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INHIBITING DOUBT AND UNCERTAINTY: INTEGRATING BEHAVIORAL AND COGNITIVE MODELS IN OBSESSIVE-COMPULSIVE DISORDER

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Abstract

Obsessive compulsive disorder (OCD) is characterized by a vicious cycle of reoccurring intrusive, anxiety-evoking thoughts or impulses (obsessions) and repetitive behaviors (compulsions). Cognitive approaches to OCD focus on the role of cognitive biases in the onset and maintenance of this vicious cycle, with increased doubts and memory uncertainty being primary factors. Behavioral approaches, on the other hand, focus on executive dysfunctions, with inhibitory deficit being most prominent. In the current paper, we review previous literature on the presence and role of inhibitory deficits, increased doubts, and memory uncertainty in OCD, followed by evidence suggesting that these factors are highly interrelated. We propose that both inhibitory deficits and increased doubts serve as prominent components of OCD and suggest that a more integrative approach is needed in order to more fully conceptualize the etiology and maintenance cycle of OCD.

Key words: OCD, executive functions, inhibitory control, doubt, uncertainty

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Obsessive-compulsive disorder (OCD) is a highly debilitating disorder with a lifetime prevalence of approximately 2.3% (Huppert et al. 2009, Ruscio et al. 2010). OCD patients experience recurrent intrusive thoughts or impulses (obsessions), and repetitive, irresistible behaviors (compulsions) aimed at feared consequences and used to reduce anxiety and/or distress (American Psychiatric Association 2013). OCD patients' typical behaviors (compulsions) cause immediate effects of relief from distress, though in the long run they tend to inflict paradoxical effects—increasing rather than decreasing the anxiety caused by obsessions— effectively perpetuating compulsions (Salkovskis 1999, van den Hout and Kindt 2003, van den Hout et al. 2008).

In the past few years many OCD researchers have tended to focus on one of the two main approaches—cognitive vs. behavioral—for OCD. The cognitive model for OCD (Salkovskis 1999) postulates that intrusive thoughts occur in at least 90% of the general population and are not pathological per se (Rachman and de Silva 1978). Hence, the vicious cycle of obsessions and compulsions begins with giving catastrophic interpretations to such intrusive thoughts. The cognitive approach suggests that a number of cognitive biases increase the likelihood of an intrusive thought becoming an obsession. Cognitive researchers thus focus on cognitive biases such as over-importance of thought, perfectionism, inflated responsibility, overestimation of probability of harm (see Rachman 2002), intolerance of uncertainty, increased doubts, etc. Indeed, cognitive models for OCD have received growing interest in recent years (see Calkins et al. 2013, for a review). On the other hand, other researchers have presented increased evidence for the dominance of behavioral models for OCD. Behavioral researchers commonly focus on executive aspects such as an inhibitory deficit, an executive function deficit, inflexible cognitive control (Kalanthroff et al. in press), reliance on rigid habits (Gillan et al. 2011), etc. While some cognitive researchers refer to the executive deficit in OCD as an "epiphenomenon" (Abramovitch et al. 2012) and doubt its importance and clinical significance (Abramovitch et al. 2013), behavioral researchers are more skeptical about the advances of cognitive models (Anholt and Kalanthroff 2013) and about the benefit from such models to therapy (Rosa-Alcázar et al. 2008). In the current paper we aim to suggest that a more integrative approach is needed. For this purpose we will first elaborate on the key aspect of behavioral models—an inhibitory deficit—and on a major cognitive bias—increased doubt. Subsequently, we will briefly review evidence suggesting the two factors are highly connected.

An inhibitory deficit in OCD

In recent years, a few researchers have suggested that goal-directed action may be compromised in OCD patients and compulsions may be driven by maladaptive habits (Boulougouris et al. 2009, Gillan et al. 2011). This is in line with findings concerning an executive

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control deficit in OCD (e.g., Greisberg and McKay 2003, Kuelz et al. 2004). More specifically, a few researchers have suggested that a deficit in response inhibition—a hallmark of executive functions—is an endophenotype of OCD (e.g., Chamberlain et al. 2005, Menzies et al. 2007, Morein-Zamir et al. 2010, de Wit et al. 2012).

