

The effects of a manipulation of memory confidence on urges to check

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ABSTRACT

The effects of a manipulation of memory confidence on urges to check

Gillian M. Alcolado

One of the most common compulsions in obsessive-compulsive disorder (OCD) is repeated checking. Although individuals often report that they check to become more certain, checking has been shown to have the opposite effect - increased checking causes increased uncertainty. However, checking may also be thought of as beginning *because of* memory uncertainty. Beliefs about memory were manipulated to test whether or not they affected urges to check. Ninety one undergraduate participants received (positive or negative) false feedback about their performance on aspects of a standardized memory test, and then completed three additional tasks. Their urges to check and levels of memory vividness and detail following these tasks were assessed. Results were generally consistent with our hypotheses, as individuals in the low memory confidence condition had greater urges to check on most tasks than those in the high memory confidence condition. Low memory confidence led to reduced memory vividness and detail for only one of the memory tasks. Results and implications are discussed in terms of cognitive-behavioural models of and treatments for OCD.

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Dedication

I would like to dedicate this work to the memory of my maternal grandmother, Elizabeth Mary Guy, who passed away during my master's training. Her strong independent spirit and pursuit of academics and writing in an era when women did not always seek higher education have always been an inspiration. I know she would be proud to know that I have become an author (of sorts) after all.

Table of Contents

List of Figures.....	viii
List of Tables.....	ix
Introduction.....	1
Methods.....	9
Participants.....	9
Measures.....	10
Procedure.....	17
Results.....	22
Missing Data.....	22
Urges to Check.....	22
Meta-Memory.....	24
Memory Ability.....	28
Discussion.....	28
Memory Confidence and Urges to Check.....	28
Memory Confidence and Meta-Memory.....	31
Strengths and Limitations of the Study.....	32
Implications and Future Directions.....	33
Summary.....	35
References.....	37
Appendix A.....	43
Appendix B.....	60
Appendix C.....	67

Appendix D.....70

Appendix E.....72

Appendix F.....75

List of Figures

Figure 1: Mean urges scores during the stove task by group.....	23
Figure 2: Mean urges scores during the Memory Game™ task by group.....	25
Figure 3: Mean urges scores during the light task by group.....	26

List of Tables

Table 1: Mean scores and standard deviations by group on measures assessing cognitive confidence, obsessive-compulsive, anxious, and depressive symptoms.	11
Table 2: Mean scores (standard deviations in brackets) by group on meta-memory variables for the laboratory tasks.....	27

The effects of a manipulation of memory confidence on urges to check

Obsessive-compulsive disorder (OCD) is an anxiety disorder (APA, 2000), affecting approximately 3.1% of the population (Stein et al., 1997). The disorder is characterized by obsessions (i.e., repetitive intrusive thoughts, images, impulses) and/or compulsions (i.e., repeated behaviour designed to decrease/prevent negative thoughts/events; American Psychiatric Association, 2000). Two of the most frequently reported compulsions in OCD are those related to repeated checking or washing behaviours, with approximately seventy-five percent of the OCD population reporting engaging in either or both types of rituals (Ball, Baer, & Otto, 1996). The aim of the current study was to examine whether urges to check could be caused by low memory confidence, as a clearer understanding of the mechanism of this disorder could improve treatment and quality of life for individuals with OCD.

OCD was historically difficult to treat, until exposure and response prevention (ERP) became the first successful psychological intervention for the disorder (Meyer, 1966; for a review, see Abramowitz, 2006). Developed from learning principles and animal research, ERP required clients to expose themselves to their feared obsessions (e.g., by turning off a stove) without allowing them to engage in compulsive or neutralizing behaviour (e.g., by not checking that it was actually off), and to observe the eventual decrease of their anxiety and fear (see Marks, 1973, for an overview). Although this treatment has been found to be equally as effective as pharmacotherapy, it still leaves a number of people unwell (e.g., Foa et al., 2005).

Salkovskis (1985) posited that the manner in which people respond to stimuli associated with OCD is based on their elevated beliefs about their personal responsibility

towards preventing harm to themselves and others. This theory has been well supported by empirical research (e.g., Lopatka & Rachman, 1995; Arntz, Voncken, & Goosen, 2007). Later, the Obsessive Compulsive Cognitions Working Group (OCCWG) created a unified tool to assess three core factors representing three groups of belief domains related to OCD and its differential diagnosis (OCCWG, 2005). These were responsibility and over-estimation of threat, intolerance of uncertainty and perfectionism, and importance of and control of thoughts (OCCWG, 2005).

