Surface structure constraints

Phonotactic theory (EGG 2025, Zagreb)

1 Introduction

- Recall that voicing is non-contrastive for the Russian affricates /t͡s, t͡ɕ/, but the affricates have voiced allophones (e.g., [ʐɛt͡ɕ]–[ʐɛd͡ʑ bɨ] 'to burn'–'would burn'), facts inconsistent with the MSC projection principle implicit in Chomsky and Halle 1965.

- Observations of this sort leads Clayton (1976) and Shibatani (1973), among others, to reject MSCs in favor of **surface structure constraints**.

2 Surface structure constraints

- Implicit in this notion is some sort of projection of surface-true phonological processes to phonotactic constraints.

  (1) Surface-Trueness: Let A, C, D be natural classes and B a phonological change, and let R be the rule $A \rightarrow B / C$ ___ D. Then R is **surface-true** just in there are no instances of the substring CAD on the surface.

  (2) Surface-True Projection Principle: Let A, C, D be natural classes and B a phonological change. Then, if there exists a surface-true rule $A \rightarrow B / C$ ___ D, any word containing the substring CAD is not a possible word.

- Let us assume that Russian has a rule of surface-true anticipatory voice assimilation. Then, (2) predicts that the presence of a hetero-voiced obstruent clusters will lead Russian speakers to regard a nonce word as ill-formed.

- **Is this prediction true?**

- By design, (2) treats surface structure constraints as a projection of phonological knowledge rather than as **autonomous** phonotactic generalizations.

- **How can a learner determine that a rule is surface-true?**

3 Morpheme structure or surface structure?

- It is not always obvious whether an apparent phonotactic constraint operates at the level of the morpheme, the surface, both, or neither.

- For example, it has long been known that Arabic lacks triliteral roots where the first and second consonants are identical.

    (3) Greenberg's (1950) generalization:

    a. ✓$C_1C_2C_2$ (e.g., √ʕzz, √ḥbb, √ḥqq, √rbb)
    b. ✗$C_1C_1C_2$ (e.g. *√ssm)

- Frisch and Zawaydeh (2001) show that Jordanian Arabic speakers are highly sensitive to Greenberg's generalization using a wordlikeness judgment task.

- At first glance, this looks like an MSC since these roots are phonologically abstract objects (i.e., the consonants need not be adjacent on the surface).

- McCarthy (1986) provides a simple derivational account of Greenberg's generalization:

    - The **obligatory contour principle** (OCP) forbids adjacent consonants underlyingly (e.g., *√ʕzz).
    - Thus triliteral roots of the (3a) shape are underlyingly biliteral (e.g., √ʕz).
    - Association of the root melody to the CV-template is left-to-right.

    (4) Biliteral √ʕz in a triliteral template:

$$
\begin{array}{ccccc}
C & V & C & V & C \\
| & & & & \\
\ ʕ & & & z &
\end{array}
$$

- **Is this a MSC, an SSC, neither, or both?**

- **Do we need to revise our projection principle(s) to link McCarthy's analysis to Frisch and Zawaydeh's wordlikeness results, and if so, how?**

4 Surface constraints in speech perception

- Many believe that phones and phonemes (and maybe features) are the units of human speech processing.

- However, speech perception is not necessarily veridical with respect to those units; it may give rise to **perceptual illusions**.

- For example, Japanese speakers, presented with [ebzo], instead hear [ebɯzo] (Dupoux et al. 1999). This perceptual illusion seems to be mediated by the grammar (at least in some shallow sense) because Japanese permits no obstruent clusters.

- **Is this a problem for our projection principle?**

- Durvasula and Kahng (2015), henceforth D&K, show that perceptual illusions reflect a **reverse inference** to plausible URs.

- For example, the sequence [...cʰm...] is illicit in Korean, and Korean speakers perceive an illusory high vowel when presented with [ecʰma]. D&K find that the illusory vowel can be perceived as:

    - [ɨ] via a hypothesized /ecʰɨma/ or
    - [i] via a hypothesized /etʰima/ and a process of regressive palatalization.[1]

- These results provide subtle experimental support for the projection principle above.

Close reading

- Kager 1999:§1.5–1.6

5   Surface structure constraints in Optimality Theory

- Prince and Smolensky (1993), henceforth P&S, describe **richness of the base** as follows:

  > Under the thesis that might be dubbed Richness of the Base, which holds that all inputs are possible in all languages, distributional and inventory regularities follow from the way the universal input set is mapped onto an output set by the grammar, a language-particular ranking of the constraints. (P&S:209)

- And here is how they describe **lexicon optimization**:

  > Suppose that several different inputs $I_1, I_2, \ldots, I_n$ when parsed by a grammar G lead to corresponding outputs $O_1, O_2, \ldots, O_n$, all of which are realized as the same phonetic form Φ—these inputs are all *phonetically equivalent* with respect to G. Now one of these outputs must be harmonic, by virtue of incurring the least significant violation marks: suppose this optimal one is labeled O_k. Then the learner should choose, as the underlying form for Φ, the input I_k. (P&S:209)

- Or, as Prince later writes:

  > A correspondent to this list wonders why, in a grammar G such that G(a)=G(b) for potential input elements /a/,/b/, a nonalternating observed element [a] is not (sometimes, always, freely) lexically /b/. The correct answer is surely "why bother?"—i.e. to set up /b/ for [a] when /a/ will do [...] The basic idea reappears as "lexicon optimization" in recent discussions. (A. Prince, electronic discussion, Nov. 1996; quoted in Hale and Reiss 2008:246)

---

[1]Durvasula and Kahng don't explicitly state that the palatalization process is surface-true, but let us assume it is for sake of argument.

