

# Accessibility Effects on Implicit Social Cognition: The Role of Knowledge Activation and Retrieval Experiences

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Performance on measures of implicit social cognition has been shown to vary as a function of the momentary accessibility of relevant information. The present research investigated the mechanisms underlying accessibility effects of self-generated information on implicit measures. Results from 3 experiments demonstrate that measures based on response compatibility processes (e.g., Implicit Association Test, affective priming with an evaluative decision task) are influenced by subjective feelings pertaining to the ease of retrieving relevant information from memory, whereas measures based on stimulus compatibility processes (e.g., semantic priming with a lexical-decision task) are influenced by direct knowledge activation in associative memory. These results indicate that the mediating mechanisms underlying context effects on implicit measures can differ as a function of the task even when these tasks show similar effects on a superficial level. Implications for research on implicit social cognition and the ease-of-retrieval effect are discussed.

*Keywords:* accessibility, context effects, ease of retrieval, implicit social cognition, implicit measures

Arguably one of the most important contributions in social cognition research within the last decade was the development of techniques to measure implicit attitudes, stereotypes, self-esteem, and self-concepts (e.g., De Houwer, 2003a; Fazio, Jackson, Dutton, & Williams, 1995; Greenwald, McGhee, & Schwartz, 1998; Nosek & Banaji, 2001; Wittenbrink, Judd, & Park, 1997). These measures—most of them based on response latencies in speeded categorization tasks—are intended to assess relatively automatic and potentially unconscious mental associations (Fazio & Olson, 2003; Greenwald & Banaji, 1995). Implicit measures have often been assumed to reflect stable representations arising from long-term socialization experiences (e.g., Dovidio, Kawakami, & Beach, 2001; Greenwald & Banaji, 1995; Rudman, 2004; Wilson, Lindsey, & Schooler, 2000). However, recent research has shown that performance on these tasks is highly susceptible to contextual influences. Indeed, contextual influences have been demonstrated for a large variety of contexts and implicit measures (e.g., Barden, Maddux, Petty, & Brewer, 2004; Blair, Ma, & Lenton, 2001; Dasgupta & Greenwald, 2001; Gawronski, Deutsch, & Seidel, 2005a; Karpinski & Hilton, 2001; Lowery, Hardin, & Sinclair, 2001; Mitchell, Nosek, & Banaji, 2003; Wittenbrink, Judd, &

Park, 2001a; for a review, see Blair, 2002). However, the specific mechanisms underlying such context effects are still not sufficiently well understood.

A particularly interesting kind of contextual influence on implicit measures is the cognitive accessibility of self-generated information. In a study by Blair et al. (2001), for example, participants were asked to imagine either a stereotypical or a counterstereotypical woman and to complete a measure of implicit gender stereotyping afterward. Results indicated that implicit gender stereotyping was much less pronounced when participants had to think of a counterstereotypical woman than when they had to think of a stereotypical woman. This effect was demonstrated for a variety of tasks, such as the Implicit Association Test (IAT; Greenwald et al., 1998) or the go/no-go association task (Nosek & Banaji, 2001).

The main goal of the present research was to investigate the mechanisms underlying accessibility effects of self-generated information on implicit measures. Specifically, we tested whether self-generated information affects implicit measures by direct knowledge activation in associative memory or whether implicit measures are instead influenced by subjective experiences pertaining to the retrieval of relevant information from memory.

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## Ease-of-Retrieval Effects in Social Judgment

Previous research has shown that people often base their judgments on the experienced ease of retrieving relevant information from memory rather than on the overall amount of activated information (for a review, see Schwarz, Bless, Wänke, & Winkielman, 2003). For example, in their seminal study on Tversky and Kahneman's (1973) availability heuristic, Schwarz et al. (1991) asked participants to recall either a high or a low number of either assertive or unassertive behaviors that they had engaged in and to indicate their general level of assertiveness afterward. In contrast to what would be expected by a direct knowledge activation effect (see Higgins, 1996), participants rated themselves higher in asser-

tiveness when they had to recall a low number of assertive behaviors than when they had to recall a high number of assertive behaviors. Conversely, participants rated themselves higher in assertiveness when they had to recall a high number of unassertive behaviors than when they had to recall a low number of unassertive behaviors. According to Schwarz et al. (1991), these results indicate that participants based their self-judgments on the experienced ease of retrieving the respective behaviors from memory. More precisely, participants seem to have inferred that they are not very assertive when the recollection of assertive behaviors seems difficult (high number), but they seem to have inferred that they are very assertive if the recollection of assertive behaviors seems easy (low number). Conversely, participants may have inferred that they are very assertive when the recollection of unassertive behaviors seems difficult (high number), but they may have inferred that they are not very assertive if the recollection of unassertive behaviors seems easy (low number).

This interpretation was corroborated by Stepper and Strack (1993) who manipulated retrieval experiences independently of the particular content of the retrieved information. In Schwarz et al.'s (1991) studies, one could argue that participants may have generated different kinds of examples as a function of whether they were required to generate a high or a low number of behaviors (e.g., specific vs. abstract examples of assertiveness). As such, Schwarz et al.'s findings could also be due to differences in the particular examples that were generated rather than to the experienced ease of retrieving these examples from memory. To rule out this alternative, Stepper and Strack (1993) asked participants to generate the same number of either assertive or unassertive behaviors under conditions of either forehead contraction or light smiling. Drawing on previous research on the facial feedback hypothesis (Strack, Martin, & Stepper, 1988), it was argued that forehead contraction induces a subjective feeling of high cognitive effort, whereas light smiling induces a feeling of low cognitive effort (see also Strack & Neumann, 2000; Winkielman & Cacioppo, 2001). Consistent with the assumption that judgments are indeed influenced by retrieval experiences (rather than by the particular content of the retrieved information), participants who had to generate assertive behaviors rated themselves higher in assertiveness when they engaged in light smiling (i.e., feeling of low effort) than when they contracted their forehead muscle (i.e., feeling of high effort) during the retrieval task. In contrast, participants who had to generate unassertive behaviors rated themselves higher in assertiveness when they contracted their forehead muscle (i.e., feeling of high effort) than when they engaged in light smiling (i.e., feeling of low effort). These and other results indicate that Schwarz et al.'s (1991) findings are independent of the particular examples that were generated but genuinely related to the experienced ease of retrieving information from memory. To date, ease-of-retrieval effects have been demonstrated in a variety of domains, such as self-perception (e.g., Schwarz et al., 1991), attitudes (e.g., Wänke, Bless, & Biller, 1996), stereotyping (e.g., Dijksterhuis, Macrae, & Haddock, 1999), group judgments (e.g., Rothman & Hardin, 1997), frequency estimates (e.g., Wänke, Schwarz, & Bless, 1995), risk perception (e.g., Rothman & Schwarz, 1999), hindsight bias (e.g., Sanna & Schwarz, 2003), or social comparison (e.g., Gawronski, Bodenhausen, & Banse, 2005b).

### Knowledge Activation Versus Retrieval Experiences in Implicit Social Cognition

The distinction between knowledge activation and retrieval experiences can also be applied to the present question of how self-generated information affects performance on implicit measures. In Blair et al.'s (2001) studies, for example, imagining a (counter)stereotypical woman could influence implicit gender stereotyping either by the direct activation of (counter)stereotypical knowledge in associative memory or by the experienced ease of retrieving (counter)stereotypical knowledge from memory. Drawing on these alternatives, the main goal of the present research was to investigate whether the impact of self-generated information on implicit measures is mediated by direct knowledge activation in associative memory or by the experienced ease of retrieving this information from memory.

On the one hand, one could argue that implicit measures are primarily affected by processes of spreading activation (e.g., De Houwer & Randell, 2004; Fazio, Sanbonmatsu, Powell, & Kardes, 1986; Greenwald et al., 2002; Hermans, De Houwer, & Eelen, 1994), thus reflecting the overall activation level of particular associations in memory. As such, implicit measures should reflect enhanced activation levels as a function of increasing stimulation (e.g., Balota & Paul, 1996). Because the stimulation of a particular association can be expected to increase as a function of relevant information that is activated in associative memory, implicit measures may be influenced by the overall amount of activated information rather than by the experienced ease of retrieving this information from memory.

