

Do Grammatically Illicit Distractors Interfere? Evidence from Matrix Agreement after Italian Relative Clauses

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Cue-based retrieval theories of sentence processing [1, 2] assume that working memory items are accessed by a parallel search based on retrieval cues such as number, gender, animacy, and more. There is robust evidence that this process can be disrupted by similarity-based interference [3], which arises when a distractor item shares a subset of the retrieval cues with the correct target for retrieval. An open question is whether grammatically illicit distractors elicit interference or not, which in turn can shed light on the sensitivity of retrieval processes to structural information. Some studies [4] report interference from clause-external distractors, while others [5] report evidence against the existence of such effects. An interesting testing ground for this issue comes from matrix subject-verb agreement after center-embedded subject and object relative clauses (SRCs and ORCs). Consider the contrast in 1:

- 1) a. *The student* [that calls the professor] *is drawing* a tree. (SRC)
- b. *The student* [that the professor calls] *is drawing* a tree. (ORC)

In (1b) the potential distractor *the professor* shares with the target *the student* features pertaining to subjecthood, while the same is not true for sentence (1a), where *the professor* is encoded as the object of the relative clause. If retrieval is not sensitive to structural information which exclude (or penalize) unlicensed distractors during the parallel search, we would expect interference to be reflected as inflated reading times (RTs) in sentence (1b) compared to (1a). Most of the data present in the literature indeed report such an effect, but a closer look suggests that this difference may be due to spillover from the preceding region(s), which elicit higher complexity in ORCs compared to SRCs. The present study investigates the question of interference from illicit distractors with two high-powered (~ 250 participants) online self-paced reading experiments conducted on Italian SRCs and ORCs. The rich inflectional morphology of Italian allows for a tight control over the retrieval cues involved in the computation as well as the complexity of the relative clause region, actively modulating spillover (see the supplementary material on page 3). The results of the two experiments were analyzed with Bayesian hierarchical models, including Bayesian auto-regressive (AR) models that account for spillover effects. Across the two experiments, the statistical analysis converges on three main conclusions: a) the complexity of the relative clause region does indeed carry over multiple following regions; b) when this effect is accounted for and/or attenuated, ORCs do not elicit longer reading times on the matrix verb when compared to SRCs; c) when spillover is both attenuated by design and statistically modeled, ORCs elicit faster RTs on the matrix verb when compared to SRCs. We argue in favor of a decay-based explanation, compatible with the results reported in [9]. In experiment 1, the AR(2) model estimates a mean difference of -14ms, with 95% CrI [-33, 5] such that the ORC condition is faster than the SRC condition, and Bayes Factor (BF) = 20. For experiment 2, which contrary to experiment 1 did not manipulate the complexity of the relative clause by design, the AR(2) model estimates a mean difference of 5ms, with 95% CrI [-16, 27] and BF = 0.8. These results provide converging evidence for the hypothesis that retrieval mechanisms are sensitive to structural information, such that grammatically illicit distractors do not elicit similarity-based interference.

References

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Figures and Tables

Figure 1: Experiment 1. Posterior distribution of the effect of interest as estimated by the “base” model, with only condition as fixed effect; and the AR(2) model, which includes the RTs from the RC region in the fixed effects.

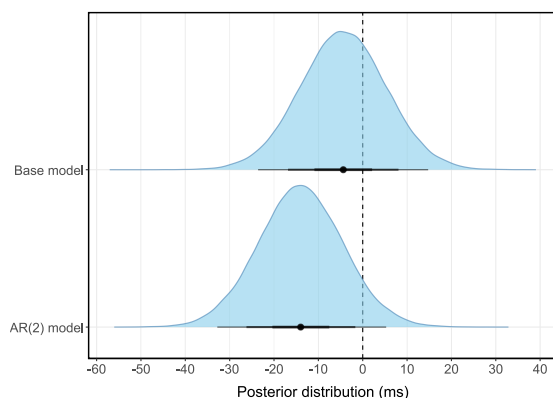
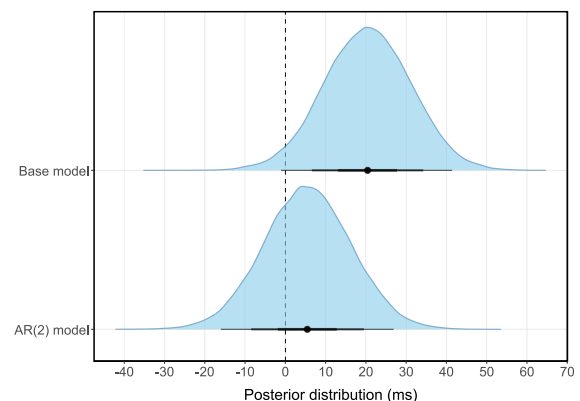


Figure 2: Experiment 2. Posterior distribution of the effect of interest as estimated by the “base” model, with only condition as fixed effect; and the AR(2) model, which includes the RTs from the RC region in the fixed effects.



Optional Supplemental Information

Experiment 1 (number mismatch) – Italian item example

SRC – L'attore che ringrazia i ballerini durante il saggio **fotografa** rapidamente la scena.

*(The._{SG} actor._{SG} that thanks the._{PL} dancers._{PL} during the show **photographs**._{SG} quickly the scene)*

ORC – L'attore che i ballerini ringraziano durante il saggio **fotografa** rapidamente la scena.

*(The._{SG} actor._{SG} that the._{PL} dancers._{PL} thank during the show **photographs**._{SG} quickly the scene)*

The critical region is always the main verb *fotografa* (photographs / takes a picture), where the parser must retrieve the main subject *l'attore* (the actor). The Prepositional Phrase (PP) inserted between the Relative Clause (RC) and the main verb has the purpose of (at least partially) absorbing spillover from the RC region(s), where the classical subject-object asymmetry is expected to lead to a greater complexity in the ORC condition. Moreover, the RC-internal Determiner Phrase (DP) *i ballerini* (the dancers) is plurally marked. The number mismatch between this DP and the main subject has the purpose of lowering the complexity on the RC region, as shown by previous research on Italian [6]. This in turn leads to lower spillover on the following regions.

Experiment 2 (all match) – Italian item example

SRC – L'attore che ringrazia il ballerino durante il saggio **fotografa** rapidamente la scena.

*(The actor._{SG} that thanks the._{SG} dancer._{SG} during the show **photographs**._{SG} quickly the scene)*

ORC – L'attore che il ballerino ringrazia durante il saggio **fotografa** rapidamente la scena.

*(The actor._{SG} that the._{SG} dancer._{SG} thanks during the show **photographs**._{SG} quickly the scene)*

Experiment 2 removes the mismatch in order to have a direct test of the potential interference from the RC-internal distractor when interference should be at its highest (same syntactic category, lexical restriction, grammatical number, animacy, semantic category).