

Laryngeal Underspecification and Richness of the Base

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1 Overview

- ☛ Lexicon Optimization and Richness of the Base conspire to produce maximally transparent underlying representations.
- ☛ Inkelas (1995, 1996) demonstrates that underspecification is possible when the material in question is both predictable and alternating.
- ☛ Some anomalous voicing patterns in Czech (Hall 2003b; Blaho and Bye 2005) look amenable to an underspecification treatment along the lines proposed for Turkish by Inkelas (1995) and Inkelas and Orgun (1994).
- ☛ However, Inkelas's Alternant Optimization predicts that underspecification in the Czech case will be possible if and only if it is unnecessary.
- ☛ It's hard to make the underspecification unnecessary by principled means (Hall 2003a).
- ☛ Something has to give...

Questions:

- ☛ What gives?
- ☛ What (if any) status do phonemic inventories have?
- ☛ Would overspecification be just as good as underspecification?

2 Optimality vs. underspecification

2.1 Contrastive specification

(1) 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.

What constitutes necessity in this context is an interesting (but separate) question; for the Toronto School of Contrast's approach, see Dresher, Piggott, and Rice (1994) and Dresher (2003).

1. I am grateful to Elan Dresher, Keren Rice, Elizabeth Cowper, Veronika Ambros, and members of the phonology group at the University of Toronto for helpful comments on this and related work, and to Sharon Inkelas for providing me with a copy of the newer version of her paper on Alternant Optimization (Inkelas 1996). Any errors, omissions, or other deficiencies are, of course, entirely my fault.

2.2 Richness of the Base and Lexicon Optimization

Richness of the Base:

- ☛ OT predicts that phonological alternations are generated by the same constraints responsible for static phonotactic generalizations.
- ☛ A successful constraint hierarchy must therefore do the following:
 - ☛ For each actual input form, produce the attested output.
 - ☛ For all other inputs, produce outputs that are phonotactically possible, though not necessarily attested.
- ☛ An unattested surface form represents a systematic gap if and only if there is no possible input form for which it is the optimal output; otherwise, its absence is accidental.
- ☛ According to Richness of the Base, all language-specific systematic gaps must be due to the constraint hierarchy; there can be no language-specific restrictions on inputs, or on GEN.

Richness of the Base and Lexicon Optimization gang up on underspecification:

- ☛ When a single attested surface form is the optimal output for more than one possible input, Lexicon Optimization (Prince and Smolensky 1993: §9.3) predicts that the learner will posit as the actual underlying form the one of these for which the output form incurs the least serious constraint violations.
- ☛ Since only input–output faithfulness constraints differentiate potential input forms, Lexicon Optimization will militate in favour of transparent inputs, and Richness of the Base ensures that all conceivable inputs are possible inputs.
- ☛ In the absence of alternations that would provide evidence to the contrary (and setting aside the possibility of opaque input–output relations introduced by non-standard sorts of constraints) input and output will be identical.
- ☛ Underspecification is difficult: surface filling in of underlyingly absent feature values introduces a putatively unnecessary mismatch between input and output.

One possibility to keep in mind (although it won't work by itself): Richness of the Base could be relativized to a language-specific inventory of segmental representations.

3 Alternant Optimization rescues underspecification

Prince and Smolensky (1993) do not provide an explicit mechanism for incorporating data from alternations into the computation of inputs. Inkelas (1995, 1996), however, does provide such a mechanism, which she calls Alternant Optimization, and shows how it can yield underspecified input forms in a rather narrowly circumscribed set of cases.

(2) ALTERNANT OPTIMIZATION (Inkelas 1995: 289):

Given a grammar G and a set $S = \{S_1, S_2, \dots S_i\}$ of surface phonetic forms for a morpheme M , suppose that there is a set of inputs $I = \{I_1, I_2, \dots I_j\}$, each of whose members has a set of surface realizations equivalent to S . There is some $I_i \in I$ such that the mapping between I_i and the members of S is the most harmonic with respect to G , i.e. incurs the fewest marks for the highest ranked constraints. The learner should choose I_i as the underlying representation for M .

