

## Investigating Syntactic Gating during Subject Retrieval with English Ditransitives

An ongoing question concerns the granularity of the retrieval cues that are diagnostic in identifying memory representations during the resolution of various dependencies [1, 2]. Evidence of interference during subject-verb dependency resolution suggests that structural cues are privileged above non-structural cues during retrieval: distractors in Subject position interfere, but distractors in syntactically mismatching Object positions do not [3]. This generalization is complicated by findings which show that Prepositional Phrase distractors can inhibit subject retrieval despite the syntactic mismatch [4]. These patterns motivate a *Syntactic Gating* hypothesis, which posits that syntactic features are sufficiently encoded for core thematic arguments, providing robust cues for the parser to accept or reject retrieval candidates, whereas oblique arguments do not benefit from the distinctive encoding necessary for rejection, and are able to interfere during retrieval [3, 2]. Previous studies, however, have contrasted interference profiles of distractors which differ in both syntactic and thematic dimensions. The present study leverages English ditransitive constructions to evaluate predictions of the gating mechanism, by comparing interference effects with thematically identical items in syntactically distinct positions. Ditransitive verbs in English alternate between the Prepositional Dative (PP) frame and Double Object (DO) frame, which differ in the position of the indirect object/Goal [5, 6].

**Experiment 1** investigates subject retrieval for thematic binding in a self-paced reading task, in which distractors in DO/PP structures intervene between the matrix subject-verb dependency. **E1a** ( $n = 80$ ) presented 48 items as in (1), crossing STRUCTURE (DO/PP) with four levels of MODIFICATION (No-Mod, Subj-Mod, Goal-Mod, Theme-Mod), which aimed to strengthen encoding of the modified constituent and elicit interference at retrieval [1]. The crucial comparison evaluated interference effects between modified Indirect Object/Goal, predicted to interfere due to partial match, and Direct Object/Theme, not predicted to interfere due to full mismatch. The gating hypothesis predicts no differences across structures, as the arguments are identical. Bayesian mixed effects models assuming an inverse Gaussian distribution in brms were fit to RT data on the critical and surrounding regions [7]. **E1a results** indicate that the critical auxiliary verb was read reliably slower in Subj-Mod vs non-subject-modified conditions across structures ( $\beta = 4.64, CI = [0.09, 9.44]$ ), and was also read slower in Goal-Mod vs. Theme-Mod conditions, but only in the PP structure ( $\beta = -6.81, CI = [-13.38, -0.92]$ ), contrary to predictions of the gating hypothesis. **E1b** ( $n = 23$ ; collection ongoing) used only the Goal- and Theme-Mod. conditions from the E1a materials to replicate the main finding. Following each sentence, participants were asked either (embedded) Subject or Goal oriented comprehension questions (2) to probe the interpretation of the matrix clause, and provide an offline measure of interference. **E1b RT results:** Linear mixed effects model regression on logRTs at the critical auxiliary reveal no main effects or interactions, though Figure 2 suggests a greater difference between Goal- and Theme-Mod conditions in PP vs DO structures.

**Experiment 2** ( $n = 40$ ) investigates subject retrieval in number agreement processing in an acceptability judgment task using intervening DO/PP structures to probe for facilitatory interference in (un)grammatical sentences with number (mis)matching subjects/verbs. We created 36 items as in (3), crossing STRUCTURE (DO, PP), DISTRACTOR NUMBER (Sg, Pl), and GRAMMATICALITY (Gram, Ungram). **Results:** generalized logistic mixed-effects regression revealed an interaction between DISTNUM and GRAM, indicating that participants were more likely to accept ungrammatical sentences in the presence of a plural distractor across structures ( $t = -4.022, p < 0.001$ ), though no three-way interaction emerged ( $t = 0.51, p = 0.61$ ). **In sum**, the results of the present experiments are not compatible with the gating hypothesis. We instead propose an account relying on mechanisms underlying incremental thematic role assignment, generating cues weighted with estimates of reliability in uniquely identifying the retrieval target according to the grammatical function of the retrieval operation.

(1) **The medic who revealed that ...**

... the pilot issued the rebel the rifle last week ...  
 ... the pilot issued the rebel the strategic rifle last week ...  
 ... the pilot issued the strategic rebel the rifle last week ...  
 ... the strategic pilot issued the rebel the rifle last week ...  
 ... the pilot issued the rifle to the rebel last week ...  
 ... the pilot issued strategic rifle to the rebel last week ...  
 ... the pilot issued the rifle to the strategic rebel last week ...  
 ... the strategic pilot issued the rifle to the rebel last week ...

