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Attentional Bias on Different Emotional Valence Information: Among College Students With Different Implicit Aggression

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Abstract
The study is a preliminary exploration on attentional bias among college students of different implicit aggression, by using different emotional valence pictures as experimental materials and dot-probe paradigm, as well as employing The Single Category Implicit Association Test which results was found being positively related to the self-reports of participants and also being consistent with the behavior of them. The experimental results show that attentional bias of college students in different implicit aggression do not be changed with the pictures of different emotional valence. But it is found that there is the significant difference between the Stimulus Onset Asynchrony and the participants of different implicit aggression during the experiments as well.

Key words: Self/evaluative implicit aggression; The Single Category Implicit Association Test (SC-IAT); attentional bias; Dot-probe paradigm; Stimulus Onset Asynchrony (SOA)

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INTRODUCTION

Implicit aggression refers to any form implicit behavioral propensity or psychological feature with the purpose of harming an organism that wants to escape from this harm under the lack of conscious monitoring or an inexplicit state of consciousness. In the mid-1990s, encouraged and inspired by studies on implicit memory, scholars such as Greenwald and Banaji (1995) proposed the concept of implicit social cognition and its research system and paradigm according to the conscious and unconscious processing of social information. They explicitly pointed out that the social behavior of an individual is implicit and spontaneous. On this basis, Chen, Yang and Liu (1996) used the task dissociation paradigm of implicit social cognition and used pictures as experimental materials to explore the aggressive behaviors of teenagers; they found that there was a significant experimental dissociation among aggressive behaviors, which implies that aggressive behaviors can also be implicit. In addition, it was discovered that the research methods for implicit memory could also be applied to other research fields in implicit social cognition. Since then, research on implicit aggression gradually began to develop. Some scholars have classified implicit aggression into evaluative implicit aggression and self implicit aggression based on existing studies (Zhou, 2007). Evaluative implicit aggression manifests as an implicit attitude towards aggressive stimuli. More active implicit attitude towards aggressive stimuli implies higher levels of evaluative implicit aggression. Self implicit aggression manifests as the strength of association between the self and aggressive concepts. The more precise the association is, the more an individual will unconsciously consider themselves as highly aggressive, thus their self implicit aggression will also be higher (Ibid.).

The Implicit Association Test (IAT) first proposed by Greenwald, McGhee, & Schwartz in 1998, is a computerized category discrimination task. Karpinski and Lytle (2005) amended the IAT and use the single category IAT (SC-IAT) to measure the association strength with a single attitude object for the first time. In some earlier

Table 1
SC-IAT Procedure for Measuring Implicit Aggression

Block	No. of stimuli	Function	Response	
			Left button	Right button
1	24	Practice	Positive + aggressive	Negative
2	72	Test	Positive + aggressive	Negative
3	24	Practice	Positive	Negative + aggressive
4	72	Test	Positive	Negative + aggressive

studies, researchers also called this modified method the Wigboldus IAT (WIAT) (Cui & Zhang, 2004). SC-IAT is composed of two stages and each stage consists of 24 practice tests followed by 72 actual tests (24 tests in a block, altogether 3 blocks) (see Table 1). During the experiment, target words will be displayed on the screen for the entire duration or for 1,500ms before the participants' response. If a participant does not react within 1500ms, a prompt saying "Please respond more quickly" will be shown on the screen for 500ms. This 1500ms response window will cause a sense of urgency and helps to reduce the possibility of participants' controlled processing during the task (Karpinski & Lytle, 2005). Wigboldus found that IAT results were positively correlated with the self report of participants, while other scholars have found that these results were consistent with the behaviors of the participants (Karpiski & Hilton, 2001; McConnell & Leibold, 2001).

