Contrastive Hierarchy Theory and the Nature of Features

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1. Introduction

I will present a brief introduction to a theory of contrastive features in phonology. I will set out the main tenets of this theory, and consider what implications it has for understanding phonological features. I propose that the language learner's task is to arrive at a set of hierarchically-ordered contrastive features that account for the phonological patterning of the input language. That is, I assume that the contrastive feature hierarchy is universal, not the features themselves or their ordering. This requirement puts strong constraints on phonological representations, and accounts for why phonological systems resemble each other, without assuming that features are innate. This approach also makes it possible for us to consider possible parallels between phonological and morphosyntactic features in a new light.

In section 2, I briefly review why there is a growing consensus that phonological features are not innate, and why it is necessary to have something else that will account for why phonological representations are the way they are. In section 3, I present the main tenets of contrastive hierarchy theory, and show how it imposes strong constraints on feature systems, and on the relation between contrast and phonological activity. Section 4 gives an extended example that illustrates how a contrastive feature hierarchy can contribute to the synchronic analysis of the Oroqen vowel system. In section 5, I review recent proposals by Cowper and Hall that morphosyntactic features are also organized into contrastive hierarchies. Section 6 is a brief conclusion.

2. Phonological features: Not innate, but why emergent?

There is a growing consensus that phonological features are not innate, but rather ‘emerge’ in the course of acquisition. Most of the contributions to a volume titled *Where do phonological features come from?* (Clements & Ridouane 2011) take an emergentist position; none argue for innate features. Mielke (2008) and Samuels (2011) summarize the arguments against innate features. From a biolinguistic perspective, phonological features are too specific, and exclude sign languages (van der Hulst 1993; Sandler 1993). Empirically, no one set of features have been discovered that ‘do all tricks’ (as Hyman 2011 writes with respect to tone features, but the remark applies more generally). Finally, since at least some features have to be acquired based on evidence of language-specific phonological activity, a prespecified list of features becomes less useful in learning than had once been thought.

But if features are not innate, what compels them to emerge at all? It is not enough to assert that features *may* emerge, or that they are a useful way to capture phonological generalizations. Assuming that phonological representations are indeed composed of distinctive features, we need to explain why features *inevitably* emerge, and why they have the properties that they do.[1] In particular, we have to

[*] University of Toronto, dresher@chass.utoronto.ca. This is a slightly revised version of portions of my talk at WCCFL 35. I would like to thank the audience for their comments and questions. For discussions, ideas, and analyses I would also like to thank Elizabeth Cowper, Daniel Currie Hall, Christopher Harvey, Peter Jurgec, Ross Krekoski, Andrew Nevins, Will Oxford, Keren Rice, Christopher Spahr, and Zhang Xi.

[1] Though I assume here that phonological primes are binary features, it is an empirical hypothesis that the learner creates binary features and not other sorts of entities, such as privative elements or dependency structures of various kinds. I have argued (Dresher 2014) that such elements should also be organized into contrastive hierarchies (*pace* Scheer 2010).

 Proceedings of the 35th West Coast Conference on Formal Linguistics, ed. Wm. G. Bennett et al., 18-29. Somerville, MA: Cascadilla Proceedings Project.

explain why learners, or some learners, do not simply posit segment-level representations. Further, are there limits to how broad or narrow features are, or how many features can be associated with a given phonological inventory? How many features should learners posit for a three-vowel system, for example?

Contrastive hierarchy theory provides an answer to these questions: learners must arrive at a set of hierarchically ordered features that distinguish between all the phonemes of their language. We will see that this requirement imposes strong constraints on the number of features that can be posited, and on what feature systems can look like.

