of timbre between Bulgarian ə and o, or between ə and e. But the proportions $o{:}a = u{:}ə$, $e{:}a = i{:}ə$, and the proportion $u{:}o = i{:}e = ə{:}a$ deduced therefrom may well be established.' We can interpret these remarks in terms of contrastive divisions by ordering [round] and [front] before any height contrasts. In this way we divide the vowel space into three vertical sets, as in (18).[11] Trubetzkoy's evidence for this analysis is the pattern of neutralization in unstressed syllables (17b), where /u/ and /o/ neutralize to /u/, /i/ and /e/ neutralize to /i/, and /ə/ and /a/ neutralize to /ə/.

(18)   Bulgarian: [round] > [front] > [low], [high]
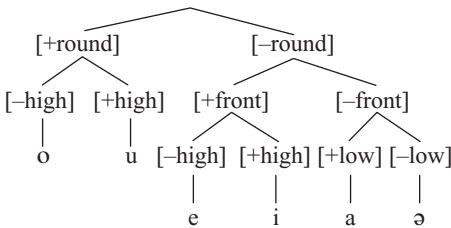
This way of cutting up the vowel space can be schematically represented as in (19). It may be the ordering of all place features before height that makes this a 'rare case' for Trubetzkoy.

11 Alternatively, a single height feature [high] or [low] can be employed if we interpret height features in a more relative manner than is the usual practice.

(19)   Bulgarian: [round] > [front] > [low], [high]
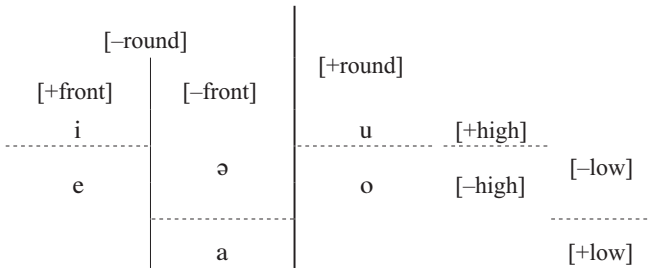
Five-vowel systems   The last set of cases I will discuss here is
Trubetzkoy's analysis of five-vowel systems. He assigns such systems a vari-
ety of contrastive relations in a way that can be modelled using a contrastive
hierarchy, but not by the pairwise method.

In a typical five-vowel system of the form /i, e, a, o, u/, the non-low vowels are
opposed in both place and rounding. Although the low vowel in such systems
is (typically) phonetically [+back] and [–round], it is not contrastively so,
according to Trubetzkoy. That is to say, the low vowel is not in the contrastive
scope of these features, even though they could in principle be relevant to it.
An example is Latin (20).

(20)   Latin
          i   u
              e   o
                  a
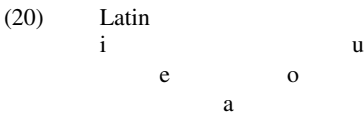
In the contrastive hierarchy of a language like Latin (21), therefore, the
feature [low] must take wider scope than the other features.

(21)   Triangular five-vowel system: [low] > [back/round], [high]
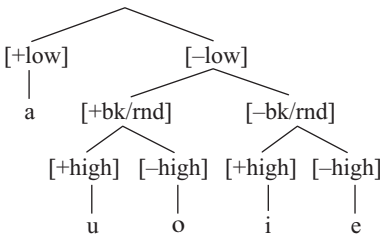
Though the above analysis is the typical case, Trubetzkoy (1969: 100) also
finds some triangular systems that have different contrastive structures, which

he deduces from the distribution of the allophones or 'from the circumstances surrounding the neutralization of the various oppositions'.

In Artshi, a language of Central Daghestan, certain consonants are divided into a rounded and unrounded variety. This contrast is neutralized before and after the rounded vowels /u/ and /o/: 'As a result, these vowels are placed in opposition with the remaining vowels of the Artshi system, namely, with unrounded *a*, *e*, and *i*. This means that all vowels are divided into rounded and unrounded vowels, while the back or front position of the tongue proves irrelevant' (Trubetzkoy 1969: 100–1). He finds further support for this view in the fact that *u*, *o* and *a* are fronted in specific environments.

This analysis of the Artshi vowels can be represented as in (22). The low vowel is contrastively specified for [round], a result that follows from ordering [round] over [low] in the contrastive hierarchy for Artshi, as shown in (23).

(22)   Artshi (East Caucasian)

[–round]	[+round]
i	
e	u
	o
a	

(23)   Artshi vowel system: [round] > [low], [high]
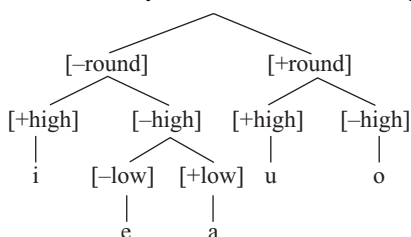
Trubetzkoy argues that neutralization of the opposition between palatalized and non-palatalized consonants before *i* and *e* in Japanese shows that these vowels are put into opposition with the other vowels /a, o, u/, and that the governing opposition is that between front and back vowels, lip rounding being irrelevant. Because of the phonological activity of the front vowels, they are the marked ones.