Alternant Optimization allows for the underspecification of phonological material that is both alternating and predictable. Unpredictable information must be stored because it cannot otherwise be recovered; non-alternating material is stored because optimization never introduces unnecessary discrepancies between input and output.

3.1 Turkish voicing alternations

Among the examples Inkelas (1995) uses to show how underspecified inputs can arise is the voicing behaviour of root-final stops in Turkish (Inkelas and Orgun 1994). The examples in (3) and (4) suggest a straightforward pattern of coda devoicing: some stops are consistently voiceless, while others are voiced prevocally but voiceless word-finally and before consonants.

- (3)
- | | | |
|----|-------------|------------|
| a. | [sɯnɯt+ʊ] | ‘art+acc.’ |
| b. | [sɯnɯt+ʊm] | ‘my art’ |
| c. | [sɯnɯt] | ‘art’ |
| d. | [sɯnɯt+lɯr] | ‘arts’ |
- (4)
- | | | |
|----|-------------|-------------|
| a. | [kɯnɯd+ʊ] | ‘wing+acc.’ |
| b. | [kɯnɯd+ʊm] | ‘my wing’ |
| c. | [kɯnɯt] | ‘wing’ |
| d. | [kɯnɯt+lɯr] | ‘wings’ |

However, there are also a few Turkish roots that end in non-alternating voiced stops, as in (5).

- (5)
- | | | |
|----|------------|--------------|
| a. | [etyd+y] | ‘étude+acc.’ |
| b. | [etyd+ym] | ‘my étude’ |
| c. | [etyd] | ‘étude’ |
| d. | [etyd+ler] | ‘études’ |

Inkelas (1995) argues that the three-way distinction in voicing behaviour can and should be attributed to a ternary distinction in underlying values for voicing features. The non-alternating stops at the ends of /sɯnɯt/ and /etyd/ are specified as [−voice] and [+voice], respectively, while the alternating stop at the end of /kɯnɯd/ has no underlying value for

[±voice]. The alternations in (4) then arise from the constraints in (6):²

- (6) a. MAX[VOICE] Input values of [±voice] are present in the output.
- b. CODA_{COND} Stops in coda position are [−voice].
- c. VOICE Stops are [+voice].
- d. DEP[VOICE] Output values of [±voice] are present in the input.

If the constraints in (6) are ranked in the order in which they are listed, underspecified stops such as the one at the end of /kʏnʏD/ will have voicing values filled in to comply with the preferred surface pattern (voiceless in codas, voiced elsewhere), but specifications for [±voice] that are present underlyingly will never be overwritten; the alternations are generated in a purely structure-filling way.

Question: What's being underspecified, segments or morphemes?

The underspecification of the /D/ in /kʏnʏD/, which Inkelas (1995, 1996) refers to as ‘Archiphonemic Underspecification,’ involves the use of a binary feature to make a ternary distinction. This places Inkelas’s analysis into apparent conflict with Halle’s (1959) Distinctness Condition:

- (7) DISTINCTNESS CONDITION (Halle 1959: 32):
Segment-type {A} will be said to be different from segment-type {B}, if and only if at least one feature which is phonemic in both, has a different value in {A} than in {B}; i.e., plus in the former and minus in the latter, or vice versa.

However, Inkelas’s analysis of the Turkish data does not rely on the claim that /D/ is phonemically distinct from /d/ or from /t/. Rather than suggesting that Turkish has three phonemically distinct coronal plosives, one of which is unspecified for [±voice], Inkelas appears to be saying instead that there are only two phonemic coronal plosives, /t/ and /d/, and that the morpheme /kʏnʏD/ is underspecified as to which of these its final segment is.

In a grammar that includes the constraint ranking in (6), the underlying representation of /kʏnʏD/ will necessarily be underspecified as to the voicing of the final segment, because this is the only input form that produces the attested range of output forms in (4). If the segment in question is specified either as [+voice] or as [−voice], it will not alternate at all. Alternant Optimization is not required here, because there is no choice to be made among possible input forms.

