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Interactive effect of motivational motor action and emotion on divergent thinking

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ABSTRACT

The present study aimed to investigate the integrated effect of approach/avoidance motor action and emotion on divergent thinking. A total of 115 participants were randomly assigned to one of the four experimental conditions (i.e., approach-positive, approach-negative, avoidance-positive and avoidance-negative). Participants' emotion was induced by videos. They were then asked to solve two Alternative Uses Tasks (AUT) while performing motivational motor action (i.e., arm flexion or extension). Results showed that approach motor action (i.e., arm flexion) engendered more ideas than avoidance motor action (i.e., arm extension). More importantly, participants in approach-negative condition performed better on AUT than those in approach-positive condition. In the same vein, avoidance-positive condition promoted divergent thinking in contrast to avoidance-negative condition. However, no effect of emotion on AUT performance was observed. Findings in this study indicate that the incongruence of motivational motor action and emotion enhances divergent thinking. The experience of novel contexts resulted from such incongruence may account for the benefits.

1. Introduction

Creativity is generally conceived as the ability to generate novel and useful ideas, insights, or problem solutions (Amabile, 1983; Sternberg & Lubart, 1999). As a key component of creativity, divergent thinking (DT) is a facet of cognition that leads in various directions (Runco & Acar, 2012). It is usually referred to as a thought process used to generate original ideas by exploring diverse possible solutions, which is involved in many creative efforts (Kaufman, Plucker, & Baer, 2008; Runco & Acar, 2012). Therefore, factors influencing DT have received a lot of attention in creativity research. One critical predictor is the type of goals that drives individuals' behaviour. Goals include approaching positive stimuli or avoiding negative stimuli. Approaching positive outcomes (approach motivation) and avoiding negative outcomes (avoidance motivation) can exert various effects on DT (Friedman & Förster, 2000, 2002, 2005; Hao, Yuan, Hu, & Grabner, 2014).

1.1. Approach and avoidance motivation with DT

Approach motivation refers to the behaviour tendency energized by positive stimuli, whereas avoidance motivation refers to the behaviour tendency energized by negative stimuli (Elliot & Covington, 2001). They are crucial to successful adaptation: avoidance motivation facilitates surviving, while approach motivation facilitates thriving.

A large body of studies has shown that approach motivation enhances DT whereas avoidance motivation blocks it (Friedman & Förster, 2000, 2002, 2005; Hao et al., 2014; Mehta & Zhu, 2009). For example, Friedman and Förster (2002) found that arm flexion associated with approach motivation engendered better DT than arm extension associated with avoidance motivation. According to Cacioppo, Priester, and Berntson (1993), over the course of lifetime, individuals repeatedly flexed their arms to acquire desired objects (i.e., approach motivation). On the other hand, individuals repeatedly extended their arms to reject undesired objects (i.e., avoidance motivation). Thus, arm flexion is considered as an approach motor action whereas arm extension as an avoidance motor action (Cacioppo et al., 1993; Friedman & Forster, 2010, 2002). Approaching appetitive objects signals a benign environment, while avoiding aversive objects signals a dangerous environment. As a result, encouraged by a benign environment clue, individuals tend to adopt heuristic strategies that benefit creative thinking. However, individuals who encounter a dangerous situation usually adopt systematic strategies, which are harmful to DT (Friedman & Förster, 2002, 2005; Hao et al., 2014).

Though researchers found approach motivation improved DT in comparison to avoidance motivation, other researchers demonstrated that persistent and systematic thinking style underlying avoidance

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motivation may also facilitate DT. Avoidance-motivated individuals are easier to feel fatigue. However, they would put more effort into the task if they conceived the task as functional for the next task, which promoted DT (Roskes, De Dreu, & Nijstad, 2012). Moreover, Icekson, Roskes, and Moran (2014) have argued that optimism can mediate the undermining effect of avoidance on DT by mitigating negative emotion. Therefore, it is possible that the systematic processing underlying avoidance motivation could bring about better DT when more effort was exerted or negative emotion was attenuated.

1.2. Approach/avoidance motivation, emotion, and DT

Approach/avoidance motivation and emotion are correlated with each other. Emotions involve multiple distinct processes including affect, appraisal of the valence of a stimulus (its goodness or badness), physiological arousal, and some sort of subjective feelings (Ellsworth, 1994). These correlated processes are posited to operate in parallel. The dissociability of these components lends credence to the possibility that some subset of them can be triggered without coactivating the "subjective feeling" component (Friedman & Forster, 2010). Approaching rewards or avoiding noxious objects signals safety or danger, leads to the appraisal of goodness or badness (Cacioppo et al., 1993). Thus, approach/avoidance motor action can be viewed as implicit affective cues by appraising the goodness or badness of the environment (Friedman & Forster, 2010).