3. A theory of phonological contrast

The theory of contrast presented here has roots in the work of the Prague School phonologists N. S. Trubetzkoy and Roman Jakobson and their colleagues and students. These phonologists emphasized the importance of contrastive features in the patterning of phonological systems; over time, contrastive features came to be associated with ‘branching trees’. This style of contrastive underspecification entered the literature rather inconspicuously, as I have tried to show in a number of publications (Dresher 2009, 2015, 2016). Early, though inexplicit, examples can be found in the work of Jakobson (1962 [1931]) and Trubetzkoy (1939) in the 1930s, and continuing with Jakobson 1941 and Jakobson & Lotz 1949. More explicit examples can be found in Jakobson, Fant & Halle 1952, Cherry, Halle & Jakobson 1953, Jakobson & Halle 1956, and Halle 1959. This approach was imported into early versions of the theory of Generative Phonology; it is featured prominently in Harms 1968, the first Generative Phonology textbook. However, branching trees (and contrastive underspecification, more generally) were omitted from Chomsky & Halle 1968, and disappeared from mainstream phonological theory for the rest of the century.

As a general theory of phonological representations, branching trees were revived, under other names, by Clements (2001, 2003, 2009), and independently at the University of Toronto, where they are called contrastive feature hierarchies (Dresher, Piggott & Rice 1994; Dyck 1995; Zhang 1996; Dresher 1998; Dresher & Rice 2007; Hall 2007; Dresher 2009; etc.). It is the latter approach I will be presenting here. It has gone under various names: Modified Contrastive Specification (MCS), ‘Toronto School’ phonology, Contrast and Enhancement Theory, or just Contrastive Hierarchy Theory.[2]

3.1. Main tenets of the theory

The first major building block of our theory is that contrasts are computed hierarchically by ordered features that can be expressed as a branching tree. Branching trees are generated by what I call the Successive Division Algorithm (Dresher 1998, 2003, 2009):

(1) The Successive Division Algorithm
Assign contrastive features by successively dividing the inventory until every phoneme has been distinguished.

What are the criteria for selecting and ordering the features? Phonetics is clearly important, in that the selected features must be consistent with the phonetic properties of the phonemes. For example, a contrast between /i/ and /a/ would most likely involve a height feature like [low] or [high], though other choices are possible, such as [front/back] or [advanced/retracted tongue root].

Of course, the contrastive specification of a phoneme can sometimes deviate from its surface phonetics. In some dialects of Inuktitut, for example, an underlying contrast between /i/ and /ɨ/ is neutralized at the surface, with both /i/ and /ɨ/ being realized as phonetic [i] (Compton & Dresher

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[2] See Dresher 2009: 163f. for references and a detailed review of early work in the MCS framework. For more recent applications and developments, see Hall 2011, 2017, Mackenzie 2011, 2013, Ko 2012, Spahr 2014, 2016, Oxford 2015, Hall & Hall 2016, and Krekoski 2016.

2011). In this case, /i/ and /ɨ/ would be distinguished by a contrastive feature, even though their surface phonetics are identical.[3]

As the above example shows, the way a sound patterns can override its phonetics (Sapir 1925). Thus, we consider as most fundamental that features should be selected and ordered so as to reflect the *phonological activity* in a language, where activity is defined as follows (adapted from Clements 2001: 77):

(2) Phonological activity
A feature can be said to be *active* if it plays a role in the phonological computation; that is, if it is required for the expression of phonological regularities in a language, including both static phonotactic patterns and patterns of alternation.

The second major tenet has been formulated by Hall (2007) as the Contrastivist Hypothesis:

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

That is, *only* contrastive features can be phonologically active. If this hypothesis is correct, then (4) follows as a corollary:

(4) Corollary to the Contrastivist Hypothesis
If a feature is phonologically active, then it must be contrastive.

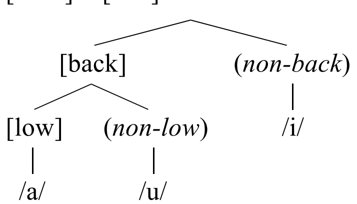
One final assumption is that features are binary, and that every feature has a marked and unmarked value. I assume that markedness is language particular (Rice 2003, 2007) and accounts for asymmetries between the two values of a feature, where these exist. I will designate the marked value of a feature F as [F], and the unmarked value as (*non-F*). I will refer to the two values together as [±F].

