Modelling common ground through referential specificity

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In the classic test of common ground use in referential communication – the so-called *Director task* (Keysar et al., 2000, *Psychological Science*; Keysar et al., 2003, *Cognition*) – common ground is fixed at the start of the game, rather than being inferred during the exchange. A more reliable test of Theory of Mind use in communication would be to see whether participants are able to infer common ground given the Director's instructions (Rubio-Fernández, 2017, *Psychonomic Bulletin & Review*). In this study, we present and test a probabilistic model of common ground that assigns reference to an expression in a given visual context by jointly deriving epistemic inferences based on the speaker's choice of referential expression and adjusting their expectations about the speaker's linguistic preferences. For example, if a rational and cooperative speaker produced an under-specific description (e.g., 'the rectangle' when there are two rectangles; see Fig.1), the listener would assume that the speaker only knows about one of the objects. Likewise, if the same speaker produced a modified description (e.g., 'the small triangle'), the listener could assume that the speaker was either preempting an ambiguity (between two triangles) or using the adjective redundantly (rather than contrastively). Our model derives three inferences from an utterance: what the speaker is talking about in a visual context, what she knows about the context, and what referential expressions she prefers. We tested our model by comparing its inferences with those made by human participants in three separate experiments, and found that the model closely mirrors participant judgments, whereas an alternative model compromising the listener's expectations of cooperativeness and efficiency reveals a worse fit to the human data. Our model shows that common ground can be computed as part of the process of reference assignment, suggesting that the derivation of epistemic inferences is an integral part of communication.
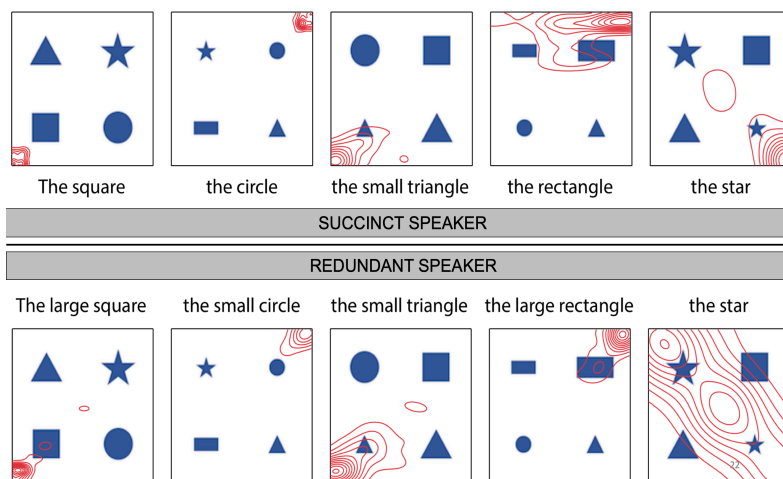

The square	the circle	the small triangle	the rectangle	the star

SUCCINCT SPEAKER

REDUNDANT SPEAKER

The large square	the small circle	the small triangle	the large rectangle	the star

Fig. 1: Density plots indicating participants' choice of referent in a sequence of five trials (clicks on a corner indicated maximum certainty). The speaker had a blind spot and could only see 3 of the quadrants in each display. The critical manipulation was the speaker's use of adjectives. In one version, the speaker was 'succinct' and used size adjectives contrastively, whereas in another version, she was 'redundant' and used adjectives systematically.

Even though the five displays are identical in the two versions of the task, participants should only be able to identify the speaker's blind spot (and hence the last referent) when the speaker is succinct and adjectives can be interpreted contrastively. Participants were randomly allocated to one of the two versions of the task and were not informed about the speaker's reliability.