Trade-offs in the contrastive hierarchy: Voicing *versus* continuancy in Slavic*

Daniel Currie Hall & B. Elan Dresher

Saint Mary's University, University of Toronto

1. Introduction

This paper explores some predictions made by the approach to contrastive phonological feature specifications set out in Dresher et al. (1994), Dresher (2009, 2015), and Hall (2007, forthcoming), and discusses how they are borne out in Russian in particular and in Slavic more generally. Modified Contrastive Specification (MCS) holds that the number of features assigned in an inventory is constrained by the contrasts present in the system, but does not stipulate which features are to be used in cases where a single contrast could be marked in multiple ways. In any inventory in which potentially contrastive features do not fully cross-classify, MCS therefore predicts trade-offs in which the specification of one feature implies the absence of another. Here, we consider such a trade-off between voicing and contiuancy in Slavic, taking Halle's (1959) analysis as a point of departure. In section 2, we outline key aspects of the theory and explain the predictions that it makes; section 3 presents the Russian facts and how they exemplify the expected trade-off; and section 4 extends the analysis to other related languages.

2. Modified Contrastive Specification

The theory of phonological representations we adopt here is known as Modified Contrastive Specification (MCS; Dresher et al. 1994, Dresher 2009, 2015, Hall 2007, forthcoming); it was given this name by Paradis & Prunet (1991) to distinguish it from other approaches to contrastive specification, such as those proposed by Steriade (1987) and Clements (1988). MCS has two crucial components: the Contrastivist Hypothesis (Hall 2007), which posits that only contrastive features can be phonologically active, and the Successive Division Algorithm (SDA), which generates specifications consisting solely of contrastive features by recursively dividing the underlying inventory.

Dresher (2009: 16) formulates the SDA as in (1). Unlike the intuitive method of identifying contrastive features by finding pairs of minimally different segments (Archangeli

*We are grateful to the audience at NELS 46 for their helpful comments and questions on this work.

Christopher Hammerly & Brandon Prickett (eds.): NELS 46, Vol. 2, 43–56.
GLSA Amherst.

1988), the SDA is guaranteed to result in specifications that are sufficient to distinguish all members of the inventory, because it does not terminate until each phoneme has been differentiated from the others.

(1) *The Successive Division Algorithm (SDA; Dresher 2009: 16)*

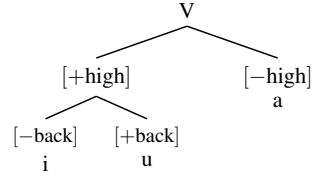
a. Begin with *no* feature specifications: assume all sounds are allophones of a single undifferentiated phoneme.
b. If the set is found to consist of more than one contrasting member, select a feature and divide the set into as many subsets as the feature allows for.
c. Repeat step (1b) in each subset: keep dividing up the inventory into sets, applying successive features in turn, until every set has only one member.

The SDA is not deterministic; while it places restrictions on how many features can be specified in a given inventory, it allows for variation in the choice of features and in the order of divisions. In any inventory in which features do not fully cross-classify, there will be some phonemic contrasts that could be marked by more than one feature. In such cases, the SDA does not stipulate which feature should be used, but once the contrast has been marked by one feature, further features marking the same contrast would be redundant and thus cannot be assigned.

The relative scope of contrasts therefore plays a crucial role in determining which features are ultimately assigned. To take a simple example for purposes of illustration, the three-vowel inventory /i u a/ can be divided in two different ways using the features [±high] and [±back], as shown in (2).[1] Whichever feature is selected first—that is, whichever one takes wider scope—will be specified on all three vowels, dividing the inventory into one subset with one vowel and another with two. The vowel in the singleton subset—either the lone [−high] vowel /a/, as in (2a), or the lone [−back] vowel /i/, as in (2b)—can receive no further specifications, because it is now fully distinct from the other two. The second feature is assigned only in the two-vowel subset.

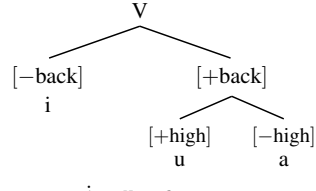
(2) *Two ways of dividing the vowel inventory /i u a/ using [±high] and [±back]*

a. [±*high*] ≫ [±*back*]*:*



	i	u	a
high	+	+	−
back	−	+	

b. [±*back*] ≫ [±*high*]*:*



	i	u	a
high		+	−
back	−	+	+

[1] Other features, such as [±round] or [±low], could be used instead, but the SDA can never use more than two binary features to distinguish any three phonemes.

