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Monetary Incentives Enhance Attentional Effects on Social and Emotional Judgment*

Su Keun Jeong Min-Shik Kim†
Department of Psychology, Yonsei University

The present study investigated how attentional selection and monetary incentives influence social and emotional judgment on unfamiliar faces and scenes. Attentional selection was modulated with a Go/No-Go task. A transparent color cue was superimposed on the face or scene stimuli. The participants responded when the Go cue appeared and inhibited their responses when the No-Go cue appeared. In the following evaluation task, the participants evaluated the trustworthiness of faces and the beauty of scenes. When monetary incentives were absent, no evaluation bias was observed on the Go trials. Only on the No-Go trials, the participants evaluated the uncued face more trustworthy than the cued one. When monetary incentives were given, however, evaluation bias was observed on both the Go and No-Go trials. On the Go trials, the uncued faces were evaluated less trustworthy and the uncued scenes were evaluated less beautiful. In addition, the participants evaluated the uncued face more trustworthy on the No-Go trials. An additional experiment confirmed that these results were due to attentional enhancement by monetary incentives. These results suggest that evaluation of stimuli can be biased by attention and that monetary incentives can strengthen attentional effects on social and emotional judgment.

Key words : monetary incentives, selective attention, attentional inhibition, social and emotional judgment

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† Corresponding author : Min-Shik Kim, Department of Psychology, Yonsei University, 134 Shinchon-dong Seodaemun-gu, Seoul (120-749), E-mail : kimm@yonsei.ac.kr

Social and emotional judgment is frequently made in everyday life. People can evaluate personality traits of others and form impressions with little effort (Ambady, Bernieri, & Richeson, 2000; Bar, Neta, & Linz, 2006; Hassin & Trope, 2000; Todorov, Gobbini, Evans, & Haxby, 2007; Wallis & Todorov, 2006). Though social and emotional judgment can be made automatically and rapidly, it can be easily biased. Earlier studies showed that cognitive process such as selective attention can influence emotional evaluation of unfamiliar stimuli (Fenske, Raymond, & Kunar, 2004; Raymond, Fenske, & Tavassoli, 2003). When stimuli were inhibited by selective attention, the inhibited stimuli were evaluated more negatively than the attended stimuli. This devaluation of inhibited stimuli is called the distractor devaluation effect (Fenske & Raymond, 2006; Raymond, Fenske, & Westoby, 2005).

Raymond, Fenske, and Tavassoli (2003) showed distractor devaluation effect with simple visual localization and evaluation tasks. An emotional evaluation task was conducted after a simple visual localization task. In the localization task, the participants were shown two types of patterns (i.e., circle patterns and square patterns) and they responded to the location of one type of the patterns. In the following emotional evaluation task, the participants rated cheerfulness or dreariness of the previously presented patterns. Interestingly, the pattern that served as a distractor in the previous localization task was evaluated more negatively than the target or a novel pattern.

Recently, Fenske and his colleagues showed that even social and emotional judgment such as trustworthiness rating could be affected by attentional inhibition (Fenske, Raymond, Kessler, Westoby, & Tipper, 2005). In their experiment, the participants were shown two unfamiliar faces in a pair and were instructed to respond when the Go cue (e.g., a transparent green oval superimposed on the one of the two faces) appeared (Go trials). The participants, however, should inhibit their responses when the No-Go cue (e.g., a transparent red oval superimposed on the one of the two faces) appeared (No-Go trials). The inhibition caused by the No-Go cue modulated trustworthiness evaluation on the face pairs. When the participants were asked to select a more trustworthy face between the two, they were more likely to choose the previously uncued face on the No-Go trials. In contrast, they selected the previously cued face more frequently when asked to choose a less trustworthy face. The participant showed attentional effect on social and emotional judgment on the No-Go trials, but they did not show any effect on the Go trials. On the Go trials, the participants selected the previously cued and uncued faces equally often regardless of question type.

In Fenske et al.'s study, a face with the Go cue was comparable to a target and a face with no cue was comparable to a

distractor in visual search. When the face with the Go cue was selected, attentional inhibition could be applied to the other face with no cue. The results of the previous studies indicated that social and emotional judgment could be influenced whenever attentional selection and inhibition occurred. Thus, social and emotional judgment on the faces on the Go trials should have been influenced by attentional inhibition, but Fenske et al. did not find such effects on the Go trials. In the present study, we conjectured that distractor devaluation effect could be found on the Go trials when attentional effect was enhanced. We thought that attentional selection and inhibition had occurred on the Go trials, but it might have been too weak to influence social and emotional judgment in Fenske et al.'s study.

