NELS 28
University of Toronto
10:00 AM, Saturday, October 25, 1997
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Alveolar stops in American English, and the nature of allophony

1.

Alternation

Neutralization ↓	**Allophony** ↓
"True" Neutralization: merger towards a value that is otherwise contrastive in that specified position, e.g. Korean syllable final [t]	"True" Allophony: contextual variant that is *not* otherwise present in the phone inventory, e.g. Spanish spirantization
"Contextual" Neutralization: merger towards a value that is otherwise contrastive, but *not* in that specified position, e.g. Southern Min tone circle	"Contextual" Allophony: contextual variant that *is* otherwise present in the phone inventory, but only in other contexts, e.g. Southern Min tone circle
Near Neutralization: A contrast threatens to neutralize, e.g. German final de-voicing	
Phonemic Overlap: merger towards a non-contrastive value, e.g. American English tapping	

2. Question: Are patterns of alternation merely random, or are there generalizations to be found from which predictions might be made regarding when an alternation should be allophonic versus neutralizing?

3. Hypothesis: Allophonic patterns may be a (diachronic) consequence of linguistic function: certain acoustic/auditory cues which convey contrasts are enhanced/modified in contexts where contrasts are otherwise vulnerable to neutralization.

4. A major function of phonology: Achieve effective communication

5. **Contrast maintenance**—an *abstract* functional constraint: "Contrastive values (whatever their origin and whatever their mental status) are maintained" (see also Martinet 1952, Kiparsky 1972, Liljencrantz and Lindblom 1972, Silverman 1997)

6. Hypothesis: Neutralizing patterns may be a (diachronic) consequence of energy constraints: neutralization may take place when insufficient energy is present in the relevant context of the speech signal (from the speaker) for contrasts to be effectively communicated (to the listener) (Jun 1995, Steriade 1995).

7. A major constraint on effective communication: Availability of energy

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8. **Energy availability**—a *physical* functional constraint: "Energy for the speech signal is limited in its availability" (see also Martinet 1952, Lindblom 1983, Jun 1995, Steriade 1995, Kirchner, in prep.)

9.

Allophony may be a consequence of contrast maintenance (given sufficient energy availability) —an *abstract* functional constraint
Neutralization may be a consequence of insufficient energy availability —a *physical* functional constraint
Unmarked values are typically natural values; marked values are typically less natural. These distinctions in naturalness/markedness carry over to contextually-conditioned alternations.
There is a necessary interdependence between abstraction and physicality in order to properly account for patterns of alternation

10. English alveolar stop contrasts possess several context-dependent manifestations. "Fortis" refers to the so-called voiceless stop ("/t/"). "Lenis" refers to the so-called voiced stop ("/**d**/").

11.

	lenis:			fortis:		
	form:	example:		form:	example:	
(a) word-initially:	t	ˈtɑk	dock	t^h	ˈt^hɑp	top
(b) syllable- and word-finally:	ːt ːd̥	ˈnɑːt˺ ˈnɑːd̥˺	nod	t˺ ˢ̬t˺ ʔ	ˈnɑt˺ ˈnɑᵍt˺ ˈnɑʔ	knot
(c) intervocalic stressed-syllable-initially:	d	əˈdɑpt	adopt	t^h	əˈt^hɑp	atop
(d) word-internal unstressed syllable-initially:	ːɾ ɾ	ɑːɾɹ̩ ɑɾɹ̩	odder (neutralized)	ɾ	ˈɑɾɹ̩	otter
(e) preceding **s**:	form: t example: stɑp˺ ; stop (non-contrastive)					

12. Contrary to standard labeling conventions, it is actually the lenis ("voiced"; [voice]) stop which is unmarked; the fortis stop ("voiceless"; [-voice], or ∅voice) is marked. The patterning of English so-called [-voice] or ∅voice stop is not parallel to the cross-linguistic norm for stops: its presence implies the presence of the "unmarked" norm, i.e., the so-called [voice] stop.