3.2. Restrictions on feature systems

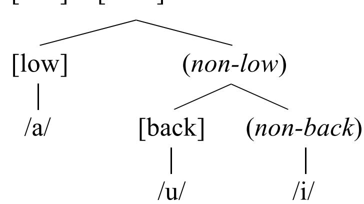
The theory proposed above imposes major restrictions on feature systems. For example, if a language has three vowel phonemes /i, a, u/, and if the vowels are split off from the rest of the inventory so that they form a sub-inventory, then they must be assigned a contrastive hierarchy with exactly two vowel features. Though the features and their ordering may vary, the limit of two features constrains what the hierarchies can be. Two possible contrastive hierarchies using the features [back] and [low] are shown in (5).

(5) Two contrastive hierarchies for a three-vowel system with [back] and [low]

a. [back] > [low]



b. [low] > [back]



In (5a), [back] is ordered over [low] (indicated as [back] > [low]); therefore, all the vowels are divided on the basis of [±back]. There is only one (*non-back*) vowel, /i/; as it is already distinguished from the other vowels, it receives no further features. In this ordering, [±low] is contrastive only

[3] While the realizations of the two phonemes are identical, their effects on neighbouring segments differ, which is how we can tell them apart.

among the [back] vowels, and distinguishes /a/ from /u/. In (5b), all the vowels are distinguished by [±low], with [±back] being contrastive only in the (*non-low*) domain. Though the two systems in (5) make use of the same features and appear to have the 'same' phonemes, we expect them to pattern differently. In (5a), /u/ is most closely connected to /a/, whereas in (5b) it is closer to /i/; we predict that these differences in organization will be reflected in patterns of merger and neutralization. In (5a), both /a/ and /u/ have a contrastive [back] feature that could participate in phonological processes, such as vowel harmony or consonant backing; in (5b), only /u/ is contrastively [back], and we would not expect /a/ to trigger backing.

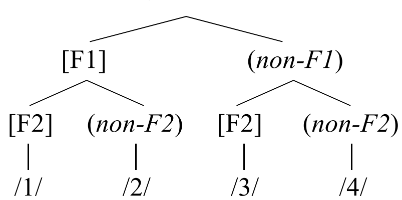
Another difference between the systems in (5) is that in (5a), the marked value of the higher feature is expanded, with the consequence that one vowel (/a/) has two marked features. In (5b), the unmarked value of the higher feature is expanded, and no vowel has more than one marked feature. Though the content of the features may vary from language to language, every three-vowel system will have a contrastive feature tree that is isomorphic to either (5a) (if the marked value of the higher feature is expanded) or (5b) (if the unmarked value is expanded).

A four-phoneme inventory can have a minimum of two features and a maximum of three. Four such feature systems are shown in (6), where *Fi* represent features whose phonetic content is to be supplied. The tree in (6a) represents a system with maximum economy, wherein the two features completely cross-classify the four phonemes, which are represented by /1/–/4/. In this system there are four marked specifications: /1/ has marked values of [F1] and /F2/; /2/ is marked for [F1]; /3/ is marked for [F2]; and /4/ has no marked specifications.

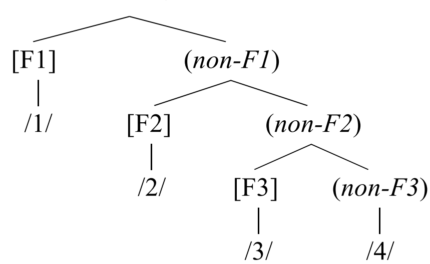
The trees in (6b–d) represent systems that use three features for four phonemes. They differ in how many marked specifications they have. The system in (6b) has three marked feature specifications: /1/, /2/, and /3/ are marked for [F1], [F2], and [F3], respectively, and /4/ is unmarked. (6c) is a system with five marked specifications, and (6d) has six, which is the maximum limit. Not shown is one more three-feature system with a symmetrical tree like (6a), where [F1] expands to [±F2] and (*non-F1*) expands to [±F3]). Though marked features may vary from three to six, the limit of three features may not be exceeded.

