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

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 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 unlike verbs that have *not* undergone NS, those that have do not exhibit priming effects in AUDITORY MASKED PRIMING [2,3], suggesting that these forms are not 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 like English, German, Dutch, and Spanish, and Semitic languages like 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 my 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 can be replicated 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-* + *gapus* → *maŋgapus*/**maŋapus* ‘to enchain’. We leverage the fact that only a handful of the prefixes 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, 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;

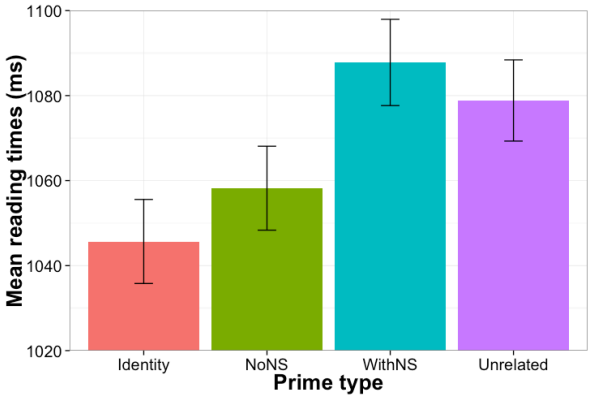
Prime type	Prime	Target
IDENTITY	patid	patid
NONS	gapatid	patid
WITHNS	namatid	patid
UNRELATED	salum	patid

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

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 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 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*-prime or a *NONS*-prime than when exposed to either an *UNRELATED*- or *WITHNS*- prime. We found no reliable difference in how fast participants were correctly identifying real words between being exposed to *IDENTITY* or a *NONS,* nor between *UNRELATED* and *WITHNS.* Figure 1 provides their mean reaction time in milliseconds by prime-type.

Figure 1. Mean RT in *ms* for real words by PRIME TYPE, measured from target onset



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 further evidence that morphologically complex words are decomposed prior to lexical access. Unlike the other studies, however, we found that some morphologically related forms, like those that have undergone NS (i.e., *WITHNS*), do not yield priming effects, suggesting that some morphologically complex words *could be* stored holistically.

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 decomposition and lexical processing in child language, or languages that have no standard orthography or that are predominantly unwritten, and use such data to bear on theories of lexical access.

REFERENCES: [1] **Zuraw (2010)**. *Natural Language and Linguistic Theory*. [2] **Kouider & Dupoux (2005).** *Psychological Science*. [3] **Ussishkin, Dawson, Wedel, & Schluter. (2015).** *Language, Cognition and Neuroscience.* [4] **Manelis & Tharp (1977).** *Memory and Cognition*. [5] **Taft & Forster (1975).** *Journal of Verbal Learning and Verbal Behavior*. [6] **Caramazza, Laudanna, & Romani. (1988).** *Cognition*. [7] **Forster & Davis (1984).** *Journal of Experimental Psychology: Learning, Memory, and Cognition.* [8] **Mathôt, Schreij, & Theeuwes. (2012).** *Behavioral Research Methods*.