(24)   Japanese

[+front]	[–front]	
i		u
e	o	
	a	

Again the low vowel is included in the scope of the front ~ back contrast, which would here be modelled by placing the feature [front] (or [coronal]) at the top of the contrastive hierarchy.[12]

In these examples there appears to be no alternative to a hierarchical analysis: the pairwise method would yield the same results for all the five-vowel systems discussed above.

3.3.4   Summary

I have argued that Trubetzkoy, despite his many contributions to our understanding of how contrasts work in a phonological system, did not explicitly work out a procedure for determining which features of a phoneme are contrastive and which are redundant. When we try to deduce what he had in mind from the particular analyses presented in the *Grundzüge*, we find that his results sometimes appear to presuppose a procedure involving pairwise comparisons of phonemes. We have seen that this method is not an adequate way to determine contrastive features. It is interesting that Trubetzkoy's most obvious applications of this method occur early in the book when he is discussing oppositions in the abstract. In these cases he brings forward no empirical evidence that the oppositions are in fact the way he proposes. Hence, I conclude that his analyses of these cases, such as French *n*, are incorrect.

Where he wishes to account for actual phonological patterning, however, Trubetzkoy's analyses usually imply a feature ordering approach to determining contrastive specifications. Indeed, in hindsight, one could see Trubetzkoy's work as the beginning of an effort to develop criteria governing the formulation of contrastive hierarchies for particular languages. However, phonological theory did not develop in this way.

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12 See Hirayama (2003) for an analysis of Japanese vowels. Her proposal agrees with that of Trubetzkoy's to the extent that the vowels /i/ and /e/ must be specified for [+front] ([coronal], in her analysis). While lip rounding ([peripheral], in her analysis) is not contrastive in the underlying representation of /u/, she proposes that it is specified for /o/ (in contrast to /a/). She proposes further that postlexical processes require the specification of additional features.

Trubetzkoy's failure to arrive at a consistent point of view concerning how to determine contrasts was to be repeated many times in the history of phonology. Particular analyses of Trubetzkoy were discussed and debated in subsequent years – his analysis of French was to give rise to a recurring debate – but little more was said about the criteria he proposed, or about the hierarchies they imply. In fact, the principles governing the selection of relevant contrasts became more obscure in subsequent work, as we shall see in the following sections. Thus, despite its drawbacks, Trubetzkoy's work on contrast attained a level of insight that remained unequalled in the phonological literature.

In the rest of this chapter I will consider three structuralist analyses of the French consonant system: Martinet (1964), Jakobson and Lotz (1949) and Hockett (1955). Each takes a different position on what the relevant contrasts are; each is also crucially incomplete as a theory of contrast. However, we can see in these works the central role that contrast played in phonological theory.

3.4   Martinet: French contrasts based on place

Martinet's *Éléments de linguistique générale,* first published in 1960 and translated into English by Elisabeth Palmer (Martinet 1964), follows in the Prague School tradition of phonological analysis, which gives a central role to contrast:

> The aim of phonological analysis is to identify the phonic elements of a language and to classify them according to their function in that language. Their function is distinctive or oppositional when they contribute to the identification, at one point of the spoken chain, of one sign as opposed to all the other signs which could have figured at that point if the message had been a different one.   (Martinet 1964: 53)

Martinet begins his analysis of the French consonants by looking at all the consonants 'which appear or may appear before *-ouche*' (1964: 64).[13] Grouping together segments characterized by a relevant feature, Martinet arrives at the sets in (25). He puts the names of the features in quotation marks to emphasize

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13 The idea is to ground the contrastive set by an objective criterion, by limiting the comparison set to segments that can occur in this one context. However, the contextual criterion is loosened considerably when it includes not only those consonants which actually appear in a given context but also those that 'may appear', since no further criteria are given as to what may appear in a given context.

that these are not intended as exhaustive phonetic descriptions, but rather as phonological contrastive categories.[14]

(25)　　　Contrastive sets of French consonants (Martinet 1964)
'unvoiced'	/p, f, t, s, ʃ, k/	'voiced'	/b, v, d, z, ʒ, g/
'non-nasal'	/b, d, j/	'nasal'	/m, n, ɲ/
'lateral'	/l/	'uvular'	/r/
'bilabial'	/p, b, m/	'labio-dental'	/f, v/
'apical'	/t, d, n/		
'hiss'	/s, z/	'hush'	/ʃ, ʒ/
'palatal'	/j, ɲ/	'dorso-velar'	/k, g/

As we observed in section 2.2 looking only at the nasal consonants, these specifications are consistent with contrastive specifications derived by pairwise comparisons. The 'voiced' consonants do not include any sonorants, which are also phonetically voiced, but only obstruents that participate in a minimal pair with an 'unvoiced' phoneme. Similarly, 'non-nasal' phonemes are only those that have a minimally distinct 'nasal' partner.

The other features can be considered as representing nine values of a single place feature. These include values that are not usually thought of as place features, such as 'lateral' as well as 'hiss' and 'hush'. However, this interpretation would account for why there is a 'lateral' category but no 'non-lateral' category. Since Martinet does not suggest that there are any internal groupings among these features (unlike Trubetzkoy, who views bilabial and labiodental as having a special relationship, for example), we will simply treat all these values on a par.

