Fast and Fragile

A New Look at the Automaticity of Negation Processing

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Abstract. Numerous studies suggest that processing verbal materials containing negations slows down cognition and makes it more error-prone. This suggests that processing negations affords relatively nonautomatic processes. The present research studied the role of two automaticity features (processing speed and resource dependency) for negation processing. In three experiments, we tested the impact of verbal negations on affective priming effects in the Affect Misattribution Paradigm. Going beyond previous work, the results indicate that negations can be processed unintentionally and quickly (Experiments 1 and 2). In Experiment 3, negations failed to qualify affective priming effects when participants' working memory was taxed by memorizing an eight-digit number. In sum, the experiments suggest that negations can be processed unintentionally, very quickly, but that they rely on working-memory resources.

Keywords: evaluative priming, affect misattribution, automaticity, negation

The present research concerns the automaticity of the cognitive process of negating. This is an important question because negations are an integral part of everyday social cognition and behavior. In communication, negations exclude whole issues (e.g., *this is about psychology, not chemistry*), focus attention to a particular content (e.g., *I want to discuss the methods, not the theory*), or refute the validity of beliefs (e.g., *earth is not a disk*). As basic logical operators, negations are part of many reasoning problems. Attempts to control behavior often entail negations both when one's own (e.g., *I do not want to take a dessert*) and other people's behaviors (e.g., *please do not touch the painting*) are in focus. Despite their frequent use, the processes involved in negation seem to be cognitively demanding, slow down reasoning, and often result in erroneous responses, which direct cognition and behavior in the opposite direction of what was implied by logic (Clark & Chase, 1974; Deutsch, Gawronski, & Strack, 2006; Evans, 1972; Gilbert, Krull, & Malone, 1990; Jung Grant, Malaviya, & Sternthal, 2004; Mayo, Schul, & Burnstein, 2004; Walster, Berscheid, Abrahams, & Aronson, 1967).

One commonly assumed reason for the error-proneness of negations is that extracting their meaning requires controlled processing. Negating is often theorized to be an abstract, rule-based process based on propositional representations (e.g., Strack & Deutsch, 2004). The latter assumption implies that the negated construct (e.g., *cold* in the negation *it is not cold outside*) is maintained in memory while the meaning of the proposition (e.g., *it is hot outside*) is construed (Kaup & Zwaan, 2003). Current theories attribute flexible maintenance and construal processes to executive control (e.g., Miller & Cohen, 2001). From this perspective, negating fails if controlled processing is undermined. In a systematic investigation of the (non-) automaticity of negation processing, Deutsch et al. (2006) employed a priming paradigm, which is often used to study processes of automatic stimulus evaluation. Modeled after Fazio, Jackson, Dunton and Williams' (1995) *Bona Fide Pipeline* (BFP),[1] Deutsch et al. (2006) presented participants with either affirmed or negated positive or negative words for 200 ms, and asked them to evaluate positive and negative target words as quickly as possible. Results indicate that both affirmed and negated positive prime words facilitated positive evaluations, whereas both affirmed and negated negative prime words facilitated negative evaluations. Using a different evaluative priming paradigm with much shorter, partially subliminal prime presentations, Draine (1997) observed similar effects. Broadly speaking, this finding suggests that the cognitive procedure of negating fails when controlled processing is undermined. Alternatively, there is reason to suspect that features of the BFP may have caused negations to remain without effect in previous studies.

First, priming effects in the BFP depend on how participants intend to categorize the targets. For example, when participants respond to semantic (but not to affective) properties of targets, only semantic properties of primes influence responses to the targets. On the other hand, when participants respond to affective (but not semantic) properties of

[1] Note that even though Fazio et al. (1995) used the term BFP in their original presentation of the task, they have rarely used this label since then (for a recent exception, see Olson & Fazio, 2003). In the present article, we use the shortcut BFP for the sake of simplicity to distinguish Fazio et al.'s (1995) task from Payne, Cheng, Govorun, and Stewart's (2005) *Affect Misattribution Procedure* (AMP).

the targets, only affective features of the primes influence target processing (De Houwer, Hermans, Rothermund, & Wentura, 2002; Deutsch & Gawronski, 2009; Klauer & Musch, 2002). A common interpretation of this finding is that priming effects in the BFP are the result of response interference (De Houwer et al., 2002; Gawronski, Deutsch, & Seidel, 2005; Klauer & Musch, 2002; Klauer & Teige-Mocigemba, 2007; Klinger, Burton, & Pitts, 2000; Wentura, 1999). Response interference refers to the process by which perceiving a prime stimulus triggers a prepotent response tendency, which then may be either compatible or incompatible with the response requirements implied by the target. Importantly, such response tendencies may be based on intentionally preprogrammed response schemata, which depend on how participants are instructed to respond to the targets (De Houwer, Beckers, Vandorpe, & Custers, 2005; Kunde, Kiesel, & Hoffmann, 2003).

Second, evidence suggests that priming effects in the BFP may depend at least to some degree on the attention directed at the primes. For example, Simmons and Prentice (2006) asked participants either to ignore or to attend to the primes. Priming effects were stronger and the external validity was higher in the attended than in the ignored condition. Another example is a study by Gawronski, Cunningham, LeBel, and Deutsch (2008a). Primes in this study were faces that varied on two dimensions that were both related to valence (i.e., race and age). Participants were instructed to either count the number of black versus white faces or the number of young versus old faces. Consequently, attention was directed either to race or to age. Results showed significant priming effects only for the dimension participants paid attention to, but not for the respective other dimension.

Taken together, these results suggest that the BFP is influenced by participants' intentions regarding the target responses and by the attention directed to the primes. These characteristics of the measure may have reduced the potential impact of negations in Deutsch et al.'s (2006) priming studies. Particularly, given that participants were instructed to respond to single target words, their preprogrammed response schemata presumably contained single evaluative words as triggering conditions. Consequently, the response schemata may not have been responsive to the affirmations or negations attached to the prime words. In a related vein, the instruction to respond to single target words presumably motivated participants to focus their attention to such stimuli, thereby ignoring the negations. Based on the results by Gawronski et al. (2008a), this shift in attention should be sufficient to reduce or eliminate any potential effect of negations in the BFP.

The Present Research

The present research had two phases. The first phase was geared toward testing whether the task-specific processes operating in the BFP suppressed potential influences of negations in affective priming. To this end, Experiment 1 compared priming effects of affirmed and negated positive and negative words in the BFP to priming effects of the same stimuli in the AMP (Payne et al., 2005). In this paradigm, participants are briefly presented with a positive or a negative prime stimulus, which is followed by a neutral Chinese character. After a brief interval, the Chinese character is replaced by a masking stimulus, and participants are asked to indicate whether they consider the Chinese character as more or less pleasant than average. Affective priming in this paradigm is reflected in assimilation effects, such that the neutral Chinese ideographs are evaluated more positively (negatively) when they were preceded by a positive (negative) prime stimulus. In the AMP, primes are typically presented only briefly, participants are instructed to ignore the primes, and the primes are irrelevant for following the task instructions regarding the targets. Consequently, the AMP can be considered as a measure of quick and unintentional processing of the primes.

The AMP differs from the BFP in several ways, the most important differences being that the targets in the AMP are of neutral valence, semantically meaningless for participants, presented very briefly, and are replaced by a masking stimulus. This makes it very hard for participants to decide about the valence of the ideograph based on their immediate perception. It is therefore unlikely that participants engage in preprogramming response schemata, which then result in priming effects based on response interference (Deutsch & Gawronski, 2009; Gawronski et al., 2008a). Instead, participants presumably have to resort to other strategies such as searching for disambiguating information in working memory or using affective feelings. Misattributing the affect elicited by the primes is the mechanism commonly assumed to drive priming effects in the AMP (Payne et al., 2005). Moreover, research suggests that the AMP is less influenced by participants' attention. For example, Gawronski et al.'s (2008a) experiment on attention to dimensions of the prime stimuli also contained a condition where an AMP was used. Whereas the BFP was sensitive only to the attended dimension of the primes, the AMP reflected both attended and unattended features. We therefore hypothesized that the AMP would be an ideal measure to provide another test of the potential influence of negations on affective priming. In support of our hypotheses, Experiment 1 of the present research revealed that negations influenced affective priming in the AMP but not in the BFP.

