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Exploring metacognitive components of confidence and control in individuals with obsessive-compulsive tendencies

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ABSTRACT

Background and objectives: Obsessive-compulsive (OC) patients typically display reduced metacognitive confidence, but findings regarding the scope of this phenomenon and factors that mediate it have been inconsistent. This study aimed to further the understanding of reduced metacognitive confidence in obsessive-compulsive disorder (OCD) by exploring the relationship between metacognitive processes and OC tendencies.
Methods: High and low OC participants answered a general-knowledge questionnaire, rated their confidence in each answer, and decided whether or not to report each answer.
Results: High and low OC participants did not differ either in their performance (general knowledge) or in their subjective estimations or confidence regarding their performance. The two groups also did not differ in the effectiveness of their metacognitive monitoring or in the relationship between monitoring and report-control decisions (control sensitivity). However, the two groups did differ in response criterion, with high OC participants less willing to report answers held with low-to-medium levels of subjective confidence.
Limitations: The study was conducted with non-clinical participants, which limits generalization to OCD.
Conclusions: These results suggest that conservative response criterion among OC individuals might be the critical factor underlying feelings of doubt and uncertainty endemic in OCD.

1. Introduction

One of the most common compulsions in obsessive-compulsive disorder (OCD) is repeated checking. It characterizes over 50% of OCD patients (Henderson & Pollard, 1988), and about 15% of the normal population show sub-clinical checking compulsions (Stein, Forde, Anderson, & Walker, 1997). Checking compulsions are characterized by repeatedly making sure whether a certain act, such as locking the door, has been performed properly. OCD patients are tormented by intrusive and worrisome thoughts about the possibility that they forgot to do something or might have done it wrong. They worry that a mistake might cause harm to themselves or to others and thus feel obligated to check whether the task at hand was indeed completed in a satisfactory manner (Müller & Roberts, 2005). For example, they might worry whether they forgot to turn off the oven before leaving home and to think that a fire might start because of that. As a result they might feel compelled to return home and make sure that the oven is indeed turned off (Cuttler & Graf, 2009).

In an attempt to explain checking compulsions, some researchers suggested that OCD patients suffer from a memory deficit. It was assumed that this memory deficit prevents OCD patients from feeling sure that they have just performed a certain act in a satisfactory, right or safe manner, leading to repeated checking (Sher, Frost, & Otto, 1983). Numerous studies examining this hypothesis have been conducted, yielding contradicting results (Müller & Roberts, 2005). While some studies found the performance of checkers in memory tasks to be impaired in comparison to non-checkers (e.g., Deckersbach, Otto, Savage, Baer, & Jenike, 2000; Sher, Mann, & Frost, 1984; Zitterl et al., 2001) others did not (e.g., Christensen, Kim, Dyksen, & Hoover, 1992; Dirson, Bouvard, Cottraux, & Martin, 1992; Moritz, Jacobsen, Willenborg, Jelinek, & Fricke, 2007; Radomsky & Rachman, 1999).

Motivated by these contradicting results, Woods, Vevea, Chambless, and Bayen (2002) conducted a meta-analysis of studies aimed at examining the memory deficit hypothesis in OCD. The analysis did reveal certain memory tasks that checkers performed less favorably compared to non-checkers, but the effect

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sizes found in these studies were only medium to small. The researchers concluded that this modest memory impairment in itself was not significant enough to account for OC checking. They suggested that a third factor might influence both memory functioning and checking behavior. For example, it might be that the less favorable performance in memory tasks was only a secondary effect of other OCD symptoms, such as distraction due to obsessional thoughts.

