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Anger and intertemporal choice: The behavioral approach system and the interactive effects of trait and state anger

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ABSTRACT

This study investigated the effects of anger on intertemporal choice from three dimensions: state anger, trait anger, and the behavioral approach motivation system (BAS). Also, the study tested whether a delayed larger (LL) reward is risky compared to an immediate smaller (SS) reward. Participants ($N = 160$) were randomly assigned to either the anger or the neutral condition. Results showed that people with higher BAS scores tended to prefer a SS reward over a LL reward when they were in a temporarily angry mood. Furthermore, results presented an interactive effect between trait and state anger on choice preference for SS rewards in the anger condition. In addition, a negative relationship was shown between the individuals' preference for SS rewards and the individuals' preference for risky gains in decisions under uncertainty, which indicated that a future reward in intertemporal choice is risky. Both the effect of the BAS and the interactive effect between trait and state anger were explained from the perspective of risk preferences. These results suggest that both situational and biological-based affective information shape decisions and that the perspective of risk preference is the underlying mechanism for the impacts of emotions on decision-making.

1. Introduction

Incidental emotions, generated from sources unrelated to the decision-making tasks, influence subsequent decision-making processes. Considering people have differences in levels of dispositional affects (e.g., extroversion or trait anxiety), Loewenstein and Lerner (2003) state that a temporary emotional state and the corresponding dispositional affect may have an interactive impact on decision making. Recent studies on emotions and decision making have provided some evidence to support this view (Augustine & Larsen, 2011; Hirsh, Guindon, Morisano, & Peterson, 2010; Zhao, Cheng, Harris, & Vigo, 2015; Zhao, Childers, Sang, & Vigo, 2016a). For example, Hirsh et al. (2010) demonstrate that positive affect and extroversion interact together to influence intertemporal decision-making processes. Zhao et al. (2015) argue, however, that emotional state and the corresponding dispositional trait are not the only two factors that influence decision making. They further incorporate a behavioral motivation system, the conceptually neurological motivation system proposed in Gray's Reinforcement Sensitivity Theory (RST; Gray, 1982; Gray & McNaughton, 2000), into the study of anxiety and intertemporal choice. Holding that emotion can be better understood by considering the underlying dimensions (Barrett, 2006; Gray, 1994), we investigate the effects of anger on intertemporal choice from three dimensions: state anger, trait anger, and the behavioral motivation system.

According to the revised RST (Gray & McNaughton, 2000), three biologically-based behavioral motivation systems are present underlying behavior and affect: the behavioral approach system (BAS), the fight/flight/freeze system (FFFS), and the behavioral inhibition system (BIS). The BAS reacts to both conditioned and unconditioned positive stimuli, and facilitates appetitive behaviors. The BAS also generates positive affect and promotes feelings such as happiness, hope, and elation. On the other hand, the FFFS reacts to all aversive stimuli, conditioned and unconditioned, facilitates defensive behaviors (e.g., avoidance and freezing), and mediates the emotion of fear. The BIS works for the resolution of goal conflicts by inhibiting ongoing conflicting behaviors, engaging in risk assessment, and attending to the environment and memories which might help solve goal conflicts (Corr, 2009). This system is related to trait anxiety and the generation of anxiety.

By considering the behavioral motivation system, we may be able to better understand the effect of anger compared to other negative emotions (e.g., anxiety and fear). From the dimension of affective valence, anger is a negative emotion, the same as anxiety. However, from the dimension of motivational tendency, Harmon-Jones and his colleagues (Carver & Harmon-Jones, 2009; Harmon-Jones, 2007; Harmon-Jones & Allen, 1998; Harmon-Jones, Lueck, Fearn, & Harmon-Jones, 2006; Harmon-Jones, Sigelman, Bohlig, & Harmon-Jones, 2003) have provided neural evidence to support that both trait and state anger are related to approach motivation, and are dissimilar from anxiety. Thus, anger is

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related to the BAS which generally responds to positive stimuli and facilitates appetitive behaviors.

We have two reasons to hypothesize that individuals with a more sensitive reward system (i.e., the BAS) tend to choose immediate smaller (SS) rewards in intertemporal choice with a greater frequency than individuals with a less sensitive reward system when they are first in a temporarily angry mood (H1). First, Van Den Bergh, Dewitte, and Warlop (2008) demonstrate that men with higher BAS scores discount monetary rewards more steeply when they are first exposed to sex cues compared to men with lower BAS scores. This indicates a positive relationship between the sensitivity of the BAS and choice preference for SS rewards. Second, in intertemporal choice, a delayed larger (LL) reward is assumed riskier compared to a SS reward because the future is always riskier compared to the known present (Andreoni & Sprenger, 2012; Zhao et al., 2015). Considering that humans prefer sure gains over risky ones (Kahnman & Tversky, 1979), we argue that SS rewards is more appetitive compared to LL rewards. Thus, we reason that the BAS serves to urge people to approach SS rewards in intertemporal choice.

Dispositional affects tend to react in particular affective ways to a variety of events across time and situations (Frijda, 1994). Thus, the effect of induced anger on intertemporal choice may not be independent of trait anger. Lerner and Keltner (2001) demonstrate that angry individuals are as optimistic as happy individuals during risk assessment, as opposed to fearful individuals who are generally more risk-aversive. This indicates that individuals with higher levels of trait anger may, by nature, be more risk-taking. Moreover, recent studies demonstrate the interactive effects between emotional states and the corresponding dispositional traits on intertemporal choice (Hirsh et al., 2010; Zhao et al., 2015).

