Inside the *wug*-test: phonological well-formedness and processing costs

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Introduction: Recent phonological research has focused on the role of lexical storage as a way to explain unexpected morpheme-specific deviations from grammar-wide phonological principles (Zuraw 2000, 2007, 2015; Moore-Cantwell & Pater 2016; Moore-Cantwell & Smith 2017; Zymet 2018, 2019). This implies a feed-forward relationship between grammar and lexicon in production: the phonological forms of morphemes are retrieved, along with optional item-specific information, and then the phonological grammar combines the morphemes subject to a set of general well-formedness principles, overridden only by lexically-specific information. This paper presents evidence for a bidirectional relationship between lexicon and phonological grammar, focusing on a phenomenon known as Lexical Conservatism (Steriade 1997). Lexical Conservatism describes scenarios in which a novel form (the Derivative (D), ex., *compensable*) unexpectedly undergoes a phonologically-motivated (markedness-improving) change to the Local Base (B_L) which would not otherwise be possible (ex., rightward stress shift, as in *cómpensate* + *-able* → *compénsabe, *cómpensable*, while *ínundate* + *-able* → *ínundable*, **inúndable*). Steriade argues that this behavior depends on the presence of a phonologically-advantageous morphologically-related word (the Remote Base (B_R); here the final-stressed root allomorph in *compéns-atory* exists but **inúnd-X* does not). This theoretical explanation makes strong psycholinguistic claims about the relationship between lexicon and grammar, suggesting the phonology can "recruit" related forms from the lexicon in real time.

Exp. 1 replicated and extended Steriade's original survey. 31 subjects were asked to read aloud 120 sentences where a B_L was presented alongside a D formed by attaching one of the affixes *-able*, *-ity,* and *-ism* (as in figure 1). Half the B_Ls had phonologically advantageous B_Rs. Afterwards, subjects completed a *knowledge check* where they were asked to read aloud and indicate whether they knew each of the B_Ls they had seen, as well as the B_Rs for the half of B_Ls which had them. The dependent variable was stress placement in the D relative to that subject's production of B_L and B_R. Analysis was carried out using Bayesian hierarchical logistic regression; here I discuss findings for which there is greater than 95% certainty of a true effect. **Results:** The effect of an individual subject knowing the relevant B_R increased the likelihood that a D had stress placement mismatching B_L. We also observe phonological determinants of stress placement (figure 2). Exp. 1 supports Steriade's informal survey results and demonstrates that the form of the D is causally related to the presence of the B_R, but the effect is probabilistic, and interacts with purely-phonological principles of stress placement.

Exp. 2 extends Exp. 1 and incorporates a priming manipulation. If the findings of Exp. 1 are due to the presence of B_Rs in individual speakers' lexicons, we might expect the strength of the effect to be moderated by lexical characteristics of the B_R such as frequency and semantic similarity between B_L and B_R, and the influence of the B_R should be able to be increased by making it more salient to the speaker before they create the D from the B_L. 30 new subjects participated in an experiment with a similar design as Exp. 1 which included 40 B_Ls, half with B_Rs, fully crossed with affixes *-able* and *-ic*. Procedure followed Exp. 1, except that the *knowledge check* for half of the B_Rs (counterbalanced across subjects) preceded the D formation task, thus priming the B_R for when its B_L was encountered during the experiment. Data annotation and modeling followed Exp. 1. **Results:** As in Exp. 1, both lexical (knowing the B_R) and phonological (syllable weight, secondary stress) factors influenced D stress placement. Focusing on those B_Ls for which the B_R was known, we observe that a primed B_R exerted a greater effect, and this interacted with semantic similarity (figure 3). These facts suggest an architecture where the phonological grammar can "recruit" non-local phonological allomorphs (B_Rs) in real time, implying a dynamic trading relationship between processing effort in retrieving a second non-local form and potential gain in phonological well-formedness by doing so. This is not compatible with strictly feed-forward assumptions, since the data show effects of optimizing both for lexical and phonological factors, but is integrable with Levelt (1993)'s production model.

“An ideology centered on *illustrating* could be called illustrism”

Figure 1: Example of a carrier sentence used in Exp. 1. The B_L is italicized, and the D is underlined.