Targetting these maladaptive beliefs and cognitions in treatment was an obvious progression. Research shows that cognitive-behavioural therapy (CBT) for obsessive-compulsive disorder changes beliefs and that this cognitive change is responsible for symptom reduction (e.g., O'Connor et al., 2005; although there is still some debate about this, see Clark, 2005). An open trial of a manualized form of cognitive therapy for obsessive-compulsive disorder has proven to be effective at treating the symptoms of OCD, the beliefs associated with OCD, and co-occurring depression and anxiety (Wilhelm et al., 2005). Interestingly, a portion of these individuals had previously failed to benefit from exposure and response prevention but improved following CT, implying that targeting maladaptive beliefs in therapy is important for improvement (Wilhelm et al., 2005). CBT has also been shown to be comparable in effectiveness to that of ERP (Whittal, Thordardson, & McLean, 2005). More recently, a randomized controlled trial of CT for obsessions showed that compared to stress management and waitlist control groups, the CT group improved significantly more on measures of OC beliefs, and had an advantage at post-treatment (Whittal et al., 2010).

As such, it may be that a broader cognitive understanding of OCD may contribute to more efficacious treatments of the disorder. Rachman (2002) proposed a cognitive theory of compulsive checking which postulated that people will check under circumstances in which they feel they have an elevated sense of responsibility for preventing serious harm, especially when they feel they cannot be sure that the threat has been removed. He further hypothesized that checking becomes more severe with the increase of three multipliers: (1) the perceived probability of harm occurring, (2) the perceived seriousness of harm, and (3) the perceived responsibility for preventing harm. Interestingly, he posited that when one feels more responsible for the outcome of an event, one also believes that the likelihood of it happening has increased.

Finally, Rachman elaborated a number of elements that help maintain checking behaviour once it has begun. One repeatedly checks in a futile search for a certain end to the harm (which does not exist). This act of checking increases one's perceived responsibility for eliminating the harm, and the perceived probability of the harm, both of which are already known to promote checking behaviour, thus prolonging the checking cycle indefinitely. Furthermore, the act of checking itself is meant to increase certainty, but checking has the paradoxical effect of reducing memory confidence, which then in turn induces more checking as one continues to strive for certainty in a self-perpetuating cycle (Rachman, 2002).

Rachman's (2002) model has been supported by empirical research from more than one research group showing that repeated checking actually decreases, rather than increases, memory confidence. van den Hout and Kindt (2003a) asked participants to engage in repeated checking of a computerized virtual gas stove. After being taught to

use the stove (the pre-test), half of the participants continued to check the stove (relevant checking condition), while the other half checked virtual light bulbs (irrelevant checking condition), before all participants completed a final post-test check of the stove.

Participants were asked at pre and post test which knobs they had manipulated and how confident they were about their answers. Although there were no differences between the groups on memory accuracy, participants who had continued to check the stove (i.e., relevant checking) demonstrated significantly decreased memory *confidence* in their answers as compared to the pre-test, and as compared to the participants in the other condition (i.e., irrelevant checking). Therefore, this study showed that repeated checking undermines confidence in one's memory (van den Hout & Kindt, 2003a). This finding was consistent across several experiments with various modifications to the original paradigm (van den Hout & Kindt, 2003b, 2004). Therefore, repeated checking has the opposite of its desired effect because one checks to become more certain, but the more one checks, the less certain one becomes (van den Hout & Kindt, 2003a). The authors also found that those who had engaged in repeated relevant checking also reported significantly decreased memory vividness and detail from pre- to post-test as compared to those who had engaged in repeated irrelevant checking. The authors proposed that repeated checking causes the object being checked to become more familiar, changing processing of the event from perceptual to conceptual. When perceptual processing is reduced, less vivid and detailed information is encoded, and this contributes to memory distrust (van den Hout & Kindt, 2003a).

Extending this work, Radomsky, Gilchrist, and Dussault (2006) asked non-clinical participants to turn on, off and check a real and functioning stove in a ritualized

manner. Following this task, they either repeatedly checked the stove for nineteen trials (relevant checking) or repeatedly checked a sink for nineteen trials (irrelevant checking). Following the trials participants checked the stove one more time. When asked about which knobs they had just checked, results demonstrated that memory confidence, vividness, and detail for this last trial had all decreased drastically for participants in the relevant checking condition, but not for those in the irrelevant checking condition (Radomsky, Gilchrist, et al., 2006). Coles, Radomsky, and Hornig (2006) replicated and extended these findings by showing that decreases in memory confidence can be seen in as few as two trials, and that decreases in meta-memory (confidence, vividness, and detail) led to a change in the type of memory reported (i.e., the memory became 'known' rather than a specific 'remembering'; Coles et al., 2006).

