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# Context Effects when Reading Negative and Affirmative Sentences

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## Abstract

In two experiments, participants were presented with narratives in which a target entity (e.g., water) was introduced. The final sentences affirmed or negated that a particular property held for the target entity (e.g., *The water was (not) warm*). The linguistic context was manipulated. In Experiment 1, reading times for the negative target sentences (but not those for the affirmative ones) were affected by the context manipulation, with shorter reading times in conditions in which the negated proposition had been explicitly mentioned in the prior text. Experiment 2 demonstrated a similar facilitation effect with respect to inferred propositions. The results of the two experiments support pragmatic considerations concerning the context dependency of the processing difficulty associated with negative sentences.

**Keywords:** Negation; Pragmatics; Context effects

## Introduction

It is well known that negative sentences are relatively hard to process. In various studies with different methods, negative sentences required more processing time and led to higher error rates than the corresponding affirmative sentences. A number of different explanations were discussed in the literature, including explanations based on sentence length, as well as explanations based on grammatical or connotational aspects of negation (for an overview see Kaup, Zwaan, Lüdtkke, in press). The most promising explanation rests on considerations concerning pragmatic aspects of negation: The contexts in which negative utterances occur are rather limited. Typically, negative statements are uttered when the negated proposition was either explicitly mentioned before by one of the discourse partners or at least constitutes a plausible assumption in the respective context. Thus, negation is used to communicate deviations from what was previously assumed or expected (e.g., Givon, 1978). This leads to the prediction that negative sentences are difficult to process mainly when presented outside of an adequate context. In this case the respective assumption or expectation is not available prior to encountering the negation, and accordingly must be created retroactively. In contrast, when presented in a context in which the negated proposition is available prior to encountering the negation this additional processing step is not required. Accordingly, in this case

negative sentences should not take longer to process than their affirmative counterparts (or at least not as much).

This prediction was tested in a study by Wason (1965) with respect to *non-linguistic* contexts. Participants were presented with pictures of eight circles, seven in one color and one in another color. They were then asked to complete affirmative or negative sentence fragments. Negative fragments (e.g., *Circle No 3 is not ...*) took longer to complete than affirmative fragments (e.g., *Circle No 3 is...*), but this difference was significantly smaller when the negative sentences referred to the circle with the exceptional color than when they referred to one of the seven other circles. Thus, participants profited from an adequate context when processing negative sentences. In a study by Glenberg, Robertson, Jansen & Johnson-Glenberg, (1999) the same prediction was tested, but by manipulating the *linguistic* context. To our knowledge this is the only study that experimentally investigated the effect of the linguistic context on the processing difficulty associated with negative sentences (for studies investigating other types of context effects with negation, see Giora, 2006). In Glenberg et al.'s study, participants were presented with longer narratives in which the penultimate sentence was either negative or affirmative (e.g., *The couch was / was not black*). In the supportive-context condition the previous text highlighted the relevancy of the attribute dimension that was referred to in the penultimate sentence (e.g., *She wasn't sure if a darkly colored couch would look the best or a lighter color*). In contrast, in the non-supportive context condition, the prior text highlighted a different attribute dimension (e.g., *She wasn't sure what kind of material she wanted the couch to be made of*). Glenberg et al. analyzed the reading times of the penultimate sentence, after correcting for sentence length. In line with the predictions, negative sentences took longer to process than affirmative ones in the non-supportive contexts only.

The goal of the present work was to further investigate the question of what constitutes an adequate context for the processing of negative sentences. We focused on the idea that negative sentences are particularly felicitous in contexts in which the proposition that is being negated was either explicitly mentioned or at least constitutes a highly plausible assumption (Givon, 1978). As in Glenberg et al.'s experiment, we manipulated the *linguistic* contexts in which

negative and affirmative sentences were being processed. In Experiment 1, the proposition that was affirmed or negated in the target sentences (e.g., *The water was / was not warm*) was either explicitly mentioned in the prior text or not. We expected to find a strong context effect in the negative but not in the affirmative conditions, with longer reading times in the negative condition in which the negated proposition was not explicitly under consideration in the prior text. In Experiment 2, the proposition that was affirmed or negated in the target sentences was *not* explicitly mentioned in any of the conditions. In this experiment, the conditions differed with respect to whether the respective proposition was highly plausible in the context or not. Thus, in this experiment we asked the question of whether the potential facilitation effects obtained in Experiment 1 would generalize to conditions where the affirmed or negated proposition was likely to be inferred by the comprehender when processing the prior text.

