

## Re-active filling

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Considerable evidence indicates that forming a filler-gap dependency proceeds actively: in advance of direct evidence that licenses it. We know less about how persistently the parser pursues this strategy, potentially risky given that the cost of retrieving fillers grows as new material is integrated. Here we find that active filling effects disappear when verbs are linearly very distant from the filler, *unless* that filler participates in another dependency preceding the verb.

In two experiments we manipulated filler plausibility [1-2] to probe for active filling effects at verbs embedded in relative clauses. We used *spray-load* verbs [3], since these ditransitives can host gaps not immediately adjacent to the verb, while their tight selectional restrictions allow for immediate detection of an implausible filler. To create distance between the verb and the position that provides bottom-up evidence for the gap, we relativized the verb's second object: thus implausibility detection effects that are slightly delayed may nevertheless be attributed to 'active' dependency formation. An off-line rating study ( $n=14$ ) confirmed that the implausible fillers were considerably worse than plausible ones in both argument positions (Bonferroni-corrected t-tests, both  $ps < 0.001$ ).

**Experiment 1.** We probed for active effects at verbs either four (SHORT) or nine words (LONG) distant from the relativizer (EX1). Material was interpolated by attaching a PP to the RC subject. Self-paced reading results ( $n = 24$ ; moving-window) reveal a strong plausibility effect one word beyond the critical verb in the SHORT condition ( $F_1(1,23)=12.4; p<0.01; F_2(1,23)=6.98; p<0.02$ ). In the LONG condition, however, no effect is observed at the verb or the first argument ( $F_s < 1.5; n.s.$ ) only after the gap position has been processed is slow-down evident ( $F_1(1,23)=9.21; p<0.01; F_2(1,23)=6.64; p<0.02$ )

**Experiment 2.** Stimuli from Experiment 1 were modified so that the RCs dominated coordinate VPs (EX2), and therefore two gaps, as required by the Coordinate Structure Constraint (CSC [4]). The second verb's ordinal position matched the critical verb's in Experiment 1's LONG condition; this LONG condition also constituted a length-matched control. Only the second verb differed in plausibility with respect to the filler. A slowdown due to filler implausibility occurs one word beyond the critical verb ( $F_1(1,30)=7.18; p<0.02; F_2(1,23)=5.95; p<0.03$ ), indicating dependency formation has taken place before direct evidence for the second gap. The control replicated the Experiment 1 LONG condition.

These results support an architecture in which filler representation decays (e.g.[5]), but they also show how it can be strengthened – by second-gap prediction, or reactivation by the first dependency [cf.6] – so active effects surface later. Previous work [7] showed that filler retrieval *time* is dependency-length-invariant, so it is unlikely that the plausibility effect's displacement reflects greater access time. We consider competing accounts of why either retrieval and integration of semantic features at the verb may be less reliable under a decay regime. Finally, we note that the processor's predictive capacity must be keenly sensitive to grammatical principles (at least, the CSC); otherwise we lack an explanation for active dependency formation at the second verb.

(1) The { **adhesive coating / computer program** } that ...

**SHORT** the talented engineer methodically sprayed the special test surfaces with in his ...

**LONG** the talented engineer from the high-tech aerospace firm methodically sprayed the special test surfaces with in his new laboratory could make his company a lot of money.

(2) The { **adhesive coating / computer program** } that ...

**TWO-GAP:** (a) the talented engineer designed for his boss and methodically sprayed ...

**ONE-GAP:** (b) the talented engineer from the high-tech aerospace firm methodically sprayed the special test surfaces with in his new laboratory ...

[1] Garnsey, S., Tanenhaus, M., & Chapman, R. (1989). *J. Psycholing. Res.*, 18, 51-60.

[2] Traxler, M., & Pickering, M. (1996). *J. Mem. Lg.*, 35, 454-475.

[3] Levin, B. (1993). *English Verb Classes And Alternations*. Chicago: UChicago Press.

[4] Ross, J. (1967) *Constraints on Variables in Syntax*. MIT PhD dissertation.

[5] Lewis, R. & Vasishth, S. (2005). *Cognitive Science*, 29, 1-45.

[6] Gibson, E. & Warren, T. (2004). *Syntax*, 7, 55-78.

[7] McElree, B., Foraker, S., & Dyer, L. (2003). *J. Mem Lg.*, 48, 67-91.