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Research article

Self-esteem as a source of evaluative conditioning

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Abstract

This study was designed to examine whether self-esteem can be used as a source of evaluative conditioning, and whether implicit or explicit self-esteem was more predictive of the evaluative conditioning effect. Moreover, the role of contingency awareness in the acquisition of the evaluative conditioning effect was also examined. Words related to the self and a general other were served as unconditioned stimuli (USs) in the evaluative conditioning process in order to see whether the evaluation could be transferred to neutral, abstract paintings after 10 times of pairing. An evaluative conditioning effect was demonstrated in that the evaluation of the paintings became more positive after repeatedly paired with words about the self but not words about general others. Implicit self-esteem predicted the magnitude of the evaluative conditioning effect, while the association between explicit self-esteem and the evaluative conditioning effect was nonsignificant, both with and without the effect of contingency awareness being controlled for.

The Associative-Propositional Evaluation (APE) Model

It is generally accepted that there are two categories of attitudes, namely implicit and explicit attitudes. Different from explicit attitudes that can be assessed by directly asking an individual how he/she feels toward a specific target, implicit attitudes are those automatic affective reactions resulting from particular associations (Gawronski & Bodenhausen (2006). Implicit attitudes are sometimes ''introspectively unidentified (or inaccurately identified)'' (Greenwald & Banaji, 1995Greenwald & Banaji, 1995). To assess implicit attitudes, some indirect techniques, such as the Implicit Association Test (IAT), were developed (Greenwald, McGhee, & Schwartz, 1998).

After several decades of research, plentiful evidence has been accumulated on the dissociation between implicit and explicit attitudes in their formation, change, and prediction of behaviors (e.g., Fazio & Olson, 2003; Wilson, Lindsey, & Schooler, 2000). For instance, the correlations between explicit and implicit attitudes were moderate to low (Fazio & Olson, 2003). Certain manipulations changed implicit attitudes, leaving explicit attitudes unaffected (e.g., Baccus, Baldwin, & Parker, 2004), while others influenced only explicit attitudes (e.g., Gawronski & Strack, 2004). Whereas explicit attitudes were predictive of deliberate behaviors, implicit attitudes were found to predict non-verbal, spontaneous behaviors better than explicit attitudes (e.g., Egloff & Schmukle, 2002).

Based on previous dual processes models (e.g., Smith & DeCoster, 2000; Strack & Deutsch, 2004), the ''associative-propositional evaluation'' (APE) was postulated as to locate the underlying mechanisms of the various change patterns of explicit and implicit attitudes (Gawronski & Bodenhausen, 2006). According to the APE model, two qualitatively different categories of processes form the basis of implicit and explicit attitudes, i.e., the associative and propositional processes, respectively. In the propostitional processes, evaluations are ''based on syllogistic inferences derived from propositional information''; in the associative processes attitudes are elicited from automatic activation of particular

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associations. Therefore, when only one of the two categories of processes is involved, the corresponding category of attitudes will be formed or altered while the other one will remain unaffected. When the associations underlying the implicit attitudes are consciously recognized and accepted, explicit attitudes will be changed, mediated by implicit attitudes. Likewise, when propositional reasoning leads to the formation of new associations, implicit attitudes will be changed, mediated by explicit attitudes. These researchers further pointed out that whereas propositional processes are concerned with the subjective validity of evaluations and beliefs, associative processes bear no truth values (Gawronski & Bodenhausen, 2006). In other words, whether a proposition is endorsed or not depends on the subjective validity of the proposition, whereas associations can be activated regardless of the validity.

According to the APE model, one way of acquiring attitudes toward novel objects, which should be based on the associative processes, is through evaluative conditioning. Gawronski and Bodenhausen (2006) contended that evaluative conditioning changes implicit attitudes directly, whereas explicit attitudes are either left unchanged, or are changed by implicit attitudes after evaluative conditioning. The researchers also reasoned that given that evaluative conditioning involves mere associative transfer of the evaluation of unconditioned stimuli (USs) to the conditioned stimuli (CSs), implicit attitudes toward the USs should be more predictive of the implicit attitudes toward the CSs than explicit attitudes (Gawronski & Bodenhausen, 2006, p. 698).

