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MEMORY AND CONFIDENCE IN MEMORY JUDGMENTS AMONG INDIVIDUALS WITH OBSESSIVE COMPULSIVE DISORDER AND NON-CLINICAL CONTROLS

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Summary—The present study investigated episodic memory functioning in: (1) obsessive compulsive disorder (OCD) patients with primarily checking symptoms (i.e. checkers); (2) OCD patients without checking symptoms (i.e. non-checkers); and (3) non-clinical control participants. On a measure of recall, all groups were statistically equivalent with respect to the proportion of words correctly recalled. Using a recognition measure, checkers were unimpaired in episodic memory, as compared to non-checkers and non-clinical controls. However, relative to the other groups, patients with checking symptoms showed decreased confidence in their correct and incorrect recognition memory judgments, according to their item-by-item self-report confidence ratings. When checkers correctly identified previously seen words, they were also slower to respond than were the other groups, supporting the view that they were less confident in their memory judgments relative to the other groups, which did not differ on this measure. The results of the present study suggest that OCD checking is not related to memory impairments *per se* but rather that checking in OCD is a symptom of decreased confidence in memory. © 1997 Elsevier Science Ltd

INTRODUCTION

Because obsessive doubt regarding whether actions were completed correctly is often a feature of obsessive compulsive disorder (OCD), investigators have recently become interested in the memory functioning of individuals with OCD. Specifically, researchers have begun to study possible differences in memory function between OCD patients who check or repeat actions (i.e. checkers) and those who do not check or repeat actions (i.e. non-checkers). Several studies have now found that among individuals with OCD and those with non-clinical OCD symptoms, checking symptoms (e.g. the need to check appliances or locks several times, the need to repeat actions many times, etc.), appear to be associated with memory impairment (Rubenstein Peynircioglu, Chambless & Pigott, 1993; Sher, Frost, Kushner, Crews & Alexander, 1989; Sher & Mann, 1984).

Sher *et al.* (1989) investigated episodic memory in sub-clinical checkers and non-checkers, as defined by scores on the checking subscale of the Maudsley Obsessive Compulsive Inventory (MOC: Hodgson & Rachman, 1977). Participants completed questionnaires, a vocabulary test, six subtests of the Wechsler Memory Scale (WMS: Wechsler, 1945), and a tape recorded task that involved recounting the details of their last vacation and describing the type and amount of imagery they employed when recalling the trip. Compared to non-checkers, checkers achieved lower WMS scores although their measures of general intellectual ability were not different. Checkers and non-checkers were also tested on their ability to recall the names of the tasks that they had performed during the experiment, as well as on their ability to recognize and order the tasks they had performed out of a list of 18 tasks. Although checkers recalled fewer tasks than did non-checkers, the two groups did not differ significantly on the recognition or ordering of tasks that they had performed. Although participants did not meet diagnostic criteria for OCD,

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checkers received higher overall scores of compulsivity on the MOC, a measure used to assess OCD severity. This study suggests that memory impairments in the recall of past actions are associated with checking compulsions.

Rubenstein *et al.* (1993) reported similar results in a study comparing individuals with subclinical checking symptoms to individuals with no OCD symptoms. Participants were assessed using a variety of memory tasks. During the first task, they were read statements describing actions and were instructed either to perform, to write, or to observe the actions. Once this first phase was completed, participants were then given a blank sheet of paper and asked to write down all the actions they could remember. They were also instructed to indicate whether they had performed, written, or observed each action. Checkers recalled fewer actions overall and were also more confused regarding whether they had performed, written, or observed the action. Despite this difference, checkers did not differ from controls in the number of actions they correctly remembered from a cartoon that they had previously observed, or in the percentage of studied words that they remembered from a list. Checkers actually recognized more words in a subsequent recognition memory test. These results suggest that subclinical OCD checkers may be impaired in the recall of actions, particularly their own.

