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Feature-based Generalization and Artificial Language Learning

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Introduction

We present the results of an artificial language learning experiment that tested the role of phonological features in language learning. A six-vowel inventory was used at test, but only four vowels were given at training. If participants are able to use features and natural classes, they should generalize to the novel segments. Results provide evidence that learners are able to generalize beyond the segment.

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) and Peperkamp, Skoruppa and Dupoux (in press) report no generalization. However, Seidl and Buckley do not control for novel segments, and Peperkamp et al. expose participants to the novel segment during training. Learners may treat this initial lack of positive evidence as negative evidence. In our study, we explicitly control for novel segments, and hold out these novel segments at training.

Hypotheses for Rule Learning

We propose three hypotheses about rule learning based on phonological categories. The *segment-based hypothesis* states that learners form their rule based entirely on individual segments, and will not generalize to novel segments. The *General Feature-Based hypothesis* states that learners will form the most general possible rule to fit all of the data, and will generalize if possible. The *Restrictive Feature-Based Learner* states that learners will form the most specific rule possible that will fit to the data and will generalize only to certain novel segments.

The Experiment

In order to differentiate between these hypotheses, we conducted an artificial learning experiment using front/back vowel harmony as the grammatical rule. Participants in the experimental conditions (12 in each group) were exposed to stem-suffix alternations, with the suffix alternating between [-mi] (for front vowel stems) and [-mu] (for back vowel stems). Participants in the control condition were exposed to a mixture of harmonic and disharmonic stems.

At test, participants were asked to make forced-choice judgments about lexical items in the language. Novel segments varied by condition: either low vowor mid vowels.

The segment-based hypothesis predicts no generalization; the general feature-based hypothesis predicts generalization in both conditions, and the restricted feature-based hypothesis predicts generalization to mid vowels only.

Results and Discussion

Results show generalization in the Mid Hold-Out,, but not the Low Hold-Out condition, supporting the restrictive feature-based learning hypothesis. However, because suffixal alternations involved changes in both backness and rounding, but low vowels only involve a change in backness, participants may have been biased towards a rounding harmony rule in which low vowels are unable to participate. Further experiments support this conclusion, drawing support for general feature-based learning that is restricted through typological considerations.

Table 2: Means and Confidence Intervals

	Control	Mid Gen	Low Gen
Old Stems	0.53 (0.12)	0.70 (0.13)	0.82 (0.099)
New Stems	0.55 (0.083)	0.60 (0.055)	0.82 (0.11)
New Vowel	0.55 (0.13)	0.69 (0.10)	0.51 (0.078)
Overall	0.53 (0.017)	0.66 (0.12)	0.72 (0.38)

Acknowledgments

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