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Effects of Self-Control Resources on the Interplay between Implicit and Explicit Attitude Processes in the Subliminal Mere Exposure Paradigm

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Abstract

Recent studies have shown that the mere exposure effect under subliminal conditions is more likely to emerge for implicit attitudes than explicit attitudes. We tested whether the implicit effects of subliminal mere exposure could spill over to the explicit level by depleting self-control resources. Participants were subliminally exposed to a novel female photograph. Then, implicit and explicit attitudes toward an exposed and an unexposed photograph were measured. This basic design was crossed with a cognitive load manipulation, which should deplete the capacity of self-control resources (low cognitive load vs. high cognitive load). Results showed that the subliminal mere exposure effect occurred for not only implicit attitudes but also explicit attitudes when participants' cognitive resources were depleted in the high cognitive load condition. In contrast, when cognitive resources were not depleted, the subliminal mere exposure effect only emerged for implicit attitudes. These findings support the contention that self-control failures could facilitate implicit effects of subliminal mere exposure toward the explicit level.

Keywords: mere exposure effect, cognitive load, self-control, implicit attitude, explicit attitude, subliminal stimuli

1. Introduction

1.1 Mere Exposure Effects and Conscious Awareness

Zajonc (1968) originally described the mere exposure effect and observed, "The mere repeated exposure of the individual to a stimulus is a sufficient condition for enhancement of his attitude toward it" (p. 1). More than 250 experimental articles in the past 45 years have examined the mere exposure effect. A broad array of stimuli encountered inside and outside of the laboratory, including photographs, drawings, polygons, words, and people, have been shown to produce this effect (for a review, see Bornstein, 1989).

The mere exposure effect is thought to be independent of the conscious awareness of exposed stimuli (Bornstein & D'Agostino, 1992; Kunst-Wilson & Zajonc, 1980). For instance, Kunst-Wilson and Zajonc (1980) showed participants 10 irregular polygon figures for 1 ms each and repeated this five times. Participants reported that they had seen something at this brief duration, but they were unsure of what they had actually seen. After seeing the repeated stimuli, participants were prompted to make forced-choice preference judgments and recognition judgments on pairs of exposed and unexposed stimuli. Results showed that exposed stimuli were preferred significantly more than chance, even though recognition accuracy was no better than chance. However, follow-up studies have found that the mere exposure effect is less likely to occur under subliminal conditions (Brooks & Watkins, 1989; Fox & Burns, 1993; Newell & Bright, 2003; Newell & Shank, 2007; Reber, Winkielman, & Schwarz, 1998; Seamon, Marsh, & Brody, 1984; Szpunar, Schellenberg, & Pliner, 2004). For example, Fox and Burns (1993) attempted to replicate Bornstein and D'Agostino's (1992) findings and showed that the mere exposure effect only occurred when stimuli were presented under supraliminal conditions but not under subliminal conditions. Thus, it is possible that repeatedly exposing a person to a stimulus under subliminal conditions may be insufficient to produce increased preference for that stimulus.