On the other hand, a possible effect of subjective retrieval experiences on implicit measures is also conceivable, given that many implicit measures are based on the interference of response tendencies (e.g., De Houwer, Hermans, Rothermund, & Wentura, 2002; Klauer, Rossnagel, & Musch, 1997; Klinger, Burton, & Pitts, 2000; Wentura, 1999). In such tasks, a given stimulus (or set of stimuli) may elicit two independent response tendencies that can be congruent or incongruent with each other. For example, in an IAT (Greenwald et al., 1998) designed to assess implicit prejudice against African Americans, a Black face may trigger both a tendency to respond "Black" and a tendency to respond "negative," and task performance depends on whether these two tendencies are mapped to the same motor response (congruent condition) or to two different motor responses (incongruent condition). There is ample evidence that subjective feelings can directly influence response tendencies, and such an influence is possible irrespective of whether these feelings are emotional or nonemotional (for a review, see Schwarz & Clore, 1996). For example, suppose that one is asked to think of 10 disliked African Americans, and one has difficulty doing so. This difficulty experienced in retrieving disliked exemplars may produce a subjective feeling of positivity toward African Americans, which could then reduce the strength of a "negative" response tendency when subsequently presented with an African American stimulus.

It therefore seems that there is theoretical precedent for anticipating *both* kinds of effects of self-generated information on implicit measures—effects of experienced ease of retrieval as well as effects of the amount of activated memory content. Which type of effect should actually emerge? We argue that the type of influence self-generated information has on implicit measures depends on the psychological structure of the task (see De Houwer,

2003b). Specifically, implicit measures that are based solely on processes of spreading activation (without response competition) should be influenced by the relative amount of relevant information activated in associative memory. In contrast, implicit measures that are based on processes of response interference should be influenced by the impact of subjective feelings on relevant response tendencies and thus by the experienced ease of retrieving relevant information from memory. We outline the rationale for this prediction in more detail in the following section.

### Stimulus Compatibility Versus Response Compatibility in Implicit Measures

From a general perspective, there seem to be at least two different kinds of compatibility that are relevant in measures of implicit social cognition: (a) stimulus compatibility and (b) response compatibility. Stimulus compatibility depends on the conceptual relatedness of stimuli and is exemplified in the phenomenon of semantic priming (Neely, 1977): We can respond more quickly to the word "butter" if we have previously seen the word "bread" than if we have seen the word "car." Whereas stimulus compatibility seems to be directly related to processes of spreading activation in associative memory, response compatibility depends instead on the interference of two competing response tendencies elicited by a given set of stimuli (see De Houwer, 2003b; Kornblum, Hasbroucq, & Osman, 1990).

A useful example to illustrate the notion of response compatibility is the Stroop color naming task (Stroop, 1935). In this task, participants are asked to name the color of a word presented on a screen as quickly as possible. The critical items in this task are words that themselves represent a color label. On these items, people usually show better performance when the ink color of the word corresponds to the color label depicted by the word (e.g., the word "RED" written in red ink). However, participants usually show impaired performance when the ink color and color label do not correspond to one another (e.g., the word "RED" written in blue ink). These differences in performance can be explained by the influence of two independent response tendencies (Lindsay & Jacoby, 1994). Whereas the first case results in two response tendencies that have synergistic effects on participants' responses, the latter case results in two response tendencies that have antagonistic effects. In other words, performance in the Stroop task depends (among other factors) on the relative strength of two competing response tendencies that can be compatible or incompatible with each other (see also De Houwer, 2003b).

As briefly noted above, the notion of response compatibility can also be applied to Greenwald et al.'s (1998) IAT. In this task, participants are asked to categorize individual stimuli (e.g., Black and White faces) as quickly as possible into a pair of target categories (e.g., Black vs. White). The strength of an "implicit association" is usually assessed by combining two pairs of target categories in an association-congruent and in an association-incongruent manner. For example, in an IAT designed to assess White participants' implicit preference for Whites over Blacks, participants are asked to respond to pictures of Black and White individuals and to pleasant and unpleasant words with a key assignment implying a prejudice-congruent combination (i.e., Black-negative; White-positive) and with a key assignment implying a prejudice-incongruent combination (i.e., White-negative; Black-positive). The difference between the mean response laten-

cies for prejudice-congruent and prejudice-incongruent assignments is usually interpreted as an index of participants' implicit preference for Whites over Blacks (see Greenwald, Nosek, & Banaji, 2003).

Applied to the present question, one could argue that the IAT is based on response compatibility processes similar to those in the Stroop task (De Houwer, 2003b). For example, in the combined blocks of an IAT to assess implicit preference for Whites over Blacks, participants can respond to the target items (e.g., Black and White faces) either according to their category membership (i.e., Black vs. White) or according to the affective reaction they evoke (i.e., negative vs. positive). In the "congruent" block, both response tendencies lead to correct responses in terms of the key assignment (synergistic effect). In the "incongruent" block, however, only category-based response tendencies lead to correct responses, whereas affect-related response tendencies lead to incorrect responses (antagonistic effect). Most importantly, whether one or the other response tendency succeeds in the incongruent block depends on the relative strength of the two response tendencies, thus implying a response compatibility mechanism similar to the one proposed for the Stroop task (De Houwer, 2003b).

A similar logic applies to affective priming effects in Fazio et al.'s (1986) evaluative decision task (see also Fazio et al., 1995). In this paradigm, participants have to indicate the valence of positive and negative target words as quickly as possible. Shortly before the presentation of a target word, participants are briefly presented with positive or negative prime stimuli. The standard affective priming effect is reflected in faster responses to positive words after priming with positive as compared with negative stimuli and in faster responses to negative words after priming with negative as compared with positive stimuli (for a review, see Fazio, 2001).

Even though affective priming effects in Fazio et al.'s (1986) evaluative decision task have been interpreted as reflecting associative processes of spreading activation (see Klauer & Musch, 2003), more recent research suggests that such effects are more likely to be driven by Stroop-like processes of response interference (e.g., De Houwer et al., 2002; Klauer et al., 1997; Klinger et al., 2000; Wentura, 1999). Specifically, it seems that the valence of the prime stimulus triggers a particular response tendency that can be compatible or incompatible with the response tendency triggered by the target word. If the prime stimulus and the target word share the same valence, the two response tendencies have synergistic effects. If, however, the prime stimulus and the target word have a different valence, the two response tendencies have antagonistic effects. In this sense, affective priming effects in the evaluative decision task seem to depend on the relative strength of two competing response tendencies, thus implying a response compatibility mechanism similar to the one proposed for the IAT and the Stroop task (De Houwer, 2003b; Klauer & Musch, 2003).<sup>1</sup>

<sup>1</sup> In this context, it is important to distinguish between conceptual and empirical propositions about stimulus versus response compatibility. From a conceptual perspective, Fazio et al.'s (1986) affective priming task implies a notion of stimulus compatibility in addition to the proposed response compatibility mechanism (De Houwer, 2003b). From an empirical perspective, however, stimulus compatibility has been challenged as a viable explanation for affective priming effects in Fazio et al.'s (1986) paradigm (see Klauer & Musch, 2003).



A different mechanism seems to underlie semantic priming effects in Wittenbrink et al.'s (1997) lexical-decision task. In this paradigm, participants have to indicate as quickly as possible whether a letter string presented on the screen constitutes a meaningful word or meaningless nonword. Before the presentation of a target letter string, participants are briefly presented with meaningful prime stimuli. Semantic priming effects are reflected in faster responses to meaningful target words when these words follow a semantically related prime word (e.g., "butter" preceded by "bread") than when these words follow a semantically unrelated prime word (e.g., "butter" preceded by "car"). Such effects are usually explained by the spreading of activation from the prime stimulus to conceptually related stimuli in associative memory (see Collins & Loftus, 1975).

Even though semantic priming effects in the lexical-decision task may appear similar to affective priming effects obtained in the evaluative decision task, priming effects obtained with lexical-decision tasks are generally independent of response compatibility processes (De Houwer, 2003b; Klauer & Musch, 2003). Prime words in the lexical-decision task are always meaningful words and thus may generally imply a tendency to respond with the key for meaningful words. This response tendency, however, is irrelevant for the facilitated identification of semantically related target words. Critically, both semantically related and semantically unrelated target words should benefit from the prime-related response tendency. There is no response-related incompatibility in responses to semantically related versus semantically unrelated target words. In contrast, semantic priming effects in the lexical-decision task exclusively depend on the compatibility of primes and targets on the stimulus level. Such compatibility effects on the stimulus level seem to be directly related to processes of spreading activation in associative memory (see De Houwer, 2003b; Collins & Loftus, 1975; Klauer & Musch, 2003; Neely, 1991).