In (2), the two possibilities are shown in branching diagrams illustrating the sequence of divisions, with the resulting feature specifications for each vowel summarized in a table below. Branching diagrams of this sort, or contrastive feature hierarchies, have a long history in phonological theory, having been used by Cherry et al. (1953), Halle (1959), Harms (1968), and Postal (1968), among others (see Dresher 2009, 2016 for discussion). However, they have not always been used to make predictions about which features will be phonologically active in a given system; Halle (1959), for example, assumes that redundant features can be filled in during the course of the derivation. The principal value of the SDA as an explanatory theoretical tool, rather than as a merely descriptive visualization of a system of contrasts, lies in combining it with the Contrastivist Hypothesis.

The Contrastivist Hypothesis holds that only contrastive features can be phonologically active—that is, that the only features that can spread, or block spreading, or delete, or otherwise be directly manipulated or referred to by phonological rules are those that serve to mark contrasts in the underlying inventory.[2] In order for the Contrastivist Hypothesis to be testable, we need a way of identifying which features are contrastive in a given inventory. This is what the SDA provides. However, as noted above, the SDA is non-deterministic. If the selection and ordering of features can vary, how do we know what the right hierarchy is for any given language?

By the Contrastivist Hypothesis, if a feature is observed to be phonologically active, it must be contrastive. The correct hierarchy must be one in which every active feature has wide enough scope to be specified on the segments on which it is active.

Is this reasoning circular, as has been suggested to the authors by anonymous reviewers of various earlier work in this framework?[3] The purpose of this paper is to argue that it is not, by demonstrating that the SDA and the Contrastivist Hypothesis make testable predictions. Given only an inventory, the SDA does not predict exactly what feature specifications must be assigned to its members, but it does make predictions about which combinations of features can or cannot be assigned. Most basically, the SDA limits the total number of features that can be assigned: if features are either binary or monovalent (making binary divisions in either case), any inventory of n phonemes will be specified using at least $log_2(n)$ and at most $n-1$ different features.[4] The SDA also predicts trade-offs between potentially contrastive features. To return to the example in (2), the inventory /i u a/ can have [+high] specified on /i/ (as in (2a)), or it can have [+back] specified on /a/ (as in (2b)), but it cannot have both of these specifications. Either of these specifications would serve to differentiate /i/ and /a/ from each other, and neither would serve to distinguish the specified vowel from /u/, so there is no way for the SDA to assign both of them. A language with this vowel inventory would falsify the theory of Modified Contrastive Specification if both [+high] on /i/ and [+back] on /a/ were demonstrably phonologically active.

[2] This is the strongest version of the Contrastivist Hypothesis; a weaker version holds that there are at least some phonological processes that are sensitive only to contrastive features, but that other processes may refer to redundant features as well (Calabrese 1995, 2005; Nevins 2010, 2015).

[3] See also Blaho (2008) and de Lacy (2010) for related criticisms of Modified Contrastive Specification.

[4] The possibilities will be further restricted if the SDA is combined with a theory of universal features, or if the order of divisions is constrained by something like Clements's (2001) feature accessibility scale.

3. A trade-off in Russian

The consonant system of Russian offers an exemplary case of the sort of trade-off we expect to find, which can best be illustrated by comparing the contrastive hierarchy used by Halle (1959) with an alternative ordering of features. The obstruent inventory of Russian is shown in (3).[5]

(3) *Phonemic obstruent inventory of Russian*

		LABIAL		DENTAL		(PRE)PALATAL	VELAR	
STOP	VLS.	p	p^j	t	t^j		k	k^j
	VD.	b	b^j	d	d^j		g	
AFFRICATE	VLS.			ts		ʧ		
FRICATIVE	VLS.	f	f^j	s	s^j	ʃ	x	
	VD.	v	v^j	z	z^j	ʒ		

Halle (1959) organizes these segments and the features that describe them into a contrastive hierarchy, but does not adopt the Contrastivist Hypothesis. Although "the hierarchy of features seems to provide an explanation for the intuition that not all features are equally central to a given phonological system" (Halle 1959: 34), non-contrastive features are filled in during the course of the derivation, and can therefore be phonologically active: phonological rules "specify all features which play no distinctive role in the language but are not randomly distributed" (Halle 1959: 63).