### Experiment 1

Participants read stories that introduced a particular target entity (e.g., water), and the final sentence of each story either affirmed or negated that a particular attribute applied to this entity (e.g., *The water was / was not warm*). There were three different versions of the prior text: The proposition that was affirmed or negated in the target sentences was either explicitly mentioned in the prior text or not, and it was either the only possibility under consideration, or it was under consideration as one of two alternatives (e.g., *She wondered whether the water would be warm / She wondered whether the water would be warm or cold / She wondered what the water would be like*). Hence, the two explicit conditions in this experiment differed with respect to implications concerning the protagonist's expectations. In the one-possibility condition (see Table 1), the target proposition corresponded to a distinguished possibility in the protagonist's mind, or in other words constituted a kind of expectation of the protagonist. In contrast, in the two-possibility condition this was not the case. Here the protagonist had not set his or her mind onto one particular possibility.

Two hypotheses were investigated. First, if it is true that negative sentences are easier to process in a context in which the negated proposition was explicitly under consideration prior to encountering the negation, then we would expect to find a polarity-by-context interaction: The processing of the negative target sentences but not (or not as much) the processing of affirmative sentences should be facilitated in the two explicit conditions (one-possibility and two-possibility) compared to the condition, in which the negated proposition was not explicitly mentioned (no-possibility condition). Second, if on top of explicit mentioning, the status of the negated proposition plays a role, then we might find a stronger facilitation effect in the one-possibility condition, in which the negated proposition was the only possibility under consideration and thereby in some sense constituted an expectation of the protagonist.

### Method

**Participants** Thirty-six students of TU Berlin participated for a financial reimbursement of EUR 8 per hour.

**Materials** The materials consisted of 66 short German stories, 36 of which were used as experimental items, and 30 as filler items. The experimental items were constructed according to the following schema (see Table 1): The first two sentences specified the setting of the story. The next sentence (variation sentence) described a situation in which the protagonist asked a question (overtly or mentally) with respect to a particular target entity (e.g., the water in the pool). This sentence was available in three versions that differed with respect to whether one, two, or no particular possibility was being mentioned (one-poss, two-poss, and no-poss condition, respectively). The next sentence (filler sentence) was the same in all conditions. The final sentence (target sentence) provided the answer to the protagonist's question. It either affirmed or negated that the attribute that was mentioned in the one-poss condition (e.g., warm) held for the target entity. This sentence was 18 syllables long in the affirmative version and 19 syllables long in the negative version for all items.

The filler stories were of comparable lengths and topics as the experimental stories. 20 of the filler stories contained a negation somewhere in the story. For each story, a simple comprehension question was constructed with half of the comprehension questions requiring a 'yes'-response and the other half requiring a 'no'-response.

Table 1: Sample Story for Experiment 1 (translated).

Setting	Danielle was glad that summer break finally started. Today she was meeting her friend Karen at the local swimming pool.
Variation	On her way to the pool, Danielle wondered
one poss	whether the water would be warm.
two poss	whether the water would be warm or cold.
no poss	what the water would be like.
Filler Sentence	She sat down at the edge of the pool next to Karen, and carefully lowered her foot into the water.
Target Sen	The water was (not) warm.
Question	Were the girls meeting at a lake?

**Design and Procedure** Each participant read all 36 experimental items intermixed with all 30 filler items. The 36 experimental items were assigned to six sets, the 36 participants to six groups, and the assignment of versions to sets and groups was according to a 6x6x6 Latin square. Thus we employed a 2(polarity of target sentence: affirmative vs. negative) x 3(context: one-poss, two-poss, no-poss) x 6 group/set design with repeated measurement on the first two variables. Text presentation was sentence by sentence, self-paced by the participant. Pressing the spacebar after reading the final sentence elicited the presentation

of the comprehension question. Participants responded by pressing the ‘.’- and ‘x’-key (marked with ‘y’ and ‘n’, respectively). The experimental session lasted approximately 30 minutes.

## Results and Discussion

The analyses were performed on the reading times of the target sentences in experimental items. Reading times longer than 8000 ms or shorter than 500 ms were omitted. In determining outliers within the remaining reading times, we took not only differences among the participants into account, but also differences among the items. We employed a two-step procedure: First, the reading times of each subject were converted to *z* scores. Then reading times with a *z* score that deviated more than *x* standard deviations from the mean *z* score of the respective item in the respective condition were discarded, with *x* depending on the number of observations per condition, as suggested by Van Selst and Jolicoeur (1994). This eliminated less than 3.2 % of the data. The data of one participant was discarded because he or she had made more than 10 mistakes in the overall 36 experimental comprehension questions. The mean reading times and standard deviations in the six conditions are displayed in Table 2.