We expected that monetary incentive could enhance selective attention so that the distractor devaluation effect might be observed on both the Go and No-Go trials. Several studies showed that monetary incentives could enhance top-down attention (Libera & Chelazzi, 2006; Small, Gitelman, Simmons, Bloise, Parrish, & Mesulam, 2005). To illustrate, in the experiments of Libera and Chelazzi (2006), each trial began with a prime display followed by randomly decided low or high monetary rewards. The prime display had two dimensions (e. g., local versus global) and the participants had to attend to one of the two dimensions in the prime display while inhibiting the other dimension. After the monetary rewards were given, a probe display was presented. The probe display contained either the previously attended or previously inhibited prime dimension. When the probe display contained the previously inhibited prime dimension, the reaction time for the probe display increased (i.e., negative priming). Interestingly, the negative priming effect occurred only in the high monetary reward condition, but not in the low monetary reward condition. Negative priming has been thought to support the inhibition mechanism modulated by selective attention (DeSchepper & Treisman, 1996; Fox, 1995; Tipper, 1985). Therefore, the results of Libera and Chelazzi (2006) implied that high monetary rewards influence selective attention, which in turn results in negative priming effect.

The present study adopted Fenske et al.'s experimental paradigm. As in Fenske et al.'s study, a Go/No-Go task was followed by an evaluation task in the two experiments of the present study. In Experiment 1, monetary reward or penalty was given after the Go/No-Go task. Experiment 1 was composed of three blocks: incentive-absent, incentive-positive, and incentive-negative blocks. In the incentive-absent block, we expected the same results as Fenske et al.'s. That is, the inhibited stimuli would be devaluated only on the No-Go trials, but not on the Go trials. In the incentive-positive and incentive-negative blocks, the participants won or lost ₩100

according to each trial's accuracy. When monetary incentives were given either positively or negatively, the inhibited stimuli on the Go trials would be devaluated just as the inhibited ones on the No-Go trials.

Experiment 2 was conducted to determine whether the devaluation effect in Experiment 1 was due to strengthened attentional selection. Experiment 2 used endogenous arrow cues instead of monetary incentives to strengthen attentional selection. It was expected that attentional selection strengthened by a valid arrow cue would increase the distractor devaluation effect just as monetary incentives did.

EXPERIMENT 1

Experiment 1 investigated the effects of monetary incentives on social and emotional judgment. It was expected that monetary incentives would strengthen the distractor devaluation effect. The current experiment followed the same paradigm as Fenske et al.'s except that the present experiment provided monetary reward or penalty after a Go/No-Go task.

When no monetary incentives were given, the same results as in Fenske et al.'s were expected; the distractor devaluation effect would be present on the No-Go trials. When monetary incentives were given, however, the distractor devaluation effect would occur on the Go trials as well as on the No-Go trials.

METHODS

Participants Twenty Yonsei University students were participated in exchange for money after giving informed consent. All had normal or corrected-to-normal vision and none of them knew the purpose of the experiment.

Apparatus The experiment was conducted with MATLAB 7.0 software with Psychophysics Toolbox extensions (Brainard, 1997) on PC. Stimuli were presented on a LG Flatron 17'monitor (75-Hz refresh rate) with viewing distance of 57cm. A standard keyboard was used as a response device.

Stimuli Four hundred and eighty grayscale face and scene photos were used. Hair and ears of faces were cropped out smoothly using Adobe Photoshop 7.0. Half of the faces were males and the other half were females. Scene stimuli were grayscale natural scene pictures. The size of face and scene stimuli was 3.5° x 3.5° of visual angle, and the distance between two stimuli in a pair was 9.5° of visual angle center to center.

A transparent red or green square patch (3.5° x 3.5°) was used as a cue to signal Go or No-Go trials. The colors of the cues were counterbalanced across the participants. A green cue was a Go signal and a red cue was a No-Go signal to half of the participants. The other half participants were instructed to do the opposite; they were instructed to

respond to red cues but not to green cues. Visual feedback text was given in 22 point white Verdana font. Questions were written in 24 point white Gulim font.

Design and Procedure The participants took a practice block of 24 trials and three experimental blocks of 72 trials. The experimental blocks were consisted of incentive-absent, incentive-positive, and incentive-negative blocks. In the incentive-absent block, no monetary reward or penalty was given. In the incentive-positive block, the participants were paid ₩100 for each correct response. In the incentive-negative block, the participants lost ₩100 for each incorrect response. After the participants finished experiment, they were paid according to their scores, and ₩14,340 were paid on average.

A visual feedback indicated the amount of monetary reward or penalty that the participants would be paid per trial. In the incentive-absent block, the visual feedback was always "0". In the incentive-positive block, the visual feedback was "+100" when response was correct, "+0" when response was incorrect. In the incentive-negative block, the visual feedback was "−0" when response was correct and "−100" when response was incorrect.

