

To Do or Not to Do? Task Control Deficit in Obsessive-Compulsive Disorder

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Task control is an executive control mechanism that facilitates goal-directed task selection by suppressing irrelevant automatic “stimulus-driven” behaviors. In the current study, we test the hypothesis that less efficient task control in individuals diagnosed with obsessive-compulsive disorder (OCD) is associated with OCD symptoms, and specifically, with the inability to inhibit unwanted behaviors in OCD. Thirty-five

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healthy controls, 30 participants with OCD, and 26 participants with generalized anxiety disorder (GAD) completed the object-interference (OI) task to measure task control, the stop-signal task to measure response inhibition, and the arrow-flanker task to evaluate executive abilities not contingent upon task control. OCD patients, but not GAD patients or healthy controls, exhibited impaired performance on the OI task. The deficit in task control, but not in response inhibition, correlated with OCD symptom severity. We suggest that reduced task control may be one of the neurocognitive processes that underlie the inability to inhibit unwanted behaviors in OCD.

Keywords: obsessive-compulsive disorder (OCD); task control; executive functions; inhibitory control; cognitive performance

Obsessive-compulsive disorder (OCD) is a debilitating disorder characterized by distressing

recurrent intrusive thoughts (obsessions) and repetitive behaviors or mental acts that the person feels compelled to perform despite fair to good insight regarding the nature of these behaviors (compulsions; American Psychiatric Association, 2013). To date, our understanding of the neurocognitive processes that underlie the inability to inhibit repetitive thoughts and behaviors in OCD is limited. Several researchers have suggested that a deficit in response inhibition (the ability to suppress irrelevant actions; Verbruggen & Logan, 2008) underlies repetitive behaviors in OCD (e.g., Morein-Zamir et al., 2016; Penades et al., 2007). However, studies of response inhibition in OCD have yielded modest effect sizes and mixed results (e.g., Abramovitch, Abramowitz, & Mittelman, 2013; Kalanthroff, Teichert, et al., 2017; Lipszyc & Schachar, 2010). Furthermore, the deficit in response inhibition has not been found to be correlated with OCD symptom severity (e.g., Boisseau et al., 2012; de Wit et al., 2012) nor to be specific to OCD (Cox, 1997; Moritz et al., 2002). The mixed findings, lack of specificity, and lack of relationship to symptom severity motivates the search for other neurocognitive processes that might better explain the inability to inhibit repetitive behaviors in OCD.

Several researchers have suggested that stimuli acquire associations with the tasks in which they occur. Hence, stimuli have the ability to evoke the performance of a task that has a strong association with it (Allport & Wylie, 2000; Rogers & Monsell, 1995; Waszak, Hommel, & Allport, 2003). For example, Monsell (2003) proposed that task sets could be activated in two ways: (a) by deliberate intentions that are governed by goals or instructions (“endogenous”), and (b) by the perception of a stimulus attribute that is strongly associated with a particular task set (“exogenous”). Moreover, as was recently shown by “motor evoked potentials,” stimuli that are associated with specific tasks can trigger the motor-planning and motor-execution brain regions (Makris, Hadar, & Yarrow, 2011). Automatic behaviors that are triggered by these stimuli are commonly referred to as “stimulus-driven” behaviors (e.g., Gibson, 1979; Monsell, 2003). For example, a soap can trigger a hand-washing task and a sink and soap can trigger a hand-washing task. When these behaviors are incongruent with one’s current goals (e.g., reading, leaving the house), a *task conflict* between these stimulus-driven behaviors and other goal-directed behaviors emerges. To resolve this conflict and maintain goal-directed behavior, we use a specific control mechanism—*task control*.

Task control is an executive control mechanism aimed at prioritizing goal-directed tasks by sup-

pressing stimulus-driven automatic behaviors when they interfere with one’s goals. For example, consider that one’s goal is to leave the house to get to work on time when a checking behavior is triggered by the door handle (i.e., turning the handle). In that case, the task control aim is to inhibit the checking behavior while prioritizing the walking behavior. According to Botvinick et al.’s model of executive control (Botvinick, Braver, Barch, Carter, & Cohen, 2001), task-demand units are activated bottom-up by the input, thus when two task units are activated, task conflict emerges and task control is required to bias information toward the relevant task dimension. In terms of *the dual mechanisms of control theory* proposed by Braver (2012), task control is a proactive control mechanism (a top-down system) that suppresses irrelevant automatic tasks, ensuring action is taken on relevant tasks (e.g., Goldfarb & Henik, 2007; Kalanthroff, Goldfarb, & Henik, 2013). This has recently been developed into a computational neural network model (Kalanthroff, Davelaar, Henik, Goldfarb, & Usher, 2016), which predicts that under conditions of reduced proactive task control, participants need to rely on a reactive control mechanism to carry out conflict tasks—a strategy that will result in slower resolution of task conflict and an increase in stimulus-driven behaviors (Kalanthroff, Avnit, Henik, Davelaar, & Usher, 2015).

In OCD, it has been suggested that compulsions might often be conceptualized as stimulus-driven behaviors (Gillan et al., 2011; Robbins, Gillan, Smith, de Wit, & Ersche, 2012). In addition, the ability (or disability) to control and inhibit unwanted behaviors (i.e., compulsions) is at the focus of both the diagnosis and treatment of the disorder. Finally, a recent study on a small sample of OCD patients found indications for reduced task control in these patients using a modified version of the Stroop task.¹ Taken together, evidence suggests that reduced task control may play a role in the inability to inhibit repetitive behaviors in OCD. In the current study, we test the hypothesis that *task control* is associated with OCD symptoms and, specifically, with the inability to inhibit unwanted behaviors in OCD.

We used the object interference (OI) task, a validated laboratory task to measure task control (La Heij & Boelens, 2011; La Heij, Boelens, & Kuipers, 2010). In this task, participants are asked

¹The classic version of the Stroop task does not allow investigation of task conflict due to the inability to tease apart task and information conflicts in congruent and in incongruent trials (for further discussion, see Kalanthroff et al., 2013).

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