

When does context shape word meanings?

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Words' meanings vary with context. When do context effects arise? The answer to this is critical for deciding between theories assuming that meanings are accessed from a stable mental lexicon and theories that suggest meanings are constructed ad hoc. On the first view, a word form activates an invariant semantic representation, which is subsequently tailored to fit the context (e.g., Evans, 2009; Machery, 2010). On an alternative view, word forms are cues to construct meaning; the information that gets activated is always co-determined by the word and its context (Elman, 2004; 2009; Lai, Hagoort, & Casasanto, 2011).

We investigated when context-induced differences arise during the activation of semantic representations cued by words. We varied the timing of context – i.e., a judgment cue, in relation to the stimulus words. In the word-in-context condition, the judgment cue was given before the word. In word-before-context condition, participants saw the word before they knew what judgment they would need to make. Both the “meaning access” and “meaning construction” views predict that ERPs time-locked to the word should differ depending on timing of the judgment cue. The “access” view predicts differences should arise only after an invariant semantic representation has been activated. The “construction” view predicts that context effects should be detectable at the earliest stages of semantic activation (~200 ms, Diens, 2009).

30 participants made 48 positive/negative and 48 animal/human judgments on 96 nouns, 24 each of 4 types: positive animals (puppy), negative animals (maggot), positive humans (princess), and negative humans (murderer). For one block, the word was presented before the judgment cue (e.g., Animal/human?), and for the other block, the word was presented after the cue. Block order was counterbalanced, and the judgment types and the nouns randomized within each block.

Two analyses were carried out. The first grand averaged ERP analysis asked whether word-in-context differed from word-before-context. ERPs showed negativity (170-450 ms, central-posterior) more negative for word-in-context than for word-before-context. The onset of the negativity was 170 ms, suggesting some context effect at the initial stage of semantic construction. The second EEG classification analysis asked that, within word-in-context, whether EEG patterns differed between affective (positive/negative) context and ontological (animal/human) context. Signals were segmented in 100-ms interval post word onset. Using single-trial multivariate analysis, Support Vector Machine (Vapnik, 2000) classifier was trained to do the binary classification. In word-before-context condition, percentage of correctly classified trials stayed at chance for all intervals (50%), as expected. Remarkably, classification accuracy in word-in-context condition was above the chance across 30 participants in 200-300 ms (54%, $p=0.0006$, against chance-level). This suggests that semantic representations for the same word in the same brain already differed between “word-in-affective-context” and “word-in-ontological-context”, initially.

Context effects are detectable at the earliest semantic stage during word processing, evidenced by both grand-averaged ERPs and single-trial EEG. These findings support a view in which default/invariant word meanings are not accessed from a mental lexicon and later modified by context. Rather, from their inception semantic representations are co-determined by word and its context.

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