The incentive-absent block was always conducted first as the previous research (Small et al., 2005). After finishing the first incentive-absent block, the participants performed the following incentive-positive and incentive-negative blocks. The order of the

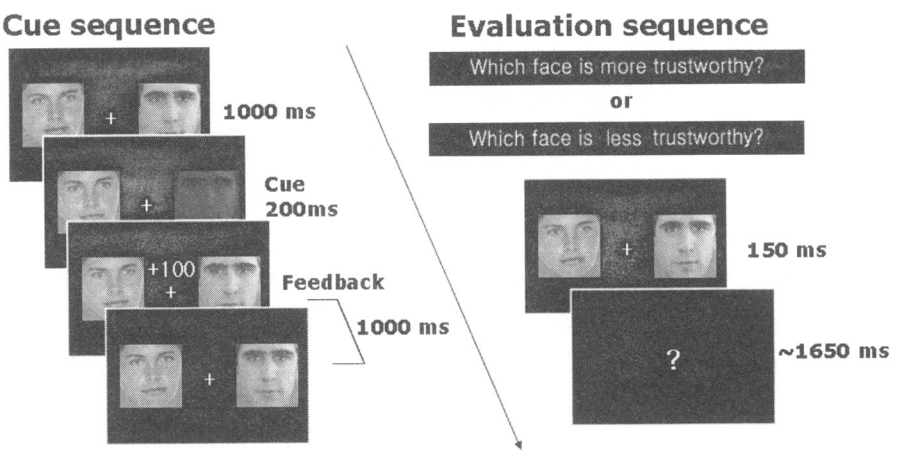

Figure 1. A schematic procedure of Experiment 1. In the cue sequences, a visual feedback was appeared above the fixation after 1,000 ms from No-Go cue onset or immediately after participants made their response to the Go cue. The scene cue and evaluation sequences (not drawn in the picture) were exactly the same as the face cue and evaluation sequences except that two scenes were presented above and below the fixation. Stimuli are not drawn to scale.

incentive-positive and the incentive-negative block was counterbalanced across the participants. The experiment including the practice block took about 80 minutes.

The experiment began with a cue sequence followed by an evaluation sequence (Figure 1). The participants were shown each cue sequence by pressing the spacebar. After a 500 ms fixation, a pair of faces appeared for 1,000 ms. Faces appearing in a pair were always matched for sex, race, and emotional expression.

A transparent cue was superimposed on one of the faces for 200 ms, and the face pair remained on the screen for additional 1,000 ms. When the Go cue appeared, the participants had to press left or right arrow key that matched to the position of the Go cue. When No-Go cue appeared, the participants were told not to press any key. The cue appeared on the left or the right face equally often. One third of the cues were Go cues, and two thirds of the cues were No-Go cues.

The visual feedback that indicated the amount of monetary incentive appeared above the fixation immediately after a response was made on the Go trials. When the participants made no response on the No-Go trials, the visual feedback appeared after 1,000 ms from cue onset. The participants heard a beep sound when their response was incorrect.

After each face cue sequence, a scene cue sequence followed. The scene cue sequences were exactly the same as the face cue sequences except that a scene pair appeared above and below the fixation. On the scene cue sequences, the participants responded with the up and down arrow keys.

After each face and scene cue sequences, face and scene evaluation sequences were followed. In the evaluation sequences, the participants evaluated face or scene pairs that had appeared in the previous cue sequences. The evaluation sequence began with a question screen. Two types of questions were used; "Which face is more trustworthy?" and "Which face is less trustworthy?" in the face evaluation sequence, "Which scene is more beautiful?" and "Which scene is less beautiful?" in the scene evaluation sequence. The two types of questions were used equally often. The question screen remained for 1,000 ms and a 'ready' text appeared. When the spacebar was pressed, a 500 ms fixation and a 150 ms face pair screen appeared followed by a screen with a question mark "?". The participants made their choice depending on question type, and heard a beep sound when no response was made within 1,650 ms. The response was made with left or right arrow key. It was emphasized that there was no right answer in the evaluation task and the participants were told to follow their gut feelings.

The procedure of the scene evaluation sequence was exactly the same as the face evaluation sequence except that two scenes

appeared above and below the fixation and response was made by pressing an up or down arrow key.

RESULTS

The overall mean accuracy was 98.8%, and the trials correct in both the cue and evaluation sequences were used for analysis. Since the incentive-positive and incentive-negative blocks had almost the same patterns, $Fs < 1$, the data from the two blocks were combined into an incentive-present block.

Choice scores for evaluation trials were calculated by subtracting the proportion of the uncued stimuli from the proportion of the cued stimuli that were chosen after the evaluation question. The choice scores for each question following the Go and No-Go trials were computed separately. If the participants selected both the previously cued and uncued stimuli equally often in the evaluation sequences, the choice score would be zero. A choice score below zero would indicate the tendency to select the previously uncued stimuli and a score above zero would indicate the tendency to select the previously cued stimuli.

The Go trials and the No-Go trials were analyzed separately. Repeated-measures Analysis of Variances (ANOVAs) with incentive type (incentive-absent or incentive-present) and question type (asked to choose a more or less trustworthy face and beautiful scene) were conducted. The data from the face stimuli trials and the scene stimuli trials were analyzed separately.