In summary, whereas performance on the IAT (Greenwald et al., 1998) and on Fazio et al.'s (1986) affective priming task seems to be driven by processes of response compatibility, performance on Wittenbrink et al.'s (1997) semantic priming task is based on stimulus compatibility processes and thus may be directly related to processes of spreading activation in associative memory. Given that, as previously described, retrieval experiences can directly influence the activation of relevant response tendencies in response compatibility tasks, both IAT performance and affective priming effects in the evaluative decision task may be affected by the experienced ease of retrieving relevant information from memory. For instance, if one is asked to think of 10 disliked African Americans and one has difficulty doing so, the experienced difficulty of retrieving disliked exemplars may produce a subjective feeling of positivity toward African Americans, which could then reduce the strength of a "negative" response tendency elicited by a Black face. In contrast, semantic priming effects in the lexical-decision task may be directly related to the overall activation level of a given association in memory, which should increase as a function of increasing stimulation (e.g., Balota & Paul, 1996). As such, semantic priming effects in the lexical-decision task should depend on the overall amount of relevant information activated in associative memory, rather than on the experienced ease of retrieving this information from memory. For instance, if one is asked to think of 10 disliked African Americans, these exemplars may increase the momentary activation of negative associations regarding African Americans. Most importantly, this increase in activa-

tion may occur irrespective of the subjective difficulty of activating these exemplars in the first place, thus leading to more negativity toward African Americans in associative memory.

To test the differential influence of knowledge activation and retrieval experiences on different kinds of implicit measures, we conducted a total of three experiments. In all of these experiments, participants were asked to generate either a high or a low number of group exemplars with a particular quality and to complete a measure of implicit group cognitions after the retrieval task. Experiment 1 tested whether the impact of self-generated information on the IAT (Greenwald et al., 1998) is mediated by direct knowledge activation in associative memory or by the experienced ease of retrieving relevant information from memory. Experiment 2 directly compared the influence of knowledge activation and retrieval experiences on Fazio et al.'s (1986) affective priming paradigm and Wittenbrink et al.'s (1997) semantic priming paradigm. Finally, Experiment 3 tested whether the differential influence of knowledge activation and retrieval experiences obtained in Experiment 2 is actually due to the nature of the measures used (i.e., stimulus compatibility vs. response compatibility) or to different kinds of processing goals implied by the tasks (i.e., semantic vs. evaluative).

### Experiment 1

Experiment 1 tested whether the impact of self-generated information on IAT performance (e.g., Blair et al., 2001) is mediated by direct knowledge activation in associative memory or by the experienced ease of retrieving relevant information from memory. For this purpose, participants were asked to generate a list of either a high or a low number of African Americans, with half of the participants being asked to generate liked individuals and half being asked to generate disliked individuals. After the retrieval task, all participants completed an IAT designed to assess their implicit preference for Whites over Blacks (Greenwald et al., 1998). If self-generated information influences IAT performance via direct knowledge activation, participants should exhibit a stronger preference for Whites over Blacks when they generated a high number of disliked African Americans than when they generated a low number of disliked African Americans. In contrast, participants should exhibit a weaker preference for Whites over Blacks when they generated a high number of liked African Americans than when they generated a low number of liked African Americans. If, however, self-generated information influences IAT performance via retrieval experiences, participants should exhibit a stronger preference for Whites over Blacks when they generated a low number of disliked African Americans (easy) than when they generated a high number of disliked African Americans (difficult). In contrast, participants should exhibit a weaker preference for Whites over Blacks when they generated a low number of liked African Americans (easy) than when they generated a high number of liked African Americans (difficult).

### Method

*Participants and design.* A total of 41 Northwestern University undergraduates (24 women, 17 men) participated in a study on memory and attitudes in return for course credit. Participants were randomly assigned to the four conditions of a 2 (number of exemplars: 3 vs. 10)  $\times$  2 (valence of exemplars: liked vs. disliked) between-subjects design. Because of a computer error, data from one participant were only partially recorded and thus

were excluded from analyses. In addition, we excluded the data from five participants of African American origin.

*Procedure and measures.* Participants were asked to list either 3 or 10 African American individuals whom they either liked or disliked. Specifically, participants were told:

The present study is concerned with memory and attitudes. For this purpose, you will be asked to think of 3 (10) African American individuals whom you particularly (dis)like. These people may be individuals you are personally familiar with, celebrities, or other people you know. Please type in the name of 3 (10) African American individuals whom you particularly (dis)like on the blank screen below.

After participants had completed the exemplar retrieval task, they completed an IAT designed to assess their implicit preference for Whites over Blacks (Greenwald et al., 1998). Following the protocol of Greenwald et al. (1998), we devised an IAT consisting of five blocks. In the initial target-concept discrimination task (Block 1), 10 typically African American names and 10 typically Caucasian names taken from Greenwald et al. (1998) had to be assigned to the categories "African American" or "Caucasian," respectively. Participants were asked to press a left-hand key ("A") when an African American name appeared on the screen and a right-hand key ("5" of the number pad) in the case of a Caucasian name. In the attribute discrimination task (Block 2), 10 positive attributes and 10 attributes drawn from the study by Greenwald et al. (1998) were presented and had to be classified according to the categories unpleasant (left-hand key) and pleasant (right-hand key). In the initial combined task (Block 3), target and attribute discrimination trials were presented and had to be categorized in a prejudice-congruent manner. Participants had to press the left-hand key when either an African American name or a negative word was presented and the right-hand key when either a Caucasian name or a positive word was presented. In the reversed target-concept discrimination task (Block 4), the initial target-concept discrimination was repeated with a switch of the categorization keys. The reversed combined task (Block 5) again combined the two individual tasks, now in a prejudice-incongruent manner. Participants had to press the left-hand key when either a Caucasian name or a negative word was presented and the right-hand key when either an African American name or a positive word was presented. Each block started with a brief instruction for the following task and a request to respond as quickly as possible without making too many errors. The three discrimination tasks (Blocks 1, 2, and 4) each comprised a total of 20 trials. The two combined tasks (Blocks 3 and 5) each consisted of 80 trials. Order of trials was randomized for each participant. The response-stimulus interval following correct responses was 250 ms. Incorrect responses were indicated with the word "ERROR!" appearing for 1,000 ms in the center of the screen. To assure the effectiveness of our ease-of-retrieval manipulation, we asked participants to indicate how difficult it was to generate the required number of exemplars at the end of the experiment. Manipulation checks were obtained with a rating scale ranging from 1 (very easy) to 7 (very difficult).

## Results

*Manipulation checks.* Overall, participants complied well with the request to generate the required number of individuals. A 2 (number of exemplars)  $\times$  2 (valence of exemplars) analysis of variance (ANOVA) on the number of generated exemplars revealed a highly significant main effect of the number of exemplars,  $F(1, 31) = 293.36, p < .001, \eta^2 = .904$ , indicating that participants who were asked to list 10 exemplars generated more exemplars than participants who were asked to generate 3 exemplars ( $M_s = 9.00$  vs.  $3.00$ , respectively). In addition, a significant main effect of valence indicated that participants who were asked to generate liked individuals generated more exemplars than those

who were asked to generate disliked exemplars, ( $M_s = 6.00$  vs.  $5.47$ , respectively),  $F(1, 31) = 4.58, p = .04, \eta^2 = .129$ . These main effects were qualified by a significant two-way interaction, showing that the effect of number of exemplars was somewhat more pronounced for liked exemplars ( $M_s = 3.00$  vs.  $9.75$ , respectively) as compared with disliked exemplars ( $M_s = 3.00$  vs.  $8.25$ , respectively),  $F(1, 31) = 4.58, p = .04, \eta^2 = .129$ . However, the effect of number was still highly significant for both liked exemplars,  $F(1, 16) = 925.71, p < .001, \eta^2 = .983$ , and disliked exemplars,  $F(1, 15) = 59.36, p < .001, \eta^2 = .798$ , confirming participant compliance with our manipulation.

In addition, a 2 (number of exemplars)  $\times$  2 (valence of exemplars) ANOVA on ease-of-retrieval ratings revealed a significant main effect of valence of exemplars,  $F(1, 31) = 26.02, p < .001, \eta^2 = .456$ , indicating that participants found it easier to generate liked than to generate disliked exemplars ( $M_s = 3.61$  vs.  $6.24$ , respectively). A significant main effect of the number of exemplars indicated that participants experienced higher difficulty in generating 10 than in generating 3 African Americans ( $M_s = 5.56$  vs.  $4.32$ , respectively),  $F(1, 31) = 5.34, p = .03, \eta^2 = .147$ . No other main or interaction effect reached statistical significance.

