

Evaluative Conditioning Changes Attitudes Toward Social Categories

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Evaluative conditioning (EC) is a procedure whereby participants' liking of conditioned stimuli change through exposure to repeated pairings of those stimuli with emotional stimuli. This study used two experiments on a participant dataset comprising female Japanese students in their early twenties, to examine whether EC could change attitude toward social categories. Experiment 1 ($N=24$) demonstrated that exposure to repeated pairings of particular country names and emotional words affected the participants' automatic evaluation of the country's flag in accordance with the emotional valence of the paired emotional stimuli. Experiment 2 ($N=24$) demonstrated that repeated pairings of these national flags with emotional pictures changed participants' IAT (Implicit Association Test) scores toward those countries. These results clearly show that EC can change attitude toward social categories.

Key Words : evaluative conditioning, attitude change, social category, implicit attitude

The associative form of evaluative learning procedure, known as evaluative conditioning (EC), has attracted attention from psychologists in many research areas, including social psychology (De Houwer, 2007; De Houwer, Perugini, & Baeyens, 2010; De Houwer, Thomas, & Baeyens, 2001; Field, 2005; Walther, Nagengast, & Trasselli, 2005). EC refers to the change that individuals' evaluation of initially neutral stimuli (conditioned stimuli, CSs) undergoes following their exposure to repeated pairings of those neutral stimuli with evaluatively positive or negative stimuli (unconditioned stimuli, UCSs). For example, if evaluatively positive pictures are repeatedly presented briefly after the presentation of a novel nonsense shape, EC predicts that, eventually, the nonsense shape will be evaluated more positively. Therefore, EC has been regarded as one of the principles of attitude formation (e.g., Walther & Langer, 2008).

Almost all studies in the visual domain that have examined EC effects have used novel and evaluatively neutral stimuli as CSs (e.g., Baeyens, Eelen, & Van den Bergh, 1990; Baeyens, Eelen, Van den Bergh, & Crombez, 1989; De Houwer, Baeyens, Vansteenvwegen, & Eelen, 2000; De Houwer, Hendrickx, & Baeyens, 1997; Field, 2000; Field & Moore, 2005; Herman, Vansteenvwegen, Crombez, Baeyens, & Eelen, 2002; Stuart, Shimp, & Engle, 1987; Walther & Grigoriadis, 2004; Walther & Nagengast, 2006). Although using novel and evaluatively neutral stimuli as CSs is a reliable way to empirically determine the precise magnitude of EC effect, Gibson (2008) used known brands (Coke and Pepsi) as CSs and found significant attitude changes toward those brands. In general, changing attitude toward well-known attitude objects is speculated to be more difficult than forming attitudes toward novel or neutral attitude objects, because in the case of changing attitude, new attitude acquired through EC may not integrate well into existing old attitude (Wilson, Lindsey, & Schooler, 2000). However, further empirical studies need to be carried out using known social stimuli as CSs to evaluate the practical, real-world utility of EC.

In line with this view, this study was designed to investigate whether EC can change attitudes

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towards familiar social categories. Social categories, for example, races, nations, or genders, are well-known attitude objects and contain a vast amount of pre-existing knowledge and attitudes. If EC can change attitudes towards these social categories, the results will be the strongest evidence of the practical utility of EC. With this in mind, this study developed two experiments to examine whether repeated pairings of countries' name—Japan and the U.S.A.—or these countries' flags with emotional stimuli could change attitudes towards the two countries. These countries were chosen because they are socially meaningful and highly familiar to the participants, that is, Japanese students.