The choice of 'uvular' is unexpected given Martinet's (1964: 54) assertion that /r/ does not always have a uvular pronunciation in French. According to Trubetzkoy's criteria, variation in place of /r/ indicates that [uvular] should not be the defining characteristic of the phoneme.

Though he does not refer to Trubetzkoy's discussion of French consonants, Martinet is clearly following Trubetzkoy in distinguishing stops and fricatives by place of articulation rather than by occlusion. Thus, occlusion is redundant in Martinet's analysis, though he gives no argument for choosing this approach over one that makes it the relevant contrast, an alternative he does not consider.

14　'Hiss' is the translator's rendering of Martinet's term 'sifflant', and 'hush' translates 'chuintant'. I use current IPA symbols in place of some of Martinet's.

Martinet represents some of these features and phonemes in tabular form, shown in (26).

(26)   French consonants (Martinet 1964: 65)

	'bilabial'	'labiodental'	'apical'	'hiss'	'hush'	'palatal'	'dorso-velar'
'voiceless'	p	f	t	s	ʃ		k
'voiced'	b	v	d	z	ʒ		g
'nasal'	m		n			ɲ	
						j	

3.5   Jakobson and Lotz (1949): French contrasts based on continuousness

A paper on the Standard French phonemic pattern by Jakobson and Lotz was published in a volume in honour of Henri Muller. The phonemes of Standard French are analysed into six features. Phonemes are assigned one of the following values for each feature: +, if a phoneme has the feature contrastively; −, if a phoneme contrastively lacks a feature; ±, if a phoneme has a contrastive intermediate value of the feature; or nothing, if a phoneme lacks a contrastive value for the feature.

In (27) I present a chart of the specifications proposed by Jakobson and Lotz; # is a 'special value' of [vocality] that Jakobson and Lotz reserve for the 'zero phoneme' /ə/.

(27)   Standard French specifications (Jakobson and Lotz 1949)

	d	t	z	s	b	p	v	f
Vocality	−	−	−	−	−	−	−	−
Nasality	−	−	−	−	−	−	−	−
Saturation	−	−	−	−	−	−	−	−
Gravity	−	−	−	−	+	+	+	+
Tensity	−	+	−	+	−	+	−	+
Continuousness	−	−	+	+	−	−	+	+

	g	k	ʒ	ʃ	n	m	ɲ	r	l
Vocality	−	−	−	−	−	−	−	±	±
Nasality	−	−	−	−	+	+	+		
Saturation	+	+	+	+	−	−	+		
Gravity					−	+			
Tensity	−	+	−	+					
Continuousness	−	−	+	+				−	+

	j	i	w	u	ɥ	y	a	â	e	ê
Vocality	+	+	+	+	+	+	+	+	+	+
Nasality	−	−	−	−	−	−	−	−	−	−
Saturation	−	−	−	−	−	−	+	+	±	±
Gravity	−	−	+	+	±	±			−	−
Tensity	−	+	−	+	−	+	−	+	−	+
Continuousness										

	o	ô	ø	ø̂	ã	ẽ	õ	ø̃	ə
Vocality	+	+	+	+	+	+	+	+	#
Nasality	−	−	−	−	+	+	+	+	
Saturation	±	±	±	±	+	±	±	±	
Gravity	+	+	±	±		−	+	±	
Tensity	−	+	−	+					
Continuousness									

Jakobson and Lotz do not discuss the method whereby they arrive at these specifications. Though they do not explicitly re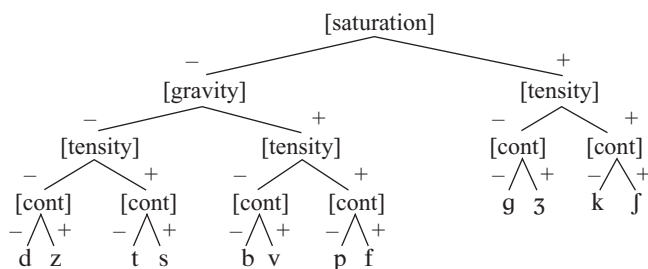fer to feature order-ing, it is clear that the specifications in (27) follow from a hierarchi-cal approach to contrastive specification in which the features are ordered as in the chart. That is, the specifications can be converted into the tree in (28).
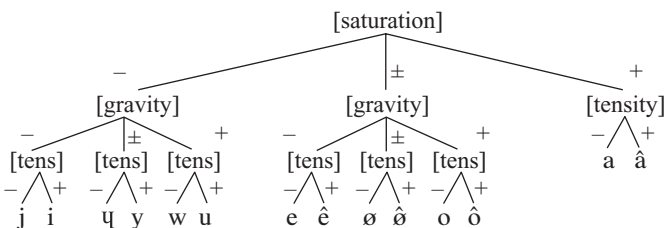
(28)   Contrastive hierarchy for Standard French