13.

	lenis:			fortis:		
	form:	example:		form:	example:	
(a) word-initially:	t	ˈtɑk	dock	t^h	ˈt^hɑp	top

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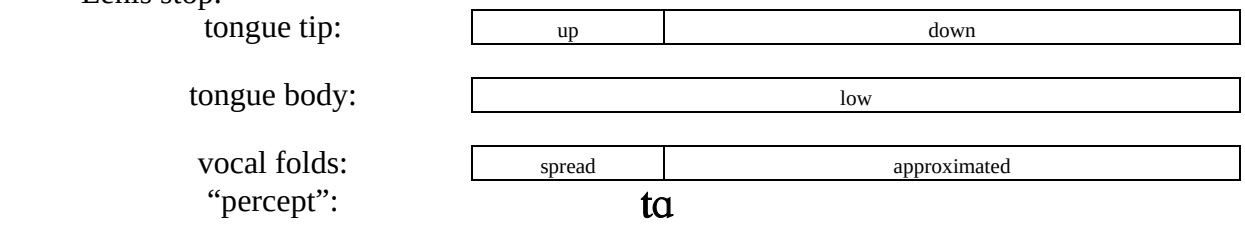
14. Natural laryngeal setting for word-initial stops is near-zero VOT, as sufficient transglottal pressure drop is not present to naturally implement vocal fold vibration until oral release (Westbury and Keating 1986, pace Rothenburg 1968).

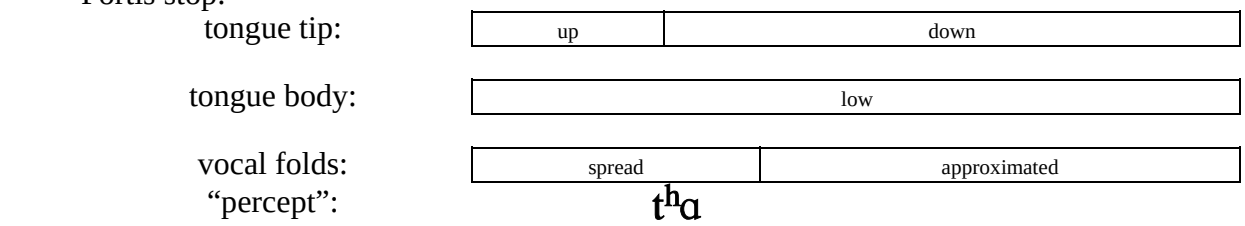
15. Gestural model (Browman and Goldstein 1986, 1989), *schematic*:

Lenis stop:



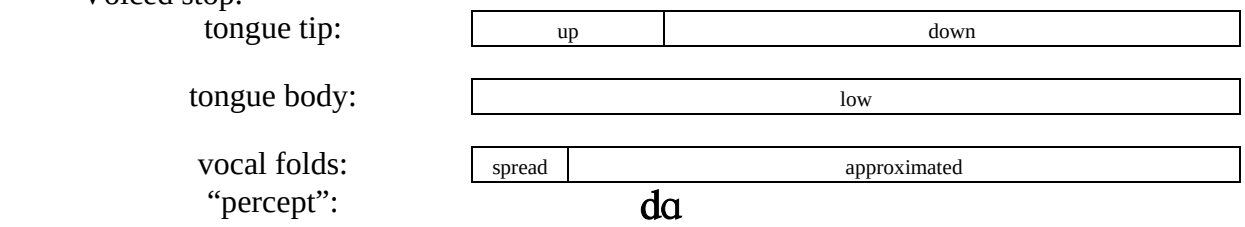
16. If there is a laryngeal contrast among stops, what is its likely manifestation? A laryngeal contrast here may be effected by pushing toward late VOT (aspiration) (e.g. English).