- OT and related theories posit that the "pathologies" that trigger phonological processes are violations of autonomous phonotactic generalizations, **markedness constraints**.

- The "cures" to these pathologies are in some sense emergent, or at least not explicitly paired with the phonotactic constraints.

- OT introduces this separation of pathology and cure to address the notion of **conspiracies** (Kisseberth 1970, 2011), in which several phonological processes which "conspire" to avoid certain configurations at surface form.

- However, Kiparsky (1973:75f.), argues that conspiracies may themselves be merely taxonomic. His argument is as follows:

    - A rule must be surface-true to contribute to a conspiracy, and

    - surface-true rules are easier to acquire, and

    - therefore, grammars will naturally accumulate surface-true rules,

    - some of which linguists will regard as functionally related.

6   The duplication problem

- The **duplication problem** (Kenstowicz and Kisseberth 1977:§3.1) is the observation that sequence structure generalizations within morphemes may also be reflected in phonological alternations across morpheme boundaries.

- For example, in Buchan Scots is a height harmony process affecting the *-ie* diminutives.[2]

    (5) Buchan Scots height harmony (Paster 2013):

    a. bitʃ-**i**   'beachie'
        hus-**i**   'housie'
    b. nel-**e**   'nailie'
        hʌrt-**e**   'hurtie'

    (6) Height Harmony:

    $$\begin{bmatrix} -\text{Stress} \\ -\text{Back} \end{bmatrix} \rightarrow \{-\text{High}\} \begin{bmatrix} +\text{Stress} \\ -\text{High} \end{bmatrix} C_0\text{—}$$

- Individual morphemes conform to height harmony as in *merse* 'mercy'.

- Paster claims both generalizations derive from the same regular sound change.

- There are a number of analytical possibilities here:

    - Perhaps (6) applies both to roots (à la Chomsky and Halle's redundancy rules) but also to derived forms.

    - Perhaps the morpheme structure generalization is just a diachronic accident.

---

[2]Once again, let us assume this is surface-true for sake of argument.

- – Perhaps (6) and the MSC are synchronically active but independent of one another:
  - * Many apparent MSCs are "violated" by phonological alternations.
  - * Many phonological rules can only be allowed to apply in **derived environments** and thus do not correspond to any MSC.

- Paster concludes:

  ...there are a number of arguments in favor of MSCs, but not all linguists agree that they exist in synchronic grammars. If they do not, then there is no 'duplication'. Even if there is duplication, I have argued that it is not a 'problem'. Duplication is problematic only if the synchronic grammar is considered to be the sole valid locus for the explanation of phonological patterns and why certain patterns cooccur. (Paster 2013:89)

Further reading

- Kisseberth (2011) reviews the notion of **conspiracy**, introduced in Kisseberth 1970, as conceived of in Optimality Theory. Conspiracies are closely related to—and in some sense a generalization of—the duplication problem.

References

Chomsky, Noam, and Morris Halle. 1965. Some controversial questions in phonological theory. *Journal of Linguistics* 1:97–138.

Clayton, Mary L. 1976. The redundance of underlying morpheme-structure conditions. *Language* 52:295–313.

Dupoux, Emmanuel, Kazuhiko Kakehi, Yuki Hirose, Christophe Pallier, and Jacques Mehler. 1999. Epenthetic vowels in Japanese: A perceptual illusion? *Journal of Experimental Psychology: Human Perception and Performance* 25:1568–1578.

Durvasula, Karthik, and Jimin Kahng. 2015. Illusory vowels in perceptual epenthesis: The role of phonological alternations. *Phonology* 32:385–416.

Frisch, Stefan A., and Bushra Adnan Zawaydeh. 2001. The psychological reality of OCP-Place in Arabic. *Language* 77:91–106.

Greenberg, Joseph. 1950. The patterning of root morphemes in Semitic. *Word* 5:162–181.

Hale, Mark, and Charles Reiss. 2008. *The Phonological Enterprise*. Oxford University Press.

Kager, René. 1999. *Optimality Theory*. Cambridge University Press.

Kenstowicz, Michael, and Charles Kisseberth. 1977. *Topics in Phonological Theory*. Academic Press.

Kiparsky, Paul. 1973. Phonological representations. In *Three Dimensions of Linguistic Theory*, ed. Osamu Fujimura, 1–135. TEC Corporation.

Kisseberth, Charles W. 1970. On the functional unity of phonological rules. *Linguistic Inquiry* 1:291–306.

Kisseberth, Charles W. 2011. Conspiracies. In *Blackwell Companion to Phonology*, ed. Marc van Oostendorp, 1644–1665. Wiley-Blackwell.

McCarthy, John J. 1986. OCP effects: Gemination and antigemination. *Linguistic Inquiry* 17:207–263.

Paster, Mary. 2013. Rethinking the 'duplication problem'. *Lingua* 126:78–91.

Prince, Alan, and Paul Smolensky. 1993. Optimality theory: Constraint interaction in generative grammar. Technical report TR-2, Rutgers University Center for Cognitive Science. Published by MIT Press, 2004. URL `https://roa.rutgers.edu/article/view/547`.

Shibatani, Masayoshi. 1973. The role of surface phonetic constraints in generative phonology. *Language* 49:87–106.