a. Top of the hierarchy: [vocality] > [nasality]

```
                              [vocality]
            ─                      ±                      +
        [nasality]          [continuousness]          [nasality]
      ─           +          −  /\  +            −              +
   d t z s b p  [saturation]  r    l    j i w ɥ y      [saturation]
   v f g k ʒ ʃ   −  /\  +              a â e ê o ô ø œ̂    ±  /\  +
              [gravity]  ɲ                          [gravity]  ã
               − /\ +                                − /|\ +
               n    m                                  − ± +
                                                      ẽ  œ̃  õ
```
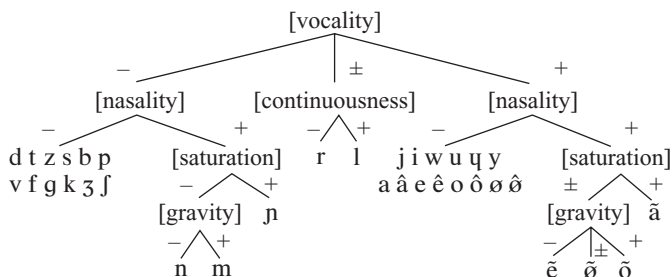
b. Consonants [−vocality, −nasality]

```
                              [saturation]
             −                                        +
          [gravity]                                [tensity]
      −              +                          −           +
  [tensity]      [tensity]                   [cont]      [cont]
  −      +        −      +                   − /\ +      − /\ +
[cont] [cont]  [cont] [cont]                 g    ʒ      k    ʃ
− /\ + − /\ +  − /\ + − /\ +
d   z  t   s   b   v  p   f
```

c. Vowels [+vocality, −nasality]

```
                              [saturation]
         −                         ±                         +
      [gravity]                 [gravity]                 [tensity]
   −     ±     +             −     ±     +                 − /\ +
[tens][tens][tens]       [tens][tens][tens]                a    â
−/\+ −/\+ −/\+          −/\+ −/\+ −/\+
j  i ɥ  y w  u          e  ê ø  œ̂ o  ô
```

The subtree in (28a) shows the expansion of the top two features, [vocal-ity] and [nasality]. Every phoneme receives a value for [vocality]: − for consonants, ± for liquids, + for vowels and glides, and the special value # for the 'zero phoneme' /ə/ (not depicted in this tree). As /ə/ is now uniquely specified, it receives no other features. The liquids need only be further dis-tinguished from each other, in this feature system by [continuousness]. All the

other phonemes participate in a nasal/oral contrast. The nasal phonemes are completed as shown in (28a).

Subtree (28b) depicts the contrasts among the consonants specified [–vocality, –nasality] and (28c) shows the remaining vowels specified [+vocality, –nasality].

Whereas Martinet (1964) stipulates that place is the main contrastive dimension for French consonants, with occlusion playing no contrastive role at all, Jakobson and Lotz make occlusion the main contrastive dimension, and collapse the place distinctions into four contrastive places, demarcated by the features [saturation] and [gravity]. They propose that saturated phonemes have longer duration, higher perceptibility and greater resistance to distortion than non-saturated (= diluted) phonemes; saturated consonants (palatals and velars) have a widened front resonator and reduced volume of the back resonator in comparison to diluted consonants (labials and dentals). The distinction between grave and non-grave (= acute) consonants is relevant only among consonants that are specified [–saturation], and opposes labials, with a predominant lower formant, to dentals, with a predominant upper formant.[15]

Jakobson and Lotz present some empirical evidence in favour of their analysis, based on the adaptation of foreign sounds, as well as on language-internal alternations. They observe:

> the difference between velar and palatal is irrelevant in French phonemics . . . These contextual variations do not hinder French speakers from rendering the English velar ŋ through the French palatal ɲ . . . or the German 'ich-Laut' through ʃ. The advanced articulation of *k g* before *j* or *i*, as well as the existence of ŋ instead of ɲ before *w* . . . illustrates the unity of saturated consonants in French.   (1949: 153)

Jakobson and Halle (1956) return to the problem of the structure of the French obstruent system, updating the Jakobson and Lotz feature system, but keeping to the same basic analysis. Instead of saturation they use diffuse/compact. A chart based on their proposal is given in (29).

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15 The limitation of the grave/acute distinction to diluted consonants is inconsistent with other definitions of gravity, where palatals, which are saturated, are acute, not grave; compare the analysis of Serbo-Croatian by Jakobson (1949) presented in the next chapter.

(29)   French consonants, based on Jakobson and Halle (1956)

	diffuse				compact	
	grave		acute			
oral	tns	lax	tns	lax	tns	lax
discontinuous	p	b	t	d	k	g
continuous	f	v	s	z	ʃ	ʒ
nasal	m		n		ɲ	

Jakobson and Halle also provide arguments for choosing their analysis over one which bases the contrasts on point of articulation. They argue (1956: 46) that this solution is 'the unique solution' on the grounds that it is optimal in terms of the number of binary decisions that have to be made. They state that if point of articulation rather than (dis)continuousness were distinctive, 'then the six French voiceless consonants ... would require, for their identification, fifteen distinctions instead of three, according to the elementary mathematical formula cited by Twaddell (1935)'.[16] Second, the narrower differences in point of articulation are 'minute' and 'hardly recognizable' by themselves. Third, they find that the distinctions between /s/ ∼ /f/ and /t/ ∼ /p/ involve the same contrast, as do /k/ ∼ /t/ and /ʃ/ ∼ /s/.[17]

3.6   Hockett: French contrasts and the 'odor of pure game-playing'

C. F. Hockett's *A manual of phonology* (1955) is an outstanding example of late Bloomfieldian American structuralism. This theory is characterized by an unyielding empiricism with respect to both science and psychology. In terms of science, Hockett (1955: 2) writes at the outset, 'it would be well to state explicitly that our view will be empiric: I accept Bloomfield's assertion that "the only useful generalizations about language are inductive generalizations".' With respect to psychology, Hockett inherited Bloomfield's extreme antimentalism that rules out any role for the mind in a scientific description. Together,

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16 This calculation assumes the worst case, that the narrower points of articulation are not generated by binary features along the lines used in their own solution.

