The importance of importance in OCD memory research

Adam S. Radomsky*

Department of Psychology

Concordia University

S. Rachman

Department of Psychology

University of British Columbia

*Corresponding author: Adam S. Radomsky, Department of Psychology, Concordia University, 7141 Sherbrooke West, Montreal, QC, H4B 1R6, CANADA, adam.radomsky@concordia.ca

Author notes

The authors would like to thank Sarah Brown Tesolin and Philippe Gilchrist for their help in the preparation of this manuscript, and Michael Morris for his help with data collection and entry. Portions of this research were presented at the 2000 Association for the Advancement of Behavior Therapy Conference in New Orleans, and at the 2001 World Congress of Behavioural and Cognitive Psychotherapies in Vancouver. This research was supported in part by an NSERC PGS-B scholarship #207769-1998.

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Investigations of memory and associated phenomena in obsessive-compulsive disorder (OCD) can advance our understanding of this often debilitating problem. Theoretical models predict both the presence and absence of memory biases in favour of threat-relevant information in association with anxiety disorders generally, and with OCD specifically. Two previous experiments (one involving compulsive washing and another involving compulsive checking) that demonstrated such a memory bias are reviewed in the context of the existing literature. Additionally, a new experiment failing to demonstrate such a bias (in association with compulsive ordering and arranging) is presented. The results are discussed in terms of cognitive-behavioural and information processing approaches to understanding OCD. It is argued that experiments which utilize stimuli that are low in ecological validity are unlikely to detect explicit memory biases in OCD. As such, experimental paradigms that are perceived as particularly significant, relevant and important to participants with OCD are encouraged.

The importance of importance in OCD memory research

Specific references to memory and related processes have only recently been incorporated into models of obsessive-compulsive disorder (OCD) (Rachman, 2002). However, investigations of these processes have provided valuable information about not only the phenomenology of OCD, but also the mechanisms on which information processing may have an impact. This is of primary importance to OCD researchers as many believe that compulsions (particularly checking compulsions) result from memory impairments or memory deficits. In fact, the nature of memory in OCD is much more complicated than this (Radomsky & Rachman, 1999; Radomsky, Rachman & Hammond, 2001; van den Hout & Kindt, this issue).

Early models of the relationships between mood and information processing (e.g., Bower, 1981) and psychopathology (Kovacs & Beck, 1978) predicted that strong attentional and memorial biases occur in favour of emotion-relevant information. The proponents of these models contended that the connections between ideas or concepts would vary according to a person's emotional state. That is, in a specific emotional state, attentional, processing and memorial resources are hypothesized to be allocated preferentially to information that is relevant or significant to that emotional state. We should therefore attend to, process and remember sad information when we are unhappy, threatening information when we are frightened, etc. Indeed, both attentional biases in association with anxiety and memory biases in association with depression have been reliably demonstrated (see Williams, Watts & MacLeod, 1997 for a review). These findings suggest that significant, important and relevant information receives preferential processing, and is consistent with fundamental cognitive models which propose that deeper levels of processing are associated with better attention and memory (Craik & Lockhart,

1972). Furthermore, it is consistent with other fundamental cognitive research demonstrating that information perceived and encoded as self-referent or personally important is better remembered than other types of information (Rogers, Kuiper & Kirker, 1977).

Unfortunately, findings of threat-relevant memory biases in association with anxiety and/or anxiety disorders have been and remain somewhat inconsistent (see a recent review by Coles & Heimberg, 2002). Research of this kind becomes increasingly difficult when it is applied to OCD for reasons based in clinical psychology (Radomsky, Rachman & Hammond, 2001), cognitive psychology (Tallis, 1993) and neuropsychology (Greisberg & McKay, 2003; Savage, Deckersbach, Wilhelm, Rauch, Baer, Reid & Jenike, 2000; Woods, Vevea, Chambless, & Bayen, 2002).

Early negative findings of memory bias in association with anxiety disorders were difficult to reconcile with existing models (Dalgleish & Watts, 1990), and as such, newer models were developed to account for the well-supported presence of attentional biases associated with anxiety but the apparent absence of strong memorial biases. These models generally fall under the description of cognitive avoidance models because they posit that while threatening information may indeed receive preferential attentional resources, further elaboration of this material is avoided because of its unpleasant nature (Mogg, Matthews, & Weinman, 1987). This approach was intuitive in that threatening information *is* unpleasant and the model is consistent with other fundamental cognitive psychology research (i.e., Graf & Mandler, 1984), but not consistent with evidence from the clinic. Many patients are able to describe relevant threatening events that occurred years earlier, in exquisite detail. For example, OCD patients with an intense fear of contamination can recall the exact details of contaminated items encountered 10 or 20 years earlier.