[DO, No-Mod.]  
 [DO, Theme-Mod.]  
 [DO, Goal-Mod.]  
 [DO, Subj-Mod.]  
 [PP, No-Mod.]  
 [PP, Theme-Mod.]  
 [PP, Goal-Mod.]  
 [PP, Subj-Mod.]

**... was late to the plane.**

(2) **Who was late to the plane?**

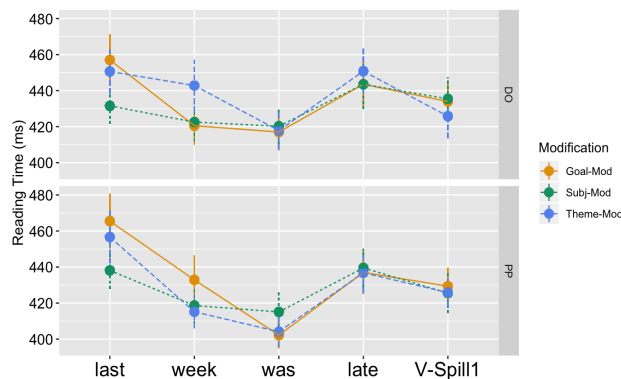
{the medic | the pilot}  
 {the medic | the rebel}

[Subject Interference]  
 [Goal Interference]

(3) **The realtor who sold ...**

... the ordinary pianist(s) the cottage ...  
 ... the cottage to the ordinary pianist(s) ...  
**... {was | were} energetic after the sale.**

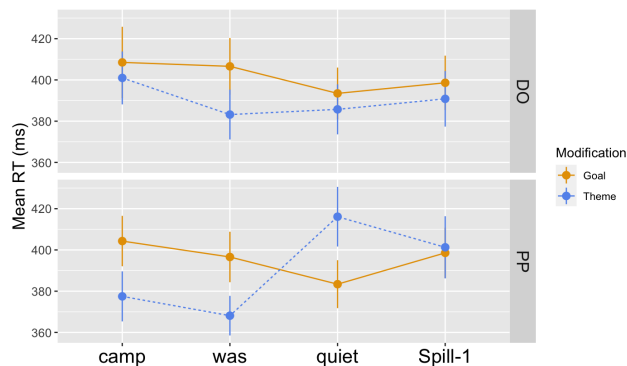
[DO, {Sg, Pl}]  
 [PP, {Sg, Pl}]  
 [Gr, UnGr]



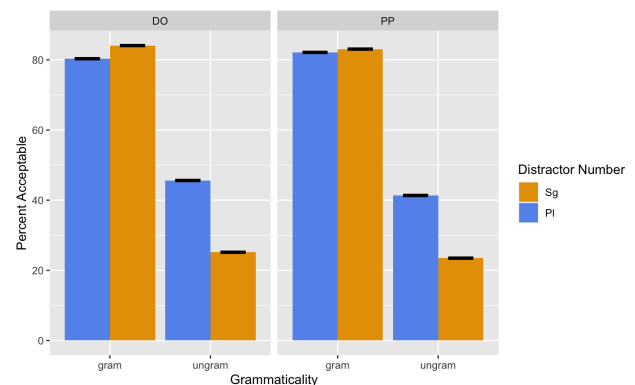
**Figure 1.** E1a mean RTs @ critical ROI (S.E.)

	Est.	95% CI
<b>Struct.</b>	-1.13	[-4.00, 1.69]
<b>G vs. Th</b>	1.71	[-1.65, 4.77]
<b>S vs. [G, Th]</b>	4.64	[0.09, 9.44]
<b>Struct * [G vs. Th]</b>	-6.81	[-13.38, -0.92]
<b>Struct * [S vs. (G, Th)]</b>	-4.64	[-14.23, 4.42]

**Table 1.** brms results for E1a RTs @ auxiliary



**Figure 2.** E1b mean RTs @ critical ROI (S.E.)



**Figure 3.** E2 % Acceptable Responses (S.E.)

**References:** [1] Arnett & Wagers, 2017. *JML*; [2] Parker & An, 2018. *Frontiers of Psych.*; [3] Van Dyke & McElree, 2011. *JML*; [4] Van Dyke, 2007. *Journal of Exp. Psych.*; [5] Harley & Jung, 2015. *Linguistic Inquiry*; [6] Bruening, 2021. *NLLT*; [7] Lo & Andrews, 2015. *Frontiers of Psych.*