3.1 Voicing assimilation

One process that crucially involves features that are redundant under Halle's (1959) hierarchy is voicing assimilation. Clusters of obstruents in Russian undergo regressive assimilation, which involves both voicing and devoicing, as shown in (4):

(4) *Regressive voicing assimilation (examples from Padgett 2002)*

a.	(i)	s-jexat^j	'move out'	b.	(i)	iz-lagat^j	'set out'
	(ii)	s-prosit^j	'ask (for)'		(ii)	is-kl^jutʃat^j	'exclude'
	(iii)	z-d^{j}elat^j	'do'		(iii)	iz-gnat^j	'drive out'

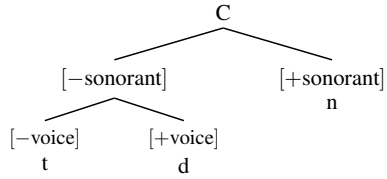
The examples in (4) illustrate voicing assimilation with alternations in the prefixes /s-/ and /iz-/. Before sonorants, these prefixes surface unaltered, as in (4ai) and (4bi). Before voiceless obstruents, both surface with voiceless [s], as in (4aii) and (4bii); before voiced obstruents, both have [z], as in (4aiii) and (4biii).

In voicing assimilation, [±voice] is phonologically active on obstruents, and inactive on sonorants. As in many other languages, most Russian obstruents can be grouped into voiced/voiceless pairs, while the sonorants are all voiced. If [±sonorant], or some other

[5]The status of [k^j g^j $ʃ^j$] in Russian is somewhat dubious (see Timberlake 2004 for discussion); here, we follow Halle's (1959) inventory, but use IPA symbols.

equivalent feature or combination of features, takes scope over [±voice], then voicing will be specified on obstruents but not on sonorants.[6] This is shown schematically in (5), with the specific segments /t/, /d/, and /n/ standing in for their respective classes:

(5) *Contrastive hierarchy with* [±*sonorant*] ≫ [±*voice*]



For pairs of obstruents like /t/ and /d/, voicing *must* be contrastive; no matter how low [±voice] is in the hierarchy, there is no other feature that could distinguish them. However, Russian also has three unpaired voiceless obstruents—/ts/, /ʧ/, and /x/.[7] Whether these segments are specified as [−voice] will depend on whether [±voice] takes wider or narrower scope than the other features that might distinguish them from the voiced obstruents.

The evidence from voicing assimilation is that [−voice] is active on /ts ʧ x/—indeed, the fact that these consonants participate in assimilation was key to Halle's (1957, 1959) argument against the structuralist separation of morphophonemic and allophonic patterns (see also Dresher 2011). As shown in (6), the unpaired obstruents undergo regressive assimilatory voicing, producing surface segments [ʣ ʤ ɣ]. As Halle argued, a unified account of voicing assimilation needs to be able to generate these allophonic voiced obstruents by the same mechanism that produces alternations between phonemes such as /s/ and /z/.

(6) *Assimilation of /ts ʧ x/ (examples from Halle 1959; Timberlake 2002)*

a.	otʲets	'father'
b.	otʲeʣ bɨl	'father was'
c.	ʒeʧ lʲi	'should one burn?'
d.	ʒeʤ bɨ	'were one to burn'
e.	mox	'moss'
f.	moɣ bɨl	'moss was'

The unpaired obstruents also trigger regressive assimilatory devoicing of voiced obstruents, as shown in (7). These examples show the assimilation of the final consonant in the preposition /bʲez/ 'without,' which forms part of the same prosodic word or clitic group as the immediately following lexical word. Before a vowel, as in (7a), we can see that the final consonant is voiced; before voiceless consonants, including the unpaired /ts ʧ x/, it devoices to [s].

[6] For Halle (1959), sonorants are distinguished by [+vocalic], [−consonantal], or [+nasal].

[7] In the inventory in (3), /kʲ/ also has no voiced counterpart. Unlike the other unpaired obstruents, though, /kʲ/ is specified as [−voice] in Halle's (1959) hierarchy; see (8b).