Our interpretation of these early negative research findings was that the lack of consistent evidence for memory bias in anxiety may have resulted from primarily methodological problems. A significant majority of early research conducted on memory bias and anxiety used clinical samples of participants with generalized anxiety disorder (GAD). It was our hypothesis that the series of ambiguous findings about memory bias in the anxiety disorders may have resulted from the use of participants without a specific circumscribed fear (a hallmark feature of GAD) and from the use of stimuli low in ecological validity (i.e., words). This type of paradigm was applied to experimental investigations using participants with GAD (Bradley, Mogg, Millar, & White, 1995; Dalgleish, 1994; Mogg, Matthews, & Eysenck, 1992), with social phobia (Rapee, McCallum, Melville, Ravenscroft, & Rodney, 1994), and slightly more successfully to participants diagnosed with panic disorder (Cloitre & Leibowitz, 1991; Cloitre, Shear, Cancienne, & Zeitlin, 1994; McNally, Foa, & Donell, 1989; Nunn, Stevenson, & Whalan, 1984). Not surprisingly, an excellent study by Constans, Foa, Franklin, and Matthews (1995) investigated memory in association with OCD using ecologically valid stimuli and found a significant memory bias in favour of threat-relevant information. In this study, the compulsive checkers had a better memory for the last completed action (most of which were checking-related and/or threat-relevant) in the experimental procedure. We then began to design and conduct experiments in which we recruited participants who reported specific feared outcomes and tested them in paradigms that included ecologically valid stimuli (objects) and provocations that conveyed a real perceived possibility of threat or harm (contamination, uncertainty about future harm, etc.). These initial investigations were successful at using stimuli and conditions which were likely perceived as *significant* and *important* by participants with OCD.

We decided to first investigate the possibility of detecting a memory bias in association with a fear of contamination in OCD because these fears tend to be intense, we felt that contamination could be manipulated in a laboratory setting and because there were many models and theories (biological, psychological and neuropsychological) which could easily be applied to OCD. For this experiment (Radomsky & Rachman, 1999), we recruited three groups of participants: an experimental group meeting the DSM-IV diagnostic criteria for OCD (APA, 1994) who reported that compulsive washing and/or a fear of contamination was their primary symptom, an anxious clinical control group meeting the DSM-IV diagnostic criteria for other (non-OCD) anxiety disorders (in this case, mostly panic disorder and social phobia), and an undergraduate student control group.

After a thorough assessment, participants were asked to watch as an experimenter touched a series of everyday objects with either a clean tissue or a 'contaminated' tissue. After watching the experimenter contaminate 25 objects and touch, but not contaminate the other 25 in one of two random counterbalanced orderings, participants were administered the Wechsler Memory Scale, Revised (WMS-R, Wechsler, 1987) which served as both an assessment of general memory abilities and as a distractor task. Following this, participants completed a free recall task in which they were asked to record as many objects from the table as they could remember, an approach test in which they were asked to state how anxious they would feel if they touched each of the objects on the table and a source recognition test in which they were asked to state which tissue (clean or contaminated) was used to touch each of the objects on the table (see Radomsky & Rachman, 1999 for a full description).

Results indicated that while all groups remembered approximately the same number of items, only the OCD group remembered significantly more contaminated items than clean items.

Neither control group showed a bias in favour or against threatening information. While overall, participants appeared to predict more anxiety in association with touching contaminated objects than clean objects, the OCD group reported significantly more anxiety about touching any object, likely due to a magical perceived spread of contamination over time (Rozin, Markwith, & Nemeroff, 1992; Rozin, Nemeroff, Wane, & Sherrod, 1989; Tolin, Worhunsky, & Maltby, this issue). During a recognition test, participants with OCD were slightly but not significantly more able to remember the source (contaminated or not contaminated) of each object than controls, however this may have been due to the low power of the study given its small sample sizes. Finally, there were no differences between any of the three groups on any of the WMS-R total scores or subscale scores.

These results indicated that participants with OCD had a positive memory bias in favour of threatening information, information which was perceived as significant and important to them. In fact, during debriefing from the study, one of the OCD participants reported that he had recently attended a business meeting during which there was a red spot on the wall. He said that he wasn't sure if it was jam or blood, but proceeded to describe the spot in exacting detail. When asked about the meeting itself, he could not recall what it had been about. This report is completely consistent with a positive memory bias in favour of threatening information associated with compulsive washing.