Face trials On the Go trials (Figure 2A), the response to question "Which face is less

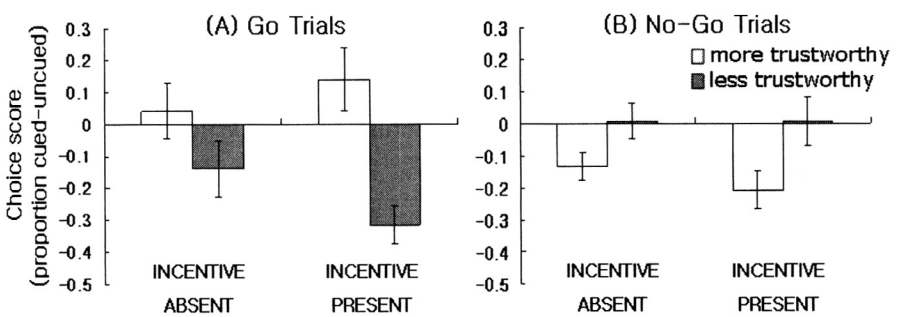

Figure 2. Results of the face trials. Data from the Go trials (A) and the No-Go trials (B). White bars indicate the question "Which face is more trustworthy?" and gray bars indicate the question "Which face is less trustworthy?". The scores on the Y-axis are the proportion of cued faces minus the proportion of uncued faces that were chosen after the evaluation questions. A score below zero means the tendency to select a previously uncued face, and a score above zero means the tendency to select a previously cued face. Error-bars represent standard errors of means.

trustworthy?" depended on incentive type. Repeated-measures ANOVAs with incentive type and question type revealed a significant interaction effect, $F(1,19) = 5.55$, $MSE = 0.069$, $p < .05$, and a significant main effect of question type, $F(1,19) = 8.63$, $MSE = 0.235$, $p < .01$. The significant interaction implied that there was no tendency to choose the previously cued or uncued face when monetary incentives were absent, all ps = n.s. However, when monetary incentives were given, the participants selected the previously uncued face more often than the cued one when asked to choose a less trustworthy face, $t(19) = -5.39$, $p < .001$. The difference between biases to select the previously uncued face in the incentive-absent and incentive-present blocks was also significant, $t(19) = 2.18$, $p < .05$. The novel finding was that distractor devaluation effect was observed on the Go trials when monetary incentives were present.

On the No-Go trials (Figure 2B), repeated-measures ANOVAs with incentive type and question type failed to reveal a significant interaction, p = n.s., and main effect of question type was significant, $F(1,19) = 6.31$, $MSE = 0.102$, $p < .05$. In both incentive-absent and incentive-present blocks, there were tendencies to select the previously uncued face when asked to choose a more trustworthy one, $t(19) = -3.12$, $p < .01$, $t(19) = -3.51$, $p < .01$, respectively. Whether monetary incentives were present or not, the inhibited face on the No-Go trials was devaluated. These results on the No-Go trials were similar to Fenske et al.'s results.

In addition, repeated-measures ANOVAs with incentive type, trial type (Go trials or No-Go trials), and question type revealed marginally significant three-way interaction, $F(1, 19) = 3.85$, $MSE = 0.078$, $p = .064$, which suggested that the incentive-present block showed strengthened distractor devaluation effect.

In sum, the cued faces were selected and the uncued ones were inhibited by selective attention on the Go trials. On the contrary, the cued faces were inhibited on the No-Go trials. When monetary incentives were absent, only the inhibited stimuli on the No-Go trials showed distractor devaluation effect, replicating Fenske et al.'s results. When monetary incentives were given, distractor devaluation effect was strengthened so that the inhibited stimuli on both the Go and No-Go trials were devaluated.

Scene trials On the Go trials (Figure 3A), the interaction between incentive type and question type was significant, $F(1, 19) = 24.36$, $MSE = 0.032$, $p < .001$, and main effect of question type was significant, $F(1, 19) = 6.37$, $MSE = 0.172$, $p < .05$. When no monetary incentives were present, the participants selected both the previously cued and uncued scene equally often regardless of question type, both ps = n.s. However, when

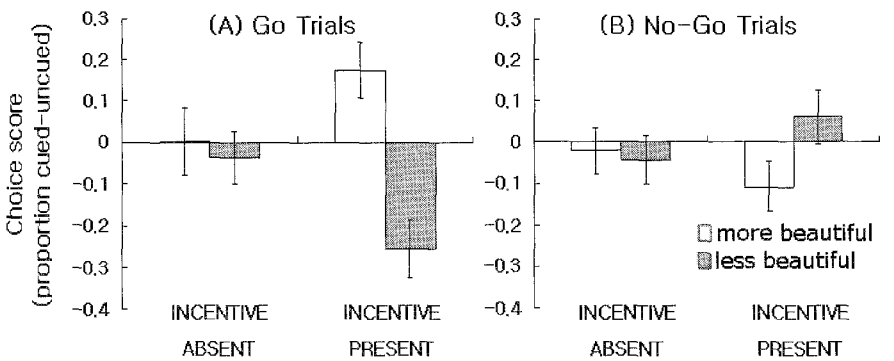

Figure 3. Results of the scene trials. Data from the Go trials (A) and the No-Go trials (B). White bars indicate the question "Which scene is more beautiful?" and gray bars indicate the question "Which scene is less beautiful?".