Inhibitory difficulties in OCD participants have been observed using a variety of cognitive tasks, including the Go/NoGo task (Bannon et al. 2002, Aycicegi et al. 2003, Penadés et al. 2007), the stop-signal task (Chamberlain et al. 2006), the Stroop task (Bannon et al. 2002, Penadés et al. 2007) and oculomotor tests (Rosenberg et al. 1997). Chamberlain et al. (2005) suggested that such inhibitory dysfunctions may account for the clinical symptoms associated with OCD. Specifically, according to these authors, failures in cognitive inhibition (i.e., control over internal cognitions) can lead to obsessions, while failures in behavioral inhibition (i.e., control over externally manifested motor activities) can lead to compulsions. This notion is in line with the intense urge of OCD individuals to execute compulsions, despite being aware of the senselessness of these actions and having no true desire for their consequences (Robbins et al. 2012). Robbins et al. (2012) presented the COD (compulsive-obsessive disorder) hypothesis—obsessions in OCD may pose "a post hoc rationalization of otherwise inexplicable compulsive urges"—thus challenging the classic notion that compulsions occur in response to obsessions. In order to explain the mechanism that is responsible for the "post hoc rationalization", other researchers (Anholt et al. 2012) used William James' classic psychological theory that argued that people tend to give emotional meaning to their own behaviors: "we feel sorry because we cry, angry because we strike, afraid because we tremble" (James 1884/1969, 1890/1950). These researchers argued that "impaired response inhibition is related to the development of OCD metacognitive beliefs". The experience of difficulty to inhibit behavior tendencies related to intrusive thoughts may lead to the perceptions of these thoughts as important and likely to occur. As a consequence, these patients may engage in thought suppression as well as compulsive behavior, and become entangled in a "vicious circle" (Anholt et al. 2012, p. 74). Based on experimental data, in a recent paper in this journal, we suggested that OCD patients are characterized by a deficit in task control, which causes them to engage in associative irrelevant automatic tasks (Kalanthroff et al. 2013).

Increased doubts

In a series of experiments, Dar et al. (2000) tested the hypothesis that uncertainty is a general characteristic of OCD checkers, which affects not only memory but other domains of knowledge as well. The researchers requested OCD and non-anxious controls to answer general knowledge questions (that were unrelated to short-term memory or to OCD). In three experiments, OCD checkers were found to be less confident in their performance, compared to controls, whereas their actual performance was not as bad as they evaluated it to be. Furthermore, confidence was found to be negatively correlated with the severity of OCD symptoms, as measured by the Y-BOCS (Yale-Brown Obsessive Compulsive Scale), and repeating the same question was found to reduce confidence and increase doubt only in OCD participates (and not in controls).

In an attempt to examine the conditions in which uncertainty induces actual checking behavior in people with subclinical OCD, Toffolo et al. (2013) developed a visual-search eye-tracking task. This task allows investigating checking behavior in both certain (i.e., when target is present) and uncertain (i.e., when target is absent) situations. These researchers found that participants from the OCD group showed increased "checking behaviors" in the uncertain condition (i.e., when the target was absent), that is, longer search times and a higher number of eye fixations. On the other hand, in the certain condition (i.e., when the target was present) participants from the OCD group did not show increased checking behavior. This finding suggests that increased general uncertainty may provoke people with OCD to engage in repetitive checking in an uncertain situation because the uncertainty of the situation adds to an elevated level of general uncertainty. These findings correspond with Lazarov et al.'s (2012) model, which depicts a more specified uncertainty in OCD. The core of this model is that patients with OCD lack a subjective conviction regarding internal states and therefore have to rely on external proxies, such as rules or procedures.

