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Saliency modulates affective evaluations but not behavioral responses in the ultimatum game

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ABSTRACT

Although numerous studies have demonstrated that the saliency of perceptual information guides attention, the effect of perceptual saliency in high-level social situations remains unclear. Here, in a modified ultimatum game that included both gain and loss sharing, we highlighted either the fairness (fair or unfair) or the valence (gain or loss) aspect of a proposed offer using salient background colors with social meanings. The results showed that emotional responses to proposed offers were influenced by visual saliency. Specifically, individuals felt more dissatisfied about unfair (as opposed to fair) offers when fairness was emphasized than when valence was emphasized or no emphasis; and similarly, individuals felt more dissatisfied about loss situations compared to gain situations when valence was emphasized than when fairness was emphasized or no emphasis. However, this attentional modulation of social information led to changes only on affective responses but not on actual behavioral responses. Our findings indicate that attentional modulation of social information has a profound impact on affective evaluation by changing how information is weighed.

1. Introduction

In our daily lives, we are constantly bombarded by a variety of stimuli, some of which merit further processing while others are redundant. Attention guides focus towards highly salient perceptual information like color, orientation, shape or motion (Fecteau & Munoz, 2006), as well as salient stimuli with social meaning such as emotional faces and signs of warning (Pessoa, McKenna, Gutierrez, & Ungerleider, 2002). How the saliency of task-relevant perceptual information guides attention has been intensively studied in the past several decades (Duncan & Humphreys, 1989). Previous studies have shown that top-down, task-relevant attention allocation can influence individuals' emotional responses to stimuli (Bishop, Duncan, Brett, & Lawrence, 2004; Johnstone, van Reekum, Urry, Kalin, & Davidson, 2007; Pessoa et al., 2002), especially towards stimuli which induce various emotions by themselves (Mitchell & Greening, 2012). Importantly, people often experience mixed emotions in social situations (Hemenover & Schimmack, 2007; Larsen & McGraw, 2011; Tanaka, Kaiser, Butler, & Le Grand, 2012). For example, when sharing a reward (e.g., \$100) with another person, receiving \$30 may elicit happy emotions for receiving some monetary reward which is better than none. Despite this, it is also possible that receiving only 30% of the total money (while also \$30 out

of the total \$100) may produce negative emotions simultaneously for being treated unfairly. Analogously, the perspective taken, such as whether a half-filled bottle of water is perceived as half-empty or half-full, affects how a situation is appraised, leading to differences in felt emotions.

Of note, previous studies focus on top-down influences on emotion, e.g. how task-related attention deployment may influence emotion. It is still unclear whether and how task-irrelevant, low-level saliency modulates individuals' emotional appraisal and actual decisions in response to complex social stimuli. Recent research has demonstrated that salient stimuli can guide attention even when saliency is task-irrelevant and redundant (Hickey & van Zoest, 2012; Lamy & Zoraris, 2009). For instance, in a study by Anderson, Laurent, and Yantis (2011), colors were associated with high or low monetary reward and were then assigned as task-irrelevant distractors in a visual search task. Results showed that reaction time for target visual searching was slowed by the presence of a task-irrelevant color distractor that was previously paired with high reward. Based on this, it can be seen that task-redundant salient information can have a direct and non-strategic influence on how our attention is deployed for stimuli capture, and possibly influence individuals' emotional responses to these stimuli. Up to this stage, no study to our knowledge has investigated whether and how task-

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irrelevant perceptual information affect decisions in high-level social situations.

Extending from previous research on task-irrelevant saliency-based attentional capture, the current research aims to investigate whether and how task-irrelevant and redundant salient information modulates the affective appraisal of social stimuli and behavioral decision-making in the context of social bargaining, particularly in the ultimatum game (Güth, Schmittberger, & Schwarze, 1982; Handgraaf, Van Dijk, & De Cremer, 2003; Pillutla & Murnighan, 2003). Typically, the game consists of two players, the proposer and the responder. The responder chooses to either accept or reject the reward allocation proposed by a proposer. Upon acceptance, the resource is divided according to the offer. Upon rejection, both players receive nothing. A completely reward-maximizing responder would accept any offer larger than zero, as receiving something is better than receiving nothing. However, a great number of studies show that responders are unwilling to accept offers that leave them with approximately 20% of the pie or less (Camerer & Thaler, 1995; Henrich et al., 2006; Hoffman, McCabe, & Smith, 1996). Considering that people are also faced with unfair division of loss between individuals, recent studies have extended the ultimatum game into the loss domain in which two persons share a common liability (Buchan, Croson, Johnson, & Wu, 2005). For a division offer in the loss scenario, an “acceptance” decision made by the responder means being penalized for the amount offered and the proposer bearing the rest, while a “rejection” decision means that each of them would incur a loss of the total sum. Because potential losses have a greater impact than equivalent gains upon people’s choices (Bilgin, 2012; McGraw, Larsen, Kahneman, & Schkade, 2010), research has demonstrated that individuals are more likely to reject unfair offers when bargaining involves negative payoffs than when it involves positive payoffs, given that individuals experience more unfairness and stronger desire to sanction social norm violations in the loss context than in the gain context (Wu et al., 2014; Zhou & Wu, 2011).