17 Note that, whereas Jakobson and Lotz's (1949) arguments primarily involve phonological patterning and phonological activity, Jakobson and Halle (1956) focus less on activity and more on arguments of economy, part of a shift in emphasis from phonological activity to economy that will be discussed in the next chapter.

this scientific empiricism and psychological behaviourism keep any theorizing about the grammar confined to rather narrow limits.

3.6.1   Hockett's approach in principle

A good example of this theoretical stance is its application to the familiar problem of the French obstruent inventory. Hockett observes (1955: 173) that it is possible to regard each consonant phoneme as 'a bundle of three coequal ultimate constituents: a voicing-term (voiceless or voiced), an occlusion term (stop or spirant), and one of three positions (say front, central, and back)'. This is essentially the analysis of Jakobson and Lotz (1949), shown in (30a). Hockett also considers the analysis of Trubetzkoy and Martinet, shown in (30b).

(30)   Two decompositions of French obstruents (Hockett 1955: 173)
        a. Major places only, stop vs spirant, voiceless vs voiced

		'front'	'central'	'back'
'stop'	'voiceless'	p	t	ʃ
	'voiced'	b	d	ȝ
'spirant'	'voiceless'	f	s	k
	'voiced'	v	z	g

b. Major and minor places, voiceless vs voiced

	'bilabial'	'labiodental'	'apico-dental'	'apico-dent. rill'	'lamino-alveolar'	'dorso-velar'
'voiceless'	p	f	t	s	ʃ	k
'voiced'	b	v	d	z	ȝ	g

After considering the merits of each approach, Hockett states his own view (1955: 173) that 'Both of these decompositions of the French obstruents have the odor of pure game-playing, an odor which is seemingly appetizing to some linguists'. He argues that if our sole guide in decomposition is retaining pre-dictability of the omitted features, then far more drastic solutions are available. He notes that any system of sixteen phonemes can be assigned values of four 'determining' (i.e., contrastive) features, as in (31). All other features are then 'determined' (i.e., redundant).

(31)   Assigning 'determining' features to a set of sixteen phonemes

	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
A	x	x	x	x	x	x	x	x								
B	x	x	x	x					x	x	x	x				
C	x	x			x	x			x	x			x	x		
D	x		x		x		x		x		x		x		x	

The chart in (31), which represents an arbitrary binary coding, is for Hockett (1955: 174) 'a psychologic reductio ad absurdum ... The opposite of this sort of game-playing is what I mean by "hugging the phonetic ground closely".'[18]

Of course, the chart in (31) assumes that the *only* criterion for assigning contrastive features is minimality of feature specifications, and that there are no testable empirical consequences of any particular feature assignment. Neither of these assumptions is necessary. This train of reasoning, however, leads Hockett to reject the possibility of making any distinctions between contrastive and redundant features:

> Furthermore, it turns out that in general we cannot divide the ostensible ultimate phonologic constituents of a system neatly into 'determining' and 'determined', assigning the latter some sort of secondary status. In the actual complexity of speech, a given feature or difference turns up in some contexts as of primary relevance, in other contexts as subsidiary ... Thus, for French obstruents, we have no choice but to recognize (1) two voicing terms; (2) two occlusion terms; (3) six combinations of articulator, point of articulation, and contour of articulator – ten features in all.   (1955: 174–5)

The fact that this system could lead one to expect twice as many phonemes as there are – for example, a bilabial spirant or a labiodental stop – 'is simply a limitation on privilege of occurrence'.

Against Hockett's arguments in this section, one can observe first that it is incorrect to reduce any example of distinguishing between a contrastive and redundant feature to an arbitrary binary coding. One could have empirical, non-arbitrary reasons for deciding that some features are contrastive. Moreover, contrastive features need not be the mathematically minimal set. Second, Hockett adduces no empirical evidence in favour of his own analysis of the French obstruents. Thus, we have no reason to think it is superior to either of the two analyses he rejects.

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18 This chart, and the related discussion, may have been inspired by Cherry, Halle and Jakobson (1953); see further section 4.4.

3.6.2   *Hockett's approach in practice*

Third, and most important, Hockett's conclusion is not consistent with his own practice in the rest of the *Manual*. If we can indeed make no distinctions between 'determining' and 'determined' features, it would be difficult to assign phonemic symbols to a set of allophones, let alone arrange them into neat schematic diagrams. But this Hockett does consistently in his presentation of types of vowel and consonant systems.

For example, he observes (1955: 84) that a 2×2 type of vowel system is widespread. He portrays such a system with the diagram in (32).