In contrast to the inconsistent findings regarding memory deficits in OCD, numerous studies have shown that OCD patients or compulsive checkers tend to be less confident regarding their memory than non-checkers (e.g., Hermans et al., 2008; Hermans, Martens, De Cort, Pieters, & Eelen, 2003; Karadag, Oguzhanoglu, Ozdel, Atesci, & Amuk, 2005; Sher et al., 1983; Tuna, Tekcan, & Topçuoğlu, 2005; Zitterl et al., 2001). This tendency has been found to exist also in the absence of any real memory deficit among checkers (e.g., Brown, Kosslyn, Breiter, Baer, & Jenike, 1994; Cougle, Salkovskis, & Wahl, 2007; Dar, 2004; Dar, Rish, Hermesh, Fux, & , Taub, 2000; MacDonald, Antony, MacLeod, & Richter, 1997; McNally & Kohlbeck, 1993). Notably, this finding is not unconditionally replicated. Moritz et al. have published several studies in which OCD did not display differences in memory confidence relative to controls (Moritz, Jacobsen, Willenborg, Jelinek, & Fricke, 2006; Moritz, Kloss, von Eckstaedt, & Jelinek, 2009; Moritz, Rietschel, Jelinek, & Bäuml, 2011; Moritz, Ruhe, Jelinek, & Naber, 2009) except under conditions that trigger inflated responsibility (Moritz et al., 2007).

The tendency of OCD patients to doubt their judgments is not restricted to memory. Hermans et al. (2008) found that OCD patients tend to mistrust not only their memory but also their perception and attention, and others have found this to be the case in regard to reality monitoring (Cougle, Salkovskis, & Thorpe, 2008; Hermans et al., 2003; McNally & Kohlbeck, 1993; Sher et al., 1983). Dar et al. (2000) demonstrated that OCD patients also doubt their general knowledge in comparison to normal individuals. In their study, participants were asked to answer general knowledge questions and to provide a confidence rating as to the correctness of their answers. Participants with OCD with primary checking compulsions were compared to panic disorder and matched control participants. Although OC checkers' actual performance on the test did not differ from that of the control participants, they were significantly less confident in their answers as evident in both their mean confidence ratings and their estimation of the number of answers they had answered correctly. In addition, confidence ratings were negatively correlated with severity of obsessive symptoms in the OCD sample.

The findings relating distrust of memory, perception, attention and decision ability to OCD are in line with clinical descriptions of this disorder, which emphasize pathological doubt, lack of conviction, indecisiveness, and uncertainty as central characteristics of OC experience (e.g., Berrios, 1989; Reed, 1985; Shapiro, 1965). Taken together, they suggest that it might be beneficial to understand OC phenomena in terms of metacognitive difficulties instead of cognitive ones. *Metacognition* is often described as "knowing about knowing," referring to people's subjective knowledge of their own cognitive processes and how this knowledge is utilized to guide performance (Koren, Seidman, Goldsmith, & Harvey, 2006; Nelson & Narens, 1990, 1994). Thus, the term metacognition implies a differentiation between the individual's actual cognitive abilities, performance and knowledge from what he or she knows, thinks, and does about them. Metacognitive abilities can be independent of cognitive ones and may be just as important. An individual who suffers from a cognitive deficit and recognizes that her cognitive abilities are not reliable would function better than an individual with the same cognitive deficit who is unaware of her cognitive deficits (Koren et al., 2006). A good example is the individual who knows that he tends to forgets birthdays, and hence writes the dates down and checks them every month in advance in order to remember them properly. OCD might represent the opposite case, that is, of people whose cognitive abilities are largely intact but whose functioning is compromised by maladaptive metacognitive processes. For example, an OCD patient who has just turned off the stove might have a correct memory representation of that action, but doubt concerning the reliability of that representation might lead to repetitive and maladaptive checking. In this case, low subjective confidence in one's memory representations has the same behavioral consequence as a "real" memory deficit—both result in the same maladaptive checking behavior (Hermans et al., 2008).

Metacognitive processes include two important aspects: Monitoring and control (Nelson, 1996; Nelson & Narens, 1990): *Monitoring* refers to the individual's subjective assessment of her own cognitive functioning. *Control* refers to the manner in which that subjective assessment is used to guide ongoing or subsequent behavior. To use our previous example, doubting one's memory of turning off the stove relates to the metacognitive monitoring process. The checking behavior that might follow the monitoring process would represent a metacognitive control process. Metacognitive control is generally based on the person's monitoring output, but there may be situational influences or individual differences in control processes and strategies. For example, doubting the reliability of his memory, the person in our earlier example chose to check the stove. Given the same subjective monitoring assessment (and actual memory), a different person might choose to move on without checking the stove and to live with the doubt about whether or not he had turned it off. There are good reasons to believe that metacognitive monitoring and control processes play a substantial role in daily functioning (Koren et al., 2006; Koriat & Goldsmith, 1996a; Perfect & Schwartz, 2002). Yet, many theories and experimental paradigms have not considered that role sufficiently (Nelson & Narens, 1994).