*Implicit prejudice.* IAT scores for implicit preference for Whites over Blacks were calculated according to the procedures described by Greenwald et al. (1998). Response latencies lower than 300 ms were recoded to 300 ms, and latencies higher than 3,000 ms were recoded to 3,000 ms. Error trials were excluded from analyses. Individual IAT scores were calculated by first log-transforming raw latencies and then subtracting the mean log-transformed latency of the initial combined task (Block 3) from the mean log-transformed latency of the reversed combined task (Block 5). Thus, higher values indicate a stronger preference for Whites over Blacks (which, for the sake of simplicity, we will refer to as implicit prejudice). Even though all analyses were conducted with log-transformed latencies, means are generally reported for nontransformed IAT scores for ease of interpretation. IAT raw latency scores ranged from  $-105$  ms to  $+583$  ms ( $M = 203, SD = 143$ ).

Submitted to a 2 (number of exemplars)  $\times$  2 (valence of exemplars) ANOVA, IAT scores revealed a significant two-way interaction,  $F(1, 31) = 6.90, p = .01, \eta^2 = .182$  (see Figure 1). The obtained interaction pattern is consistent with the assumption that self-generated exemplars affected IAT performance via retrieval experiences. However, it is inconsistent with the assumption that self-generated exemplars affected IAT performance via direct knowledge activation.<sup>2</sup> Specifically, participants who generated disliked African Americans showed a significantly higher level of implicit prejudice when they generated a low number (easy) than when they generated a high number of exemplars (difficult),  $F(1, 15) = 7.99, p = .01, \eta^2 = .384$ . Conversely, participants who generated liked African Americans showed a nonsignificant tendency for higher implicit prejudice when they generated a high number (difficult) than when they generated a low number of exemplars (easy),  $F(1, 16) = 1.79, p = .20, \eta^2 = .100$ . Moreover, implicit prejudice did not differ as a function of the valence of generated exemplars when participants generated 3

<sup>2</sup> The new scoring algorithm by Greenwald et al. (2003) produced the same interaction pattern. However, the interaction effect was only marginally significant in this case,  $F(1, 31) = 3.09, p = .09, \eta^2 = .091$ .

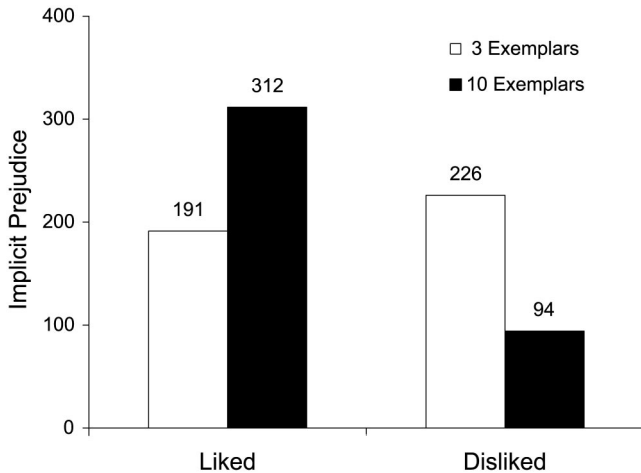


Figure 1. Mean IAT scores of implicit preference for Whites over Blacks as a function of the number (3 vs. 10) and valence (liked vs. disliked) of African Americans generated by participants, Experiment 1.

Africans Americans,  $F(1, 17) = .66, p = .43, \eta^2 = .038$ . However, in generating 10 African Americans, participants showed a significantly higher level of implicit prejudice when they generated liked exemplars than when they generated disliked exemplars,  $F(1, 14) = 8.20, p = .01, \eta^2 = .369$ . IAT scores were significantly different from zero in all of the four experimental conditions (all  $t_s > 3.10$ , all  $p_s < .02$ ).<sup>3</sup> Taken together, these results are consistent with the assumption that self-generated exemplars affected IAT performance via retrieval experiences. However, they are inconsistent with the assumption that the self-generated information affected IAT performance via direct knowledge activation in associative memory.

Discussion

Results from Experiment 1 provide initial evidence for the assumption that the impact of self-generated information on implicit measures is mediated by subjective experiences pertaining to the retrieval of information from memory rather than by direct knowledge activation in associative memory. It is notable that these effects were obtained regardless of whether the information retrieved from memory was congruent or incongruent with the social stereotype of African Americans. In the present study, White participants exhibited lower scores in an IAT designed to assess implicit preference for Whites over Blacks when they had to generate a high number than when they had to generate a low number of disliked African Americans. Conversely, participants tended to show a stronger preference for Whites over Blacks when they had to list a high rather than a low number of liked African Americans.

Even though these results indicate that retrieval experiences can influence performance on the IAT, it remains to be seen whether this effect would emerge on other implicit tasks. Drawing on the distinction between response compatibility and stimulus compatibility outlined in the introduction (see De Houwer, 2003b; Kornblum et al., 1990), the IAT can be regarded as a response compatibility task. Experiment 2 addressed the questions of (a) whether the same pattern would again emerge on a different

response compatibility task and (b) whether, as predicted, the converse pattern would emerge on a task based on stimulus compatibility.

Experiment 2

The main goal of Experiment 2 was to directly compare the processes underlying accessibility effects of self-generated information on stimulus versus response compatibility tasks. Specifically, it was expected that response compatibility processes are influenced by retrieval experiences, whereas stimulus compatibility processes are influenced by direct knowledge activation in associative memory. In Experiment 2, we sought to test these assumptions by comparing the influence of direct knowledge activation and retrieval experiences on Fazio et al.'s (1986) affective priming paradigm and Wittenbrink et al.'s (1997) semantic priming paradigm (see Wittenbrink, Judd, & Park, 2001b). For this purpose, participants were asked to generate a list of either a high or a low number of African Americans they personally disliked and to complete a priming measure of implicit prejudice against African Americans afterward. In the priming task, participants were subliminally primed with the words "Black" or "White," and then had to respond to positive or negative target words that were related either to the positive stereotype of Whites or to the negative stereotype of Blacks. In the response compatibility condition, participants were asked to indicate the valence of the target words (evaluative decision task; see Fazio et al., 1986). In the stimulus compatibility condition, participants had to indicate whether the target word was a meaningful English word or a meaningless nonword (lexical-decision task; see Wittenbrink et al., 1997). Drawing on the considerations outlined above, we expected participants in the response compatibility condition to show higher levels of implicit prejudice when they generated a low number of disliked African Americans (easy) than when they generated a high number of disliked African Americans (difficult). In contrast, participants in the stimulus compatibility condition were expected to show higher levels of implicit prejudice when they generated a high number than when they generated a low number of disliked African Americans.

Method

*Participants and design.* A total of 44 Northwestern University undergraduates (29 women, 15 men) participated in a study on memory and attitudes in return for course credit. Participants were randomly assigned to the four conditions of a 2 (number of exemplars: 3 vs. 10) × 2 (task: response compatibility vs. stimulus compatibility) between-subjects design. Data from one participant with an error rate close to chance-level performance (60.8%) were excluded from analyses.

*Procedure and measures.* Participants were asked to list either 3 or 10 disliked African Americans following the instructions used in Experiment

<sup>3</sup> Note that values significantly higher than zero do not necessarily reflect a significant level of prejudice. First, IAT scores are generally influenced by the specific stimulus material (Bluemke & Friese, in press), thus making inferences about neutral reference points impossible. Second, congruent and incongruent blocks were not counterbalanced in the present study in order to reduce the impact of error variance (Perugini & Galluci, 2004). As such, the present data only reflect relative differences in implicit prejudice as a function of the experimental manipulations, rather than differences in the absolute level of implicit prejudice.



1. Immediately afterward, participants completed a subliminal priming measure of implicit prejudice against African Americans that involved either lexical or evaluative responses to a set of target words. The procedure of the two tasks was identical to that used by Wittenbrink et al. (2001b). Each trial started with a fixation cross (“+”) that was presented for 1,000 ms in the center of the screen. Immediately afterward, the prime word “Black” or “White” was presented for 15 ms, which was followed by a masking stimulus (“XXXXX”) for 250 ms. The masking stimulus was replaced by a target letter sequence that remained on the screen until participants had responded. Target letter sequences included meaningful English words and pronounceable but meaningless nonwords. Meaningful target words were identical to those used by Wittenbrink et al. (2001b), and were either related to the positive stereotype of Whites or to the negative stereotype of Blacks.<sup>4</sup> Target words related to the positive stereotype of Whites were: *intelligent, successful, ambitious, industrious, educated, responsible, wealthy, and ethical*. Target words related to the negative stereotype of Blacks were: *poor, dishonest, complaining, violent, shiftless, superstitious, lazy, and threatening*. Meaningless nonwords were also identical to those used by Wittenbrink et al. (2001b) and included: *ummy, blosed, unstructive, tolid, gafty, fappy, shirsty, joaked, nerfect, ettentive, grestigious, misible, hiberal, lecent, gamous, and ictive*.