Hirsh et al. (2010) find that positive affect, eliciting from winning a puzzle game, moderates extroversion to shape subsequent intertemporal decisions. More specifically, for people in a low positive mood, extroverts show no significant difference in making a choice between a SS and a LL reward from non-extroverts. For people in a medium or high positive mood, extraverts tend to prefer a SS reward over a LL reward compared to non-extraverts. Furthermore, Hirsh et al. (2010) employ a "hot" motivational system (i.e., emotional arousal), appealing to the immediately available rewards, to explain the nature of the interactive effect between positive affect and extroversion (Metcalfe & Mischel, 1999).

Zhao et al. (2015) demonstrate that state and trait anxiety interact to influence choice preference for a SS reward in intertemporal decision making when people are first in a temporarily anxious state. Specifically, for people in a high anxious state, those with a high trait anxiety score tend to prefer a LL reward over a SS reward compared to those with a low trait anxiety score. For people in a low anxious state, those with a high trait anxiety score tend to prefer a SS reward over a LL reward compared to those with a low trait anxiety score. However, the psychological processes of a "hot" system was not applicable in explaining the interactive effect of state and trait anxiety because anxious people tend to prefer a LL reward when they are in a high anxious state (i.e., high emotional arousal). Instead, Zhao et al. (2015) propose the perspective of risk preference to explain the interactive finding of state and trait anxiety with the assumption that a future reward is risky compared to an immediate reward (Andreoni & Sprenger, 2012). When people are in a low anxious state, those with a high trait anxiety prefer SS rewards over LL rewards because trait anxiety is associated with risk-aversion (Eisenberg, Baron, & Seligman, 1998). Furthermore, since negative emotional states with high arousal lead to behaviors contrary to their risk tendencies, people with high trait anxiety tend to prefer LL rewards (i.e., high-risk-high-reward options) when they are in a high anxious state (Leith & Baumeister, 1996).

Based on Hirsh et al. (2010) and Zhao et al. (2015), we argue that the interactive effect between an emotional state and the corresponding dispositional affect on intertemporal choice may be a global effect, which mainly influences risk preferences toward choice options. Therefore, we hypothesize that trait anger moderates state anger to affect choice preference for SS rewards in intertemporal decision-making processes (H2). Considering the opposite risk tendencies between trait anger and trait anxiety, we specifically predict that for people in a high angry mood, those with high trait anger tend to prefer SS rewards over LL rewards compared to those with low trait anger, whereas for people in a low angry mood, those with high trait anger tend to prefer LL rewards compared to those with a low trait anger.

In addition, the present study examines whether LL rewards in intertemporal choice are risky by comparing individuals' choice preference for LL rewards with individuals' preference for risky gains in decision under risk. If people prefer both risky gains over sure gains in decision under risk and LL rewards over SS rewards in intertemporal choice, we argue that LL rewards are risky. Thus, we predict that peoples' preference for LL rewards is positively related to peoples' preference for risky gains (H3).

2. Method

2.1. Participants

Undergraduates ($N = 160$), 97 females and 63 males, were recruited to participate in the experiment to receive one course credit. Students were eligible for participation if they had no known diagnosed mental disorders. Participants were randomly assigned to either the anger condition or the neutral condition.

2.2. Measures

2.2.1. State-Trait Anger Expression Inventory (STAXI; Spielberger, Krasner, & Soloman, 1988)

The STAXI is a self-report measure of the experience and expression of anger. It consists of forty-four items in which ten items assess trait anger (i.e., how often people feel angry routinely) and another ten items measure state anger (i.e., how angry people feel like at a specific moment). Example items for trait anger are "I feel furious when I am criticized in front of someone I know" and "I have a fiery temper." Example items for state anger are "I feel like yelling at someone" and "I feel like banging on the table."

Similar as state and trait anxiety measured in Zhao, Harris, and Vigo (2016) and Zhao, Childers, Sang, and Vigo (2016a), we revised the original STAXI from a 4-point scale to a 9-point scale ranging from *1* (never) to *9* (extremely). Exactly the same as the two studies, we used non-intrusive procedures to induce emotion and predicted the induced anger would be very mild. However, the items in the STAXI assessing trait and state anger, especially state anger, reflect high intensity of anger. Thus, participants with different degrees of induced anger may be more often included into the same category using a 4-point scale as compared to using a 9-point scale (Blanton & Jaccard, 2006). Therefore, a 9-point scale may increase sensitivity and accuracy of assessing mild anger. Furthermore, since the revised scale point in STAI does not affect reliability and validity of the inventory (Zhao, Harris, & Vigo, 2016), we deduce the reliability and validity in the STAXI are not affected by revising the scale point. Cronbach's alpha was 0.875 for trait anger and 0.914 for state anger.

2.2.2. Sensitivity to punishment and sensitivity to reward questionnaire (SPSRQ) (Torrubia, Avila, Molto, & Caseras, 2001)

The SPSRQ has two scales: the sensitivity to punishment scale (SP) and the sensitivity to reward scale (SR). SPSRQ consists of 48 *yes-no* response items which assess individual differences in the sensitivity of two motivational systems: the Behavioral Approach System (BAS) and the Behavioral Inhibition System (BIS). Odd items belong to SP and even items to SR. Scores for each scale are derived by summing all *yes* answers. Participants were told that the questions included on the