The current study used the paradigm proposed by Koriat and Goldsmith (1996b), which combines the logic of signal-detection theory (Green & Swets, 1966) with concepts and measures from metacognitive research. A key aspect of this paradigm is the distinction between forced and free responding. Under conditions of forced responding, participants must provide an answer to each and every question. The standard measures of performance in such cases (e.g., percent correct) reflect the efficiency of memory encoding and retrieval processes under the specified conditions. Under free responding, participants are given the option to choose whether to report or withhold each retrieved answer. Under these conditions, the person uses a monitoring process to evaluate the subjective correctness of his or her best-candidate answer, and a control process to decide whether or not to overtly report that answer. The control process operates as a response criterion on the monitoring output: the answer is reported if subjective confidence is high enough (passing the criterion); otherwise the answer is withheld. Thus, by this model, the quantity and accuracy of information provided under free-report conditions depends not only on the efficiency of memory per se (i.e., memory encoding and retrieval), but also on the operation and effectiveness of the metacognitive monitoring and control processes that are used in the attempt to avoid making wrong responses.

The Koriat and Goldsmith framework was developed together with a special experimental paradigm and procedure that combines free and forced reporting with the elicitation of confidence judgments, which can be used to isolate and assess the postulated cognitive and metacognitive components (for further details, see Goldsmith & Koriat, 2008). In this paradigm, participants are presented with a series of questions, and for each question they are asked to answer the question (forced report), to estimate the probability that their answer is correct (confidence judgment), and finally, to decide whether or not to report the answer for points. Participants are told beforehand the point reward that they will receive for each reported correct answer, and the penalty that they will pay for each reported wrong answer.

Thus, in addition to yielding information about cognitive ability per se (forced-report performance) and free-report performance (both quantity and accuracy of reported information), the procedure also yields information about monitoring (the subjective probability assessments) and control (the decisions about whether to report or withhold each answer). The effectiveness of monitoring can be evaluated in terms of both *calibration bias* (over/under-confidence) and monitoring *resolution* (or discrimination accuracy)—the extent to which confidence in one's answers successfully differentiates correct from incorrect answers. The extent to which a person's behavior is related to (guided by) the output of his or her monitoring process, called *control sensitivity*, can be examined in terms of the correlation between confidence in an answer and the decision to report it. The *response criterion setting* can also be examined by identifying the confidence level above which the participant decided to report her answers, and below which she decided to withhold them. A great deal of empirical evidence using this procedure or its variants (e.g., Higham, 2007) has supported Koriat and Goldsmith's general model (for a review, see Goldsmith & Koriat, 2008).

The aim of the present study was to examine the potential relationship between OC tendencies and the metacognitive processes of monitoring and control explicated in Koriat and Goldsmith's (1996b) framework. Specifically, we wanted to see whether people with high OC tendencies would differ from people with low OC tendencies in monitoring effectiveness, control sensitivity or response criterion. To that aim, we combined the Koriat and Goldsmith paradigm (1996b) with the procedure of Dar et al. (2000) described earlier. Participants were asked to answer a 100-item, 2-alternative general-knowledge questionnaire, to rate their confidence in each answer, and to decide whether or not to report the answer for points. At the end of the questionnaire, participants were asked to estimate their total number of correct answers. As in previous studies, we calculated for each participant the mean confidence rating, over/under confidence (calibration bias) and over/under estimation. In addition, following Koriat and Goldsmith (1996b), we calculated monitoring resolution, control sensitivity and response criterion setting.

We predicted that high and low OC participants would not differ in the cognitive aspect of general-knowledge performance, indexed by the percentage of correct forced-choice answers. Based on previous findings, however, we predicted that high OC participants would be less confident than low OC participants in their answers and would exhibit less overconfidence and less overestimation. Finally, we wanted to elucidate the relationship between the remaining metacognitive components (monitoring resolution, control sensitivity, and response criterion setting) and OC tendencies, in an attempt to determine which specific processes might be related to symptoms of OCD.