3.2 Yoruba ATR harmony

Inkelas (1995) uses Yoruba ATR harmony to demonstrate that Alternant Optimization can produce underspecified inputs when there is a choice to be made. The Yoruba nomi-

2. I’ve replaced Inkelas’s PARSE and FILL constraints with the now more familiar MAX and DEP introduced by McCarthy and Prince (1995).

nalizing prefix /O-/ predictably takes on the $[\pm\text{ATR}]$ value of the first vowel to its right, as illustrated in (8).³

- (8) a. [dɛ] ‘to hunt’
b. [ɔ̣+dɛ] ‘hunter’
c. [kú] ‘to die’
d. [ò+kú] ‘corpse’

The pattern in (8) can obviously be quite straightforwardly derived if the prefix /O-/ is underlyingly unspecified for $[\pm\text{ATR}]$. Unlike the Turkish case, however, such archiphonemic underspecification here is not a matter of descriptive necessity. Data such as those in (9) indicate that Yoruba tongue root harmony is not a purely structure-filling process.

- (9) a. [àwò] ‘colour’
b. [ɛjò] ‘snake’
c. [àwò ɛjò] ‘colour of a snake’
d. [ɔwó] ‘money’
e. [ɔmò] ‘child’
f. [ɔwó ɔmò] ‘child’s money’

The data in (9) suggest that the constraint or constraints responsible for driving harmony must outrank not only $\text{DEP}[\text{ATR}]$ but also $\text{MAX}[\text{ATR}]$: underlying specifications for $[\pm\text{ATR}]$ can be overwritten in order to produce a harmonic surface form. Because of this ranking, the prefix /O-/ will surface with the appropriate values for $[\pm\text{ATR}]$ in all contexts regardless of whether it is underlyingly specified as $[\text{+ATR}]$, $[\text{−ATR}]$, or neither. The choice of underlying representation is now a matter for Alternant Optimization. The candidate input forms are shown in the tableau in (10).

(10)

A. O.		$\text{MAX}[\text{ATR}] : \text{DEP}[\text{ATR}]$		
/ɔ̣-/	[ɔ̣+dɛ]	*	:	*
	[ò+kú]		:	
/ɔ̣-/	[ɔ̣+dɛ]		:	
	[ò+kú]	*	:	*
/O-/	[ɔ̣+dɛ]		:	*
	[ò+kú]		:	*

If $\text{MAX}[\text{ATR}]$ is ranked above $\text{DEP}[\text{ATR}]$, then the underspecified input /O-/ will be preferred, because each of the other input forms has its underlying $[\pm\text{ATR}]$ specification

3. For the sake of explicitness, all $[\text{+ATR}]$ vowels in the data are transcribed here with [ɔ̣], and all $[\text{−ATR}]$ vowels with [ò]. This should not be taken to reflect the precise articulatory implementation of $[\pm\text{ATR}]$, nor to suggest that $[\pm\text{ATR}]$ is contrastive on all vowels. The data are from Pulleyblank (1988) and Archangeli and Pulleyblank (1989), cited in Inkelas (1995).

deleted in one set of surface forms. Inkelas (1995) proposes that, in cases in which the data do not determine the relative ranking of MAX (or PARSE, in pre-Correspondence Theory OT) and DEP (or FILL), the question is resolved in favour of MAX by the principle of Grammar Optimization:

- (11) GRAMMAR OPTIMIZATION (Inkelas 1995: 292):

The optimal grammar is the most transparent, i.e. the one in which alternations are maximally structure-filling (Kiparsky 1993). In terms of Optimality Theory, this means that PARSE is ranked as high as possible.

In the absence of evidence to the contrary, Grammar Optimization will rank MAX[ATR] over DEP[ATR], and Alternant Optimization will accordingly select /O-/ as the underlying form of the prefix.

Question: What would happen if DEP[ATR] $\gg$ MAX[ATR]?

If there were data that made the opposite ranking necessary, the underspecified form would be ruled out—but which of the two specified forms would be optimal? The tableau in (10) suggests that /ɔ-/ and /ɔ̃-/ would be equally good underlying representations, and offers no obvious way of choosing between them.