Table 2: Mean reading times and standard deviations in Experiment 1 as a function of sentence polarity and context.

Polarity	Context		
	One-poss M / SD	Two-poss M / SD	No-poss M / SD
Aff	2589 / 650	2602 / 657	2686 / 764
Neg	2776 / 786	2840 / 830	2991 / 901

An overall ANOVA produced a main effect of negation ( $F(1,29) = 22.5, p < .001; F(2,30) = 43.5, p < .001$ ), and a main effect of context ( $F(1,28) = 5.3, p < .01; F(2,29) = 4.5, p < .01$ ). The negation-by-context interaction was not significant ( $F(2,28) = 1.14, p = .32; F(2) < 1$ ). According to the hypotheses we analyzed the data separately for the two polarity conditions. As expected, a significant context effect emerged for the negative conditions but not for the affirmative conditions (negation:  $F(1,28) = 5.4, p < .01; F(2,29) = 4.0, p < .05$  affirmation:  $F(1,28) = 1.1, p > .33; F(2) < 1$ ). Planned comparisons indicated that participants took significantly longer to read the negative sentences in the no-possibility condition than in the one-possibility or two-possibility condition (no-poss vs. one poss:  $F(1,29) = 7.5, p < .01; F(2,30) = 7.9, p < .01$ ; no-poss vs. two poss:  $F(1,29) = 7.8, p < .01; F(2,30) = 2.7, p < .11$ ). The reading times in the latter two conditions did not differ statistically ( $F(1) < 1; F(2,30) = 1.1, p > .30$ ).

The results of the overall ANOVA do not correspond to the predictions: We did not find a significant polarity-by-negation interaction. However, according to the hypotheses we nevertheless conducted separate analyses for the two polarity conditions. The results of these analyses correspond

nicely to the predictions: Whereas the reading times for the affirmative sentences were not significantly affected by the context manipulation, the reading times for the negative sentences were. As expected, the processing of the negative sentences was greatly facilitated when the negated proposition was explicitly mentioned in the prior text. The fact that the two explicit conditions (one-poss and two-poss) did not differ, indicates that for a negative sentence to be felicitous, it is not necessary that the negated proposition corresponds to a distinguished possibility. Rather, what seems to be important is merely whether or not the negated proposition was under consideration prior to encountering the negation. It should be noted that the facilitating effect due to explicitly mentioning the negated proposition cannot be due to surface level priming, because the respective effect was not observed in the affirmative conditions.

One might wonder whether the reading time differences between the no-poss condition and the two explicit conditions are indeed due to the fact that the explicit conditions explicitly mentioned the negated proposition. Wouldn't it be possible that the difference has something to do with whether or not the relevant attribute dimension was being activated when processing the context, as in Glenberg et al.'s study? To obtain more information on this issue, we conducted a norming study: 17 new participants read the experimental stories in the no-poss version, up to the word prior to the negation. They reframed the question that the protagonist was asking by mentioning two alternatives (as in the two-poss condition). The answers were rated by two judges with respect to whether or not the two alternatives reflected the attribute dimension referred to in the target sentence. Inter-rater reliability was .90 (determined according to Cohen, 1960), and all discrepancies were resolved by discussion. An ANOVA based on only those items ( $N=26$ ) for which more than 80 % of the participants correctly produced the relevant attribute dimension, replicated the earlier results: The context significantly affected the negative but not the affirmative conditions (negation:  $F(1,28) = 3.6, p < .05; F(2,19) = 4.2, p < .05$  affirmation: both  $F_s < 1$ ). Reading times in the negated conditions were significantly faster in the two explicit conditions than they were in the no-poss condition (no-poss vs. one poss:  $F(1,29) = 3.0, p = .09; F(2,20) = 5.3, p < .05$ ; no-poss vs. two poss:  $F(1,29) = 6.8, p < .05; F(2,20) = 4.2, p < .05$ ; one-poss vs. two-poss: both  $F_s < 1$ )<sup>1</sup>.

