Using negation to refer to exceptions: Do comprehenders take into account pragmatic aspects of negation when identifying targets in a visual world paradigm?

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The contexts in which negative sentences can felicitously occur are rather limited (Halliday & James, 1993), and negative sentences are thus associated with specific pragmatic inferences (for an overview, see Moeschler, 1992). Typically, negative sentences are used in situations in which the speaker corrects a false statement or belief or communicates exceptions from a rule (Clark & Clark, 1977; Colston, 1999; Wason, 1965). Previous psycholinguistic research has indeed shown that negation – when used in these types of contexts – is relatively easy to comprehend but induces comprehension difficulties when used without such a legitimizing context (e.g., Glenberg, Robertson, Jansen, & Johnson-Glenberg, 1999; Lüdtke & Kaup, 2006; Schindele, Lüdtke, & Kaup, 2008; Wason, 1965; but see Valle Arroyo, 1982, for some qualifications). Thus, it seems that comprehenders are sensitive to the pragmatic aspects of negation during comprehension. In the present study, we aimed at finding out whether comprehenders also make use of pragmatic aspects of negation when identifying targets in a visual world paradigm.

We presented participants with two different kinds of displays. In the biased display, three children all had the same type of object (the majority object) and one child had a different object (the minority object). In the unbiased display, the two types of objects occurred equally often (see Figure 1, upper left plots). Thus, the biased display provides a felicitous context for using negation, namely when referring to the minority object (i.e., the cloud). In contrast, the unbiased display should not provide a felicitous context (because technically there is no minority object in this type of display). Accordingly, if comprehenders take into account such pragmatic aspects of negation when identifying referents in a visual world, then encountering the negation in the context of a biased display (i.e., "Click on the girl who has no ….") should lead them to predict the minority object as the upcoming referent (i.e., the girl with no wool), whereas for the unbiased display no predictions can be made on the basis of pragmatic reasoning. Thus, identification times for the minority object (biased display) should be faster than identification times for the same object in the unbiased display - in particular for negative sentences. In addition, in case comprehenders indeed engage in pragmatic reasoning to predict upcoming referents, they should be particularly slow if these predictions are not born out. Accordingly, negative sentences in the context of a biased display should lead to longer identification times when these sentences refer to the majority rather than to the minority object. Again, if this potential difference indeed reflects negation-specific pragmatic reasoning processes then it should be particularly pronounced for negative sentences.

We conducted two experiments in which participants read affirmative and negative sentences referring either to the minority or the majority object in biased displays, and to the same objects in unbiased displays. Participants pressed a resting key (the "5" on the number pad) with their right index finger while reading the sentences. As soon as they had identified the target referent, they left the resting key and pressed one of the keys "1" (bottom left), "3" (bottom right), "7" (upper left) or "9" (upper right) on the number pad, depending on the location of the target square. Response times for negative sentences referring to the minority object (biased display) were indeed shorter than negative sentences referring to the same object in the unbiased display. However, the same held for affirmative sentences. Thus, in contrast to our predictions, the advantage of the biased displays was not specific to or at least stronger for negative compared to affirmative sentences. In addition, in biased displays negative sentences referring to the minority object were faster than those referring to the majority object, as expected. However, the same held true for affirmative sentences. Here the difference was even more pronounced (see results in Figure 1, bottom left plot).

Our first interpretation was that these results reflect the fact that the minority object in the biased display is extremely visually salient. This would explain why comprehenders focused on this object as the preferred referent in all conditions. Thus, in Experiment 2 we used different displays that aimed at reducing the visual pop-out effect (see Figure 1, upper right plots). Nevertheless, the exact same results were observed (see Figure 1, bottom right plot). We therefore conclude that

comprehenders predict upcoming referents when identifying targets in a visual world paradigm, but they do not seem to do so on the basis of pragmatic aspects that are specific to negation. This result is surprising in the light of the many studies that indicate that comprehenders are sensitive to the pragmatic aspects of negation during regular sentence comprehension. In future studies it will be investigated whether also the reading times for the here described negative and affirmative sentences are influenced in a similar way if accompanied by according visual input, or whether the observed results are specific for prediction processes in the here implemented visual search paradigm.
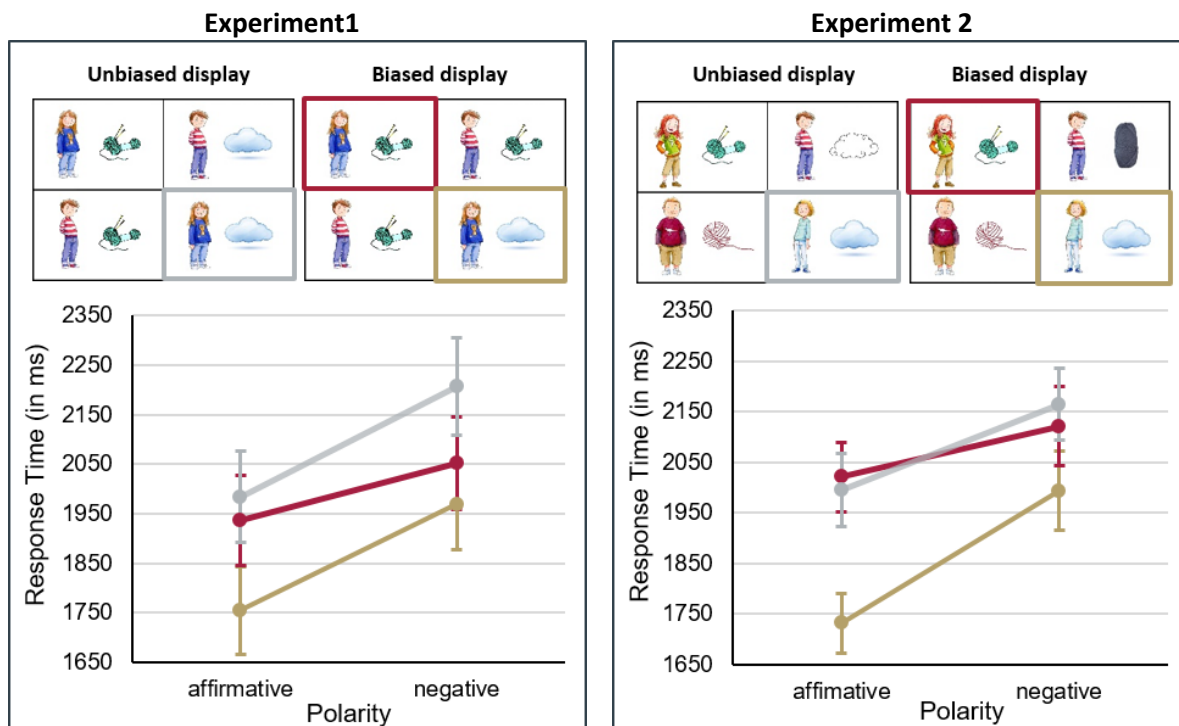

Figure 1. Upper plots: Visual search displays in Experiment 1 (left) and Experiment 2 (right). Bottom plots: Results of Experiment 1 (left) and 2 (right). Highlighted on the visual search displays is the target referent which participants had to select (e.g. grey frame = unbiased display: negated "The girl who has no wool" or affirmative "The girl who has a cloud"; red frame = majority object: negated "The girl who has no cloud" or affirmative "The girl who has a wool"; golden frame = minority object: negated "The girl who has no wool" or affirmative "The girl who has a cloud"). The colors of the lines correspond to the colors of the frames and indicate the target referent. Please note: Which objects were used as minority objects and which were used as majority objects was counterbalanced across participants.

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