However, many participants, when evaluating social categories like country, have been found to be concerned about the “social desirability” of their ratings, which then influences their evaluation (e.g., Paulhus, 1984). To address this issue, social psychology studies have established indirect ways to measure attitudes in such contexts. One of the most popular ways to measure attitudes is the use of emotional priming (Fazio, Sanbonmatsu, Powell, & Kardes, 1986). In a typical emotional priming experiment, a prime—a word/picture with a positive or negative emotional valence—is presented for 200 ms and a positive or negative target word is presented after 100 ms (thus giving a stimulus onset asynchrony of 300 ms). In such experiments, the most frequently adopted task for participants is the positive/negative evaluative judgment of a target word (e.g., Fazio et al., 1986). If participants are able to automatically evaluate the valence of the prime stimulus at the presentation, the response latency of the target appearing after the prime stimulus becomes shorter when the valence of the prime and the target are congruent than when the valences are incongruent (Fazio et al., 1986). The most important feature of the priming procedure in a short stimulus onset asynchrony like this, is that the intentional response strategy must not be allowed to affect the response latency (e.g., Neely, 1977); accordingly, the pattern of response latencies has been considered to reflect participants' automatic evaluation to primes. There-

fore, by assigning the attitude object to the prime stimulus of the emotional priming, we can measure attitude where the participants' evaluation is likely to be unaffected by concerns about social desirability (e.g., Fazio, Jackson, Dunton, & Williams, 1995; Wittenbrink, Judd, & Park, 1997). In Experiment 1, we assigned pictures of flags of Japan and the U.S.A. to prime stimuli of emotional priming to measure participants' attitudes toward the two countries after the acquisition phase. In Experiment 2, we used the implicit association test (IAT; e.g., Greenwald, McGhee, & Schwartz, 1998) to measure the implicit attitudes toward the concepts of Japan and the U.S.A. Since the IAT has been considered an effective way of circumventing participants' concerns about social desirability (e.g., Nosek, Banaji, & Greenwald, 2002), we felt that it is, together with emotional priming, an appropriate methodology for the present study.

Experiment 1

The purpose of Experiment 1 was to examine whether repeated pairings of countries' names with emotional words can change attitudes toward these countries.

Method

Participants. Twenty-four female Japanese students ($M_{age}=20.08$ years, age range : 19-21 years), participated in the experiment. Each participant received approximately \$5 for participating.

Materials. During the acquisition phase, the names of the following countries were displayed on a computer screen that was shown to the participants : “Japan,” “U.S.A.,” “China,” “Germany,” “Korea,” and “Russia.” To ensure the participants were familiar with the countries, we ensured that the countries were either members of the G8 or a neighboring country of Japan. The names of countries other than Japan and the U.S.A. were used as filler stimuli to avoid the successive or rhythmical presentation of “Japan” and “U.S.A.”

The 12 Japanese trait words assigned to the UCSs in the acquisition phase covered a range of positive, neutral, or negative emotions; these were chosen from the list compiled by Aoki (1971). The positive adjectives were “cheerful,” “honest,” “diligent,”

“well-organized,” “friendly,” “polite,” “sincere,” “active,” “kind,” “flexible,” “honorable,” and “tender.” The negative adjectives were “indecisive,” “imprudent,” “hard-hearted,” “unkind,” “flirtatious,” “empty,” “selfish,” “feckless,” “irresponsible,” “weak,” “violent,” and “brutal.” The neutral adjectives were “discreet,” “bold,” “hypersensitive,” “emotional,” “easy going,” “stubborn,” “introverted,” “docile,” “optimistic,” “tough,” “judgmental,” and “innocent.” In the test phase, as prime stimuli, the pictures of national flags of Japan and the U.S. A. were presented on the screen. The target words of emotional priming were presented using eight Japanese logographs that had a positive valence and eight that had a negative valence. These logographs were chosen based on the findings of the preparative investigation to ensure that the visual complexity (number of strokes) and the familiarity between the positive and negative list was approximately equal.

Apparatus. A personal computer and a color 17” CRT monitor were used to display the stimuli. In the emotional priming procedure, a voice key was used to record participants’ responses. A full-sized keyboard was used for the dummy task mentioned below.

Procedure.

Acquisition phase. Participants were tested individually. Half of the participants were assigned to group A, and half to group B. They were seated approximately 60 cm in front of the CRT monitor. At the outset, the researcher explained to the participants that the purpose of the experiment was to investigate how being presented with the names of the countries might influence the psychological processing of succeeding adjectives. The researcher then asked the participants to make a judgment, as fast as possible, as to whether the presented trait adjective was a word that they used frequently in their daily life, and accordingly press the “yes” or “no” key as fast as possible. This task was a dummy part of the acquisition phase that was conducted to ensure that the participants had a chance to be exposed to the presented word.