In the stimulus compatibility condition, participants were asked to make a lexical decision about whether the target letter sequence constituted a meaningful English word or a meaningless nonword (Wittenbrink et al., 1997). In the response compatibility condition, participants were asked to make an evaluative decision about whether the target letter sequence made them think of something positive and good or something negative and bad (Fazio et al., 1986). Participants in the lexical-decision task had to press a right-hand key (“5” of the number pad) when the target letter sequence constituted a meaningful English word, and they had to press a left-hand key (“A”) when the target letter string constituted a meaningless nonword. Participants in the evaluative decision task were asked to press a right-hand key (“5” of the number pad) when the letter sequence made them think of something positive and to press a left-hand key (“A”) when the letter sequence made them think of something negative. Participants in the evaluative decision task were additionally told that they might see target letter sequences that do not form a meaningful English word. For these words, participants were asked to respond according to their first affective inclination. Aside from these differences in the instructions, the two priming tasks were identical in the two conditions.

The priming tasks were implemented using the software package DirectRT 2002.5 (Empirisoft, New York, NY) and four Pentium IV personal computers (Intel, Santa Clara, CA), with 17-inch monitors and a resolution of 1248 × 768 pixels. Stimuli were presented in Times New Roman typeface in yellow on a black background in a font size of 28 points. Each of the 32 letter sequences was presented twice with each of the two prime words, thus resulting in a total of 128 trials. Order of trials was randomized individually for each participant. Manipulation checks of subjective ease of retrieval were identical to Experiment 1.

## Results

**Manipulation checks.** As with Experiment 1, participants complied reasonably well with the request to generate a list of the required number of individuals. A 2 (number of exemplars) × 2 (task) ANOVA on the number of generated exemplars revealed a highly significant main effect of number of exemplars,  $F(1, 39) = 32.52, p < .001, \eta^2 = .455$ , indicating that participants who were asked to think of 10 exemplars generated more exemplars than participants who were asked to think of 3 exemplars ( $M_s = 7.45$  vs. 2.74, respectively). No other main or interaction effect reached statistical significance.

A 2 (number of exemplars) × 2 (task) ANOVA on ease-of-retrieval ratings revealed a significant main effect of number of exemplars,  $F(1, 39) = 13.74, p = .001, \eta^2 = .261$ . Consistent with

the intended manipulation, participants experienced higher difficulty in generating 10 than 3 disliked African Americans ( $M_s = 6.80$  vs. 5.17, respectively). No other main or interaction effect reached statistical significance.

**Implicit prejudice.** Before conducting analyses, we excluded outliers by discarding responses lower than 300 ms and higher than 3,000 ms. Error trials were excluded from analyses. Latencies were then log-transformed in order to achieve normal distribution (Fazio, 1990). Even though all of the following analyses were conducted with log-transformed latencies, means are generally reported in milliseconds for ease of interpretation. Mean response latencies for the different conditions are presented in Table 1. A 2 (prime type) × 2 (target type) × 2 (task) × 2 (number of exemplars) ANOVA on response latencies revealed a significant main effect of target type,  $F(1, 39) = 20.17, p < .001, \eta^2 = .341$ , a significant main effect of task,  $F(1, 39) = 7.71, p = .008, \eta^2 = .165$ , a significant two-way interaction of task and number of exemplars,  $F(1, 39) = 4.74, p = .04, \eta^2 = .108$ , and, the most important finding, a significant four-way interaction of prime type, target type, task, and number of exemplars,  $F(1, 39) = 9.38, p = .004, \eta^2 = .194$ .

To specify this interaction in terms of the present hypotheses and to allow a direct comparison with Experiment 1, we calculated difference scores reflecting implicit preference for Whites over Blacks. These indices were calculated by first subtracting the mean response latency to positive words after White priming from the mean response latency to positive words after Black priming (i.e., higher scores indicate stronger activation of positivity by White as compared to Black) and by subtracting the mean response latency to negative words after White priming from the mean response latency to negative words after Black priming (i.e., higher scores indicate stronger activation of negativity by White as compared to Black). Negativity scores were then subtracted from positivity scores, resulting in an index of implicit prejudice (i.e., implicit preference for Whites over Blacks).

Figure 2 presents the mean values of this index as a function of the number of generated disliked African Americans and type of task. Consistent with our predictions, participants in the response compatibility condition (see Fazio et al., 1986) showed a significantly lower level of implicit prejudice when they generated a high number of disliked African Americans than when they generated a low number of disliked African Americans,  $F(1, 19) = 6.64, p = .02, \eta^2 = .259$ . In contrast, participants in the stimulus compatibility condition (cf. Wittenbrink et al., 1997) showed a marginally significant tendency for higher implicit prejudice when they generated a high number of disliked African Americans than when they generated a low number of disliked African Americans,  $F(1, 20) = 3.77, p = .07, \eta^2 = .159$ . Implicit prejudice scores tended to be higher than zero in the response compatibility condition when participants generated 3 disliked African Americans,  $t(11) = 2.00, p = .07$ , but they tended to be lower than zero when participants generated 10 disliked African Americans,  $t(8) = -1.95, p = .09$ . In the stimulus compatibility condition, implicit prejudice scores tended to be higher than zero when participants

<sup>4</sup> Wittenbrink et al. (1997, 2001b) generally found no priming effects in response to target words related to the positive stereotype of Blacks and to target words related to the negative stereotype of Whites. For this reason, those target words were not included in the present study.

generated 10 disliked African Americans,  $t(10) = 2.05, p = .07$ , but they were not different from zero when they generated 3 disliked African Americans,  $t(10) = -.16, p = .88$ .

*Discussion*

Results from Experiment 2 support our assumption that the impact of self-generated information on measures based on response compatibility is mediated by retrieval experiences, whereas the impact of self-generated information on measures based on stimulus compatibility is mediated by direct knowledge activation in associative memory. In the present study, participants exhibited higher levels of implicit prejudice against African Americans in a sequential priming task implying a response compatibility mechanism (i.e., affective priming with an evaluative decision task; see Fazio et al., 1986) when they had to generate a low number of disliked African Americans (easy) than when they had to generate a high number of disliked African Americans (difficult). In contrast, participants exhibited higher levels of implicit prejudice in a sequential priming task implying a stimulus compatibility mechanism (i.e., semantic priming with a lexical-decision task; see Wittenbrink et al., 1997) when they had to generate a high number of disliked African Americans than when they had to generate a low number of disliked African Americans.

Even though these findings are consistent with the proposed interpretation in terms of response compatibility versus stimulus compatibility, one could object that the two measures used in Experiment 2 differed not only with regard to their type of compatibility but also with regard to the processing goal involved in these tasks. Whereas the measure used in the response compatibility condition (Fazio et al., 1986) involved an evaluative processing goal, the measure used in the stimulus compatibility condition (Wittenbrink et al., 1997) involved a semantic processing goal. More precisely, participants in the response compatibility condition had the goal of evaluating the presented target stimuli, whereas participants in the stimulus compatibility condition had the goal of extracting the semantic meaning of the presented target stimuli. As such, implicit task performance could have been influenced by retrieval experiences when participants had an evaluative processing goal but by direct knowledge activation when participants a semantic processing goal.<sup>5</sup> Although this kind of effect would be interesting in its own right, such effects of evaluative

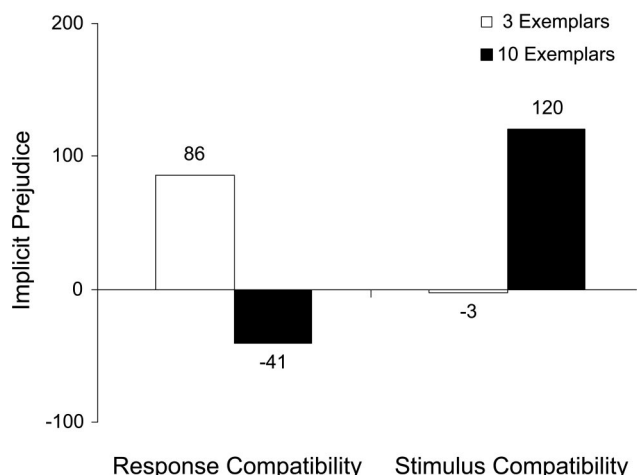


Figure 2. Mean scores of implicit preference for Whites over Blacks as a function of the number of disliked African Americans (3 vs. 10) generated by participants and kind of task (response compatibility vs. stimulus compatibility), Experiment 2.

versus semantic processing goals could be independent of the specific nature of the measure used, thus challenging our interpretation in terms of response compatibility versus stimulus compatibility. This question was addressed in Experiment 3.