1.2 Implicit and Explicit Attitude Changes

Research on attitudes has been going through a revolutionary change due to newly developed indirect measures. These new measures differ from traditional self-report measures in that they do not require participants' explicit evaluations. Instead, indirect measures are based on participants' performance on experimental tasks, such as priming and response interference tasks. Examples of indirect measures are the affective priming task (Fazio, Jackson, Dunton, & Williams, 1995), the Implicit Association Test (Greenwald, McGhee, & Schwartz, 1998), and the Affect Misattribution Procedure (Payne, Cheng, Govorun, & Stewart, 2005). Attitudes measured by these indirect methods are called implicit attitudes, in contrast to explicit attitudes measured by traditional direct methods that rely on conscious self-reports. Some researchers have suggested that implicit and explicit attitude measures tap into two, distinct evaluative systems that have roots in qualitatively different, albeit interrelated, processes (Olson & Fazio, 2006; Gawronski & Bodenhausen, 2006; Rydell & McConnel, 2006; Rydell, McConnell, Mackie, & Strain, 2006). These dual system models provide a useful framework for understanding implicit and explicit attitude change (Gawronski & Bodenhausen, 2006; Rydell & McConnell, 2006). One system is associative and operates through automatic processes. The other is propositional and operates through controlled processes. According to these models, changes in implicit attitudes are likely to be caused by associative learning, whereas propositional learning influences explicit attitudes. Therefore, in some cases, experimental manipulations might only affect implicit attitudes but not explicit attitudes. From this dual model perspective, such patterns should emerge when a given factor leads to a change in the associative structure in memory and, additionally, other relevant propositions lead to a rejection of associative evaluations as a valid basis for an evaluative judgment. An illustrative example is found in research on (subliminal) evaluative conditioning (Dijksterhuis, 2004; Gawronski & LeBel, 2008; Grumm, Nestler, & von Collani, 2009) and repeated approach-avoidance behavior (Kawakami, Steele, Cifa, Phills, & Dovidio, 2008). According to Gawronski and Bodenhausen (2006), these asymmetrical influences may have been caused by the fact that people usually feel that they must have reasons for making evaluative judgments (Yzerbyt, Schadron, Leyens, & Rocher, 1994). Although people have access to the evaluative implication of the associative information, such as those involved in subliminal stimuli that is presented below conscious awareness, this information is not incorporated into an explicit attitude. This is because people perceive this information as invalid input and do not have a reason to express an explicit change in attitude.

With regard to the mere exposure effect, only a few studies have focused on differences between implicit and explicit attitudes (e.g., Kawakami, 2012; Smith, Dijksterhuis, & Chaiken, 2008). This work has demonstrated that when stimuli are presented subliminally, changes occur in implicit but not explicit attitudes. As mentioned above, this asymmetrical influence is because people usually feel they must have reasons for making firm, evaluative judgments (Yzerbyt et al., 1994). Under subliminal conditions, clearly identifiable reasons for affirming the validity of evaluative judgments are absent. Individuals may reserve judgment because they do not feel "entitled" to judge. In particular, for nonsense or novel stimuli of the type mainly used in past research (Bornstein, 1989), it may be hard to generate any reason to prefer a given stimulus. Thus, participants may revert to the scale midpoint, given that participants have no justification for making any firm positive or negative judgments (Yzerbyt et al., 1994). Previous findings showing that the mere exposure effect does not necessarily occur under subliminal conditions may be due to the use of self-report methods, such as Likert scales or semantic differentials. These measures possibly reflect the propositional processes that underlie explicit attitudes as evaluative judgments. This results from syllogistic inferences based on propositional information considered relevant for a given judgment.

Changes in implicit attitudes caused by exposure to subliminal stimuli are rarely expressed explicitly, as mentioned above. Can such changes become explicit? Here, we provide a new way to address this question by demonstrating that depleting self-control resources might cause implicit effects of subliminal mere exposure to spill over to the explicit level.

1.3 Self-Control and Explicit Attitudes

Self-control plays an important role in our lives because even the maintenance of a coherent train of thought and occasional engagement in effortful thinking require self-control. However, self-control undoubtedly fails for a variety of reasons since self-control requires attention and effort, which deplete limited cognitive resources (Muraven, Tice, & Baumeister, 1998). It is known that people who deplete their cognitive resources are more likely to make selfish choices (Hinson, Jameson, & Whitney, 2003), make superficial judgments in social situations (Friese, Hofmann, & Wänke, 2009), and undertake short-term focused actions (Shiv & Fedorikhin, 1999; Ward & Mann, 2000). More importantly, propositional processes that relate to the formation and change of explicit attitudes are dependent on self-control (Hofmann, Friese, & Strack, 2009; Hofmann, Rauch, &

Gawronski, 2007; Strack & Deutsch, 2004) because propositional processes are based on deliberative and conscious thoughts that use a fair share of cognitive resources. When self-control resources are low, people tend to rely on their impulses or intuitions relating to associative processes that underlie the implicit attitude (Hofmann et al., 2007). Therefore, any manipulation that depletes cognitive resources should weaken self-control, resulting in a reliance on an individual's intuitions. This allows someone to report directly the evaluative implication of associative information, such as subliminal mere exposures. More precisely, when participants make explicit evaluations, participants believe that judging something based on a vague sense of positivity or negativity is inappropriate (Yzerbyt et al., 1994). However, if an individual's cognitive resource capacity is depleted, he/she likely cannot control these social judgeability concerns. As a result, participants' evaluative implications regarding associative information could spill over to the explicit level.