The same effect has been found in clinical populations, using both similar and dissimilar paradigms. Boschen and Vuksanovic (2007) used van den Hout and Kindt's (2003a) virtual stove paradigm to examine the effects of repeated checking on meta-memory with a clinical population. Participants checked a virtual stove-top twenty times and were asked questions about their memory both before and after the repeated checking. Repeated checking significantly decreased memory confidence and meta-memory, but not memory accuracy for the check (Boschen & Vuksanovic, 2007).

Tolin and colleagues (2001) exposed participants with OCD, non-anxious controls, and students to a set of objects that were rated by the participants with OCD as either safe, unsafe, or neutral. Subsequently, they were asked to recall as many objects as possible and to rate their confidence in their answers. This process was repeated six times with the same objects. Memory accuracy was the same across groups but participants with OCD

had a decline in memory confidence for the unsafe objects as the number of trials increased, supporting the idea that people with OCD have decreased memory confidence for threatening information (Tolin et al., 2001).

Hermans and colleagues (2003) asked participants with OCD and non-anxious controls to imagine or actually perform a series of fifteen actions that were either relevant or irrelevant to the checking concerns of the OC participants. Individuals with OCD reported significantly less confidence in their memories in general, and significantly less confidence for their actions than did controls, but only for actions that were not specific to their own checking concerns (Hermans et al., 2003). More recently they found that participants with OCD had decreased confidence in their memory for checking tasks (Hermans et al., 2008). This finding is in line with earlier work conducted by Radomsky, Rachman, and Hammond (2001), who demonstrated that people with OCD were less confident in their memory for checking tasks completed under conditions of elevated responsibility, even though they were more accurate about the details of those tasks.

Recent research has demonstrated that the opposite effect is also true - low memory confidence predicts repeated checking. In their psychometric investigations, Nedeljkovic and colleagues (2009) replicated the finding by Nedeljkovic and Kyrios (2007) that low trait meta-memory factors such as memory confidence was predictive of OCD symptoms, moreso than other OCD-related cognitions reported by the OCCWG (2005). Participants with OCD, non-clinical students, and non-clinical community participants completed questionnaires relating to OCD symptomatology, beliefs, and trait meta-memory (which assessed factors such as confidence in memory and decisions). Results showed that low meta-memory was predictive of OC symptomatology

(Nedeljkovic & Kyrios, 2007). Surprisingly, low memory confidence was more predictive of OC symptoms than were cognitions already purportedly predictive of OCD, such as beliefs about importance of control over thoughts, perceived responsibility, and intolerance of uncertainty. This relationship, and its predictive power over and above other OC cognitions, was observed even when using a student analogue population (Nedeljkovic et al., 2009). These findings call for investigation into low 'trait' meta-memory as a risk factor for OCD. Although Rachman (2002) includes low memory confidence as one belief that contributes to the self-perpetuating mechanism of checking (whereby repeated checking leads to low memory confidence, which causes more repeated checking), the OCCWG neglected to include beliefs about memory early on in the development of their Obsessive Beliefs Questionnaire (OCCWG, 1997). As such, closer examination of the potential importance of low trait meta-memory for compulsive checking behaviour is necessary.

The aim of this study was to directly examine Rachman's (2002) hypothesis that low memory confidence contributes to the self-perpetuating checking mechanism by investigating empirically whether increased urges to check follow induced low memory confidence. Repeated evidence has shown that, as Rachman (2002) postulated, repeated checking does indeed lead to lower memory confidence (e.g., van de Hout & Kindt, 2003a). To date, only correlational evidence has suggested that the second part of the cycle holds true – that low memory confidence leads to more repeated checking (e.g., Nedeljkovic et al., 2007). The ability to empirically and experimentally demonstrate this phenomenon would add to the support for low memory confidence as an important

obsessive belief, and suggest a new target of treatment, which could increase the efficaciousness of CT for OCD.