monetary incentives were given, the participants showed biases to select the previously cued scene when asked "Which scene is more beautiful?" and uncued scene when asked "Which scene is less beautiful?", $t(19) = 2.62$, $p < .05$, $t(19) = -3.75$, $p < .01$, respectively. The tendency to select the previously cued scene when question was "Which scene is more beautiful?" in the incentive-absent block was significantly different from that in the incentive-present block, $t(19) = -3.06$, $p < .01$. Also the tendencies to select the previously uncued scene when question was "Which scene is less beautiful?" in the incentive-absent block and the incentive-present block were significantly different, $t(19) = 2.91$. $p < .01$.

On the No-Go trials (Figure 3B), no significant main effect or interaction was observed, all ps = n.s. Regardless of incentive type and question type, the participants selected both the previously cued and uncued scenes equally often.

A significant three-way interaction with incentive type, trial type (Go trials or No-Go trials), and question type supported that the distractor devaluation effect was enhanced when monetary incentives were given, $F(1, 19) = 15.02$, $MSE = 0.057$, $p < .01$. The distractor devaluation effect, however, was observed only on the Go trials. Scene stimuli on the No-Go trials of both the incentive-absent and incentive-present blocks did not show any distractor devaluation effect. This could be due to the scene stimuli being less homogenous than the face stimuli. This possibility will be discussed further in general discussion.

DISCUSSION

Experiment 1 investigated the effects of

monetary incentives on social and emotional judgment. The participants attended or inhibited unfamiliar faces or scenes with the transparent Go or No-Go cues, and made social and emotional judgment on the face or scene pairs.

In the incentive-absent block, distractor devaluation effect was observed on the No-Go trials with the face stimuli. Results showed that on the No-Go trials, the participants selected the uncued face more often than the cued when asked to choose a more trustworthy one. In the incentive-absent block, faces and scenes on the Go trials and scenes on the No-Go trials were not evaluated differently. The patterns of results from the incentive-absent block were similar to those of Fenske et al.'s experiment in which the evaluation of inhibited faces became more negative than that of selected ones. A novel finding in our experiment was, however, that when monetary incentives were added, the incentives influenced social and emotional judgment even on the Go trials. On the Go trials with monetary incentive, the participants evaluated the uncued faces and scenes less trustworthy and less beautiful than the cued ones, and evaluated the cued scenes more beautiful. These results confirmed that monetary incentives could strengthen distractor devaluation effect.

According to the Prospect theory (Kahneman & Tversky, 1979), people make different choices when they face a situation that might give them gains or losses. However, positive and negative monetary incentives had the same effect in Experiment 1. Though it is not clear why the participants showed similar patterns both in the incentive-positive and incentive-negative blocks, it might be explained with recent findings that humans are sensitive to the context of reward (Nieuwenhuis, Heslenfeld, von Geusau, Mars, Holroyd, & Yeung, 2005). Though there were only penalties in the incentive-negative block, no penalty (-₩0) was a more rewarding option than penalty (-₩100). Thus, it seems plausible that no penalty (-₩0) in the incentive-negative block had the same effect as the reward (+₩100) in the incentive-positive block.

EXPERIMENT 2

In Experiment 1, monetary incentives strengthened the distractor devaluation effect. Though we had shown that monetary incentives could influence social and emotional judgment, it was not clear how monetary incentives influenced social and emotional judgment. Experiment 2 was designed to answer this question. Distractor devaluation effect was found when attentional selection and inhibition occurred (Fenske et al., 2004, 2005; Fenske & Raymond, 2006; Raymond et al., 2003, 2005). When stimuli were inhibited by selective attention, the inhibited stimuli were devaluated. We conjectured that

attentional selection and inhibition were enhanced by monetary incentives. Enhanced by monetary incentives, the effect of attentional selection and inhibition could result in robust distractor devaluation.

In Experiment 2, selective attention was modulated directly by using an endogenous arrow cue. A neutral or valid arrow cue always preceded Go or No-Go cues. The participants could not predict the onset location of the Go or No-Go cue when the arrow cue was neutral. When a valid arrow cue appeared, the participants could attend to the cued location preparing for the onset of the Go or No-Go cue while inhibiting the uncued location. In this way selective attention was enhanced directly without any monetary incentives. If monetary incentives in Experiment 1 enhanced selective attention, direct modulation of selective attention in Experiment 2 should show the same results.

In addition, both neutral and valid arrow cue trials were intermixed within an experimental block. In experiment 1, an incentive-absent block always preceded incentive-present blocks. It might be argued that the order of blocks could be a problem. The distractor devaluation effect found in the Go trials of the incentive-present blocks could be due to practice or block order effect. This alternative explanation that the order of blocks influenced the results of Experiment 1 could be rejected when the results of Experiment 2 was the same as those of Experiment 1.

