









## Referential domains, priming and the effect of invisible objects

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Referring Expressions (REs) are determined not just by properties of the referent, but also by the properties of *other* objects; the set of relevant objects is known as the *referential domain* [1]. The referential domain contains objects in the local visual context from which the referent needs to be distinguished: when there are two boxes in the visual context, referring to one of these requires a modifier (e.g., “*the open box*”). Interestingly, speakers sometimes include a modifier even when the contrasting entity is no longer visible, saying “*the closed box*” when the local visual context contains only a single box, but after they referred to a different (open) box earlier [2,3]. We note that this pattern suggests that previously-mentioned objects are also part of the referential domain, and ask (i) whether *unmentioned* earlier objects can also be part of the referential domain (Exp. 1), and (ii) whether earlier and current objects are all part of a *single* referential domain (Exp. 2).

**General Method.** Participants (n=24) performed a referential communication task over Zoom. Participants viewed grids of 15 “cards” each, completing 8 trials per grid: 1 ENTRAINMENT trial, 1 TEST trial, and 6 interspersed fillers. On each trial, 4 of the 15 cards were “flipped” to reveal their images, and the participant described a target card for the experimenter to click.









**Exp. 1.** To examine whether an earlier, unmentioned object is part of the referential domain, we manipulated whether the earlier ENTRAINMENT trial contained a pair of objects (e.g., an open and a closed box) or just a single object (an open box). The TEST trial was held constant: it always included one object (e.g., a striped closed box). If the referential domain only includes the earlier mentioned object (e.g., open box), the later RE should only encode contrast with this object (e.g., “*the closed box*”), regardless of the presence or absence of an earlier closed box. Alternatively, if the earlier contrasting object is part of the referential domain despite being unmentioned, speakers should avoid saying “*the closed box*” because this RE would not distinguish the current target from the earlier closed box. This pressure stands in contrast to a priming effect, whereby saying “*the open box*” earlier should prime “*the closed box*”. For control, we also manipulated whether the ENTRAINMENT trial included the same or a different noun (e.g., box vs. eye).

	ENTRAINMENT	TEST	Trials that follow an entrainment trial with modification	
			All trials	
a) <i>Same-Pair</i>	 box: 0% open box: <b>100%</b>	 box: 50% closed box: 23%		50% <b>23%</b>
b) <i>Same-Single</i>	 box: 67% open box: <b>33%</b>	 box: 59% closed box: 13%		31% <b>49%</b>
c) <i>Different-Pair</i>	 eye: 3% open eye: 97%	 box: 60% closed box: 11%		62% 11%
d) <i>Different-Single</i>	 eye: 80% open eye: 20%	 box: 70% closed box: 1%		67% 5%

On ENTRAINMENT trials, speakers produced the modifiers at ceiling for pairs (same: 100%, diff: 97%), and much less for a single object (same: 33%; diff: 20%). This (expected) difference means

that speakers were more likely to be primed by their own modified REs in the pair conditions than in the single condition. To control for priming, we focused on those trials which had a modified RE in ENTRAINMENT (e.g., “the open box”). As expected from prior priming studies [e.g., 4], speakers produced more primed modifiers when the noun was repeated. More importantly, the primed RE was much *less* likely when the entrainment trial contained a second, unmentioned box (Same-Pair 23% vs. Same-Single 49%). This indicates that when the primed form (e.g., “the closed box”) did not distinguish the current target from the earlier, unmentioned box, speakers avoided using a RE that was sensitive to the historical context. This effect reveals that the earlier, unmentioned object is part of the referential domain.

**Exp. 2.** To examine whether all three objects are part of one referential domain, and to control for priming, we exploited the fact that the intermediate object in a set of three is called “*medium*” (pilot: 94%), but the same object is called “*big(ger)*” when paired with just one object (pilot: 97%). Participants described the object of intermediate size: (i) the TEST contained either a *Pair* of objects or a *Single* object, and (ii) the ENTRAINMENT trial either completed the set of 3 (Critical), or had one less object (Baseline). Most importantly, the effect of the historical context was again observed: comparatives (e.g., “*bigger*”) were more likely when a third object of the same category was seen earlier (72%) than when it was not (59%): speakers were less likely to call the medium object “*big*” when the historical context contained an even bigger flower. Nevertheless, speakers rarely produced “*medium*” in the critical conditions, revealing that the three objects do not in fact form a *single* referential domain. Importantly, these effects are independent of any priming effects (modifiers are not repeated across ENTRAINMENT and TEST).

	ENTRAINMENT	TEST
a) <i>Pair-critical</i>	 <p>flower: 76% big flower: 6% bigger flower: 0%  medium flower: 0%</p>	 <p>flower: 0% big flower: 24% bigger flower: 72%  medium flower: 3%</p>
b) <i>Pair-baseline</i>	 <p>garlic: 77% big garlic: 6% bigger garlic: 1%  medium garlic: 0%</p>	 <p>flower: 1% big flower: 35% bigger flower: 59%  medium flower: 4%</p>
c) <i>Single-critical</i>	 <p>flower: 0% big flower: 54% bigger flower: 40%  medium flower: 0%</p>	 <p>flower: 85% small flower: 2% smaller flower: 3%  medium flower: 6%</p>
d) <i>Single-baseline</i>	 <p>flower: 83% big flower: 3% bigger flower: 0%  medium flower: 0%</p>	 <p>flower: 83% small flower: 2% smaller flower: 6%  medium flower: 4%</p>

**Conclusions.** We observe a novel effect where an entity is part of the referential domain – thereby affecting referential forms – despite not being physically present in the local context (and thus a potential referent) and not being referred to earlier. This effect reveals that speakers do not just represent the language previously uttered, but also aspects of the non-linguistic context that has given rise to their utterance. More specifically, these patterns could be explained by positing two simultaneous referential domains [cf. 5], one for the historical context, and a second one for the local visual context, with the local context taking precedence over the historical context.

**References** [1] Roberts (2003). *Linguistics and Philosophy* • [2] van der Wege (2009). *J of Memory and Language* • [3] Yoon & Brown-Schmidt (2013). *J of Memory and Language* • [4] Cleland & Pickering (2003). *J of Memory and Language* • [5] Heller et al., (2016). *Cognition*.