Fortis stop:



17. Or, a laryngeal contrast here may be effected by pushing toward early VOT (e.g. Spanish, Dutch, Japanese).

Voiced stop:



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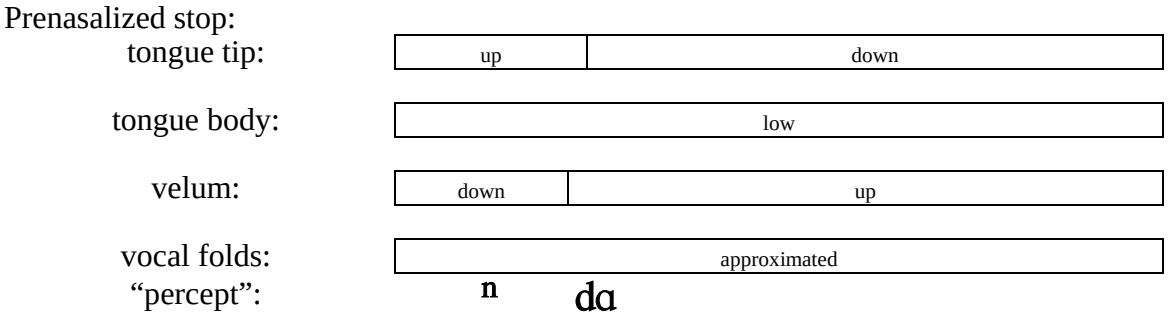
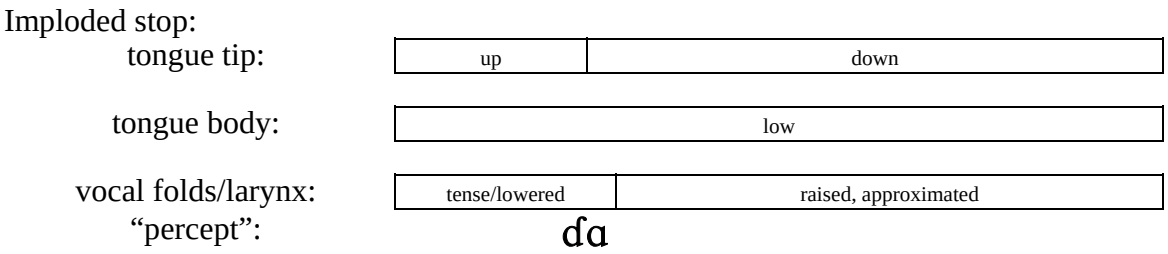
18. Or there may be prenasalization (e.g., Chinantec):



19. Or there may be implosion (e.g. Vietnamese):



20. These environment-specific manifestations maintain the contrast by accommodating to particular articulatorily natural constraints; by shifting the natural laryngeal posture (for the unmarked pattern) to a somewhat less natural laryngeal posture (for the marked pattern); either extend vocal fold spreading beyond release (aspiration), or extend voicing to precede release (prevoicing, prenasalization, implosion). The observed contrast can be motivated by comparing the natural, unmarked value ([t]) to the unnatural, marked value ([t^h], [d], [^{n}d], or [ɗ]).

	(a) word-initially:
Lenis/natural	t
	⇳
Fortis/less natural	t^h

21. Nothing explanatory emerges by generating the respective values from some hypothesized lexical representations, by *changing* (not temporally shifting) particular hypothesized distinctive feature values that cannot be formally related to one another:

