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On the compositional interpretation of scalar quantifiers: The role of the residue set

Recent visual world studies examined whether comprehenders interpret some as some and not all in the same timecourse as they compute the semantic interpretation of all. [1] reported that referential disambiguation based on pragmatic some was delayed compared to all, whereas [2-3] found no evidence for such delay. [4] manipulated target set sizes and found stronger target bias after hearing all than some only when the set size was big. So far, the timecourse question remains unsolved and how set size interact with scalar processing is unclear. Here we demonstrate that people have prior expectations about the target set size in a display given the quantifier use and these expectations influence target bias formation. Unlike previous studies, we also examine the time course question by comparing looks to the ‘residue set’ after hearing quantifiers and numerical determiners. Looks to the residue set reflect incremental integration of compositional interpretation of quantifiers and are not affected by other expectations. We find the timecourse of gaze bias based on pragmatic some is not different to that for all.

Exp.1 Given [4], our hypothesis is that people have prior expectations that an agent with a total set of something will possess a relatively large set of objects. We asked participants to indicate on a slider scale which image fits better with a statement containing a quantifier, (fig.1). The statement could equally be true of both. Participants (N=39) judged 2 critical items and 4 fillers, of which two were clearly unambiguous and two ambiguous (e.g. the girl has red and green apples). Results: for both quantifiers, participants prefer the agent with the larger set as the referent (both ps<.001). And the preference for all to be used with a big set was stronger than that for some (p =.024). The big set preference in all is consistent with our hypothesis. The result for some could reflect a preference for using some with a set containing three over two. Note that in [1] all targets have three items, some targets have two.

Exp.2 We re-examine the timecourse question and test how prior expectations influence scalar processing. Participants viewed a visual display (fig.2) while listening to an instruction of the form “Click on the [girl/boy] that has [Det] of [name’s] [noun]”, [Det] is one of some, all, two, three (fully counterbalanced). The residues of partitioned sets were in the centre.

Prediction 1. Less looks to the residue set for numbers than all because anticipating a referent in number conditions does not require checking the residue set. Prediction 2. Only if some is interpreted as ‘some and not all’ should there be also less looks to the residue set in numbers than some. Prediction 3. Given exp.1’s results, in all and some condition, looks to the target should increase faster when the target set size was big compared to when it is small. Prediction 4. Anticipatory looks to the target should increase faster in all than in some when the target set size was big. Results. Residue set results show rapid integration of pragmatic some. As shown in fig.3, during disambiguation regions, looks to the residue set decrease faster in numbers than both all and some ([Det]: ps<.001; [name’s]: ps<.001). Critically, growth curve analysis reveals that during [Det] window for all and some, there is a quadratic increase in looks to the residue set (rise/fall), but such trend is not found in numbers. With regard to prediction 3 and 4, shown in fig.4, the target bias in big all is stronger than in small all (both windows, ps<.001) and a marginal diff. between big and small some in ([Det]: p=0.09). We also find looks in big all condition increase more rapidly than looks in big some ([Det]: p=.02). These results show that prior expectation has bigger influence on how target bias develop over time in all. Independent of size, we find target bias emerged earlier and stronger in numbers than in all and some (for both windows, ps <.001), whereas all and some, did not differ. Conclusion prior expectations affect target identification when set size is not
controlled. Our results render the interpretation of previous visual world data, incl. in [1], problematic. When prior expectations are controlled, overall target results and residue set results indicate that enriched some was as fast as all.

Figure 1 experimental items used in exp.1

Figure 2: 2(a) can be paired with instructions ‘Click on the boy that has all/three of Susan’s apples’ or ‘Click on the girl that has some/two of Susan’s pears’. 2(b) can be paired with instructions ‘Click on the girl that has all/two of Susan’s pears’ or ‘Click on the boy that has some/three of Susan’s apples’.

Figure 3 Time course plot of looks to the residue set (empirical logit) by Determiner from the instruction onset to the instruction offset

Table 1: Log ratio of looks to target over competitor by Determiner and Target size from the display onset to the instruction offset