While there was only a trend in favour of threat recognition in our study, a recent replication of the study by Ceschi, Van der Linden, Dunker, Perroud and Brédart (2003) found a significant threat-relevant recognition bias, only in their OCD washing group. Interestingly, this study failed to replicate the free recall memory bias reported in Radomsky & Rachman (1999), suggesting that further replication may be desirable. However, Ceschi et al.'s (2003) failure to

replicate our earlier findings may have been due to the fact that all of their clinical participants were receiving treatment for their OCD at the time of the study, whereas the majority of participants in our sample began treatment only after completing the experiment. Participants who had successfully completed treatment would not be expected to show such a memory bias and those receiving treatment would likely show an attenuated bias. Furthermore, participants in the European study were all tested in a hospital setting that was quite familiar to them (likely producing a lower perceived threat) whereas the North American study involved testing participants in a novel university department setting. Additionally, due to the idiosyncratic nature of OCD, it is possible that participants who interpret the *contamination* as threatening will show a recognition bias whereas participants who interpret the *objects* as threatening will show a recall bias. Finally, neither of the two studies included an assessment of the perceived contamination of the objects before testing, and it is possible that participants began the experiment with the perception that some objects were more contaminated than others. Since different sets of objects were used in the two investigations, it is unclear whether this factor or any of the others mentioned above may have influenced recall, recognition, encoding and/or retrieval processes. These are empirical questions and may benefit from further investigation.

While these results, indicating a memory bias for threatening information in compulsive washers were encouraging, we felt that memory problems are much more likely to be associated with compulsive checking than with compulsive washing (Radomsky, Rachman & Hammond, 2001). Indeed, patients who wash compulsively don't report that they engage in this compulsive behaviour because they can't remember if they washed their hands properly; they tend to report that they feel an urge to wash because they no longer feel clean. On the other hand, patients who engage in compulsive checking frequently report that their checking often follows an inability to

recall whether or not something has been properly checked, locked, turned off, etc. As such, we sought to investigate memory biases in association with compulsive checking as an extension of the above experimental analysis of memory in association with compulsive washing.

In a small study of memory in compulsive checkers who met DSM-IV diagnostic criteria for OCD (APA, 1994) and indicated that compulsive checking was their primary symptom, we went to participants' homes. Participants completed a thorough assessment, and, following a baseline check of an item in their home that would normally cause anxiety if left unchecked, additional checks were completed and videotaped under conditions of both high and low perceived responsibility (Radomsky et al., 2001). Under the high responsibility condition, participants completed a responsibility contract stating that they took full and complete responsibility for the check and its outcome and agreed to assume complete and total liability for anything that might happen as a result of the check not being properly completed, and then proceeded to complete the check. Under the low responsibility condition, the experimenter signed the contract assuming responsibility and subsequently proceeded to complete the check, attempting to match as closely as possible the baseline check completed earlier. (Participants rated the experimenter's checks as nearly identical to their own.) Following each check, we administered a Memory and Confidence Interview that was designed to test for memory accuracy and confidence for both threat-relevant information (i.e., "How many times did you touch the knob on the stove?") and threat-irrelevant information (i.e., "What was the colour of the pen on the experimenter's collar?"). All participants completed one high responsibility check and one low responsibility check, and the order of these was counterbalanced across participants. One week later, participants came to the lab, watched the videotaped checks that were made in their homes (which were defined as 'no responsibility' checks because they had

already occurred in the past, and because the videotapes were not depicting activities that could produce any current or future harm) and again completed Memory and Confidence Interviews about these taped checks.

Results indicated that a memory bias was present in favour of threat-relevant information and that this bias was amplified under conditions of high responsibility. That is, for both of the in-home checks, participants remembered significantly more threat-relevant information than threat-irrelevant information, although this difference was greater for the high responsibility check than for the low responsibility check. Under conditions of 'no responsibility', this bias was undetectable. Interestingly, when we analysed the data from the confidence portion of the interviews, we found that as perceived responsibility increased, confidence in memory decreased. That is, confidence in memory was significantly greater under conditions of low or no responsibility than under conditions of high responsibility. This finding was consistent with other research on repetition and memory in OCD (Tolin, Abramowitz, Brigidi, Amir, Street, & Foa, 2001; van den Hout & Kindt, 2003, this issue), showing that repetition of compulsive or related actions can lead to decreases in aspects of metamemory while leaving memory accuracy (especially for threat-relevant memory) intact. Again, we found evidence supporting the hypothesis that *significant* and *important* information is better remembered than other information.

One of the clinical experimental group participants excluded from the Radomsky & Rachman (1999) study was someone who did not have a fear of contamination but who instead ordered and arranged many of her belongings at home. This participant was run through the experimental protocol accidentally (only compulsive washers were to be included in the experimental group - and a diagnosis of OCD was an exclusionary criteria for both control

groups). During the recall task, this participant reported that she had probably recalled all of the objects that were "not put right" on the table "because they stood out - like they needed to be moved a bit", and had trouble recalling the objects that had been 'properly placed'. This excluded participant was the inspiration for the current study.

