Priming parasitic gaps: multiple ways to produce silence

Null elements are sometimes analyzed as mapping onto syntactically distinct representations. E.g.,
(1) *Which error did the editor notice before correcting __?*
(2) *Which error did the editor notice and correct __?*
(3) *Which editor corrected the error after noticing __ ?*
Sentences like (1) involve parasitic gaps (PGs; Engdahl, 1983), sentences like (2) involve across-the-board (ATB) extractions (Williams, 1978), and sentences like (3) involve definite implicit objects (Dowty, 1982; Partee, 1989; Condorvdi & Gawron, 1996). Many, but not all, linguistic theories regard these phonologically null elements as involving distinct syntactic representations or distinct types of syntactic dependencies between the filler and the gap. For example, some analyze PGs as pronoun-like (Cinque, 1990), ATB gaps as real gaps (Williams, 1990), and definite implicit objects as definite descriptions (Condorvdi & Gawron, 1996). However, it is unclear if these distinctions should indeed be maintained, and even if they should, the distinction may not be realized during processing and production (Bever & McElree, 1988). Here we examine whether these phonologically null elements correspond to distinct syntactic representations in speakers' minds, using *structural priming*, the tendency of speakers to repeat the syntactic structures they recently encountered (e.g., Bock, 1986). We argue that PGs, ATB gaps, and definite implicit objects indeed correspond to distinct representations during production, supporting (a) the grammatical theories that distinguish these phonologically null elements and (b) the architectural view that detailed knowledge of grammar guides production (Lewis & Phillips, 2015).

Task. In both experiments, a type of sentence recall task was used. Critically, structural priming of various types, such as the priming of dative alternation (Potter & Lombardi, 1998), spray/load alternation (Chang et al. 2003), and overt/covert complementizer alternation (Ferreira, 2003) has been observed in past sentence recall studies. In each trial of the current experiments, speakers read aloud and memorized a target sentence and a prime sentence, in this order. Speakers then recalled the target sentence given a few words from the target sentence as memory cues (Fig.1). We used 24 critical item sets distributed across 6 experimental lists, according to a Latin Square design. 58 fillers were included in Experiment 1, and 56 fillers were included in Experiment 2. In filler trials, participants were sometimes asked to recall the second, not the first, sentence, meaning that speakers could not reliably predict which sentence they needed to recall until they saw the recall cue. In both experiments, we exploited the near-synonymity between PG sentences with minimally different sentences where the PG is replaced with an overt pronoun *it* (e.g., *Which diamond did the merchant buy without examining?* and *Which diamond did the merchant buy without examining it?*). Structural priming here can be defined as the decrease in the proportion of *it* production as a function of prime structures. If ATB and PG share the same representations, priming should occur from ATB gaps to PGs. Meanwhile, if ATB gaps and PGs distinct, priming occurs from PGs to PGs, but not from ATB gaps to PGs.

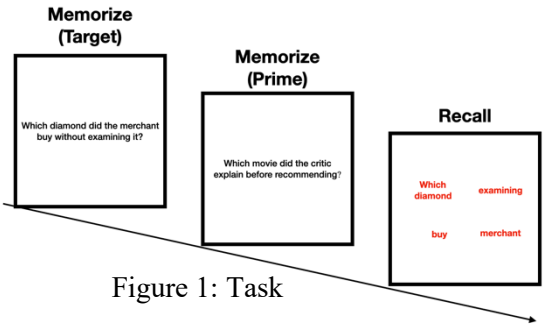

Figure 1: Task

Experiment 1 (n = 46) tested priming from PGs to PGs and ATB gaps to PGs. PG sentences and minimally different sentences with the overt pronoun *it* like (4) were used as target sentences. PG sentences like (5a) and ATB sentences like (5b) were used as prime sentences. Note that the heads of adjunct clauses in PG sentences (e.g., *without/before*) were never shared between prime and target sentences, so the number of words shared between target and prime sentences were identical between ATB and PG prime conditions. The verbs in control prime sentences were in the *-ing* form, to make sure that the potential difference between PG and ATB conditions cannot be attributed to the difference in the inflectional form of the relevant verbs. Also, target sentences contained *it* half the time (this manipulation corresponds to the factor *Target Type* in Figure 2). We also made sure that the prime sentences were grammatical. An independent acceptability judgement study (n = 24, recruited from the same participant pool as the main experiments, on 1-7 scale, 7 being perfectly acceptable) confirmed that the acceptability of sentences like (5a) and (5b)

are at near ceiling, with the mean acceptability of 6.5 for ATB primes and 6.2 for PG primes. For reference, good fillers (e.g., *They were both great kids with a marvelous future.)* received the mean acceptability of 6.5, and bad fillers, which included various types of violation (e.g., Which phone did the engineer wonder where it is invented?) received the mean acceptability of 2.54.

