



Effects of context on risk taking and decision times in obsessive-compulsive disorder



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ABSTRACT

Despite the fact that OCD patients show altered decision making in everyday life, few studies have investigated how patients make risky decisions and what contextual factors impact choices. We investigated cognitive context with the use of the “framing effect” task, which investigates decision making based on whether monetarily equivalent choice options are framed in terms of a potential to either lose (lose \$20 out of \$50) or gain (gain \$30 out of \$50) money. In addition, we manipulated social context by providing positive or neutral feedback on subjects’ choices. Overall, participants were risk taking for options framed in terms of potential loss and risk averse for options framed in terms of potential gain (the classic framing effect). Although OCD patients were generally more risk averse, the effect of the frame on choices did not differ significantly from healthy participants and choices were not impacted by social context. Within OCD patients, greater self-reported indecisiveness was associated with a larger effect of the frame on choices. OCD patients were also significantly slower to make choices in the loss compared to gain frame, an effect that was not observed among healthy participants. Overall, our results suggest that the framing of choice options has a differential effect on decision times but not the actual choices made by OCD patients, and that patients are not sensitive to social feedback when making choices. The correlation between indecisiveness and the framing effect in OCD suggests that further work interrogating the relationship between specific symptoms and decision making among patients may yield new insights into the disorder.

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1. Introduction

Obsessive-compulsive disorder (OCD) is associated with intrusive and unpleasant feelings, thoughts, or images (obsessions) and repetitive behaviors (compulsions). The disorder is marked by impaired decision making, which may be a core feature of OCD (Cavedini et al., 2006; Sachdev and Malhi, 2005). Patients exhibit greater uncertainty (Fear and Healy, 1997; Stern et al., 2013), intolerance of uncertainty (Frost and Shows, 1993; Tolin et al., 2003), and increased evidence gathering during decision making (Fear and Healy, 1997; Milner et al., 1971; Volans, 1976). A key phenomenological feature of OCD is aversion to risky behaviors and situations, which may be due to an overestimation of the likelihood and severity of negative outcomes (Steketee and Doppelt, 1986; Steketee et al., 1998). Risk averse behavior has also been found

in experimental tests of decision making in OCD (Admon et al., 2012). Despite the central role of impaired decision making in OCD, few studies have investigated the various contextual factors that contribute to this process. Such an investigation is critical in order to identify behavioral mechanisms that could be targeted by novel treatments.

Research in healthy individuals has provided ample evidence that decision making, and particularly risk taking, is influenced by contextual and subjective factors, including personal tolerance for risk and uncertainty, psychological states, and choice presentation (De Martino et al., 2006; Tversky and Kahneman, 1981). Specifically, in studies where participants make a binary choice between a safe option with a certain outcome and a risky option with an uncertain outcome but potentially higher payoff, participants’ willingness to choose the safe option depends on whether it is presented (or framed) as an opportunity to gain (e.g., keeping \$30 out of \$50) or lose (e.g., losing \$20 out of \$50) (see De Martino et al., 2006). It has been repeatedly shown that healthy individuals exhibit a cognitive bias in decision making by displaying greater willingness to choose

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a risky option (i.e., increased risk taking) when choices are framed as a potential loss, and greater willingness to choose a safe option (i.e., increased risk aversion) when choices are framed as a potential gain (e.g., (De Martino et al., 2006; Porcelli and Delgado, 2009; Sip et al., 2014). This phenomenon, known as the *framing effect* (Tversky and Kahneman, 1981), highlights the critical role of cognitive context in choice behavior. Interestingly, a recent study found a positive correlation between the framing effect and trait anxiety among healthy undergraduates (Xu et al., 2013), indicating that psychopathological traits are linked to altered processing of context during decision making.

In addition to the effects of the framing of choices on behavior, social context also plays a vital role (Bault et al., 2008; Sip et al., 2014; Smith et al., 2014; Steinberg, 2004, 2010). Making decisions in the presence of peers increases risk taking in adolescents (Chen et al., 2011; Steinberg, 2008), and participants exhibit opposite patterns of risk taking depending on whether a choice is made privately or in a social context (i.e., when another player can see the participant's choices, Bault et al., 2008; Bault et al., 2014). In a recent study examining the effects of the framing of choices on risk taking, Sip et al. (2014) manipulated social context by varying whether or not participants received on-line social feedback from another person regarding their choices. Results from this study demonstrated that participants increased risk taking in the loss frame after receiving positive social feedback about their choices from a friend compared to conditions where they received negative or no feedback. Together, these studies indicate that social information has an impact on choice behavior. Although there is no precedent in the OCD literature to suggest an effect of social feedback on choice behavior, the work by Sip et al. (2014) indicates that positive social feedback reduces risk aversion in some circumstances. In addition, it has been found that positive social interactions predict treatment gains from cognitive-behavioral therapy in OCD (Steketee, 1993). These data suggest that positive feedback may be a useful tool for modulating risk-averse decision making in patients with OCD.