Just as memory biases in favour of threatening information have been demonstrated in our previous work with compulsive washers (Radomsky & Rachman, 1999) and compulsive checkers (Radomsky et al., 2001), we sought to investigate this bias in association with another OCD subtype, namely compulsive ordering and arranging. One would expect that compulsive orderers and arrangers will have a biased recall for objects which are out of place or disorderly as these are likely perceived as significant, important and relevant to their concerns. An experimental analysis of compulsive ordering and arranging that was already underway (Radomsky & Rachman, in press) provided an excellent opportunity to test for the presence of this bias in association with this type of compulsive behaviour.

Aim: The aim of this experiment was to test for the presence of a memory bias for threat-relevant information (disorderliness) among people who feel compelled to keep their surroundings orderly and arranged.

Predictions:

1. Participants who score highly on the Symmetry, Ordering and Arranging Questionnaire (SOAQ – Radomsky & Rachman, in press), or high orderers and arrangers will remember more threat-relevant information (groups of objects that were disordered) than threat-irrelevant information (groups of objects that were well ordered and arranged).

2. Participants who score low on the SOAQ will not demonstrate this bias and will recall similar amounts of threat-relevant and threat-irrelevant information.

Method

Participants were selected for this experiment from a questionnaire package that was distributed to university undergraduate students. The package included the Symmetry, Ordering and Arranging Questionnaire (SOAQ – Radomsky & Rachman, in press), the Beck Depression Inventory, Second Edition (BDI – Beck, Steer & Garbin, 1996), the Beck Anxiety Inventory (BAI – Beck & Steer, 1990), the Vancouver Obsessional Compulsive Inventory (VOCI – Thordarson et al., in press), and the Social Phobia and Anxiety Inventory (SPAI – Turner, Beidel & Dancu, 1996). Twenty-four participants with SOAQ scores greater than 0.5 standard deviations above the normative mean were assigned to the High SOAQ group, and twenty-four participants with SOAQ scores lower than 0.5 standard deviations below the normative mean were assigned to the Low SOAQ group.

After completion of the questionnaire package, participants were told to prepare a small 5-minute speech about a topic of their choice, which was to be presented to a panel of three University faculty members. Participants were informed that their speech was to be graded on both its content and delivery/style. They were told that because this task often produces some anxiety, they would be given a few minutes and a space in which to prepare their speech.

Participants were then randomly assigned to one of two conditions. In the 'organized workspace' condition, participants were taken to a desk in a room which had been neatly ordered and arranged. In the 'disorganized workspace' condition, participants were taken to a desk in a room which had been disordered in a standardized manner. Two experimenters verified that the

desk was in the appropriate ordered or disordered state. Regardless of the condition to which the participant was assigned, there were four groups of objects on the windowsill in front of the desk. Two were organized (e.g., books arranged by height, crayons sorted in box by colour) and two were disorganized (e.g., books piled randomly, crayons in random pile out of box).

After 3 minutes of preparation time, the experimenter took the participant away from the workspace and asked each participant to write a list of all objects that were on the windowsill in front of the desk in the room in which the speech was prepared. Participants were given 2 minutes to complete this task.

Participants

The 48 participants in this study had a mean age of 21.7 (SD=5.5) years. 79.2% of participants were female. Other participant characteristics are displayed in Table 1.

Results

Recall scores for organized items and disorganized items, from Low SOAQ and High SOAQ participants in the organized workspace and disorganized workspace conditions are displayed in Figure 1. Out of a possible total recall score of 4, no single participant achieved a score greater than 1. A 2 (group) by 2 (room condition) by 2 (type of object) MANOVA was conducted on these data. Despite the fact that high SOAQ participants were made significantly more anxious by having to prepare the speech in a disorganized workspace (see Radomsky & Rachman, 2003 for a complete analysis of non-memorial data obtained in this protocol), no significant memory effects were found (all F's < 1). Furthermore, no single memory score was significantly greater than 0 for any object group (all Z's < 1.96).

Discussion

The memory results of the current study did not confirm our hypotheses. High SOAQ participants did not recall more disordered groups of items than groups of ordered items. In fact, participants did not recall many groups of items at all. While this may simply be the result of floor effects (e.g., the task was too difficult), it is more likely because of the design of this particular experiment. At least two studies have confirmed that if ecologically valid stimuli are used that are perceived as personally threatening, a memory bias in OCD is strong and detectable using a free recall test (Radomsky & Rachman, 1999; Radomsky at al., 2001) and a third study found the same bias using a recognition test (Ceschi et al., 2003). The current experiment probably had a greater effect on attention than it did on memory, and hence the result was null. That is, the paradigm may have directed attention away from critical and personally significant information (the state of the objects in the room) and toward the speech preparation task, thus blocking the expected biased access to threat-relevant information. This is consistent with research by Mathews & Sebastien (1993) who found that a threat-relevant attentional bias was suppressed in the presence of distracting surroundings. Additionally, it is unlikely that participants perceived any responsibility for the state of the room. It has been proposed that in social anxiety disorder (or social phobia), anxiety provocations result in self-focused attention (Mansell, Clark & Ehlers, 2003; Rapee & Heimberg, 1997; Woody, 1996). Asking participants to prepare a speech is a common provocation associated with investigations of social anxiety. Even though the current study had stimuli and even a workspace that would be appropriate to test for phenomena associated with compulsive ordering and arranging, it is quite likely that the provocation used directed participants' attention inward and away from their external