Indeed, correlational research examining the correspondence between implicit and explicit attitude measures provides some evidence for this hypothesis. Here, participants who were instructed to either "trust their intuition" (Jordan, Whitfield, & Zeigler-Hill, 2007) or "go with their gut" before responding (Ranganath, Smith, & Nosek, 2008) modified their explicit attitude reports, bringing them more in line with the attitudes expressed on implicit measures. Namely, modified instructions free participants from social judgeability concerns, thereby encouraging participants to rely on their own intuitions relating to associative processes.

1.4 Present Study

We tested the hypotheses that participants with depleted cognitive resources would show the subliminal mere exposure effect, not only on implicit attitudes, but also on explicit attitudes. In contrast, when participants have enough cognitive resources, the subliminal mere exposure effect would only emerge for implicit attitudes. To test these hypotheses, we conducted a subliminal mere exposure experiment in which participants were exposed to a novel female photograph. Then, their implicit and explicit attitudes toward an exposed and an unexposed photograph were measured. Critically, we crossed this basic design with a cognitive load manipulation that depleted cognitive resource capacity. Although all participants were asked to perform single-digit calculation tasks between the exposure and attitude measurements, whereby participants had to memorize answers in their exact order, task difficulty was manipulated. For half of the participants, the order of correct answers was easy to memorize (low cognitive load), and for the remaining half, the order of correct answers was difficult to memorize (high cognitive load). This type of manipulation has been used previously in self-control research and was adequately found to deplete cognitive resources (Lalwani, 2009).

2. Method

2.1 Participants and Design

Sixty-nine undergraduates (40 female) participated voluntarily in this experiment. Participants' mean age was 20.25 years (SD = 1.14). They were randomly assigned to a 2 (stimulus exposure: exposed vs. unexposed) × 2 (cognitive load: high vs. low) mixed design. Stimulus exposure was a within-subjects factor while cognitive load was a between-subjects factor.

2.2 Apparatus

This experiment was conducted on a desktop PC running Microsoft Windows XP. Stimuli were displayed on a 17-inch 100-Hz CRT screen, and the viewing distance was always 57 cm.

2.3 Stimuli

Photographs of two females were used as stimuli. In a preliminary study, 15 participants (7 male, 8 female) who did not participate in the main experiment, rated these photographs based on the question, "How much do you like this person?" on a 9-point scale (from 1 = *not at all* to 9 = *very much*). Results showed that the two females were evaluated as equally favorable (Ms = 5.04 vs. 5.25, respectively), $t < 1$. In addition, there was no significant difference between these scores and the midpoint on a 9-point scale (i.e., 5), ts < .1. All photographs were shown as grayscale images, approximately 235 pixels x 314 pixels in the main experiment.

2.4 Procedures

Participants were tested individually. The experimenter told participants that this experiment investigated how rapidly people could process visual information. After providing informed consent, all participants performed the exposure task in which one of the two photographs were presented. The exposed stimulus was randomized among participants. The format of each trial was as follows: (1) a fixation cross appeared in the middle of the computer screen for 2,000 ms, (2) a photograph was shown for 10 ms, and (3) a black-and-white pattern mask appeared for 200 ms. There was a 1,000 ms interval between each trial. The exposure task consisted of 60 trials,

during which the photograph of the target person was presented 20 times, and 4 nonsense figures were also presented as filler stimuli, 10 times each, for 40 trials. The presentation order of the 60 trials was randomly determined for each participant.