METHODS

Participants Seventeen Yonsei University students were participated in exchange for course credit after giving informed consent. All had normal or corrected-to-normal vision and none of them knew the purpose of the experiment.

Apparatus The apparatus and viewing conditions were exactly the same as those used in Experiment 1.

Stimuli In trials with face stimuli, valid arrow cue was a white arrow which pointed either left or right side, and neutral arrow cue was a white arrow with two heads pointing both left and right side. In trials with scene stimuli, valid arrow cue pointed up or down side, and neutral arrow cue pointed both up and down side. The size of the arrow cue was 0.5° x 0.5° of visual angle. All other stimuli were the same as those used in Experiment 1.

Design and Procedure Participants took a practice block of 12 trials and an experimental block of 96 trials. General procedure was the same as Experiment 1 with one exception (Figure 4). Before the Go or No-Go cue onset, an arrow cue appeared at fixation for 100 ms. When the valid arrow cue pointed a direction, the Go or No-Go cue always appeared in that direction. The participants were told that the valid arrow cue

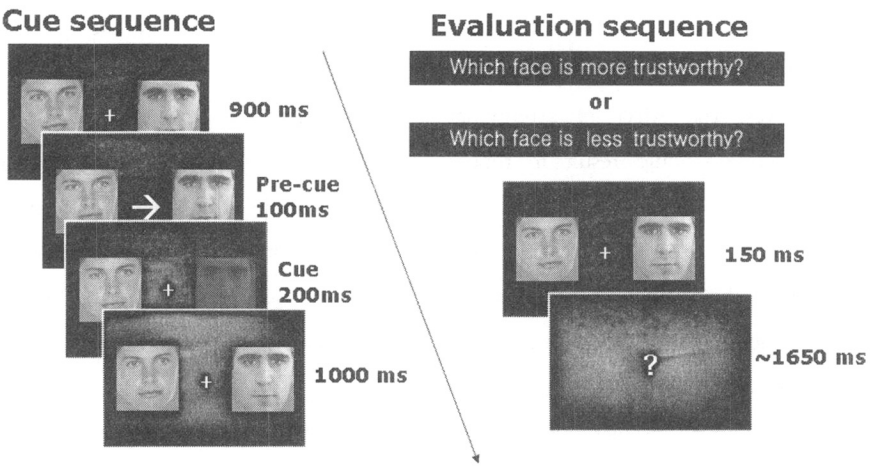

Figure 4. A schematic procedure of Experiment 2. The arrow cue in the face cue sequence is an example of valid one. The scene cue and evaluation sequences (not drawn in the picture) were exactly the same as the face cue and evaluation sequences except that two scenes were presented above and below the fixation. Stimuli are not drawn to scale.

would give the information of the following Go or No-Go cue onset location. One third of the cues were Go cues, which was the same as Experiment 1. Half of the arrow cues were valid and the other half were neutral. Both the neutral and valid arrow cue were randomly distributed within an experimental block.

RESULTS

The trials correct in both the cue and evaluation sequences were analyzed. Two participants whose accuracy of face or scene trials was below 3 standard deviations were excluded from further analysis. The overall mean accuracy of remaining fifteen participants was 95.4%.

The Go trials and the No-Go trials were analyzed separately. Repeated-measures Analysis of Variances (ANOVAs) with arrow cue type (neutral or valid) and question type (asked to choose a more or less trustworthy face and beautiful scene) were conducted. Data from face stimuli trials and scene stimuli trials were analyzed separately.

Face trials On the Go trials (Figure 5A), interaction between arrow cue type and question type was significant, $F(1, 14) = 6.23$, $MSE = 0.114$, $p < .05$, and main effect of question type was also significant, $F(1, 14) = 8.65$, $MSE = 0.240$, $p < .05$. The significant interaction between arrow cue type and question type implied that there was a tendency to choose the previously cued or uncued face depending on the arrow cue type. When the arrow cue was neutral, the

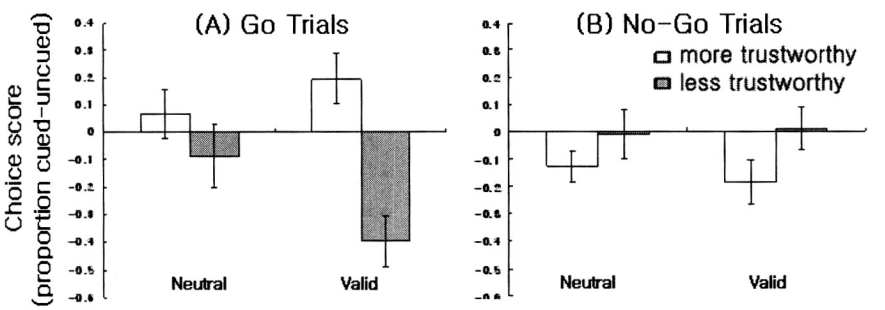

Figure 5. Results of the face trials. Data from the Go trials (A) and the No-Go trials (B). White bars indicate the question "Which face is more trustworthy?" and gray bars indicate the question "Which face is less trustworthy?".