The second phase of the present research built upon the results of Experiment 1. The following experiments used the AMP to dissect the (non-) automaticity of negation processing. Automaticity and control are not unitary qualities of cognition, but can be divided into subcomponents such as intentionality, controllability, awareness, or efficiency (Bargh, 1994; Moors & De Houwer, 2006). These features do not correlate perfectly, such that a process may be intentional and very efficient at the same time. To examine which automaticity features apply to negations, Experiments 2 and 3 studied the potential role of *speed of processing* and *resource dependency*. In Experiment 2, we manipulated presentation times and maximum response latencies. Results indicate that negations affect the AMP even when the opportunity for prime processing was very limited. To study the role of resource dependency, Experiment 3 introduced a secondary task that had to be maintained while working on the

AMP. Results indicate that such a distracter task selectively inhibits negation processing in the AMP, but leaves valence processing intact.

Experiment 1

Experiment 1 tested whether negations were without effect in previous experiments because of features of the specific priming paradigm used in these studies. We compared affective priming effects of affirmed and negated valenced prime words in a priming paradigm that encourages participants to quickly respond to single target words (BFP) and in a priming paradigm with neutral pictures as targets (AMP), which presumably is less dependent on attention and intentions (Gawronski, Deutsch, LeBel, & Peters, 2008b). We hypothesized that for the BFP the clear semantic meaning of the targets boosts the preprogramming of S-R associations that contain single affective words as their response trigger. For this reason, we expected that processing the negations attached to prime words would be undermined under these conditions. For the AMP, on the other hand, we hypothesized that the lack of a clear evaluative and semantic meaning of the Chinese characters requires participants to adopt a broader focus in information integration. Therefore, we expected the negations to fall into the scope of processed stimuli, thereby opening a possibility for them to influence priming effects.

Method

Participants and Design

Forty-five nonpsychology students of the University of Würzburg (27 females) participated in a study purportedly concerned with word processing. The experiment employed a 2 (valence: positive vs. negative) × 2 (qualifier: affirmation vs. negation) × 2 (measure: AMP vs. BFP) design, with valence and qualifier as within-subject factors and measure as between-subject factor.

Materials

For both the AMP and the BFP employed in this and the following experiments, prime and target words were taken from a previous study on negation (Deutsch et al., 2006). Ten positive and ten negative nouns were presented together with qualifiers indicating an affirmation (e.g., a friend) or negation (e.g., no friend), resulting in four lists of 10 different qualifier-word combinations each. Additionally, another 10 positive and 10 negative nouns were used as target words in the BFP (see Appendixes A and B).

Procedure

The experiment was run in groups of 1–3 participants, with all tasks implemented on personal computers. All experiments were controlled by the DirectRT/MediaLab (Empirisoft) software bundle.

AMP

Participants were told that they would see pairs of words (e.g., no sunshine), followed by Chinese ideographs. Following Payne et al. (2005), their task was to judge the visual pleasantness of the Chinese ideographs as either above or below average. There were four practice trials, followed by two blocks with 80 trials each. In each block, each qualifier prime combination (e.g., affirmed positive and negated negative) was shown twice, with primes being presented in a quasi-random order with the following restrictions: No qualifier prime combination (e.g., affirmed positive) was shown twice in succession, no prime valence (i.e., the valence of the qualifier-word compound) was shown more often than twice in succession, and no qualifier (e.g., negation) was shown more often than three times in succession. The quasi-random order was the same for every participant. The two blocks were separated by a short break.

Each trial started with a warning signal (XXX) for 500 ms in the center of the screen, followed by a blank screen for 200 ms. Then, a qualifier-word combination was shown for 200 ms in 30-point Arial font in bold face in white color on a black background. Next, the Chinese ideograph was shown for 100 ms (256 × 256 pixels at a resolution of 96 dpi). Finally, the ideograph was replaced by a masking stimulus consisting of gray and white "noise" (450 × 450 pixels), together with the key assignment *above-average pleasant* on the right key and *below-average pleasant* on the left key. For each participant and each trial, the Chinese ideograph was randomly drawn from a sample of 218 pictographs, with no repeated presentations of the ideographs. The next trial began after the participant reacted on one of two designated keys (A for unpleasant and 5 on the number keypad for pleasant).

BFP

Participants were told that they would see white-colored word pairs followed by positive or negative yellow-colored single words. Their task was to evaluate the yellow single words as positive or negative as quickly and as accurately as possible. Following the procedure by Deutsch et al. (2006, Exp. 4), participants first completed 20 practice trials by reacting only to positive or negative yellow target stimuli. The assessment phase (with both white prime words and yellow target words) consisted of four practice trials followed by two blocks with 80 trials each. The order of qualifier prime combinations within each block and the selection of the prime stimuli followed the same rules as for the AMP (see above). The target stimuli were shown in a quasi-random order with the restriction that no target valence (e.g., positive) was shown more often than three times in succession.

Each trial started with a warning signal (XXX) for 500 ms in the center of the screen, followed by a blank screen for 200 ms. Then, a qualifier word combination was shown for 200 ms in 30-point Arial in white color on a black background. Next, a yellow-colored target word was shown in 30-point Arial together with the key assignment of *positive* (right key) and *negative* (left key). The next trial began when the participant reacted on one of two designated keys (A for negative and 5 on the number keypad for positive). If participants responded quicker than 300 ms or slower than 2,000 ms, they were reminded to wait for the stimulus until responding or to respond more quickly, respectively.

Results

Data Preparation

For the AMP, all responses stemming from the practice trials were excluded. The proportion positive responses toward Chinese ideographs for each of the four compound primes (i.e., affirmed positive, negated positive, affirmed negative, and negated negative) served as dependent variable. This proportion is an estimate of the degree of positivity, that is, triggered by a given prime.[2] Although participants were instructed to use the pleasant- and unpleasant-key about equally often, some participants failed to follow this request and stereotypically responded with one or the other key. Because extreme response biases may reduce the sensitivity of the measure, we excluded participants with a percentage of pleasant responses above 80% or below 20% from the analyses in all three experiments. In Experiment 1, no participant was excluded for this reason.

For the BFP, all data from the practice trials were excluded. Incorrect responses (3.9%) were excluded and the remaining latencies were log-transformed.[3] To simplify the comparison between the BFP and the AMP, we calculated positivity indices for each of the four qualifier prime word combinations by subtracting the log-transformed latencies for positive targets from the latencies for negative targets, given a specific compound prime. Just as the AMP score, this index is an estimate of the degree of positivity, that is, triggered by a given prime. To allow for statistical comparisons, the positivity scores of the BFP and the AMP were *z*-transformed, based on the distribution of each measure.

Priming Measures

The *z*-transformed positivity scores were submitted to a 2 (valence) × 2 (qualifier) × 2 (measure) mixed-model analysis of variance (ANOVA). The two measures responded differently to the affirmed and negated primes, as is reflected in a significant three-way interaction, $F(1, 43) = 4.68$, $p = .04$, $\eta_p^2 = .10$ (see Figure 1). The analysis further indicated a main effect of valence, $F(1, 43) = 13.96$, $p = .001$, $\eta_p^2 = .25$, and a marginally significant interaction of valence and qualifier, $F(1, 43) = 3.87$, $p = .06$, $\eta_p^2 = .08$. No other effect reached significance (all *p*s > .13, all *F*s < 2.4). To further specify the nature of the three-way interaction, we conducted separate analyses for each measure.

AMP

The *z*-transformed positivity scores of the AMP were analyzed using a 2 (valence) × 2 (qualifier) ANOVA for repeated measures. Positive prime words ($M = 0.16$, $SD = 1.11$) resulted in more positive responses in the AMP than negative prime words ($M = -0.16$, $SD = 0.86$), $F(1, 19) = 8.92$, $p = .008$, $\eta_p^2 = .32$. Most importantly, this main effect was qualified by a significant two-way interaction of valence and qualifier, $F(1, 19) = 5.12$, $p = .04$, $\eta_p^2 = .21$, indicating that the negations attached to the words were effective in the AMP. The main effect qualifier was not significant, $F(1, 19) = 2.59$, $p = .12$.

