

Anaphoric reference to a structured object

Corpus evidence suggests that in contexts such as [1a] below (in which the presence of multiple antecedents might favour plural reference), the disadvantage typically observed for singular reference may disappear if the potential antecedents are combined in a larger entity or group (Poesio & Reyle, 2001; Poesio, Reyle, & Stevenson et al., 2006).

(1a) The engineer **hooked up** the engine to the boxcar and sent **it/them** to London.

(1b) The engineer **detached** the engine from the boxcar and sent **it/them** to London.

In three Experiments, we examined the relative salience of antecedents in conditions where the context either made a group interpretation available (e.g., The engineer hooked up the engine to the boxcar..., where group = train), or did not (e.g., The engineer detached the engine from the boxcar...). In these experiments, we contrasted **verb types** (attachment verbs vs. detachment verbs) and **anaphora types** (it vs. them). We **predicted**: (i) the created group (i.e., the engine + the boxcar = train) in [1a] can be the antecedent of a singular pronoun *it* due to the semantics of the verb (i.e., hook up/attachment verb); (ii) in contrast, in [1b] no such group interpretation is available, but a reference to a set of entities (e.g., engine and boxcar) is possible; and (iii) in [1b] a single object reference (either engine or the boxcar) would be an antecedent of *it*. On the other hand, in [1a] & [1b], *them* would be interpreted as referring to two-objects (i.e., engine and boxcar) instead of a single object (i.e., engine or boxcar).

In **Experiment 1**, using Amazon Mechanical Turk, ($N = 40$) English speakers were asked to identify and write the referents of *it* and *them* for each item: a single entity (e.g., engine), group (e.g., train), two-object references (e.g., engine + boxcar), or not sure. Two logistic mixed effects regressions, incorporating all fixed effects (verb types and pronouns) and interactions in a single step, were conducted. All analyses reported below incorporated crossed random intercepts for participants and items. In Model 1, we compared referent choices for a single entity with a second category that combined 'entity references' and 'group references' in a single response category. In Model 2 we excluded single entity references and separated 'two-object references' and 'group references' into two categories. In both models, the predicted interaction was observed (anaphora * verb types: Model 1: $\beta = -1.086$, $SE = 0.479$, $Z = -2.264$, $p = .023$; Model 2: $\beta = -2.143$, $Z = -2.987$, $SE = 0.717$, $p = .002$). As can be seen below in Figs. 1 & 2, there was a clear preference for *it* when referring to the group entity (See 1a.). In contrast, in [1b] participants interpreted *it* referring to a single entity. Irrespective of verb type, participants preferred two-objects as a referent of *them*. In **Experiment 2**, English speakers ($N = 32$) were provided with an initial context and asked to complete the sentence starting with *it* or *them*. After completion of experiment, they were asked to underline the referents of *it/them*. The interaction between verb and pronoun types was significant in the LMER with random slopes and intercepts (anaphora * verb types: $\beta = -1.468$, $SE = 0.4772$, $Z = -3.078$, $p = .002$; Fig 2). Our results confirmed that participants interpreted *it* as referring to the group entity in [1a], and only to a single entity in [1b]. In **Experiment 3**, using the same stimuli from Experiment 1, each participant ($N = 50$) was asked to paraphrase/rewrite the sentences with attachment/detachments verbs and pronouns (See Fig. 4.). Two LMER analyses were conducted (anaphora * verb types: Model 1: $\beta = -0.914$, $SE = 0.805$, $Z = -1.135$, $p = .256$; Model 2: anaphora * pronoun: $\beta = 1.458$, $SE = 0.992$, $Z = 1.468$, $p = .141$). Both models showed that in [1a], the participants' mental representation of *it* was the group entity (i.e., train) whereas their representation of *them* in [1a] was two-objects (Model 1: anaphora: $\beta = -1.377$, $SE = 0.992$, $Z = -3.407$, $p = .001$; Model 2: $\beta = -1.377$, $SE = 0.992$, $Z = -3.407$, $p = .001$). However, in [1b], the mental representation was one object for *it* (i.e., engine or boxcar) and two-objects for *them*. Collectively, our three experiments provided evidence that the creation of a "group" makes that entity (i) a possible referent for a singular anaphoric reference and (ii) more salient than its constituents. Our results provide new evidence regarding the interpretation of singular and plural pronouns in mereological contexts (i.e., entities constructed from two parts of an object).