(6) Contrastive hierarchies for a four-phoneme system

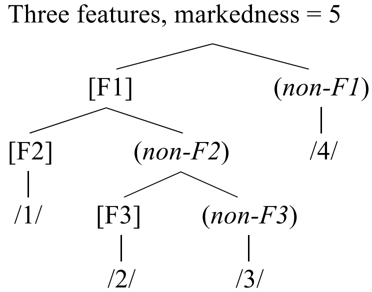
a. Two features, markedness = 4



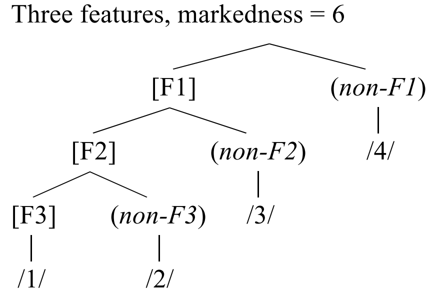
b. Three features, markedness = 3



c. Three features, markedness = 5



d. Three features, markedness = 6



In general, the number of features required by an inventory of *n* elements will fall in the following ranges: the minimum number of features is equal to the smallest integer that is greater or equal to $\log_2 n$; and the maximum number of features is equal to n–1. Some sample values of feature minima and maxima for inventories of different sizes are shown in Table 1.

Phonemes	$\log_2 n$	min	max
2	1	1	1
3	1.58	2	2
4	2	2	3
5	2.32	3	4
6	2.58	3	5
7	2.81	3	6
8	3	3	7

Phonemes	$\log_2 n$	min	max
10	3.32	4	9
12	3.58	4	11
16	4	4	15
20	4.32	5	19
25	4.64	5	24
32	5	5	31
36	5.17	6	35

Table 1: Minimum and maximum number of features for various-sized phoneme inventories

As can be observed in Table 1, the minimum number of features goes up very slowly as phonemes are added; the upper limit rises with *n*. However, inventories that approach the upper limit are extremely uneconomical. At the maximum limit, each new segment is distinguished by a unique contrastive feature that is unshared by any other phoneme. For practical reasons, this upper limit is almost unattainable for larger inventories. Thus, the contrastive hierarchy and Contrastivist Hypothesis account for why phonological systems resemble each other in terms of representations, without requiring individual features to be innate.

3.3. Enhancement of contrastive features

Unless a vowel is further specified by other contrastive features (originating in another vowel or in the consonants), it is made more specific only in a post-phonological component. Stevens, Keyser & Kawasaki (1986) propose that feature contrasts can be enhanced by other features with similar acoustic effects (see also Stevens & Keyser 1989; Keyser & Stevens 2001, 2006). Hall (2011) shows how the enhancement of contrastive features can result in configurations predicted by Dispersion Theory (Liljencrants & Lindblom 1972; Lindblom 1986; Flemming 2002). Thus, a vowel that is [back] and (*non-low*), like /u/ in (5), can enhance these features by adding {[round]} and {[high]}, becoming [u]. I follow Purnell & Raimy (2015) in indicating non-contrastive properties contributed by enhancement in curly brackets. These enhancements are not necessary, however, and other realizations of /u/ in (5) are possible (Dyck 1995; Hall 2011).