participants did not have any tendency to select the previously cued or uncued face regardless of question type, all *p*s = n.s. When the arrow cue was valid, the cued face gained benefit from enhanced attentional selection while the uncued one was inhibited. These enhanced attentional effects by valid arrow cue resulted in distractor devaluation effect. On the valid arrow cue trials, the previously cued face was evaluated slightly more trustworthy than the uncued one, $t(14) = 2.14$, $p = .05$, and the previously uncued face was evaluated less trustworthy than the cued one, $t(14) = -4.37$, $p < .01$. The difference between biases to select the previously uncued face in neutral arrow cue and valid arrow cue trials was also significant, $t(14) = 2.80$, $p < .05$.

On the No-Go trials (Figure 5B), repeated-measures ANOVAs with arrow cue type and question type did not reveal a significant interaction, *p* = n.s. No main effects were present, all *p*s = n.s. On both neutral and valid arrow cue trials, the previously uncued face was selected more often than the cued one when question was to choose a more trustworthy face, $t(14) = -2.22$, $p < .05$, $t(14) = -2.29$, $p < .05$, respectively.

Repeated-measures ANOVAs with arrow cue type, trial type, and question type revealed a significant three-way interaction, $F(1, 14) = 5.55$, $MSE = 0.089$, $p < .05$, which suggested that the distractor devaluation effect was strengthened when the arrow cue was valid.

The result patterns of the neutral and valid arrow cue trials were well matched to those of the incentive-absent and incentive-present blocks in Experiment 1.

Scene trials On scene trials, there were no significant main effects or interactions present, all *p*s = n.s. Though there were no statistically significant effects, the Go and No-Go trials were separately scrutinized to

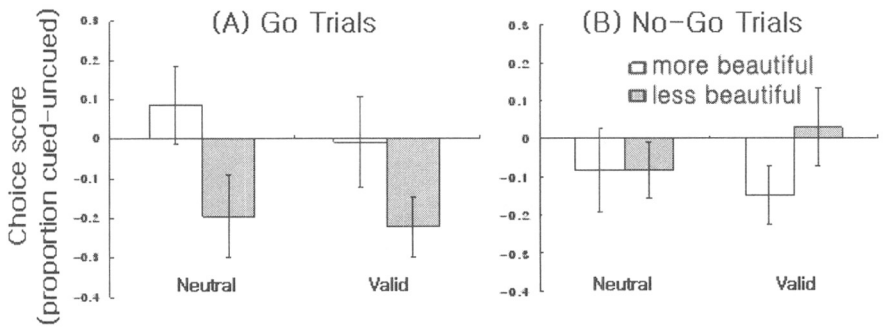

Figure 6. Results of the scene trials. Data from the Go trials (A) and the No-Go trials (B). White bars indicate the question "Which scene is more beautiful?" and gray bars indicate the question "Which scene is less beautiful?".

find any meaningful pattern.

On both the Go and No-Go trials with neutral arrow cue, no significant tendency was found, all *p*s = n.s. On the Go trials with valid arrow cue (Figure 6A), however, the previously uncued scene was selected more often than the cued one when question was to choose a less beautiful one, $t(14) = -2.98$, $p < .05$. On the No-Go trials with valid arrow cue (Figure 6B), the tendency to select the previously uncued scene when question was to choose a more beautiful scene was marginally significant, $t(14) = -1.93$, $p = .07$. Although there was no significant interaction, the pattern of the results implied that distractor devaluation effect could be observed when the valid arrow cue was present.

DISCUSSION

The results of Experiment 2 replicated the main findings of Experiment 1. When a neutral arrow cue preceded the Go or No-Go cue, only the inhibited face stimuli by the No-Go cue were devaluated. However, when a valid arrow cue guided selective attention, the inhibited stimuli on the Go trials were devaluated as well as on the No-Go trials. By manipulating attention directly with valid arrow cues, Experiment 2 suggested that the process that monetary incentives influenced in Experiment 1 was selective attention.

In addition, these results rejected an alternative explanation that the results of Experiment 1 were due to the order of blocks. In Experiment 1, the incentive-absent block always preceded the incentive-present block. If the results of Experiment 1 were caused by block order effect, the patterns of neutral and valid arrow cue trials in Experiment 2 should have been different from those of the incentive-absent and incentive-present blocks. In spite of being

intermixed within an experimental block, the neutral and valid arrow cue trials in Experiment 2 showed similar patterns as those in Experiment 1.

GENERAL DISCUSSION

The present study investigated the effects of monetary incentives and selective attention on social and emotional judgment. The results of the present study suggested that unfamiliar stimuli could be devaluated by attentional selection and inhibition, and this distractor devaluation effect became more robust when monetary incentives enhanced attentional effects. Experiment 1 showed that distractor devaluation effect was strengthened when monetary incentives were given. The results of Experiment 2 confirmed that monetary incentives in Experiment 1 modulated selective attention. Also Experiment 2 ruled out the possibility of the order effect in Experiment 1.