Beliefs about memory confidence were manipulated (by giving positive or negative false feedback following the completion of portions of a standardized memory test) in a student population to see if they could effect changes in urges to check on three subsequent laboratory-based memory tests. Furthermore, as other indices of meta-memory such as vividness and detail are also affected by repeated checking, and are potentially contribute to reduced memory confidence, changes in these variables were measured as well.

It was hypothesized that students in whom a low level of memory confidence had been induced would have increased urges to check on laboratory-based memory tasks as compared to those students in whom a high level of memory confidence had been induced. Second, it was hypothesized that students in whom a low level of memory confidence had been induced would report accompanying lower levels of memory vividness and detail for the laboratory-based memory tasks as compared to those students in whom a high level of memory confidence had been induced. If the manipulation of memory confidence beliefs result in changes in checking symptoms, the inclusion of this domain as one of the belief types that contribute to OCD symptomatology may be warranted. Moreover, the results of this study have the potential to allow us to better identify and treat people who suffer from this disorder by facilitating prevention, assessment, and treatment focus on beliefs about one's own memory.

Methods

Participants

Participants were 120 undergraduate students at Concordia University participating for either course credit or an entry for a cash draw. Inclusion criteria were the ability to understand, read, and communicate in English. One participant's data had to be omitted because they were underage and unable to legally consent to participation, and another because at the end of the study they reported that they completely disbelieved the feedback about their memory performance (see below). Six more participants' data were omitted due to outliers on the dependent variables of interest (using the outlier exclusion method according to Tabachnick & Fidel, 2007). Finally, twenty participants' data were removed because the manipulation check question (see post-feedback questionnaire, below) showed that the false feedback had not had the appropriate effect, either because they considered themselves to have a good memory (reporting an excellent, good, or average memory) after receiving information that they had a poor memory, or because they considered themselves to have a bad memory (reporting an average, fair, or poor memory) after receiving information that they had a good memory. This left ninety-one participants in total, with forty-three participants in the low memory confidence (LMC) condition and forty-eight participants in the high memory confidence (HMC) condition.

The mean age of participants was 23.56 ($SD = 6.05$) years old, with participants ranging from 19 to 47 years of age. Eighty-five percent of the sample was female. In the LMC condition the mean age was 23.05 years old ($SD = 4.94$), with participants ranging in age from 19 to 40. Eighty-eight percent of participants in the LMC condition were women. In the HMC condition the mean age was 24.02 ($SD = 6.92$), with participants

ranging in age from 19 to 47. Eighty-three percent of participants in the HMC condition were women. There were no significant differences between the two groups in age, $t(89) = -0.76$, n.s., or sex, $\chi^2(1) = 0.47$, n.s..

In order to verify that the sample was non-clinical in nature, the MCQ, MACCS, VOCI, OBQ, BAI, and BDI-II were administered to all participants (see *Measures*, below, and Table 1, for means and standard deviations). There were no significant differences between the groups on cognitions related to confidence in memory, as evidenced by the MCT scores, $t(89) = 0.81$, n.s., the subscale of the MCT that specifically measures cognitive confidence $t(89) = 1.50$, n.s., MACCS scores, $t(89) = 1.24$, n.s., or the subscale of the MACCS that specifically measures memory confidence, $t(89) = 1.63$, n.s.. There were no significant differences between the groups on OCD behaviours and beliefs, as evidenced by VOCI scores, $t(79.88) = 0.57^1$, n.s., the subscale of the VOCI which specifically measures checking compulsions in OCD, $t(89) = 1.10$, n.s., or OBQ scores, $t(89) = 0.90$, n.s. There were no differences between the groups on anxiety and depression, as evidenced by BAI scores, $t(89) = 1.19$, n.s., and BDI-II scores, $t(89) = -0.17$, n.s..

Measures

The Metacognitions Questionnaire (MCQ-30; Wells & Cartwright-Hatton, 1999) is a 30-item self report questionnaire that assesses metacognitive beliefs along five factors (cognitive confidence, positive beliefs about worry, cognitive self-consciousness, negative beliefs about uncontrollability of thoughts and anger, and beliefs about the need to control thoughts). It is an updated and shortened version of the original MCQ

¹ Levene's test of homogeneity of variance was significant ($p = .049$), therefore F and df values reported assume unequal variances.