4 The Czech data

In Czech, most obstruents both trigger and undergo regressive voicing assimilation:

- (12) Regressive assimilation illustrated by the prepositions *s* ‘with’ and *z* ‘from’

Before sonorants:

- | | | | |
|----|----------------|-----------|-----------------|
| a. | <i>s lesem</i> | [ˈslesɛm] | ‘with a forest’ |
| b. | <i>z lesa</i> | [ˈzlɛsa] | ‘from a forest’ |
| c. | <i>s mužem</i> | [ˈsmuʒɛm] | ‘with a man’ |
| d. | <i>z muže</i> | [ˈzmuʒɛ] | ‘from a man’ |

Before voiced obstruents:

- | | | | |
|----|-----------------|-------------|-----------------|
| e. | <i>s domem</i> | [ˈzdomɛm] | ‘with a house’ |
| f. | <i>z domu</i> | [ˈzdomu] | ‘from a house’ |
| g. | <i>s hradem</i> | [ˈzɦɪradɛm] | ‘with a castle’ |
| h. | <i>z hradu</i> | [ˈzɦɪradu] | ‘from a castle’ |

Before voiceless obstruents:

- | | | | |
|----|-----------------|-----------|------------------|
| i. | <i>s polem</i> | [ˈspolɛm] | ‘with a field’ |
| j. | <i>z pole</i> | [ˈspolɛ] | ‘from a field’ |
| k. | <i>s chybou</i> | [ˈsxɪboʊ] | ‘with a mistake’ |
| l. | <i>z chyby</i> | [ˈsxɪbɪ] | ‘from a mistake’ |

Word-final obstruents and obstruent clusters are consistently voiceless, including those that can be seen from alternations to be underlyingly voiced:

(13) Final obstruent cluster devoicing

a.	<i>muž</i>	[muʃ]	‘man’ (nom. sg.)
b.	<i>mužem</i>	[‘muʒem]	‘man’ (inst. sg.)
c.	<i>myš</i>	[miʃ]	‘mouse’ (nom. sg.)
d.	<i>myši</i>	[‘miʃi]	‘mouse’ (inst.sg.)
e.	<i>hrad</i>	[fɪrat]	‘castle’ (nom. sg.)
f.	<i>hradem</i>	[‘fɪradem]	‘castle’ (inst. sg.)
g.	<i>robot</i>	[‘robot]	‘robot’ (nom. sg.)
h.	<i>robotem</i>	[‘robotem]	‘robot’ (inst. sg.)
i.	<i>hvozd</i>	[fivost]	‘deep forest’ (nom. sg.)
j.	<i>hvozdem</i>	[‘fivozdem]	‘deep forest’ (inst. sg.)
k.	<i>host</i>	[fiost]	‘guest’ (nom. sg.)
l.	<i>hostem</i>	[‘fiostem]	‘guest’ (inst. sg.)

Two exceptional obstruents, /v/ and /ɾ/, undergo but fail to trigger regressive assimilation. When preceded by a voiceless obstruent, /ɾ/ undergoes progressive assimilatory devoicing. In some varieties of Czech, this happens to /v/, too; in others, /v/ remains [v] after voiceless obstruents.

(14) Voicing behaviour of /v/ and /ɾ/

a.	<i>v lese</i>	[‘vlese]	‘in a forest’
b.	<i>v pole</i>	[‘fpole]	‘in a field’
c.	<i>květ</i>	[kfjet] ~ [kvjet]	‘flower’
d.	<i>tvůj</i>	[tfuːj] ~ [tvuːj]	‘your’
e.	<i>vrána</i>	[vraːna]	‘crow’
f.	<i>s vránou</i>	[sfraːnou] ~ [svraːnou]	‘with a crow’
g.	<i>nářek</i>	[‘naːɾek]	‘lamentation (nom. sg.)’
h.	<i>nářky</i>	[‘naːɾki]	‘lamentations (nom. pl.)’
i.	<i>při</i>	[pɾi]	‘near’
j.	<i>středa</i>	[‘stɾeda]	‘Wednesday’

Here, I will focus on the varieties in which /v/ and /ɾ/ pattern identically.