Other studies, however, contradict these findings of memory deficits among individuals reporting excessive checking. McNally and Kohlbeck (1993) investigated episodic memory and reality monitoring (i.e. the ability to distinguish memories for performed actions from memories for imagined actions) among OCD checkers, OCD non-checkers, and non-clinical control participants. Participants were required either to trace drawings or words, to imagine that they were tracing drawings or words, or to simply look at drawings or words on cards. After a period of distraction, participants performed a recognition memory test for the items that had been presented in the first phase. Following the recognition memory test, participants were asked to recall the activity that they had performed *vis-à-vis* the item. After each of these tests, participants were asked to rate their confidence about each decision.

Participants with OCD correctly recognized slightly fewer of the old items, although no differences occurred across groups in their rejection of new items. Groups also did not differ in their confidence regarding correct recognition or in their accuracy of recall of the activity performed, suggesting that OCD checkers do not have deficits in reality monitoring. Both checkers and non-checkers, however, expressed less confidence in their recall of activities performed compared to normal controls. They demonstrated less confidence in their reality monitoring judgments even though these judgments were as accurate as control participants' judgments.

Similarly, Foa, Molnar, Amir and Gershuny (1994) found that OCD patients did not demonstrate memory impairments relative to controls. Phase 1 of their study consisted of presenting contamination and non-contamination sentences to participants and having them repeat the sentences aloud. After a period of distraction, participants heard half of the old sentences and some new sentences accompanied by white noise. Participants were asked to repeat the sentence that they heard amidst the noise. All participants repeated the old sentences more accurately than the new ones, indicating that OCD participants do not differ in terms of implicit memory for the old sentences compared to control participants. As a test of explicit memory, participants were then asked to discriminate old sentences from new sentences. Participants with OCD did not differ from controls in terms of their recognition memory judgments, regardless of sentence content. However, the groups did differ with respect to their confidence ratings for the recognition judgments. Participants with OCD were more confident in their recognition judgments of correctly recognized contamination sentences than non-contamination sentences, whereas control participants were more confident in their recognition judgments of correctly recognized non-contamination sentences than contamination sentences.

Despite these previous studies showing that OCD patients differ from other groups in their confidence regarding memory judgments (Foa *et al.*, 1994; McNally & Kohlbeck, 1993), a recent study by Brown, Kosslyn, Breiter, Baer and Jenike (1994) did not confirm this finding. Specifically, Brown *et al.* (1994) found that participants with OCD were actually better at discriminating seen from imaged words than were control *S*s using a signal detection analysis. Their analysis also revealed that individuals with OCD tended not to use an especially conservative criterion for deciding whether they had seen a word, but rather their response criterion equalled

that of control participants. The authors interpreted their findings as indicating that patients with OCD are good at making decisions about their memories. They concluded that patients with OCD are not less confident about their memories than are people without OCD.

Rationale for the present experiment

The present study investigated the performance of OCD checkers, OCD non-checkers, and non-clinical controls on recall and recognition tests of episodic memory. Previous studies of episodic memory among individuals with OCD and individuals with compulsive checking rituals have yielded inconsistent results (Amado-Boccara, Longevialle, Galinowski & Poirier, 1989; Otto, 1992). The present study differed from previous research in several important ways.

First, this study examined memory in patients diagnosed with OCD, whereas most previous studies examining differences between checkers and non-checkers (e.g. Rubenstein *et al.*, 1993; Sher *et al.*, 1989), did so using individuals with sub-clinical OCD symptoms. Moreover, the present study investigated differences between checkers and non-checkers, whereas of the few studies that did use clinical OCD patients, only one (McNally & Kohlbeck, 1993) distinguished between OCD checkers and non-checkers. Also, it was our intention to increase the level of difficulty of the tests of memory by making the study periods quite brief and by lengthening the periods of distraction between the study phases and the tests. By increasing the difficulty of the tasks, we hoped to allow group differences that may have been masked by near-ceiling performance in previous studies to emerge.

In addition, the present study investigated the issue of confidence regarding memory judgments using a recognition memory test. Specifically, participants' self-report confidence ratings as well as latencies were collected for each recognition memory judgment. Latency was assumed to be a more objective measure of confidence. We reasoned that the longer participants took to decide whether an item was old or new in the experiment, the less confident of the accuracy of their decision they likely were. We expected that the groups (especially the OCD checkers) would differ in their mean confidence ratings for both correct and incorrect items on the recognition memory test. We also hypothesized that OCD checkers would have longer latencies than other groups in making their recognition judgments.