environment, leading to very poor memory about their surroundings at the later recall test. Furthermore, if participants were left with no sense of responsibility for the state of the room, it is likely that the state of the room was perceived as less significant and less important in this paradigm. Using an alternate provocation, (e.g., asking participants to tidy up the desk, increasing their perceived sense of responsibility) might have enabled better encoding and subsequent testing of both recall and recognition memory associated with this subtype of OCD. It might also be fruitful to consider a provocation in which a room is only slightly disordered (e.g., a very tidy desk with a plant tipped over in one corner) as a means of examining the sensitivity of participants to the degree of disorder in their surroundings and its subsequent effects on information processing and emotional arousal. This illustrates the importance of designing an experimental paradigm which contains not only relevant stimuli and surroundings but that also contains a provocation that is significant to the construct being assessed. In order to maximize the match between task and stimuli, it is recommended that the meaning of the task be related to the function of the cognitive bias under investigation. In essence, it is proposed that the meaning of the task is just as important as the meaning of the stimuli.

Of course, it is also possible that the recall task was simply too difficult, in which case, a recognition test of memory could have been used. However, in a study with only four groups of objects to be remembered, a recognition test is quite likely to produce ceiling effects. In our previous work with memory in OCD, recall tests were sufficient to detect effects that were quite strong (Radomsky & Rachman, 1999; Radomsky et al., 2001). Attempts at replication (Ceschi et al., 2003; Tolin et al., 2001) have produced mixed results although generally support the idea that OCD participants tend to have better attentional, processing and memorial resources available for information which is threat-relevant, significant and perceived as important. This

finding is consistent with early cognitive (Bower, 1981) and clinical (Kovacs & Beck, 1978) models of emotional arousal and memory, although there are several predictable obstacles that will likely make further investigations of memory in OCD quite challenging.

One of the most prominent obstacles to overcome in this area is related to the complicated interplay between memory accuracy and metamemory. If a person has a strong metamemory for an object or an event (as demonstrated by high confidence in memory, high vividness in memory, high detail in memory, etc.), it is fairly easily to detect whether or not this person has an accurate memory for that object or event. They should know whether or not they remember it. If however, the person has a weak metamemory (low confidence, vividness, detail, etc., in memory), it can be exceedingly difficult to determine their memory accuracy because the doubt and uncertainty can lead a person to state that they can't recall something when in fact, they may have recalled it correctly. They may remember it without really knowing that they have. This distinction is similar to the constructs of remembering and knowing outlined by Tulving (1985), and requires attention in experimental investigations of memory in OCD. We attempted to address this complication in our investigation of memory in compulsive checking (Radomsky at al., 2001) by explaining to participants the distinctions between accuracy and confidence in memory before the study began. We gave examples of accurate memories about which a person can feel very confident; accurate memories that a person can have with very low confidence; inaccurate memories that a person can (incorrectly) feel very confident about; and inaccurate memories that a person can have with very low confidence. Participants were encouraged to report their answers to the memory part of the interview regardless of their confidence in these answers and then to provide confidence ratings afterwards. This may have helped to disentangle these two constructs in that particular study and the lack of this kind of

psychoeducation in other studies could be partly responsible for weak or negative findings. Investigations of both explicit and implicit memory will also likely help to elucidate some of the factors that distinguish between memory accuracy and memory confidence. Participants who strongly doubt their memory are probably much less likely to report these memories than participants without this pathological doubt. Since uncertainty and doubt are hallmark features of OCD (Rachman & Hodgson, 1980), this must be taken into account in any investigation of memory accuracy in this population.

A central recent finding related to metamemory in OCD is also related to the effects of repeated checking. An exceptional set of studies by van den Hout and Kindt (this issue) found that repeated relevant checking produces significant reductions in memory confidence, vividness and detail when compared with repeated irrelevant checking. Interestingly, despite these reductions in metamemory, memory accuracy was relatively unimpaired by this repetition. As such, any investigation which includes repetition (e.g., Tolin et al., 2001; van den Hout & Kindt, 2003) may be producing decrements in metamemory which could cloud participants' responses to explicit memory questions. Unfortunately, it may be extremely difficult to capitalize on the ecological validity of repeated checking in this way without compromising the impact of poor metamemory on actual memory performance. While some investigations have done this successfully (Radomsky at al., 2001; Tolin et al., 2001; van den Hout & Kindt, this issue), this challenge cannot be neglected when reporting memory effects following task repetition in OCD.