2. Method

2.1. Participants

Two hundred and twenty psychology students (169 women, 51 men) at Tel-Aviv University were screened with the Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002; see Measures below). We invited students who scored at the top and bottom of the distribution, with a cut-off score of 24 for high OC participants and a cut-off score of 5 for low OC participants. The final sample included 47 students (M age = 23.13 years, SD = 2.39, range = 21–33 years): Twenty two (19 women and 3 men) with high OC tendencies (M = 31.09, SD = 6.35) and 25 (21 women and 4 men) with low OC tendencies (M = 2.64, SD = 1.52). For comparison, the mean OCI-R for OCD patients in Foa et al. (2002) was 28.01 (SD = 13.53) with a cut-off score of 21 for differentiating OCD patients from non-anxious controls and 18 for differentiation from anxious controls. In a previous study in our laboratory (Reuven-Magril, Dar, & Liberman, 2008) the mean OCI-R for OCD patients was 29.22 (SD = 15.22). In addition we calculated for each participant his Checking subscale score, which is the sum of the three Checking items of the OCI-R. Participants signed an informed consent and received course credit for participation.

2.2. Apparatus

The principal apparatus for this study was a computerized 100-item two-alternative general-knowledge questionnaire (e.g., "which play was written about the Vietnam war? (a) Hair; (b) Funny Girl") used originally in the study conducted by Dar et al. (2000). The items were adapted from psychometric examinations and were provided to us by the National Institute for Testing and Evaluation in Israel.

2.3. Measures

2.3.1. Obsessive-compulsive tendencies

Obsessive-compulsive tendencies were measured by the Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002). The OCI-R lists 18 characteristic symptoms of OCD. Each symptom is followed by a 4-point Likert scale ranging from 0 (*not at all)* to 4 (*extremely*), on which participants indicate the symptom's prevalence during the previous month. The OCI-R has been shown to have good validity, test-retest reliability and internal consistency in both clinical (Foa et al., 2002) and non-clinical samples (Hajack, Huppert, Simons, & Foa, 2004).

2.3.2. Confidence level

Confidence in the answer to each item (subjective probability that the answer is correct) was rated on a scale ranging from 50% to 100%. Mean confidence level of each participant was calculated by averaging the confidence ratings over the 100 items.

2.3.3. Over/under confidence (calibration bias)

Over/under confidence was calculated by the formula $R - C$, where R is the mean confidence rating over the 100 items and C is the number of correct answers.

2.3.4. Over/under estimation

Over/under estimation was calculated by the formula $E - C$, where E is the participants' estimate, following the test, of the number of questions the participant has answered correctly, and C is the participant's total number of correct answers.

2.3.5. Monitoring resolution

Whereas calibration bias indexes the (mis)correspondence between subjective monitoring and objective correctness in an absolute sense, monitoring resolution (or discrimination accuracy) indexes this correspondence in a relative sense—the extent to which one's confidence judgments discriminate between correct and incorrect answers. Monitoring resolution was indexed by calculating the within-participant Kruskal–Goodman gamma correlation between confidence and the correctness of each answer (Nelson, 1984).

2.3.6. Control sensitivity

Control sensitivity was indexed by calculating the Kruskal–Goodman correlation between the participant's confidence ratings for each item and the decision whether or not to report the corresponding answer to his scoring database.

2.3.7. Response criterion

The process of estimating the response criterion for each participant was adopted from Goldsmith and Koriat (2008). According to their model, the response criterion is the confidence level above which items are reported and below which they are not reported. Because participants are not always consistent in utilizing their response criterion in this manner, the response criterion chosen was the one that best fulfilled this condition. For each participant, each confidence level from 50% to 100% was evaluated as a possible response criterion. Each potential response criterion was evaluated by summing the number of reported answers with an equal or higher confidence rating and the number of unreported answers with a lower confidence rating. The response criterion with the highest proportion of such (correctly predicted) report decisions was chosen as the response criterion estimate. If a range of values yielded an equally good fit, the average of these estimates was chosen.