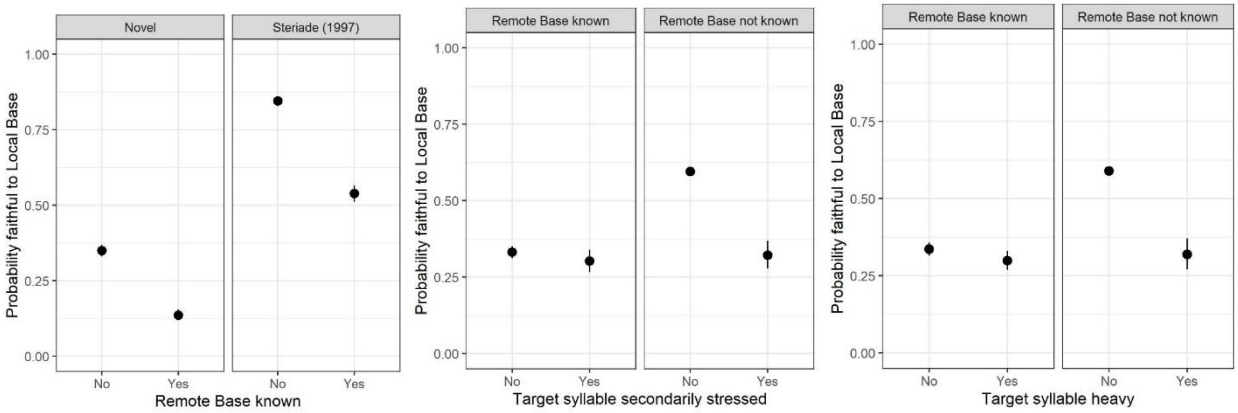

Figure 2: Partial results of Experiment 1, mean and standard error in each plot. The leftmost panel plots the probability of Derivative stress matching B_L stress as a function of whether the B_L was from Steriade (1997)’s original study, or novel for Experiment 1. The center panel plots the intersection of whether the B_R was known to an individual subject with whether the target syllable bore secondary stress (*no* as in *métăl* vs. *yes* as in *ínsèct*). The rightmost panel plots the intersection of whether the B_R was known to an individual subject with whether the target syllable was heavy (*no* as in *drama* vs. *yes* as in *ballast*).

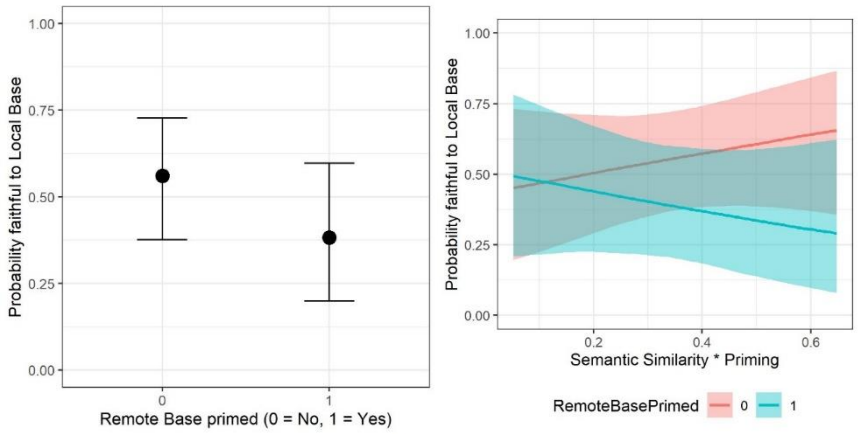

Figure 3: Marginal means and 95% Credible Intervals from the Bayesian hierarchical regression model in Exp. 2. Left panel indicates that Derivatives with primed B_Rs are more likely to be unfaithful in stress placement to their B_L. Right panel plots the interaction of priming with the semantic similarity between B_L and B_R, estimated by using the cosine similarity of their word embeddings in a Word2Vec neural network, normalized to the 0 (less similar) -1 (more similar) interval.

Selected References

Levelt, W. J. (1993). Speaking: From intention to articulation (Vol. 1). MIT press. **Steriade, D. (1997).** Lexical conservatism. *Linguistics in the morning calm*, 157-179. **Zymet, J. (2018).** Lexical propensities in phonology: corpus and experimental evidence, grammar, and learning (Doctoral dissertation, UCLA).