Word context affects the categoricity of segment representations
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Exemplar theories versus rule-based theories often make opposing predictions about the nature of segment representations. Exemplar theories predict strong categoricity for segments at morpheme or word boundaries[1] – such segments occur in many environments, so their exemplar clouds include a range of phonetic variants over which listeners can generalize. On the other hand, rule-based theories predict strong categoricity for segments that participate in contrast or phonological rules[2,3] – such segments interact with other segments regardless of phonetic variation. For example, in English words such as *filled* [fɪl-d], the presence of sonorant /l/ triggers voicing agreement *[fɪl-t], which suggests that /l/ has a special status in these words.

In the current study, we tested these differing predictions by asking American English listeners to judge differences among phonetic variants of sonorants [l], [n], [ɹ] in three conditions: 1) at morpheme boundaries without rules, such as [l] in *ill-ness,* which does not trigger change on the following suffix, 2) at morpheme boundaries with a rule, such as [l] in *fill-ed,* which triggers voicing assimilation on the following suffix, and 3) internally without rules, such as [l] in *guild,* which triggers no change (e.g. *guilt* [gɪlt] is grammatical).

We created a set of 162 words, equally divided among the three conditions. Conditions were frequency-balanced, and included equal numbers of words with [l], [n], [r]. We used Praat synthesis with three different acoustic settings to create three variants, e.g., $[l]_1$, $[l]_2$, $[l]_3$, which were spliced into a base to produce three tokens, *fi*$[l]_1$*ed, fi*$[l]_2$*ed*, *fi*$[l]_3$*ed*. Importantly, identical variants were used across conditions (e.g., in condition 3: *gui*$[l]_1$*d, gui*$[l]_2$*d, gui*$[l]_3$*d*). On each trial, participants heard two tokens of the same word (e.g., *fi*$[l]_1$*ed* – *fi*$[l]_2$*ed*) and rated the difference between the target sonorants using a sliding scale with endpoints "0% (totally identical)" and "99% (totally different)". Stimuli were divided into lists; on each list, half of the trials were "same" and half were "different". As a baseline, participants also did the task for [l], [n], [ɹ] variants in isolation.

Generally, we expect listeners to be less sensitive to phonetic differences when the target consonant is more categorical[4]. Thus, exemplar theories predict difference ratings should be lowest when variants of the target sonorant are at a boundary: *illness, filled < guild.* Rule-based theories predict difference ratings should be lowest for words when variants of the target sonorant trigger a rule: *filled < illness, guild.* That is, since any phonetic variant, such as $[l]_1$, $[l]_2$, $[l]_3$, etc., acts as a rule trigger, this may encourage listeners to generalize over these variants.

Results (n=24) were analyzed with a linear mixed-effects model, and included only "different" trials. All three word conditions exhibited significantly lower ratings than the isolation condition; this is expected.[5] More interestingly, analysis revealed the pattern:

illness < filled < guild

That is, condition 1 (*illness*) had lower ratings than condition 2 (*filled*); although unexpected, this pattern is conceivably reconcilable with exemplar theories but notably incompatible with rule-based theories. Condition 2 (*filled*) had significantly lower difference ratings than condition 3 (*guild*), a result that supports the predictions of both theories. Finally, condition 1 (*illness*) had significantly lower ratings than condition 3 (*guild*), a result that supports exemplar theory only.

	Isolation *l*	Cond. 1 *illness*	Cond. 2 *filled*	Cond. 3 *guild*
Mean difference rating (sd):	53.11 (30.67)	20.70 (26.28)	30.69 (31.10)	36.49 (33.19)

The study shows that, even for segments that are phonemic, categoricity depends upon context. Furthermore, the strength of this categoricity crucially depends upon the presence of boundaries, as predicted by exemplar theories.

References
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