In recent years, some researchers have applied the method of behavioral experiment to explore the attentional bias of different aggressors. With the rise of cognitive psychology, Dodge et al. proposed a processing model for social information since the 1980s, analyzing the mechanism of human aggression from the perspective of information processing. According to this model, from facing an external stimulus to responding with aggressive reactions, individuals with aggressive propensities have their unique style for each step in information processing, showing certain cognitive defects, such as in attention, memory etc. Existing studies mostly discuss the attentional bias of aggressors from the perspective of explicit aggression, but rarely involve implicit aggression.

Attentional bias refers to the phenomenon that an individual can only be aware of certain stimuli when there is multiple stimuli. The result of study (Peng & Zhou, 2005) demonstrated that the processing of affective information is a spontaneous bottom-up process driven by stimuli. In the attentional experiment, affective stimuli drew more attention or occupied more attentional resources compared to non-affective ones, thus resulting in attentional biases. The attentional bias of aggressors means that they are highly sensitive to hostile stimuli, and prefer selectively processing aggressive stimuli in their attention (Yu & Guo, 2009).

To resolve the response preparedness effect encountered in the Stroop tasks, MacLeod, Mathews, & Tata (1986) designed the dot-probe paradigm, which can effectively investigate the orientation and maintenance of attention, and thus is widely applied in studies on attentional biases. The paradigm involves presenting a pair of emotional stimuli, and performing a button press in response to the dot probe appearing at one of the stimuli positions in order to observe attentional biases. If the reaction time toward the dot probe after the negative stimuli is reduced, this shows that there is an attentional bias towards the negative stimuli; if the reaction time towards the dot probe after the positive stimuli is reduced, this shows that there is an attentional bias towards the positive stimuli. For better investigation of the cognitive processing of subliminal affective stimuli, Holender proposed a masked version of the dot probe task paradigm based on the dot probe task (Holender, 1986). In addition, some researchers have also tried to modify the Stimulus Onset Asynchrony (SOA) between the cues and targets to explore whether the attentional bias in the dot-probe paradigm originated from attentional vigilance or caused by attentional engagement (Fox, Russo, Bowles, & Dutton, 2001).

In summary, our study used an SC-IAT which had been proved to be consistent with participants' behaviors and a modified dot-probe task to perform a preliminary investigation on the existence of attentional biases towards information with different valences in college students with different implicit aggression, trying to find out the bridge between the external attack behavior and the implicit aggression through the attention to effectively reduce or prevent the destructive behavior.

1. PRE-EXPERIMENTS

1.1 Participants

130 participants were randomly selected among undergraduates from 3 universities, 67 of them were male and 63 females, with an average age of 20. They were tested using the SC-IAT paradigm and paid adequate remuneration after the experiment.

1.2 Instruments and Materials

Instruments: a computer (CPU: Celeron E3200 2.40GHz, 1G RAM, onboard graphics, 19-inch monitor, resolution: 1440*900, refresh rate: 60Hz, OS: XP SP3) with no response box. The participants completed the experiment using the keyboard instead.

Materials: Self implicit aggression measures the implicit evaluation of an individual towards their own

Table 2
Words Selected for SC-IAT

Type	Sample				
Self	I	We	Oneself	Myself	We
Non-self	He	Them	Him	Her	Others
Positive	Excellent	Clever	Successful	Beautiful	Strong
Negative	Evil	Hateful	Disgusting	Shameful	Dirty
Aggressive	Attack	Violate	Seizure	Slander	Frame

aggression; evaluative implicit aggression measures the implicit attitude of an individual towards aggression (see Table 2).

1.3 Program

The SC-IAT measurement program (see Table 1) was programmed using e-prime 2.0 by computer. The principle of "single person, single machine" was used in the experiment. After a brief explanation of the experimental requirement by the experimenter or the assistant, no guidance and interference were given to the participants. The participants independently finished all the tests in accordance with the instruction of the program and all their responses, reaction times and accuracies were automatically recorded by the computer. To avoid the sequential effect, the ABBA experimental design was used, that is, half of the participants finished the self SC-IAT program first and the other half finished the evaluative SC-IAT program first. To avoid the fatigue effect, once a program was finished, another program was carried out after 5 minutes of rest.

