Paradigmatic Gaps Impact Early Morphological Decomposition: Evidence from Masked Priming

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Words are decomposed into (potential) morphological constituents early during visual word recognition.[1–5] Using masked priming lexical decision[6] with brief prime durations (< 50 ms), both semantically transparent (e.g., *farmer* → *farm* + *er*) and opaque (e.g., *corner* → *corn* + *er*) items show reaction time (RT) facilitation relative to items where no morphological decomposition is possible (e.g., *brothel* → *broth* + **el*) and unrelated controls. These findings have been extensively replicated in different languages[7] and support models where morphemes make contact with the lexicon.[8] No work, however, to our knowledge, has investigated the impact of paradigmatic gaps on morphological decomposition during word recognition. Here, we report the results of a masked morphological priming experiment in English where items with no gaps in their paradigm (e.g., *history-historic-historical*) are compared against items whose paradigm contains a gap (e.g., *bible-*biblic-biblical*). We observe faster reaction times for NoGap pairs (e.g., historical-HISTORY; prime-TARGET) relative to Gap pairs (e.g., biblical-BIBLE), suggesting that this decomposition mechanism is sensitive to the structure of the morphological paradigm.

Method. Thirty-six native speakers of English participated in a visual masked morphological priming experiment with lexical decision. Fifty-eight pairs (29 Gap, 29 NoGap) were selected from the Corpus of Contemporary American English.[9] The two members of the pair were always a root (e.g., *history*) and its tri-morphemic derivation (root + 2 suffixes; e.g., *historical*). For the NoGap pairs, the bimorphemic item in the paradigm was a word of English (e.g., *historic*). For the Gap pairs, the bimorphemic item was not a word of English (e.g., **biblic* in *bible-biblical*). The prime was always the complex morphological item (e.g., *biblical*) and the target was always the root (e.g., *bible*). Note that we never directly tested the bimorphemic items (e.g., *historic*, **biblic*) and all our pairs were both semantically and morphologically transparent. In a given trial, a visual mask (i.e., #######) was presented for 500 ms. This was immediately followed by the tri-morphemic prime presented in lower case for 41.6 ms, which was immediately followed by the target presented all in upper case. The target remained on the screen until participants made a lexical decision response. Each participant was presented with 116 trials. Half of trials had non-word targets preceded by real word primes. Of the primes for the real word targets, half were related primes (biblical-BIBLE) and the other half were unrelated (changeability-BIBLE). We made two lists so that participants saw each target once. Stimuli were randomized and presented with DMDX.[10]

Results. Overall, participant accuracy was very high, and there were no robust inter-condition differences (Gap words: $\bar{x}$ = 93.5%; NoGap words: $\bar{x}$ = 96%). We submitted our results to a 2 × 2 repeated measures ANOVA with the factors Condition (Gap, NoGap) and Prime Relation (Related, Unrelated). There was a main effect of priming. Related words elicited faster RTs ($\bar{x}$ = 548 ms) than unrelated words ($\bar{x}$ = 572 ms; $F_1(1,33) = 14.27$, $p < 0.001$; $F_2(1,56) = 11.70$, $p < 0.01$]). Moreover, we observed a main effect of Condition. Targets in the Gap condition elicited slower RTs ($\bar{x}$ = 570 ms) than targets in the NoGap condition ($\bar{x}$ = 550 ms; $F_1(1,33) = 22.94$, $p < 0.001$; $F_2(1,56) = 4.16$, $p < 0.05$). There was no Condition × Prime Relation interaction.

Conclusion. These findings are consistent with models of word recognition that posit the decomposition of morphologically complex words.[5,7,8,11–13] Moreover, the presence of a gap in the paradigm affects responses: Prime-target pairs with no intermediate paradigmatic gap show faster RTs than those with a gap. Masked priming is thought to tap into the early stages of visual word recognition, and as such, this sensitivity might be due to uncertainty in whether to decompose *biblical* into *bible+ic+al* or *bible+ical*. Overall, we take our results to suggest that word recognition is,

therefore, sensitive to the overall structure of the paradigm even when those gaps are not directly tested.

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