2. Study 1

Here we contemplated the effect of task-redundant visual saliency on both affective appraisal and behavioral action in social bargaining. Specifically, we identified two factors (fairness: fair/unfair and valence: gain/loss) in the ultimatum game that are different in nature but elicit the same emotional valence. Taking advantage of the fact that both unfairness and loss induce negative emotions and both fairness and winning elicit positive emotions, we orthogonalized the two factors and then used salient colors to emphasize either the valence aspect or the fairness aspect of distribution offers in the ultimatum game. The main purpose of this study was to investigate whether affective appraisal and behavioral response to the valence or the fairness aspect of each distribution offer would be modulated by the saliency of color highlighting each of their corresponding aspect.

2.1. Method

2.1.1. Participants

Thirty-six healthy participants (mean age \pm SD, 20.44 \pm 1.34 years) participated in return for payment. The sample size was determined based on effect sizes (Cohen’s d $M = 0.71$) obtained from previous studies examining the influence of saliency on value-based decisions (Kim, 2006; McLeish & Oxoby, 2011; Nieuwenhuis, Yeung, Holroyd, Schurger, & Cohen, 2004), and we set the value α at .05 and $1 - \beta$ at .8. The resulting sample size necessary to achieve a given level of power of .8 is 34 people. All participants were right-handed and reported no history of cognitive or psychiatric disorders, had normal or corrected-to-normal vision and no history of color blindness. The study was approved by the Institute Review Board of the University. The methods were carried out in accordance with the approved guidelines and all participants gave written, informed

consent.

2.1.2. Experimental paradigm

At the start of the experiment, each participant was made aware of the rules of the ultimatum game (see Appendix 1). All participants played the role of the responder who chose to either accept or reject the reward allocation offer proposed by a proposer. In the gain condition, accepting the offer led to the division of the money according to the offer, whereas rejection resulted in both players receiving nothing. In the loss condition, accepting the offer led to the suggested division of the loss, whereas rejection results in both players incurring the whole loss. In order to control for potential confounding variables caused by authentic proposers and to assign a predetermined number of trials to the experimental conditions, we did not invite real proposers to participate in the experiment, which is in line with previous experiments (Guo et al., 2013; Wu et al., 2014; Zhou & Wu, 2011). The participant was told that these distribution offers were collected from participants in a previous experiment and that there were different proposers for each trial of the game. Each trial was therefore a “one-shot” game.

The whole experiment consisted of two sessions, each involving 40 rounds of the game. In one session, a red or green rectangular background surrounding the display for each proposal indicated that a distribution was either relatively fair or relatively unfair (see Fig. 1). Participants were explicitly informed of this color-fairness mapping but were not told that they needed to pay specific attention towards the information that is highlighted by the color in the corresponding trial. The color feature therefore served as a coincidental object that shared common aspects of information to the bargain itself but not an integral factor in the bargain itself as the feature did not convey specific information how fair or the magnitude of the gains or losses itself. This meant that participants had to pay attention to the amount offers to make a response while the purpose of the accompanying color feature served only to highlight the aspect to which the offers can be interpreted, i.e. in terms of fairness, or valence. For fair offers, proposers allocated 45%–55% of the total money to responders, both in gain and loss scenarios; for unfair offers, proposers gave responders < 15%–35% of the total money in gain scenarios, but made responders bear a loss of > 65%–85% of the total money in loss scenarios. The specific distribution of offers for all trials was listed in Table S1 (see Appendix 2) and this splitting protocol was fixed across participants. In the other session, a blue or purple rectangular background on the display for each proposal emphasized either gain or loss respectively. Participants were explicitly informed of this color-valence mapping. To control for the psychological impact of colors, the mapping between colors and type of offer was counterbalanced across participants. For example, red represented fair offers for half of the participants but it represented unfair offers for the other half of the participants. The division proposals were selected to include the same offers in each of the two sessions, for each of 10 trials under the four conditions of fair/gain, fair/loss, unfair/gain, and unfair/loss.

Each trial started with the presentation of a fixation cross, which remained on the screen that was jittered from 1 to 3 s (see Fig. 1). Then two gray rectangles appeared on either side of the screen, marking the specific amount of money to be dealt to the proposer and the responder respectively as determined by the proposer. A ‘+’ sign before each number indicated they had gained a sum of money together, and a ‘–’ sign indicated they had lost a sum of money together. The total money they gained or lost ranged from 10 to 46 Chinese yuan (about \$1.6–7.4). To increase the verisimilitude for participants, the names of the proposer and responder were displayed above each gray rectangle. At the same time, a filled colored rectangle (red/green in one scenario and blue/purple in the other) was displayed around the distribution ratio to emphasize the fair/unfair or gain/loss value of the distribution offer. The two sessions’ sequences were counter-balanced across participants. After 5 s, the participants were asked to evaluate how satisfied they were about the distribution offer by pressing 1 to 9 on the

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