1.4 Data Processing

All the data were processed using the statistical analysis software SPSS13.0.

The experimental data was pre-processed using the scoring method proposed by Karpinski and Steinman (2006), whereby test data with reaction times below 350ms were deleted and then participants whose reaction time was 0ms were deleted; wrong reaction times were replaced by the average of the correct reaction time of B2 or B4 and adding 400ms; then the standard deviation of the correct reaction times of both blocks B2 and B4 was calculated; finally the average difference of reaction times was divided by the standard deviation to obtain D value (Karpinski &Steinman, 2006). A larger D value indicated higher implicit aggression.

D values were sorted in a descending order were divided into two groups, high implicit aggression group and low implicit aggression group, according to the highest and lowest scoring 27% (Kelley, 1939), for different subsequent experiments.

2. EXPERIMENT 1

2.1 Participants

Self SC-IAT was used for the screening of participants and 5 participants with incomplete data were deleted. There were a total of 58 valid participants and their average age was 19.86 with 27 of them in the high-score group and 31 in the low-score group. All the participants joined voluntarily in all the experiments. Their uncorrected or corrected visual acuity was normal and no one had total or partial color blindness. Furthermore, all of them were unfamiliar with the dot-probe paradigm and were given adequate remuneration after the experiment.

2.2 Instruments and Materials

Instruments: a computer (CPU: Celeron E3200 2.40GHz, 1G ram, onboard graphics, 19-inch monitor, resolution: 1440×900, refresh rate: 60Hz, OS: XP SP3), with no response box. The participants finished all the experiment by keyboard.

Materials: 32 positive, 32 negative and 42 neutral pictures selected from the Chinese Affective Picture System (CAPS) (Bai, Ma, Huang, & Luo, 2005). The polarization degree of valence were matched between the positive and negative pictures, with the average valence of positive pictures at 7.38±0.20 and that of negative pictures at 2.00±0.30; their arousal degrees were also consistent, with the average arousal of positive pictures was 5.67±0.65 and that of negative pictures was 6.01±0.80. The average valence of neutral pictures was 5.05±0.14 and average arousal was 3.75±0.67. All the selected affective pictures were made into the same size (about 300×272 pixels, at a size of about 12cm*9.6cm) (Bradley, Field, Mogg, & De Houwer, 2004). 10 neutral pictures were selected randomly as practice materials and the remaining 96 affective pictures (32 positive, neutral and negative pictures, respectively) were used as actual test materials.

The fixation point was "+" and the dot probe was the letter "E" or "F", with all their height at 0.80 cm.

2.3 Design and Program

2.3.1 Design

Three-factor mixed design: 2 (level of implicit aggression: high implicit aggression group and low implicit aggression group)×3 (picture valence: positive, negative and neutral)×2 (SOA: 67ms and 100ms), among which the level of implicit aggression level is a between-group factor, while picture valence and SOA are both within-group factors. The dependent variable was the reaction time of the response to the dot probe ("E" or "F").

2.3.2 Program

The experimental program was an adapted dot-probe task. The task programmed using E-prime2.0 was displayed on

the screen with a black background, white fixation point and letter probe, and colored pictures. Each participant was tested separately.

At the beginning of the experiment, the participant sat about 60cm away from the center of the screen. When the fixation point "+" appeared on the screen, which lasted for 1,000ms, the participant was required to focus on the fixation point. Then pairs of affective pictures were displayed on the left and right sides of the screen (the horizontal distance between the internal edges of each pair of affective pictures was about 6cm) for a duration of 67ms or 100ms. 50ms of blank screen was displayed after the disappearance of the affective pictures. Finally, the letter probe "E" or "F" was shown at either of the position that had previously displayed the affective pictures, which lasted until the participants responded. The participant was required to press the numeric key on the keyboard quickly and accurately. After the completion of the key press, the participant would automatically be shown the next trial after an inter-trial interval of 1,000ms with a blank screen. Before the experiment, the participants were required to complete some practice (as all of them were not familiar with the test, thus practice could be carried out repeatedly by pressing the key) to have a solid understanding of the experimental task and then performed the actual experiment.