4. Contrastive feature hierarchies in synchronic phonology: The Oroqen vowel system

The Xunke dialect of Oroqen (Tungusic, Northern China and Inner Mongolia) has nine vowel phonemes (length contrasts are omitted; they are not relevant here):[4]

(7) Xunke Oroqen vowel system (length distinctions omitted)

/i/		/u/
		/ʊ/
/e/	/ə/	/o/
/ɛ/		/ɔ/
	/a/	

For insight into what features might be contrastive in this language, we need to look at how the vowels pattern, that is, at the types of phonological activity they exhibit. The three most notable kinds of phonological activity involving vowels are RTR (retracted tongue root) harmony, labial (rounding) harmony, and palatalization. We will consider each of these in turn.

[4] This inventory is based on the accounts of Hu (1986), Zhang, Li & Zhang (1989), Li (1996), and Zhang (1996). Every vowel except /e/ and /ɛ/ has a long counterpart. Sources differ as to whether /e/ and /ɛ/ are short, long, or diphthongs, but these details are not relevant here.

4.1. RTR harmony

Vowels fall into two sets: yin, or non-RTR, vowels include /u, e, ə, o/; yang, or RTR, vowels include /ʊ, ɛ, a, ɔ/. Only vowels from the same set may co-occur in a word, as shown in (8):

(8) [RTR] and (*non-RTR*) vowels do not co-occur in a word (Zhang 1996: 155–156)

a. RTR words		b. Non-RTR words	
ʊla	'quill'	ulə	'meat'
ɔɔjalɛɛ	'sisters-in-law'	ujəlee	'cousin'
kɔɔsʊn	'empty'	kosuun	'pond'

The vowel /i/ is neutral and may co-occur with either set (9):

(9) /i/ occurs in both [RTR] and (*non-RTR*) words (Zhang 1996: 157)

a. RTR words		b. Non-RTR words	
mʊrin-	'horse'	nəkin-	'sweat'
tari-	'that'	ulin-	'gifts'
birakan-	'river'	bitə-	'letter'

Except for /i/, every non-RTR vowel has an RTR counterpart with which it alternates: /u/ alternates with /ʊ/, /e/ with /ɛ/, /ə/ with /a/, and /o/ with /ɔ/. The RTR vowels /ʊ/, /ɛ/, /a/, and /ɔ/ trigger RTR stem-to-suffix harmony within a word, creating alternations in suffix vowels. An example is the definite object, which alternates between *-wə* in non-RTR words and *-wa* in RTR words; in the words in (10), /w/ appears as *m* following a nasal consonant. Another example is the dative suffix *-du/dʊ*.

(10) Stem-to-suffix RTR harmony (Zhang 1996: 180–181)

a. RTR words		b. Non-RTR words	
kɔɔkan-ma	'child DEF.OBJ'	bəjun-mə	'moose DEF.OBJ'
bʊwa-dʊ	'place DAT'	utə-du	'son DAT'

The vowel /i/ is neutral and transparent to harmony (11): it does not disrupt the RTR or non-RTR character of a word:

(11) /i/ is neutral and transparent to RTR harmony (Zhang 1996: 158, 180–181, 190)

a. RTR words		b. Non-RTR words	
mʊrin-sal	'horse PL'	dəji-səl	'bird PL'
wargi-tʃara	'salty DIM'	toŋgorin-tʃərə	'round DIM'
tʊkala-dʒi	'clay INST'	sukə-dʒi	'axe INST'

The evidence from activity, therefore, is that every vowel except /i/ has a plus or minus value of an active feature that I have been calling [RTR]; by hypothesis, this feature must be contrastive. Note that /i/ is phonetically {(*non-RTR*)}, so it is not immediately obvious on phonetic grounds that /i/ is not contrastive for this feature.[5] Nevertheless, in order to account for the facts of RTR harmony, the Oroqen learner will have to find a feature ordering in which the feature [±RTR] does not apply to /i/.