Simple contrasts suggest that affirmed positive prime compounds had a more positive valence than affirmed negative prime compounds, $F(1, 19) = 9.74$, $p = .006$, $\eta_p^2 = .34$. Negated positive prime compounds did not differ significantly from negated negative prime compounds, $F(1, 19) = 1.25$, $p = .28$, $\eta_p^2 = .06$. This suggests that the negation attached to the positive and negative words was effective enough to reduce the valence difference between the two. Moreover, negated positive primes had a less positive valence than affirmed positive primes, $F(1, 19) = 5.56$, $p = .03$, $\eta_p^2 = .23$. At a marginal level of significance, negated negative primes had a more positive valence than affirmed negative primes, $F(1, 19) = 3.22$, $p = .09$, $\eta_p^2 = .15$. This result further suggests that negations were effective in the AMP. Even though affirmed positive prime compounds had a more positive valence than negated negative prime compounds, $F(1, 19) = 7.14$, $p = .02$, $\eta_p^2 = .27$, affirmed negative prime compounds did not significantly differ from negated positive prime compounds, $F(1, 19) = 1.07$, $p = .31$, $\eta_p^2 = .05$.

BFP

The priming indices were submitted to a same 2 (valence) × 2 (qualifier) ANOVA. Positive words ($M = 0.24$, $SD = 1.02$) had a more positive priming index than negative words ($M = -0.24$, $SD = 0.93$), $F(1, 24) = 7.77$, $p = .01$, $\eta_p^2 = .25$. Importantly, the analysis also suggests that negations remained ineffective in the BFP, as reflected by a nonsignificant two-way interaction of valence and qualifier,

[2] As with any other implicit measure, this proportion presumably is not a process-pure measure of the evaluation of primes. Instead, task-related mediators or strategic cognitive processes could additionally contribute to the priming score (Deutsch & Gawronski, 2009; Gawronski et al., 2008b).

[3] We further validated the results with a second analysis with a cut-off at a latency of 1,000 ms (see Ratcliff, 1993). This analysis revealed corresponding results.

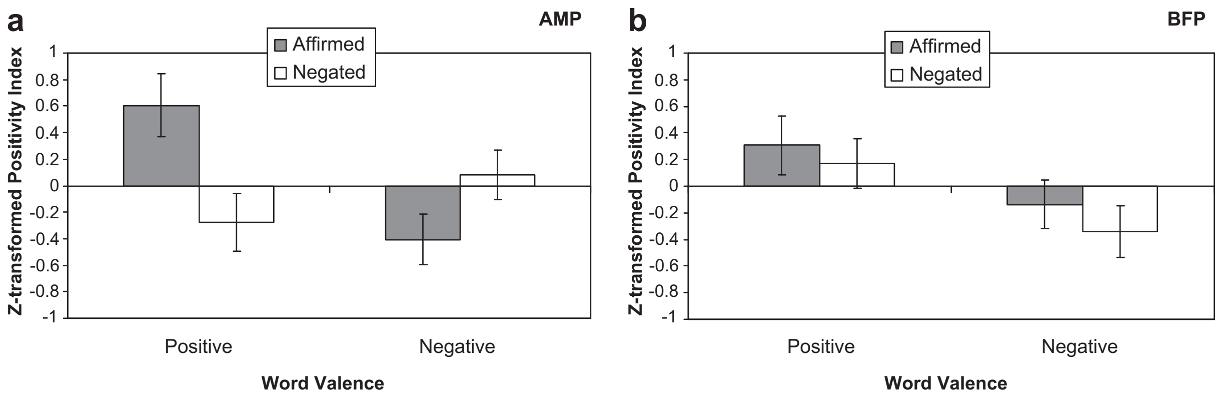

Figure 1. Mean *z*-transformed positivity scores in the AMP (a), the BFP (b) as a function of word valence and qualifier, Experiment 1. Higher values indicate more positive valence. Error bars indicate standard errors of the mean.

$F(1, 24) = 0.04$, $p = .85$, $\eta^2 < .01$. The main effect of the qualifier was not significant, $F(1, 24) = 0.77$, $p = .39$, $\eta_p^2 = .03$.

Discussion

The results from Experiment 1 indicate that negations differentially influence affective priming effects depending on which measure is used. In line with previous findings (Deutsch et al., 2006; Draine, 1997), we found that only the word valence of affirmed versus negated prime stimuli influenced affective priming in the BFP. Particularly, affirmed and negated positive primes facilitated responding to positive versus negative targets, whereas affirmed and negated negative primes facilitated responding to negative versus positive targets. The negations attached to the to-be-ignored prime stimuli had no significant effect, whereas the word valence did influence target processing. In line with our expectations, negations significantly influenced affective priming effects in the AMP. Negated positive primes resulted in fewer positive responses than affirmed positive primes. Likewise, negated negative primes resulted in more positive responses than affirmed negative primes, although this effect was only marginally significant. This result suggests that even at short presentation times and without an intention to process the negations, their meaning is nevertheless extracted in the AMP and influences further processes. This is first evidence that negations may be processed automatically to a greater degree than previously thought. Because Experiment 1 and previous research (Deutsch et al., 2006) revealed no automatic negation effects with the BFP, Experiments 2 and 3 exclusively relied on the AMP in order to study the role of processing time and working memory for negation processing.

Experiment 2

The AMP and BFP differ remarkably with respect to the ease with which participants can make their decisions about the target stimuli. Specifically, instructions in the BFP typically encourage quick responding, and feedback on slow latencies is often used to encourage complying with this demand. Instructions in the AMP, on the other hand, do not involve a focus on speed. Consequently, responses in Experiment 1 were slower in the AMP ($M = 956.38$ ms, $SD = 304.68$) than in the BFP ($M = 630.39$ ms, $SD = 66.30$), $F(1, 43) = 27.16$, $p < .001$, $\eta_p^2 = .387$. Thus, the influence of negations in the AMP could have occurred simply because participants spent more time processing the primes. Experiment 2 tested the influence of prime-processing times on negation effects in the AMP.

The maximum processing time of a prime is a function of the latency between prime onset and response onset (stimulus-response interval, SRI). In addition, processing of the prime is also determined by the presentation time of the prime stimulus. In Experiment 2, we independently manipulated presentation times at two levels (75 ms vs. 200 ms), and introduced response windows to the AMP, forcing participants to either respond faster than 600 ms or slower than 600 ms. This threshold was chosen based on the response latencies observed in Experiment 1. Deviating from Experiment 1, we also introduced a 100 ms blank interval between prime presentation and target presentation in the AMP. This was done to align our AMP with standard procedures (Payne et al., 2005), and because we feared that with in the 75 ms presentation time condition, some participants may have trouble perceiving the primes properly if they are immediately replaced by a Chinese ideograph.

As a consequence of these manipulations, 775 and 900 ms were the maximum SRI for the short response window condition, and the minimum SRI for the long response window condition. Given that the average response latency in the BFP was 629 ms, and the presentation time of the primes was 200 ms (with an ISI between prime and target of 0 ms), the average SRI was 829 ms. Participants with the short response window in the AMP can be thus expected to process the primes for a shorter average time than participants in the BFP. Therefore, if negations were ineffective in the BFP because of the shorter average processing time, one could expect significantly reduced negation processing in the AMP with short response windows. If, on the other hand, extended processing time was not the factor that eased negation processing in the AMP, the experimental variation of the processing time should not influence the negation effect in the AMP.

Method

Participants and Design

Eighty nonpsychology students of the University of Würzburg (47 females) took part in a study purportedly concerned with the processing of shortly presented words. Participants received a chocolate bar as compensation. We removed the data of three nonnative speakers, resulting in a total *N* of 77. The experiment was a 2 (valence: positive vs. negative) × 2 (qualifier: affirmation vs. negation) × 2 (prime duration: 75 ms vs. 200 ms) × 2 (response window: below 600 ms vs. above 600 ms) design, with valence and qualifier as within-subject factors and prime duration and response window as between-subject factors.

