The learnability of the mora-counting alternation of /g/ nasalization in Japanese compounds

Breiss et al. (2022) argues that the mora count can partly explain the variation in a g/ŋ alternation in Japanese (fig.3). It is typologically weird and this study shows that such a mora-counting pattern is not internalized by native Japanese speakers in a wug-test.

Background - Counting: There is a discussion about whether UG and phonological generalizations can count (for example Carr 2006). The traditional view is that phonology does not count (past 2) and counting within 2 is not essentially counting (Paster 2019); indeed, there are some languages in which phonological generalizations can only be analyzed to be counting to 3 or 4, e.g., many Bantu languages (see Paster 2019), but even so, they never count past 4 (for a review, see Paster 2019); they focus on prosody as an example of a counting phenomenon involving segmental features is missing (Paster 2019).

Motivation - Japanese /g/ nasalization: Tokyo (Yamanote) Japanese exhibits a typologically bizzare alternation of /g/ nasalization in compounds. Usually, word-initial and medial /g/ surfaces as [g] and [ŋ], respectively; however, in /X-gY/ compounds where the second members start with /g/, sometimes /g/ optionally remains unchanged as [g] (Ito & Mester 1996), and the probability of undergoing nasalization is reported to be *significantly* conditioned by three factors: relative frequency of each member of the compounds, local nasality and *mora count of the compound* (Breiss et al. 2022). The first two of them are natural and can be easily explained by theory: paradigm uniformity (Breiss et al. 2021) and local harmony in nasality, but the third factor (Fig.3) is unnatural because the exact count of moras is usually regarded as unaccessible by phonology, let alone regulating an oral-nasal alternation which involves segmental features. Stunningly, it counts up to 7, as there is a huge difference between 6 and 7-mora words. This study looks at whether and how the (un)natural statistics in lexicon is internalized as speakers' knowledge of grammar.

Method: A *wug-test* was conducted to test whether **local nasality** (natural) and **mora count** (unnatural) were equally learned in nonce words. The test maintains control over the factor of relative frequency of each member, with each member appearing only once. Fifteen native speakers of Tokyo Japanese were recruited to complete an online test in which they were required to rate the relative naturalness between two potential forms of each nonce words, one with [g] and the other with [ŋ] (e.g., *temigemo* & *temiŋemo*), when compounding two free nonce words (*temi* & *gemo*). All the nonce words were created by manipulating the two factors. Moreover, an extra ABX test was made to ensure that participants can reliably distinguish the allophonic [g] and [ŋ].

Results: Quantitatively, in terms of mora count (Fig.4), the results show that almost no pattern is really internalized by native speakers, as the actual rate of undergoing nasalizations are always close to 50%, the chance level. This is totally different from the regularity in the real lexicon (Fig.3). However, in terms of local nasality (Fig.2), one thing is learned: nasals give rise to slightly more nasalizations than vowels, and this is consistent with the statistics in real lexicon (Fig.1).

Discussion: The natural pattern of local nasality is learned to some degree (Fig. 1&2), although greatly distorted towards the chance level. In terms of mora count, statistical patterns in real and wug lexicon are totally different (Fig. 3&4). We can argue that there exists an analytic bias against counting in phonology, which is unnatural because it reflects second-order phonotactics, and the results show a 'surfeit of the stimulus' effect as reported in Becker et al. (2011, 2012). The non-internalized pattern may be just a seemingly true generalization rather than the fact that

really works. Moreover, whether such pattern can be learned with more input remains unknown with the current experiment manipulations. An artificial grammar learning paradigm could address this issue, as in White (2014).