The actual experiment consisted of 192 trials (affective picture pairs consisting of 96 actual experimental materials were shown twice respectively for 67ms and 100ms). It was divided into 4 blocks with 48 trials in each block. After the completion of each block, there was a pause for the participants to rest. During the experiment, affective pictures and probe positions (left and right) were matched. The trial sequence of every block was randomized for each participant. After the experiment, the experimenter recorded the test process and answers from participants (such as whether they were fatigued, they used strategy and problems during program display or running).

Figure 1 is a complete dot probe trial for affective pictures.

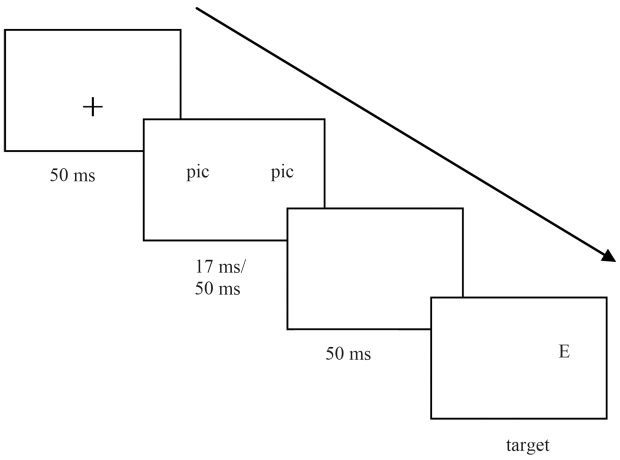

Figure 1
Sample of Dot Probe Task for Affective Pictures

2.4 Data Processing

Statistical analysis software SPSS13.0 and analysis of variance (ANOVA) for multivariate mixed design were used to process the experimental data.

2.5 Results and Analysis

Participants whose average reaction time was below 100ms or above 1,000ms or their accuracy rate less than 90% were deleted. After doing so, there were altogether 51 valid participants. 7 participants were deleted as their reaction accuracy rate was less than 90%, of whom 2 belonged to the high implicit aggression group and the remaining 5 belonged to the low implicit aggression group.

The reaction times of different implicit aggression groups with different picture valences and SOAs are in Table 3:

Table 3
Reaction Times of Different Self Implicit Aggression Groups for Different Picture Valences and Soas

Picture valence	SOA	High implicit aggression group	Low implicit aggression group
Positive	67 ms	727.29±145.85	712.84±144.02
	100 ms	653.30±109.01	678.89±95.94
Negative	67 ms	711.81±120.37	703.32±119.71
	100 ms	698.30±140.67	700.84±123.78
Neutral	67 ms	738.97±133.75	718.03±166.75
	100 ms	698.78±140.67	713.53±140.84

Repeated measures ANOVA showed that SOA [$F(1, 49) = 6.94$, $p < .05$, $\eta^2_p = .12$] had a significant main effect; picture valence [$F(2, 98) = .14$, $p > .05$, $\eta^2_p = .04$] did not have a significant main effect; SOA × implicit aggression level [$F(1, 49) = .18$, $p > .05$, $\eta^2_p = .04$], picture valence × implicit aggression level [$F(2, 98) = .92$, $p > .05$, $\eta^2_p = .00$], SOA × valence [$F(2, 98) = 1.32$, $p > .05$, $\eta^2_p = .03$] and SOA × implicit aggression level × picture valence [$F(2, 98) = .15$, $p > .05$, $\eta^2_p = .00$] did not have significant interaction effect. Since there was no interaction effect between all the independent variables, the data was not further analyzed.

The ANOVA results indicate that there were differences between the attentional biases of college students with different levels of self implicit aggression for different SOAs but the difference did not exist for

different picture valences. Hence, further experiment was performed after changing the participant's grouping condition.

