

Probing Facilitatory and Inhibitory Interference with English Ditransitives

Matthew Kogan & Matt Wagers (UC Santa Cruz) | mjkgogan@ucsc.edu

Evidence of retrieval interference during subject-verb dependency resolution suggests that structural cues are privileged during retrieval: distractors in Subject position interfere, but distractors in syntactically mismatching Object positions do not [1]. This pattern is complicated by the finding that Prepositional Phrase distractors interfere during subject retrieval despite the syntactic mismatch [2]. These patterns motivate a *Syntactic Gating* hypothesis: syntactic features are strongly encoded for core thematic arguments, providing robust cues for the parser to accept/reject retrieval candidates, whereas oblique arguments do not benefit from the distinctive encoding necessary for rejection [1,3]. The present study leverages English ditransitive constructions to directly evaluate predictions of the gating mechanism, comparing interference effects with thematically identical distractors 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 [4,5].

Exp.1 - Facilitatory Interference (n=40) used an acceptability judgment task with intervening DO/PP structures to probe facilitatory interference in number agreement processing (i.e. agreement attraction). We created 32 items (1) in a 2x2x2 design crossing STRUCTURE (DO, PP), DISTRACTOR NUMBER (Sg, Pl), and GRAMMATICALITY (Gram, Ungram). Syntactic Gating predicts no differences between structures, as the thematic roles are held constant; it remains an open question whether indirect objects/Goals pattern with core or oblique arguments [2]. If retrieval is instead modulated by the syntactic context of a Prepositional Phrase, we predict larger attraction effects for PP-Goals, in line with previous findings [2]. **Results:** Generalized logistic mixed-effects regression revealed an effect of GRAM, reflecting a greater proportion of acceptable ratings for grammatical ($t = -17, p < 0.001$) and a DISTNUM*GRAM interaction, indicating a greater proportion of acceptable ratings for ungrammatical sentences with a plural Goal ($t = -4.0, p < 0.001$). No three-way interaction between DISTNUM, GRAM, & STRUCT emerged ($t = 0.51, p = 0.61$), indicating no differences between structures. **Discussion:** We observed agreement attraction from intervening Goals, but no differences across structures, providing support for Syntactic Gating, in that interference was not modulated by syntactic position.

Exp.2 - Inhibitory Interference (n=96) investigated inhibitory retrieval interference during thematic binding using SPR, in which distractors in DO/PP structures intervened between the matrix subject-verb dependency. We presented 48 items (2) in a 2x2 design, crossing STRUCTURE (DO/PP) with MODIFICATION LOCUS (Goal-Mod, Theme-Mod), aimed to strengthen encoding of the modified constituent to elicit interference at retrieval [6]. We had two measures of interference: (i) RTs at the critical matrix VP across Goal-Mod and Theme-Mod. conditions; and (ii) answers to a comprehension question (3), whose correct answer was always the matrix subject, but presented with either an Embedded Subject or Goal foil answer. **Results:** For RTs, Bayesian linear mixed effects regression [7], revealed no effects of the experimental factors or their interaction. In CompQ accuracy, Bayesian logistic mixed effects regression [7] only revealed a main effect of Question Type, indicating lower accuracy for (embedded) subject questions ($\beta = -0.41, 95\%CI: [-0.66, -0.17]$). **Discussion:** We observed no evidence for differences in Goal-interference profiles between structures, consistent with the results from Exp. 1, providing additional support for Syntactic Gating.

In sum, the present results provide support for the Syntactic Gating hypothesis, whereby retrieval is in part mediated by thematic properties of potential retrieval candidates, rather than their syntactic position. By maintaining thematic roles constant, the present studies suggest that previous findings of interference from oblique arguments are not due to their position within a Prepositional Phrase. However, unlike Direct Object Themes, Indirect Object Goals do generate (facilitatory) interference. Additionally, the CompQ accuracy results of Exp. 2 provide offline evidence of subject interference, replicating previous findings [1,6].

(1) **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]

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

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

[DO, Theme-Mod.]
 [DO, Goal-Mod.]
 [PP, Theme-Mod.]
 [PP, Goal-Mod.]

... was late to the plane.

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

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

[Subject Interference]
 [Goal Interference]

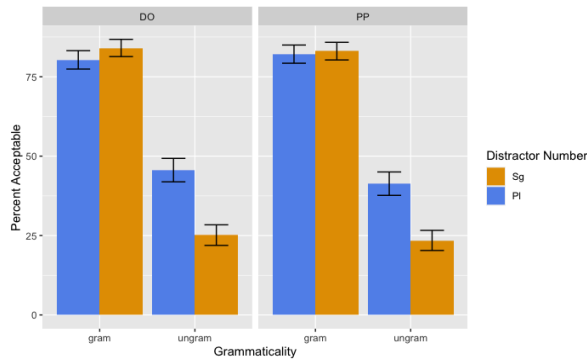


Figure 1. E1 % Acceptable Responses (S.E.)

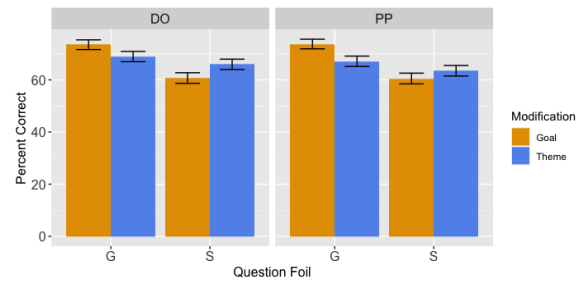


Figure 3. E2 % Correct CompQ answers (S.E.)

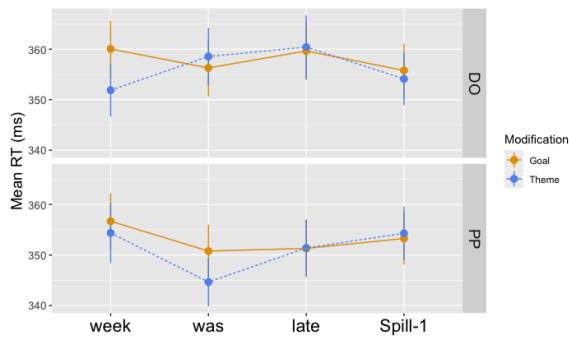


Figure 2. E2 mean RTs @ critical ROI (S.E.)

	Est.	95% CI
Struct.	-0.05	[-4.00, 1.69]
Mod.	0.05	[-1.65, 4.77]
Q-Type	-0.41	[-0.66, -0.17]
Struct. * Mod.	0.10	[-0.16, 0.37]
Struct. * Q-Type	-0.03	[-0.29, 0.23]
Mod. * Q-Type	-0.54	[-1.17, 0.09]
Struct * Mod * Q-Type	0.00	[-0.54, 0.53]

Table 2. brms results for E2 CompQ accuracy

	Est.	95% CI
Struct.	-1.65	[-5.58, 2.26]
Mod.	1.24	[-2.69, 5.11]
Struct * Mod.	2.04	[-5.65, 10.04]

Table 1. brms results for E2 RTs @ auxiliary

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