After the exposure task, all participants were required to perform single-digit calculation tasks in which participants had to memorize responses to the task in the exact order presented and report answers to the experimenter at the end of the experiment. The calculation tasks consisted of 9 addition and subtraction (e.g., 8 − 3 = ?, 3 + 4 = ?) operations. The calculations appeared in the middle of the computer screen for 2 s each, during which participants were required to push the correct number on the keyboard. Although all calculations were the same within the high or low cognitive load conditions, the order of the calculations depended on the condition. In the low cognitive load condition, the order of correct answers was easy to memorize (e.g., 1, 2, 3, 4, 5, 6, 7, 8, and 9). In the high cognitive load condition, the order of correct answers was difficult to memorize (e.g., 5, 9, 3, 8, 1, 6, 2, 4, and 7).

Next, participants were administered the implicit and explicit measure, which was designed to assess attitudes toward the exposed photograph and an unexposed photograph. Measure order was counterbalanced across participants.

At the end of the experiment, participants were required to report answers and the subjective difficulty of the calculation tasks.

2.5 Attitude Assessment

2.5.1 Implicit Attitude Measure

To assess implicit attitudes, we used a variant of the affective priming paradigm (Fazio et al., 1995). Participants were first presented with a blank screen for 1,000 ms, which was followed by a picture prime showing one of the two photographs (exposed or unexposed) for 200 ms. Picture primes were immediately followed by a target word (SOA = 200 ms). Participants were required to push the assigned keys as quickly as possible whether the target word presented on the screen was positive or negative. The assignment of response keys was randomized across participants. Each of the two picture primes was presented once each with 20 positive target words (i.e., happy, pleasure, freedom, honest, lucky, paradise, vacation, heaven, hope, honor, miracle, sunrise, loyal, peace, smile, heaven, beautiful, brilliant, safe, warm) and 20 negative words (i.e., bad, sad, pain, sickness, accident, death, grief, evil, fear, angry, rude, hell, agony, ugly, lonely, disgust, poverty, tragedy, abuse, dark), resulting in 80 trials.

The implicit attitude score was calculated by subtracting the mean response latency for positive target words from the mean response latency for negative target words for each of the two primes. Thus, higher scores reflected more positive implicit attitudes. Before analyzing the affective priming data, we eliminated latencies from incorrect responses and truncated outlier latencies that were higher than 1,500 ms. Response latencies were then log-transformed in order to achieve a normal distribution. Although analyses were conducted with log-transformed latencies, means were reported in milliseconds for ease of interpretation.

2.5.2 Explicit Attitude Measure

To assess explicit attitudes, we asked participants to judge each photograph on the question, "How much do you like this person?" on a 9-point rating scale (from 1 = *not at all* to 9 = *very much*). We counterbalanced the photograph order.

3. Results

3.1 Manipulation Check

To ensure that we successfully manipulated the cognitive load factor, we analyzed the subjective difficulty (from 1 = *very easy* to 9 = *very difficult*) of memorizing answers on the calculation task. Results showed that participants in the high cognitive load condition reported the memorizing task as being much more difficult than those in the low cognitive load condition (*M*s = 8.41 vs. 1.14 respectively), t (67) = 49.90, $p < .001$, $d = 12.20$. Indeed, the proportion of participants who were able to recall the correct answer was only 8% in the high cognitive load condition and 100% in the low cognitive load condition.

3.2 Implicit Attitudes

Mean implicit attitude scores for stimuli in both conditions are shown in Figure 1. A 2 (stimulus exposure: exposed vs. unexposed) × 2 (cognitive load: high vs. low) mixed-model ANOVA showed a significant main effect of stimulus exposure, $F(1, 67) = 8.70$, $p < .01$, $\eta_p^2 = .12$. As shown in Figure 1, participants' implicit attitudes indicated a greater preference for exposed photographs as compared to unexposed ones. However, there

was no significant interaction, $F(1, 67) = .001$, $p = .97$, and no main effect of cognitive load, $F(1, 67) = .07$, $p = .79$. Thus, the subliminal mere exposure effect occurred for implicit attitudes regardless of high or low cognitive load.

