The syllable in domain generalization: Evidence from artificial language learning

Background: *Domain generalization* refers to a type of diachronic account of certain domain-edge phenomena, in which the domain of application of a phonological pattern narrows from a larger level (e.g. the phrase/utterance) to a smaller one (e.g. the word). Myers & Padgett (2014) tested this through two artificial language learning experiments, showing that participants could learn a pattern of utterance-final voicing neutralization and generalize it to the word level.

Myers & Padgett (2014) and others (e.g. Blevins 2006) point out that, given generalization to the word, one might also expect generalization to the syllable level, but most discussion of generalization deals with word-level phenomena. There is a crucial difference between the word and smaller units: The word exists as a morphosyntactic and semantic unit, as well as a phonological one. Syllables (and feet), on the other hand, are purely phonological. It is possible that they are not stored in memory or otherwise accessible to the grammar in the same way as words. If generalization requires some sort of calculation over experienced tokens of language, it is possible that the syllable is not available as a unit for these calculations.

Additionally, the syllable may not be the type of domain over which generalizations occur. Bermudez-Otero & Trousdale (2012), for example, posit generalization among phonological strata that make reference to morphosyntactic structures. Phonological patterns, they claim, generalize from the phrase stratum to the word stratum, and then to the stem stratum.

Zec & Zsiga (2022), however, cite generalization from the phrase level as the source of high tone retraction in Štokavian varieties of Serbian, claiming that some varieties show generalization to the word level while others show generalization to the *foot*. This appears to be a case of generalization to a smaller-than-word phonological domain. Given this example, as well as numerous attested syllable-final phenomena, I investigate whether learners can generalize to the syllable level in an artificial language learning experiment.

> **Upshot:** Domain generalization to the syllable is possible.
> - Generalization can occur across *phonological* domains.
> - The syllable is accessible to the learner's grammar on some necessary level.

Experiment: The artificial learning paradigm allows researchers to control the structure of the language material to which learners are exposed during a learning phase to observe the acquisition that has occurred through a test phase. This experiment (like Myers & Padgett 2014) also employed a *poverty of the stimulus* design, wherein there were classes of stimuli present in the test phase that were not included during the learning phase, in order to test for generalization to novel classes. The phonological pattern presented was a liquid /l/~/ɹ/ neutralization.

Stimuli were trisyllabic nonce words/utterances of the two shapes in (1).

(1)   a.   *final coda*   CV.CV.CV**C**
       b.   *medial coda*   CV.CV**C**.CV

During the learning phase, the consonants [t,k,m,n,l,ɹ] occurred with equal frequency in syllable onsets, but [ɹ] did not occur utterance-finally, and neither liquid ([l,ɹ]) occurred in the non-final coda position (1b). Participants listened to the stimuli and repeated them aloud during this phase.

During the test phase, participants heard new utterances, this time with all consonants occurring in all positions. For each item, they were asked to answer (*yes/no*) whether it was an utterance in the language they had been learning. *If participants learned the pattern presented in the learning phase, they should prefer [l] to [ɹ] in the final coda position (1a). If the pattern was generalized to a smaller domain, this preference should extend to the medial coda condition (1b).*

Participants were broken into two learning groups: one which was told they were listening to three-word sentences (utterance-to-word/UtW group), and one which was told they

were listening to three-syllable words (word-to syllable/WtS group). The audio stimuli for these two groups were identical, but the verbal and on-screen instructions either made frequent reference to *sentences* (UtW group) or *words* (WtS group). Exit survey responses reflect that participants in the UtW group believed they were listening to multi-word items, while participants in the WtS group believed they were listening to single-word items. *If the UtW group but not the WtS group showed evidence of generalization, this would support arguments that the syllable is not a possible unit/target for domain generalization.*

Results Data from 61 participants (30 UtW, 31 WtS) were analyzed using a linear mixed-effects regression with liquid coda consonant ([l] or [ɹ]), utterance/word position of the target coda (final or medial), and learning group (UtW or WtS) as fixed effects and response (yes/no) as the dependent variable. A significant main effect of coda liquid was found overall, as well as for each learning group in the final coda position (showing learning) and the medial coda position (showing generalization). There was also a significant effect of coda position, suggesting that participants were less certain about the medial position, for which they had no evidence of liquid-coda-goodness during the learning phase. Crucially, there was no significant effect of (or interaction with) learning group. Both groups showed evidence of learning and generalization.
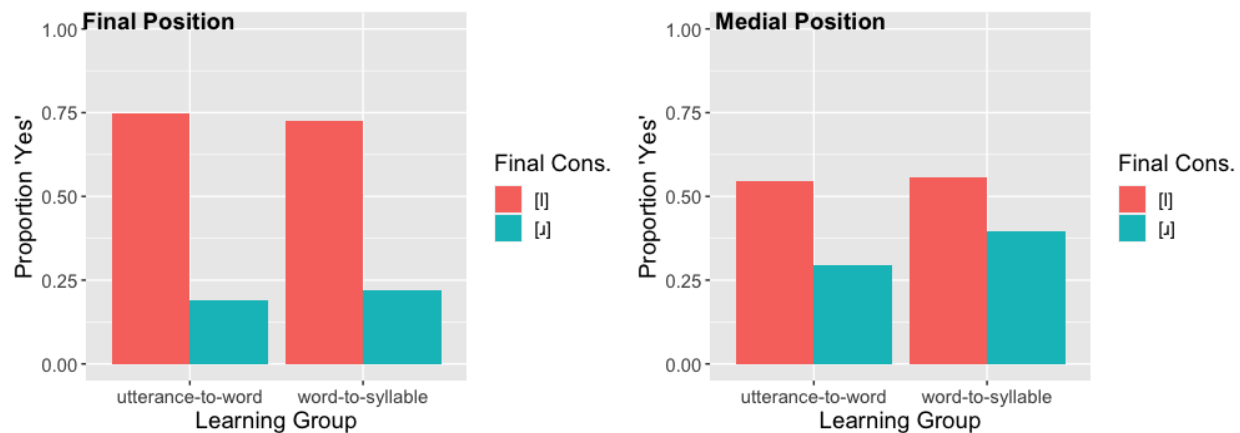

Figure 1: Proportion of 'yes,' or 'accept,' responses by liquid consonant and learning group: (left) final coda position; (right) medial coda position

Discussion: These results indicate that learners can generalize a phonological pattern from a larger domain (the word/utterance) to the *syllable* level. This suggests that sub-word units like the syllable may be stored in memory or otherwise encoded in phonological representations in a way that makes them available for the types of calculations that lead to domain generalization. It also speaks to the nature of domain generalization, showing that generalization can go beyond the word level to smaller prosodic domains.

References

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