Other factors to be considered when investigating memory phenomena in OCD include the idiosyncratic nature of OCD and the widely varying interpretations of stimuli and provocations that participants can make. For example, a doorknob can be threatening to an individual with OCD because it might appear unlocked, or because it might appear unclean.

Furthermore, some kinds of contamination may be threatening to one person who engages in compulsive washing while they might be completely benign to another. This has been addressed in a number of ways including the use of an ambiguous contaminant (Radomsky & Rachman, 1999), participant selection of threatening and non-threatening stimuli (Tolin et al., 2001), and home visits (Radomsky et al., 2001). It is likely that other paradigms and methodologies can be employed to address this aspect of the disorder, but careful piloting is recommended to ensure that an experimental paradigm successfully captures the essence of the features to be investigated.

One possible way for investigators to increase ecological validity and maintain a solid connection between the perceived importance of the experimental paradigm and stimuli and the beliefs and interpretations of the participants would be to take advantage of some of the newer theoretical approaches to understanding the cognitive and behavioural features of OCD. While earlier models of OCD provided a broad description of important psychological features in OCD such as the concept of inflated responsibility (Salkovskis, 1985), newer models have been successful at elucidating some of the more subtle aspects associated with specific manifestations of OCD such as compulsive hoarding (Frost & Hartl, 1996), obsessions (Rachman, 1997, 1998), and compulsive checking (Rachman, 2002). Furthermore, advances in our understanding of beliefs in OCD have produced specific domains (Obsessive Compulsive Cognitions Working Group, 1997, 2001, in press) that could well be useful for integration into investigations of memory in OCD. The use of current theories and constructs can help to provide ideal paradigms and stimuli by matching and grouping the constructs of theoretical models with the symptoms, beliefs and cognitions of participants with the stimuli and provocations in experimental protocols.

We propose that when these general conditions are met, empirical findings will support the hypothesis that people with OCD tend to remember information that is perceived to be significant, threat-relevant and important (specific recommendations are listed below). This hypothesis is adaptive in nature (remembering this kind of information is probably adaptive) and consistent with current theories. Failure to conduct experimental investigations that accommodate these issues will likely perpetuate the ambiguous state of the literature on memory in OCD specifically and, more generally on memory and attention in mood and anxiety disorders.

Future research

In light of the findings so far, some improvements in approach are needed. We propose several suggestions for increasing the magnification of memory biases in anxiety and OCD, in order better to comprehend this phenomenon. In essence, there are two ways to conceptualize predicted memory biases in anxiety. The first is a mood dependant memory bias, in which memory should be enhanced by provoking the same mood state at retrieval as was experienced at encoding (see Eich, 1995) and the second is a mood congruent bias, in which memory should be enhanced for information that is consistent with a person's mood (see Gilligan & Bower, 1983). That is, mood dependant biases should be detectable if participants are equally anxious when they attempt to remember the information as they were when they learned it, and mood congruent biases should be detectable if the information to be remembered is perceived as significant, important and threatening. While both models make similar predictions, their implications for methodology will be somewhat different.

Firstly, it is essential to ensure the efficacy of the experimental manipulation – the participants in the key group must report either high levels of anxiety at encoding and retrieval

(while control groups must not), or they must report that threatening items are indeed perceived as threatening and anxiety provoking (while control groups must not). Secondly, the items in the memory task must be ecologically valid, perceived as *important* and *significant*, and used in preference to degraded or remote cues (such as those used in a Stroop-like paradigm). Thirdly, the number of items used in the task must allow for sufficient error in either direction and ideally should result in overall recall rates of approximately 50%. Fourthly, especially for investigations of memory bias in association with contamination fears, care needs to be taken to avoid "cross contamination" or the spread of threat from one set of items to another, or in the case of mood dependent memory, the spread of perceived threat from one testing setting to another. Fifthly, it is essential to measure the perceived threat associated with items *before* any experimental manipulations of their threat value (or of mood state) occur. Finally, both recall and recognition memory must be assessed.

Research into memory and related processes in OCD is important. Furthermore, it is essential that the paradigms employed capture what is critically important to the individuals with OCD being tested. The importance of importance in OCD memory research should not be underestimated. A combination of these refined methods should enhance the probability of obtaining clear and strong results, and hopefully lead to definitive conclusions about memory bias and anxiety, and more specifically about memorial processes in OCD.