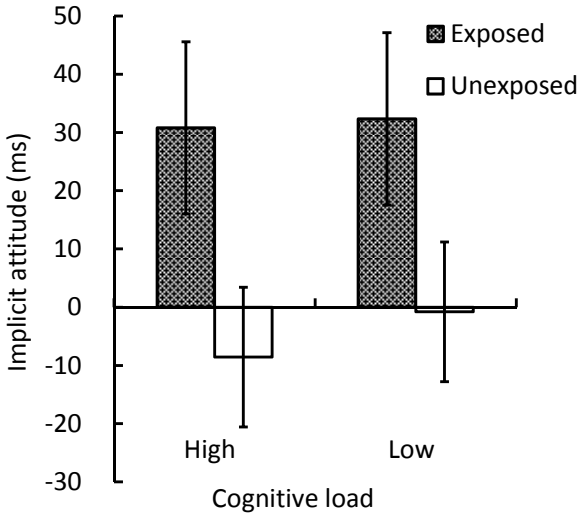

Figure 1. Mean implicit attitude scores (ms) as a function of stimulus exposure (exposed vs. unexposed) and cognitive load (high vs. low) Higher values indicate more positive attitudes, the bars indicate ±1 standard errors of the mean

3.3 Explicit Attitudes

Mean explicit attitude scores for stimuli in both conditions are shown in Figure 2. A 2 (stimulus exposure: exposed vs. unexposed) ×2 (cognitive load: high vs. low) mixed-model ANOVA was conducted. Overall, a significant main effect of stimulus exposure showed a greater preference for exposed photographs compared to unexposed ones as with implicit attitudes, $F(1, 67) = 9.99$, $p < .01$, $\eta_p^2 = .13$. However, this main effect was qualified by the predicted interaction between cognitive load and stimulus exposure, $F(1, 67) = 15.56$, $p < .001$, $\eta_p^2 = .19$. As shown in Figure 2, a series of simple effects tests showed that participants in the high cognitive load condition evaluated the exposed stimuli as more likable than the unexposed stimuli, $F(1, 67) = 24.88$, $p < .001$, $\eta_p^2 = .27$. On the other hand, no such effect was observed in the low cognitive load condition, $F < 1$. This indicated that the subliminal mere exposure effect on explicit attitudes occurred in the high cognitive load condition but not the low cognitive load condition.

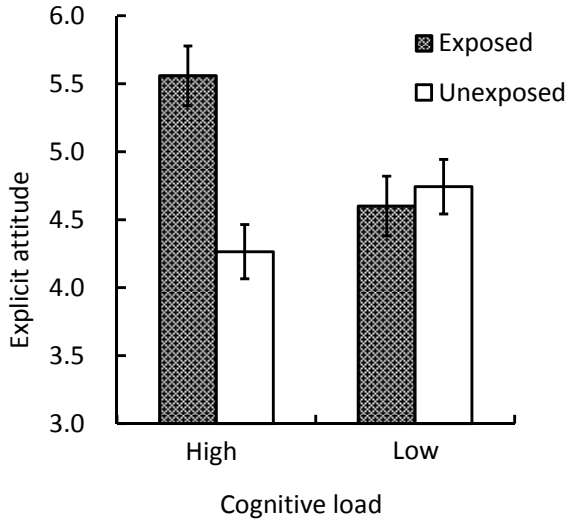

Figure 2. Mean explicit attitude scores (range = 1–9) as a function of stimulus exposure (exposed vs. unexposed) and cognitive load (high vs. low). Higher values indicate more positive attitudes, the bars indicate ±1 standard errors of the mean

3.4 Additional Recognition Test

None of the participants indicated awareness of the subliminal prime or suspicion of any sort. More specifically, none of the participants could report having seen the prime, and no participants came close to guessing the true nature of the experiment. However, 24 additional participants (10 male, 14 female) who had not participated in the main experiment took part in a forced-choice recognition task that was designed to serve as an additional test of subliminal priming stimuli from the main experiment. To ensure reliability, 10 female photographs were presented 20 times each using the same computer and display as the main experiment. Next, a pair of exposed and unexposed photographs was shown on a display, with each photograph placed at the center of each half of the screen. One of the two photographs had actually appeared in the prior session, and the other was an unexposed photograph. Participants were asked to choose the one that they had actually seen during the task. In total, 10 pairs of exposed and unexposed photographs were presented to participants. A one-sample t test revealed that there was no significant difference between the corrected recognition proportion for the exposed photograph (M = .51, SD = .15) and chance level (.50), t (23) = .57, p = .57. Therefore, the exposures used in the main experiment were subliminal in that participants could not correctly recall the exposed stimuli.