Evaluative Conditioning

Evaluative conditioning (EC) refers to the phenomenon that mere pairing of a positive or negative stimulus (unconditioned stimulus, US) with a previously neutral stimulus (conditioned stimulus, CS) changes the valence of the latter to the same direction of the evaluation of the former (e.g., Olson & Fazio, 2001; Walther, 2002). As one specific form of Pavlovian conditioning, evaluative conditioning is said to possess some characteristics that render it different from the traditional Pavlovian conditioning. Instead of measuring some physiological indices such as the secretion of saliva or heart rate, in EC we are examining the acquisition of preference of the CS. Also, in evaluative conditioning, mere spatio-temporal contiguity, rather than the expectation of the US following the CS, is supposed to be at work to shift the liking of the CS (e.g., Olson & Fazio, 2001).

Though robustly demonstrated as a valid method of obtaining new attitudes, conflicting results continue to emerge in the literature regarding the conditions under which the evaluative conditioning effects can be observed (for reviews, see De Houwer, Thomas, & Baeyens, 2001; De Houwer & Beckers, 2005; Walther, Nagengast, & Trasselli, 2005). Evaluative conditioning was once regarded as being independent of contingency awareness (i.e., whether an individual is aware of the contingencies between the USs and the CSs or not when the conditioning occurs), and resistant to extinction (i.e., the effect persists even after the CSs being presented alone repeatedly after the evaluative conditioning process; see De Houwer, Thomas, & Baeyens, 2001; Dijksterhuis, 2004). However, inconsistent findings have challenged these beliefs. For example, in some studies, the evaluative conditioning effects have been found to be unaffected by the awareness of the contingencies (e.g., Dickinson & Brown, 2007), whereas in other studies, contingency awareness served as the prerequisite of the evaluative conditioning effects (e.g., Pleyers, Corneille, Luminet, & Yzerbyt, 2007). Likewise, with regard to the characteristics of resistance to extinction, evidence for the extinction and evidence supporting that the evaluative conditioning effects persist even when only the CS presented after the CS–US pairings co-exists (e.g., Diaz, Ruis, & Baeyens, 2005 vs. Lipp & Purkis, 2006).

To reconcile these conflicting results, De Houwer (2007) contended that the associative processes based solely on spatio-temporal links of the CS and the US are not the only processes underlying the evaluative conditioning effects. Instead, multiple processes may be involved. Specifically, for those studies in which the evaluative conditioning effects depended on the contingency awareness and were sensitive to extinction, the propositional processes should be involved. On the other hand, the associative processes underlay the evaluative conditioning effects that occurred independently of the knowledge about the contingencies and were resistant to extinction.

Current Study

It is routine in previous studies on evaluative conditioning that firstly, some stimuli, explicitly evaluated as positive or negative, were chosen to serve as the USs, while some other stimuli, evaluated as neutral, were chosen to serve as the CSs.

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After going through an evaluative conditioning procedure in which the USs and the CSs were presented several times in pairs, participants' evaluation of the CSs were then measured again as to see if any changes occurred. An evaluative conditioning effect was said to be obtained if the valence of the CSs after the conditioning procedure changed to the same direction of the valence of the USs.

Surprisingly, we are not aware of any previous studies using implicit attitudes toward the USs as a source of evaluation. In fact, implicit attitudes are seldom considered as one source of attitude change. The only study we found in the literature that used implicit attitudes as a potential source of attitude change investigated the association between implicit self-evaluation and the change of implicit evaluations of objects after the objects being chosen (Gawronski, Bodenhausen, & Becker, 2007). A moderate association (*r*s among 0.3–0.4) was found in this study between implicit self-evaluation and the post-decisional implicit evaluations of the chosen objects (Gawronski, Bodenhausen, & Becker, 2007, Experiments 3 and 4). We expected that implicit attitudes would be a valid source of attitude acquisition.

Moreover, when examining the attitude changes toward the CSs, usually only the valence is concerned, but not the magnitude of changes. In other words, we do not know whether there is any association between the strength of attitude toward the USs and the magnitude of changes in the evaluation of CSs after the EC procedure. An investigation of whether there is any association between the magnitude of attitude toward the USs and EC effect would be interesting.

By applying the EC paradigm with words about the self and others serving as the USs, and abstract paintings as the CSs, we examined whether any linear associations would be found between explicit self-esteem, implicit self-esteem, and the change of liking of the abstract paintings. In addition, we also examined the role of contingency awareness in the association between the attitudes toward the USs and the CSs.