References

American Psychiatric Association (4th ed.). (1994). *Diagnostic and statistical manual of mental disorders.* Washington, DC: American Psychiatric Press.

Beck, A.T., & Steer, R. A. (1990). *Beck Anxiety Inventory Manual*. Toronto: Psychological Corporation.

Beck, A. T., Steer, R. A., & Garbin, M. G. (1996). *Beck Depression Inventory Manual (2nd ed.).* San Antonio: Psychological Corporation.

Bower, G. H. (1981). Mood and memory. *American Psychologist, 36,* 129-148.

Bradley, B. P., Mogg, K., Millar, N., & White, J. (1995). Selective processing of negative information: Effects of clinical anxiety, concurrent depression, and awareness. *Journal of Abnormal Psychology, 104,* 532-536.

Ceschi, G., Van der Linden, M., Dunker, D., Perroud, A., Brédart, S. (2003). Further exploration memory bias in compulsive washers. *Behaviour Research and Therapy, 41*, 737-747.

Cloitre, M., & Liebowitz, M. R. (1991). Memory bias in panic disorder: An investigation of the cognitive avoidance hypothesis. *Cognitive Therapy and Research, 15,* 371-386.

Cloitre, M. Shear, M. K., Cancienne, J., & Zeitlin, S. B. (1994). Implicit and explicit memory for catastrophic associations to bodily sensation words in panic disorder. *Cognitive Therapy and Research, 18,* 225-240.

Craik, F. I., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11,* 671-684.

Coles, M. E. & Heimberg, R. G. (2002). Memory biases in the anxiety disorders: Current status. *Clinical Psychology Review, 22,* 587-627.

Constans, J. I., Foa, E. B., Franklin, M. E., & Matthews, A. (1995). Memory for actual and

imagined events in OC Checkers. *Behaviour Research and Therapy, 33,* 665-671.

Dalgleish, T. (1994). The relationship between anxiety and memory biases for material that has been selectively processed in a prior task. *Behaviour Research and Therapy, 32,* 227-231.

Dalgleish, T. & Watts, F. N. (1990). Biases of attention and memory in disorders of anxiety and depression. *Clinical Psychology Review, 10,* 589- 604.

Eich, E. (1995). Searching for mood dependant memory. *Psychological Science, 6,* 67-75

Frost, R. O., & Hartl, T. L. (1996). A cognitive-behavioral model of compulsive checking. *Behaviour Research and Therapy, 34,* 341-350.

Gilligan, S.G., & Bower, G.H. (1983). Reminding and mood-congruent memory. *Bulletin of the Psychonomic Society, 21,* 431-434.

Graf, P. & Mandler, G. (1984). Activation makes words more accessible, but not necessarily more retrievable. *Journal of verbal learning and verbal behaviour, 23,* 553-568.

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

Hout, M.A. van den, & Kindt, M. (2003). Repeated checking causes memory distrust. *Behaviour Research and Therapy, 41,* 301-316.

Hout, M.A. van den, & Kindt, M. (this issue). Obsessive compulsive disorder and the paradoxical effects of perseverative behaviour on experienced uncertainty.

Kovacs, M., & Beck, A. T. (1978). Maladaptive cognitive structures in depression. *American Journal of Psychiatry, 135,* 525-533.

Mansell, W., Clark, D. M., & Ehlers, A. (2003). Internal versus external attention in social anxiety: an investigation using a novel paradigm. *Behaviour Research and Therapy, 41,* 555-572.

Mathews, A.M., & Sebastian, S. (1993). Suppression of emotional Stroop effects by fear-arousal. *Cognition and Emotion, 7,* 517-530.

McNally, R. J., Foa, E. B., & Donnell, C. D. (1989). Memory bias for anxiety information in patients with panic disorder. *Cognition and Emotion, 3,* 27-44.

Mogg, K., Matthews, A., & Weinman, J. (1987). Memory bias in clinical anxiety. *Journal of Abnormal Psychology, 96,* 94-98.

Mogg, K., Matthews, A., & Eysenck, M. (1992). Attentional bias to threat in clinical anxiety states. *Cognition and Emotion, 6,* 149-159.

Nunn, J. D., Stevenson, R. J., & Whalan, G. (1984). Selective memory effects in agoraphobia patients. *British Journal of Clinical Psychology, 23,* 195-201.

Obsessive Compulsive Cognitions Working Group. Cognitive assessment of obsessive-compulsive disorder. *Behaviour Research and Therapy, 35,* 667-681.

Obsessive Compulsive Cognitions Working Group. Development and initial validation of the obsessive beliefs questionnaire and the interpretation of intrusions inventory. *Behaviour Research and Therapy, 39,* 987-1006.