METHOD

Participants

Three groups of individuals participated in the study: (1) OCD patients with excessive checking (i.e. checkers; $n = 10$); (2) OCD patients without excessive checking (i.e. non-checkers; $n = 10$); and (3) non-clinical controls ($n = 10$). OCD patients were recruited from the Anxiety Disorders Clinic at the Clarke Institute of Psychiatry and were paid $10.00 (Canadian dollars) in exchange for their participation in the study. All patients met DSM-IV criteria (American Psychiatric Association, 1994) for OCD according to the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID: First, Spitzer, Gibbon & Williams, 1994). Consistent with previous studies (e.g. Sher *et al.*, 1989), participants with OCD were assigned to checker and non-checker groups based on their scores from the Maudsley Obsessive Compulsive Inventory (MOC: Hodgson & Rachman, 1977). Participants with a subscore ≥ 4 on the MOC checking scale were classified as checkers, whereas those scoring < 4 on this subscale were classified as non-checkers.

Participants in the non-clinical control group were recruited from the introductory Psychology class at the University of Toronto at Scarborough and volunteered to participate in the experiment in exchange for bonus credit. All control participants failed to meet DSM-IV criteria for OCD during administration of the OCD section of the SCID.

Measures

MOC. The 30-item MOC assesses OCD severity on four types of OCD rituals (Hodgson & Rachman, 1977). The subscales include cleaning, checking, slowness, and doubting and the items are broken down along these four factors. The MOC has been shown to have adequate

levels of internal consistency, stability, and concurrent validity (Hodgson & Rachman, 1977). This measure was completed by all participants as a measure of OCD severity and was used to assign OCD patients to the checker and non-checker groups.

Yale–Brown Obsessive Compulsive Scale (YBOCS: Goodman, Rasmussen, Price, Mazure, Heninger & Charney, 1989). The YBOCS was administered only to individuals in the OCD groups as a measure of OCD severity. This measure is a semi-structured interview that assesses type and severity of obsessions and compulsions separately. Although the revised YBOCS comprises 19 items, only the psychometric properties of the first 10 items are secure. Therefore, *S*s only answered questions 1–5, reporting on obsessions, and questions 6–10, reporting on compulsions in the current study. Administered in this manner, the YBOCS appears to have excellent inter-rater reliability and good convergent validity (Woody, Steketee & Chambless, 1995).

State–Trait Anxiety Inventory—State version (STAI-S: Spielberger, Gorsuch & Luschene, 1970). The STAI-S is a 20-item measure that assesses subjective feelings of anxiety and tension on a 4-point likert scale at the particular moment during which the test is completed. This measure was completed by all participants to assess levels of general anxiety during the study.

Beck Depression Inventory (BDI: Beck, Ward, Mendelson, Mock & Erbaugh, 1961). The BDI was completed by all participants to evaluate their levels of depression. It assesses 21 symptoms that are associated with depression, each based on a severity rating from 0 to 3

Shipley Institute of Living Scale—vocabulary portion (SILS: Shipley, 1940). The SILS was used as an estimate of verbal ability for all participants in the present study. This measure employs a multiple choice format, whereby participants are asked to choose the synonym of a word printed in upper case from among four alternatives printed in lower case.

Stimuli

Forty-eight words, taken from Battig and Montague (1969), were presented in random order in the study phase for the recall task (lists available upon request). Two lists of 48 words were selected from Battig and Montague (1969) for the recognition task. These lists were matched by category (i.e. each word in List 1 had a category counterpart in List 2). Half of the participants in each group received List 1 during the study phase, whereas the other half of the participants received List 2. The order of the item presentation within lists was random. All participants received the same recognition memory test, however, composed of 24 words from List 1 and 24 words from List 2.

