

Neural Evidence for Hierarchical Structure in Multimorphemic Word Processing

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Multimorphemic words are assumed to be represented in terms of hierarchical structure rather than as linear sequences of morphemes. Although limited behavioral evidence supports this assumption [1], direct neurophysiological evidence is currently lacking, to our knowledge. To address this gap, the present study uses EEG to examine whether hierarchical structure (left- and right-branching structure; see Figure 1) guides the composition of morphemic representations during the online processing of trimorphemic words (e.g., [[*re-use*]-*able*], [*un*-[*law-ful*]]). Specifically, we focus on the P600/LPC, a neural response associated with structural reanalysis.

To isolate the effect of abstract hierarchical structure in the composition of trimorphemic words, we employed an overt priming paradigm (SOA = 350 ms) in which primes and targets matched or mismatched in branching direction without any morphemic overlap (see Table 1). In the Match condition, primes and targets shared the same structure (i.e., left-branching → left-branching or right-branching → right-branching). In the Mismatch condition, primes and targets differed in structure (i.e., left-branching → right-branching or right-branching → left-branching). Participants performed a go/no-go semantic judgment task, responding only to synonymous filler prime–target pairs (e.g., *assignment* → *homework*), thereby ensuring attention to meaning.

ERP data from 26 native English speakers revealed a significant P600 effect (750–1000 ms; $\beta = 0.445$, $p = .0386$ *), with greater positivity in the Mismatch than in the Match condition. We interpret this effect as reflecting structural reanalysis during meaning composition when hierarchical structure conflicts across prime–target pairs. However, the effect showed a later onset and a modest magnitude compared to canonical P600 responses (see Figure 2). This pattern suggests that such reanalysis is a cognitively demanding process operating at the morphology-semantics interface, arising only after initial composition based on an incompatible structure fails. The modest magnitude may further reflect the present design’s isolation of structural overlap, with no form- or meaning-based overlap between primes and targets.

Taken together, our results provide evidence that abstract hierarchical structure plays an active role in the real-time processing of multimorphemic words. Crucially, this effect emerged even in the absence of shared form or meaning, suggesting that abstract hierarchical representations guide morphological parsing independently of morphemic content. More broadly, these findings are consistent with the view that hierarchy is a central organizing principle of human language.

Table 1. Examples of critical stimuli

	Condition	Prime	Target
Example 1	Match	<i>unfairness</i> (left-branching)	<i>refillable</i>
	Mismatch	<i>unforceful</i> (right-branching)	(left-branching)
Example 2	Match	<i>revictimize</i> (right-branching)	<i>unskillful</i>
	Mismatch	<i>reclaimable</i> (left-branching)	(right-branching)

Note: Left- and right-branching structures were counterbalanced across the Match and Mismatch conditions.

Figure 1. Schematic representations of right- and left-branching structures

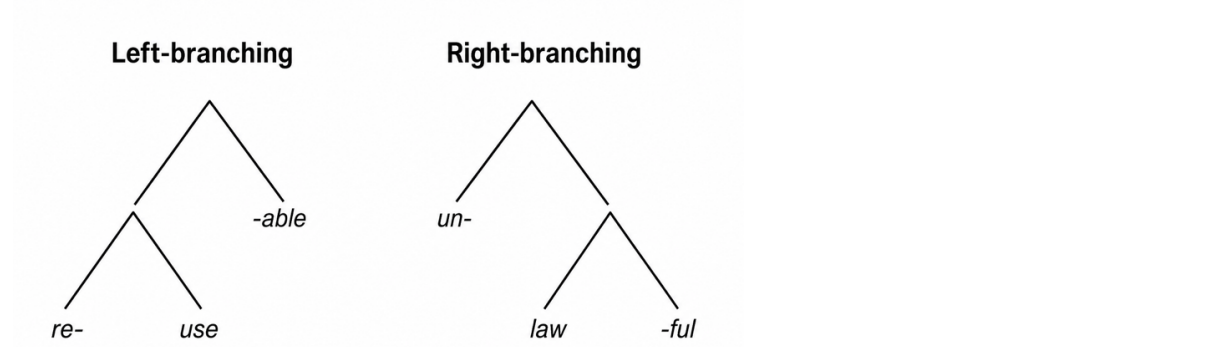
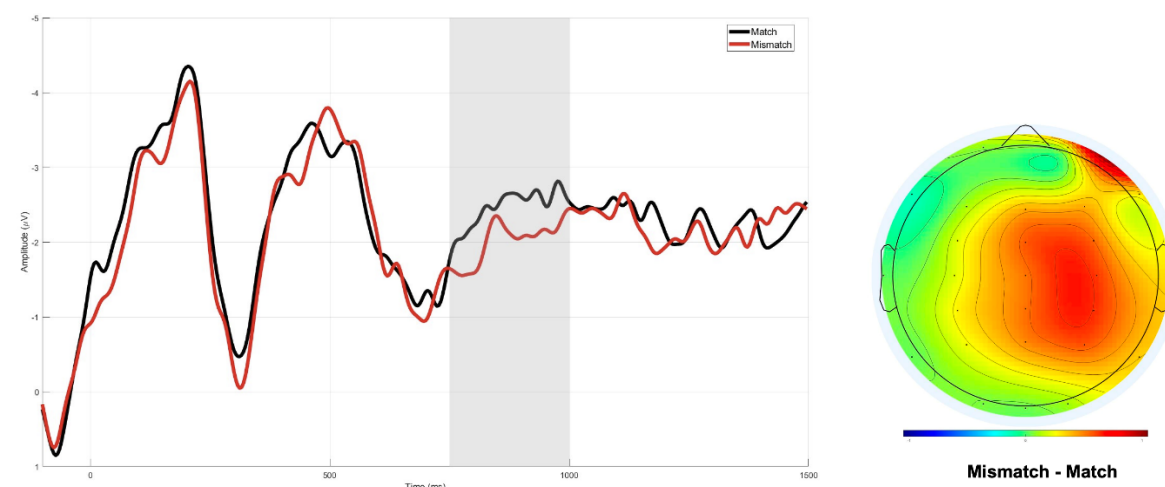


Figure 2. Grand-Average EEG waveforms and scalp topography for the Match and Mismatch conditions



Note: In the waveforms, the shaded window (750-1000 ms) marks the P600 time window (Match = black; Mismatch = red). The scalp topography shows the difference wave (Mismatch – Match) over the same interval.

References

- [1] Song, Y., Do, Y., Lee, J., Thompson, A. L., & Waegemaekers, E. R. (2019). The reality of hierarchical morphological structure in multimorphemic words. *Cognition*, 183, 269–276.