Experiment 3

The main goal of Experiment 3 was to test whether the differential influence of knowledge activation and retrieval experiences obtained in Experiment 2 was due to the different processing goals involved in the tasks (i.e., evaluative vs. semantic) or to the specific kind of compatibility (i.e., response compatibility vs. stimulus compatibility). For this purpose, participants in Experiment 3 were asked to generate either a high or a low number of counterstereotypical women (see Blair et al., 2001) and to complete a measure of implicit gender stereotyping afterward. As with Experiment 2, this measure implied either a response compatibility or a stimulus compatibility mechanism. In contrast to Experiment 2, however, the two variants of the task were designed such that both involved a semantic processing goal. Hence, if the effects obtained in Experiment 2 were due to different processing goals (i.e., evaluative vs. semantic), participants in the present study should exhibit a lower level of implicit gender stereotyping when they generated a high number of counterstereotypical women than when they generated a low number of counterstereotypical women. Most importantly, this effect should emerge irrespective of whether the task is based on response compatibility or stimulus compatibility. If, however, the effects obtained in Experiment 2 were due to the specific nature of the task (i.e., response compatibility vs. stimulus compatibility), participants in the response compatibility condition should exhibit a lower level of implicit gender stereotyping when they generated a low number of counterstereotypical women (easy) than when they generated a high number of coun-

Table 1  
Mean Response Latencies in Milliseconds as a Function of Valence of Target Word (Positive vs. Negative), Prime Word (White vs. Black), Kind of Task (Response Compatibility vs. Stimulus Compatibility), and Number of Disliked African Americans Generated (3 vs. 10 Exemplars), Experiment 2

	Positive Target		Negative Target	
	White prime	Black prime	White prime	Black prime
Response compatibility task				
3 exemplars	709	758	793	755
10 exemplars	662	635	717	731
Stimulus compatibility task				
3 exemplars	596	594	610	611
10 exemplars	648	671	751	654

<sup>5</sup> This reasoning is also applicable to the IAT used in Experiment 1, which required participants to determine the valence of the attribute stimuli.



terstereotypical women (difficult). In contrast, participants in the stimulus compatibility condition should exhibit a lower level of implicit gender stereotyping when they generated a high number of counterstereotypical women than when they generated a low number of counterstereotypical women.

## Method

**Participants and design.** A total of 70 University of Western Ontario undergraduates (48 women, 22 men) participated in a study on memory and attitudes in return for course credit. Participants were randomly assigned to the four conditions of a 2 (number of exemplars: 3 vs. 10)  $\times$  2 (task: response compatibility vs. stimulus compatibility) between-subjects design. Because of a computer error, data from two participants were only partially recorded and thus were excluded from analyses. In addition, we excluded the data from one participant with an error rate close to chance-level performance (44.4%). Participant gender did not qualify any of the obtained effects and thus was dropped from the following analyses.

**Procedure and measures.** Participants were asked to generate a list of either 3 or 10 women they considered to be strong. Retrieval instructions were identical to those in Experiment 1. Immediately after the retrieval task, participants were administered a subliminal priming measure of implicit gender stereotyping that involved either lexical or semantic responses to a set of target words (see Banaji & Hardin, 1996). The general procedure of the two tasks was identical to that used in Experiment 2. Each trial started with a fixation cross (“+”) that was present for 1,000 ms in the center of the screen. Immediately afterward, the prime word “male” or “female” was presented for 15 ms, followed by a masking stimulus (“XXXXX”) for 250 ms. The masking stimulus was replaced by a target letter sequence that remained on the screen until participants had responded. Target letter sequences included meaningful English words and pronounceable but meaningless nonwords. Meaningful target words were semantically related to either strength (i.e., stereotypically male) or weakness (i.e., stereotypically female). Target words related to strength were *mighty, powerful, forceful, assertive, potent, tough, vigorous, intense, and big*. Target words related to weakness were *dainty, delicate, weak, fragile, small, tender, slight, wispy, frail, and feeble*. Meaningless nonwords were: *parastelpic, bealp, altgrammindy, asften, cloralizable, reallomit, unpro-maladanian, recrableize, unger, vamit, bingle, cament, flamens, garder, wernd, hallid, cransory, distital, buntyl, and masseter*.

In the stimulus compatibility condition—which conceptually corresponded to the semantic priming condition in Experiment 2—participants were asked to make a lexical decision about whether the target letter sequence constituted a meaningful English word or a meaningless nonword (see Banaji & Hardin, 1996, Experiment 2). In the response compatibility condition—which conceptually corresponded to the affective priming condition in Experiment 2—participants were asked to make a semantic decision about whether the target letter sequence made them think of strength or weakness (see Banaji & Hardin, 1996, Experiment 1). Participants in the stimulus compatibility condition had to press a right-hand key (“5” of the number pad) when the target letter sequence constituted a meaningful English word, and they had to press a left-hand key (“A”) when the target letter string constituted a meaningless nonword. Participants in the response compatibility condition were asked to press a right-hand key (“5” of the number pad) when the letter sequence made them think of strength and to press a left-hand key (“A”) when the letter sequence made them think of weakness. As in Experiment 2, participants in the response compatibility condition were additionally told that they might see target letter sequences that did not form a meaningful English word. Again, for these words, participants were asked to respond according to their first semantic inclination. Aside from these differences in the instructions, the two priming tasks were identical in the two conditions. As such, the stimulus compatibility task (i.e., lexical-decision task) reflected a task structure similar to the semantic priming paradigm in Experiment 2 (see Wittenbrink et al., 1997). In contrast, the response compatibility task (i.e.,

semantic decision task) reflected a task structure similar to the affective priming paradigm in Experiment 2 (see Fazio et al., 1986). Even though the two tasks differed with regard to their underlying structure (i.e., stimulus compatibility vs. response compatibility), both tasks implied a semantic processing goal (i.e., participants had to extract the semantic meaning of the target words, rather than their valence). Each of the 40 target stimuli was presented twice with each of the two prime words, thus resulting in a total of 160 trials. Order of trials was randomized individually for each participant. Manipulation checks of subjective ease of retrieval were identical to those used in Experiment 1.

## Results

**Manipulation checks.** Participants generally complied with the request to generate a list of the required number of women. A 2 (number of exemplars)  $\times$  2 (task) ANOVA on the number of generated exemplars revealed a highly significant main effect of number of exemplars,  $F(1, 63) = 148.35, p < .001, \eta^2 = .702$ , indicating that participants who were asked to list 10 exemplars generated more exemplars than participants who were asked to list 3 exemplars ( $M_s = 8.76$  vs. 2.76, respectively). No other main or interaction effect reached statistical significance.

A 2 (number of exemplars)  $\times$  2 (task) ANOVA on ease-of-retrieval ratings revealed a significant main effect of the number of exemplars,  $F(1, 63) = 9.92, p = .002, \eta^2 = .136$ . Consistent with the intended manipulation, participants experienced higher difficulty in generating a list of 10 strong women than in generating a list of 3 strong women ( $M_s = 5.26$  vs. 4.09, respectively). No other main or interaction effect reached statistical significance.

**Implicit stereotyping.** Outliers and error trials were treated according to the procedures described for Experiment 2. Response latencies were then log-transformed in order to achieve normal distribution (Fazio, 1990). Even though all of the following analyses were conducted with log-transformed latencies, means are generally reported in milliseconds for ease of interpretation. Means and standard deviations for the different conditions are presented in Table 2. A 2 (prime type)  $\times$  2 (target type)  $\times$  2 (task)  $\times$  2 (number of exemplars) ANOVA on response latencies revealed a significant main effect of prime type,  $F(1, 63) = 5.78, p = .02, \eta^2 = .084$ , a significant main effect of target type,  $F(1, 63) = 23.79, p < .001, \eta^2 = .274$ , and, the most important finding, a significant four-way interaction of prime type, target type, task, and number of exemplars,  $F(1, 63) = 8.37, p = .005, \eta^2 = .117$ .