Procedure and Materials

The procedure of the AMP was the same as in Experiment 1 with the following exceptions: First, primes were presented either for 200 ms or for 75 ms (between subjects). Second, participants' reaction times were limited to either faster than 600 ms or slower than 600 ms (between participants). When participants failed to respond as quickly or as slowly as instructed, they were reminded of the response window. Third, we added a 100 ms lag between prime offset and target presentation. Fourth, in order to reduce the overall length of the task, only one block of 80 trials was presented in the AMP. Finally, we replaced two of the original prime words in the AMP, because independent data had revealed that some participants had trouble intentionally extracting the meaning of these negations (see Appendix A).

Results

As in Experiment 1, all responses stemming from the practice trials were excluded. Three participants showed a response bias of 80% or above positive responses (80, 81, and 91% positive responses) and thus were excluded from the following analyses.

Manipulation Check

A 2 (prime duration) × 2 (response window) ANOVA on the response latencies yielded a significant main effect of response window, $F(1, 70) = 143.50$, $p < .001$, $\eta_p^2 = .67$, indicating that reactions in the below 600 ms condition ($M = 349.45$, $SD = 100.00$) were faster than those in the above 600 ms condition ($M = 1244.61$, $SD = 434.93$). Further, there was a marginally significant main effect of prime duration, $F(1, 70) = 3.56$, $p = .06$, $\eta_p^2 = .05$, indicating that reactions in the 75 ms ($M = 754.14$, $SD = 439.89$) were faster than those in the 200 prime-duration condition ($M = 933.16$, $SD = 647.83$). The interaction of prime duration and response window was marginally significant, $F(1, 70) = 2.89$, $p = .09$, $\eta_p^2 = .04$.

AMP

As in Experiment 1, the proportion of positive responses was used as dependent variable. To facilitate comparisons with the first experiment, the AMP positivity score was *z*-transformed and then submitted to a 2 (valence) × 2 (qualifier) × 2 (prime duration) × 2 (response window) ANOVA for repeated measures. Positive prime words ($M = 0.10$, $SD = 0.98$) generally resulted in more positive responses than negative prime words ($M = -0.27$, $SD = 0.93$), $F(1, 70) = 9.08$, $p = .004$, $\eta_p^2 = .12$. Importantly, this main effect was qualified by a significant two-way interaction of valence and qualifier, $F(1, 70) = 11.35$, $p = .001$, $\eta_p^2 = .14$. Replicating our findings from Experiment 1, this interaction suggests that the negations were generally effective in the AMP (see Figure 2a).

Simple contrasts indicate that affirmed positive prime compounds had a more positive valence than affirmed negative prime compounds, $F(1, 73) = 17.74$, $p < .001$, $\eta_p^2 = .20$. Negated positive prime compounds did not significantly differ from negated negative prime compounds, $F(1, 73) = 0.10$, $p = .76$, $\eta_p^2 = .001$. Moreover, negated positive primes had a less positive valence than affirmed positive primes, $F(1, 73) = 10.67$, $p < .01$, $\eta_p^2 = .13$. Negated negative primes were associated with less negativity than affirmed negative primes, though this difference failed to reach significance, $F(1, 73) = 1.66$, $p = .20$, $\eta_p^2 = .02$. Even though affirmed positive prime compounds had a more positive valence than negated negative prime compounds, $F(1, 73) = 10.56$, $p < .01$, $\eta_p^2 = .13$, affirmed negative prime compounds did not significantly differ from negated positive prime compounds, $F(1, 73) = 2.03$, $p = .16$, $\eta_p^2 = .03$. Together, this pattern suggests that negations were effective in the AMP, especially with positive primes.

Most importantly, the variables that we had hypothesized to affect processing time had no statistically reliable influence on the effect of negation in the AMP. First, prime duration did not qualify the effect of negations, as reflected by a nonsignificant three-way interaction of valence, qualifier, and prime duration, $F(1, 70) < 0.01$, $p = .98$, $\eta_p^2 < .01$. Second, the response window did not qualify the effect of negations, as evidenced by a nonsignificant three-way interaction of valence, qualifier, and response window, $F(1, 70) < 0.01$, $p = .99$, $\eta_p^2 < .01$. The four-way interaction of valence, qualifier, prime duration, and response window was also not significant, $F(1, 70) = 1.52$, $p = .22$, $\eta_p^2 = .02$. Despite this interaction not being significant, the means in each Response window × Prime-duration combination showed a slightly different pattern (see Figure

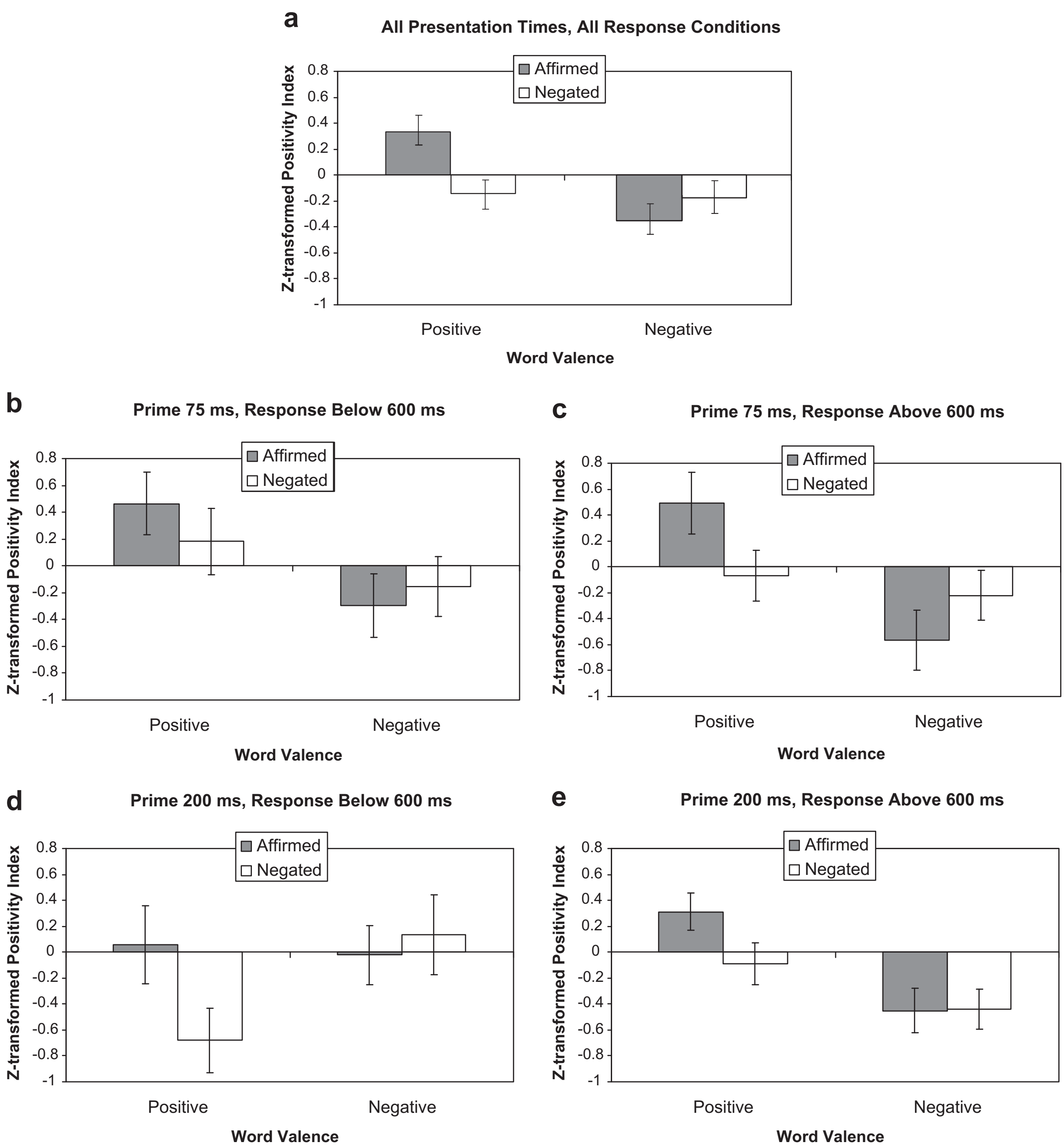

Figure 2. Mean *z*-transformed positivity scores in the AMP as a function of valence and qualifier across all presentation times and response conditions (a), for the 75 ms prime-presentation reaction time below 600 ms condition (b), for the 75 ms prime-presentation reaction time above 600 ms condition (c), for the 200 ms prime-presentation reaction time below 600 ms condition (d), and the 200 ms prime-presentation reaction time above 600 ms condition (e), Experiment 2. Higher values indicate more positive valence. Error bars indicate standard errors of the mean.