3. EXPERIMENT 2

3.1 Participants

Evaluative SC-IAT was used for the screening of participants and 6 participants with incomplete data were deleted. There were altogether 56 valid participants and their average age was 19.83 years, with 30 of them in the high-score group and 26 in the low-score group. All the participants joined all the tests voluntarily. Their uncorrected or corrected visual acuity was normal and no one had total or partial color blindness. Furthermore, all of them were unfamiliar with the dot-probe paradigm and were given adequate remuneration after the experiment.

3.2 Instruments and Materials

Same as Experiment 1.

3.3 Design and Program

Same as Experiment 1.

3.4 Data Processing

Statistical analysis software SPSS13.0 and ANOVA for multivariate mixed design were used to process the experimental data.

3.5 Results and Analysis

Participants whose average reaction time were below 100ms or above 1000ms or their accuracy rates were less than 90% were deleted. After doing so, there were altogether 49 valid participants. 7 participants were deleted as their reaction accuracy rate was less than 90%, of whom 4 belonged to the high implicit aggression group and 3 to the low implicit aggression group.

Table 4
Reaction Times of Different Evaluative Implicit Aggression Groups for Different Picture Valences and Soas

Picture potency	SOA	High implicit aggression group	Low implicit aggression group
Positive	67 ms	698.58±83.90	744.98±191.33
	100 ms	654.78±114.21	681.39±88.80
Negative	67 ms	709.06±127.86	705.54±116.00
	100 ms	708.96±92.06	691.72±133.01
Neutral	67 ms	759.73±177.50	697.32±114.27
	100 ms	697.19±139.02	716.82±144.51

Table 4 shows the reaction times of different implicit aggression groups for different picture valences and SOAs:

Repeated measures ANOVA shows that SOA [F (1, 47) = 6.01, $p < .05$, $\eta^2_p = .11$] had a significant main effect; picture valence×implicit aggression level [F(2, 94) = 3.21, $p < .05$, $\eta^2_p = .06$] had a significant interaction effect; but picture valence [F(2, 94) = 1.80, $p > .05$, $\eta^2_p = .04$] did not have a significant main effect; picture valence×SOA[F(2, 94) = 1.33, $p > .05$, $\eta^2_p = .03$], SOA×implicit aggression level [F(1, 47) = .52, $p > .05$, $\eta^2_p = .01$], and SOA×implicit aggression level×picture valence [F(2, 94) = 1 .89, $p > .05$, $\eta^2_p = .04$] showed no significant interaction effect.

Combining the research hypotheses, simple effects analysis on the interaction effect for implicit aggression level×picture valence was performed, which revealed that when SOA was 67ms, the reaction time of the high implicit aggression group towards the dot probe for positive pictures was significantly shorter than that towards the dot probe of neutral affective pictures ($p < .05$, two-tailed); The reaction time to the dot probe of negative pictures was also shorter than that of neutral pictures, but did not reach significance level (see Table 5).

4. GENERAL DISCUSSION

4.1 Implicit Aggression and Attentional Bias

Based on the dot-probe study on self and evaluative implicit aggression in college students, it was found that between the attentional biases of college students with high and low implicit aggression, there was no significant difference in the dimension of affective valence, which is

Table 5
Reaction Time Differences of Different Evaluative Implicit Aggression Groups in Dot Probe

Mean difference of reaction times	SOA	High implicit aggression group		Low implicit aggression group	
		M	*SD*	*M*	*SD*
$RT_{positive}$-$RT_{negative}$	67 ms	–10.48	110.84	39.45	168.51
	100 ms	–54.16	101.23	–10.33	138.07
$RT_{positive}$-$RT_{neutral}$	67 ms	–61.15	182.39	47.66	136.90
	100 ms	–42.41	99.10	–35.43	128.95
$RT_{negative}$-$RT_{neutral}$	67 ms	–50.67	150.42	8.22	107.34
	100 ms	11.77	115.74	–25.11	130.55

consistent with the conclusion of previous studies (Li, 2013). Whereas in the SOA dimension, our preliminary investigation revealed that there was a significant difference between the two types of aggression ($p < .05$). However, this significant difference only existed in the attentional biases of high and low implicit aggression in college students towards positive and neutral picture valences when SOA was 17ms, and the difference was not extremely significant ($p < .001$).

