

Notes on Hayes & Steriade (2004)

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1 The vision

Hayes and Steriade envisage an approach to the study of phonology that:

- ... proposes that (most) phonological rules/constraints are *grounded* in speech production and perception, (and speech processing more broadly speaking)
- assumes that this grounding is *mediated by the synchronic grammar*
- ... is *deductive* rather than *inductive* methodologically: hypotheses about phonological systems are to be formulated on the basis of independent knowledge concerning *difficulty* in speech production and perception then tested against phonological data
- ... is formalised using the core devices of OT

2 Articulatory difficulty

Hayes and Steriade exemplify the nature of their approach with an account of the role of voice production in the shaping of plosive inventories. First, they claim that the following hierarchy of articulatory difficulty is plausible on aerodynamic grounds (cf. [Hayes 1996](#)):

(1) [g:] > [d:] > [b:] > [g] > [d] > [b]

They then investigate how closely phonological grammars mirror this hierarchy. (2) represents the closest possible match, but more coarse-grained mappings such as (3) are also conceivable.

(2) *[-son,+long,+dorsal,+voice] >> *[-son,+long,+coronal,+voice] >>
*[-son,+long,+labial,+voice] >> *[-son,-long,+dorsal,+voice] >>
*[-son,-long,+coronal,+voice] >> *[-son,-long,+labial,+voice]

(3) a. *[-son,+dorsal,+voice] >> *[-son,+coronal,+voice] >> *[-son,+labial,+voice]
b. *[-son,+long,+voice] >> *[-son,-long,+voice]

3 Perceptual difficulty and phonotactics

A second example concerns the availability of place cues and its effects on contextual neutralisation of place of articulation in consonants ([Ohala, 1990](#); [Jun, 1995](#); [Wright, 1996](#); [Steriade, 1997](#)). Generally speaking:

(4) Partial perceptual difficulty map for place contrast:

V__C, V__# > C__V, #__V

(5) Resultant constraint hierarchy:

*Place/V__C, *Place/V__# > *Place/C__V, *Place/#__V

However, for apicals:

(6) Partial perceptual difficulty map for place contrast in apicals:

C__V, #__V > V__C, V__#

(7) Resultant constraint hierarchy:

*Place/C__V, *Place/#__V > *Place/V__C, *Place/V__#

4 Phonetic difficulty is language specific

To the extent that the phonetic implementation of the 'same' phonological categories differs cross-linguistically, we should find corresponding differences in phonetic difficulty maps, and hence in phonological patterns:

(8) Standard Thai: duration of VR > duration of V: before obstruents

a. /CVR/ → full tonal paradigm

b. /CV:O/ → LH, M

(9) Navajo: duration of VR = duration of V: before obstruents

a. /CVR/ → HL, LH

b. /CV:O/ → full tonal paradigm

5 Inventory optimisation and contrast-based constraints

Sometimes it seems as if the phonological markedness of a sound [x] does not depend on its *intrinsic difficulty* (in context) but on its confusion potential within the global configuration of the inventory that it belongs to.

For example, central high vowels such as [y] and [ɨ] are perceptually difficult (and therefore dispreferred) in systems that have multiple high vowels, but not in systems that fail to exploit the front-back dimension phonologically.

Given the approach advocated by Hayes and Steriade this necessitates the introduction of constraints evaluating *sets of contrasting sequences*. Global inventory optimisation has been incorporated as part of the phonological grammar elsewhere (e.g., [Clements 2003](#)), but see for example [de Boer \(2001\)](#) for a strictly 'local' (non-teleological) alternative solution.

6 Stabilisation

Problem: phonological constraints tend to be stable across intraspeaker phonetic variation (modulo any effects of style/rate-specific phonology), but synchronic grounding would seem to predict that constraints are (fully) rate/style dependent.

Solution: Grammar refers to phonetic forms that are *normalised* in some way

7 Some points for discussion

- Predictions derived from phonetic difficulty maps can be treated as deterministic (in which case they can be falsified on the basis of single counterexamples) or as probabilistic (in which case they can be falsified on the basis of statistical generalisations). Hayes and Steriade do not seem to commit explicitly to either of these
- Given the methodology mentioned under 1 above, are there any general strategies for approximating the resolution of phonological constraints vis-à-vis phonetic maps, or is this something that can only be discovered inductively (cf. Hayes & Steriade 2004, section 5 on [+voice] vs. [-voice])?
- Languages can have phonetically (or phonologically) *crazy rules* to an extent that largely remains to be determined. Apart from having a bearing on Hayes and Steriade's arguments against the 'diachronic grounding' models of Ohala, Blevins, this capacity might be part of a broader *stabilisation* issue.

References

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