2b–e), with the effect of negations seeming less pronounced with very short processing times (Figure 2b) or very long processing times (Figure 2e). In sum, these results suggest that the negation effect in the AMP is relatively robust against factors that influence processing time.

Finally, the interaction of valence and prime duration, $F(1, 70) = 4.68$, $p = .03$, $\eta_p^2 = .06$; and of valence and response window, $F(1, 70) = 4.87$, $p = .03$, $\eta_p^2 = .07$ was significant. Separate analyses for each condition of prime duration indicate that the main effect of valence was significant only in the 75 ms condition, $F(1, 35) = 15.40$, $p < .001$, $\eta_p^2 = .31$, but not in the 200 ms condition, $F(1, 35) = 0.32$, $p = .58$, $\eta_p^2 = .01$. Analyses for each condition of response window indicate that the main effect of valence was significant only in the above 600 ms condition, $F(1, 39) = 16.94$, $p < .001$, $\eta_p^2 = .30$, but not in the below 600 ms condition, $F(1, 31) = 0.26$, $p = .61$, $\eta_p^2 = .01$. Although these interactions were unexpected, they are not informative about our main concern of how the effectiveness of negations is influenced by presentation time and the response window. All other effects were not significant (all *F*s < 3.82, *p*s > .05).

Discussion

The results of Experiment 2 provide further support for the hypothesis that negation processing can occur very quickly and unintentionally. Specifically, we manipulated prime-presentation times and response windows. In the short response window condition, participants had a maximum SRI of either 775 or 900 ms; in the long response window condition, participants had an SRI of at least 775 or 900 ms. As a consequence of this manipulation, the average response latency in the short response window condition was well below the average response latency in the BFP of Experiment 1 (BFP Experiment 1: *M* = 630.39, *SD* = 66.30 vs. AMP Experiment 2: *M* = 345.49, *SD* = 100.00). Still, we found that negations were effective in the AMP under these conditions. Specifically, affirmed positive primes elicited more positive responses in the AMP than negated positive primes. Although not statistically reliable, negated negative primes elicited more positive positivity scores in the AMP than affirmed negative primes, and negated positive primes were as negative as affirmed negative primes. Descriptively, the effect of negations seemed weaker with very short or very long processing times, but this trend was not statistically reliable. In sum, this pattern suggests that longer processing times in the AMP were not responsible for our observation that only the AMP but not the BFP proved sensitive to negations in Experiment 1.

Experiment 3

Experiment 3 was geared toward testing the resource dependency of negation processing. Efficiency results in subjective feelings of effortless processing. Empirically, resource dependency is often operationalized as dual-task interference (Moors & De Houwer, 2006). Particularly, a process can be considered being the more efficient, the less its performance declines when cognitive resources are taxed by a secondary task. If negation processing was relatively efficient, taxing participants' cognitive resources while they work on an AMP should have no effects. If, on the other hand, processing negations was highly dependent on cognitive resources, introducing a cognitively demanding secondary task to the AMP should result in a reduced impact of negations on affective priming effects. Based on earlier findings (Hermans, Crombez, & Eelen, 2000; Klauer & Teige-Mocigemba, 2007; Rotteveel & Phaf, 2004) we expected that the impact of the word valence should not be affected by a cognitively demanding secondary task. Following previous studies on the impact of working-memory load on affective priming, half of the participants in Experiment 3 were distracted by a digit memory task while performing on an AMP with affirmed or negated positive or negative words as primes. The control group worked on the same AMP without memory load.

Method

Participants and Design

Sixty-nine nonpsychology students of the University of Würzburg (52 females) took part in a study purportedly concerned with word processing. Participants received € 6 (~ US $ 8 at that time) as compensation. The data of four nonnative speakers were discarded, resulting in a total *N* of 65. The experiment was a 2 (valence: positive vs. negative) × 2 (qualifier: affirmation vs. negation) × 2 (memory load: eight-digit number vs. no load) design, with valence and qualifier as within-subject factors and memory load as between-subject factor.

Procedure and Materials

The procedure was the same as in Experiment 2, with the following exceptions: First, participants in the memory-load condition were instructed to memorize an eight-digit number that was presented shortly before the AMP trials began. Immediately after the AMP was completed, participants were asked to enter the digits into the computer in the correct order. Second, diverging from Experiment 2, we neither manipulated the presentation time, nor did we introduce a response window. Following the warning signal (XXX, 500 ms) and a blank screen for 200 ms, all primes were presented for 200 ms, followed by a blank screen for 100 ms, a Chinese ideograph for 100 ms, which was replaced by a mask, which remained on the screen until participants pressed one of the two response buttons.

Results

Memory Performance

Participants in the eight-digit number memory-load condition remembered the digits very well during the AMP (*M* = 90.32% correct, *SD* = 23.43).

AMP

Four participants showed a response bias of 80% or above positive responses (80, 88, and two times 100% positive responses), and thus were excluded from the following analyses.

The *z*-transformed positivity scores of the AMP were submitted to a 2 (valence) × 2 (qualifier) × 2 (memory load)

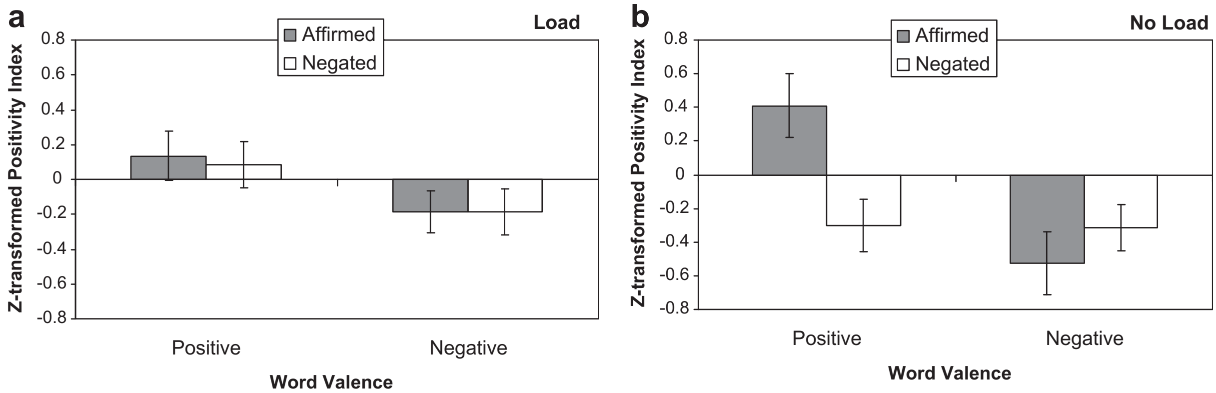

Figure 3. Mean *z*-transformed positivity scores in the AMP as a function of word valence and qualifier in the eight-digit number memory-load condition (a) and the no memory-load condition (b), Experiment 3. Higher values indicate more positive valence. Error bars indicate standard errors of the mean.