Apparatus

An IBM 486 compatible microcomputer with a 14 in. colour VGA monitor was used for testing. The controlling program was written in QuickBasic 4.5 using the routines provided by Graves and Bradley (1987, 1988) to achieve millisecond timing accuracy. Response times were measured as the interval between the stimulus onset and the *S*'s manual, key pressing response in all cases. Participants' key presses were recorded by the program and were later analyzed for accuracy. Testing for all control participants was conducted at the University of Toronto at Scarborough. Testing for all experimental participants, took place at the Clarke Institute of Psychiatry.

Procedure

All participants performed both the recall and recognition memory tasks. The experiment consisted of six phases: (a) Study Phase 1; (b) Distraction Phase 1; (c) Recall Test; (d) Study Phase 2; (e) Distraction Phase 2; (f) Recognition Memory Test (with an on line confidence rating for accuracy). During both study phases, each word in the list appeared by itself in the centre of the computer screen for 1 sec. Participants were instructed to commit the words to memory and they were informed of the respective memory test that would follow each study phase. A focal point (******) appeared in the centre of the screen for 500 msec preceding the presentation of the word by 250 msec. During Distraction Phase 1, participants completed the BDI. Participants were given 7 min to complete the self-report questionnaire before performing the recall test. If participants completed the questionnaire before the 7 min had expired, they were instructed to count backwards until the time was up. The recall test consisted of asking

Table 1. Means and (standard deviations) on measures of OCD severity.

Measure	OCD checker (n = 10)		OCD non-checker (n = 10)		Control (n = 10)		t	F
YBOCS[a]	29.6	(7.50)	20.3	(7.41)	—	—	2.79*	
MOC total[b]	19.0	(4.97)	10.1	(4.68)	5.1	(6.70)		28.37***
Contrast 1								33.72***
Contrast 2								23.18***
MOC checking[c]	5.6	(1.78)	1.9	(2.33)	0.6	(0.97)		21.20***
Contrast 1								39.79***
Contrast 2								2.67
MOC cleaning[d]	5.5	(3.38)	3.2	(2.70)	1.9	(1.20)		4.96*
Contrast 1								5.97 *
Contrast 2								3.95***
MOC slowness[e]	3.7	(1.77)	2.3	(1.34)	0.8	(0.63)		11.81***
Contrast 1								18.32***
Contrast 2								5.52*
MOC doubting[f]	5.9	(1.01)	4.4	(2.01)	2.1	(0.99)		17.60***
Contrast 1								29.82***
Contrast 2								5.40*

[a] Mean scores on the Yale–Brown Obsessive Compulsive Scale (out of a maximum score of 40 composed of a score for obsessions and a score for compulsions).
[b] Mean total scores on the Maudsley Obsessive Compulsive Inventory (out of a maximum score of 30).
[c] Mean scores on the checking subscale of the MOC (out of a maximum score of 7).
[d] Mean scores on the cleaning subscale of the MOC (out of a maximum score of 11).
[e] Mean scores on the slowness subscale of the MOC (out of a maximum score of 7).
[f] Mean scores on the doubting subscale of the MOC (out of a maximum score of 7).
Contrast 1 = a comparison of scores for participants in the OCD groups to those of participants in the control group. Contrast 2 = a comparison of scores for participants in the OCD checker group to those of participants in the OCD non-checker group.
*$P < 0.05$; *** = $P < 0.001$.

participants to write down as many words as they could recall from the study list. A maximum of 5 min was allotted for the recall test. During Distraction Phase 2, participants completed the vocabulary portion of the SILS. They were given 10 min to complete this verbal intelligence measure.

In the recognition memory test, participants were presented with words on the computer screen one at a time. The words remained on the screen until participants responded by pressing the 'a' key that had an 'O' sticker on it or by pressing the "'" key that had an 'N' sticker on it. 'O' stood for old and participants were instructed to press this key if they had seen the word during Study Phase 2. 'N' stood for new and participants were instructed to press this key if they had not seen the word during Study Phase 2. Each word was preceded by an orienting stimulus (******) that appeared on the screen for 500 msec followed by a blank screen for 250 msec. After the old/new decision was made, the test word disappeared from the screen and the word 'Confidence' appeared in the centre of the screen prompting participants to provide a confidence judgment of their accuracy on the recognition decision they had just made. They indicated their confidence by pressing either the '1' key for *not at all confident*, the '2' key for *somewhat confident*, the '3' key for *moderately confident* or the '4' key for *extremely confident*. Participants' latencies were also collected for each old/new decision they made during the test. Latency was taken as an objective indicator of confidence.