5 Archiphonemic Underspecification in Czech?

Diachronically, it’s pretty obvious why /v/ and /ɾ/ don’t act like the other obstruents: they’re former sonorants, historically derived from /*w/ and /*r^j/. But what can we say about them synchronically?

This looks like a job for Archiphonemic Underspecification: we ought to be able to say that ordinary voiced obstruents are [+voice], ordinary voiceless obstruents are [−voice], and /V/ and /ɾ/ are unspecified for [±voice].

Assuming specifications along those lines, we can generate the Czech pattern using the constraints in (15):

- (15)
- | | |
|--|---|
| a. MAX[SON]
b. *[+SON, -VOI]
c. MAX[VOI] / — [+SON]

d. *[+VOI] / — #
e. AGREE[VOI]

f. MAX[VOI]

g. VOICE
h. DEP[VOI] | Underlying values of $[\pm\text{sonorant}]$ are preserved in the output.
All sonorants are voiced.
The rightmost underlying instance of $[\pm\text{voice}]$ to the left of each sonorant is preserved in the output. ⁴
Word-final consonants are voiceless.
Adjacent obstruents have identical values for $[\pm\text{voice}]$.
Underlying values of $[\pm\text{voice}]$ are preserved in the output.
Segments are voiced.
Output values of $[\pm\text{voice}]$ are present in the input. |
|--|---|

The crucial rankings of these constraints are as follows:

- ☛ MAX[SON], *[+SON, -VOI] $\gg$ *[+VOI] / — #:
Sonorants will always be voiced, even word-finally. (This will be true even if sonorants are not underlyingly specified as [+voice].)
- ☛ *[+VOI] / — # $\gg$ MAX[VOI], VOICE, DEP[VOI]:
All obstruents are subject to final devoicing.
- ☛ MAX[VOI] / — [+SON] $\gg$ AGREE[VOI] $\gg$ MAX[VOI], DEP[VOI]:
In a non-final obstruent cluster, the rightmost obstruent that is underlyingly specified for $[\pm\text{voice}]$ will retain its specification, and the other obstruents in the cluster will assimilate to it.
- ☛ AGREE[VOI] $\gg$ VOICE $\gg$ DEP[VOI]:
An obstruent that is unspecified for $[\pm\text{voice}]$ will assimilate to another obstruent on either side, but if there is no adjacent obstruent to assimilate to, it will be voiced by default.
- ☛ MAX[VOI] $\gg$ VOICE $\gg$ DEP[VOI]:
Default voicing applies only to segments with no underlying specification for $[\pm\text{voice}]$.

The tableaux in (16–18) illustrate the interactions of these constraints in various relevant contexts. In (16), underlying /V tom/ yields surface [ftom], illustrating the application of regressive assimilation to underspecified /V/:⁵

4. The somewhat ungainly formulation of this constraint is designed to accommodate clusters such as the one in *od tŕi* /od tRi:/ [ot tŕi:] ('from three'), in which the rightmost obstruent specified for $[\pm\text{voice}]$, the /t/, is not in immediately pre-sonorant position, but nonetheless determines the voicing of the whole cluster.

5. In order to save space, the top-ranked constraint, MAX[SON], is not shown in these tableaux, as no relevant candidates violate it.

(16) Tableau for *v tom* /V tom/ [ftom] ‘in that’

/V tom/	*[+SON, −VOI]	MAX[VOI] / — [+SON]	*[+VOI] / — #	AGREE [VOI]	MAX [VOI]	VOICE	DEP [VOI]
☞ [ftom]			*			**	*
[vtom]			*	*!		*	*
[vdom]		*!	*		*		**
[ftom]	*!				*	***	**

The next example illustrates both word-final obstruent cluster devoicing and progressive assimilation of underspecified /V/:

(17) Tableau for *hvozď* /fVozd/ [fivost] ‘deep forest’