Table 2  
*Mean Response Latencies in Milliseconds as a Function of Target Word (Weakness-Related vs. Strength-Related), Prime Word (Female vs. Male), Kind of Task (Response Compatibility vs. Stimulus Compatibility), and Number of Strong Women Generated (3 vs. 10 Exemplars), Experiment 3*

	Weakness Target		Strength Target	
	Female prime	Male prime	Female prime	Male prime
Response compatibility task				
3 exemplars	776	758	716	740
10 exemplars	763	776	746	691
Stimulus compatibility task				
3 exemplars	602	606	579	563
10 exemplars	657	610	606	623

To specify this interaction in terms of the present hypotheses and to allow a direct comparison with Experiments 1 and 2, we calculated difference scores reflecting the degree of implicit gender stereotyping. These indices were calculated by first subtracting the mean response latency to strength-related words after male priming from the mean response latency to strength-related words after female priming (i.e., higher scores indicate stronger activation of strength for male compared with female primes) and by subtracting the mean response latency to weakness-related words after female priming from the mean response latency to weakness-related words after male priming (i.e., higher scores indicate stronger activation of weakness for female compared with male primes). The two scores were then averaged, resulting in an index of implicit gender stereotyping.

Figure 3 presents the mean values of this index as a function of the number of generated strong women and type of task. Consistent with our predictions, participants in the response compatibility condition (i.e., semantic decision task) showed a higher level of implicit gender stereotyping when they generated a high number of counterstereotypical women (difficult) than when they generated a low number of counterstereotypical women (easy),  $F(1, 31) = 4.14, p = .05, \eta^2 = .118$ . In contrast, participants in the stimulus compatibility condition (i.e., lexical-decision task) showed a lower level of implicit gender stereotyping when they generated a high number of counterstereotypical women than when they generated a low number of counterstereotypical women,  $F(1, 32) = 4.25, p < .05, \eta^2 = .117$ . Implicit stereotyping scores tended to be higher than zero in the response compatibility condition when participants generated 10 counterstereotypical women,  $t(15) = 2.10, p = .05$ , but scores did not differ from zero when participants generated 3 counterstereotypical women,  $t(16) = -.93, p = .37$ . In the stimulus compatibility condition, implicit stereotyping scores were significantly lower than zero when participants generated 10 counterstereotypical women,  $t(17) = -2.14, p < .05$ , but scores did not differ from zero when participants generated 3 counterstereotypical women,  $t(15) = .78, p = .45$ .

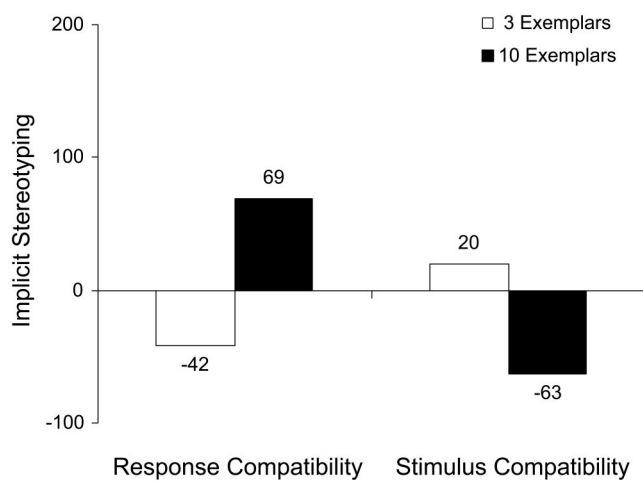


Figure 3. Mean scores of implicit gender stereotyping as a function of number of strong women (3 vs. 10) generated by participants and kind of task (response compatibility vs. stimulus compatibility), Experiment 3.

Discussion

Results from Experiment 3 corroborated our assumption that the effects obtained in Experiment 2 were due to the particular nature of the tasks used (i.e., response compatibility vs. stimulus compatibility) rather than to different processing goals (i.e., evaluative vs. semantic). Using a sequential priming task that generally involved a semantic processing goal, performance in this task was influenced by the ease of retrieving relevant information from memory when it was based on response compatibility. However, the same task was influenced by the overall amount of activated information when it was based on stimulus compatibility. If the effects obtained in Experiment 2 were indeed due to the different processing goals involved in the two tasks, the two measures used in Experiment 3 should have been influenced by the overall amount of activated information irrespective of whether they were based on stimulus or response compatibility.

General Discussion

In contrast to the prevailing assumption that implicit measures reflect stable representations arising from long-term socialization experiences (e.g., Dovidio et al., 2001; Greenwald & Banaji, 1995; Rudman, 2004; Wilson et al., 2000), recent research has shown that performance on implicit measures is highly susceptible to contextual influences. The main goal of the present research was to investigate the mechanisms underlying a particular kind of contextual influence on implicit task performance, namely the impact of self-generated information (e.g., Blair et al., 2001). Specifically, we were interested in whether self-generated information affects implicit measures by direct knowledge activation in associative memory or by subjective experiences pertaining to the retrieval of information from memory. Using Schwarz et al.'s (1991) ease-of-retrieval paradigm for the present studies, we found that the processes underlying accessibility effects of self-generated information differ as a function of the structural properties of the task (see De Houwer, 2003b; Kornblum et al., 1990). Specifically, our results suggest that implicit measures that are based on response compatibility are influenced by the ease experienced in retrieving relevant information from memory. In contrast, implicit measures that are based on stimulus compatibility are influenced by direct knowledge activation in associative memory. Of note, the respective effects were obtained regardless of whether the information retrieved from memory confirmed or disconfirmed a social stereotype (e.g., disliked African Americans, strong women). In the present studies, effects of retrieval experiences were demonstrated for the IAT (Greenwald et al., 1998), affective priming using an evaluation decision task (Fazio et al., 1986), and semantic priming using a semantic categorization task (see Banaji & Hardin, 1996, Experiment 1); effects of knowledge activation were shown for two semantic priming tasks using a lexical-decision task (Wittenbrink et al., 1997; see also Banaji & Hardin, 1996, Experiment 2). Even though these measures represent only a small subset of all implicit measures that are available to date, we believe that the present findings can be generalized to other response compatibility tasks, such as, for example, the Extrinsic Affective Simon Task (De Houwer, 2003a), as well as to other stimulus compatibility tasks, such as affective priming using a pronunciation task (Bargh, Chaiken, Raymond, & Hymes, 1996).

### *Underlying Mechanisms of Contextual Influences*

Compared with previous research, the present studies go beyond the mere demonstration of contextual influences on implicit measures because by investigating the underlying mechanisms. As such, the present results expand on previous research by Gawronski et al. (2005a) who investigated the underlying processes of how externally provided context stimuli influence implicit evaluations in Fazio et al.'s (1986) affective priming task. Drawing on two alternative accounts of affective priming effects in the evaluative decision task—spreading activation versus response compatibility—Gawronski et al. (2005a) argued that the impact of evaluative context stimuli could be mediated either by (a) differences in the attention to evaluative information or (b) differences in the activation of evaluative information in associative memory. Whereas the first mechanism can be derived from the response compatibility account, the latter is a direct implication of the spreading activation account (see Klauer & Musch, 2003). Whereas the response compatibility account predicts a contrast effect of evaluative context stimuli, the spreading activation account implies an additive effect. Results clearly supported the prediction derived from the response compatibility account. However, they are inconsistent with the prediction derived from the spreading activation account. Specifically, affective priming effects elicited by a given prime stimulus were more pronounced when this stimulus was preceded by a context prime of the opposite valence. In contrast, affective priming effects were less pronounced when the prime stimulus was preceded by a context prime of the same valence. These results suggest that the impact of evaluative context stimuli in affective priming is mediated by contrast effects in the attention to evaluative information, rather than by additive effects in the activation of evaluative information in associative memory. Most interestingly, whereas affective priming effects in the evaluative decision task showed contrast effects of evaluative context stimuli (Gawronski et al., 2005a), semantic priming effects using a lexical-decision task showed additive effects in a conceptually identical study (Balota & Paul, 1996). Hence, it seems that similar contexts can produce different effects on implicit measures depending on whether these measures are based on response compatibility (e.g., affective priming with an evaluative decision task) or stimulus compatibility (e.g., semantic priming with a lexical-decision task).

