

The cognitive basis for restrictions on vowel harmony

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Abstract representations such as features play a vital role in explanations of phonological processes, leading many to take for granted the idea that these representations play an equally prominent role in the learning process. This assumption is tested in three artificial grammar learning experiments of morphophonological alternations relating to backness/rounding vowel harmony (Experiment 1), backness harmony (Experiment 2) and height harmony (Experiment 3). In each experiment, adult participants were exposed during training to stem-suffix pairs containing four vowels from a six-vowel inventory: words with the two remaining vowels appeared at test only. If participants use features and natural classes, they should generalize to the novel segments. Results show positive evidence for a cognitively restricted feature-based rule learning account that is sensitive to the inventory of the native language and is constrained by principles governing cross-linguistic vowel harmony typologies.

Previous research in artificial language learning has provided mixed results concerning the level of representation at which learners form their rule hypotheses. Seidl and Buckley (2005) report generalization to novel segments, while Peperkamp and Dupoux (in press) report no generalization. We discuss potential explanations for this disparity, and address the issues in our own experiments. These issues include the necessity for presenting novel segments independently of old segments at test, the use of control participants, and the role of holding out novel segments until test.

Participants in the experimental conditions (12 in each group) were exposed to pairs displaying stem-suffix alternations resembling vowel harmony (e.g., [kinæ kinæmi]). Participants in the control condition were exposed to both harmonic and disharmonic stems. At test, participants made forced-choice judgments of suffixed lexical items ([mepemi] vs. *[mepemu]). Novel segments varied by condition (e.g., either low or mid vowels for the high vowel suffix in Experiment 1).

In Experiment 1 participants were exposed to back/round harmony, with the suffix alternating between [-mi] (for front vowel stems) and [-mu] (for back), and were exposed to either non-low or non-mid vowels. Participants generalized to mid vowels (choosing the harmonic form in 69% of trials) but not low vowels (51%) (harmonic forms were chosen 54% for Controls), reflecting a principle evident cross-linguistically; low vowels are opaque to round harmony. In Experiment 2, participants were exposed to back harmony with a low vowel suffix ([-mak]/[-mæk]), and were exposed either to non-high vowels or non-mid vowels. Participants generalized to mid vowels (69%), but less to high front vowels (55%) (Controls were 50% harmonic), reflecting the cross-linguistic tendency for high front vowels to be neutral to vowel harmony. In Experiment 3, participants were exposed to a height harmony alternation ([-mi]/[-me]) and exposed either to front vowels or lax vowels only. Participants generalized to back vowels (56%) but not lax vowels (49%) (Controls were 47% harmonic), mirroring the cross-linguistic tendency for height harmony languages to be conditioned by tenseness but not backness.

This set of experiments provides evidence for feature-based learning that is constrained by the same cognitive mechanisms that constrain cross-linguistic typologies.

References:

- Peperkamp, S., Skoruppa, K., & Dupoux, E. (in press). *The role of phonetic naturalness in phonological rule acquisition*. Paper presented at the Boston University Conference on Language Development.
- Seidl, A., & Buckley, E. (2005). On the learning of arbitrary phonological rules. *Language Learning and Development, 1*, 289-316.