In Beck's Schema Theory, once a stimulus is consistent with the schema or knowledge structure, it will be easier to process this type of information. Other researchers have also considered that the cognitive basis of explicit high aggressors consists of aggressive schemas, namely coding personal experience in a hostile manner so as to distort their consciousness and cause a deviation in the interpretation of information. Information consistent with the schema or affective attributes will be processed more easily and the activation of schema or knowledge structure leads to attentional biases (Peng & Zhou, 2005). It has been shown in foreign and local research results (Dai & Feng, 2008; Zhang & Wu, 2011; Eckhardt & Cohen, 1997) that explicit high aggressors have attentional biases towards hostile stimuli. However, this conclusion was not detected in high implicit aggressive people.

The reason for the lack of significant difference between the high-score group and the low-score group may have two explanations. The first is that as an instinct, implicit aggression does not show overall differences between individuals, that is, human beings have the same driving tendency for aggression. However, in the process of socialization, human beings have different expressions of their aggression instinct due to the influence of various factors. Thus, for the attentional bias toward negative or threatening stimuli, there was no significant difference between high-score and low-score implicit aggression groups though there was a significant difference between high-score and low-score explicit aggression groups. The other explanation is that perhaps implicit aggression and explicit aggression belongs to two separate structures with different psychological processing mechanisms. Thus, there was a significant difference between implicit aggression and explicit aggression, specifically that there was no significant correlation between implicit and explicit aggression, or low correlation between them and might even be disparate phenomena (e.g. Hofmann et al., 2005; Nosek, 2005; Nosek & Smyth, 2007; Zhang, 2010; Li, 2013).

4.2 Implicit Aggression, Affective Valence and SOA

Although some researchers have found that for different affective valence information, college students with different affective styles have significant differences in their attentional biases (Wang, 2011), it seems that these differences still did not exist in college students with different implicit aggression in this study. Although they were all college students, selecting affective style as the criterion for grouping may have a higher possibility of revealing a difference. As for aggression, it is closely related to the sociality of individuals. Under non-stressful circumstances, aggression may possibly be concealed by the effect of social expectation, thus it is quite difficult for the difference to be shown in general college student groups. However, in this study, every effort was made to set up conditions such that the participants could finish the test subliminally.

This study found that when SOA was 67ms, college students with different implicit aggression had significant differences in their attentional biases towards positive and negative picture valences. However, when SOA was 100ms, the same significant difference was not found, which is not consistent with existing research results (Wang, 2011). This phenomenon seems to indicate that the length of SOA will affect the attentional bias of participants. Since all the differences detected were only in the positive and neutral valences, it cannot be shown that college students with high implicit aggression will have attentional bias towards negative or threatening stimuli. On the contrary, the experimental results may be universal.

The study found that no significant interaction effect was found between different affective potencies and SOAs, which are also inconsistent with previous research results (Wang, 2011). This inconsistency may be caused by the selection of participants and the difference of their personalities, but this hypothesis still needs further verification.

CONCLUSION

This study used the SC-IAT paradigm and the adapted the dot-probe paradigm to carry out a preliminary investigation on the attentional bias of college students with different implicit aggression (evaluative and self). The results show that college students with different implicit aggression showed no difference towards the attentional bias of different affective valence information, but it seems that the length of SOA will affect the attentional bias of college students with different implicit aggression. Specifically, the longer the SOA was, the less significant the difference in attentional biases of college students with different implicit aggression, which is inconsistent with the results of existing studies and needs more meticulous investigation in the future studies. This study only carried out a preliminary investigation on general college students and the external effect of this study has not been verified. The author intends to carry out further in-depth studies to reveal the characteristics and mechanisms of attentional biases in implicit aggressors.

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