Table 1: Mean scores and standard deviations by group on measures assessing cognitive confidence, obsessive-compulsive, anxious, and depressive symptoms

Questionnaire	LMC		HMC	
	Mean	<i>SD</i>	Mean	<i>SD</i>
MCQ	59.20	15.67	56.67	14.08
MCQ-CC*	11.09	3.86	9.94	3.46
MACCS	71.75	20.80	66.72	17.96
MACCS-CONF**	36.89	12.10	33.13	9.91
VOCI	32.92	29.78	31.66	23.57
VOCI-CHECK***	3.56	4.66	2.62	3.44
OBQ-44	132.33	43.30	124.12	43.47
BAI	12.33	10.25	10.07	7.92
BDI-II	8.96	6.85	9.21	7.16

Note. *Denotes the subscale of the MCQ (Metacognitions Questionnaire) that measures cognitive confidence, **denotes the subscale of the MACCS (Memory and Cognitive Confidence Scale) that measures memory confidence, ***denotes the subscale of the VOCI (Vancouver Obsessional Compulsive Inventory) that measures checking symptomatology

(Cartwright-Hatton & Wells, 1997) that exhibits good fit to the original five factors. It has good-excellent internal consistency with α scores ranging from 0.72 to 0.93 across the factors. The test-retest reliability for the total scale is 0.75 and its significant correlations with tests measuring similar concepts supports the convergent validity of its five factors (Wells & Cartwright-Hatton, 1999). It was administered to check for baseline differences between participants on metacognitive beliefs, using both the total score and the subscale measuring cognitive confidence.

The Memory and Cognitive Confidence Scale (MACCS; Nedeljkovic & Kyrios, 2007) is a recently developed 28-item self-report questionnaire that measures trait meta-memory, which encompasses four factors: concentration and attention, decision-making abilities, perfectionism regarding one's memory, and confidence in one's memory abilities. All of these factors have been found to be associated with symptoms of OCD (Nedeljkovic & Kyrios, 2007). Exploratory factor analysis supported the existence of these four factors, suggesting it is adequately valid (and a recent study using confirmatory factor analysis has confirmed this factor structure; Nedeljkovic et al., 2009), with item loadings ranging from 0.45 to 0.81 on each of their respective factors. Its reliability is also good to excellent, with internal consistency for the overall scale at 0.92, and α levels for the four subscales ranging from 0.79 to 0.93. It was administered to check for differences between participants on trait meta-memory using both the total score and the confidence in memory subscale.

The Vancouver Obsessional Compulsive Inventory (VOCI; Thordarson et al., 2004) is a 55-item self-report questionnaire on a 0 (not at all) to 4 (very much) point Likert scale that measures agreement with symptoms of OCD across a broad range of

obsessions, behaviours, and personality characteristics known to be associated with the disorder. The six factors assessed in this scale are contamination, checking, obsessions, hoarding, 'just right', and indecisiveness. The total scale and subscales all have good internal consistency, with α levels ranging from 0.79 to 0.98 (Thordarson et al., 2004). The measure also exhibits excellent test-retest reliability ($r = 0.91$; Radomsky, Ouimet, et al., 2006) as well as convergent and discriminant validity (Thordarson, et al., 2004; Radomsky, Ouimet, et al., 2006). With a non-clinical student sample it exhibits excellent internal consistency ($\alpha = 0.96$; Thordardson et al., 2004) and high convergent validity ($r = 0.83$; Radomsky, Ouimet et al., 2006). It was administered to assess OCD (especially checking) symptoms.

The Obsessional Beliefs Questionnaire (OBQ-44; OCCWG, 2005) is a 44-item self-report inventory that assesses the degree to which one has beliefs associated with OCD symptomatology. Scale items load onto three factors: responsibility and threat estimation, perfectionism and intolerance for uncertainty, and importance and control of thoughts (OCCWG, 2005). Internal consistency is good with *Cronbach's alpha* ranging from 0.89 to 0.93 across the three subscales. The criterion, convergent and discriminant validity are all good (OCCWG, 2005). It was administered to assess OCD-relevant beliefs.

The Beck Anxiety Inventory (BAI; Beck & Steer, 1990) is a 21-item self-report questionnaire that assesses symptoms of anxiety. It has high internal consistency (*Cronbach's alpha* = 0.92) and test retest reliability ($r = 0.75$) as well as discriminant and convergent validity with a clinical sample (Beck et al., 1988). With a non-clinical sample

it has high internal consistency with a *Cronbach's* α of 0.90 and good convergent validity (Osman et al., 1997). It was administered to assess anxious symptomatology.