If, as stated in the APE model, implicit attitudes are based on the associative processes, and the evaluative conditioning effects are resulted from such processes, one would expect that the magnitude of implicit attitudes toward the USs should be more strongly associated with the magnitude of the attitude change toward the USs than explicit attitudes.

If, however, as speculated by De Houwer (2007), evaluative conditioning involves not only the associative processes, but also the propositional processes, then, whether implicit or explicit attitudes toward the USs are more predictive of the evaluative conditioning effect depends on which category of processes dominates the process of transferring the evaluation from the USs to the CSs. If the associative processes are mainly involved, implicit attitudes should predict the evaluative conditioning effect better than explicit attitudes. If not, one would then expect that explicit attitudes should be more predictive of the evaluative conditioning effect.

Given that most people tend to adopt a positive evaluation toward the self both implicitly and explicitly (e.g., Greenwald & Farnham, 2000; Koole, Dijksterhuis, & Knippenberg, 2001), we expected that an evaluative conditioning effect would be found in our study in that the paintings associated with information about the self would be liked more after the evaluative conditioning procedure.

Hypothesis 1: Paintings associated with the self, by repeated pairing with information of the self, would be rated as more positive than those without the pairings.

No specific hypothesis was generated regarding the effect of contingency awareness since it was still unclear under which conditions it would matter (De Houwer, 2007). However, if an association between the strength of attitudes toward the USs and the EC effect can be observed only when the participants are aware of the contingencies between the USs and the CSs, we could infer that the evaluative conditioning effect in our study might be mainly due to the propositional processes. Otherwise, we would decide the relative effects of the associative processes and the propositional processes by comparing the effects among the participants who were aware of the contingencies with those who were not.

We argued that whether implicit or explicit self-esteem would have a stronger association with the EC effect depends on the processes dominated in the EC process. However, the conditions under which a certain process takes place remain unknown. We expected that implicit self-esteem would be more predictive of the EC effect when the associative processes were mainly involved, i.e., among the participants or items without contingency awareness. Meanwhile, explicit self-esteem would be more predictive of the EC effect when the propositional processes were mainly involved, i.e., among the participants or items with contingency awareness.

Hypothesis 2a: The EC effects obtained without contingency awareness would be associated stronger with implicit than explicit self-esteem.

Hypothesis 2b: The EC effects obtained with contingency awareness would be associated stronger with explicit than implicit self-esteem.

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METHOD

Participants

Seventy-eight undergraduate students at a university in Hong Kong participated in this study, among which 56 were females. The mean age of the participants was 19.26, with a standard deviation of 1.69. Participants were recruited from an introductory psychology course and were compensated by course credits for their participation.

Materials

The USs in evaluative conditioning were the target words (i.e., five words about the self and five words about a general other) that were generated by the participants in the IAT (Greenwald, McGhee, & Schwartz, 1998). Details of the USs were provided in the following measurement section.

The CSs were 18 colored, abstract paintings obtained from the Internet. No concrete objects could be identified from these paintings. Pilot test found that they were evaluated neutrally. In fact, the mean evaluation of the chosen paintings before the evaluative conditioning procedure was 0.86 in a scale from −5 (very dislike) to 5 (very like), showing that the participants adopted a slightly positive attitude toward the paintings. The paintings were displayed on the center of a computer screen with a size about 10 cm*8 cm.

Procedure

Participants went to the laboratory by appointment. When they arrived, a female experimenter greeted them and guided them to sit in front of a computer screen. Participants did the experiment either individually or in groups with not more than four participants. All introductions were presented on the screen. Participants were informed that they could consult the experimenter if necessary.

The computer program first asked the participants to perform an alleged categorization task, which actually was the IAT of self-esteem (Greenwald & Farnham, 2000). After completing this task, they were told that they had to perform another unrelated task, which was designed to examine whether their evaluation of some neutral objects, in this case paintings, would change after repeated viewing of the objects. Firstly, the 18 paintings were presented simultaneously on the screen, six paintings per row in three lines. Participants were required to select four abstract paintings (CSs) that were the most neutral to them from the original paintings. Then, they were asked to evaluate these four chosen paintings individually along an 11-point Likert scale ranging from −5 (absolutely negative) to 5 (absolutely positive). After the first time of evaluation of the four paintings, they went through the evaluative conditioning procedure. Two of the chosen paintings (paintings 1 and 3, the numbers were arbitrarily assigned to the four paintings) were paired with information of the self, while the other two (paintings 2 and 4) were paired with information of a general other. After the evaluative conditioning procedure, participants were then asked to evaluate the four paintings again on the same 11-point Likert scale.[1]

