Disambiguation of scalar quantifiers' meanings in context: Mouse-tracking evidence for the role of real-time social reasoning

The scalar quantifier *some* is ambiguous between a semantic (some and possibly all) and a pragmatic (some but not all) meaning. Loy et al. (2019) investigated how its interpretation was affected by a speaker's manner of speech in real time. They showed that where speakers were disfluent ("I ate, uh, some oreos"), listeners were more likely to make an early commitment to the semantic interpretation than when the speakers were fluent. However, it remains unclear whether this early disambiguation of semantic and pragmatic meanings of *some* merely reflects a simple bias from disfluency towards a semantic interpretation, or whether it reflects listeners' rapid reasoning in a context where the semantic meaning of *some* (*some and possibly all*, i.e., eating more oreos), is socially undesirable.

Here, we disentangle these two possibilities by using a different social context for the interpretation of *some*. In an online mouse-tracking experiment, we use the context of a job interview, in which, critically, the pragmatic meaning ("I got some but not all 'A's for my psychology courses") is the meaning that is socially undesirable. Therefore, we ask whether the presence of disfluency favours the semantic meaning (simple effect of disfluency regardless of context) or a pragmatic meaning (via social reasoning about concealing a context-specific socially undesirable meaning).

We recorded 150 participants' mouse movements in a web-based task in which we manipulated disfluency (present vs. absent) within-subjects in a set of 12 target trials. In target trials, participants saw four images with different numbers of qualifications, each representing one of four potential interpretations of the meaning of *some* (Fig. 1), and heard an interviewer ask an interviewee about their qualifications (Example 1). We included 24 filler trials, which did not contain *some* or the disfluency 'uh'. We measured both the final click results (i.e., which image each participant clicked at the end) as well as the trajectories of participants' mouse movement during each trial.

The total numbers of clicks on each image by condition are shown in Table 1. Participants' responses showed that the presence of disfluency biases interpretation in favour of the socially undesirable meaning, here the pragmatic interpretation of *some*: For the disfluent compared to the fluent condition, there were fewer clicks on the two- and four-A images, but more clicks on the one-A image. Clicks on the one-A image were modelled using a mixed-effects logistic regression with the within-participant predictor of manner of delivery (fluent and disfluent), with random intercepts and slopes by participant and trial. Participants were more likely to click on the one-A image following a disfluent utterance compared to a fluent utterance ($\beta = 8.074$, SE = 0.591, $p = <0.001$).

Figure 2 shows participants' aggregated mouse trajectories towards each image in each condition (disfluent/fluent). The colours of points (from red points at the centre of the screen to violet in each corner) indicate each 10% of trial time. Only the patterns of mouse movements in which participants eventually click on the one-A image show obvious differences. Participants appear to move faster, and more directly, towards the one-A image in the disfluent condition. In the fluent condition, they show hesitant movements towards other images, taking more of the time before they click to decide to move towards and click the one-A target.

This preliminary exploration of the mouse-tracking leads to two important conclusions. First, in this context (in which it is desirable to have more qualifications), disfluency does bias towards an interpretation of *some* which is associated with smaller numbers (the pragmatic interpretation). In fact, it would appear that the semantic meaning of *some* is quite often ignored (in 17% of disfluent trials and 8% of fluent trials), in that participants rarely clicked the 'all' and instead favoured an interpretation where *some* was associated with the meaning 'one'. Taken together with the results from Loy et al. (2019), this suggests that listeners take the social context into account when reasoning about scalar quantifiers such as *some*. Second, this reasoning happens very quickly: Where utterances are disfluent, listeners make the decision to select the one-A target (if they are going to) very quickly, and initiate mouse movements appropriately. Where the utterances are fluent, however, they are more hesitant, showing early movements which suggest that other interpretations of *some* are initially in contention. The incremental nature of the participants' response is evident in their fast integration of the disfluency cue in the interpretation of the sentence, even before the full sentence has been encountered.