The notion that repeated checking causes a reduction in memory certainty (i.e., the "paradoxical effect") is illustrated by van den Hout's seminal work on healthy participants, demonstrating that compulsive-like behaviors, such as checking, are enough to induce memory distrust in healthy participants (van den Hout and Kindt 2003, van den Hout et al. 2008). These researchers instructed healthy participants to engage in a repeated-checking compulsive-like task using a computer animation of gas stoves. Results yielded reduction in memory confidence, but not in memory objective performance, following 20 checking trials. Radomsky et al. (2006) replicated these effects using a real checking procedure rather than a virtual computerized task. Linkovski et al. (2013) replicated this effect and showed that participants were also more likely to act on this uncertainty by choosing to voluntarily wait (while prolonging the experiment) in order to make sure their memory was accurate. These findings suggest a descriptive maintenance model of a vicious circle of doubt, uncertainty and compulsive behavior that underlies OCD.

Integrating behavioral and cognitive theories – inhibition and increased doubts

As mentioned above, van den Hout's work (van den Hout and Kindt 2003, van den Hout et al. 2008) demonstrated the effect of repeated checking on memory distrust. However, these studies do not explain why some people are more prone to engage in these behaviors and become entangled in the vicious cycle described above. In a recent paper, Linkovski and colleagues (2013) suggested that memory uncertainty following repeated checking occurs mainly in individuals with low inhibitory control. These researchers conducted a replication of van den Hout and Kindt's (2003) task; they instructed participants to conduct 20 trials of a repeated-checking compulsive-like task using virtual gas-stoves. Replicating van den Hout and Kindt's (2003) results, Linkovski et al. (2013) found that although actual memory performance was not influenced by repeated checking, subjective confidence in memory was reduced following repeated checking. Next, participants conducted the stop-signal task (Logan and Cowan 1984, Logan 1994) in order to measure inhibitory control efficiency. Results indicated a significantly larger decrease in memory confidence in

participants with low inhibitory control compared with participants with high inhibitory control. This pattern led the researchers to conclude that deficits in inhibitory control might underlie cognitive vulnerability for OCD.

More recently, the connection between increased doubts and inhibition was demonstrated again using the visual-search task (Kalanthroff et al. in press). As mentioned earlier, Toffolo et al. (2013) used the visual-search task and found that participants in the OCD group showed increased "checking behavior" in the uncertain condition (i.e., when the target was absent). Kalanthroff et al. (in press) used a similar visual-search task and combined it with the stop-signal task; participants were asked to decide whether a target was present or absent while in some trials a stop-signal (an auditory tone delivered through headphones) was presented, indicating that response to the current trial should be inhibited. Two conditions were used in this experiment—high inhibition (stop signal in 30% of the trials) and low inhibition (stop signal in 10% of the trials). This design enabled the researches to investigate the causal effect of inhibition on increased doubts. Importantly, the usage of a high proportion of stop signals to increase inhibitory control had been previously established and validated (Verbruggen et al. 2012). As predicted, in two experiments the researchers found that increased "checking behavior" (indicated by reaction time) in the uncertain condition was substantially reduced in the high inhibition condition. In other words, in the high inhibition condition the difference between target-present and target-absent trials was significantly smaller than in the low inhibition condition. This pattern led the researchers to conclude that when inhibition is high, the effect of doubt is reduced.

To conclude, we propose that OCD patients are characterized by both inhibitory deficit and cognitive biases such as increased doubts and memory uncertainty. Most importantly, we propose that both factors serve as important components of OCD. It remains a "chicken and egg" debate whether inhibitory deficit arises as an epiphenomenon caused by obsessions or whether inhibitory deficit is a core symptom or endophenotype of OCD. We suggest that a more integrative model of OCD is needed and that more research is required on the relations between executive deficits and cognitive biases in OCD.

References

Abramovitch A, Abramowitz JS, Mittelman A (2013). The neuropsychology of adult obsessive-compulsive disorder: a meta-analysis. *Clinical Psychology Review* 33, 8, 1163-1171.

