1. Introduction

Cognitive control, including conflict processing, is an important issue in the fields of cognitive neuroscience and cognitive psychology. Conflict processing which involves overcoming conflict and performing effectively (Kerns et al., 2004) has been investigated using the Stroop task, Simon task, and flanker task. In particular, Simon task has been used to account for resolving response conflict using the sequential effect. There have been debates over the underlying process of cognitive control. One explanation is that conflict monitoring systems, which evaluate the current level of conflict, pass this information on to the cognitive control centers and adjust the strength of their influence on conflict processing (Botvinick et al., 2001). Another explanation is the feature integration viewpoint, which takes into account the binding and unbinding of stimuli and responses (Hommel et al., 2004). In this view, the sequential effect includes complete consistency, partial consistency, or complete inconsistency of stimuli and responses between preceding and current trials.

Fronto-striatal regions, including the anterior cingulate cortex (ACC), medial prefrontal cortex (MPPC), dorsolateral prefrontal cortex (DLPFC), ventrolateral prefrontal cortex (VLPFC), and striatum, are considered to be essential for recruiting cognitive control and responding correctly in conflict trials (Botvinick et al., 1999; Kerns et al., 2004). Further, top-down control of the orbitofrontal cortex over the ventral striatum is an important component in decision making during uncertain conditions (Jung et al., 2010). In particular, ACC activation has been observed in cognitive control using various conflict-provoking tasks, such as the Simon task, flanker task, global-local paradigm, go/no-go paradigm, and other response override tasks (Botvinick et al., 2001, 2004). The ACC significantly contributes to executive functions through the detection of conflict occurring at response-related levels of processing (van Veen et al., 2001) and conflicts between plans of action (Botvinick et al., 2001). The PFC, including the MPFC, DLPFC, and VLPFC, is also involved in effective integration of information for complex behaviors (Miller, 2000), maintaining flexible cognitive control.
state for task-dependent decision making (Stokes et al., 2013), and modulation of behavior adjustment (Riddervik et al., 2004) through top-down influence on a variety of interconnected neocortical regions. In particular, the VLPC engages in the cognitive evaluation of the emotional discrimination of ambivalent stimuli (Jung et al., 2008).

In terms of inter-regional relationships, conflict-related ACC activity may induce changes in prefrontal activity and behavioral adjustments. For example, increased ACC activity resulting from incongruence with preceding trials is associated with increased DLPFC activity through incongruence and decreased reaction time in the current trial (Kerns, 2006). In addition, fronto-striatal activations depend on a trial sequence or repetition of stimulus alternation (Botvinick et al., 1999; Ullsperger et al., 2005). Repeated exposure to stimuli leads to increased behavioral performance and this adaptation effect by repetition has been associated with repetition suppression in neural activity (Grill-Spector et al., 2006). For some cognitive variables, however, repetition effects may be related to neural responses towards enhancement instead of suppression (Segaert et al., 2013). In a previous study using the faces, repeated exposure to stimuli had an influence on neural activity in regions related to novelty detection and memory processing (Fischer et al., 2003).

Emotion interacts with executive functions responsible for dynamic behavioral adaptation (Padmala et al., 2011). In terms of conflict regulation, emotional processing includes a modulation through conscious application of top-down executive control and implicit modulation for processing of an emotional stimulus (Etkin et al., 2011). The affective quality of an event may provide important information about the amount and type of executive control needed to make sure that goals are reached as planned (van Steenbergen et al., 2009). Conversely, cognitive control strategies such as emotional reappraisal allow us to alter the strength (van Steenbergen et al., 2009). Therefore, functional connectivity between ACC and striatum may have an influence on neural activity in regions related to novelty detection and memory processing (Fischer et al., 2003).

Behavioral results are shown in Table 1. Repeated measures ANOVA revealed no significant main effects or interactions in terms of error rate. Post-congruence interference (cI-cC) showed a difference among the emotional conditions: significantly larger under repeated positive (pP) than under non-repeated positive (nP) (t20 = 2.36, p = 0.029). Post-incongruence interference (iI-iC) and interference adaptation effect ([cI-cC]–[iI-iC]) were not significantly different among the emotional conditions. In addition, post-incongruence interference was significantly smaller only under repeated positive than post-congruence interference (t20 = -2.61, p = 0.017).

For reaction time, no main effects in congruency were observed, whereas there was a marginal trend toward a main effect of current emotion (F1,20 = 4.10, p = 0.056, Eta2 = 0.17) and significant main effect of preceding emotion (F1,20 = 38.57, p = 0.0001, Eta2 = 0.66). Significant interaction was observed between the current and preceding congruency types (F1,20 = 10.78, p = 0.004, Eta2 = 0.35), but not between the current and preceding emotion types. As shown in Fig. 1, reaction time was significantly shorter for repeated congruence (cC) than for non-repeated congruence (cC) and non-repeated incongruence (cl) (t20 = -2.28, p = 0.034; t21 = -2.13, p = 0.046, respectively) and for repeated incongruence (iI) than for non-repeated incongruence (cl) (t20 = -2.65, p = 0.015). Repeated positive (pP) showed a significantly shorter reaction time than non-repeated negative (pN) (t20 = -2.85, p = 0.01), non-repeated positive (nP) (t20 = -5.59, p = 0.0001), and repeated negative (nN) (t20 = -4.06, p = 0.001), but a difference between non-repeated negative (pN) and repeated negative (nN) was not significant. Post-congruence interference (cC-cC), post-incongruence interference (iI-iC), and interference adaptation effect ([cC-cC]–[iI-iC]) showed no significant difference among the emotional conditions. Additionally, post-incongruence interference was significantly smaller than post-congruence interference under non-repeated positive (t20 = -2.89, p = 0.009), and smaller at a marginal significance under non-repeated negative and repeated negative (t20 = -1.94, p = 0.067; t20 = -2.05, p = 0.054, respectively).

2. Results

2.1. Behavioral results

As shown in Table 2, there were no significant differences between the current congruence and incongruence trials and between the preceding congruence and incongruence trials.

2.2. Imaging results

2.2.1. Cognitive interference-related activity

As shown in Table 2, there were no significant differences between the current congruence and incongruence trials and between the preceding congruence and incongruence trials.
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