(7) */ts ʧ x/ as triggers of assimilation (examples from Calabrese 1995)*

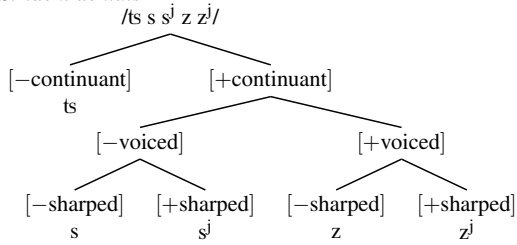
a. bʲez ozʲera ‘without a lake’
b. bʲes xlʲeba ‘without bread’
c. bʲes tsenɨ ‘without price’
d. bʲes ʧestʲi ‘without honour’

3.2 Specifying the obstruents

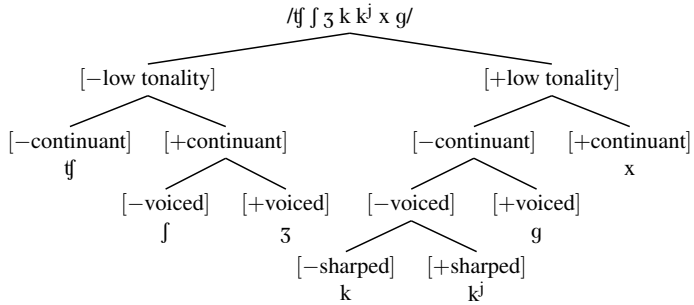
Given that [−voice] is phonologically active on /ts ʧ x/, MCS predicts that the appropriate feature hierarchy for Russian must be one in which [±voice] takes wide enough scope to be specified on them underlyingly. This is not the case in Halle’s (1959: 46) feature hierarchy, the relevant parts of which are shown in (8).

(8) *Halle’s hierarchy:* [±*low tonality*] ≫ [±*continuant*] ≫ [±*voiced*] ≫ [±*sharped*]

a. *Strident dentals*



b. *Palatals and velars*



In Halle’s hierarchy, /ts/, /ʧ/, and /x/ are distinguished from other obstruents at the same place of articulation by [±continuant] before [±voiced] can be assigned to them. For example, /ts/ is specified as [−vocalic] (distinguishing it from vowels and liquids), [+consonantal] (distinguishing it from the glide /j/), [−compact] (distinguishing it from palatals and velars), [−low tonality] (distinguishing it from labials), [+strident] (distin-

guishing it from /t d n/ and their palatalized counterparts), and [−continuant] (distinguishing it from /s sʲ z zʲ/). Given these specifications, /ts/ is fully distinct from all other Russian phonemes, and so any further feature values, including [−voiced], would be redundant.

For Halle (1959), this is not a problem, because he does not assume the Contrastivist Hypothesis. In his system, predictable features can be filled in by rules during the course of the derivation, and once they have been filled in, there is nothing to distinguish them from contrastive features. Halle's rules include the two shown below: (9) fills in redundant [−voiced] on the unpaired obstruents before (10) imposes regressive voicing assimilation.

(9) "Rule P 1b. Unless followed by an obstruent, {c}, {č} and {x} [=IPA /ts ʧ x/] are voiceless" (Halle 1959: 63).

(10) "Rule P 3a. If an obstruent cluster is followed by a – (dash) boundary or by a sonorant, then with regard to voicing the cluster conforms to the last segment; if it is voiced, so are all other segments in the cluster; if it is voiceless, so is the entire cluster" (Halle 1959: 64).

As shown in (11), the derivation of a form like (7b) [bʲes xʲʲeba] 'without bread' would start with /x/ underlyingly unspecified for [±voiced], but the redundancy rule in (9) would apply in time to feed the assimilation rule in (10).

(11)

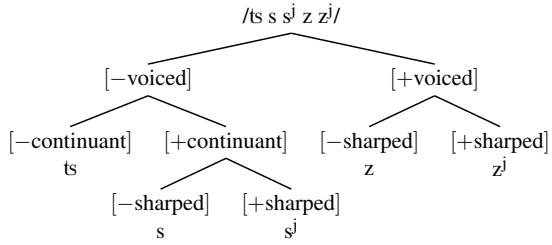
	bʲe z x ʲʲeba	→	bʲe z x ʲʲeba	→	bʲe s x ʲʲeba
[±voiced] :	+ ∅		+ −		− −

However, if we adopt the Contrastivist Hypothesis, then [−voiced] cannot be active on /ts ʧ x/ unless it is contrastively specified on them. The absence of minimally different phonemic voiced counterparts */ʣ ʤ ɣ/ does not necessarily mean that voicelessness is redundant on /ts ʧ x/, because they contrast with voiced obstruents more broadly, and [±voiced] could be used to mark this contrast if given wide enough scope. The flexibility of the SDA allows for this possibility, but also predicts that it should have consequences. If [±voiced] is promoted in the hierarchy, then some other feature must be concomitantly demoted.