ANOVA with the last factor varying between, the other factors varying within participants. In line with our predictions, the memory-load manipulation eliminated the negation effects in the AMP (see Figure 3). This effect is reflected in a significant three-way interaction of valence, qualifier, and memory load, $F(1, 59) = 3.99$, $p = .05$, $\eta_p^2 = .06$. The analyses further indicate a main effect of valence, $F(1, 59) = 14.74$, $p < .001$, $\eta_p^2 = .20$, a marginally significant main effect of qualifier, $F(1, 59) = 3.39$, $p = .07$, $\eta_p^2 = .05$, and a two-way interaction of valence and qualifier, $F(1, 59) = 4.94$, $p = .03$, $\eta_p^2 = .08$. No other effect reached significance (all Fs < .2.3, ps > .13). To further specify the nature of the three-way interaction, we conducted separate analyses for each memory-load condition.

For participants who were under memory load, a 2 (valence) × 2 (qualifier) ANOVA revealed that negations were ineffective, as indicated by a nonsignificant interaction between valence and qualifier, $F(1, 30) = 0.06$, $p = .80$, $\eta_p^2 < .001$. At the same time, word valence affected positivity scores, $F(1, 30) = 4.88$, $p = .03$, $\eta_p^2 = .14$, in the absence of a main effect of the qualifiers, $F(1, 30) = 0.08$, $p = .78$, $\eta_p^2 < .001$. Positive prime words ($M = 0.11$, $SD = 0.75$) resulted in a greater positivity score than negative prime words ($M = -0.19$, $SD = 0.70$), irrespective of whether an affirmation or negation was attached.

For the no memory-load condition, results of a 2 (valence) × 2 (qualifier) ANOVA suggest that negations were effective in the AMP. This conclusion is supported by a significant two-way interaction of valence and qualifier, $F(1, 29) = 5.42$, $p = .03$, $\eta_p^2 = .16$. Simple contrasts indicate that negated positive primes were more negative than affirmed positive primes, $F(1, 29) = 6.97$, $p = .01$, $\eta_p^2 = .19$. Moreover, negated positive primes did not significantly differ from affirmed negative primes, $F(1, 29) = 1.40$, $p = .25$, $\eta_p^2 = .05$. Negated negative primes, however, did not differ from affirmed negative primes, $F(1, 29) = 1.29$, $p = .27$, $\eta_p^2 = .04$, and affirmed positive primes were more positive than negated negative primes, $F(1, 29) = 13.58$, $p < .01$, $\eta_p^2 = .32$. Finally, affirmed positive primes were more positive than affirmed negative primes, $F(1, 29) = 10.99$, $p < .01$, $\eta_p^2 = .28$, and negated positive primes did not differ from negated negative primes, $F(1, 29) < 0.01$, $p = .97$, $\eta_p^2 < .01$. In addition, there was a main effect of valence, $F(1, 29) = 10.06$, $p = .004$, $\eta^2 = .26$, indicating that positive words resulted in a greater positivity score ($M = 0.05$, $SD = 1.01$) than negative words ($M = -0.42$, $SD = 0.90$). Finally, a main effect of qualifier emerged, indicating that affirmed primes resulted in a greater positivity score ($M = -0.06$, $SD = 1.13$) than negated primes ($M = -0.31$, $SD = 0.80$), $F(1, 29) = 4.32$, $p = .05$, $\eta_p^2 = .13$.

Discussion

In sum, the results of Experiment 3 suggest that negation processing in evaluative priming depends on mental resources. Priming effects in the AMP were different depending on whether participants' processing resources were taxed by a memory task or not. Without a distracting memory task, negations were effective for positive words in the AMP, thereby replicating the results of Experiments 1 and 2. When participants had to memorize 8 number digits, however, negations did not influence priming effects in the AMP. Instead, only the valence of the words determined priming effects, irrespective of whether they appeared in an affirmed or negated version. This result is in line with previous research on the effect of working memory load on affective priming (Hermans et al., 2000; Klauer & Teige-Mocigemba, 2007; Rotteveel & Phaf, 2004), and suggests that the process of merely activating the valence of a word versus applying a negation is differentially fragile in the presence of competing working-memory tasks.

General Discussion

Three studies examined the role of automaticity features for processing negations in an affective priming paradigm.

Experiment 1 demonstrated that negations remained ineffective in an evaluative priming paradigm that requires participants to respond to clearly positive or negative targets (BFP, Fazio et al., 1995). In line with previous findings (Deutsch et al., 2006; Draine, 1997), only the word valence affected evaluative priming effects in the BFP. Using the same stimuli and presentation times, Experiment 1 further demonstrated that negations were effective in an evaluative priming paradigm that required participants to evaluate ambiguous stimuli (AMP, Payne et al., 2005). This result suggests that negations can be processed unintentionally and relatively quickly. Experiment 2 tested whether negations were more effective in the AMP because participants typically respond more slowly in the AMP than in the BFP, and thus have more time to process the prime stimuli. To this end, we manipulated the presentation time and, at the same time, introduced a response window. Results indicate that negations were effective in the AMP even when the processing time of the primes was restricted to a maximum below the average processing time in the BFP. This result further corroborates the conclusion drawn from Experiment 1 that negations may operate rather quickly under specific circumstances. Experiment 3 compared negation priming effects in the AMP under conditions of cognitive load and without load. Results suggest that cognitive load eliminated the effect of negations in the AMP, whereas the effect of word valence remained significant even under load.

Asymmetric Negation Effects for Positive and Negative Words

The present data revealed significant effects of negations in the AMP for positive words, but not reliably for negative words. To test if this asymmetry was due to low statistical power and if there were differences between experiments in this respect, we conducted a meta-analytic comparison across all three experiments using the total number of 122 participants. Because we expected no negation effect in the load condition of Experiment 3, this condition was excluded from the meta-analytic comparison. For the meta-analysis, we used effect sizes for four contrasts: (a) affirmed positive versus negated positive primes (negation effect for positive words), (b) affirmed negative versus negated negative primes (negation effect for negative words), (c) affirmed positive versus affirmed negative primes (valence effect of affirmed words), and (d) negated positive versus negated negative primes (valence effect of negated words). To control for potential statistical biases, we calculated *d* effect size corrected for repeated measure designs (Dunlap, Cortina, Vaslow, & Burke, 1996). As expected, there was a significant medium to large negation effect of the positive words, $d = 0.62$, $p < .01$. Further and consistent with our hypothesis, there was a small to medium negation effect on negative words, $d = 0.25$, $p < .05$. In addition, there was a large valence effect of the affirmed words, $d = 0.82$, $p < .01$. The valence effect of negated words was not reliable, indicating that negated positive and negated negative words were not significantly different from each other, $d = 0.09$, *ns*. The three experiments can be regarded as homogeneous with respect to the analyzed effects (all $\chi^2 < 1.3$, all $p > .05$).

These results indicate that negations reversed the priming effect of both positive and negative prime words in the AMP. Nevertheless, the effect of negations on responses to negative words is smaller compared to positive words. We suspect that this may derive from a genuine asymmetry in the understanding of positive and negative negations. Based on psycholinguistics (Boucher & Osgood, 1969; Clark & Clark, 1977), Unkelbach, Fiedler, Bayer, Stegmüller, and Danner (2008) argued that it is much more common to use negations to express negative instances (i.e., negated positive words) than to express positive instances (i.e., negated negative words). Consequently, it should be more cognitively demanding to extract the full meaning of negated negative words than of negated positive words. This, in turn, could have compromised the influence of negations on negative words in the AMP. Although this interpretation is consistent with the present data, future research will be needed to further test its viability.

Alternative Explanations

Given that automatic influences of negations were rarely demonstrated before, it is important to consider three alternative explanations of the present data. First, one could suspect that participants processed the qualifiers and nouns in isolation instead of extracting the meaning of the compound prime. To the degree that the negation qualifier elicits negative affect in itself, this affect could have an additive influence on top of the isolated influence of the prime words. This alternative theory, however, implies a main effect of the qualifier such that affirmed primes should generally activate more positivity than negated primes. At the same time, it does not predict an interaction of the qualifier and prime valence. The main effect of the qualifier in the AMP was not significant in Experiments 1 and 2, and marginally significant in Experiment 3. The interaction, however, was significant in all relevant conditions of the three experiments. As revealed by our meta-analytic comparison, negated negative words had a more positive priming score than affirmed negative words. If the negation qualifier merely added negativity to the prime, the opposite effect should occur. Therefore, drawing on the valence of qualifiers cannot explain the full range of results.