Thus, the prolonged reading times in the no-poss condition cannot be explained (away) by assuming that in the no-poss condition the relevant attribute dimension was not activated when the prior text was being processed. Rather, what this post-hoc analysis indicates is that there is contextual facilitation for the processing of negative sentences beyond the mere activation of the relevant

<sup>1</sup> Another potentially relevant variable concerns the protagonist's preference (e.g., in Table 1, Danielle most likely hopes that the water will be warm). However, the present results do not seem to depend on this variable: If we analyze the 13 items for which there is clearly no preferred state, we get qualitatively equivalent results.

attribute dimension. A context that explicitly mentions the negated proposition is a better context for the processing of a negative sentence than a context that merely activates the relevant attribute dimension.

The present experiment was geared towards a comparison of the reading times in the three different contexts *within* the two polarity conditions. Comparing the reading times within the two polarity conditions allowed us to analyze the exact same material in the different contexts, whereas a comparison *between* the polarity conditions would have meant comparing different sentences. However, Glenberg et al.'s main result concerned a comparison *between* polarity conditions, and our results thereby only indirectly relate to these findings. We therefore conducted additional analyses that directly compared the processing times required for the affirmative and negative target sentences. Raw reading times could not be analysed, as negative sentences always contained one more syllable than their affirmative counterpart. Thus, we corrected for sentence length by means of dividing the sentence reading times by the number of syllables in the sentence.<sup>2</sup> Outliers were determined according to the same procedure as before, except that per-syllable reading times of more than 400 ms were excluded prior to the standardization of the reading times. As expected on the basis of Glenberg et al.'s study, negative target sentences were read significantly longer than the affirmative target sentences in the no-possibility context condition, in which the target proposition was not under consideration prior to the target sentence ( $F(1,29) = 4.3$ ;  $p < .05$ ;  $F(1,30) = 4.0$ ;  $p = .05$ ). In contrast, in the two other context conditions, negative and affirmative conditions did not differ (two-possibility condition:  $F(1,29) = 1.1$ ;  $p > .30$ ;  $F(1,30) = 1.5$ ;  $p > .20$ ; one-possibility condition:  $F(1,29) = 1.0$ ;  $p > .30$ ;  $F(1,30) < 1$ ). Thus, this analysis replicates Glenberg et al.'s results, except that facilitation in the present case resulted from explicitly mentioning the negated proposition rather than from explicitly mentioning the relevant attribute dimension.

In the present experiment, we demonstrated contextual facilitation due to the explicit mentioning of the negated proposition. In Experiment 2, we investigated whether there is contextual facilitation due to *implied* propositions.

## Experiment 2

Participants were presented with narrative stories that suggested an inference concerning a particular property of a target entity (e.g., that a boy's T-shirt is dirty after he played outside in the backyard). In the final sentences of each

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<sup>2</sup> We are aware of the fact that this procedure is not optimal, because it may overestimate the per-syllable reading time, and thereby risks an overcorrection. However, in the present case, the preferred procedure of performing a linear regression with number of syllables as predictor is not an option, because all of our affirmative and negative target sentences were 18 and 19 syllables long, respectively. Thus, number of syllables is perfectly confounded with polarity in the present experiment.

narrative, this inference was denied, either by means of an affirmative statement (e.g., ... *the T-shirt was clean*) or by means of an explicit negation (e.g., ... *the T-shirt was not dirty*). The stories differed with respect to how strongly they implied the respective inference, as was assessed by a prior norming study with an independent group of participants. If it is true that a context which implies a particular proposition, constitutes an adequate context for a negative sentence that denies this proposition, then we would expect to find a stronger facilitation effect for the processing of negative sentences with 'strongly implying' stories compared to 'weakly implying' stories. In other words, we expect an interaction of polarity and implication strength, with the difference in processing time between affirmative and negative target sentences being smaller for the strongly implying stories than for the weakly implying stories.

## Method

**Participants** Sixty-four students of the Berlin University of Technology participated in the experiment for a financial reimbursement of EUR 8 per hour. Sixty-four additional students participated in the norming study.

**Materials** We created 80 short German stories, 40 of which were used as experimental items, and 40 as filler items. The experimental items were constructed according to the following schema (see Table 3): The first paragraph specified the setting of the story. The next paragraph (context-variation paragraph) was available in two versions that implied contrary properties with respect to a particular target entity (e.g., a boy's T-shirt, either dirty or clean). The final sentence of the story (target sentence) always denied that the previously implied property was true for the target entity, either by means of an affirmation or by means of negation. The target sentences were 23-27 syllables long.