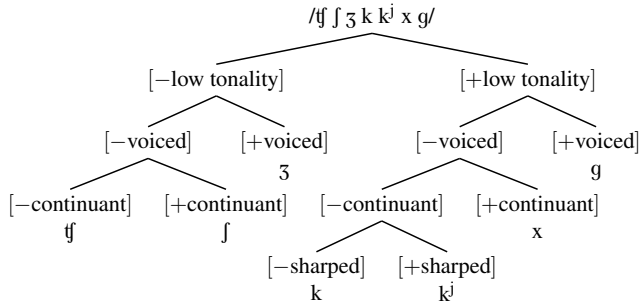
The minimal revision to the hierarchy in (8) that would cause [−voiced] to be specified on all voiceless obstruents would be to give [±voiced] scope over [±continuant], leaving the order of all other features unaltered. The relevant parts of the revised hierarchy are shown in (12).

(12) *Revised hierarchy:* [±*low tonality*] ≫ [±*voiced*] ≫ [±*continuant*] ≫ [±*sharped*]

a. *Strident dentals*



b. *Palatals and velars*



3.3 The other unpaired obstruents

In the revised hierarchy, [−voiced] is now specified on /ts ʧ ʃ x/, but [±continuant] is no longer contrastive on /z zʲ ʒ g/. This casts the gaps in the underlying inventory—the absence of phonemic */ʣ ʤ ɣ/—in a new light. The missing segments are not the voiced counterparts to /ts ʧ ʃ x/, but the [−continuant] counterparts to /z zʲ ʒ/ and the [+continuant] counterpart to /g/.

Combined with the Contrastivist Hypothesis, the hierarchy in (12) predicts that the feature [±continuant] cannot be phonologically active on /z zʲ ʒ g/. Minimally, this means we expect that omitting [±continuant] from the representations of these consonants will not lead to what Nevins (2015) calls an 'Oops, I Need That' problem—that is, there should be no phonological processes that require this feature to be active on these segments. More than this, though, we note that there is at least some positive evidence in favour of the underspecification of [±continuant]; that is, there are some phonological patterns that are easier to account for if this feature is not specified on /z zʲ ʒ g/.

3.3.1 Variation

Circumstantially, we note that the phonetic continuancy of Russian /ɡ/ is variable; in some dialects it is realized as [ɣ] or [ɦ] (Timberlake 2002: §6; Sussex & Cubberley 2006: 523). Because this is dialect variation, rather than variability within any single variety of Russian, it does not necessarily demonstrate that a single underlying representation surfaces both as a stop and as a fricative. However, to the extent that different dialects of Russian have similar phonologies, we expect their inventories to have the same specifications. The fact that this segment variously shows up as [ɡ] and as [ɣ]/[ɦ] is consistent with—though it does not entail—the proposition that it is unspecified for [±continuant] as predicted by (12b).

3.3.2 Alternations

Evidence from morpho-phonological alternations is also consistent with underspecification of [±continuant] not only on /ɡ/, but also on /ʒ/ and /z zʲ/.

In patterns historically arising from the First Velar Palatalization, /ɡ/ alternates with /ʒ/ in the same context in which [+continuant] /x/ alternates with [+continuant] /ʃ/ and [−continuant] /k/ alternates with [−continuant] /ʧ/, as summarized in (13). Using Halle's (1959) feature system with the revised hierarchy in (12), the alternation can be described as changing [+low tonality] velars into the corresponding [−low tonality] palatals, with no reference to [±continuant]. The hierarchy that assigns [−voiced] to /ts ʧ x/ also correctly identifies /ɡ/ and /ʒ/ as counterparts.

(13) *The pattern arising from the First Velar Palatalization*

		[+low tonality]	→	[−low tonality]
[−voiced]	[+continuant]	x	→	ʃ
[−voiced]	[−continuant]	k	→	ʧ
[+voiced]	∅	ɡ	→	ʒ

Examples of these alternations are shown in (14). (The /ɡ/ in (14civ) is subject to word-final devoicing in the citation form of the noun; it surfaces as [ɡ] in inflected forms such as genitive/accusative [vraga].)