In addition, according to Regulatory Focus Theory, both approach-avoidance behaviour and emotional sensitivities are parts of promotion/prevention motivation system (Higgins, 1997). To fully understand the psychological quality of emotions, promotion or prevention focus must be considered (Cacioppo, Gardner, & Berntson, 1999). Specifically, when individuals successfully reach the appetitive ends, they can have positive emotions such as happiness. Failing to reach appetitive ends leads to negative emotions such as sadness. Likewise, successfully avoiding aversive stimuli leads to positive emotions such as ease or calm, whereas failing to avoid aversive stimuli evokes negative emotions such as fear. Taken together, it is interesting to investigate how implicit emotional cues (i.e., approach/avoidance motor action) and explicit emotions shape DT.

Within the emotion-DT literature, most researchers have distinguished emotion in terms of valence and activation/arousal. De Dreu, Baas, and Nijstad (2008) have developed a dual pathway to creativity model to understand emotion's influence on DT. This model accounts for the joint mood activation and mood valence effect on DT. According to the model, activating moods (e.g. angry, fearful, happy, elated moods) facilitate creative performance through enhanced cognitive flexibility when the tone is positive or through enhanced persistence when the tone is negative. That is, mood activation determines the likelihood of DT, while valence determines the routes by which DT comes out (flexibility route or perseverance route). Recently, researchers have distinguished emotions in terms of valence, activation and orientation (Baas, De Dreu, & Nijstad, 2011; Yeh, Lai, & Lin, 2016). Orientation indicates whether the emotional states focus on approaching rewards or avoiding threats. For example, Gasper and Middlewood (2014) have found that respondents in approach-oriented states (elated) performed better on making creative associations than those in avoidance-oriented states (distressed).

1.3. The present study

Taken together, both motivational motor action and emotion share the same attribute of orientation (approach vs. avoidance). Meanwhile, both are predictors of DT. Though arm motor actions associated with approach/avoidance are not capable of inducing explicit emotions (Friedman & Förster, 2000, 2002), they may occur simultaneously with situations inducing emotions such as happiness or fear during creative ideation. However, it is still unknown how these two factors interact during DT.

To investigate this question, participants in this study were asked to watch a 2-minute video to induce positive/negative emotions. Afterwards, they completed the DT task while performing arm flexion (approach motor action) or extension (avoidance motor action). Efforts of executing the arm motor actions and the enjoyment of task were measured to rule out the potential contaminant effects of these variables on DT. We were interested in the question whether the interaction between motivational motor action and emotion could promote DT. We were not able to make exact prediction for the following reasons. On the one hand, motivational motor action combined with emotion may promote DT. That is, approach motor action combined with positive emotion may lead to higher DT than other combinations of motivational motor action and emotion. On the other hand, motivational motor action may interact with emotion during creative thinking. That is, approach motor action with negative emotion, or avoidance motor action with positive emotion could promote DT.

2. Method

2.1. Participants and design

A total of 115 college students participated in the experiment. A 2 (Motivational Motor Action: approach motor action vs. avoidance motor action) × 2 (Emotion: positive emotion vs. negative emotion) between-subject design was employed. Participants were randomly assigned to one of the four experimental conditions. The data of 7 participants were excluded from further analyses, because these participants did not observe the instruction of thinking ideas that are both novel and useful. Based on evaluation of raters, their ideas were not of usefulness at all. Thus, the final sample consisted of 108 participants (85 females, 23 males; age ranged from18 to 28 years old, $M = 22.05$, $SD = 2.56$). There were 26, 28, 26, 28 participants in the approach-negative, approach-positive, avoidance-negative, and avoidance-positive conditions respectively. Results of Pearson Chi-square test showed no difference in gender ratios among four conditions, $\chi^2 = 0.54$, $p = .91$. All participants were right-handed and native speakers of Chinese. They gave written informed consent prior to the experiment and received approximately 5 US dollars for their participation. The protocol of the experiment was approved by the Institutional Ethics Committee at East China Normal University.

2.2. Procedure

Upon arrival, participants were seated at a table approximately 29.5 in. in height. An instruction sheet with a cover story was provided to them, similar as what used in previous studies (Friedman & Förster, 2000, 2002):

> "Today, you will be participating in a study examining the effects of hemispheric lateralization on problem solving. We are trying to understand the relationship between left and right brain activation and the ability to solve certain type of problems. Basically, there is an on-going debate, with some people saying that the left hemisphere is the centre for this type of cognitive activity and others saying that the right hemisphere is more critical."

Following the cover story, participants were asked to watch videos to induce emotions (see details in Emotion inductions). Then, participants were informed that he or she had been randomly assigned to the left hemisphere activation condition. They were required to assume a particular right arm position. The experimenter demonstrated how to perform arm flexion or extension. A computer screen was placed on the table, and two foam balls were fixed on the top and the underside of the table. In arm flexion condition, a participant's right elbow was bent (Friedman & Förster, 2002), with the palm upward holding the ball on the underside of the table (see panel A in Fig. 1). In arm extension