2.4. Procedure

Participants were tested individually in a small and quiet room in the university. Upon arriving they were told that during the experiment they would be taking a computerized two-alternative general-knowledge questionnaire, involving a 3-step response procedure for each question: First, they would have to choose one of the two answer options, even if this required a guess (forced choice). Second, they would rate the likelihood that their answer was correct, on a scale of 50%–100%. Finally, they would decide whether or not to report their answer for points. Participants were told that they would gain 1 point for each reported correct answer but lose 4 points for each reported wrong answer, whereas unreported answers would neither add to nor detract from their total scores. They were told that the higher penalty for a wrong answer compared to the reward for a right answer was due to the 50% chance of guessing an answer correctly. They were told that at the end of the experiment they would receive a monetary reward proportional to their total score, and therefore they should try to maximize it. After finishing the questionnaire, participants were asked to assess how many questions they had answered correctly and rate how satisfied they were with their answers on a 0–10 scale. At the end of the experiment, participants were debriefed and received their monetary reward (the equivalent of $0–$15 in Israeli New Shekels).

3. Results

Following Koriat and Goldsmith (1996b), we first examined cognitive performance in terms of the percentage of correct forced-choice answers, thereby excluding the potential contributions of metacognitive monitoring and control processes. As expected, high OC participants achieved a percentage of correct answers ($M = 73.45$, $SD = 7.40$) that was equivalent to the percentage achieved by low OC participants ($M = 75.44$, $SD = 5.8$), $t(45) = 1.03$, $p = .31$. Thus, the two participant groups do not appear to differ in their level of general knowledge or in their ability to access such knowledge.

Turning now to examine performance on the free-choice phase, that is, the number of points earned for the freely reported correct answers while penalizing for wrong answers (cf. formula scoring; Thurstone, 1919), here too the high OC participants ($M = 23.82$, $SD = 17.72$) and low OC participants ($M = 29.84$, $SD = 16.81$) achieved similar test scores, $t(45) = 1.19$, $p = .24$.

With respect to monitoring, we examined the hypotheses that high OC participants, as compared with low OC participants, would show less overconfidence and less overestimation and would be less confident in their answers. Contrary to our predictions, the two groups did not differ on any of these variables: High OC and low OC participants gave similar confidence ratings, with both groups exhibiting no overconfidence and similar levels of underestimation. In addition, the two groups did not differ with regard to monitoring resolution [$M = 0.63$, $SD = 0.14$, for high OC; $M = 0.67$, $SD = 0.15$, for low OC; $t(45) = 1.10$, $p = .28$], or in how satisfied they were with their answers (see Table 1).

Interesting differences between the two groups, however, emerged with respect to metacognitive control. Control sensitivity was high and equally so for both groups [$M = 0.95$, $SD = 0.06$, for high OC; $M = 0.96$, $SD = 0.04$, for low OC; $t(45) = 1.09$, $p = .28$]. Yet, High OC participants were substantially more conservative in their reporting, setting a higher response criterion ($M = 77.12$, $SD = 11.3$) than low OC participants ($M = 69.40$, $SD = 9.39$), $t(45) = 2.56$, $p = .01$. The fit rate of these criterion estimates (mean percentage of volunteer-withhold decisions correctly accounted for by the criterion) was equivalently high for both groups [$M = 92.23$, $SD = 4.25$, for high OC; $M = 91.16$, $SD = 4.38$, for low OC; $t(45) < 1$]. As a result, under the free-report instructions, the high OC participants chose to report fewer answers ($M = 50.86$, $SD = 17.14$) than did the low OC participants ($M = 60.64$, $SD = 12.44$), $t(45) = 2.26$, $p = .03$. They also reported fewer correct answers under the free-report instructions [$M = 45.45$, $SD = 14.93$ for high OC; $M = 54.48$, $SD = 10.08$ for low OC; $t(45) = 2.45$, $p = .02$]. Surprisingly, despite the more conservative reporting, the accuracy of the answers reported by the high OC ($M = 89.95$, $SD = 6.99$) and low OC ($M = 90.44$, $SD = 5.98$) groups did not differ $t(45) < 1$. Thus, overall, the high OC group suffered a larger quantity-accuracy trade-off compared to the Low OC group: the increase in accuracy between free and forced report was equivalent [$M = 16.49$, $SD = 5.60$ for high OC; $M = 15.00$, $SD = 7.03$ for low OC; $t(45) < 1$], whereas the decrease in the number of correct answers was larger for the high OC group ($M = 28.00$, $SD = 12.16$) than for the low OC group ($M = 20.96$, $SD = 7.16$), $t(45) = 2.45$, $p = .02$.

