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Interaction effect of body position and arm posture on creative thinking ☆

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ABSTRACT

Previous studies revealed that in the seated body position, an approach motor action of arm flexion can improve creative thinking compared to an avoidance motor action of arm extension. However in the lying body position, the associations of arm flexion/extension to approach/avoidance motor action are converse. Therefore, there is an opposite prediction for the effect of arm posture on creative thinking. The study reported here asked the participants to work on Alternative Uses Task (AUT) problems while performing arm flexion and arm extension, in the body contexts of being seated on a chair or lying in bed. The results demonstrated that arm flexion and extension in the lying body position exerted effects on AUT performance in a converse pattern compared to that in the seated body position. This is the first study that revealed an interaction effect of body position and arm posture on creative thinking.

1. Introduction

In daily life, people occasionally ponder on problems when lying in bed at night, with the arms under the head, beside the body, on the chest, and so on. Does the generation of creative problem solutions depend on how one's arms are positioned next to the body?

Embodiment theories propose that motor systems influence cognitive processes (Barsalou, 2008; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005). Interestingly, arm posture in the seated body position was found to influence creative cognition. Specifically, being seated with arm flexion, relative to arm extension, could help bolster insight processes and promote more original idea generation (Friedman & Förster, 2000, 2002).

When people are seated, arm extension or flexion gives rise to bodily feedbacks associated with avoidance or approach, respectively (Cacioppo, Priester, & Berntson, 1993; Förster, Higgins, & Idson, 1998; Förster & Strack, 1997, 1998; Neumann & Strack, 2000; Strack, Martin, & Stepper, 1988). Performing arm extension may function as a subtle alert for threatening circumstances, spontaneously triggering a local processing style to deal with the situation, whereas performing arm flexion may serve as a cue to safety, eliciting a global processing style in the given situation (Förster & Dannenberg, 2010; Förster, Friedman, Özelsel, & Denzler, 2006; Kuschel, Förster, & Denzler, 2010). According to the *attentional tuning model* (Friedman & Förster, 2008, 2010), global processing style would facilitate the ability to activate inaccessible conceptual representations and more abstract concepts (e.g., thinking of a brick as a "reddish substance"), which can trigger more remote concepts (e.g., "make-up") and thereby enhance performance in creativity tasks (see Hao, 2010; Ward, 2008; Ward, Patterson, & Sifonis, 2004).

Would arm flexion when lying in bed also facilitate creative thinking? This is a question worth considering. When people are seated, arm flexion is regarded as an approach motor action, because it has a tendency to decrease the physical distance between the self and an object in the hand, whereas arm extension is an avoidance motor action, as it increases such distance (Cacioppo et al., 1993; Koch, Holland, & van Knippenberg, 2008; Markman & Brendl, 2005; Priester, Cacioppo, & Petty, 1996). However, the case is contrary in the lying body position. When people lie in bed, arm extension has a tendency to decrease such distance and it could be seen as an approach motor action, while arm flexion increases the distance and reflects an avoidance motor action (see Fig. 1). Starting from the findings that approach motor actions are associated with better creative performance (Friedman & Förster, 2000, 2002), it would be predicted that arm flexion and arm extension in the lying body position affect creative thinking in a reverse pattern compared to that in the seated body position. That is, lying with arm extension (in contrast to flexion) should unfold positive effects on creative thinking.

To test this hypothesis, participants with arm flexion or extension when seated or lying were asked to solve *Alternative Uses Task* (AUT)