22. Distinctive feature theory: [voice] → ∅voice, ∅voice → [spread]

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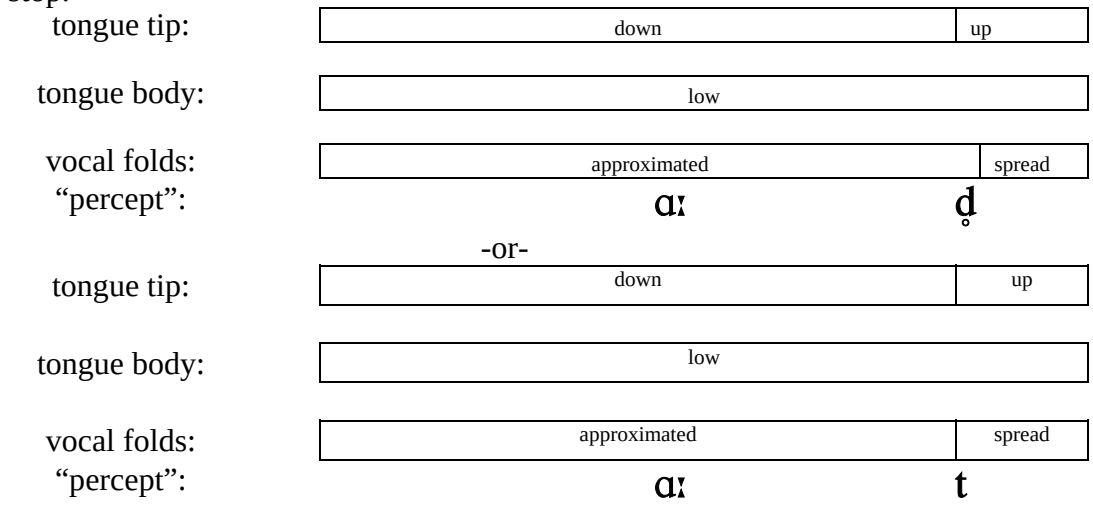
23.

	lenis:			fortis:		
	form:	example:		form:	example:	
(b) syllable- and word-finally:	ːt ːd̥	ˈnɑːt˺ ˈnɑːd̥˺	nod	t˺ ˀ͡ᵛt˺ ʔ	ˈnɑt˺ ˈnɑᵍt˺ ˈnɑʔ	knot

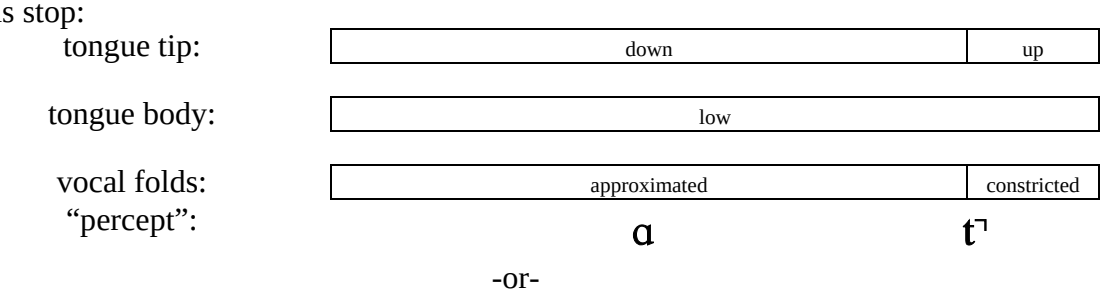
24. Lenis stop:



25. Word-final and syllable-final stops are naturally voiceless. The natural laryngeal posture for syllable-and word-final stops is rather sudden dissipation of vibration, as the sealed oral cavity quickly fills to capacity, resulting in a rapid equalization of subglottal and supraglottal pressure (Westbury and Keating 1986).

26. For the fortis stop, concomitant vowel shortening and/or glottal constriction may be implemented to enhance the contrast.

Fortis stop:



-or-

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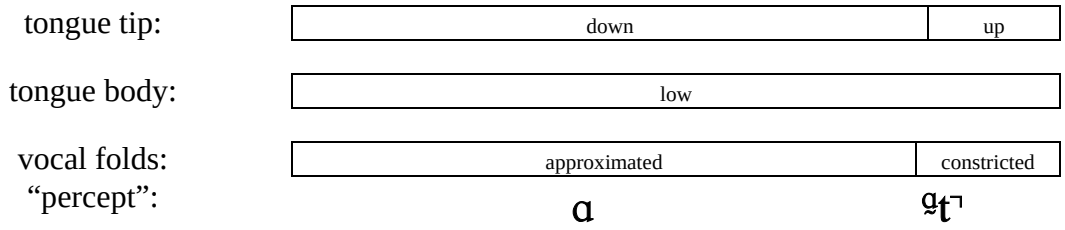
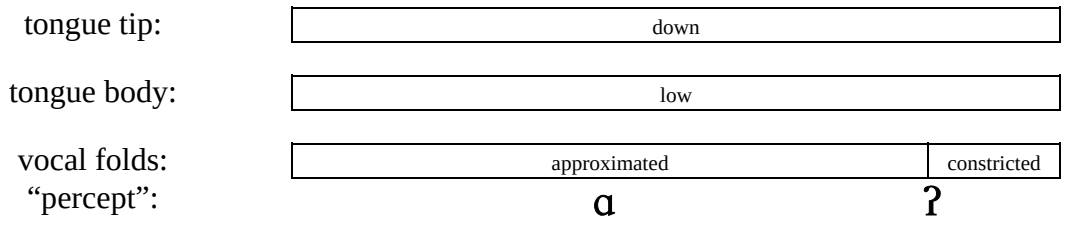


-or-

The glottal constriction can take the place of the oral occlusion. This configuration mimics the acoustic properties of a voiceless alveolar stop (silence with far less pronounced formant transitions than labials or velars).



27. Again, this environment-specific manifestation maintains the contrast by accommodating to particular articulatorily natural constraints. The natural (unmarked) pattern involves voicelessness, and so the marked value normally involves a moderately less natural laryngeal posture.

	(b) syllable- and word-finally:
Lenis/natural	ːt/ːd
	⇳
Fortis/less natural	t/ ˬt/ʔ

28. Distinctive feature theory: [voice] → ∅voice, ∅voice → [constricted]

29.

	lenis:			fortis:		
	form:	example:		form:	example:	
(c) intervocalic stressed-syllable-initially:	d	əˈdɑpt	adapt	t^h	əˈt^hɑp	atop

30. An "embarrassment of riches": Stressed syllables, with their increased energy, duration, and articulatory force (de Jong 1991) allow for maximally distinct values to be readily implemented.

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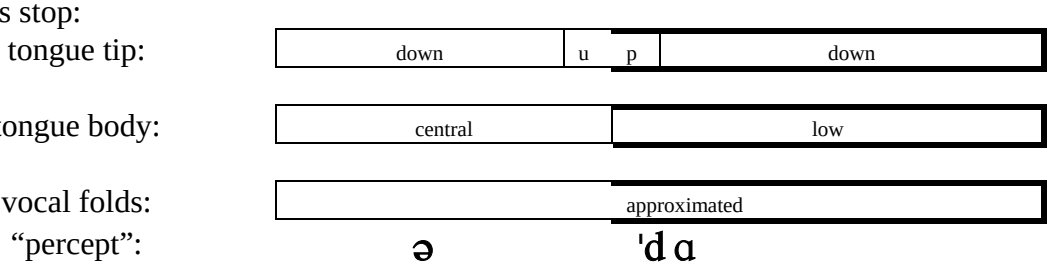
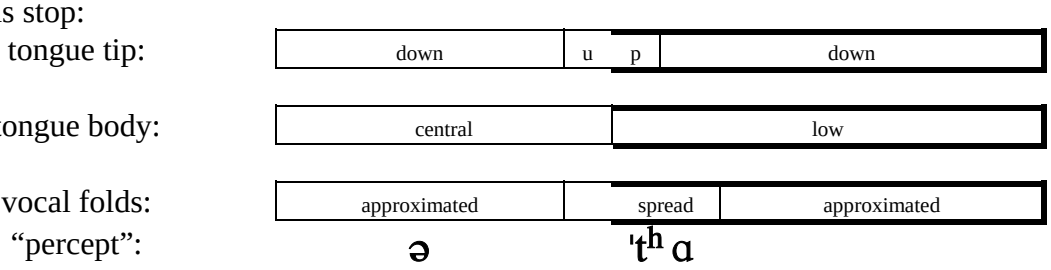
31. Lenis stop:



32. Fortis stop:



33.