RESULTS

Questionnaire and interview measures

Means and standard deviations for the OCD-related measures (i.e. YBOCS, MOC) are presented in Table 1. To compare groups on these measures, one-way analyses of variance (AVOVAs) were conducted for MOC scores and t-tests were conducted for YBOCS scores because these were only available for the clinical groups. On the YBOCS, checkers' scores were more elevated than those of non-checkers. On the MOC, OCD patients had significantly higher scores than non-clinical controls for total scores and on all subscales. Checkers had significantly higher scores than non-checkers for total MOC scores and for cleaning, slowness, and doubting subscales. Overall, checkers' and non-checkers' scores on the YBOCS and MOC were consistent with previous studies of OCD patients, suggesting moderate levels of OCD severity.

Table 2. Means and (standard deviations) for various measures other than OCD severity

Measure	OCD checker (n = 10)		OCD non-checker (n = 10)		Control (n = 10)		F
Age[a]	36.0	(9.93)	37.1	(9.43)	19.3	(0.68)	15.87***
Contrast 1							31.46***
Contrast 2							< 1
BDI[b]	22.8	(8.83)	19.3	(15.09)	6.0	(3.89)	10.96***
Contrast 1							21.06***
Contrast 2							< 1
Shipley[c]	31.8	(4.78)	31.0	(4.42)	29.9	(3.00)	< 1
STAI-S[d]	49.3	(16.17)	40.8	(15.09)	34.7	(6.72)	3.02**
Contrast 1							4.01**
Contrast 2							2.03

Note: The *df* for the error term in all cases was 27.
[a] Mean age in years.
[b] Mean scores on the Beck Depression Inventory (out of a maximum score of 63).
[c] Mean scores on the verbal section of the Shipley Institute of Living Scale (out of a maximum score of 40).
[d] Mean scores on the State version of the State–Trait Anxiety Inventory (out of a maximum score of 80).
Contrast 1 = a comparison of scores for participants in the OCD groups to those of participants in the control group. Contrast 2 = a comparison of scores for participants in the OCD checker group to those of participants in the OCD non-checkers group.
** = $P < 0.01$; *** = $P < 0.001$.

Means and standard deviations for variables and measures not directly related to OCD (i.e. age, BDI, SILS, STAI-S) are presented in Table 2. To compare groups on these measures, one-way AVOVAs were conducted, followed by planned orthogonal contrasts. Checkers and non-checkers tended to be older than individuals in the non-clinical control group, but did not differ in age from one another. With respect to anxiety and depression, the two OCD groups did not differ from one another, but these groups did have significantly higher scores on the BDI and STAI-S than non-clinical controls. This is consistent with previous studies showing elevated levels of depression and anxiety in OCD patients (Riggs & Foa, 1993). Groups did not differ in verbal intelligence, as measured by the SILS.

Analyses of recall data

The mean proportions of words correctly recalled among checkers, non-checkers, and non-clinical controls were 0.179, 0.142, and 0.188, respectively. To assess group differences in the proportion of words correctly identified during the recall task, a one-way ANOVA was conducted. The mean proportion of words correctly recalled did not differ significantly across the three groups, $F(2,27) < 1$, NS.

Analyses of recognition data

Rather than comparing groups on the proportion of hits (i.e. correctly recognized words) or the proportion of false alarms (i.e. incorrectly identifying a word as having been previously seen), groups were compared on their *d'* scores. The *d'* score is an indicator of participants' ability to differentiate signal (i.e. items that were previously seen) from noise (i.e. items that were not previously seen). Because the *d'* measure takes both hits and false alarms into account, it was deemed a better indicator of recognition memory than either hits or false alarms alone. A one-way ANOVA comparing the three groups on *d'* was non-significant, $F(2,27) < 1$, NS, suggesting that groups did not differ on this measure. Table 3 includes *d'* values for each group.