4. Discussion

The present study compared high and low OC participants on several cognitive and metacognitive variables within a paradigm that differentiates and allows the examination of various aspects of metacognitive monitoring and control. As predicted, high and low OC participants did not differ in the cognitive aspect of their performance on the general knowledge questionnaire, exhibiting equivalent percentages of correct forced-choice answers. However, contrary to our expectations and to previous findings, high OC

Table 1
Confidence levels, over/under confidence, over/under estimation and satisfaction among high and low OC participants.

	High OC	Low OC	*t* score	*p* level
Confidence levels	$M = 74.70$ $SD = 5.70$	$M = 75.21$ $SD = 6.01$	−0.3	0.767
Over/under confidence	$M = 1.24$ $SD = 8.46$	$M = -0.23$ $SD = 5.38$	0.72	0.474
Over/under estimation	$M = -25.64$ $SD = 20.36$	$M = -24.28$ $SD = 16.03$	−0.26	0.780
Satisfaction	$M = 6.36$ $SD = 2.32$	$M = 6.84$ $SD = 1.65$	−0.82	0.418

participants also did not differ from low OC participants with regard to confidence levels, overconfidence or overestimation. Nor did the two groups differ in their levels of monitoring resolution or control sensitivity.

Instead, the primary difference that emerged between the two groups was the setting of a more conservative response criterion by the high OC participants compared to the low OC participants, with the high OC group demanding a higher level of subjective confidence before they would be willing to venture an answer for points. This difference led the high OC participants to report fewer answers than the low OC participants, and in particular, to report a lower number of correct answers, thereby yielding a larger quantity-accuracy trade-off in their use of the option of free report. The resulting free-report performance scores (points earned for reported correct answers minus the penalty paid for reported wrong answers), though numerically lower for the High OC group, did not yield a statistically significant difference.

The lack of difference in confidence and related measures between high and low OC participants may be due to the novel procedural aspects of the present study. In contrast to Dar et al. (2000) and other studies that examined metacognitive confidence in OCD patients (e.g., Cougle et al., 2007, 2008; MacDonald et al., 1997; McNally & Kohlbeck, 1993; Zermatten & Van der Linden, 2008), participants in this study were not only asked to rate their confidence in their answers but also to decide whether to act on it by reporting their answers. This additional procedural step separates the two metacognitive aspects of monitoring and control. In the confidence-rating step participants are making a *monitoring* judgment, that is, they are estimating the likelihood that their answer is right. In the reporting step, they are making a *control* decision, that is, they are deciding how to act in light of their monitoring judgment.

The procedural separation between these two metacognitive processes might be responsible for the absence of confidence differences between the high and low OC participants in this study. According to Salkovskis (1998), one of the main cognitive characteristics of OCD is a fusion of cognitions and actions, such that for an individual with OCD having a thought is equivalent to committing the act it represents. He gives the example of a mother with OCD that is afraid she would harm her baby. In her mind the existence of the thought is an indication that she might indeed commit the act and hence she feels obligated to perform some kind of prevention behavior. Put in metacognitive terms, the thought-action fusion notion can be reframed as suggesting that OCD patients may spontaneously fuse monitoring and control processes. Accordingly, when asked in previous studies how sure they are in their cognitive responses, the elicited judgments of OCD participants may have derived not only from monitoring but also from control processes. They may not simply ask themselves “How sure am I in my answer?” but also “To what extent would I be willing to act accordingly?” In the present study these two considerations were clearly separated, which may have enabled High OC participants to make “pure” (control-free) probability assessments based exclusively on the monitoring process, leading to less conservative confidence ratings.

A key implication of the present results, then, is that the main locus of metacognitive differences between high and low OC individuals may be found not in the domain of monitoring, but rather, of control. In the present study, High OC participants were not less confident in their answers than Low OC participants, but they did demand a higher level of conviction (confidence) in order to be willing to act on that conviction.