The researcher then told the participants that some countries would always follow positive adjectives

and some other countries would always follow negative adjectives. This manipulation has also been used in previous research (Hermans et al., 2002), and was conducted to eliminate the possible effect of contingency awareness. At the beginning of the acquisition trial, an asterisk was shown at the center of the screen for 500 ms. After this, one of the country names was shown at the center of the screen for 4000 ms. One thousand milliseconds after the country name had appeared on the screen, one of the trait adjectives was presented right under the country name, where it remained for 3000 ms. This meant that the country name appeared on its own for 1000 ms, while the country name and adjective appeared together for 3000 ms. The participants had to judge the trait adjective and press the “yes” or “no” key as fast as possible within 3000 ms. After 3000 ms had passed, a row of three asterisks, which indicated the inter-trial interval, was presented for 500 ms regardless of whether participants had given a response. Each letter was 1.8 cm high and 1.8 cm wide. Each country name consisted of two to four Japanese letters, and each trait adjective consisted of three to six Japanese letters.

Participants assigned to group A were always shown the positive adjective after the word “Japan” and the negative adjective after “U.S.A.” This order was reversed for participants assigned to group B. Thus, it was expected that, eventually, participants in group A would exhibit a preference for “Japan” over “U.S.A.,” and participants in group B would exhibit a preference for “U.S.A.” over “Japan.” In both groups, one other country name, chosen randomly from the remaining four country names, always followed the positive adjectives, while another country name, chosen randomly from the remaining three country names, always followed the negative adjectives. The remaining two country names always followed emotionally neutral trait adjectives. Each of the six country names was presented 12 times; as a result, the acquisition phase consisted of 72 trials. The presentation order of these 72 trials was randomized within participants, with the restriction that a country name could never be presented in more than two successive trials.

Since there were 36 adjectives, each trait adjective was presented twice throughout the phase.

Test phase. The researcher started the test phase immediately after the end of the acquisition phase. As part of the practice trials, each target word (logograph) was presented once on the center of the screen in a randomized order, and participants evaluated their valence. The size of the target words was 1.8 cm × 1.8 cm. The participants then evaluated the target words by saying the words “good” or “bad” into the voice key located in front of them. Speed and accuracy were equally emphasized.

Immediately before the beginning of the main trials, the researcher asked the participants to evaluate the valence of the target words while ignoring the prime stimuli. In each main trial, the participants were shown a fixation point for 500 ms, followed by the color picture of national flag of Japan or the U.S.A.—the prime stimuli—for 200 ms, followed by a blank screen for 100 ms. The size of each stimuli was 4.2 cm × 6.3 cm. After this, the target word appeared and remained on the screen until the participant responded with the voice key. The response latency in ms from the onset of the target word to the voice key input was recorded.

After the response latency was recorded, participants were presented with the inter-trial interval asterisks for 500 ms. All the stimuli were presented at the center of the screen. In the test trials, each of the two prime stimuli made 16 pairs with 16 target words. Therefore, there were 32 total pairs, which were presented two times in a random order (total 64 trials). The researcher recorded the participants’ response (the words “good” or “bad” or any other sound) from a position that was diagonally behind the

participant.

After the acquisition phase, the participants were debriefed. Each participant spent approximately 30 min on the experiment.

Results

Response latencies that were less than 300 ms and over 1500 ms were defined as outliers and excluded from the analysis (1.56% of all observations). Responses where participants had evaluated targets incorrectly or responded to the stimuli with a sound rather than the words “good” or “bad” were also excluded (2.15% of all observations). Because the error rate was very low, it was not considered as a dependent variable.

Table 1 shows the mean response latencies for the target stimuli of each condition. Regarding the appropriate interpretation of the result of the emotional priming experiment, Fazio et al. (1986) asserted that response latency is facilitated by the emotional congruency between the prime stimulus and the target stimulus. On the other hand, some previous studies have suggested that the response latencies increase when there is emotional incongruency between the prime and target stimuli (Wentura, 1999, 2000).