Abramovitch A, Dar R, Hermesh H, Schweiger A (2012). Comparative neuropsychology of adult obsessive-compulsive disorder and attention deficit/hyperactivity disorder: implications for a novel executive overload model of OCD. *Journal of Neuropsychology* 6, 2, 161-191.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders*, 5th. ed. text rev. APA, Washington.

Anholt G, Kalanthroff E (2013). Letter to the Editor: Recent advances in research on cognition and emotion in OCD: A review. *Current Psychiatry Reports* 15, 416.

Anholt G, Linkovski O, Kalanthroff E, Henik A (2012). If I do it, it must be important: Integrating basic cognitive research findings with cognitive behavior theory of obsessive-compulsive disorder. *Psicoterapia Cognitiva e Comportamentale* 18, 69-77.

Aycicegi A, Dinn WM, Harris CL, Erkmen E (2003). Neuropsychological function in obsessive-compulsive disorder: effects of comorbid conditions on task performance. *European Psychiatry* 18*,* 241-248.

Bannon S, Gonsalvez CJ, Croft RJ, Boyce PM (2002). Response inhibition deficits in obsessive-compulsive disorder. *Psychiatry Research* 110, 2, 165-174.

Boulougouris V, Chamberlain SR, Robbins TW (2009). Cross-species models of OCD spectrum disorders. *Psychiatry Research* 170, 15-21.

Calkins AW, Berman NC, Wilhelm S (2013). Recent advances in research on cognition and emotion in OCD: A review. *Current Psychiatry Reports* 15, 5, 1-7.

Chamberlain SR, Blackwell AD, Fineberg NA, Robbins TW, Sahakian BJ (2005). The neuropsychology of obsessive compulsive disorder: the importance of failures in cognitive and behavioural inhibition as candidate endophenotypic markers. *Neuroscience and Biobehavioral Reviews* 29*,* 3, 399-419.

Chamberlain SR, Fineberg NA, Blackwell AD, Robbins TW, Sahakian BJ (2006). Motor inhibition and cognitive flexibility in obsessive-compulsive disorder and trichotillomania. *The American Journal of Psychiatry* 163, 7, 1282-1284.

Dar R, Rish S, Hermesh H, Fux M, Taub M (2000). Realism of confidence in obsessive-compulsive checkers. *Journal of Abnormal Psychology* 109, 673-678.

de Wit SJ, de Vries FE, van der Werf YD, Cath DC, Heslenfeld DJ, Veltman EM (2012). Presupplementary motor area hyperactivity during response inhibition: A candidate endophenotype of obsessive-compulsive disorder. *American Journal of Psychiatry* 169, 1100-1108.

Gillan CM, Papmeyer M, Morein-Zamir S, Sahakian BJ, Fineberg NA, Robbins TW, De Wit S (2011). Disruption in the balance between goal-directed behavior and habit learning in obsessive-compulsive disorder. *The American Journal of Psychiatry* 168, 7, 718-726.

Greisberg S, McKay D (2003). Neuropsychology of obsessive-compulsive disorder: a review and treatment implications. *Clinical Psychology Review* 23*,* 95-117.

Huppert JD, Simpson HB, Nissenson KJ, Liebowitz MR, Foa E (2009). Quality of life and functional impairment in obsessive-compulsive disorder: A comparison of patients with and without comorbidity, patients in remission, and healthy controls. *Depression and Anxiety* 26, 39-45.

James W (1969). What is an emotion? In J William (ed) *Collected essays and reviews*. Russell and Russell, New York. (Original work published 1884).

James W (1950). *The principles of psychology*. Dover, New York. (Original work published 1890.)

Kalanthroff E, Anholt EG, Henik A (in press). Always on guard: Test of high vs. low control conditions in Obsessive-Compulsive Disorder patients. *Psychiatry Research.* Doi: 10.1016/j.psychres.2014.05.050

Kalanthroff E, Anholt EG, Keren, Henik A (2013). What should I (not) do? Control over irrelevant tasks in obsessive-compulsive disorder patients. *Clinical Neuropsychiatry* 10*,* 61-64.