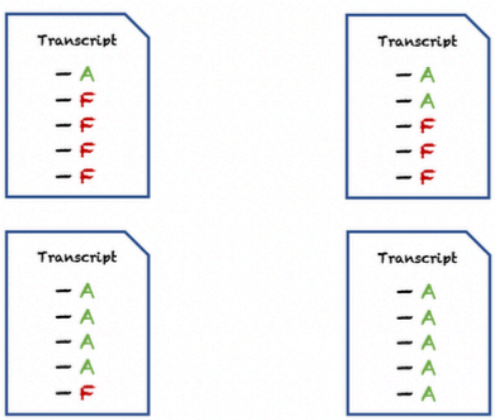

Fig. 1 One example of screen display presented in a target trial

Example 1 How many 'A's have you got for your psychology-related courses?
(a) I've got *some* 'A's.
(b) I've got, uh, *some* 'A's.

Table 1:
Total number of mouse clicks recorded on each qualification image (named respectively as one-A, two-A, four-A, or all-A for the convenience of presenting) by manner of delivery (disfluent/fluent)

Condition	One A	Two As	Four As	All As
Disfluent	148	688	45	0
Fluent	67	724	78	1

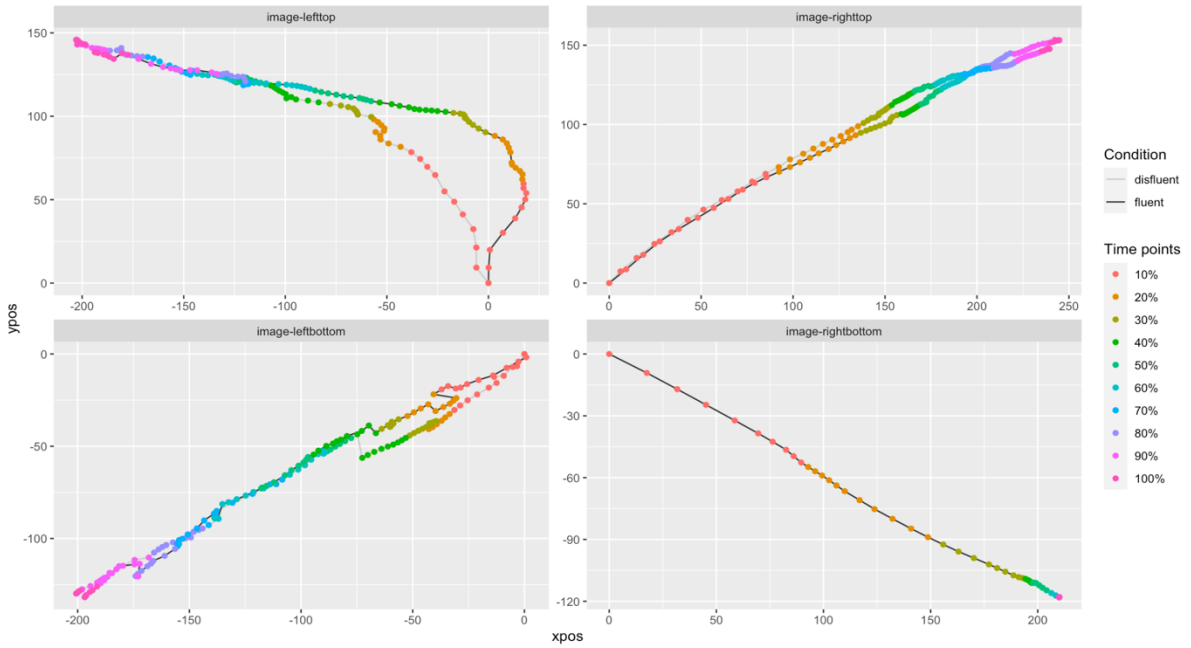

Fig.2 Aggregated mouse trajectories towards four images by condition (disfluent/fluent), and the colours of points (from red points at the centre of the screen to violet in each corner) indicate 10%, 20%, 30%...100% of trial time

Reference

Loy, J. E., Rohde, H., & Corley, M. (2019). Real-time social reasoning: The effect of disfluency on the meaning of some. *Journal of Cultural Cognitive Science*, *3*(2), 159-173.