(32)   A 2×2 vowel system (Hockett 1955)

i	o
e	a

As examples, Hockett cites Rutul (Caucasian), in which the high back vowel is sometimes rounded, sometimes not, depending on environment; Fox and Shawnee (Algonquian), where the low back vowel is usually unrounded, though rounded in certain environments; and a number of other languages. He adds that 'we class Fox as a two-by-two system despite the fact that the vowel classed as low back, /a/, is typically lower than that classed as low front, /e/'. Though he lists no features, thus leaving open whether the relevant contrast is one of roundness, backness or both, the arrangement in (32) can only mean that these dimensions, as well as a single height contrast, are the relevant (determining) ones. In particular, it is not relevant that /o/ may be phonetically lower than /i/, and /a/ lower than /e/; indeed, the choice of these symbols suggests that /o/ and /e/ might be at the same height phonetically, though functioning phonemically at different heights, whereas /i, o/ and /e, a/ show the reverse. If it were not so, we would have to diagram the vowel system as in (33).

(33)   A different four-vowel system

|		
i		
e		o
	a	
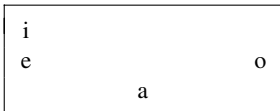
Thus, the schematization in (32) does not 'hug the phonetic ground' as closely as it might; on the contrary, it appears to be specifically chosen to show how the contrastive structure of a vowel system can *differ* from its surface phonetic appearance.
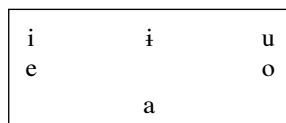
Hockett (1955: 84) admits that in his survey he may have made some 'arbitrary' decisions. Thus, he observes that he has assigned three vowel heights rather than two to systems like /i, y, u, e, a, o/ and /i, ɨ, u, e, a, o/ (34), because 'the /a/ in any such case is typically lower than the /e o/'.

(34)   Six-vowel systems: three heights
   a. Sixth vowel /y/   b. Sixth vowel /ɨ/

i	y		u
e			o
		a	

i		ɨ		u
e				o
		a		
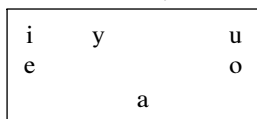
He goes on, 'Yet such a minor difference in height is not always decisive', as,
for example, in Fox. Though Hockett would no doubt deny it, it appears clear
that his decisions here are not arbitrary (though they may be incorrect), but are
based on his understanding of how these systems function.

Hockett makes decisions like these throughout his survey of vowel and
consonant systems. To take one more example involving vowels, he writes
(1955: 84–5) that a 3+1 system 'is reported for Amahuaca' (35a), 'though the
/ɨ/ may be lower than /i, u/, placing Amahuaca rather with Ilocano and others'
(35b). He observes that in the Filipino (Austronesian) languages represented
by (35b), /ə/ has fronted variants, and also higher central or back unrounded
variants.

(35)   Vowel systems: 3+1 vs 2+1+1 (Hockett 1955)
        a. Amahuaca   b. Ilocano

i		ɨ		u
		a		

i				u
		ə		
		a		
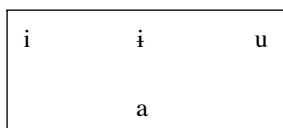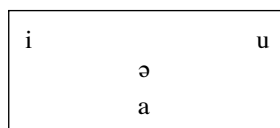
It is not important, for the purposes of this discussion, whether Amahuaca (a
Panoan language of Peru and Brazil) is as in (35a) or (35b). What is important
is that Hockett believes it is meaningful to assign it to one or the other. If there
is indeed no way to distinguish between determined and determining features,
we could not represent Ilocano as in (35b), since this diagram implies that
the determining features of /ə/, for example, are that it is central and mid,
even though it has variants that are front and others that are high. Similarly,
Amahuaca could not be represented as in (35a) if /ɨ/ is phonetically lower than
/i, u/ to any extent, because that means making a decision that its centrality is
the determining feature and its lower height is the determined feature.

Hockett's discussion of consonant systems is also at odds with his stated
theoretical position. He begins his discussion of classification of consonants by
observing, 'It does not seem feasible to handle them as wholes for constitutional
classification; it seems better to develop some manner of breaking them up into

subsystems' (1955: 95). The breaking up into subsystems begins with a binary split, typically dividing the obstruents from the sonorants. To illustrate, he presents the table of Ossetic (Iranian) shown in (36).[19]

(36)   Consonant system of Ossetic (Hockett 1955)

p		t		c	tʃ	k	
pʰ		tʰ		cʰ	tʃʰ	kʰ	
b		d		ɟ	dʒ	g	ʔ
f				s	ʃ	x	
v				z	ʒ	ɣ	
m		n					
w	j		r	l			

As to what counts as an obstruent, Hockett writes, 'We include among the obstruents not only all stops and affricates and most spirants, but also, in some cases, a [y]-like, [w]-like, or [l]-like consonant *if it fits neatly into the scheme*, and if distributional facts do not militate against such a treatment' (1955: 96, italics added).

Though the main split in the consonant system is often obstruent ~ sonorant, 'In a few cases all the consonants, apart from manner consonants (if any), must be otherwise dichotomized in the first instance, the classification into obstruent and sonorant coming second'. He illustrates with Lifu (Malayo-Polynesian), in which the voicing contrast 'is operative throughout the system except for /h/; the latter is a manner consonant and pairs off with the whole set of voiceless obstruents and sonorants'.