Obsessive Compulsive Cognitions Working Group. (in press). Psychometric validation of the Obsessive Beliefs Questionnaire and the Interpretation of Intrusions Inventory: Part I. *Behaviour Research and Therapy*.

Rachman, S. (1997). A cognitive theory of obsessions. *Behaviour Research and Therapy, 35,* 793-802.

Rachman, S. (1998). A cognitive theory of obsessions: Elaborations. *Behaviour Research and Therapy, 36,* 385-401.

Rachman, S., & Hodgson, R. J. (1980). *Obsessions and compulsions.* NJ: Prentice-Hall.

Rachman, S. (2002). A cognitive theory of compulsive checking. *Behaviour Research and Therapy, 40,* 624-639.

Radomsky, A. S., & Rachman, S. (1999). Memory bias in obsessive-compulsive disorder (OCD). *Behaviour Research and Therapy, 37,* 605-618.

Radomsky, A. S., & Rachman, S. (in press). Symmetry, ordering and arranging compulsions. *Behaviour Research and Therapy*.

Radomsky, A.S., Rachman, S., & Hammond, D. (2001). Memory bias, confidence and responsibility in compulsive checking. *Behaviour Research and Therapy, 39,* 813-822.

Rapee, R. M., Heimberg, R. G. (1997). A cognitive-behavioral model of anxiety in social phobia. *Behaviour Research and Therapy, 35,* 741-756.

Rapee, R. M., McCallum, S. L., Melville, L. F., Ravenscroft, H., & Rodney, J. M. (1994). Memory bias in social phobia. *Behaviour Research and Therapy, 32,* 89-99.

Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology, 35,* 677-688.

Rozin, P., Nemeroff, C., Wane, M., & Sherrod, A. (1989). Operation of the sympathetic magical law of contagion in interpersonal attitudes among Americans. *Bulletin of the Psychonomic Society, 27,* 367-370.

Rozin, P., Markwith, M., & Nemeroff, C. (1992). Magical contagion beliefs and fear of AIDS. *Journal of Applied Social Psychology, 22,* 1081-1092.

Salkovskis, P. M. (1985). Obsessional-compulsive problems: A cognitive-behavioural analysis. *Behaviour Research and Therapy, 23,* 571-583.

Savage, C. R., Deckersbach, T., Wilhelm, S., Rauch, S. L., Baer, L., Reid, T., & Jenike, M. A. (2000). Strategic processing and episodic memory impairment in obsessive compulsive

disorder. *Neuropsychology, 14,* 141-151.

Tallis, F. (1993). Anxiety: The cognitive perspective. *Personality and Individual Differences, 15,* 481.

Thordarson, D. S., Radomsky, A. S., Rachman, S., Shafran, R., Sawchuk, C., & Hakstian, A. R. (in press). The Vancouver Obsessional Compulsive Inventory (VOCI). *Behaviour Research and Therapy.*

Tolin, D. F., Abramowitz, J. S., Brigidi, B. D., Amir, N. P., Street, G. P., & Foa, E. B. (2001). Memory and memory confidence in obsessive-compulsive disorder. *Behaviour Research and Therapy, 39,* 913-927.

Tolin, D.F., Worhunsky, P., & Maltby, N. (this issue). Sympathetic magic in contamination-related OCD.

Tulving, E. (1985). Memory and consciousness. *Canadian Psychology, 26,* 1-12.

Turner, S. M., Beidel, D. C., & Dancu, C. V. (1996). *Social phobia and anxiety inventory: manual.* Toronto: Multi-Health Systems Inc.

Wechsler, D. (1987). *Manual for the Wechsler Memory Scale – Revised.* NY: Psychological Corporation.

Williams, J. M. G., Watts, F. N., MacLeod, C. M. (1997). *Cognitive psychology and emotional disorders.* NY: Wiley.

Woods, C. M., Vevea J. L., Chambless, D. L., Bayen, U. J. (2002). Are compulsive checkers impaired in memory? A meta-analytic review. *Clinical Psychology: Science and Practice, 9,* 353-366.

Woody, S. R. (1996). Effects of attention on anxiety levels on social performance of individuals with social phobia. *Journal of Abnormal Psychology, 105,* 61-69.

Table 1 – Participant characteristics

Group	SOAQ	VOCI Total Score	VOCI "just right" Subscale	BDI	BAI	SPAI
Low SOAQ (n=24)	4.75 (3.00)	14.25 (18.25)	3.92 (5.09)	6.22 (5.13)	6.25 (6.58)	39.85 (27.96)
High SOAQ (n=24)	44.42 (12.96)	59.71 (39.66)	15.57 (8.67)	16.71 (10.38)	15.13 (11.06)	54.36 (19.92)

Figure 1 – Target item recall scores by group and condition