The present study investigated how contextual factors affect decision making in OCD patients in comparison to healthy participants. Clinically, OCD patients exhibit over-pronounced fear of bad consequences (e.g. Hinds et al., 2012) and a tendency to frame outcomes in terms of negative results (loss) (Lavy et al., 1994). Experimentally, OCD patients show a cognitive bias in the form of slowed reaction times in response to negative information (Williams et al., 1996; Foa et al., 1993; Lavy et al., 1994), yet it is unknown whether this bias also influences decision making under risk. We used a well-established framing effect task to determine whether risk-taking in patients is impacted by a cognitive bias to potential negative outcomes during the loss frame. The use of social feedback was motivated by our prior findings that it impacts risk taking during the loss frame in a group of healthy controls (Sip et al., 2014), and thus could be used to modulate decision making in OCD. Our aim was three-fold: 1) to examine baseline risk taking in patients with OCD (i.e., in the absence of social feedback); 2) to test whether OCD patients are susceptible to the framing effect; and 3) to investigate whether receipt of social feedback modulates risk taking in patients with OCD. We predicted that OCD patients would be more risk averse overall than healthy participants, but would exhibit a greater framing effect, consistent with previous findings in participants with high trait anxiety (Xu et al., 2013). Based on prior findings (Sip et al., 2014), we also hypothesized that positive social feedback would increase risk taking and potentially "normalize" the framing effect in OCD.

2. Methods

2.1. Participants

Thirty-eight individuals including 19 patients with OCD and 19 healthy controls (HC) participated in the experiment. Four participants were excluded from the final analyses: One HC was excluded due to technical malfunction, and two HC and one OCD patient were eliminated based on exclusionary information revealed after running through the task. The final groups were matched on gender, education, and age, and consisted of 18 OCD patients (12 females; 13 patients on psychoactive medication including 11 on serotonin-reuptake inhibitors, SRIs, 1 patient on lisdexamfetamine, and 1 patient on clomipramine) and 16 HC (12 females, never diagnosed with or medicated for a psychiatric disorder). Regarding the use of other substances, only two patients and one healthy control reported smoking cigarettes on regular basis. Given this small sample, we did not measure nicotine and its potential impact on task performance. None of the other subjects were taking any psychotropic substances (stimulants, sedatives) at the time of study participation. Tables 1 and 2 show demographic and clinical information for both groups.

Participants were assessed for Axis I disorders using the Mini-International Neuropsychiatric Interview (M.I.N.I., Sheehan et al., 1998). HC were excluded for current or previous diagnosis of Axis I disorder. All OCD patients met DSM-IV criteria for current OCD, excluding primary hoarding subtypes. Patients were also excluded for lifetime presence of psychosis, bipolar disorder, substance dependence, and major developmental or neurological disorder. Although major depressive disorder (MDD) is a common comorbidity in OCD, patients in a current depressive episode were excluded because depression is associated with multiple changes in reaction time and decision making (Beard et al., 2015; Snyder, 2013; Wagner et al., 2012). However, we did allow OCD patients with a history of MDD, if in remission (67% of the sample), to ensure that our sample was representative of the OCD population as a whole. Axis I comorbidities in the patient group were relatively few in number (phobia: $n = 3$; panic disorder lifetime: $n = 1$; eating disorder NOS: $n = 2$; impulse control disorder: $n = 5$; generalized anxiety disorder: $n = 5$; tic disorder: $n = 1$; body dysmorphic disorder: $n = 3$; agoraphobia: $n = 2$). Symptom severity for OCD patients was assessed using the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS, Goodman et al., 1989). Mean Y-BOCS score for the OCD group was 21.2 (range: 12–36, see Table 1), indicating moderate severity on average but encompassing a wide range. The Institutional Review Board of the Icahn School of Medicine at Mount Sinai approved this research. All participants provided written informed consent.

2.2. Experimental paradigm

The framing effect task (Fig. 1), adapted from Sip et al. (2014),

Table 1

Demographics and clinical information. Y-BOCS (Yale-Brown Obsessive-Compulsive Scale) indicates the mean symptom severity score in the OCD group (\pm SEM). SRIs = serotonin-reuptake inhibitors.

	OCD ($n = 18$)	HC ($n = 16$)
Age (years)	27.3 (5.8)	27.6 (7.0)
Education (years)	16.7 (2.3)	16.6 (1.9)
Gender	12 F, 6 M	11 F, 5 M
Y-BOCS	21.2 (7.2)	n/a
Age of onset (years)	10.8 (6.6)	n/a
Currently on medication	13 (11 on SRIs)	n/a

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