Second, one could suspect that seeing a negation in the prime compound allocates cognitive resources to the negation and thereby reduces the priming effect of the word. At first sight, this seems compatible with the observation that we observed a significant main effect of word valence for affirmed primes in all experiments, but failed to observe a statistically reliable reversed effect of word valence in the negated case. This alternative theory, however, is incompatible with the results of Experiment 3. In this study, we compromised participants' cognitive resources by means of a working-memory task. Still, we observed a significant main effect of word valence, irrespective of whether an affirmation or negation was attached. This alternative explanation is also questioned by the fact that negations did not undermine the effect of the prime-word valence in the BFP in Experiment 1 (see also Deutsch et al., 2006).

Finally, one could argue that the present results simply show that the AMP is strongly influenced by strategic cognitive processes, and thus is less implicit than other measures such as the BFP. On one hand, this interpretation bears some face validity because priming scores in the regular AMP reflect the percentage of nonspeeded positive decisions about the targets. On the other hand, Experiment 2 included conditions where presentation times and response deadlines were very stringent and secured shorter total processing times than in the BFP. Moreover, participants were instructed to ignore the primes, and the primes were irrelevant for their task. Consequently, the intention to process the negations was minimized under the present conditions. Thus, even if one were inclined to label the influence of negations in the AMP as being based on strategic cognitive processes, the present results suggest that these processes operate unintentionally and at speeds that are usually attributed to automaticity.

Implications

The present findings have important implications for research on the automaticity of negations. Previous research suggests that processing verbal negations generally requires cognitive control and often results in slow or erroneous responses (e.g., Deutsch et al., 2006; Gawronski, Deutsch, Mbirkou, Selbt, & Strack, 2008c; Gilbert et al., 1990; Mayo et al., 2004). The present findings provide a more differentiated view of the automaticity of negations. In line with the notion that automaticity is not a monolithic property of cognitive processes (Moors & De Houwer, 2006), the present research suggests that negations may be processed unintentionally and very quickly, but that they nevertheless depend on working-memory resources. The present findings imply that the processes underlying negations are more dependent on working memory than those underlying the mere extraction of valence. Previous research already indicated that evaluative priming effects of single affective words or faces remain or even increase with working-memory load (Hermans et al., 2000; Klauer & Teige-Mocigemba, 2007; Rotteveel & Phaf, 2004). The present research extends these findings by revealing that working memory load eliminated the effect of negations in evaluative priming, but left the effect of word valence intact.

It is important to note that the partial automaticity of negations in the present study differs from previous demonstrations of efficient negation processing. Research by Deutsch et al. (2006) suggests that in line with the notion of memory-based automaticity (Logan, 1988), efficient negation processing may occur when the overall meaning of the negated stimulus is stored as an independent unit in associative memory. This should primarily occur when the negation has been practiced extensively, such as in the expression *no problem* (Deutsch et al., 2006), or when the negated term implies a clear opposite such as *not rich* or *not active* (Hasson, Simmons, & Todorov, 2005; Mayo et al., 2004). Both conditions, however, were not met in the present priming materials. We therefore suggest that we rather observed a partially automatic application of the abstract procedure of negating instead of a quick retrieval from associative memory. This interpretation is also supported by the fact that with the present materials, working-memory load eliminated negations but not the retrieval of word valence (Experiment 3).

The present findings are also relevant for the measurement properties of indirect measures of attitudes (Fazio & Olson, 2003; Wittenbrink & Schwarz, 2007). Earlier conceptualizations of indirect measures assumed them to provide relatively direct access to mental associations. Recent evidence, however, suggests that indirect measures typically reflect a mixture of processes which may include the activation of associations, but also more complex processes such as appraisals or attempts to overcome biases (Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005; Moors, De Houwer, Hermans, & Eelen, 2005). The present findings extend on this literature in that they suggest that abstract logical operations such as negations may influence indirect attitude measures. Importantly, we uncovered that two evaluative priming paradigms (BFP vs. AMP) were differentially susceptible to the influence of negations. In line with other findings (Deutsch & Gawronski, 2009; Gawronski & Bodenhausen, 2005), this suggests that superficially similar measures may follow quite different operational principles, and perhaps capture different mixtures of processes. Without detailed knowledge of such differences, relying on only one measure may increase the risk of theoretical distortions. For example, with a focus on only one evaluative priming measure, one might have concluded that negations either operate unintentionally and quickly (AMP) or only intentionally and slowly (BFP).

We hypothesized that the clear valence of the single-word targets in the BFP encourages participants to intentionally preprogram response schemata, which link single positive and negative words with the appropriate key presses. The response schemata, in turn, are the basis for response interference, the dominant mechanism involved in the BFP (De Houwer et al., 2002; Klauer & Musch, 2002). At the same time, the response schemata may focus participants' attention to single words, thereby excluding the attached affirmations and negations from further processing. We further hypothesized that the procedural characteristics of the AMP undermine quick responding and the preprogramming of response schemata because the target stimuli are neutral, presented only briefly, and are masked. This makes the operation of response interference unlikely. For the same reason and in line with empirical evidence (Gawronski et al., 2008a), the AMP should be less susceptible to attentional manipulations. We suspected that this broadens attention during priming in the AMP such that negations would have a greater chance to enter information processing than in the BFP. Although the present results are in line with this interpretation, systematic research on how the mechanisms underlying the AMP and how they differ from those underlying the BFP is still in its beginning (Deutsch & Gawronski, 2009; Gawronski et al., 2008a).

Consequently, one must consider our interpretation as preliminary, and thus still open to empirical testing. Further research is needed to provide more direct evidence for the role of response schemata and attention.

Conclusion

In summary, the present findings provide important insights into the automaticity of negation processing. Extending previous research, the present results suggest that negation processing may occur very quickly and unintentionally even without extended and consistent practice of the negated expressions. At the same time, negations seem to rely on working-memory resources, and their processing can be easily disturbed when these resources are taxed. Hence, negation processing is probably best characterized as a semi-automatic process.

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References

Bargh, J. A. (1994). The four horsemen of automaticity: Awareness, intention, efficiency, and control in social cognition. In R. S. Wyer & T. K. Srull (Eds.), *Handbook of social cognition* (Vol. 1, pp. 1–40). Hillsdale, NJ: Erlbaum.

Boucher, J., & Osgood, C. E. (1969). The Pollyanna hypothesis. *Journal of Verbal Learning and Verbal Behavior, 8*, 1–8.

Clark, H. H., & Chase, W. G. (1974). Perceptual coding strategies in the formation and verification of descriptions. *Memory and Cognition, 2*, 101–111.

Clark, H. H., & Clark, E. (1977). *Psychology and language: An introduction to psycholinguistics*. New York, NY: Harcourt Brace Jovanovic.

Conrey, F. R., Sherman, J. W., Gawronski, B., Hugenberg, K., & Groom, C. J. (2005). Separating multiple processes in implicit social cognition: The quad model of implicit task performance. *Journal of Personality and Social Psychology, 89*, 469.

De Houwer, J., Beckers, T., Vandorpe, S., & Custers, R. (2005). Further evidence for the role of mode-independent short-term associations in spatial Simon effects. *Perception & Psychophysics, 67*, 659–666.

De Houwer, J., Hermans, D., Rothermund, K., & Wentura, D. (2002). Affective priming of semantic categorisation responses. *Cognition and Emotion, 16*, 643–666.

Deutsch, R., & Gawronski, B. (2009). When the method makes a difference: Antagonistic effects on "automatic evaluations" as a function of task characteristics of the measure. *Journal of Experimental Social Psychology, 45*, 101–114.

Deutsch, R., Gawronski, B., & Strack, F. (2006). At the boundaries of automaticity: Negation as reflective operation. *Journal of Personality and Social Psychology, 91*, 385–405.

Draine, S. C. (1997). Analytic limitations of unconscious language processing. *Dissertation Abstracts International: Section B: The Sciences and Engineering, 58*, 3331.