In this study, it was not possible to clarify whether response latencies reflected the facilitation effect or the interference effect, because there was a lack of emotionally neutral controlled prime stimuli. However, the present study did consider the difference between the latencies for positive targets and negative targets presented immediately after a certain prime as representing an automatic evaluation of that prime stimulus. For instance, by subtracting the response latencies for the positive targets that followed the flag of Japan from the

Table 1 Mean response latencies (ms) for target words and mean automatic evaluation scores in Experiment 1.

Group	Group A				Group B			
	Japan		U.S.A.		Japan		U.S.A.	
Target	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative
	553(27)	567(47)	579(41)	559(34)	600(68)	591(63)	600(67)	590(71)
Evaluation scores	15(44)		-21(45)		-9(44)		-10(35)	

NOTE: The values in parentheses are the standard deviations.

response latencies for the negative targets that followed the flag, we can identify participants' automatic positive evaluation for the flag. Table 1 shows the evaluation score for each flag. As shown in Table 1, participants in group A gave a higher average evaluation score for the flag of Japan than they did for the flag of the U.S.A.; as predicted, on the other hand, the participants in group B did not show this difference. To investigate this further, a 2 (group; A, B) \times 2 (prime; flag of Japan, flag of the U.S.A.) mixed design ANOVA was conducted, where the evaluation score was set as the dependent variable. This revealed a significant two-way interaction effect ($F(1, 22)=5.09, p<.05$) between the two groups. Tukey's HSD test revealed that the simple main effect of prime on group A was significant ($F(1, 22)=10.90, p<.01$). This demonstrated that the participants in group A preferred the flag of Japan to the flag of the U.S.A. In contrast, the simple main effect of the prime on group B was not found to be significant ($F(1, 22)=0.01, n.s.$).

Discussion

Although the significant interaction effect and the simple main effect of the prime on group A conformed to the prediction, the significant simple main effect of prime on group B was not found. Presumably, this is because the participants were themselves Japanese students and were likely to harbor a preference for Japan over the U.S.A. This would explain why the acquisition phase for group A may have made participants prefer the flag of Japan to the flag of the U.S.A., while the reversed contingency on the group B acquisition phase may have canceled out the pre-experimental asymmetry.

As is clear from this significant interaction effect, this experiment succeeded in demonstrating that EC could change attitudes toward countries' flags. It is also worth noting that, in the experiment, country names were shown as CSs in the acquisition phase while, in the test phase, their flags were presented as the prime stimuli of emotional priming. This semantic generalization is thought to have occurred as follows: paired presentations of country names and emotional words during the acquisition phase changed participants' attitudes toward two social

categories Japan and the U.S.A., and this effect was spread to members of those categories. This study then conducted another experiment—Experiment 2—to further confirm the occurrence of this effect. Contrary to Experiment 1 that used only linguistic stimuli for the acquisition phase, this experiment used only picture stimuli for the acquisition phase. Since we tend to use many advertisements with pictorial information, examining the learning effect using picture stimuli will help evaluate the practical utility of EC.

Experiment 2

Unlike Experiment 1, this experiment used flags as the CSs in the acquisition phase, and then measured the attitude of the participants toward each country indirectly in the test phase. Other than the usage of flags during the acquisition phase, three major modifications were made: First, emotionally valenced pictures, rather than the trait adjectives in the previous experiment, were used as the UCSs. Second, in this experiment, the acquisition phase did not include the presentation of a pair of CS-negative UCS. This is because presenting pairs of national flags and negative UCSs under the condition that participants may realize the intention of the experimenter might have been a sensitive procedure in the country this study was conducted in. Therefore, for the acquisition phase of this experiment, the emotionally negative stimuli were presented that were not contingent to any specific CS. Third, this experiment measured participants' implicit attitude toward Japan and the U.S.A. twice, once before and once after the acquisition phase. This allows the evaluative learning effect to be estimated by comparing the IAT scores of the two measurements. Repeated measurements were performed to improve reliability, since, in this experiment, the overall learning effect was expected to be reduced by the lack of CS-negative UCS paired presentations.