In the evaluative conditioning procedure, each CS was paired with all the five USs, and each pair of US–CS was displayed twice, resulting in 40 (4×5×2) trials in total. Paintings and words about the self or a general other were presented simultaneously on the screen for 1000 ms (the USs were displayed beneath the CSs in black, Font 12), with an inter-trial interval of 1500 s. The order of the trials was randomized.

To assess contingency awareness, participants were asked whether the paintings were associated with information of the self or a general other by choosing one from the three options, ''self'', ''other'', and ''I don't know'' (Pleyers et al., 2007). They were also asked to indicate whether their attitudes toward the paintings had changed after the evaluative conditioning procedure, and to write down the reason of attitude change, if any (Walther & Grigoriadis, 2004). Finally,

[1]IAT measure of implicit self-esteem was taken before the EC procedure. The reason of such an arrangement was to avoid priming participants the association between words about the self, the general other, and the paintings. It would be more natural for our participants to do a categorization task based on the information that they just provided than to view some paintings totally unrelated to the information. In other words, we tried to obscure the association between the words and the paintings, or at least to minimize any suspicion of such an association.

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participants were required to complete a questionnaire that contained Rosenberg's items on self-esteem embedded in several irrelevant items. Participants were thanked and debriefed after finishing the study.

Measurement

Implicit Self-Esteem

Implicit self-esteem was measured by the IAT (Greenwald & Farnham, 2000). We asked the participants to give information about their name, birthday, and the city they live in. Participants were also asked to think of a general other who (a) was not liked or disliked by them, (b) was familiar to them, (c) had no relationship with them, and then write down her/his name, birthday, and the city he/she lives in. Participants were reminded that it could be either a real person or an imagined one, and that all the information of this general other could not be the same as theirs. The information about the self together with ''me'' and ''mine'' served as the target words for the self, while the information about the general other together with ''they'' and ''their'' served as the target words for the general other. Five pleasant words, and five unpleasant words selected from earlier IAT studies served as the attribute words. As suggested by Olson and Fazio (2004), we used ''I like'' and ''I don't like'' as the attribute categories.

For efficiency we used a 5-block structure in the IAT. In the first block, only the target words were presented. Participants were asked to react to the words as quickly and accurately as possible by pressing ''z'' for words of the self and ''/'' for words of the general other. In the second block, only the attribute words were presented. Participants were asked to react to the words as quickly and accurately as possible by pressing ''z'' for the words categorized under ''I like'' (i.e., these pleasant words) and ''/'' for the words categorized under ''I don't like'' (i.e., these unpleasant words). The third block was a combination of blocks 1 and 2, in which both the target words and the attribute words were presented. Participants were supposed to press ''z'' when a target word of the self or a pleasant word was presented, and press ''/'' when a target word of the general other or an unpleasant word was presented. Like in the first block, only target words were presented in the fourth block. However, the reactions were reversed. That is, ''z'' was supposed to be pressed when words of the general other were displayed while ''/'' was supposed to be pressed when words of the self were displayed. The fifth block was a combination of blocks 2 and 4.

Explicit Self-Esteem

A Chinese version of Rosenberg's (1965) 10-item self-esteem scale was administered to assess participants' self-esteem (Chen et al., 2006; Kwan et al., 1997). Items were anchored with a 4-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree). The reliability coefficient of this scale in the current study was .88.

RESULTS

General EC Effects

Paintings 1 and 3 were associated with information of the self, while paintings 2 and 4 were associated with information of the general other. To investigate the overall EC effect, ratings for paintings 1 and 3 were collapsed, as well as ratings for paintings 2 and 4 (Table 1). Repeated ANOVA with pairing (associated with self vs. associated with other) and measure (pre vs. post EC procedure) as two within-subject factors revealed a significant interaction between pairing and measure, $F(1, 77) = 8.31$, $p < .01$. That is, changing in attitude toward the paintings depended on the category of word–painting pairings. Simple effect tests found that the evaluation of the paintings associated with the self changed, $F(1, 77) = 24.70$, $p < .01$, but not the evaluation of the paintings associated with the other, $F(1, 77) = .34$, ns. As can be observed from the mere ownership effect (Feys, 1995) and name–letter effect (Koole, Dijksterhuis, & Knippenberg, 2001), people normally adopt a positive attitude toward things associated with the self. A shift of evaluation toward paintings 1 and 3 to the positive