The present studies expand on the obtained differences between stimulus versus response compatibility tasks by investigating the mechanisms underlying accessibility effects of self-generated (in contrast to externally provided) information. Whereas Gawronski et al. (2005a) studied the influence of context stimuli that were directly included into the affective priming task, the present research investigated how information retrieved from memory influences different types of implicit measures. Specifically, our findings indicate that the impact of self-generated information on measures based on stimulus compatibility is mediated by direct knowledge activation in associative memory. In contrast, the impact of self-generated information on measures based on response compatibility seems to be mediated by the experienced ease of retrieving relevant information from memory. We believe that future investigations on the underlying mechanisms of other kinds of context effects could help to provide a better understanding not only of contextual influences per se but of implicit measures in general.

### *Prediction of Social Behavior*

A common finding in research on implicit social cognition is that implicit measures are better predictors of spontaneous behavior, whereas explicit measures are better predictors of deliberate behavior (e.g., Asendorpf, Banse, & Mücke, 2002; Dovidio, Kawakami, Johnson, Johnson, & Howard, 1997; Egloff & Schmukle, 2002; Fazio et al., 1995; Neumann, Hülsebeck, & Seibt, 2004). To our knowledge, however, studies investigating the usefulness of implicit measures in predicting spontaneous behavior have been conducted exclusively using response compatibility tasks, such as Greenwald et al.'s (1998) IAT or Fazio et al.'s (1986) affective priming task. Thus, the question of whether implicit measures that are based on stimulus compatibility (e.g., Wittenbrink et al., 1997) show similar effects in the prediction of spontaneous behavior remains open. Drawing on the present findings, it seems possible that the predictive power of response compatibility tasks is due to their relation to subjective feelings. That is, subjective feelings may directly translate into overt responses, thus influencing not only response tendencies in response compatibility tasks but also spontaneous reactions in social interactions. As such, the obtained relations between performance in response compatibility tasks and spontaneous behavior may be due to their common grounding in subjective feelings.

This, however, may be different for implicit measures that are based on processes of stimulus compatibility (e.g., Wittenbrink et al., 1997). According to the present findings, these measures seem to be more directly related to the activation of concepts in associative memory. As such, implicit measures based on stimulus compatibility may be better predictors of behaviors that imply a conceptual, cognitive component. However, they may be less suitable to predict responses that imply an experiential, affective component. Consistent with this assumption, Wittenbrink et al. (2001b) found that a sequential priming task based on response compatibility (Fazio et al., 1986) exhibited higher correlations to explicit measures that implied affective rather than conceptual responses. In contrast, the same priming task based on stimulus compatibility (Wittenbrink et al., 1997) showed higher correlations to explicit measures implying conceptual rather than affective responses. Future research may help to clarify the differential relation of response compatibility and stimulus compatibility tasks to social behavior.

### *Implications for the Ease-of-Retrieval Effect*

The present results also have important implications for the interpretation of ease-of-retrieval effects in social judgment. Many accounts of the ease-of-retrieval effect assume that the impact of retrieval experiences on social judgments is mediated by higher order metacognitive inferences (e.g., Schwarz et al., 1991; Torralba, Petty, & Briñol, 2002). Schwarz et al. (1991), for example, argued that people commonly use their retrieval experiences to make inferences about the total number of available instances. For instance, if people experience difficulty in retrieving assertive behaviors that they had engaged in, they may infer that there are only few examples of assertive behaviors, and thus they judge themselves lower in assertiveness. If, however, people experience the retrieval of assertive behaviors as easy, they may infer that there are many examples of assertive behaviors, and thus they judge themselves higher in assertiveness. In a similar vein, Tor-



mala et al. (2002) proposed that the influence of retrieval experiences on social judgments is mediated by judgmental confidence. For instance, if people experience the retrieval of assertive behaviors as difficult, their subjective confidence in the activated information may be reduced, thus leading to lower judgments of assertiveness. If, however, people experience the retrieval of assertive behaviors as easy, subjective confidence may be enhanced, thus leading to higher judgments of assertiveness. Hence, given the present finding that retrieval experiences influence performance on implicit response compatibility tasks, one could argue that these measures do not reflect automatic processes but are the result of higher order metacognitive inferences pertaining to the number of available examples (Schwarz et al., 1991) or judgmental confidence (Tormala et al., 2002).

Alternatively, however, one could question whether retrieval experiences actually require higher order inferences to influence judgments and behavior. In contrast, retrieval experiences may impact judgments and behavior rather automatically (e.g., Menon & Raghbir, 2003), thus challenging previous accounts of the ease-of-retrieval effect in terms of higher order metacognitive inferences. This assumption would be consistent with the results obtained in the present studies, showing ease-of-retrieval effects even for subliminal priming measures (Experiments 2 and 3).

In outlining this argument, it seems useful to reconsider the findings that are commonly interpreted as evidence for the metacognitive account. In one of their seminal studies, for example, Schwarz et al. (1991) manipulated the diagnostic value of retrieval experiences by telling participants that most people experience the retrieval task as either difficult or easy. Subjective retrieval experiences of high versus low difficulty were induced by asking participants to generate either a high or a low number of relevant examples. Depending on the provided information about task difficulty, participants were expected to perceive their retrieval experiences as diagnostic only when these experiences were in contrast to those of other people. However, participants should consider their retrieval experiences as nondiagnostic when their retrieval experiences do not deviate from those of other people. Drawing on these considerations, Schwarz et al. (1991) predicted and found ease-of-retrieval effects on social judgments only when the perceived diagnostic value of retrieval experiences was high. However, when the perceived diagnostic value of retrieval experiences was low, participants based their judgments on the overall amount of the activated information. These findings are usually interpreted as evidence that the impact of retrieval experiences on social judgments depends on people's causal attributions for these experiences, thus implying higher order metacognitive inferences. Drawing on this interpretation, one could argue that response compatibility tasks do not reflect automatic processes but are influenced by higher order inferences pertaining to the cause of retrieval experiences.

An alternative interpretation of Schwarz et al.'s (1991) findings, however, is implied by Whittlesea and Williams' (1998, 2000) research on feelings of familiarity. Specifically, these authors raised the question why processing fluency produces feelings of familiarity under some conditions but not under others. Whittlesea and Williams argued that a crucial factor determining the emergence of feelings of familiarity is the discrepancy between expected and actual fluency. That is, feelings of familiarity arise only when the actual fluency is higher than the expected fluency but not when actual and expected fluency are equal. Applied to the present

question, one could argue that the same might be true for retrieval experiences. Specifically, the emergence of retrieval experiences might depend on the discrepancy between expected and actual cognitive effort (Menon & Raghbir, 2003). If this assumption is true, the diagnosticity manipulation used by Schwarz et al. (1991) could have affected the relative discrepancy between expected and actual cognitive effort and thus the *emergence* of retrieval experiences per se. That is, the retrieval task may have induced retrieval experiences only when expected and actual cognitive effort differed but not when expected and actual cognitive effort matched. Such influences on the emergence of retrieval experiences depend on mere expectancy violations rather than on higher order metacognitive inferences. In other words, if a priori expectancies regarding cognitive effort affect the mere emergence of retrieval experiences and if retrieval experiences directly affect the activation of response tendencies in response compatibility tasks, retrieval expectancies could be sufficient to affect performance on response compatibility tasks without requiring higher order metacognitive inferences. Given that both Experiment 2 and Experiment 3 used a subliminal priming procedure, the proposed explanation in terms of expectancy violation seems to provide a better account for the present data than the one posed in terms of higher order metacognitive inferences. Nevertheless, future research should help to clarify the precise nature of ease-of-retrieval effects on social judgments and response compatibility processes.

## Conclusion

The main goal of the present research was to investigate the mechanisms underlying accessibility effects of self-generated information on implicit measures (e.g., Blair et al., 2001). Drawing on the distinction between response compatibility and stimulus compatibility (see De Houwer, 2003b; Kornblum et al., 1990), the present results indicate that implicit measures based on response compatibility are influenced by the ease experienced in retrieving relevant information from memory. In contrast, implicit measures based on stimulus compatibility are influenced by direct knowledge activation in associative memory. Therefore, context effects on different kinds of implicit measures can differ with regard to their underlying processes even when they show similar effects on a superficial level. Thus, future studies investigating contextual influences on implicit measures may benefit from going beyond the mere demonstration of such influences to focusing more strongly on their underlying processes. Such a focus may provide a better understanding not only of contextual influences per se but of implicit measures in general.

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