	(c) stressed-syllable-initially:
Lenis/natural	d
	⇳
Fortis/less natural	t^h

34. Distinctive feature theory: ∅voice → [spread]

35. In sharp contrast, intervocalically before a *stressless* syllable is a poor context for laryngeal contrasts to be maintained (but cf. place features). Voicing is natural intervocalically (Westbury and Keating 1986), as the oral closure is typically short enough so that trans-glottal flow does not markedly dissipate. Moreover, stresslessness corresponds to a reduction of duration, energy and articulatory force, which establishes a natural environment for (obstruent) stops to turn into (sonorant) taps (cf. English vowel reduction; de Jong 1991).

36.

	lenis:			fortis:		
	form:	example:		form:	example:	
(d) word-internal unstressed syllable-initially:	ːɾ ɾ	ˌɹɑːɾˌɹ ˌɹɑɾˌɹ	odder (neutralized)	ɾ	ˈɑɾˌɹ	otter

37. Not surprisingly, in such energy-deprived contexts, the contrast only barely survives (in vowel length); in many dialects, it is lost.

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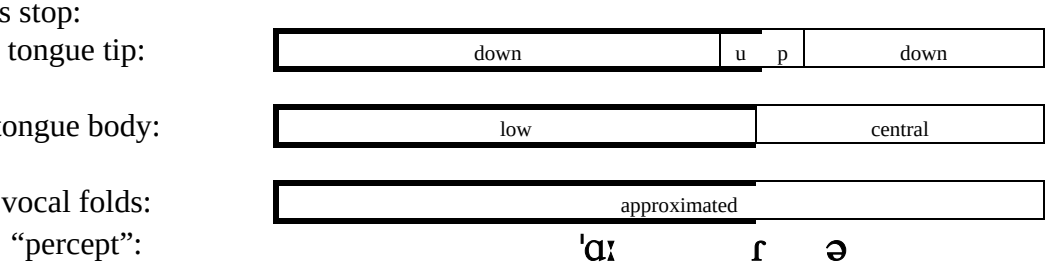
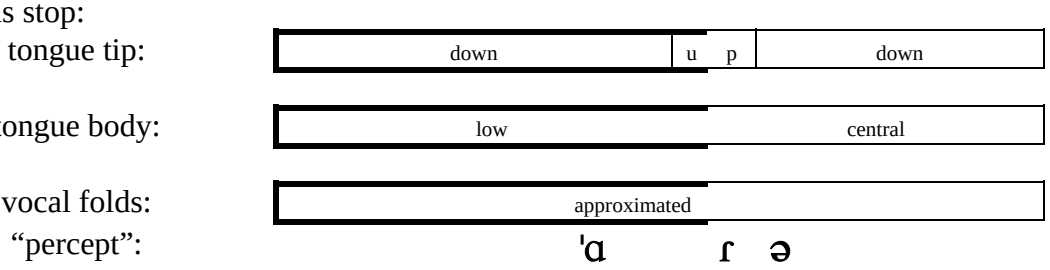
38. Lenis stop:



39. Fortis stop:



40.

	(d) word-internal unstressed syllable initially:
Lenis/natural	(ː)ɾ
	⇳
Fortis/less natural	ɾ

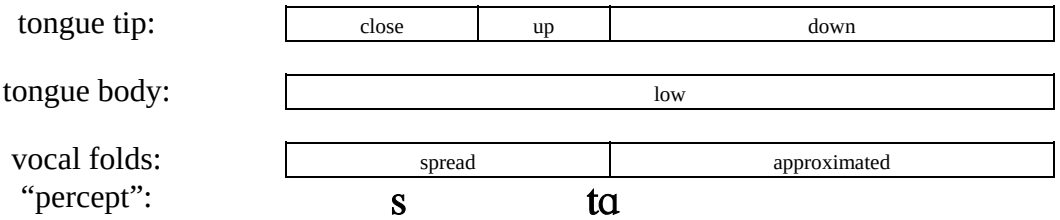
41. Distinctive feature theory: [voice] → [+sonorant], ∅voice → [+sonorant]

42.

	lenis:		fortis:	
	form:	example:	form:	example:
(e) preceding **s**:	form: t	example: stɑp˺ ; stop (non-contrastive)		

43. Due to the laryngeal articulatory demands of the voiceless fricative (sustained laryngeal spreading), energy availability becomes the overriding factor here.