Kuelz AK, Hohagenb F, Voderholzer U (2004). Neuropsychological performance in obsessive-compulsive disorder: a critical review. *Biological Psychology* 65, 185-236.

Lazarov A, Dar A, Liberman N, Oded Y (2012). Obsessive-compulsive tendencies and undermined confidence are related to reliance on proxies for internal states in a false feedback paradigm. *Journal of Behavior Therapy and Experimental Psychiatry* 43, 1, 556-564.

Linkovski O, Kalanthroff E, Henik A, Anholt G (2013). Did I turn off the stove? Good inhibitory control can protect from influences of repeated checking. *Journal of Behavior Therapy and Experimental Psychiatry* 44, 30-36.

Logan GD (1994). Spatial attention and the apprehension of spatial relations. *Journal of Experimental Psychology:*

Human Perception and Performance 20, 5, 1015-1036.
Logan GD, Cowan WB (1984). On the ability to inhibit thought and action: A theory of an act of control. *Psychological Review* 91, 3, 295-327.
Menzies L, Achard S, Chamberlain SR, Fineberg N, Chen CH, del Campo N, Sahakian BJ, Robbins TW, Bullmore E (2007). Neurocognitive endophenotypes of obsessive-compulsive disorder. *Brain* 130, 3223-3236.
Morein-Zamir S, Fineberg NA, Robbins TW, Sahakian BJ (2010). Inhibition of thoughts and actions in obsessive-compulsive disorder: extending the endophenotype? *Psychological Medicine* 40*,* 263-272.
Penadés R, Catalan R, Rubia K, Andres S, Salamero M, Gasto C (2007). Impaired response inhibition in obsessive compulsive disorder. *European Psychiatry 22*, 404-410.
Rachman S (2002). A cognitive theory of compulsive checking. *Behaviour Research and Therapy* 40, 6, 625-639.
Rachman S, de Silva P (1978). Abnormal and normal obsessions. *Behaviour Research and Therapy* 16, 233-248.
Radomsky AS, Gilchrist PT, Dussault D (2006). Repeated checking really does cause memory distrust. *Behaviour Research and Therapy* 44, 2, 305-316.
Robbins TW, Gillan CM, Smith DG, de Wit S, Ersche KD (2012). Neurocognitive endophenotypes of impulsivity and compulsivity: towards dimensional psychiatry. *Trends in Cognitive Sciences* 16, 1, 81-91.
Rosa-Alcázar AI, Sánchez-Meca J, Gómez-Conesa A, Marín-Martínez F (2008). Psychological treatment of obsessive–compulsive disorder: A meta-analysis. *Clinical Psychology Review* 28, 1310-1325.
Rosenberg DR, Dick EL, O'Hearn KM, Sweeney JA (1997). Response-inhibition deficits in obsessive-compulsive disorder: an indicator of dysfunction in frontostriatal circuits. *Journal of Psychiatry & Neuroscience* 22, 1, 29-38.
Ruscio AM, Stein DJ, Chiu WT, Kessler RC (2010). The epidemiology of obsessive-compulsive disorder in the National Comorbidity Survey Replication. *Molecular Psychiatry* 15, 53-63.
Salkovskis PM (1999). Understanding and treating obsessive-compulsive disorder. *Behaviour Research and Therapy* 37, 29-52.
Toffolo M, van den Hout MA, Hooge I, Engelhard IM, Cath DC (2013). Mild uncertainty promotes checking behavior in subclinical obsessive-compulsive disorder. *Clinical Psychological Science* 1, 2, 103-109.
van den Hout M, Kindt M (2003). Repeated checking causes memory distrust. *Behaviour Research and Therapy* 41, 301-316.
van den Hout MA, Engelhard IM, de Boer C, du Bois A, Dek E (2008). Perseverative and compulsive-like staring causes uncertainty about perception. *Behaviour Research and Therapy* 46, 12, 1300-1304.
Verbruggen F, Adams R. Chambers CD (2012). Proactive motor control reduces monetary risk taking in gambling. *Psychological Science* 23, 805-815.