(14) *Effects of the First Velar Palatalization (examples from Lightner 1965)*

a. *Adjectives*

	POSITIVE	COMPARATIVE	GLOSS
(i)	tʲix-ij	tʲiʃ-e	'quiet(er)'
(ii)	ʒark-ij	ʒarʧ-e	'hot(ter)'
(iii)	dorog-oj	doroʒ-e	'dear(er)'

b. *Verbs*

	3RD PL.	3RD SG.	GLOSS
(i)	max-ut	maʃ-et	'wave(s), wag(s)'
(ii)	pek-ut	peʧ-et	'bake(s)'

	(iv)	strig-ut	striʒ-et	‘shear(s)’

c. *Denominal adjectives*

(i)	NOUN	ADJECTIVE	GLOSS
(ii)	ʧerepax-a	ʧerepaʃ-ij	‘turtle’ / ‘testudinian’
(iii)	volk	volʧ-ij	‘wolf’ / ‘lupine’
(iv)	vraǧ	vraʒ-ij	‘enemy’ / ‘hostile’

In historical relics of the Second Velar Palatalization, we find alternations pairing /g/ (and [gʲ]) with /z zʲ/ where /k/ alternates with /ts/. In Halle’s (1959) feature system, these alternations change more features than those in (13), but they, too, are more readily unified if /g z zʲ/ are unspecified for [±continuant], as shown in (15).

(15) *The pattern arising from the Second Velar Palatalization*

		$\begin{bmatrix}+\text{compact}\\+\text{low tonality}\\-\text{strident}\end{bmatrix}$		$\begin{bmatrix}-\text{compact}\\-\text{low tonality}\\+\text{strident}\end{bmatrix}$
[−voiced]	[−continuant]	k	∼	ts
[+voiced]	∅	g, gʲ	∼	z, zʲ

Some examples of these alternations are shown in (16). (Like the /g/ in (14civ), the /zʲ/ in (16d) is devoiced word-finally, but surfaces as voiced before inflectional suffixes.)

(16) *Effects of the Second Palatalization (examples from Lightner 1965)*

a.	brjakatʲ	‘to let fall with a clang’	brjatsatʲ	‘to clang’
b.	voskliknutʲ	‘to exclaim’ (pf.)	vosklitsatʲ	‘to exclaim’ (impf.)
c.	tjagatʲsja	‘to sue’	sostjazatʲsja	‘to contend with’
d.	knjagʲinja	‘princess’	knjazʲ̥	‘prince’

These alternations are not productive in Modern Russian, but they are consistent with the prediction that /g/ and /z zʲ/ are unspecified for continuancy.

4. Elsewhere in Slavic

As might be expected from the diachronic origins of the Russian pattern, other modern Slavic languages have similarly asymmetrical inventories and exhibit similar alternations. This section briefly describes a few of these patterns, all of which are consistent with the underspecification of continuancy predicted by the contrastive hierarchy in (12).

4.1 Serbian

Like Russian /g/, Serbian /g/ also has no continuant counterpart. Working in the MCS framework, Radišić (2009) argues for a contrastive hierarchy for Serbian that leaves /g/ unspecified for continuancy based on alternations arising from the First and Second Ve-

lar Palatalizations. As shown in (17), /g/ alternates with /ʒ/ and /z/ in contexts where /k/ alternates with /ʧ/ and /ts/ and /x/ with /ʃ/ and /s/.

(17) a. *Serbian First Palatalization alternations (data from Radišić 2009)*

(i)	ruk-a	'hand'	ruʧ-itsa	'hand'+DIMINUTIVE
(ii)	prax	'dust' (N)	praʃ-iti	'to dust' (V)
(iii)	kɲig-a	'book'	kɲiʒ-ɛtina	'book'+AUGMENTATIVE

b. *Serbian Second Palatalization alternations (data from Radišić 2009)*

(i)	pek-u	'bakes' (3SG.PRES.)	peʦ-i	'bake!' (2SG.IMPER.)
(ii)	ɔrax	'walnut'	ɔras-i	'walnuts'
(iii)	nɔg-a	'leg' (F.NOM.SG.)	nɔz-i	'leg' (F.DAT.SG.)

Although Serbian has no */ɣ/ or */ʤ/, the Serbian inventory differs from that of Russian in that it does have a phonemic /ʤ/ that is the non-continuant counterpart to /ʒ/. Radišić (2009), who uses monovalent features, treats [+continuant] as an unmarked default, using [Stop] as the marked feature. In alternations arising from the First Velar Palatalization, unpaired /g/ palatalizes to /ʒ/ rather than to /ʤ/ because palatalization applies before redundant [Stop] can be filled in. Like Russian, Serbian has regressive voicing assimilation in which all obstruents participate, consistent with the proposition that voicing takes scope over continuancy in the contrastive hierarchy.

4.2 Lower Sorbian

In Lower Sorbian, /g/ again has no phonemic continuant counterpart */ɣ/, and /z/ has no phonemic affricate counterpart */ʤ/. In contexts where /k/ alternates with /ʦ/ and /x/ with /ʃ/, /g/ becomes either [z] or [ʤ]. Here, the continuancy or non-continuancy of fronted /g/ is determined by phonotactic markedness: it is realized as [ʤ] after /z/, and as [z] elsewhere.