/fVozd/	*[+SON, −VOI]	MAX[VOI] / — [+SON]	*[+VOI] / — #	AGREE [VOI]	MAX [VOI]	VOICE	DEP [VOI]
☞ [fivost]					**	**	***
[fivozd]			*!				*
[fivozt]				*!	*	*	**
[hfost]		*!			***	****	****
[fifost]				*!	**	***	***

In (18), we can see both regressive assimilation affecting a regular obstruent and progressive devoicing affecting /R/:

(18) Tableau for *od tří* /od tRi:/ [ot tri:] ‘from three’

/od tRi:/	*[+SON, −VOI]	MAX[VOI] / — [+SON]	*[+VOI] / — #	AGREE [VOI]	MAX [VOI]	VOICE	DEP [VOI]
[ot tri:]					*	***	**
[od tri:]				*!		**	*
[od tri:]				*!		*	*
[od dri:]		*!			*		**

Assumption: All output forms are fully specified.

The possibility of underspecification in the output (see, e.g., Itô, Mester, and Padgett 1995) is not contemplated in the tableaux in (16–18). In the cases Itô, Mester, and Padgett consider, the phonetic realization of the underspecified segments is not at issue; here, it would be unfair to pass the problematic /V/ and /R/ on to phonetic implementation.

6 The problem

6.1 The empirical difficulty

Given underspecified representations for underlying /V/ and /R/, the constraint hierarchy in (15) produces the right outputs. But there is no way of guaranteeing that /V/ and /R/ will consistently be underspecified; Richness of the Base tells us that we should also be able to deal with input forms that include fully specified /f/, /v/, /r̥/, and /r̥/, which will behave exactly like regular obstruents.

(The good news: Czech does have /f/, although only marginally. The bad news: None of the other predicted segments is attested.)

Why isn't this working out the way Turkish works for Inkelas (1995)? Because Turkish really does have all three of /t/, /D/, and /d/. For Turkish to work, we need underspecification of particular morphemes; for Czech to work, we need underspecifications of particular segments (in all contexts in which they appear).

There is no way of barring the fully specified segments from the input. We can't constrain the input directly, and we can't promote output markedness constraints against them, because we still want them to occur at the surface.

We can't even retreat to an inventory-relative version of Richness of the Base, because Lexicon Optimization tells us that the fully specified segments will be in the optimal input forms for non-alternating contexts such as *dva* /dva/ [dva] 'two':

(19)

L. O.		MAX[SON]	MAX[VOI] / — [+SON]	MAX[VOI]	DEP[VOI]
☞	/dva/	[dva]			
	/dVa/	[dva]			*!

If /v/ freely occurs in inputs, as predicted by Richness of the Base, then we should expect to find such forms as */vra:n-/ alongside /Vra:n-/ ('crow'); there would be no difference between the forms in isolation, but when preceded by *s* ('with'), the former would produce *[zvra:nou].

6.2 The theoretical paradox

The only orthodox way out is to ensure that even fully specified inputs will produce the correct range of surface forms—that is, we need to make sure that /v/ and /r̥/ and /r̥/ will act just like /V/ and /R/.

We can do this in a very simple and unprincipled way by replacing the constraints MAX[VOICE] / — [+SON] and MAX[VOICE] in the hierarchy in (15) with constraints that apply only to segments other than /V/ and /R/, and demoting the more general MAX[VOICE] constraint to below VOICE, as in (20):

- (20)
- a. MAX[SON]
 - b. * [+SON, -VOI]
 - c. MAX[VOI] / [+SON], EXCEPT FOR /V/ AND /R̥/
 - d. * [+VOI] / #
 - e. AGREE[VOI]
 - f. MAX[VOI], EXCEPT FOR /V/ AND /R̥/
 - g. VOICE
 - h. MAX[VOI]
 - i. DEP[VOI]

Given this new constraint hierarchy, both the fully specified /vra:n-/ and the underspecified /Vra:n-/ will alternate as desired. And, now that we've arranged not to need the underspecified form, Alternant Optimization will happily give it to us, as shown in (21):

(21)

Alternant Optimization		MAX [SON]	MAX[VOI] / <u> </u> [+SON] (NOT V OR R̥)	MAX[VOI] (NOT V OR R̥)	MAX [VOI]	DEP [VOI]
/vra:n-/	[vra:n+a] [s+fra:n+ou]				*!	*
☞ /Vra:n-/	[vra:n+a] [s+fra:n+ou]					* *

This would be fine if there were a principled way of producing the effect of (20). We would need to be able to show:

- ☹ that /V/ and /R̥/ form a natural class, and
- ☹ that there is a reason for them to be treated differently from other obstruents by MAX[VOICE] constraints.