One way to conceptualize the conservative response criterion of high OC individuals is to view it as indicating risk avoidant behavior. In the present study, the higher response criterion reflected the preference of high OC individuals to forgo points for correct answers in order to avoid the risk of losing points for wrong answers. It is well known that people suffering from higher levels of anxiety tend to avoid taking risks in decision making processes (Maner et al., 2007). Steketee and Frost (1994) found that OCD patients tend to avoid routine actions that might be harmful, such as sipping from a friend’s cup or leaving their car momentarily unlocked. However, these studies did not address the question of whether this avoidance is related to lower confidence levels or a conservative risk taking policy. According to Foa, Amir, Gershuny, Molnar, and Kozak (1997), the basic psychopathology in OCD is related to decision making processes. The present study is in line with this proposal, in suggesting that decision making in OCD is strongly affected by risk avoidance. This interpretation of our findings may also resonate with the findings of Moritz et al., that OCD participants did not display differences in memory confidence relative to controls (Moritz et al., 2006, 2009a, 2009b, 2011) except under conditions that trigger inflated responsibility (Moritz et al., 2007). These findings suggest that people with OCD display reduced confidence only when it has real consequences for which they might feel responsible.

Another potentially interesting difference in control between the high OC and low OC participants concerns the relationship between control sensitivity and monitoring resolution. In an ancillary analysis, we found that the correlation between these indexes was significant among low OC participants, $r(25) = 0.45$, $p = .02$, but not among high OC participants, $r(22) = 0.05$, $p = .83$. That is, the more effective low OC participants were in their ability to discern wrong from right answers, the more they relied on their confidence in deciding to report their answers. Among high OC participants, the tendency to rely on their monitoring process in making behavioral decisions was not related to the effectiveness of the monitoring process. There are at least two alternative interpretations for this finding. First, it might be that high OC individuals are less able to gauge their monitoring effectiveness (i.e., their ability to discern right from wrong answers), and therefore, although this “second-order” metacognitive evaluation does influence their behavioral decisions, it cannot be identified in the correlation with actual monitoring effectiveness. Alternatively, it might be that high OC individuals are just as effective as low OC individuals in gauging their monitoring effectiveness, but for some reason do not behave accordingly. The present results do not allow us to distinguish between these two possibilities.

We should note two important differences between the present study and the study of Dar et al. (2000). First, participants in Dar et al. (2000) were OCD patients rather than students with high OC tendencies. Second, participants in Dar et al. (2000) rated their confidence level on a scale ranging from 5% to 100%, whereas in the present study the confidence scale started at 50%, corresponding to the chance probability that an answer is correct (i.e., a guess has a 50% chance of being correct). In Dar et al. (2000), OCD patients tended to use the whole scale, while control participants tended to use only the higher part of the scale. It is therefore possible that the findings of Dar et al. (2000) may be partially attributed to the tendency of OCD patients to rate their confidence levels as lower than 50% (not taking into account the chance probability of correct guessing), which was prevented in the present study.

There are several aspects and limitations of the present study that should be addressed in future research. First, it is well known that many anxiety disorders are characterized by avoidant behavior (e.g., Maner et al., 2007). Future research should examine whether the observed conservative response criterion is unique to OCD or may be found in other anxiety disorders. Second, we do not know which factors might affect the observed conservative risk taking policy. For example, Cougle et al. (2007) found that higher perceived risk and responsibility lead to lower confidence levels. It is worth examining whether the response criterion would be similarly affected by these variables, and whether the effect on confidence would remain even when the monitoring and control aspects are procedurally separated (as in the present study). Third, the present study examined our hypotheses in the specific context of general knowledge. It is important to examine the same dependent variables in the context of OCD-relevant contents, such as contamination. Finally, our findings are based on a non-clinical, highly functioning, largely female student sample and their generalization to OCD requires replication with a clinical sample. Nevertheless, we believe that this line of research, with its general metacognitive approach, can serve as a good starting point to facilitate further understanding of the mechanisms that create and maintain incessant doubts in OCD.

Our study suggests that one of the characteristics of OCD is conservative risk taking policy, which exists even when confidence levels are at normative levels. This conclusion may have implications for cognitive therapy of patients with OCD. For example, it might direct therapists to understand and talk about the malignant doubt and indecision that their clients often experience in terms of risk avoidance and inflated responsibility rather than in cognitive terms per se. Such a perspective might make more sense to clients with OCD, as it connects their experience of doubt with the fear of harm to themselves or to others. This perspective might also shift the focus of the therapy from attempting to alleviate doubt to adopting a more realistic sense of responsibility and danger and encouraging a more adaptive risk taking policy.

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