44. No contrast:



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45.

	(e) preceding **s**:
(no contrast)	t

46. English allophonic chain shift:

(a) word-initially:		**(b)** syllable- and word-finally:		**(c)** intervocalic stressed-syllable-initially:		**(d)** word-internal unstressed syllable initially:		**(e)** preceding **s**:
t (natural)	⇔	ːt/ːd̥ (natural)	⇔	d (natural)	⇘			
⇳		⇳		⇳		(ː)ɾ	⇔	t
t^h (less natural)	⇔	$t^{\neg}$/ ˜$t^{\neg}$/ʔ (less natural)	⇔	t^h (less natural)	⇗			
Contrast maintenance		Contrast maintenance		Contrast maintenance		Creeping energy availability		Energy availability

* (ː)ð/(ː)z (less natural) ⇳ ɾ (natural)

* t (natural) ⇳ t^h (less natural)

47. In (d), alternation with spirants would provide no functional gain, as ð and z are contrastive in these contexts, e.g. ‘lather’ (cf. ‘ladder’), ‘reason’ (cf. ‘heathen’). Moreover, this contextual manifestation of the contrast would involve the unmarked, or natural lenis stop being realized in a marked fashion (a spirant), while the marked, unnatural fortis stop would be implemented naturally, as a tap. This sort of contextual markedness reversal is thus correctly predicted unattested.

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48. Some other systems:

Corsican (Dinnsen and Eckman 1977); true allophony:

# ___:		**V___V:**
Voiceless stops:	⇔	Voiced stops:
peðe 'foot'		u beðe 'the foot'
tengu 'I have'		u dengu 'I have it'
sɑkːu 'bag'		u zɑkːu 'the bag'
⇳	⇔	⇳
Voiced stops:		Voiced fricatives:
bokːɑ 'mouth'		ɑ βokːɑ 'the mouth'
dente 'tooth'		u ðente 'the tooth'
golɑ 'throat'		diɣolɑ 'of throat'

49. β, ð, ɣ *exclusively* alternate with b, d, g; they do not contrast with b, d, g. Spirantization is thus non-neutralizing.

50. Spirantization maintains the contrast, again, by shifting to a less natural (more marked) value: fricatives are marked (and presumably involve more effort to properly implement) in comparison to stops.

51.

Voiceless stops (p,t,k):	Truly allophonic (word-initially only)
Voiced stops (b,d,g):	Contextually allophonic (word-initially opposed to voiceless stops, and intervocalically opposed to voiced spirants)
Voiced spirants (β, ð, ɣ):	Truly allophonic (intervocalically only)

52. Southern Min "free" syllable tone circle (Chen 1987); contextual allophony/contextual neutralization:

___ #		~___ #
24	⇔	22
⇳		⇳
22	⇔	21
⇳		⇳
21	⇔	53
⇳		⇳
53	⇔	44
⇳		⇳
44	⇔	22

53. Most sandhi forms are contextually allophonic; non-neutralizing. Only 22 is a (contextually) neutralized value (deriving from both 24 and 44) in the sandhi environment (non-final position).

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54. Summary and conclusion:

Allophony may be a consequence of contrast maintenance (given sufficient energy availability) —an *abstract* functional constraint
Neutralization may be a consequence of insufficient energy availability —a *physical* functional constraint
Unmarked values are typically natural values; marked values are typically less natural. These distinctions in naturalness/markedness carry over to contextually-conditioned alternations.
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