The Beck Depression Inventory II (BDI-II; Beck, Steer, & Garbin, 1996) is 21-item self-report measure that assesses symptoms of depression and suicidality. It has high internal consistency, with an α level of 0.91, and high convergent validity, as it correlates strongly with the original BDI with an r of 0.93 (Dozois, Dobson, & Ahnberg, 1998). It was administered to assess depressive symptomatology.

(See Appendix A for questionnaires)

Three *Wechsler Memory Scale-III (WMS-III) subtests (Faces, Letter-Number Sequencing, & Spatial Span; Wechsler, 1997)*. The WMS-III is a battery of tests that measures various facets of memory. *Faces* is a measure of immediate visual memory. Participants are shown a series of faces for two seconds each, and then shown a second set of faces and asked if they have seen each face before or not. *Letter-Number Sequencing* assesses auditory working memory. Participants are read increasingly longer strings of randomly ordered numbers and letters, and then asked to repeat them back with the numbers first in numerical order, followed by the letters in alphabetical order. Finally, *Spatial Span* is a measure of visual working memory. The administrator taps a series of blocks in increasingly longer sequences and asks the participant to tap them in the same order. This is followed by a similar task in which participants must now tap them in backwards order. The reliability coefficients (r) were estimated using the split-half internal consistency method. The mean r values for Faces, Letter-Number Sequencing, and Spatial Span, across all age groups are on average 0.74, 0.82, and 0.79, respectively. Confirmatory factor analysis shows that the full WMS has five factors (immediate &

delayed auditory memory, immediate and delayed visual memory, and working memory). The WMS-III correlates highly with its predecessor, the WMS-R with r values ranging from 0.86 to 0.97 across all indexes, indicating good to excellent construct validity (The Psychological Corporation, 1997). The reason for its inclusion in this study was not only as a tool for giving false feedback, but also to ensure that participants did not differ, on average, in their general memory abilities. It should be noted that all items of each subtest were administered, regardless of their respective discontinue rules, so that all participants would have the same amount of exposure to the test. The discontinue rules were implemented later, for scoring purposes (i.e., if a participant correctly answered an item after they should technically have been discontinued from that subtest, they received a 0 for that item).

Subjective Units of Distress Scale (SUDS). This measure is on the 100-point scale and was used to assess anxiety levels, ranging from '0' which is not anxious at all, to '100', which is extremely anxious, the most the participant has ever felt in their life. The participants were asked to rate their anxiety following the WMS-III administration, and after each laboratory-based memory task (see Appendix B).

Verbal Analogue Scales (0-100). Following the WMS-III administration only, participants were asked to rate their confidence in remembering the WMS-III tasks on a standard 100-point scale (0 being not at all, and 100 being extremely).

Following both the WMS-III administration, and each of the laboratory-based memory tasks, participants were also asked to rate their memory vividness and detail for what they had done using the same 100-point scale.

After the stove task (the first laboratory-based memory task, see *Procedure*, below), this scale was used to assess participants' urges to check that they had correctly answered the question "What are the three knobs that I asked you to check?", their urge to check that the stove was actually off, and their urge to destroy the results of the exercise and to try again.

After the Memory Game™ (the second laboratory-based memory task, see *Procedure*, below) task, this scale was used to assess participants' urges to check that they had correctly answered the question "Which was the first card pair that you found?", and their urge to destroy the results of the exercise and to try again.

After the light task (the third laboratory-based memory task, see *Procedure*, below), this scale was used to assess participants' urges to check that the light was actually off, following the question "What did I ask you to do as we left the laboratory kitchen?", and their urge to destroy the results of the exercise and to try again.

Finally, following debriefing at the end of the study, a 0 to 100 point scale was used to assess the believability of the study (see Appendix B for these items).

Post-Feedback Questionnaire. This questionnaire was administered to participants under the guise of providing the laboratory with information about the skills of the experimenter who delivered the feedback about their WMS-III performance. This questionnaire (see Appendix C) served as a manipulation check, as the one question of interest was "Following this feedback, I believe my memory is: a) excellent; b) good; c) average; d) fair; e) poor", to assess that the false feedback had achieved the desired effect in participants (i.e., that those in the low memory confidence condition now felt they had poorer memories than those in the high memory confidence condition). It was necessary

to assess the quality of the manipulation in this way so as not to arouse suspicions from participants as to the true nature of the study. This manipulation check revealed that the manipulation was successful in seventy-six percent of participants overall, and it was their data only that was included in the final analyses.