[5] On the contrary, it has been asserted that high front vowels are particularly compatible with an advanced tongue root and antagonistic to a retracted tongue root (Archangeli & Pulleyblank 1994); one might therefore suppose that /i/ would be the vowel *most* likely to occur exclusively with (*non-RTR*) vowels, but this is not the case. It appears that it is the contrastive status of /i/, and not its phonetic characteristics, that determines its non-participation in RTR harmony.

4.2. Labial (rounding) harmony

Only the low vowels /o/ and /ɔ/ trigger labial harmony, and only /ə/ and /a/ undergo rounding: /ə/ alternates with /o/, and /a/ alternates with /ɔ/. Two successive /ɔ/ or /o/ vowels cause a suffix /a/ or /ə/ to become round.[6] In RTR words, the present tense suffix *-ra* alternates with *-rɔ*, and in non-RTR words, *-rə* alternates with *-ro*, as shown in (12). Note that /u/ and /ʊ/ do *not* trigger rounding, as shown in (13).

(12) Stem-to-suffix labial harmony

a.	RTR words		b.	Non-RTR words	
	baka-ra	'get PRES.TNS'		nəkə-rə	'weave PRES.TNS'
	ɔlgɔɔ-rɔ	'dry PRES.TNS'		mooro-ro	'moan PRES.TNS'

(13) No labial harmony with /u, ʊ/

a.	RTR words	ʊrʊʊn-ma	'hoof DEF.OBJ'	*ʊrʊʊn-mɔ
b.	Non-RTR words	ulgulu-wə	'moose DEF.OBJ'	*ulgulu-wo

The evidence from activity here, then, is that /o/ and /ɔ/ must have an active, therefore contrastive, feature that causes rounding. [round] (or [labial]) is an obvious candidate. These vowels alternate with /ə/ and /a/, the only vowels that undergo rounding, suggesting they are contrastively (*non-round*). As with [RTR], the restriction of the contrastive feature [±round] to these particular vowels is not obvious from the phonetics, because /u/ and /ʊ/ are also phonetically {[round]}; however, there is no evidence that that they have an active [round] feature.

4.3. Palatalization

The front vowels /i/, /e/ and /ɛ/ cause palatalization of a preceding /s/, shown in (14); this suggests that they have a contrastive triggering feature we will call [front] (or [coronal]).

(14) Palatalization of /s/ to [ʃ] before front vowels (Zhang 1996: 171–172)

a.	[s] before non-front vowels			b.	[ʃ] before front vowels		
	sukə	[suxə]	'axe'		asi	[aʃi]	'now'
	sʊnta	[sʊnta]	'deep'		sɛɛn	[ʃɛɛn]	'ear'
	sɔkɔ-	[sɔxɔ]	'fill'				
	sələ	[sələ]	'iron'				
	sarbʊ	[sarbʊ]	'chopsticks'				

4.4. Height contrast

We still need to distinguish /ə/ ~ /u/, /a/~ /ʊ/, and /e/ ~ /i/. The alternations we have seen, /ə/ ~ /a/ ~ /o/~ /ɔ/ and /u/ ~ /ʊ/ (to which we can add /e/ ~ /ɛ/), suggest that there is only one height contrast, which we can designate [±low] ([±high] would also serve here, depending on whether we consider the low or high vowels as marked).