However, the results of the scene stimuli were not as clear as those of the face stimuli. The distractor devaluation effect by selective attention and monetary incentives was found on both Go and No-Go trials with face stimuli whereas no effect was present on the No-Go trials with scene stimuli. One possibility is that faces are more homogenous stimuli than scene stimuli. The face stimuli had more similar configurations, and faces in a pair were always matched for sex, race, and emotional expression. Unlike the face stimuli, scene stimuli were heterogeneous. Scene stimuli could contain rivers, trees, buildings, and so on. The heterogeneity of the scene stimuli might have made the response of the participants less consistent. Though not clear enough, the results of the scene stimuli on the Go trials fell in line with hypothesis of the present study. The effects of monetary incentives and valid arrow cue on the Go trials with scene stimuli showed patterns similar with the results of face stimuli. When monetary incentives were given or when the valid arrow cue was present on the Go trials, the inhibited scene stimuli were evaluated less beautiful than the attended ones.

The present study showed similar results as Fenske et al.'s that inhibited stimuli on the No-Go trials were devaluated. We found distractor devaluation effect not only on the No-Go trials but also on the Go trials when monetary incentives or valid arrow cue were given. The reason why Fenske et al. did not find any effect on the Go trials could be that attentional selection on the Go trials might have been too weak to influence evaluation in their study. Enhancing attentional effects on the Go trials resulted in distractor devaluation effect as we expected. Therefore, the present study is consistent with other previous researches that found distractor devaluation effect whenever attentional selection and inhibition had occurred, and is able to expand Fenske et al.'s results.

It might seem probable that simple Go

trials are so easy that there is no need to apply attentional inhibition to distractors. However, a study with macaque monkeys showed that distractors were inhibited even in an easy pop-out visual search (Bichot & Schall, 2002). Moreover, other previous studies consistently showed that distractor devaluation effect could be observed whenever there were inhibited stimuli. In One study, Raymond, Fenske, and Westoby (2005) used a simple visual search task to show distractor devaluation effect. One of the visual search tasks that they used was to find a red Mondrian pattern among green ones or to find a green one among red ones. The search slope was very shallow and was not affected by set size. However, they found distractor devaluation effect in the stimuli seen as distractors in previous visual search display.

In this regard, we used monetary incentives and valid arrow cues to enhance attentional effects. The validity of using monetary incentives and arrow cues to enhance selective attention can be supported by other studies. Previous researches showed that monetary incentives enhanced the activity of brain areas mediating top-down attention (Small et al., 2005), and endogenous cues such as the arrow cue we used in the Experiment 2 recruited top-down attention (Posner & Snyder, 1975; Jonides, 1981).

In summary, the present study suggests that attention and social-emotional judgment are very closely related with each other. Selective attention can influence social and emotional judgment, and the attentional effects on social and emotional judgment can be strengthened by monetary incentives.

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금전적 보상과 내재적 주의 조작에 의한 사회정서적 판단 변화

정 수 근 김 민 식

연세대학교 심리학과

본 연구는 금전적 보상과 선택적 주의가 사회정서적 판단에 미치는 영향을 알아보았다. 반응/반응억제 과제를 통해 선택적 주의를 조작하였고 참가자들은 낯선 얼굴이나 자연 풍경 사진 위에 반투명하게 나타나는 단서의 종류에 따라 반응을 하거나 억제하였다. 반응/반응억제 과제에 이어서 얼굴의 신뢰도 혹은 자연 풍경의 아름다움을 평가하는 과제로 사회정서적 판단 변화를 측정했다. 금전적 보상이 주어지지 않은 반응억제 시행에서 참가자들은 반응억제 단서가 나오지 않은 얼굴을 더 신뢰할 수 있어 보인다고 평가하는 경향을 보인 반면 반응 시행에서는 어떠한 편향도 보이지 않았다. 그러나 금전적 보상이 주어진 경우 반응과 반응 억제 시행 모두 사회정서적 판단의 편향이 나타났다. 참가자들은 반응 시행에서 반응 단서가 나오지 않은 얼굴과 풍경 사진이 각각 더 신뢰할 수 없고 더 아름답지 않아 보인다고 답하는 경향을 보였으며 반응억제 시행에서는 금전적 보상이 없을 때와 마찬가지로 반응억제 단서가 나오지 않은 얼굴이 더 신뢰할 수 있어 보인다고 평가하였다. 후속 실험에서는 이러한 결과가 금전적 보상에 의한 선택적 주의 강화 때문이라는 추가적인 증거를 제시하였다. 본 연구의 결과는 금전적 보상이 사회정서적 판단에 영향을 미치는 선택적 주의 효과를 강화할 수 있음을 시사한다.

주제어 : 금전적 보상, 선택적 주의, 주의 억제, 사회정서적 판단