

Semantic plausibility and prediction in English noun-noun compounds

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Introduction: Early models of the processing of nominal compounds, such as *table_{N1} lamp_{N2}*, suggest that interpretation is driven by the modifier noun, or N1 (Gagne & Shoben, 1997, Spalding et al, 2010). However, these studies rely on paradigms where the compounds are presented in isolation, rather than in a sentential context; recent work on these compounds in context suggests that a parser cannot immediately recognize N1 as a modifier, as it is not until presentation of N2 that it can be known a compound is present, and thus the parser will commit to N1 as the head of its phrase (Staub et al., 2010). Further work suggests that syntactic cues, such as a gender mismatch, are able to delay this commitment (Whelpton et al., 2014). The present study uses semantic cues to probe the effects of this commitment or forestalling at both N1 and N2 in compound processing.

Self-paced reading task: Fifty participants read sentences with either familiar or novel compounds, presented in sentential contexts that made N1 either semantically plausible or implausible as a head (15 sentences per condition novel/familiar x plausible/implausible). Item (1), for example, is implausible because, at N1, the meaning is anomalous (*Claire folded her puppy* is a semantically odd sentence) and is only repaired at N2, but (2) is semantically licit at both N1 and N2.

(1) Novel & Implausible: *Claire folded her puppy_{N1} blanket_{N2} the other day.*

(2) Novel & Plausible: *Claire washed her puppy_{N1} blanket_{N2} the other day.*

(3) Familiar & Implausible: *George cracked the water_{N1} bottle_{N2} on his shelf.*

(4) Familiar & Plausible: *George bought the water_{N1} bottle_{N2} on his shelf.*

We found that, for novel compounds, reaction times were slower in the implausible condition at both N1 and N2. The slower RT at N1 we interpret as a reaction to the implausibility. At N2, the continued slowdown could be spillover from the effect at N1 or a separate processing event; though SPR cannot distinguish these two options, event related potentials (ERPs) can. If the effect at N2 is spillover, we will observe an early effect; if there's a separate processing event, a later effect will be observed.

ERP reading study: Twenty participants were presented with novel compounds in plausible and implausible sentence contexts via RSVP (700 ms SOA). Stimuli were the same as in the SPR task. At N1, the implausible condition elicited an N400 at Pz, with the Centroparietal region approaching significance. At N2, an N400 was observed for the plausible condition in the Centroparietal and Frontocentral Right regions. No significant effects were observed for N2 before 500ms post stimulus, so we conclude that there is a separate processing event. As the effect was this time measured for the plausible condition on N2, we interpret these findings in line with Whelpton et al. (2014) as the added cost of revision following initial commitment to a licit structure. However, this conclusion assumes that semantic plausibility is a strong enough cue that a compound should be predicted. Given the difficulty of knowing what the parser can and does predict, we followed this with an offline task using the same paradigm.

Sentence completion task: Thirty-two participants completed sentences similar to those in (1-4), but with the portion following N1 left blank. All implausible sentences could be corrected by creating a compound. We found that, in the implausible condition, participants created a nominal compound 80% of the time, compared to 35% of the time in the plausible condition. We interpret this as a strong offline bias towards compounding as a means of repairing semantically implausible sentences.

General discussion: Taken together, the results of these studies support the claim that head nouns have an important role in compound processing. Semantic information that is available in sentential contexts can give a parser cues that they should predict a compound. When those cues are absent, the parser commits, sometimes inaccurately, to the noun as the head of its phrase. Following an initial commitment in the plausible cases, however, the parser is forced to reassess at N2 to recommit to the second noun as the head. This reanalysis is seen in the ERP study as an N400 effect. Broadly, this study challenges the notion of modifier prominence in compound processing and demonstrated the need for a processing account that addresses the interpretation of compounds in sentential contexts rather than simply in isolation.

References:

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