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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]: *p*s<.001; [name's]: *p*s<.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, *p*s<.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, *p*s <.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*.

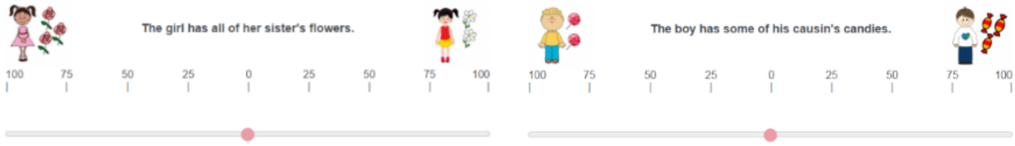


Figure 1 experimental items used in exp.1

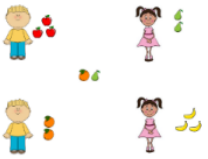
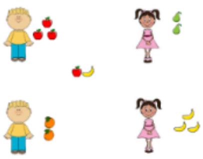

(a)

(b)

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'.

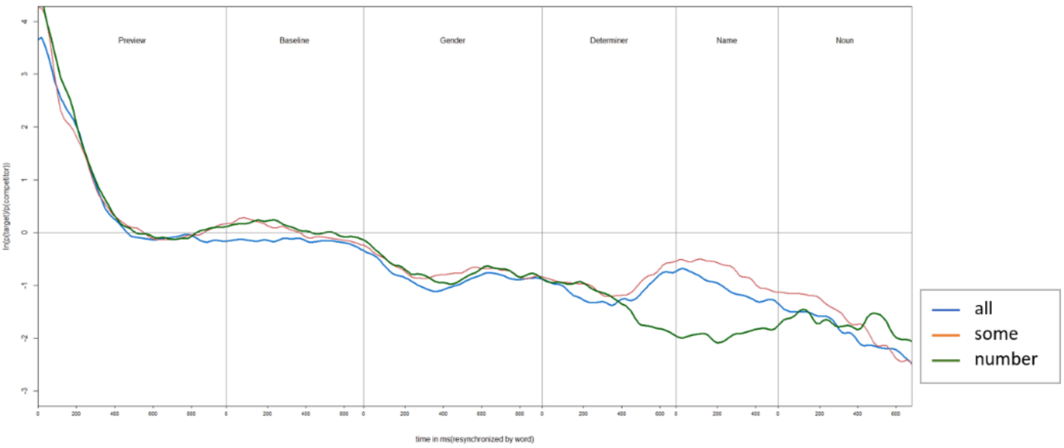


Figure3 Time course plot of looks to the residue set (empirical logit) by *Determiner* from the instruction onset to the instruction offset

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6.8

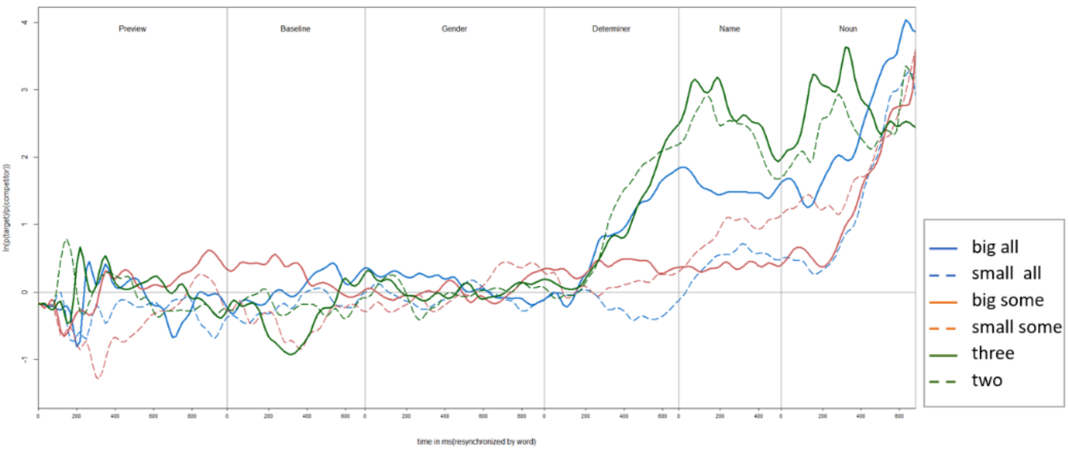

Figure 4. Log ratio of looks to target over competitor by Determiner and Target size from the display onset to the instruction offset

References: [1] Huang, Y. T., & Snedeker, J. (2009). *Cognitive Psychology*, 58(3), 376–415. [2] Grodner, D. J., Klein, N. M., Carbary, K. M., & Tanenhaus, M. K. (2010). *Cognition*, 116(1), 42–55. [3] Breheny, R., Ferguson, H. J., & Katsos, N. (2012). *Language and Cognitive Processes*, 28(4), 443–467. [4] Degen, J. & Tanenhaus, M. K. (2016). *Cognitive Science* 40 (1):172-201.