An auditory masked priming study of nasal substitution in Dabaw Bisaya (Cebuano)

Jed Sam Pizarro-Guevara

Overview. In morphologically complex words, the root may be obscured when phonological processes are triggered. For example, in Western Malayo-Polynesian languages, there is a phenomenon called NASAL SUBSTITUTION (NS), in which the final nasal of a prefix fuses with the initial obstruent of the verbal stem [1]. In this study, we ask whether NS impedes morphological decomposition, the process of breaking down an incoming word into its constituent morphemes, by rendering the verbal stem less transparent. We investigated NS in Dabaw Bisaya (Cebuano), an Austronesian language spoken in the Philippines. We found that verbs that have undergone NS, unlike those that have not, do not exhibit priming effects in AUDITORY MASKED PRIMING [2,3]. These results suggest that these more opaque forms might not be decomposed prior to lexical access.

Background. When we hear a morphologically complex word like *singers*, do we break it down into the verbal stem *sing* and the suffixes -*er* and -*s*? One of the main issues in word recognition concerns the role of morphological decomposition vis-à-vis lexical access. On one end, FULL-LISTING models argue holistic representations of complex words; thus, decomposition is not necessary for lexical access [4]. On the other, DECOMPOSITIONAL models maintain that complex words are decomposed into their putative parts prior to access [5]. In the middle, DUAL-ROUTE/HYBRID models allow for both types of processing [6].

Studies using VISUAL MASKED PRIMING (VMP) [7] have found that a morphologically complex word facilitates the recognition of the root or another morphologically related word in comparison to an unrelated baseline. Morphological priming effects have been observed across languages, though most studies have focused on Indo-European languages (*e.g.,* English, German, Dutch, and Spanish) and Semitic languages (*e.g.*, Hebrew, Arabic, and Maltese).

The present study. We have two goals: one empirical and one methodological. First, we ask whether NS obscures the identification of the verbal stem and thus, impedes word-recognition in real-time. To our knowledge, this is the first time an Austronesian language is brought to bear on theorizing about lexical access. Second, we want to explore AUDITORY MASKED PRIMING (AMP), a nascent methodology that exploits the aural modality—instead of visual—and seek to validate whether the priming effects found using VMP do obtain using AMP.

When a prefix like /maŋ-/ attaches to verbs, stems that begin with /p, t, k/, as well as /s, b, d, ʔ/, undergo NS: /maŋ+tuwad/ → [manuwad]/*[mantuwad] 'to present one's rump'. Those that begin with /g, h, tʃ, dʒ/ do not: /maŋ+gahiʔ/ → [maŋgahiʔ]/*[maŋahiʔ] 'to become hard'. We leverage the fact that only a handful of the prefixes in Dabaw Bisaya trigger NS to directly compare the decomposition of the same verbal stem when it has undergone NS (with the prefix /maŋ-/) and when it has not (with the prefix /ga-/).

In a typical experimental trial, participants (n = 64) were presented with a masked prime, followed by a target, and were asked to perform a lexical decision task on the target. To auditorily mask the prime, it was durationally compressed (35%), embedded in noise containing reversed compressed real words, and attenuated to 15dB. We manipulated PRIME TYPE to create 60-item sets for real words that were distributed evenly across four lists via Latin Square: *IDENTITY*, the prime is the same word as the target; *NONS*, the prime is morphologically related to the target and has not undergone NS; *WITHNS*, the prime has undergone NS; and finally, *UNRELATED*, the prime and the target are not morphologically

Table 1. Sample item with the verb *patid* 'kick'

Prime type	Prime	Target
IDENTITY	patid	patid
NONS	gapatid	patid
WITHNS	namatid	patid
UNRELATED	salum	patid

related. Provided in Table 1 is a sample item. We also included 60 nonce words and 30 real words as fillers. These items were presented randomly using Open Sesame [8]. Accuracy and reaction times (RT) in milliseconds were recorded.

Results. We found that participants were faster at correctly identifying real words than nonce words. We also found that they were faster at correctly identifying real words when exposed to either an *IDENTITY* or a *NONS*-prime than when exposed to either an *UNRELATED*- or *WITHNS*-prime. We found no reliable difference between *IDENTITY*- and *NONS*, nor between *UNRELATED*- and *WITHNS*. Figure 1 provides their mean RT by prime-type.

Discussion. We observed a common effect found in other masked priming studies in the aural modality: priming of identity and morphologically related forms do obtain and have comparable magnitude (i.e., *IDENTITY* ≈ *NONS*). This provides evidence that morphologically complex words are decomposed prior to lexical access. Unlike the other studies, however, we also found that some morphologically related forms, like those that have undergone NS (i.e., *WITHNS*), do not yield priming effects. These findings suggesting that some morphologically complex words *could* be stored holistically.

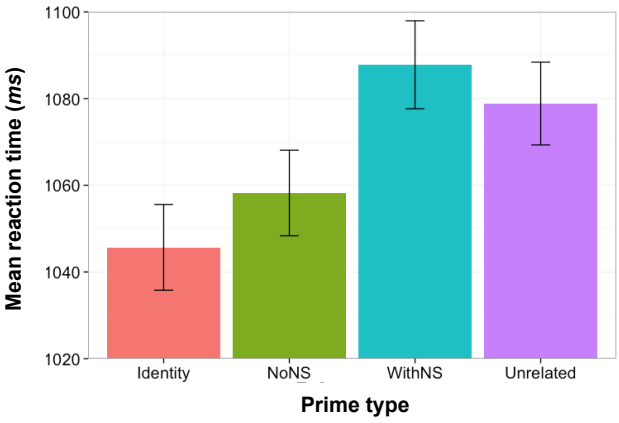

Figure 1. Mean reaction time in *ms* for real words by prime type, measured from target onset

Conclusion. First, the present study found identity priming, as well as form priming for words that did not undergo NS. There was, however, no evidence of priming for words that underwent NS. In future studies, we are investigating what factors may have prevented us from observing form priming in *WITHNS*. Second, AMP was successful in obtaining morphological priming effects, with the proviso that the verbal stem needs to be transparent for the form to be decomposed prior to access. This suggests that this methodology could be used to investigate morphological decomposition and lexical processing in child language, or languages that have no standard orthography, or those that are predominantly unwritten and use such data to bear on theories of lexical access.

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