(37)   Consonant system of Lifu (Hockett 1955: 96)

p	t		ʈ	tʃ	k	
f	θ	s		ʃ	x	h
m̥	n̥			ɲ̊	ŋ̊	
w̥	l̥					
b	d		ɖ	dʒ	g	
v	ð	z		ʒ	ɣ	
m	n			ɲ	ŋ	
w	l					

<hr>

19 I have replaced some of Hockett's symbols with their IPA counterparts in this and the following chart.

Hockett calls the laryngeals in Ossetic and Lifu 'manner consonants' because 'they match one or another of the styles of delivery found for obstruents'. He also considers Russian /y/ (= IPA /j/) a manner consonant, because it 'matches the whole set of palatal consonants as over against the plain consonants'.

Hockett's analysis translates easily into a contrastive hierarchy. Indeed, it is exactly a hierarchy of successive binary splits, but not carried out all the way or entirely explicit. Ossetic first splits into obstruent ∼ sonorant sets. Then /ʔ/ splits from the rest of the obstruents. We could interpret Hockett's designation of 'manner consonant' to mean that /ʔ/ is placeless, being characterized only by the fact it is an obstruent. The rest of the obstruents are then split into place and manner categories. The diagram suggests that the coronal sonorants do not have a definite place. In Lifu, the first division is voiceless ∼ voiced. Then /h/ splits away from the voiceless set, and can be interpreted along the lines of Ossetic /ʔ/.

Hockett's grounds for adopting these diagrams are distributional. With respect to Lifu, he notes (1955: 96) that 'Distributional classification supports the constitutional grouping indicated above: only voiced consonants (and all of them except /w ŋ g ɣ v/) occur finally.' Thus, there are empirical grounds, based on phonological patterning, for organizing segment inventories one way rather than another. We see, then, that Hockett's practice throughout the *Manual* is inconsistent with his discussion of the French obstruents.

One could argue that Hockett viewed his diagrams simply as ways of expressing distributional or other generalizations about inventories, and not as expressing any 'correct' analysis of the grammar. Ultimately, it is not really important if Hockett thought of his classifications as real or as useful fictions. What is important is his practice, which is reminiscent of Trubetzkoy's in this sense: when he considers the problem of contrast in the abstract, he arrives at conclusions that are not consistent with what he does when he needs to make sense of actual data; in such cases, where there is real empirical evidence for doing things a certain way, he assigns contrastive features in terms of a language-particular contrastive hierarchy.

3.7 Prolegomenon to a theory of contrastive specification

In this chapter we have surveyed the work of some leading phonologists from the structuralist period (Roman Jakobson will be discussed further in the next chapter). I have argued that issues of phonological contrast were central to their thinking. Matters are somewhat more obscure when we try to isolate an explicit or consistent approach to assigning contrastive features. However, when we put

together their most insightful and empirically supported analyses we can begin to distil the main principles of a theory of contrastive specification.

Of the various features that characterize a phoneme, we must distinguish between those that are contrastive and those that are redundant. We do so by ordering the features into a contrastive hierarchy, and assigning features to phonemes in order until each phoneme has been uniquely distinguished from every other one. The contrastive features make up the 'phonemic content' of a phoneme. There are in principle different ways of ordering the features for a given set of phonemes, and each ordering corresponds to a particular set of contrastive specifications. In this sense, the contrastive structure of a language is a function of 'point of view', that is, of a particular way of ordering the features.

This variability gives rise to a fundamental question: how do we know what the particular ordering is in any given case? The works surveyed in this chapter suggest a general answer to this question. We can recognize the phonemic content of a phoneme by its 'patterning', that is, by the way it behaves. A common assumption of the authors surveyed above is that the behaviour of a phoneme is a function of its contrastive features. Reviewing the cases discussed above, we can compile a list (38) of diagnostics used in this chapter for identifying contrastive features.

(38)   Diagnostics used in identifying contrastive features
        A phoneme φ has contrastive feature F if:
        a. φ enters into an alternation or neutralization that is best explained if F is part of φ (cf. Sapir (1); Trubetzkoy, Czech /ɦ/, Polabian front vowels (13), Bulgarian vowels (19)).
        b. φ causes other phonemes to alternate or neutralize in a way that is best explained if F is part of φ (Trubetzkoy, Polabian (13), Artshi round vowels (22), Japanese front vowels (24)).
        c. φ participates in a series with other phonemes, Φ, with respect to phonotactic distribution, where F is required to characterize Φ in a general way (Sapir (1); Trubetzkoy, Greek (10)).
        d. the set of allophones which make up φ all have F in common (Trubetzkoy, German /x/ and German, Czech and Gilyak /r/; Hockett, Rutul, Fox, Shawnee back vowels (32)).
        e. speakers adapt a sound from another language in a way that can be explained by supposing that they assign F to the foreign sound (Jakobson and Lotz, English /ŋ/ adapted as French /ɲ/; also Jakobson (1962b [1931]), Slovak, Russian and Czech ability to pronounce foreign front rounded vowels).

To the extent they are not present or contradicted, some of these diagnostics can be used conversely to identify system-redundant features (39).