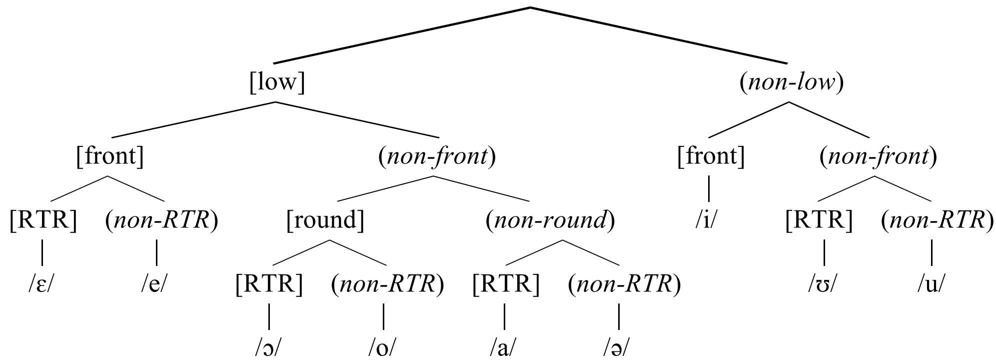
4.5. Xunke Oroqen contrastive features

Putting together the evidence of phonological activity surveyed to here, we need to arrive at a feature hierarchy that yields the required values. Zhang (1996) proposes the hierarchy: [low] >

[6] On rounding harmony in Oroqen I follow Zhang 1995, 1996, Zhang & Dresher 1996, Dresher & Zhang 2005, and Dresher & Nevins 2017; see Li 1996 and Walker 2014 for a different view. On the restriction that rounding harmony is not triggered by a single initial round vowel, see Zhang 1996, Zhang & Dresher 1996, Walker 2001, and Dresher & Nevins 2017.

[coronal] > [labial] > [RTR]. I adopt this analysis, substituting [front] for [coronal] and [round] for [labial]. This feature hierarchy, applied to the vowels in (7), yields the tree diagram in (15).

(15) Xunke Oroqen contrastive hierarchy: [low] > [front] > [round] > [RTR]



The feature specifications in (15) satisfy the requirement that every active feature be contrastive. Every vowel except /i/ is specified for [±RTR], thereby accounting for why only /i/ does not participate in RTR harmony. Only vowels with contrastive [±round] participate in labial harmony, and only vowels specified [front] cause palatalization.

To sum up, we have been able to give an account of the vowel phonology of Oroqen that is consistent with the Contrastivist Hypothesis: all the active features are contrastive. Moreover, this analysis *explains* why certain vowels participate in certain processes and others do not, in ways that are not obvious from their phonetic descriptions.

5. Contrastive feature hierarchies in morphosyntax

In a series of papers, Elizabeth Cowper and Daniel Currie Hall have shown that language-particular contrastive feature hierarchies are not limited to phonology, but also play an important role in morphosyntax (Cowper & Hall 2013, 2014a, 2014b, 2017). Here I will review two of their examples: number features in English, and non-present tenses in Bamileke-Dschang.

5.1. English number features

English nouns are classified as being either singular (as in *this book*, *a book*), plural (*these books*, *books, some books*) or mass (*this mud*, *mud*, *some mud*). As shown in (16a), singular and mass nouns share the demonstrative *this* against the plural, which takes *these*. But mass nouns and plurals share the null article and *some* against the singular, which requires *a* (16b).

(16) Syncretisms in the English number system

	SINGULAR	MASS	PLURAL
a.	*this book*	*this mud*	*these books*
b.	*a book*	*Ø/some mud*	*Ø/some books*

Cowper & Hall (2017) show that these syncretisms can be captured better with a contrastive hierarchy than with feature geometry. They propose that the feature [number] in English is sub-divided by two features: [atomic], which marks singular, and [discrete], for plural. These features are ordered [atomic] > [discrete], as in (17).

(17) English number hierarchy

[atomic] *a, an*
SINGULAR
this, -Ø

(*non-atomic*) *Ø, some*

(*non-discrete*)
MASS
this, -Ø

[discrete]
PLURAL
these, those, -s

The first split is between [atomic] and (*non-atomic*). [atomic] marks singular nouns and is spelled out by the determiner *a(n)*; (*non-atomic*) is the default, spelled out by *Ø* or *some*. (*non-atomic*) is divided by [discrete], which marks plural, spelled out by *these*, *those*, and the plural suffix -*s*. Nouns that are not [discrete] default to *this* and -*Ø*.