An initially promising approach would be to try to relate the un-obstruent-like phonological properties of /V/ and /R̥/ to some un-obstruent-like phonetic property, as Padgett (2002) does for Russian /v/ (or rather /v̥/). But, as argued by Hall (2003a), this doesn't seem to be possible for Czech /V/, which is much farther removed phonetically from its /*w/ ancestor than its Russian cousin is. In fact, Czech /V/ doesn't seem to be any more acoustically sonorous than the phonologically well-behaved obstruent /b/:

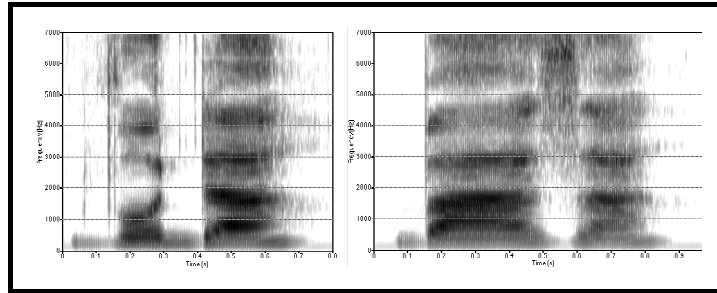


Figure 1: Spectrograms of Czech *voda* /voda/ 'water' and *váza* /va:za/ 'vase'

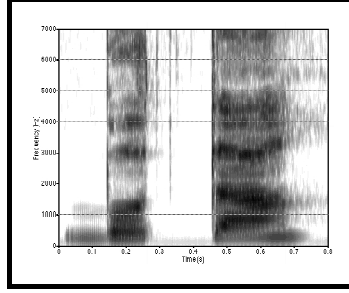


Figure 2: Spectrogram of Czech *bota* /bota/ ‘shoe’

(The spectrograms in figs. 1 and 2, from Hall (2003a), were produced using the speech analysis program Praat (Boersma and Weenink 1992) from recordings of a female native speaker of Czech. The recordings are part of a set of sound files designed to accompany the IPA *Handbook* (International Phonetic Association 1999).)

7 Some inconclusive conclusions

It seems that the anomalous behaviour of Czech /V/ and /R̥/ must be stipulated, one way or another.

☹ **One way:** Put the stipulation in the constraint hierarchy.

- ✱ But constraints are supposed to be universal. Should we allow a bill of attainder like MAX[VOI] /___ [+SON], EXCEPT FOR /V/ AND /R̥/ into U.G.?
- ✱ There’s no way to demonstrate the absence of MAX[VOI] /___ [+SON], EXCEPT FOR /V/ AND /R̥/; its effects can always be masked by other constraints.

☹ **Another:** Retreat from the predictions of Richness of the Base and Alternant Optimization, and put the stipulation in the inventory.

- ✱ This would require us to say that there can be language-specific restrictions on the underlying representations of segments.
- ✱ The phonemic inventory would have to become something more than an epiphenomenon.
- ✱ Richness of the Base could still permit all sequences of phonemes as potential inputs—the only phonotactic properties that would no longer be in the jurisdiction of CON would be gaps in the phonemic inventory.
- ✱ We would need a new account for various loanword adaptation phenomena—e.g., a theory of how acoustic stimuli are mapped onto native phonemic representations (see, e.g., Boersma (1998); Lahiri and Reetz (2002)).
- ✱ We would need a principled means of generating inventories of feature combinations (see, e.g. Dresher (2003)).

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