Dunlap, W. P., Cortina, J. M., Vaslow, J. B., & Burke, M. J. (1996). Meta-analysis of experiments with matched groups or repeated measures designs. *Psychological Methods, 1*, 170–177.

Evans, J. S. B. T. (1972). Reasoning with negatives. *British Journal of Psychology, 63*, 213–219.

Fazio, R. H., Jackson, J. R., Dunton, B. C., & Williams, C. J. (1995). Variability in automatic activation as an unobtrusive measure of racial attitudes: A bona fide pipeline? *Journal of Personality and Social Psychology, 69*, 1013–1027.

Fazio, R. H., & Olson, M. A. (2003). Implicit measures in social cognition research: Their meaning and uses. *Annual Review of Psychology, 54*, 297–327.

Gawronski, B., & Bodenhausen, G. V. (2005). Accessibility effects on implicit social cognition: The role of knowledge activation and retrieval experiences. *Journal of Personality and Social Psychology, 89*, 672.

Gawronski, B., Cunningham, W. A., LeBel, E. P., & Deutsch, R. (2008a). Attentional influences on affective priming: Does categorization (always) influence spontaneous evaluations of multiply categorizable objects? Manuscript submitted for publication.

Gawronski, B., Deutsch, R., LeBel, E. P., & Peters, K. (2008b). Response interference as a mechanism underlying implicit measures: Some traps and gaps in the assessment of mental associations with experimental paradigms. *European Journal of Psychological Assessment, 24*, 218–228.

Gawronski, B., Deutsch, R., Mbirkou, S., Selbt, B., & Strack, F. (2008c). When "Just Say No" is not enough: Affirmation versus negation training and the reduction of automatic stereotype activation. *Journal of Experimental Social Psychology, 44*, 370–377.

Gawronski, B., Deutsch, R., & Seidel, O. (2005). Contextual influences on implicit evaluation: A test of additive versus contrastive effects of evaluative context stimuli in affective priming. *Personality and Social Psychology Bulletin, 31*, 1226–1236.

Gilbert, D. T., Krull, D. S., & Malone, P. S. (1990). Unbelieving the unbelievable: Some problems in the rejection of false information. *Journal of Personality and Social Psychology, 59*, 601–613.

Hasson, U., Simmons, J. P., & Todorov, A. (2005). Believe it or not: On the possibility of suspending belief. *Psychological Science, 16*, 566–571.

Hermans, D., Crombez, G., & Eelen, P. (2000). Automatic attitude activation and efficiency: The fourth horseman of automaticity. *Psychologica Belgica, 40*, 3–22.

Jung Grant, S., Malaviya, P., & Sternthal, B. (2004). The influence of negation on product evaluations. *Journal of Consumer Research, 31*, 583–591.

Kaup, B., & Zwaan, R. A. (2003). Effects of negation and situational presence on the accessibility of text information. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 29*, 439–446.

Klauer, K. C., & Musch, J. (2002). Goal-dependent and goal-independent effects of irrelevant evaluations. *Personality and Social Psychology Bulletin, 28*, 802–814.

Klauer, K. C., & Teige-Mocigemba, S. (2007). Controllability and resource dependence in automatic evaluation. *Journal of Experimental Social Psychology, 43*, 648–655.

Klinger, M. R., Burton, P. C., & Pitts, G. S. (2000). Mechanisms of unconscious priming: I. Response competition, not spreading activation. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26*, 411–455.

Kunde, W., Kiesel, A., & Hoffmann, J. (2003). Conscious control over the content of unconscious cognition. *Cognition, 88*, 223–242.

Logan, G. D. (1988). Toward an instance theory of automatization. *Psychological Review, 95*, 492–527.

Mayo, R., Schul, Y., & Burnstein, E. (2004). "I am not guilty" vs. "I am innocent": Successful negation may depend on the schema used for its encoding. *Journal of Experimental Social Psychology, 40*, 433–449.
Miller, E. K., & Cohen, J. D. (2001). An integrative theory of prefrontal cortex function. *Annual Review of Neuroscience, 24*, 167–202.
Moors, A., & De Houwer, J. (2006). Automaticity: A theoretical and conceptual analysis. *Psychological Bulletin, 132*, 297–326.
Moors, A., De Houwer, J., Hermans, D., & Eelen, P. (2005). Unintentional processing of motivational valence. *The Quarterly Journal of Experimental Psychology A: Human Experimental Psychology, 6*, 1043–1063.
Olson, M. A., & Fazio, R. H. (2003). Relations between implicit measures of prejudice: What are we measuring? *Psychological Science, 14*, 636–639.
Payne, B. K., Cheng, C. M., Govorun, O., & Stewart, B. D. (2005). An inkblot for attitudes: Affect misattribution as implicit measurement. *Journal of Personality and Social Psychology, 89*, 277–293.
Rotteveel, M., & Phaf, R. H. (2004). Loading working memory enhances affective priming? *Psychonomic Bulletin & Review, 11*, 326–331.
Simmons, J. P., & Prentice, D. A. (2006). Pay attention! Attention to the primes increases attitude assessment accuracy. *Journal of Experimental Social Psychology, 42*, 784–791.
Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review, 8*, 220–247.
Unkelbach, C., Fiedler, K., Bayer, M., Stegmuller, M., & Danner, D. (2008). Why positive information is processed faster: The density hypothesis. *Journal of Personality and Social Psychology, 95*, 36–49.
Walster, E., Berscheid, E., Abrahams, D., & Aronson, V. (1967). Effectiveness of debriefing following deception experiments. *Journal of Personality and Social Psychology, 6*, 371–380.
Wentura, D. (1999). Activation and inhibition of affective information: Evidence for negative priming in the evaluation task. *Cognition and Emotion, 13*, 65–91.
Wittenbrink, B., & Schwarz, N. (2007). *Implicit measures of attitudes*. New York, NY: Guilford Press.

Appendix A

Stimuli Used as Prime Stimuli in the AMP and BFP in Experiments 1–3

Affirmed (Negated) Positive. EIN (KEIN) VERGNÜGEN (an [no] enjoyment), EIN (KEIN) FREUND (a [no] friend), EIN (KEIN) URLAUB (a [no] vacation), EIN (KEIN) SOMMER (a [no] summer), EINE (KEINE) PARTY (a [no] party), EINE (KEINE) BLUME (a [no] flower), EIN (KEIN) GESCHENK (a [no] present), EIN (KEIN) GENUSS (a [no] pleasure), EINE (KEINE) SCHOKOLADE (a [no] chocolate), EIN (KEIN) KUCHEN (a [no] cake).
Affirmed (Negated) Negative. EINE (KEINE) BOMBE (a [no] bomb), EINE (KEINE) KRANKHEIT (a [no] disease), EINE (KEINE) BEERDIGUNG (a [no] funeral), EIN (KEIN) VIRUS (a [no] virus), EIN (KEIN) VERBRECHEN (a [no] crime), EINE (KEIN) REZESSION (a [no] recession), EINE (KEINE) KAKERLAKE (a [no] cockroach), EIN (KEIN) MOSKITO (a [no] mosquito), EINE (KEINE) RATTE (a [no] rat), EIN (KEIN) WURM (a [no] worm).
Note. In Experiments 2 and 3, the same stimuli were used as in Experiment 1, except for EINE (KEINE) REZESSION and EIN (KEIN) WURM; instead EIN (KEIN) GEFÄNGNIS (a [no] prison) and EIN (KEIN) TOD (a [no] death) were used.

Appendix B

Stimuli Used as Target Stimuli in the BFP in Experiment 1

Positive. SONNENSCHEIN (sunshine), MUSIK (music), KINO (cinema), ERDBEERE (strawberry), HAWAII (Hawaii), BABY (baby), EISCREME (ice cream), SCHWIMMEN (swimming), KÄTZCHEN (kitten), TANZ (dance).
Negative. KRIEG (war), ALKOHOLISMUS (alcoholism), ZAHNSCHMERZ (toothache), HASS (hatred), HITLER (Hitler), HÖLLE (hell), SCHEIDUNG (divorce), KREBS (cancer), MÜLL (garbage), ABFALL (waste).

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