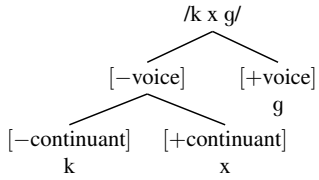
(18) *Alternations in Lower Sorbian (examples from Schaarschmidt 1998)*

	F.NOM.SG.	F.DAT.SG.	GLOSS
a.	ruk-a	ruʦ-e	'hand'
b.	mux-a	muʃ-e	'fly'
c.	nog-a	noz-e	'leg'
d.	rozg-a	rozʤ-e	'twig'

4.3 Ukrainian

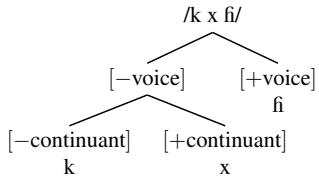
In Ukrainian, historical */g/ has become /ɦ/, which has made its alternations with coronal continuants more transparent phonetically. A new, marginally contrastive stop /g/ is emerging through borrowings (Shevelov 1977). This suggests the diachronic sequence of contrastive hierarchies shown in (19)–(21). In the first stage, in (19), the Ukrainian velar obstruents are organized as in Russian, with /g/ unspecified for continuancy.

(19) *Stage 1: Unpaired /g/ is unmarked for* [±*continuant*]



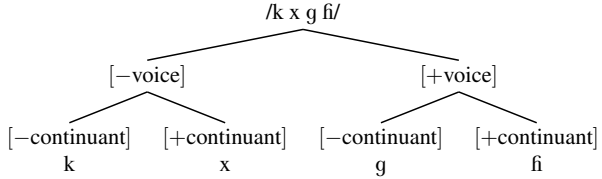
When /g/ changes to /fi/, only its phonetic realization is altered; its feature specifications and place in the system of contrasts remain the same, as shown in (20).

(20) *Stage 2: /g/ becomes /fi/; no change to the hierarchy*



The emergence of the new phoneme /g/ creates a contrast in continuancy, so that /fi/, which alternates with [+continuant] coronal segments in palatalization, is specified for [+continuant] contrastively, as in (21).[8]

(21) *Stage 3: New /g/ makes* [+*continuant*] *contrastive on /fi/*



5. Conclusions

Because the Successive Division Algorithm does not stipulate a fixed ordering of features, it cannot predict from an inventory alone exactly which features will be contrastive (and thus potentially active) in a given system. This means that similar inventories may be specified in different ways, and it also makes the SDA compatible with the proposition that features themselves are emergent rather than universal (Mielke 2008), as discussed by Dresher

[8]This hierarchy in (21) suggests that the new /g/ should remain [−continuant] when palatalized; unfortunately, we do not know of any examples of new /g/ in contexts where palatalization would apply.

(2014) and Cowper & Hall (2014). To the extent that we find cross-linguistic consistency in the order of divisions—e.g., if all vowel systems make at least one height contrast before making any place or rounding contrasts (Walker 1993, Dyck 1995)—we can seek formal or phonetic explanations for these patterns outside the SDA itself. In identifying the contrastive hierarchy of any specific language, though, we must rely on evidence from phonological activity to tell us which features must be specified. As we have shown here, though, this does not make Modified Contrastive Specification circular; the theory makes predictions about how many features can be specified, and about trade-offs between potential specifications. These predictions are in principle falsifiable, but, in the specific case of voicing and continuancy in Slavic examined here, they appear not to be false.

Daniel Currie Hall, B. Elan Dresher
daniel.hall@utoronto.ca, dresher@chass.utoronto.ca

References

Archangeli, Diana. 1988. Underspecification in phonology. *Phonology* 5:183–207.

Blaho, Sylvia. 2008. The syntax of phonology: A radically substance-free approach. Doctoral dissertation, Universitetet i Tromsø.

Calabrese, Andrea. 1995. A constraint-based theory of phonological markedness and simplification procedures. *Linguistic Inquiry* 26:373–463.

Calabrese, Andrea. 2005. *Markedness and economy in a derivational model of phonology*. Berlin: Mouton de Gruyter.

Cherry, E. Colin, Morris Halle, & Roman Jakobson. 1953. Toward the logical description of languages in their phonemic aspect. *Language* 29:34–46.

Clements, G. N. 1988. Towards a substantive theory of feature specification. *NELS* 18:79–93.