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Table 1. Mean and SD of pre-evaluation and post-evaluation of the four paintings

	Pre-evaluation		Post-evaluation	
	Paintings associated with the self	Paintings associated with the other	Paintings associated with the self	Paintings associated with the other
Mean	.88	.84	1.38	.90
SD	1.52	1.55	1.53	1.70

side after being associated with information of the self indicated an evaluative conditioning effect. Moreover, the effect could not be accounted for by mere exposure effect since the evaluation toward paintings 2 and 4 remained unchanged.

To combine the ratings from the four paintings, we then calculated an index of attitude change by subtracting the changes of paintings 2 and 4 from the changes of paintings 1 and 3. One-sample *t* test of this mean index revealed that it was significantly larger than zero, $t(77) = 2.89$, $p < .01$.

Correlations Between the EC Effects and Contingency Awareness

To assess the participants' knowledge of contingencies, we conducted *participant-based analysis*, based on their knowledge about the pairing between the words and the paintings, and their reasons of attitude change, if any (Walther & Grigoriadis, 2004).

We assigned a score of 0 to the cases that could not identify or incorrectly identified the USs associated with all four paintings. A score of 1 was given when one ''US–CS'' pair was correctly identified. Therefore, a participant would be assigned a score of 4 if he/she could identify the categories of information that went with all the four paintings. With this scoring system, the mean contingency awareness score was 3.05, and the SD was 1.20.

Correlation between the awareness score and the index of attitude change was marginally significant, $r = .22$, $p = .053$, implying a possible association between contingency awareness and the evaluative conditioning effect.[2]

When asked whether their attitudes toward the paintings changed after the evaluative conditioning procedure and the reasons for change if any, 31 of the participants replied that their attitudes changed because of the words associated with the paintings. Mean of attitude change among those participants was 1.60, compared to 1.05 among those who provided reasons of attitude change other than the association between words and paintings ($n = 23$) and $-.54$ among those who indicated no change ($n = 24$). ANCOVA with explicit and implicit self-esteem being controlled for revealed nonsignificant difference in attitude change between those two groups of subjects who reported changes in their ratings, $F(1, 48) = .28$, ns.

We also conducted an *item-based analysis* on the two paintings paired with the self, i.e., paintings 1 and 3, as suggested by Pleyer et al. (2007). For painting 1, no significant difference was found in the attitude change between participants with contingency awareness ($n = 67$) and those without contingency awareness ($n = 11$), $t(76) = .85$, ns.[3] However, the magnitude of attitude change toward painting 3 were significantly greater among those who were aware of the contingencies between the self ($n = 23$) and painting 3 than those who were not aware of the contingencies ($n = 55$), $t(76) = 2.42$, $p < .05$. These results were generally consistent with those from the participant-based analysis, indicating that contingency awareness may play a role in the acquisition of the EC effect.

Implicit Self-Esteem, Explicit Self-Esteem and the EC Effects

Implicit self-esteem was calculated according to the improved scoring algorithm suggested by Greenwald, Nosek, and Banaji (2003). Firstly, the mean reaction time in block 3 was subtracted from that in block 5. Then, we combined the

[2]Another way to evaluate the association between contingency awareness and the EC effect was to take into consideration only the awareness of US–CS pairings for self-related US. All the results remained the same with this index.

[3]The mean difference of attitude change towards painting 1 between participants who knew the contingency of the self ($M = .61$) and painting 1 and those who did not know ($M = .27$) was .34. The nonsignificant result might be due to the small amount of participants without contingency awareness ($n = 11$).

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Table 2. Mean and SD of implicit self-esteem, explicit self-esteem, and attitude change

	Implicit self-esteem	Explicit self-esteem	Attitude change
Mean	.58	28.42	.86
SD	.43	4.47	2.62

reaction times in blocks 3 and 5 and computed the SD. Finally, we computed a *D* value by dividing the mean differences in blocks 3 and 5 by the SD. Only the reaction times from the correct trials were used. A positive D means that implicit self-esteem is positive. Consistent with previous studies, the mean implicit self-esteem was significantly positive, $t(77) = 12.10$, $p < .01$.