(4) *Which diamond did the merchant buy without examining (it) carefully?* [Target]

(5) a. *Which movie did the critic explain before recommending?* [PG prime]
b. *Which movie did the critic explain and recommend?* [ATB prime]
c. *Which movie was the critic recommending?* [Control prime]

The dependent variable was the presence or absence of *it* in the target responses. A hierarchal Bayesian logistic regression model was constructed, with Target Type (Gap vs. Pronoun), Prime Type (ATB vs. Control vs. PG) and their interaction as fixed effects, and with maximal random effect structures in the sense of Barr et al. (2013). Prime Type was Helmert-coded such that PG primes were compared to the other two types of prime. As can be seen in Figure 2, PG primes reduced the rate of *it* production by approximately 11.7% compared to the other two types of primes (beta = -0.85, 95% CrI [-1.30, -0.40]), and ATB and control primes did not differently affect the rate of it production (beta = -0.16, 95% CrI =[-0.68, 0.36]). Thus, PGs prime PGs, but ATB gaps did not prime PGs, suggesting that speakers' mental representations of PGs and the ATB gaps are distinct. It is also worth noting that, as far as we know, this is the first study that demonstrates that PGs can be structurally primed.

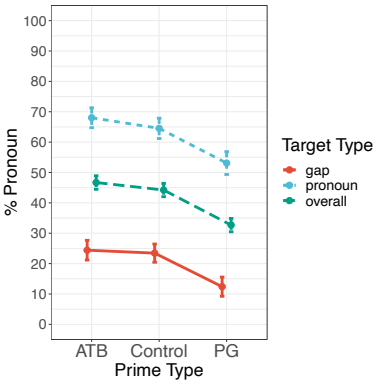

Figure 2: results of Exp. 1

Experiment 2 (n = 100) contrasted PGs with implicit definite objects like in *Which tutor corrected the mistake after noticing __?* To be certain that the second verb of target sentences do not license implicit objects, the PGs/pronouns in target sentences in this experiment were inside a PP, as in (6) below. Prime sentences contained PGs as in (7a), implicit definite objects as in (7b), or neither as in (7c). An acceptability norming study confirmed that verbs like *notice* can indeed host implicit objects, as indicated by a relatively high acceptability rating of sentences like (7b) (Mean acceptability = 5.57) and verbs like *find* used in PG prime conditions does not (easily) host implicit objects unlike verbs like *notice*, as indicated by low acceptability ratings of sentences like *Which tutor corrected the mistake after finding*? (Mean acceptability = 3.73). In comparison, PG prime sentences like (7a) received the mean acceptability of 5.48. The target sentences like (6) had the mean acceptability of 5.64.

(6) *Which idea did the philosopher accept without contemplating on (it) carefully?* [Target]

(7) a. *Which mistake did the tutor correct after finding?* [PG prime]
b. *Which tutor corrected the mistake after noticing?* [Implicit object prime]
c. *Which tutor corrected the mistake?* [Control]

As can be seen in Figure 3, PG primes decreased the rate of *it* production by approximately 7.3%, compared to other types of primes (b = -0.58, 95%Crl = [-0.95, -0.23]), and implicit object primes and control primes did not differentially affect the rate of *it* production (b = -0.21, 95%CrI = [-0.57, 0.14]). These results suggest PGs and definite implicit objects are distinct in speakers' mind.

Conclusion. These results suggest that speakers create distinct representations of null elements in sentence production, consistent with theories that posit distinct syntactic representations for PGs and ATBs, and PGs and definite implicit objects. Grammatical theories that assimilate PGs and ATB gaps and PGs and definite implicit arguments must explain these results by some other means. More broadly, the current study provides evidence for the architectural hypothesis that detailed grammatical knowledge is causally involved in sentence production.

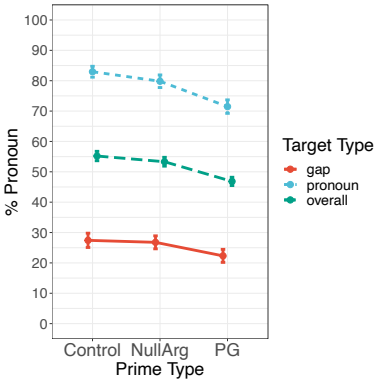

Figure 3: results of Exp. 2