Early non-plural interpretation of 'some' in context

Mouse-tracking evidence for the role of real-time social reasoning

Early **non-plural** interpretation of ‘some’ in contexts: Mouse-tracking evidence of the role of real-time social reasoning

Listeners’ interpretations of an ambiguous word like the scalar quantifier ‘some’ is shown to be contextual (Breheny, Katsos, & Williams, 2006; Politzer-Ahles and Husband, 2018), varying from a semantic meaning ‘some and possibly all’ to a pragmatically strengthened meaning ‘some and possibly all’. Loy et al. (2019) further explored that the interpretations of ‘some’ depends on listeners’ reasoning of a speaker’s manner of speech. They found that, within a context where interpreting ‘some’ semantically (to a larger some-and-possibly-all value) is socially undesirable (‘I ate some oreos’), listeners were more likely to make an early commitment to a semantic interpretation (‘I ate some and possibly all oreos’) when the speaker is disfluent (‘I ate, uh, some oreos’). However, listeners no longer associate disfluency with the semantic interpretation of ‘some’ when we varied the social context in one of our mouse-tracking experiments (presented in XPRAG 2022).

We used the context of a job interview where participants listened to conversations where an interviewer asks, “How many ‘A’s have you got for your psychology courses?” with interviewees answering, “I got some ‘A’s” or “I got, uh, some ‘A’s”. Critically in this context, the semantic interpretation (‘I got some and possibly all As for my psychology course’) is now in favour while the pragmatic meaning is the undesirable one (‘I got some, but in fact fewer As’). Our results showed the opposite to Loy et al., as people now tend to move quickly towards a pragmatic interpretation when hearing disfluent utterances, almost as soon as they heard the disfluent ‘uh’.

Combining with the results of Loy et al., we can assure that listeners take context into consideration, and they take disfluency as a cue to enable social reasoning for the interpretation of ‘some’. However, participants’ clicking results in our experiment showed that, following disfluent utterances, people are more likely to click on the image corresponding to ‘some’ meaning ‘one’, compared to when the sentences are fluent. It seems that following disfluency in this context, listeners are more inclined to interpret ‘some’ as ‘one’ rather than the other numbers that are compatible with the pragmatic meaning of ‘some’. This non-compatible interpretation of ‘some’ makes us wonder what the listeners could be reasoning about when disambiguating the meaning of ‘some’.

We assume that listeners could be reasoning out of two accounts; (1) Lying account: They could be reasoning that disfluency serves as a cue of lying so that they decide to choose the image with the least number, no matter what number it is; (2) Stretching account: Listeners are reasoning that the existence of disfluency makes them decide to stretch the meaning of ‘some’ to meaning specifically ‘one’ in this context.

To further distinguish between these two possibilities, we ran another experiment (zero-A experiment) within the same job interview context but changing the one-A image to zero-A (Fig. 1). This is to test what participants’ choices could be when the image with the least A available in the options is an image with a number that is not compatible with meaning of ‘some’ at all. If the results of participants’ mouse clicks and mouse movements are similar to those in the previous one-A experiment, we could conclude that they are treating zero-A and one-A option similarly, indicating that listeners regard disfluency as a cue of speaker’s lying and they always choose the image with the least A available, no matter the number is one or zero.