Results from the Rosenberg (1965) self-esteem scale also revealed that our participants generally adopted a positive attitude toward themselves (mean = 28.42), as this mean score was significantly higher than the mid point of the scale (25), $t(77) = 6.59$, $p < .01$. The means and SDs of implicit self-esteem, explicit self-esteem, and attitude change are listed in Table 2.

Correlations were computed among implicit self-esteem, explicit self-esteem, and attitude change. Consistent with previous studies, the correlation between implicit and explicit self-esteem was low, $r = .15$, ns (Greenwald & Farnham, 2000). No significant correlation was found between explicit self-esteem and attitude change either, $r = .06$, ns. However, a significant correlation between implicit self-esteem and attitude change emerged, $r = .31$, $p < .01$. Generally speaking, implicit self-esteem was predictive of the evaluative conditioning effect, while explicit self-esteem was not.

A hierarchical regression was performed so as to examine the effects implicit self-esteem had on the EC effect with contingency awareness and demand awareness (i.e., whether or not participants were aware that their attitudes were changed because of the pairings) being controlled for (see Table 3). The interactions between contingency awareness, demand awareness, and implicit self-esteem were entered in the third block to examine whether contingency awareness or demand awareness would moderate the relation between implicit self-esteem and the EC effect. Regression results showed that implicit self-esteem significantly accounted for the variance of the EC effect beyond what could be explained by contingency awareness and demand awareness, $\beta = .27$, $p < .05$, but the moderating effects of contingency awareness and demand awareness were both nonsignificant, $\beta s = -.46$ and .001, ns. Therefore, the regression model without interaction terms was selected, which explained 14% of the variance of the EC effect.[4]

No significant relation between explicit self-esteem and the EC effect was found, either with contingency awareness controlled for or not. Further analysis showed that, even among the participants who were fully aware of the contingencies between the USs and the CSs, i.e., those who had an index of contingency awareness of 4, the correlation between explicit self-esteem and EC effect was nonsignificant and slightly negative, $r = -.10$, ns.

Table 3. Regression: EC effect (n = 54)

Step	Variable	Beta	*t*	R^2 change	Cumulative R^2
1				.07	.07
	Contingency awareness	.218	1.59		
	Demand awareness[a]	.117	.85		
2				.07*	.14*
	Contingency awareness	.184	1.38		
	Demand awareness	.083	.63		
	Implicit self-esteem	.274	2.06*		
3				.01	.15
	Contingency awareness	.151	1.05		
	Demand awareness	.102	.73		
	Implicit self-esteem	.292	1.97*		
	Implicit self-esteem *Contingency awareness	−.108	−.74		
	Implicit self-esteem *Demand awareness	.001	.00		

[a]Demand awareness was coded as: 1-showing demand awareness, 0-no demand awareness.
*$p < .05$.

[4]Analyses based on all cases yielded similar results. The coefficient of implicit self-esteem was 2.25, $p < .05$.

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We also analyzed the relations among implicit self-esteem, explicit self-esteem, and the EC effect among the participants who attributed their attitude change to the pairing of words and paintings ($n = 31$). Among this subgroup, the correlation between implicit self-esteem and attitude change was almost the same ($r = .32$) as the correlation among the whole sample, and a little higher than in the subgroup indicated change for reason other than the pairings ($r = .26$). Similarly, the correlation between explicit self-esteem and attitude change in this subgroup was also nonsignificant, $r = -.07$, ns.

These results revealed that the EC effect obtained was not likely to be an effect of demand compliance. They also confirmed that implicit self-esteem was predictive of the EC effect independent of contingency awareness, whereas explicit self-esteem did not predict the EC effect either with or without contingency awareness.

DISCUSSION

In this study, one special category of the US, i.e., the self, was employed to see if the evaluative conditioning effect could be observed when pairing this US with some neutral novel objects, in this case abstract paintings. The EC effect was analyzed not only in terms of valence, but also possible linear relation between the strength of attitude toward the US and the magnitude of the EC effect. We further examined whether implicit or explicit self-esteem would predict the EC effect better, and whether the associations between implicit self-esteem, explicit self-esteem, and the EC effect would be influenced by contingency awareness.