(39)   Diagnostics used in identifying system-redundant features
        Feature F is system redundant (noncontrastive) in phoneme φ if the set of
        allophones which make up φ do not have F in common:
        a. Trubetzkoy: dorsal and palatal features not contrastive in German /x/.
        b. Trubetzkoy: place of articulation not contrastive in German /r/.
        c. Hockett: [round] not contrastive in Rutul, Fox, Shawnee back vowels (32).

We have also seen some arguments for ordering features in a given system
(40).

(40)   Diagnostics for ordering features
        If a phoneme φ has two features, F and G:
        a. F is ordered above G if F is contrastive in φ and G is system redundant in
           φ (based on the general assumption in all authors above that
           phonologically irrelevant features do not participate in phonemic content).
        b. if F and G are both contrastive, F is ordered above G if G is neutralizable
           and F is not (Trubetzkoy, Polabian (13)).
        c. F is ordered above G if F applies to a wider range of phonemes than G
           (Hockett, Ossetic [sonorant] > [voiced] (36), Lifu [voiced] > [sonorant]
           (37)).

The above make up a preliminary set of principles that may contribute to
a theory of contrastive specification. It is not clear that all of the above diag-
nostics are valid, or valid in all circumstances, and we will try to refine these
principles in later chapters. Much has also been left open. To take one important
issue, we have not attempted to clarify the relationship between contrast and
specification. A natural assumption is that contrastive features are specified
in a phoneme and redundant features are unspecified; but this is not a neces-
sary position to take. As Stephen Anderson (1985) and Calabrese (1995) have
emphasized, distinguishing between contrastive and redundant features does
not necessarily imply that the latter must be absent from representations. In
a theory where all features are specified, for example, we can still designate
some as contrastive. In that kind of theory, the above remarks about phonemic
content and related matters still hold, but must be understood not as making a
distinction between features that are present and those that are entirely absent,
but rather as distinguishing between features that are present as contrastive
features and those that are not. However, this and other issues must be deferred
to chapters 7 and 8.

To conclude this section, let us first subsume the various diagnostics in
(38) under a general term, and look at a sample example. We will say that
a feature that exhibits one of the characteristics of (38) is *phonologically*

active. Conversely, a feature that does not have one of these characteristics is *phonologically inert*. Now the various diagnostics for identifying contrastive features follow from the hypothesis in (41).

(41)   Contrast and phonological activity (preliminary hypothesis)
        Only contrastive features are active in the phonology. System-redundant
        features are inert.

D. C. Hall (2007: 20) calls this idea the *Contrastivist Hypothesis*, which he formulates as in (42).

(42)   The Contrastivist Hypothesis (D. C. Hall 2007)
        The phonological component of a language L operates only on those features
        which are necessary to distinguish the phonemes of L from one another.

Let us consider again the Artshi example (22) as analysed by Trubetzkoy. The vowels /u/ and /o/ cause the distinction between rounded and unrounded consonants to be neutralized, when they are adjacent to these consonants. Since the affected feature involves rounding, it is reasonable to suppose that the neutralization is caused by the feature [+round] associated with these vowels. That is, the feature [round] is active in these vowels. By hypothesis (41), only contrastive features are active. Therefore, the feature [round] must be contrastive in /u/ and /o/. Since there is no evidence that the feature [back] is contrastive in these vowels, we assume that this feature is system redundant, because no contrastive hierarchy exists that would assign these vowels the contrastive feature [+back] if they are already assigned [+round].

Note a certain benign circularity here: we hypothesize that only contrastive features are active, and then we decide that the feature [round] is contrastive in /u/ and /o/ because it is active in these vowels. This circularity is 'benign' because it is the typical circularity characteristic of scientific explanation. To explain why objects fall to the earth with a certain acceleration, we posit a force of gravity; evidence for this force is the fact that objects fall with a certain acceleration. What is important is that contrast and activity are not defined in terms of each other: activity is not part of the definition of contrast, and contrast is not part of the definition of activity. Activity is not defined in terms of contrast because the various manifestations of activity do not refer to the contrastive status of features. Contrast is not defined in terms of activity because the notions of feature ordering and the SDA do not refer to activity. Moreover, there are situations where we must designate features as contrastive to differentiate between phonemes in the absence of any evidence of activity.

At a practical level, the hypothesis that only contrastive features are active can be easily falsified. If in Artshi, for example, we found that the features [round] and [back] were both active in /u/ and /o/, and that [+low] was active in /a/, this result would not be consistent with the hypothesis in (41). For there is no feature ordering that would make all these features contrastive at the same time. Conversely, this hypothesis is supported to the extent that we find cases where the active features are consistent with orderings that make them contrastive.

To sum up, based on the work surveyed in this chapter, we have sketched the beginnings of a theory of phonology that assigns a central role to contrastive feature specifications. So far, this theory has two main tenets: (1) only contrastive feature specifications are active in the phonology (the Contrastivist Hypothesis), and (2) contrastive features are assigned by ordering the features and applying the SDA.

In the work surveyed above, the Contrastivist Hypothesis was much in evidence in practice, if not in name, but the contrastive hierarchy was not clearly understood. In the next chapter we will see that the contrastive hierarchy was promoted to a leading place in phonological theory by Roman Jakobson and his colleagues; its connection to phonological activity, however, was loosened and eventually lost, along with the Contrastivist Hypothesis.