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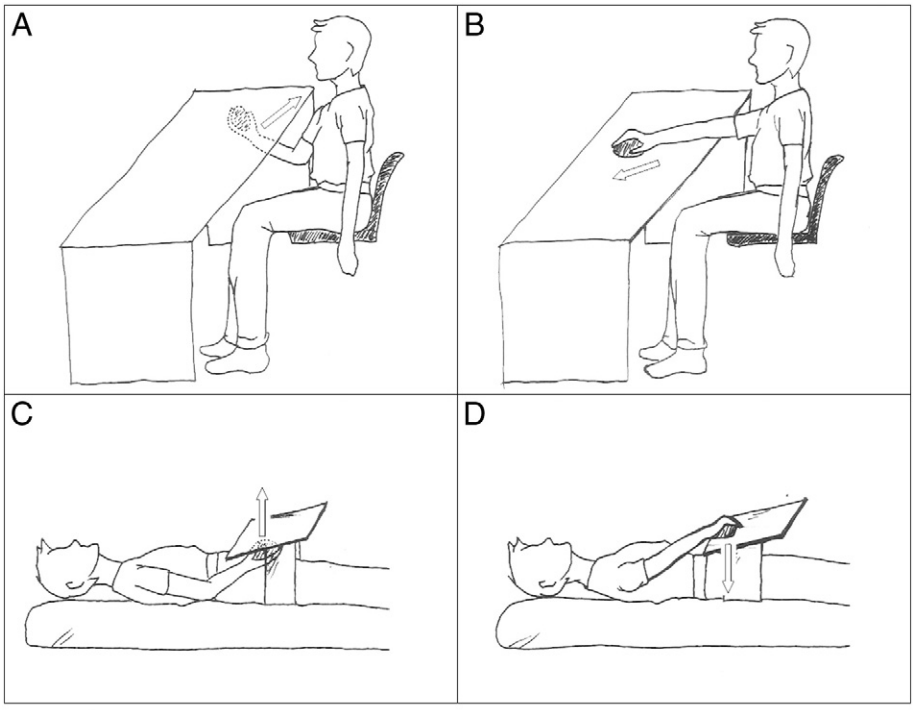

Fig. 1. Illustrations of arm flexion and arm extension in the seated body position (panel A and B) and in the lying body position (panel C and D). Arrows illustrate the tendencies to increase or decrease the physical distance between the self and an object in the hand.

problems (Guilford, 1967). The AUT is a well-established creativity task, in which participants are required to list as many unusual or original uses as possible for everyday objects, such as comb ("an instrument", "a wind-bell"). Performance on such a divergent thinking task has been proven to be a reliable predictor of creative potential (Runco & Acar, 2012). Participants were also asked to solve GRE (Graduate Record Examination) reasoning problems (i.e., analytical task), similar to a previous study (Friedman & Förster, 2000). This allowed assessing whether the effects of arm motor actions on task performance depend on the cognitive processes that are required by the task. Specifically, if the performance on the AUT problems was moderated by an arm position, as was the performance on the GRE problems, this finding would rule out alternative explanations related to task-specific effects.

Moreover, previous studies suggested that the effects of arm motor actions on cognitive processes were independent of the effects of various emotional experience (Förster & Dannenberg, 2010; Friedman & Förster, 2008, 2010) and the effortfulness of arm motor action (Förster et al., 2006; Friedman & Förster, 2002; Koch et al., 2008; Thibodeau, 2011). Thus, a series of paper-and-pencil surveys were utilized to assess participants' mood, various emotions, enjoyment for the experimental task, as well as effortfulness in maintaining the given arm posture.

The hypotheses were that performance on the AUT problems would be better when being seated with arm flexion (compared to extension) and lying with arm extension (compared to flexion). Whereas, the reverse effect should occur in the GRE task, for it was suggested that avoidance motor action would elicit the local processing style (see Förster & Dannenberg, 2010; Friedman & Förster, 2010), thereby improving performance on tasks that require detail-oriented analytical reasoning (see Clore, Schwarz, & Conway, 1994; Friedman & Förster, 2000; Schwarz & Bless, 1991). Furthermore, these observed interaction effects should be independent of the effects of affective factors and the effortfulness of maintaining arm postures.

2. Method

2.1. Participants

One hundred right-handed undergraduates who majored in various academic disciplines were recruited from the East China Normal University. They were randomly assigned to one of the four experimental conditions, viz. 2 (body position: seated and lying) × 2 (arm posture: arm flexion and arm extension). They participated individually in the experiment. Four participants when lying in bed (two in arm flexion and two in arm extension) quitted the experiment because of being nervous. Thus a total of 96 participants (28 males, 68 females; $M = 20.76$ years, $SD = 2.34$, Range: 17–26 years) completed the study. There were 7 males in each of four experimental conditions. The participants gave written informed consent and were paid for their participation.

2.2. Procedure

On arrival, the participant was told with a cover story, similar to those used in previous studies (see Friedman & Förster, 2000, 2002): "Today, you will be participating in a study examining the effects of hemispheric lateralization on problem solving. More specifically, we are trying to understand the relationship between the left and right brain activation and the ability to solve certain types of problems. Basically, there is an ongoing debate, with some people saying that the left hemisphere is the center for this type of cognitive activity and others saying that the right hemisphere is more critical." Following the instruction, the participant was told that he or she had been randomly assigned to the left hemisphere activation condition and that the "standard way" in which this hemisphere is activated is "by having the participants assume a particular right arm position."

Afterwards, the participant was randomly assigned to sit on a chair or lie in bed, and was then instructed to perform a given arm posture.