To our knowledge, though self-evaluation has been identified as an important source of attitudes (Greenwald & Banaji, 1995), the self has seldom been used in studies on evaluative conditioning (for an exception, see Dijksterhuis (2004) where self-esteem, however, was a CS rather than a US). The only study we found in the literature using the self as a US was two between-subjects experiments conducted by Walther and Trasselli (2003), in which only explicit self-evaluation (manipulated by means of false feedback) was used.

In our study, more constant evaluations of the self were assessed. Still, we obtained an evaluative conditioning effect successfully. Our results demonstrated that self-evaluation could be observed when pairing information of the self with neutral objects that were unrelated to the self. Since our results were comparable to what was found using an ownership paradigm (rs in .3–4, Gawronski, Bodenhausen, & Becker, 2007, experiments 3 and 4), we contend that mere association is sufficient to induce the formation of new attitudes. Our findings further confirmed that people adopt positive attitudes toward objects belonged to them not because they own them, but because the objects are associated with their selves.

We also examined if there were any correlations between the magnitudes of attitude toward the USs and attitude change toward the CSs after the EC. It was found that implicit self-esteem, but not explicit self-esteem, was significantly correlated with the EC effect ($r = .31$ vs .06). To rule out the possibility that the correlation between explicit self-esteem and attitude change was low because the attitude change was a relative index while explicit self-esteem was an absolute index, we aggregated the attitude changes toward the two paintings that were associated with the self and calculated the correlation between explicit self-esteem and this index of attitude change. Again, the correlation coefficient was near zero ($r = .02$). Therefore, we concluded that explicit self-esteem was not a significant predictor of evaluative conditioning in our study.

We did fail, however, to include an implicit attitude test toward the CSs in our study. Therefore, it was impossible for us to examine whether implicit attitudes toward the CSs were changed more than explicit attitudes by evaluative conditioning, or to examine the path in the APE model that changes of explicit attitude was mediated by the changes of implicit attitude after evaluative conditioning (Gawronski & Bodenhausen, 2006). Nevertheless, the explicit attitudes we measured should be an accurate reflection of the implicit attitudes toward the paintings, since there was no need for impression management or self-deception among our participants (Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005).

Awareness of contingencies did play a role in evaluative conditioning. There was a tendency that the more knowledge of contingencies between the USs and the CSs an individual had, the stronger the EC effect displayed, both when contingency awareness was analyzed at the participant level and at the item level. The EC effect was also a little more pronounced among participants who could attribute their attitude change to the EC procedure than those who could not lent credit to the existence of the propositional process. However, one should be cautious in generalizing this finding

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because in our study, more than half of the participants indicated full awareness of the contingencies between the USs and the CSs. Whether the EC effect can be acquired in studies when the contingencies are not so easily identified is still open to question.

Contrary to our prediction, implicit self-esteem could predict the EC effect with or without contingency awareness, whereas the association between explicit self-esteem and the EC effect was nonsignificant in both conditions. These results revealed that implicit attitudes toward the USs were predictive of the EC effect even when the propositional process was involved. An important point to note was that the propositional and associative processes are not mutually exclusive. When there is no contingency awareness, the propositional process is unlikely to occur, since it depends on subjective reasoning. However, when there is contingency awareness, both propositional and associative processes could be involved. Therefore, one plausible explanation is that the effect of the associative process was more powerful than the propositional process. The other explication could be that only implicit attitudes could be transferred, even when people form new attitudes through propositional process. Only relying on explicit attitudes might have been a potential problem in previous studies in which the evaluative conditioning effect was not obtained. Further investigation is needed to find out the conditions under which the association between explicit attitudes toward the USs and the EC effect would be elicited.

A potential problem of this study was that implicit self-esteem was measured before the EC procedure. Such an arrangement made it salient the pairings of the words and paintings, and the relation between the IAT measure and the EC procedure, making demand characteristics as an alternative explanation for our results. However, as Greenwald and Banaji (1995) suggested, implicit self-esteem is not introspectively known to the actor. Therefore, even if our participants were aware of the purpose of the experiment, it would still be difficult if not impossible for them to adjust their ratings of the paintings so as to ''produce'' a significant association between these ratings and the implicit self-esteem measure. Consistent with this line of argument, the relation between implicit self-esteem and the EC effect held with both contingency awareness and demand awareness being controlled for, corroborating the validity of our findings.

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