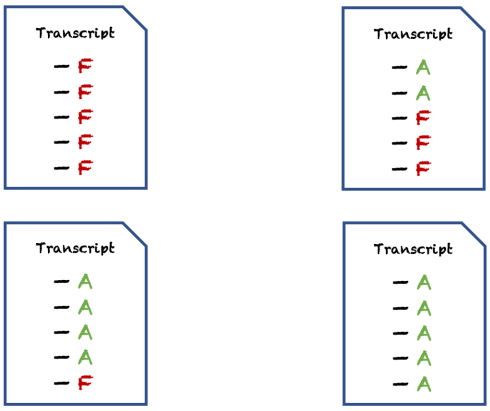


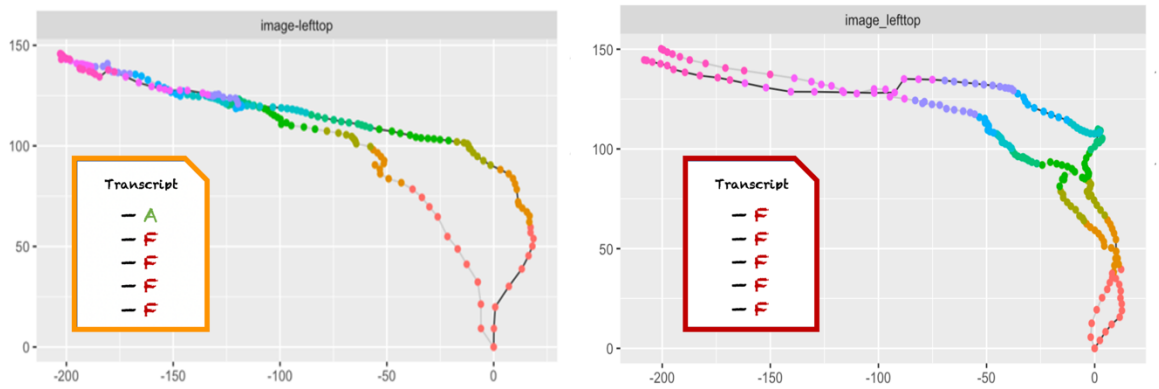
Fig. 1 Screen display of an example trial

Similar to one-A experiment, we recorded 173 native English 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. As shown in Fig.1, participants saw four images with different numbers of qualifications displayed on the screen and heard an interviewer asked an interviewee about their qualifications (Example 1; other examples asked about, e.g., numbers of languages spoken, with ticks against 1, 2, 4 or 5 out of five national flags). Each session additionally included 24 filler trials, which did not contain *some* or the disfluency 'uh', to reduce the chance that participants noticed the experimental manipulation.

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 percentage of clicks on each image by condition for zero-A experiment shows that, for the disfluent compared to the fluent condition, there were fewer clicks on the two- and four-images (from 94% to 81%), but more clicks on the zero-A image (6% to 19%). This is quite similar to that in one-A experiment, with 9% less clicks on two- and four-A images and 10% more clicks on the one-A image. This reconfirms that disfluency can serve as a cue to enable social reasoning rather than simply a cue for a semantic interpretation of 'some'. Participants' responses showed that the presence of disfluency indeed bias the interpretation in favour of the socially undesirable meaning of 'some', and here, as well as in the one-A experiment, the meaning corresponds to the pragmatic interpretation of the word 'some'.

Despite the similarity in the click results, participants' mouse movement showed differences between zero- and one-A experiments. Figure 2 shows participants' aggregated mouse trajectories towards one-A image (a) and zero-image (b) 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. For one-A image, it seems that participants move faster and more directly towards the image in disfluent condition while showing hesitant movements towards other options, taking more of the time before they click to decide to move towards the one-A target. However, this difference between conditions is less clear for zero-A image as people hesitated towards other images and failed to move directly towards the zero-A target in both conditions.



(a) (b)

Fig. 2 Aggregated mouse trajectories towards one-A image (a) and zero-A image (b) 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

To explore this difference in detail, we further used the Bootstrapped Differences of Timeseries (BDOTS) package to analyse participants' mouse trajectories in these two experiments. Specifically, for each experiment, we calculated the perpendicular distance from each mouse point to the diagonal line formed by two-A and four-A image, which is further referred to as 2A-4A diagonal line. We chose the 2A-4A diagonal line as a reference line because both two-A and four-A images represent meanings that are compatible with the pragmatic meaning of 'some' and are the most clicked choices. This distance, therefore, depicts a participant's tendency of moving away/to the plural meanings/common understandings of 'some'. We analysed this distance over time-normalised 101 timesteps to map listeners' *non-plural tendency* when hearing disfluent/fluent utterances for both zero- and one-A experiments.

The BDOTS results in Figure 3 showed that, between fluent and disfluent conditions, individuals' movements showed an obvious difference at an early point for one-A image (Fig. 3a) while there is no significant time period found for differences between conditions for zero-A image (Fig. 3b). Within disfluent conditions (Fig. 3c&d), people made the decision to start moving towards one-A target averagely after 355ms of the onset of disfluency (Fig. 3c), but they decided far later, averagely 2013ms after the disfluency onset when they were presented with zero-A image instead of one-A image (Fig. 3d).