The filler stories were of comparable lengths and topics as the experimental stories. 20 of the filler stories contained a negation somewhere in the story. For 22 of the filler stories, a simple comprehension question was constructed with half of the comprehension questions requiring a 'yes'-response and the other half requiring a 'no'-response.

**Norming study** Prior to the experiment proper, the 40 experimental stories were subjected to a norming study to assess how strongly each story implied the target property. Sixty-four participants were presented with the stories up to but not including the target sentences. The relevant background information from the target sentences was provided below the story (e.g., for the story in Table 3: [*background information: The son is approaching his mother; he is wearing a T-shirt*]). Participants were then asked a question concerning the target entity, which either mentioned the target property or a contrary property (e.g., *Is the boy's T-shirt dirty? / Is the boy's T-shirt clean?*). Answers were given on a five-point scale ranging from *No, definitely not* to *Yes, definitely*. Each story was available in 2(context) x 2(questioned property: target vs. contrary) versions. There were eight different questionnaires with 20 stories each.

From the participants' answers we calculated the implication strength of each story: First, we re-coded

participants' answers such that a +2 was given in case participants had checked "yes definitely" when asked about the target property or "no, definitely not" when asked about the contrary property. A +1 was given when participants in these cases checked "yes, probably" and "no, probably not" respectively. For the opposite check marks we gave negative values (i.e., -2 or -1 for "yes" responses when asked about the contrary property or "no" responses when asked about the target property). A zero was given for "don't know" answers. The resulting mean implication strength for all stories was .60 (range: -.14 – 1.54) with a mean standard deviation of 1.2 (range: .85 – 1.61). The fourty experimental stories were then ranked according to their mean value, and grouped into five sets of 8 stories each (mean values of .075, .31, .60, .86, and 1.16, respectively). For the analyses of the target-sentence reading times, stories in the lower two sets were combined into the category "weakly implying stories", and stories in the upper two sets were combined into the category "strongly-implying stories". Stories in the middle category (N=8) were excluded from these analyses.

Table 3: Sample Story for Experiment 2 (translated).

<b>Setting</b>	During the wedding reception the kids of the guests were playing in the backyard of the hotel.
<b>Context 1</b> (dirty expected)	Betty's young son was not shy and participated in any nonsense that the kids could come up with. Just before dinner, Betty summoned her son. She was going to change his clothes because she wanted him to look neat during the banquet.
Target Sen	When her son came running up to her, Betty was astonished to see that his T-shirt
Neg / Aff	was not dirty. / was clean.
<b>Context 2</b> (clean expected)	Only Betty's young son was sitting inside in the corner reading books by himself. Just before dinner, Betty summoned her son. She was going to put a bib on him, because she wanted him to look neat even after the banquet.
Target Sen	When her son came running up to her, Betty was astonished to see that his T-shirt
Neg / Aff	was not clean. / was dirty.

**Design and Procedure** Each participant read all 40 experimental items intermixed with all 40 filler items. Of the 40 experimental items, 20 were presented in the affirmative and 20 in the negative condition, whereby 10 of each of these were presented in the first context and the remaining 10 in the second context (see Table 3). Within the ten stories in each of these four versions, the five norming-study categories were represented by 2 stories each. Each of the overall 40 experimental stories was read by 64 participants, 16 in each of the four versions.

For the reading-time analyses we collapsed across the two affirmative and the two negative conditions, but included

the between-items variable 'implication strength' ('weakly implying' vs. 'strongly implying') that was determined in the norming study (see above). Thus, we employed a 2(polarity of target sentence: aff. vs. neg.) x 2(implication strength: strong vs. weak) design, with repeated measurement on the first variable in both the by-participant and the by-items analyses, and repeated measurement on the second variable in the by-participants analyses only.

Text presentation was sentence by sentence, self-paced by the participant pressing the space-bar. After reading the final sentence of the story, participants were presented with a picture of an entity which they were asked to name out loud. The results of this task are irrelevant for the issues at hand, and will therefore not be reported. For some of the filler items, a comprehension question was presented after the picture. Participants responded by pressing the appropriate key ('.'- and 'x'-key, marked with 'y' and 'n', respectively). The experimental session lasted approximately 45 minutes.