Clements, G. N. 2001. Representational economy in constraint-based phonology. In *Distinctive feature theory*, ed. T. Alan Hall, 71–146. Berlin: Mouton de Gruyter.

Cowper, Elizabeth, & Daniel Currie Hall. 2014. Reductiō ad discrīmen: Where features come from. *Nordlyd* 41:145–164.

Dresher, B. Elan. 2009. *The contrastive hierarchy in phonology*. Cambridge: Cambridge University Press.

Dresher, B. Elan. 2011. The phoneme. In *The Blackwell companion to phonology*, ed. Marc van Oostendorp, Colin J. Ewen, Elizabeth Hume, & Keren Rice, volume 1, 241–266. Oxford: Wiley-Blackwell.

Dresher, B. Elan. 2014. The arch not the stones: Universal feature theory without universal features. *Nordlyd* 41:165–181.

Dresher, B. Elan. 2015. The motivation for contrastive feature hierarchies in phonology. *Linguistic Variation* 15:1–40.

Dresher, B. Elan. 2016. Contrast in phonology 1867–1967: History and development. *Annual Review of Linguistics* 2:53–73.

Dresher, B. Elan, Glyne L. Piggott, & Keren D. Rice. 1994. Contrast in phonology: Overview. *Toronto Working Papers in Linguistics* 13:iii–xvii.

Dyck, Carrie. 1995. Constraining the phonology–phonetics interface, with evidence from Spanish and Italian dialects. Doctoral dissertation, University of Toronto.

Hall, Daniel Currie. 2007. The role and representation of contrast in phonological theory. Doctoral dissertation, University of Toronto.

Hall, Daniel Currie. forthcoming. Contrastive specification in phonology. In *Oxford research encyclopedia of linguistics*, ed. Mark Aronoff. Oxford: OUP.

Halle, Morris. 1957. On the phonetic rules of Russian. Presented to the Linguistic Society of America, Chicago, 1957.

Halle, Morris. 1959. *The sound pattern of Russian: A linguistic and acoustical investigation*. The Hague: Mouton.

Harms, Robert T. 1968. *Introduction to phonological theory*. Englewood Cliffs, NJ: Prentice-Hall.

de Lacy, Paul. 2010. Review of Dresher (2009). *Phonology* 27:532–536.

Lightner, Theodore. 1965. Segmental phonology of Modern Standard Russian. Doctoral dissertation, Massachusetts Institute of Technology.

Mielke, Jeff. 2008. *The emergence of distinctive features*. Oxford: Oxford University Press.

Nevins, Andrew Ira. 2010. *Locality in vowel harmony*. Cambridge, Mass.: MIT Press.

Nevins, Andrew Ira. 2015. Triumphs and limits of the contrastivity-only hypothesis. *Linguistic Variation* 15:41–68.

Padgett, Jaye. 2002. Russian voicing assimilation, final devoicing, and the problem of [v] (*or,* the mouse that squeaked). Ms., University of California, Santa Cruz. ROA #528.

Paradis, Carole, & Jean-François Prunet. 1991. Introduction: Asymmetry and visibility in consonant articulations. In *The special status of coronals: Internal and external evidence*, ed. Carole Paradis & Jean-François Prunet, volume 2 of *Phonetics and Phonology*, 1–28. San Diego: Academic Press.

Postal, Paul. 1968. *Aspects of phonological theory*. New York: Harper and Row.

Radišić, Milica. 2009. The double nature of the velar /g/ in Serbian. *Toronto Working Papers in Linguistics* 30:91–103.

Schaarschmidt, Gunter. 1998. *The historical phonology of the Upper and Lower Sorbian languages*. Heidelberg: C. Winter.

Shevelov, George Y. 1977. On the chronology of *h* and the new *g* in Ukrainian. *Harvard Ukrainian Studies* 1:137–152.

Steriade, Donca. 1987. Redundant values. *CLS* 23:339–362.

Sussex, Roland, & Paul Cubberley. 2006. *The Slavic languages*. Cambridge: Cambridge University Press.

Timberlake, Alan. 2002. Russian. In *The Slavonic languages*, ed. Bernard Comrie & Greville G. Corbett, 827–886. London: Routledge, first paperback edition.

Timberlake, Alan. 2004. *A reference grammar of Russian*. Cambridge: Cambridge University Press.

Walker, Rachel. 1993. A vowel feature hierarchy for contrastive specification. *Toronto Working Papers in Linguistics* 12:179–197.