Table 3. Response latencies (msec), confidence ratings, *d'* scores and response bias across groups during the recognition test

	Hits		False alarms			
Group	RT	Conf	RT	Conf	*d'*	Bias
Checker	3389	2.6	3793	1.4	1.65	0.084
Non-checker	2751	3	2959	2.6	1.52	0.283
Control	2128	3	2998	2.3	1.39	–0.214

Note: RT = reaction time (i.e. response latencies) in msec. Confidence ratings are based on a scale from 1 (not at all confident) to 4 (*extremely confident*). *d'* = an indicator of participants' ability to differentiate between previously seen words and new words. Higher *d'* scores reflect more accurate recognition. Bias = response bias (high scores reflect a tendency to identify words as previously seen; low scores reflect a tendency to identify words as new; scores close to zero reflect no systematic response bias).

Analyses of response bias

To assess differences among checkers, non-checkers, and non-clinical controls in response bias, a oneway ANOVA was conducted. Significant group differences emerged overall, $F(2,27) = 5.41$, $P < 0.03$, although subsequent planned contrasts failed to find significant differences between checkers and non-checkers, $F(1,27) < 1$, NS, or between non-checkers and controls, $F(1,27) = 1.26$, NS. Also, a *post hoc* comparison of individuals in the control group to those in the two OCD groups was non-significant, $F(1,27) = 1.05$, NS. The planned and unplanned comparisons failed to explain the source of the overall significant group difference in response bias. Examination of the group means suggests that *S*s showed relatively little response bias in the recognition memory test. Response bias values are included in Table 3.

Confidence during recognition test

In order to assess group differences in confidence for recognition memory judgments, a one-way ANOVA was performed on mean confidence ratings for hits across groups. The overall ANOVA was non-significant, $F(2,27) = 2.25$, NS, as was the planned contrast between OCD non-checkers and controls, $F(1,27) < 1$, NS. However, a planned orthogonal contrast between OCD checkers and the combined group of non-checkers and non-clinical controls was significant, $F(1,27) = 4.45$, $P < 0.05$, suggesting lower confidence ratings for hits among OCD checkers.

An analogous ANOVA was used to examine confidence ratings across groups for false alarms. This ANOVA was significant, $F(2,27) = 7.07$, $P < 0.005$, suggesting that groups differed in confidence regarding words incorrectly judged to have been previously seen. A planned orthogonal contrast was conducted to compare OCD checkers and the combination of OCD non-checkers and non-clinical controls. This difference was statistically significant, $F(1,27) = 13.36$, $P < 0.001$, reflecting lower confidence judgments for OCD checkers compared to OCD non-checkers and controls for false alarms. A second planned comparison between OCD non-checkers and controls was non-significant, $F(1,27) < 1$, NS.

As a second indicator of confidence in recognition memory, groups were compared on their mean latencies for judging whether they recognized the words or not in the recognition task. The one-way ANOVA comparing latencies across groups for hits was non-significant, $F(2,27) = 2.42$, NS. The planned comparison between OCD checkers and OCD non-checkers and non-clinical controls combined was marginally significant, $F(1,27) = 3.65$, $P < 0.1$, indicating longer latencies for OCD checkers than for OCD non-checkers and controls. The orthogonal contrast comparing OCD non-checkers and controls was not significant, $F(1,27) = 1.18$, NS. The corresponding ANOVA comparing latencies for false alarms was non-significant, as were the planned contrasts between OCD checkers and non-checkers and controls combined and between OCD non-checkers and controls, all Fs < 1, NS. Although the latencies for false alarms were statistically equivalent for OCD checkers, non-checkers, and controls, it should be noted that the variability for the latency measure was quite large. Mean confidence ratings and latencies are reported in Table 3.