Method

Participants. Twenty-four female Japanese students ($M_{age}=19.17$ years, age range: 19–20 years), participated in this experiment, and received approxi-

mately \$5. None of them had participated in Experiment 1.

Apparatus. The same personal computer and 17" CRT monitor that were used in Experiment 1 were used in this experiment to display the stimuli. A full-sized keyboard was used to record participants' responses in the IAT.

Materials. The national flags of Japan and the U.S.A. were used as the CSs for the acquisition phase. For the positive UCSs, 10 emotionally positive pictures were chosen from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005). The mean affective rating score assessed by Lang et al. (2005) for these pictures was 7.82 ($SD=0.38$). Ten emotionally negative filler pictures were chosen for the acquisition phase from IAPS. The mean affective rating score according to the score proposed by Lang et al. (2005) for these pictures was 2.68 ($SD=0.81$). These emotional pictures were presented at the center of the screen.

The four categories that were used for the IAT were Japan, the U.S.A., the pleasant adjectives, and the unpleasant adjectives. The Japan category included three pictures (a picture of former prime minister Junichiro Koizumi, a picture of a blank map of Japan, and a picture of a ¥1,000 bill) and two words ("Japan" and "Tokyo"). Likewise, the U.S.A. category included three pictures and two words related to the U.S.A. (a picture of former president George Bush, a picture of a blank map of the U.S.A., a picture of a \$10 bill, and the words "U.S.A." and "Washington D.C."). Likewise, five positive adjectives were used as the members of the pleasant category and five and negative trait adjectives were used as members of the unpleasant category ("generous," "calm," "sincere," "kind," "gentle," "spiteful," "irresponsible," "selfish," "violent," and "brutal").

Procedure.

Pretest phase. Participants were tested individually before the acquisition phase, to assess their implicit attitude toward Japan and the U.S.A. The IAT consisted of seven trial blocks; at the beginning of each block, the labels of the categories were presented at the upper left and the upper right of the screen and remained on the screen during each block. Participants were then instructed to categor-

ize the stimuli that appeared at the center of the screen. Participants categorized the stimuli by pressing either left ("A" on the keyboard) or right ("6" on the keyboard) according to where the relevant category was placed. Both speed and accuracy were emphasized equally.

The seven trial blocks used and the number of categories assigned to each key (yes/no) are detailed below :

Block (1) The Japan and the U.S.A. categorization task (20 trials). In this task, five category members related to Japan and five category members related to the U.S.A. appeared twice in a random order.

Block (2) The pleasant and unpleasant adjective categorization task (20 trials). Five pleasant adjectives and five unpleasant adjectives appeared twice in a random order.

Block (3) The Japan + pleasant adjectives and the U.S.A. + unpleasant adjectives mixed categorization task (20 trials). All 20 category members appeared once in a random order.

Block (4) The Japan + pleasant adjectives and the U.S.A. + unpleasant adjectives mixed categorization task (40 trials). All 20 members appeared twice in a random order.

Block (5) The U.S.A. and Japan categorization task (20 trials). This task was identical to Block (1), with the exception that the assignment of categories was reversed.

Block (6) The U.S.A. + pleasant adjectives and Japan + unpleasant adjectives mixed categorization task (20 trials). All 20 category members appeared once in a random order.

Block (7) The U.S.A. + pleasant adjectives and Japan + unpleasant adjectives mixed categorization task (40 trials). All 20 members appeared twice in random order.

Half of the participants completed the seven blocks in this order, but the other half completed them in the order (5), (2), (6), (7), (1), (3), and (4), to balance out the order effect. In Block (4) and (7), the response latency in milliseconds from the onset of the member to the voice key input was recorded.

