Plural definites in positive and negative contexts: a cross-linguistic study on homogeneity effects in French and German

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Background: Previous theoretical and experimental work on plural definites investigated why we interpret sentences like (1) homogeneously and, therefore, observe truth-value gaps in non-homogeneous scenarios (e.g. Magri, 2014; Bar-Lev, 2021; Križ, 2015; Križ and Chemla, 2015; Križ and Spector, 2021). While (1a) is usually interpreted as 'All the teapots are pink.' and is true in scenario 1, its negated counterpart (1b) is usually interpreted as 'None of the teapots are pink.' and is true in scenario 2. Neither of the two is completely true in scenario 3.

(1)   a.   The teapots are pink.
        b.   The teapots are not pink.

(1a) ascribes a concrete property, *pink*, to the denoted plurality while (1b) ascribes the lack of that property to the plurality. Nevertheless, the truth-value gap in the non-homogeneous scenario seems to be caused by the same mechanism. Homogeneity requires that the ascribed predicate applies to all entities of the denoted plurality for the sentence to be true, or, for the sentence to be false, that the predicate does not apply to all members of the denoted plurality. However, results from experimental investigations by Tieu et al. (2019) indicate differences in acceptance between positive and negative sentences with plural definites in French. While adults rejected positive sentences with definite descriptions in gap contexts, they accepted negative sentences at a rate over 25%. Children showed the opposite pattern, they rejected gap contexts with negative sentences but accepted them with positive sentences. We wanted to investigate whether we can replicate these findings with adults and see whether we get the same results by testing another language, German, in particular.

French and German show differences in scope taking that might effect the interpretation of plural definites in gap contexts. In particular, the preferred interpretation of a universally quantified sentence such as (2) in French is 'Not all teapots are pink.' The preferred interpretation of the German translation is 'None of the teapots are pink.' That is, despite the parallel structure of the French and German translations of (2) that we see in (4) the two versions have completely different meanings.

(2)   All teapots are not pink.

Above we saw that plural definites and universally quantified noun phrases have similar interpretations. In (5) we see that the French and German plural definite counterparts of (2) have the same parallel structure but might have different preferred interpretations, just like the universals. If this is true, we should find higher acceptance of negative sentences in non-homogeneous scenarios in French than for positive sentences. For German we expect that there are no differences between acceptances ion positive and negative scenarios.

Methods: In our online study we presented a sentence together with a picture on the screen and asked participants to judge whether the displayed picture matches the displayed sentence by pressing a key on the keyboard as quickly as possible. All pictures consisted of four instances of the same object where either all of the objects had the same color (homogeneous conditions) or two

items had one color and the other two items had another color (non-homogeneous condition). We recorded the judgments of 36 French speaking, and 36 German speaking adults, showing them French or German target sentences, respectively. The design was adopted from experiment 1 in Tieu et al. (2019). We created new stimuli but also included all of their original stimuli in our experiment. Table 1 gives an overview of the target conditions. All these conditions displayed sentences with plural definites like in (1). Other than in the original setup by Tieu et al. (2019), we used a 2x3 design with plural definite sentence type (positive and negative) and the number of objects with the target property (color) in the depicted image (4 out of 4 matching, 2 out of 4 matching, or 0 out of 4 matching) as factors. Conditions with the same kinds of pictures and sentences with quantifiers *all*, *some*, and *none* like in (3) served as fillers.

(3)   a.   All pants are blue.
        b.   Some pants are blue.
        c.   None of the pants are blue.

Results: Below we report the results of the French and German datasets invidually. After that we describe the results of the combined data of speakers of French and German. Note that we did not find an effect of language. However, the French and German data was obtained by conducting two distinct experiments with distint stimuli and distinct instructions.

French data: Mean acceptances of the target conditions are displayed in figure 1a. We fitted a generalized linear mixed effect model with the R `lm4e` package and found and interaction effect between displayed scenario and sentence type (Formula: response $\sim$ scenario $*$ sentence_type + (1 + sentence_type | individual)). We used the R package `multcomp` and Tukey's test to detect differences between the conditions. We did not detect differences between the acceptance rates of positive and negative sentences with plural definites in the non-homogeneous scenario ($P(>|z|) \approx 0.854$). However, the acceptance of positive and negative sentences differs in both, the matching ($P(>|z|) < 0.001$) and the non-matching scenarios ($P(>|z|) \approx 0.005$). While participants prefer the positive sentence over the negative one in the matching condition, they prefer the negative over the positive sentence in the non-matching condition. This does not match the findings of Tieu et al. (2019) where French speaking adults consistently reject negative sentences in non-matching scenarios, and positive sentences in non-homogeneous scenarios. While the non-homogeneous conditions are preferred over the non-matching conditions in most of the cases , we do not find a difference in acceptance between the positive sentence in the non-homogeneous scenario and the negative sentence in the non-matching scenario ($P(>|z|) \approx 0.702$).