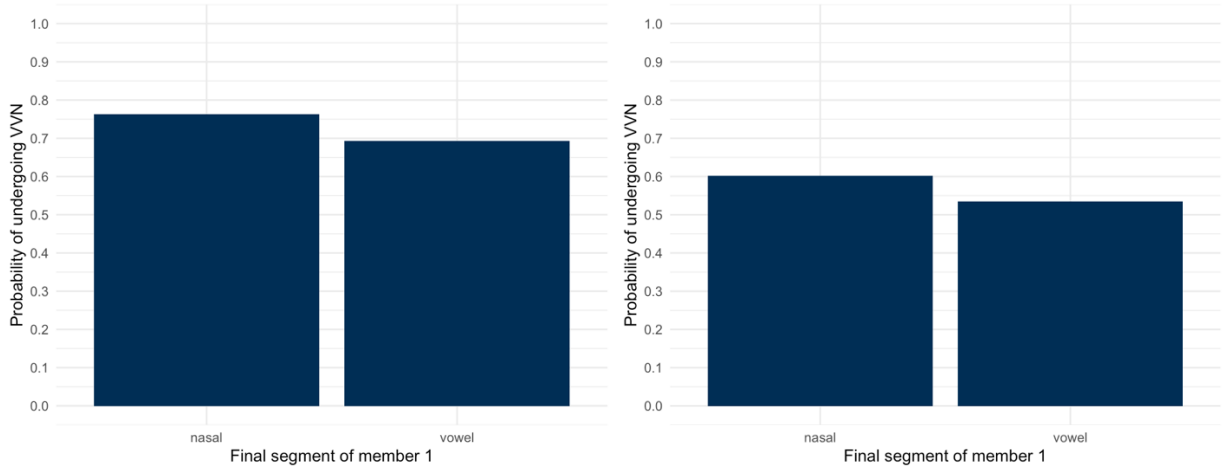

Fig.1&2 Statistics in real (left) / wug (right) lexicon (predictor: local nasality)

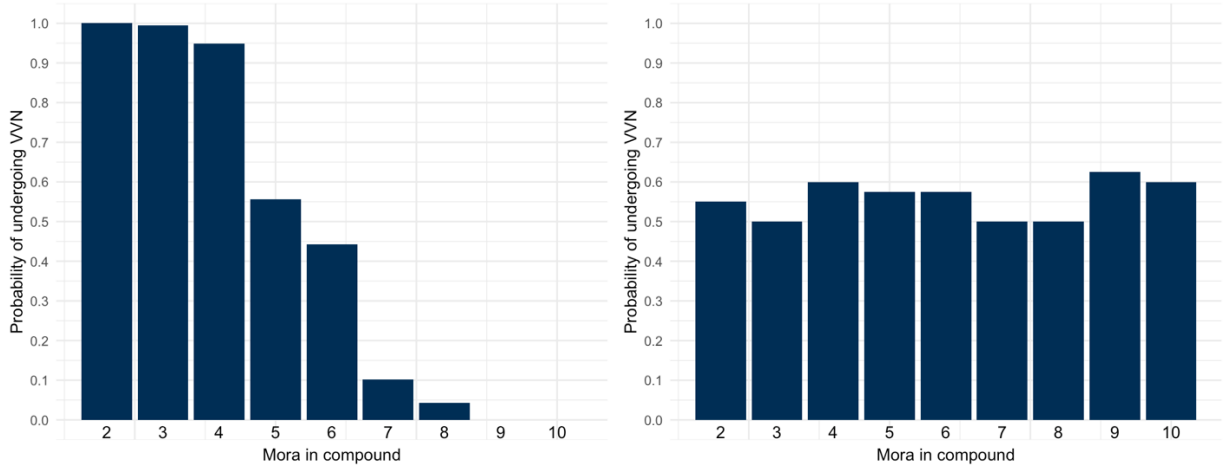

Fig.3&4 Statistics in real (left) / wug (right) lexicon (predictor: mora count)

Selected References:

Becker, M., Ketrez, N., & Nevins, A. (2011). The surfeit of the stimulus: Analytic biases filter lexical statistics in Turkish laryngeal alternations. *Language*, 84-125.

Becker, M., Nevins, A., & Levine, J. (2012). Asymmetries in generalizing alternations to and from initial syllables. *Language*, 231-268.

Breiss, C., Katsuda, H., & Kawahara, S. (2021). Paradigm uniformity is probabilistic: Evidence from velar nasalization in Japanese. In *Proceedings of WCCFL* (Vol. 39).

Breiss, C., Katsuda, H., & Kawahara, S. (2022). A quantitative study of voiced velar nasalization in Japanese. *University of Pennsylvania Working Papers in Linguistics*, *28*(1), 4.

Carr, P. (2006). Universal grammar and syntax/phonology parallelisms. *Lingua*, *116*(5), 634-656.

Itô, J., & Mester, A. (1996). Correspondence and compositionality: The ga-gyō variation in Japanese phonology.

Paster, M. (2019). Phonology counts. *Radical: A Journal of Phonology*, *1*, 1-61.

White, J. (2014). Evidence for a learning bias against saltatory phonological alternations. *Cognition*, *130*(1), 96-115.