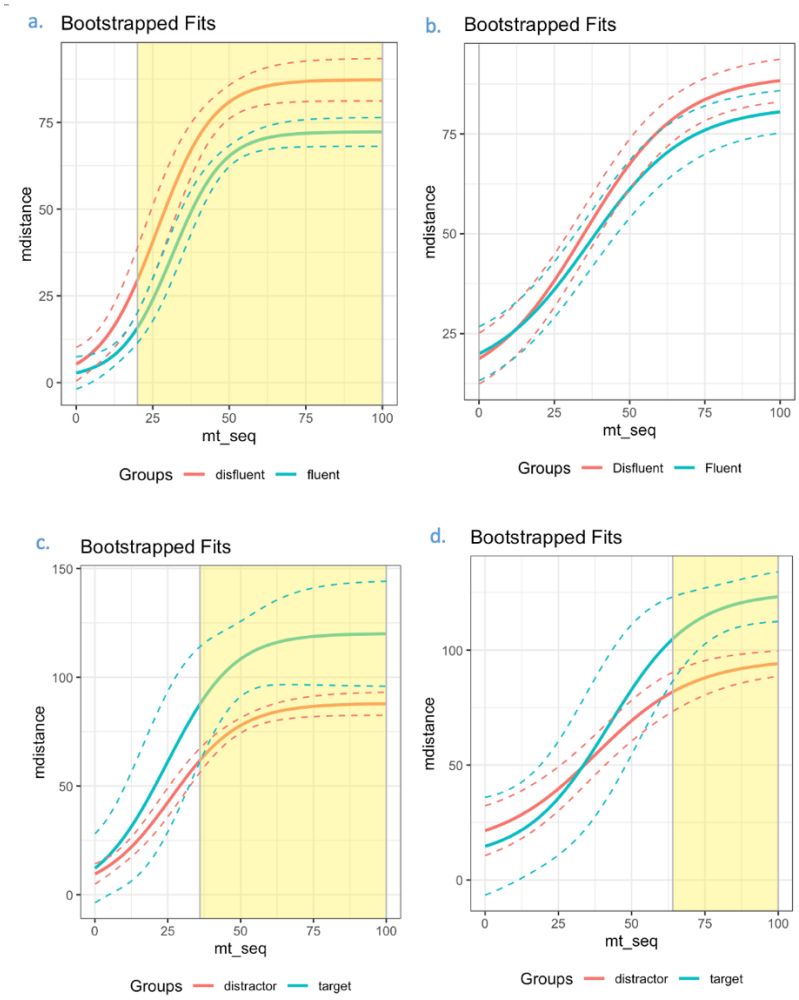


Fig.3 BDOTS analysis results of trajectory-differences between disfluent and fluent conditions for one-A image (a) and zero-A image (b); trajectory-differences in disfluent condition between participants clicking one-A image (c) and clicking zero-A image (d).

The exploration of the mouse-tracking analysis leads to three important conclusions. First, in our context (where it is desirable to have more qualifications), disfluency bias towards interpretations which imply smaller numbers (the pragmatic interpretation). Taken together with the results from Loy et al. (2019), listeners take social context into account when reasoning about the interpretations of the scalar quantifier 'some'. Second, this reasoning process happens very quickly. Listeners integrate contexts, i.e., speaker goals, quickly and they compute and update their guesses in real-time processing. Moreover, by comparing the results from our two experiments, we found that people's comprehension process of 'some' may reflect combination of guesses about deception and expansion of the meaning of 'some'. Individuals' tendency of moving towards non-plural options showed obvious difference between disfluent and fluent conditions for 'some' meaning 'one' but showed similar pattern when 'zero' replaced 'one'. It is reasonable to assume that listeners regard one to be a more plausible answer than zero to interpret 'some' in this specific context. They need much more time to believe that 'some' could mean 'zero' compared to meaning 'one'.

Reference

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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.
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