Acquisition phase. Immediately after the pretest phase, the participants were asked to begin the

acquisition phase. At the beginning of the phase, the participants were told that the phase was a sort of visual memory skill test and that they should pay attention to all the pictures that were presented on the screen, throughout the phase. The researcher then explained the ambiguous country name–adjectives contingency in a similar way that had been adopted in Experiment 1. Half of the participants were assigned to group A, and the other half, to group B. The participants in group A were shown a pair of stimuli made up of the flag of Japan and an emotionally positive picture. Participants in group B were presented with a pair made up of the flag of the U.S.A. and an emotionally positive picture. The flag and the positive picture with which it was paired were presented every succession and in quick succession. The negative pictures for both groups were presented for 1 s without a flag pairing; the flag of the U.S.A. was presented to group A for 1 s without any paired picture, and the flag of Japan was presented to group B for 1 s without any paired picture. An inter-trial interval was for 3 s. The presentation size of the flags was 7.4 cm × 10.0 cm, and the size of the emotional pictures was approximately 18.0 cm × 24.0 cm. In both groups, the flag–positive picture pair, the unpaired flag, and the unpaired negative pictures were all presented 10 times each. They were presented in a random order that changed for each participant, with the restriction that a country name could never be presented on more than two successive trials. Unlike Experiment 1, this experiment did not include other country names in the presentation; this was to shorten the amount of time required for the experiment.

Posttest phase. Immediately after the acquisition phase, participants started the tasks of the IAT. The procedure was identical to that of the pretest

phase.

Then participants were debriefed. The amount of time that each participant spent on completing the entire experiment was approximately 40 minutes.

Results and Discussion

The main areas of focus for this analysis were the response latencies for block (4) and (7) in the IAT. All error responses were excluded from the analysis (3.13% of all the observations). Response latencies below 300 ms and over 3000 ms were replaced with 300 ms and 3000 ms, respectively (0.03% of all the observations), in a similar fashion to Greenwald et al. (1998). Table 2 shows the mean response latencies for block (4) and (7) for all participants.

In the present IAT measure, the IAT score obtained by subtracting the response latency for block (4) from block (7) indicates the degree of preference that a participant has for Japan over the U.S.A. Table 2 shows the mean IAT scores of the pre- and posttest phase for all participants. In this experiment, if the evaluative learning occurred, the IAT score of group A was predicted to increase across two measurements and the IAT score of group B was predicted to decrease across two measurements. As shown in Table 2, the apparent means of the IAT scores corresponded with this prediction. In order to examine this interaction, the 2 (group: A, B) × 2 (timing: pre, post) mixed design ANOVA was performed, where the IAT score was set as the dependent variable; the results revealed that there was a significant interaction effect ($F(1, 22)=4.44, p<.05$).

Tukey's HSD test revealed the marginal simple main effect of timing on group A ($F(1, 22)=3.50, p<.10$). The simple main effect of timing on group B was not found to be significant ($F(1, 22)=1.23, n.s.$). Finally, the main effect of group and of timing were not

Table 2 Mean response latencies (ms) for two mixed blocks and IAT scores for Experiment 2.

	Group A		Group B	
	Pre	Post	Pre	Post
Japan + Pleasant / U.S.A. + Unpleasant	608(90)	593(81)	588(62)	577(64)
U.S.A. + Pleasant / Japan + Unpleasant	670(69)	690(132)	658(73)	626(54)
IAT score	62(62)	97(93)	69(57)	49(54)

NOTE: The values in parentheses are the standard deviations.

found to be significant ($F(1, 22)=0.69, n.s.$; $F(1, 22)=0.29, n.s.$).

The significant interaction effect between group and timing strongly suggests that the participants' evaluative learning for the concept of Japan and the U.S.A. did occur. One important modification that was made on this experiment was the comparison of the index value across two timings, in contrast to the previous experiment. In order to compare only the posttest score across groups in a way that was analogous to previous experiments, the t -test was performed; the results of the t -test did not indicate a significant effect ($t(22)=1.56, n.s.$). As predicted previously, the comparison that was conducted without CS-negative UCS pairings had weaker learning effects than those observed in Experiment 2.