References

- Poesio, M. & Reyle, U. (2001). Underspecification in anaphoric reference. *Proceedings of 4th International Workshop on Computational Semantics*, Tilburg University.
- Poesio, M., Reyle, U. & Stevenson R. (2006). Justified sloppiness in anaphoric reference. In H. Bunt and R. Muskens (Eds.), *Computing Meaning 3* (pp.1-20). Kluwer, Amsterdam.

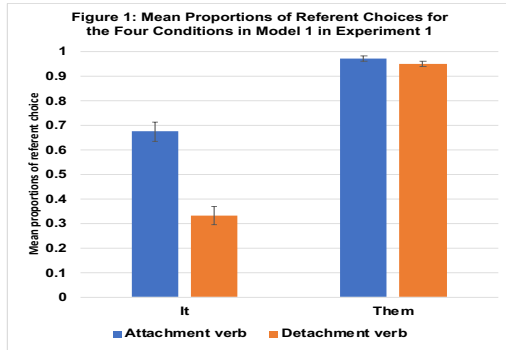


Figure 1. Mean proportion of group reference (e.g., train) relative to two-object reference (i.e., engine +boxcar) plus single object reference (e.g., engine).

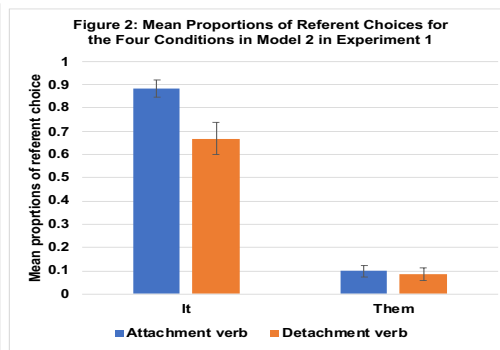


Figure 2. Mean proportion relative to group reference (e.g., train) to two-object reference (engine + boxcar)

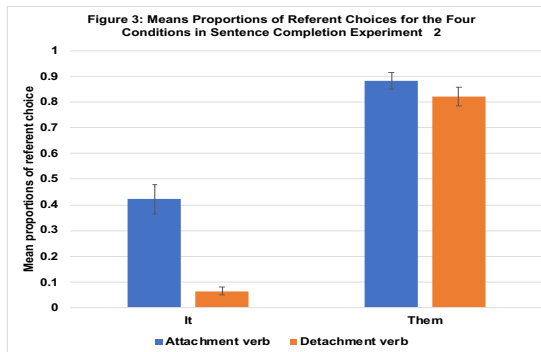


Figure 3. Mean proportion of single-object reference (e.g., engine) relative to two-object reference (engine + boxcar)

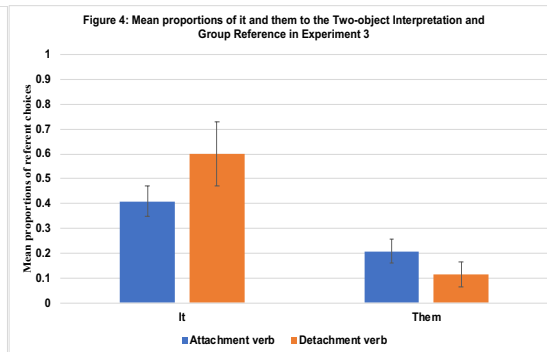


Figure 4. Mean proportion of two-object references (e.g., engine + boxcar) relative to the group reference as 1 (e.g., train).

Experiment 1: Conditions 1 & 2 with it/them in the attachment verb: *The railway man **hooked up** the engine to the boxcar and **sent it/them** quickly to the central station.*

Conditions 3 & 4 with it/them in the detachment verb: *The railway man **detached** the engine from the boxcar and **sent it/them** quickly to the central station.*

Experiment 2: Conditions 1 & 2 with it/them in the attachment verb: *Sarah **pressed** the ham onto the bread and admired **it/them**...*

Conditions 3 & 4 in the detachment verb: *Sarah **separated** the ham from the bread and admired **it/them**...*

Experiment 3: Conditions 1 & 2 with it/them in the attachment verb: *The shoemaker **glued** the leather to the sole and inspected **it/them** meticulously with his eyepiece.*

Conditions 3 & 4 with it/them in the detachment verb: *The shoemaker **separated** the leather from the sole and **inspected it/them** meticulously with his eyepiece.*