Semantic similarity and temporal contiguity in subject-verb dependency processing
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Current models of memory in language processing are conceived as content-addressable: items are encoded as feature bundles, a subset of which can be used as cues for retrieval [1]. If the cues are overloaded, i.e., associated with multiple items, then processing difficulty can occur, because multiple encodings compete for retrieval [2]. Retrieval interference of this sort has been identified in several linguistic dependencies [3,4]. Arguably less well-understood is the interference that occurs when to-be-retrieved items are semantically similar and temporally contiguous at encoding [5,6]. This sort of encoding interference [7,8] is a challenge to isolate from retrieval interference. Here we attempt to do so by looking for evidence of retrieval difficulty before selective cues become available. In two reading-time studies, we show that when two similar NPs are encoded in temporal proximity, it can be harder to accurately retrieve the target NP later, even when cues aren’t overloaded.

Method. We created a set of 42 sentences in which RC-modified target NPs had to be integrated with a VP (1). There were two important ingredients in this design. First, we crossed the factors Similarity and Contiguity (3x2): the RC contained a distractor NP which was inherently similar to the target (knife v. sword), functionally similar (knife v. stick, e.g., both sharpenable), or not similar. (knife v. shirt). The distractor either occurred immediately after the target (1a) or several words later (1b). Second, we designed an extended retrieval zone: the VP was preceded by an auxiliary-adverb sequence that could initiate retrieval without providing any lexically-specific information. We tested for evidence of a slowdown at the auxiliaries/adverbs, reasoning that any difficulty due to similarity, before any information from the lexical root could be used in retrieval. Furthermore, following the verb itself, we found a marginal penalty for functional/late conditions (p < .05). However, in an attempt to replicate in the lab (N = 36 UGs; identical items), we failed to find an effect in the pre-VP retrieval zone.

LSA. We conjectured participants in the two samples could have different category boundaries for similarity than what we imposed in our design, so we reanalyzed our data using a continuous metric. Using Latent Semantic Analysis (LSA; [9]), we calculated similarity scores (cos θ) between the target and each distractor, and entered those as predictors in a regression of RT. We found a significant interaction between LSA-Sim and Contiguity (t = 2.3, p < .05) at the adverb: highly similar interveners in immediate conditions lead to longer RTs before the lexical root is reached, for all participants (Fig 2). We also collected direct similarity ratings from local UGs (n=40); and as predictors these resulted in the same interaction (t = 2.3, p < .05).

Discussion. Two studies provide evidence for long-distance semantic encoding interference in the absence of semantic cue overload: a penalty for similar interveners during retrieval, when no semantic retrieval cues are available. This penalty obtains specifically when a target and intervener were encoded in close succession, a finding reminiscent of the influence of temporal contiguity on semantic clustering in list recall [10]. Future research will have to determine the underlying mechanism [cf. 7, 8, 10].
**Sample item illustrating Contiguity x Similarity Design**

It seems that...

1a. Immediate the knife that the \{sword\text{\_inh}, stick\text{\_func}, shirt\text{\_con}\} had been placed near...

1b. Late the knife that someone placed the \{sword\text{\_inh}, stick\text{\_func}, shirt\text{\_con}\} near...

... critical had been recently |lex.root sharpened |spill in the kitchen.

*Target* is underlined; *{competitors}* in braces. Analysis regions indicated by pipes.

**Immediate Contiguity and Inherent Similarity Cause Integration Difficulty**

![Graph 1](image1.png)

*Figure 1* Experiment 1 Mean RT

![Graph 2](image2.png)

*Figure 2* Experiments 1 & 2 Mean RT, split to visualize LSA Similarity Coefficient

**References**