## Results and Discussion

As the context manipulation was between materials in this experiment, data analysis was directed towards a direct comparison of the required processing time in the two polarity conditions (manipulated within participants and within items). In order to receive a measure for the required processing time that is independent of sentence length, we performed (separately for each participant) a linear regression with the number of syllables as predictor. Analyses were performed on the residual reading times. Residuals below -500 and above 10000 were eliminated. Otherwise, outlier elimination was performed as in Experiment 1 (reducing the data set by less than 2.5 %). The data of three participants were eliminated because they had made mistakes with more than one third of the comprehension questions in the experiment. The mean residuals in the four conditions are displayed in Table 4.

Table 4: Mean residual reading times and standard deviations in Experiment 2

Polarity	Implication strength	
	Weak M / SD	Strong M / SD
Aff	-125 / 301	-83 / 410
Neg	22 / 329	-71 / 344

An overall ANOVA did not produce any significant effects (polarity:  $F(1,60) = 2.78, p = .10, F(1,30) = 2.60, p = .12$ ; implication strength: both  $F_s < 1$ ; polarity-by-implication-strength:  $F(1,60) = 1.69, p = .20; F(1,30) = 1.29, p = .27$ ). According to the hypotheses, we nevertheless conducted separate analyses for the two implication-strength conditions. As expected, the time required for processing the target sentences in the affirmative and negative conditions differed significantly only for the weakly-implying stories (weak:  $F(1,60) = 5.42, p < .05; F(1,15) = 4.88, p < .04$ ; strong: both  $F_s < 1$ ).

As in Experiment 1, the results of the overall ANOVA do not correspond to the predictions, because we did not find a significant interaction effect. However, as in Experiment 1, the results of the separate analyses corresponded nicely to the predictions. Negative target sentences required more processing time than their affirmative counterparts when the context did not strongly suggest the negated proposition. In contrast, when the context *did* strongly suggest the negated proposition then negative sentences did not require more processing time. Thus, the results replicate the previous results, but this time the facilitation effect was due to inferred instead of explicitly stated propositions.

## General Discussion

The present paper was concerned with the question of whether the processing of negative sentences is facilitated when they are presented within an adequate context. More specifically, we tested the hypothesis that negative sentences are particularly felicitous in contexts in which the proposition that is being negated was either explicitly mentioned as a potential possibility in the prior text or at least constitutes a highly plausible assumption (Givon, 1978). The results of the two experiments were in line with this hypothesis. Experiment 1 demonstrated contextual facilitation due to an explicit mentioning of the negated proposition. Experiment 2 demonstrated that contextual facilitation can be achieved without explicit mentioning the negated proposition, namely when the respective proposition corresponds to a highly plausible assumption in the respective context.

The results of the present experiments are in line with previous studies in the negation literature in demonstrating the context dependency of the processing difficulty that is associated with negative sentences. They go beyond what is already known in the literature in two respects: First, whereas Glenberg et al. (1999) showed that the processing of negative sentences can be facilitated by highlighting the relevant attribute dimension, our results suggest that there is additional facilitation if the proposition that is being negated was explicitly considered as a possibility in the prior text (Experiment 1). Second, whereas Wason demonstrated that negative sentences are relatively easy to process when they state exceptions to a regularity that comprehenders infer from their perceptual surrounding, our experiments demonstrate that the same is true in narrative texts where comprehenders build expectations on the basis of their world knowledge (Experiment 2).

In Glenberg et al.'s experiment and in our Experiment 2, the difficulty of processing negation was not only reduced but completely eliminated when the sentences were presented in an adequate context (as indicated by the fact that processing times were even shorter in the negative compared to the affirmative condition). This is surprising if one considers the necessarily more complex representations that need to be constructed for negative compared to affirmative sentences. In propositional theories of language comprehension this complexity comes about because a

negative sentence generally contains one additional proposition as well as one additional level of propositional encapsulation. In the experiential-simulations view of language comprehension (e.g., Zwaan, 2004), this complexity comes about because comprehenders of negative sentences are assumed to create two simulations instead of one, namely a simulation of the negated state of affairs as well as a simulation of the actual state of affairs (e.g., Kaup & Zwaan, 2003). Thus, on the basis of these considerations one would have expected adequate contexts to reduce the processing difficulty but not to eliminate it. What then are the implications of this finding? One possibility is that negative sentences are pragmatically even more adequate than affirmative sentences when a prior expectation needs to be denied (i.e., "not dirty" is preferred to "clean" when it comes to denying the expectation that a particular T-shirt is dirty). Possibly, this pragmatic advantage of negation in the context of denial then makes up for the higher processing complexity. Future studies are necessary to systematically investigate polarity effects with different kinds of speech acts.

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