General Discussion

The purpose of this study was to examine whether EC can change attitudes toward social categories. Experiment 1 used linguistic stimuli for the acquisition phase and showed that a significant learning effect could be observed for stimuli that were members of categories used in the acquisition phase. Moreover, Experiment 2 used only picture stimuli for the acquisition phase and revealed that participants' evaluative learning toward national flags also changed evaluations of concepts that were linked to those countries. It is important to note that these learning effects were detected by two indirect measures, the emotional priming procedure and the IAT; this improves the reliability of the finding. Since these measures have been thought to be relatively independent from the intentional response strategies of participants (e.g., Fazio et al. 1995; Nosek et al., 2002), the obtained effects are therefore not regarded as products of the participants' awareness of the demand of the researcher. It should also be noted that EC could change attitudes toward social categories by the acquisition procedure that used only picture stimuli in Experiment 2. This result implies that the evaluative learning effect on social categories is not limited to the domain of verbal learning. Overall, these results supported the hypothesis that EC can change

implicit attitudes towards well-known social categories.

However, investigating a more detailed learning process was beyond the scope of this study. Several studies have suggested that the stimulus-stimulus (S-S) and stimulus-response (S-R) associative learning hypotheses, in accordance with Pavlovian conditioning, may explain the underlying mechanism of EC, has been proposed (for review, see Hofmann et al., 2010; Walther & Langer, 2008). Interestingly, there are studies involving experiments using visual CSs and visual UCSs that indicate that participants do not need to be aware of the fact that a CS was paired with a positive or negative UCS to exhibit a change in their evaluation of the CS (e.g., Baeyens et al., 1990; Walther & Nagengast, 2006). In addition to this, some researchers have found that the EC effect can be observed even when the visual UCS is presented subliminally (De Houwer et al., 1997; Field & Moor, 2005). These reports indicate that the learning process behind EC is automatic. However, De Houwer (2006) has suggested that the significant change in evaluation occurs solely through the propositional knowledge that is formulated during the instruction regarding the CS-UCS contingencies. In his experiments, participants were instructed to memorize the regularity of stimulus presentations, which was that two nonsense syllables would follow positive pictures and two other nonsense syllables would follow negative pictures. Participants were then tested by the IAT to measure their implicit evaluations of these four syllables in an experiment that was conducted without the actual acquisition phase where the syllable-picture pairs were presented. The mean response latencies for the IAT showed that participants evaluated the former two syllables more positively than the latter two syllables. This suggests that the formulation of propositional knowledge may be an additional hint as to why this evaluative change can be observed during EC. In accordance with this report, some researchers reported that contingency awareness played the important role to produce EC effect (Field, 2000; Pleyers, Corneille, Luminet, & Yzerbyt, 2007).

In this study, participants were informed of the

ambiguous CS-USC contingencies at the beginning of the acquisition phase; therefore, we can infer that participants quickly formulated their propositional knowledge about the contingency between categories and emotional stimuli, in addition to the S-S and S-R associations. Consequently, the EC effects observed in this study can be assumed to be obtained via the associations acquired by exposure to repeated pairings of CSs-USCs and/or via propositional knowledge formulated by the instruction, and repeated CSs-USCs pairings. To clarify this further, future research should investigate whether EC can change attitudes toward social categories by presenting the UCSs subliminally.

There are limitations with regard to the practical significance of the present research. First, the measurements of implicit attitudes used in this study might not have fully encapsulated the attitude of the participants. Traditionally, attitude has been thought to encompass three components— affect, cognition, and behavior (Rosenberg & Hovland, 1960), and this study may have only assessed the affective component of attitude. Therefore, it is difficult to clarify with certainty that the evaluative change observed in this study caused the behavioral change in the participants toward the specific member of categories. Second, it would help if further research is conducted to clarify the duration of effect, as this was not examined in this study. EC has been known to last a long time and be highly resistant to extinction (De Houwer et al., 2000; Levey & Martin, 1975; Baeyens, Eelen, & Crombez, 1995; Baeyens et al., 1989). However, the evaluative change for social categories, like those used in this study, may fall into extinction for a brief period because these categories appear frequently in participants' daily lives without being paired with UCSs.

However, from the perspective that implicit attitudes measured by indirect methods like this study predicts people's impulsive behaviors (e.g., Olson & Fazio, 2009), results obtained in this study also suggest the possibility that EC can change people's behaviors toward members of social categories. If so, EC will be the efficient way to change people's prejudiced behaviors, brand choices, voting behav-

iors, and other various social behaviors. If we are to fully comprehend this potential practical applications of EC, there is a clear need for additional research that will examine above issues.

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