Because groups differed in their YBOCS and MOC total scores, Pearson correlations were computed between total scores on these measures and confidence ratings in order to assess whether group differences in confidence might have been related to group differences in severity, rather than the presence or absence of checking compulsions. YBOCS scores across the two clinical groups were not significantly correlated with confidence regarding hits ($r = 0.35$, NS) or confidence regarding false alarms ($r = -0.37$, NS). However, total MOC scores across all three groups were significantly correlated with confidence regarding hits ($r = -0.41$, $P < 0.03$) and confidence regarding false alarms ($r = -0.62$, $P < 0.001$).

DISCUSSION

Even in a very difficult test of recall, OCD patients did not differ from control participants in their episodic recall abilities. It should be noted that the proportion of words recalled by all groups was extremely low overall. This might be due to the long, 7 min period of distraction

that separated the study phase and the test phase and the very brief, 1 sec study presentation for each word. Similarly, the present study found no differences among groups with respect to recognition memory. Overall, these findings are inconsistent with previous studies showing that compulsive checking is related to memory impairments in sub-clinical groups (Sher & Mann, 1984; Sher *et al.*, 1989), although they confirm other results showing that OCD patients are not impaired in terms of episodic recall and recognition memory (e.g. Foa *et al.*, 1994; McNally & Kohlbeck, 1993). A possible explanation for this finding is that sub-clinical checkers check in response to accurate appraisals of their memory impairment, whereas individuals with clinical levels of OCD check in response to doubts that are related to their OCD symptoms rather than to actual deficits in memory.

Despite the absence of memory impairments for OCD checkers, group differences in self-reported confidence ratings and measures of response latency indicated that OCD checkers may be less confident about their recognition memory than OCD non-checkers or individuals without OCD. To the extent that response latency was an objective measure of confidence, OCD checkers tended to be more tentative and less confident in their correct identification of previously seen old items compared to the other groups, although this difference only approached significance. In contrast, the response latencies of checkers did not differ significantly from those of other groups for incorrect identification of words (i.e. incorrectly identifying new words as words that were previously seen). This may have been due, in part, to the very large degree of variability in response latency. We attribute this variability to the fact that participants were unaware that latency was being measured as well as to the fact that the study instructions did not specify quick responding.

The self-report confidence ratings also confirm a decreased confidence in recognition memory for OCD checkers compared to OCD non-checkers and controls. When OCD checkers correctly identified previously seen words, they were less confident than OCD non-checkers and controls; this was also true for words that they incorrectly judged to be previously seen when, in fact, they were new words. Despite the reduced confidence among OCD checkers, they did not generally demonstrate a negative response bias (i.e. an increased tendency to respond 'no' with respect to both previously seen and new items). Overall, these findings suggest that OCD checkers generally underestimate their own episodic retrieval abilities despite the absence of any actual memory impairments.

The fact that groups differed in OCD severity, as measured by the YBOCS and MOC complicates the interpretation of these findings. Specifically, it is possible that groups differed in confidence not because of the presence or absence of checking rituals, but rather because the checking group was more severely ill than the non-checking group. Significant correlations between MOC total scores and confidence ratings support this explanation. However, arguing against this explanation, groups were expected to differ with respect to MOC scores, because the MOC was used to assign patients to the checking and non-checking groups. Furthermore, correlations between YBOCS scores and confidence ratings did not reach significance, supporting the possibility that the relationship between confidence and severity was not strong. Finally, because the main requirement for inclusion in the non-checking group was the absence of a symptom (i.e. checking) and inclusion in the checking group was contingent on the presence of the same symptom, the assignment of participants to groups may have enhanced group differences in severity. Unfortunately, sample sizes in the present study made it impractical to statistically control for severity.

In summary, the findings of the present study suggest that OCD patients (even those who check excessively) do not differ from individuals without OCD on measures of recall and recognition memory. This finding is particularly interesting given the compulsions of checkers that lead them to repeat tasks many times and the obsessions that require them to constantly question whether they have correctly performed acts such as locking a door or turning off a stove. Rather, OCD checkers appear to be impaired only in their confidence regarding their episodic memories. Cognitive and behavioural interventions that specifically target patients' confidence regarding their ability to recall information may help to alleviate the symptoms of some individuals who suffer from OCD.

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