Cowper & Hall (2017) point out that the expansion of the unmarked feature (*non-atomic*) in (17) would not be possible if the feature [atomic] were privative, as there would be no unmarked feature to expand. In a privative system [non-atomic] would have to be treated as the marked value, to allow for the further expansion of that node. They argue that such an analysis is less adequate and intuitive than the one in (17).

5.2. Bamileke temporal proximity features

The Dschang dialect of Bamileke (Grassfields Bantu) distinguishes five degrees of proximity that cross-classify with a distinction between past and future, giving ten non-present tenses: P1–P5 and F1–F5 (Hyman 1980, citing work by Maurice Tadadjeu). These tenses are shown in Table 2:

DEGREE	INTERPRETATION: PAST	INTERPRETATION: FUTURE
1	'immediate past'	'immediate future'
2	'same day'	'same day'
3	'previous day'	'next day'
4	'several days ago'	'several days in the future'
5	'distant past' (a year or more)	'distant future' (a year or more)

Table 2: Bamileke-Dschang non-present tenses (Hyman 1980)

Cowper & Hall (2017) propose that the five degrees of temporal proximity can be specified using three features, which create the hierarchy shown in (18):

(18) Bamileke temporal proximity feature hierarchy: [same day] > [near] > [far]

[past/future]

[same day]

[near]
1
'immediate pst/fut'

(*non-near*)
2
'same day'

(*non-same day*)

[near]
3
'previous/ next day'

(*non-near*)

(*non-far*)
4
'several days ago/in the fut'

[far]
5
'distant pst/fut'

The first feature is [±same day]. The positive value is divided by [±near]: the most proximate time is [same day, near], which is degree 1; [same day, *non-near*] is degree 2. The same feature [±near] also divides (*non-same day*). The closest in time one can be if not on the same day is the previous day or the next day (degree 3). The (*non-near*) branch is divided by a new feature, [±far]. (*non-far*) is degree 4 (not the same day, and not the previous or next day), and [far] is the distant past or future.

Cowper & Hall (2017) point out that both the *applicability* and the *interpretation* of a feature depends on its place in the hierarchy. Thus, the feature [±far] is contrastive only for events that are (*non-same day, non-near*). It does not apply to [same day] or [near] events. And the feature [±near] is interpreted differently depending on whether it applies to [same day] or (*non-same day*) events. Here, too, it is crucial to allow both marked and unmarked feature values to be expanded. Contrastive feature hierarchies thus allow for elegant and economical representations of the ten non-present tenses.

6. Conclusion

It is a recurring intuition of phonological theorists that the phonological systems of the world's languages use a very limited set of features (Jakobson, Fant & Halle 1952; Chomsky & Halle 1968). I have argued here that this is not because there is a limited set of innate universal features; the impression that all languages use the same substantive features is to some extent an illusion. Rather, it is because Universal Grammar requires speakers to construct contrastive feature hierarchies, and *they* are what limit the number of features available to the phonology of a given language. And contrastive feature hierarchies may not be limited to phonology, but play a role in other components of language, such as morphosyntax, and perhaps in other cognitive domains as well (Nevins 2015).

In the words of Jakobson, Fant & Halle (1952: 9): "The dichotomous scale [= the contrastive feature hierarchy/BED] is the pivotal principle of the linguistic structure. The code imposes it upon the sound."

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Proceedings of the 35th West Coast Conference on Formal Linguistics

edited by Wm. G. Bennett, Lindsay Hracs, and Dennis Ryan Storoshenko

Cascadilla Proceedings Project   Somerville, MA   2018

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ISBN 978-1-57473-472-0 library binding

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This paper can be cited as:

Dresher, B. Elan. 2018. Contrastive Hierarchy Theory and the Nature of Features. In *Proceedings of the 35th West Coast Conference on Formal Linguistics*, ed. Wm. G. Bennett et al., 18-29. Somerville, MA: Cascadilla Proceedings Project. www.lingref.com, document #3371.