German data: Mean acceptances of the target conditions are displayed in figure 1b. We fitted a generalized linear mixed effect model with the R `lm4e` package and found and interaction effect between displayed scenario and sentence type (Formula: response $\sim$ scenario $*$ sentence_type + (1 + scenario + sentence_type | individual)). We used the R package `multcomp` and Tukey's test to detect differences between the conditions. We did not detect differences between the acceptance rates of positive and negative sentences with plural definites in the non-homogeneous scenario ($P(>|z|) \approx 0.835$). Participants prefer the positive sentence over the negative one in the matching condition ($P(>|z|) \approx 0.019$) but there is no difference between the acceptance of positive and negative sentences in the non-matching condition ($P(>|z|) \approx 0.097$). Both, positive ($P(>|z|) < 0.001$) and negative ($P(>|z|) \approx 0.014$) sentences in the non-homogeneous conditions are preferred

over positive sentences but not over negative sentences in the non-matching conditions.

Datasets combined: Mean acceptances of the target conditions are displayed in figure 1. We fitted a generalized linear mixed effect model with the R `lm4e` package and found and interaction effect between displayed scenario and sentence type but no effect of language. (Formula: response $\sim$ scenario $*$ sentence_type + (1 + sentence_type | individual)). We used the R package `multcomp` and Tukey's test to detect differences between the conditions. We did not detect differences between the acceptance rates of positive and negative sentences with plural definites in the non-homogeneous scenario ($P(> |z|) \approx 0.986$). Participants prefer the positive sentence over the negative one in the matching condition ($P(> |z|) < 0.001$) and prefer the negative over the positive ones in the non-matching condition ($P(> |z|) < 0.001$). Both, positive ($P(> |z|) < 0.001$) and negative ($P(> |z|) < 0.001$) sentences in the non-homogeneous conditions are preferred over positive sentences in the non-matching conditions. Only the negative sentences in the non-homogeneous conditions are preferred over positive sentences in the non-matching conditions ($P(> |z|) < 0.001$). While we see some variation between acceptance rates of individuals we could not find evidence for different populations among the participants.

Discussion: In contrast to our expectations we did not find any differences between the acceptance of positive and negative sentences with plural definites in non-homogeneous contexts. Apart from that, we could not detect an effect of language, that is, our predictions with respect to differences in scope interactions did not turn out correct. Surprisingly, we find differences between acceptance of positive and negative sentences in matching as well as non-matching homogeneous contexts. This might be partly explained by the fact that the verification of true negatives seems to be more difficult than to verify true positives (Kaup et al., 2006, 2007). Another part of the explanation might be a stroop effect. In the non-matching, negative scenarios participants see the word *pink*, for instance, see only pink items, but have to reject this condition under time pressure. In general, our findings show that the experimental paradigm and small changes in the setup, such as adding a component of time pressure, can change the outcome of the experiment. Another interesting result is that gap contexts seem to be, to some extend, preferred over non-matching homogeneous scenarios if participants have a binary choice. This provides further evidence for the existence of a truth-value gap in both, positive and negative sentences. That is, sentences with plural definites seem to be neither completely true nor completely false in non-homogeneous contexts as shown by Križ and Chemla (2015).

References

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Tables, figures, and glossed examples

(4) a. Toutes les théières (ne) sont pas roses.
         ALL   def.pl teapot.pl (neg) BE.3rd.pl NEG pink.pl
         'NOT ALL the teapots are pink.'

     b. Alle Teekannen sind nicht pink.
         ALL teapot.pl   BE.3rd.pl NEG pink
         'All teapots are not pink.'

(5) a. Les théières (ne) sont pas roses.
         def.pl teapot.pl (neg) BE.3rd.pl NEG pink.pl
         'The teapots are not pink.'

     b. Die Tekannen sind nicht pink.
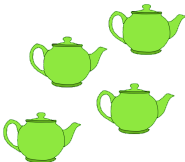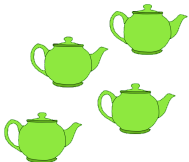   def.pl teapot.pl BE.3rd.pl NEG pink
         'The teapots are not pink.'
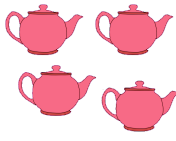
Table 1: Target conditions of the study.

Figure 1: Mean acceptance across conditions of French and German speakers. The barplots show the overall means, the dots indicate the mean acceptances of individuals.

Figure 2: Mean acceptance across conditions of the combined responses of French and German speakers.The barplots show the overall means, the dots indicate the mean acceptances of individuals.