4. Discussion

As expected, we found evidence that the subliminal mere exposure effect occurred for not only implicit attitudes but also explicit attitudes when participants' cognitive resources were depleted. In contrast, when participants had enough cognitive capacity available, the subliminal mere exposure effect only emerged for implicit attitudes, supporting previous findings (Kawakami, 2012). These results support our contention that failing at self-control causes implicit effects of subliminal mere exposure to spill over to the explicit level.

Self-control plays an important role in this process. In light of research on discrepancies related to the effect of associative information on explicit attitudes (Gawronski & LeBel, 2008; Grumm et al., 2009), participants have access to the evaluative implication of associative information. However, this information is not incorporated into an explicit attitude because they perceive that information as invalid input and do not have a reason to express an explicit change in attitude (Loersch, McCaslin, & Petty, 2011; Rydell et al., 2006). This is especially true of the subliminal mere exposure effect (Kawakami, 2012) in which stimuli are presented below conscious awareness. Since clearly identifiable reasons for affirming the validity of evaluative judgments are absent, subliminal repeated exposures lead to a change only in associative structures in memory. However, other relevant propositions lead to a rejection of this associative information as a valid basis for an evaluative judgment. In the present study, when cognitive load was high, participants depleted their cognitive resources and failed at self-control, prompting participants to rely on their intuitions to report directly the evaluative implication of the associative information. We are often taught to avoid basing our attitudes on vague feelings whenever possible (Peng & Nisbett, 1999). This may have caused a hesitation in reporting an exposed stimulus

as preferable when it was not consciously processed. However, when self-control resources are low, people cannot control these social judgeability concerns, therefore relying on their intuitions that relate to the associative processes that underlie implicit attitudes (Hofmann et al., 2007; Hofmann et al., 2009; Strack & Deutsch, 2004).

Our findings also provide some theoretical contributions. First, although early research has shown that the mere exposure effect occurred even if stimuli are presented below conscious awareness (Bornstein & D'Agostino, 1992; Kunst-Wilson & Zajonc, 1980), follow-up research has often failed to replicate the subliminal effect on explicit attitudes (Brooks & Watkins, 1989; Fox & Burns, 1993; Newell & Bright, 2003; Newell & Shank, 2007; Reber et al., 1998; Seamon et al., 1984; Szpunar et al., 2004). Indeed, in our experiment, the subliminal mere exposure effect on explicit attitudes was not observed under a relatively normal condition (i.e., low cognitive load condition). As prior literature on the dissociations observed between implicit and explicit attitude measures has mentioned (Dijksterhuis, 2004; Gawronski & LeBel, 2008; Grumm et al., 2009; Kawakami et al., 2008; Rydell et al., 2006), associative information, such as subliminal stimuli, rarely affects explicit attitudes. In that sense, the fact that the mere exposure effect is likely to occur for explicit attitudes when stimuli are presented under not subliminal conditions, but supraliminal conditions, might fit into the recent dual system model of attitudes (Olson & Fazio, 2006; Gawronski & Bodenhausen, 2006; Rydell & McConnel, 2006). Therefore, the subliminal mere exposure effect on explicit attitudes seems to be a rare case. Although there is no unified explanation for this issue (i.e., low reproducibility of the subliminal mere exposure effect on explicit attitudes) at this point, we suggest a new possibility related to the effect of self-control resources. Future research needs to examine the various conditions, such as exposure frequency and exposure duration, in which the subliminal mere exposure effect consistently influences explicit attitudes.

Second, although spill-over effects related to depleting self-control resources have been suggested by correlational research examining the correspondence between implicit and explicit attitude measures (Jordan et al., 2007; Ranganath et al., 2008), few studies experimentally address this issue. In this sense, our study is the first experimental test indicating a relationship between self-control and the interplay between implicit and explicit attitudes. We believe that future studies addressing how both types of attitudes interplay through self-control will lead to a better understanding of the causes of why people often perform impulsive or intuitive behaviors.

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