Time to complete a memory game. The *Original Memory Game*™ (Milton Bradley, 2007) is a children's memory game. A 6 x 5 grid of thirty cards (fifteen pairs) from the game, depicting drawings of typical toys, food, and animals was used from a set of seventy six cards (for the cards used and layout, see Appendix D). The experimenter used a stop-watch to record the time it took for participants to uncover all of the correct card pairs.

Procedure

Participants were told that they were participating in a study investigating the validity of newer memory tasks that the laboratory wanted to use in future research studies, by comparing their performance and thoughts about these newer tests to their performance and thoughts about portions of an already validated memory test – the Wechsler Memory Scale-III (WMS-III).

Following the informed consent process (see Appendix E for the consent form) participants were asked to complete a questionnaire package which was comprised of well validated and commonly used self-report measures. These included the Memory and Cognitive Confidence Scale (Nedeljkovic & Kyrios, 2007), the Metacognitions Questionnaire (Wells & Cartwright-Hatton, 1999), the Vancouver Obsessional Compulsive Inventory (Thorardson, et al., 2004), the Obsessive Beliefs Questionnaire

(OCCWG, 2005) the Beck Anxiety Inventory (Beck & Steer, 1990), and the Beck Depression Inventory II (Beck, Steer, & Garbin, 1996).

Participants then completed the three subtests of the WMS-III mentioned above (see *Measures*)². Their scores were tabulated, but their actual results were not given (see below). After the subtests were administered, participants answered questions related to their anxiety, confidence in their memory for their performance, memory vividness, and memory detail, for the tasks they had just completed. After the completion of this task participants were assigned to one of two conditions: the low memory confidence (LMC) condition, or the high memory confidence (HMC) condition. This was done via a random draw from an envelope to ensure randomization and blindness to condition assignment until this point in the study. The experimenter pretended to have forgotten something in order to excuse themselves from the room to do this. The experimenter then returned and falsely tabulated (because the calculations were not real) the scores while in the same room as the participant, before giving them their false scores, to ensure credibility of the feedback.

Participants in the LMC condition were given the following feedback: “Alright so the scores we report to you are in percentile ranks. Are you familiar with percentile ranking? What it means is that we have a database of scores of thousands of men and women in North America across all the age ranges, and that’s what we compare your scores to. Each age range is comprised of a representative sample of the different ethnicities that exist in North America, as well as a range of students, blue collar and white collar workers who took the test. All of that is just to say that as much as possible

² As the WMS-III is a protected test, neither the specific instructions for these tasks nor the score sheets are appended.

we are trying to compare your scores to the real population that is out there. So it is technically possible to have scored very highly on the test, but to still get a low ranking, or vice versa, to score very low, but still get a high ranking. The range of scores on this test are also normally distributed, meaning that we expect most people to fall at about the mid point (or 50th percentile), but your scores were actually between the 35th and 40th percentile, which is very low. Your scores were significantly lower compared to the standard scores of people your age on this test, so most people your age would have performed better than you on average across these three tasks. This means you may not be able to rely on your memory to tell you how well you've done. You may already be aware of this. For example, think about how many times you've been sure you know where your keys are, only to find out that you don't. If you're interested, at the end of the study, I can give you a resource list that we have in the lab that contains information about how to improve your memory.”

Participants in the HMC condition were told: “Alright so the scores we report to you are in percentile ranks. Are you familiar with percentile ranking? What it means is that we have a database of scores of 1000s of men and women in North America across all the age ranges, and that's what we compare your scores to. Each age range is comprised of a representative sample of the different ethnicities that exist in North America, as well as a range of students, blue collar and white collar workers who took the test. All of that is just to say that as much as possible we are trying to compare your scores to the real population that is out there. So it is technically possible to have scored very highly on the test, but to still get a low ranking, or vice versa, to score very low, but still get a high ranking. The range of scores on this test are also normally distributed,

meaning that we expect most people to fall at about the mid point (or 50th percentile), but your scores were actually between the 85th and 90th percentile, which is very high. Your scores were significantly higher compared to the standard scores of people your age on this test so most people your age would have performed worse than you on average across these three tasks. This means you may be able to rely on your memory to tell you how well you've done. You may already be aware of this. For example think about all the times you haven't been sure you know where your keys are, but then they are in the first place you looked. If you're interested, at the end of the study, I'd like to talk to you about getting your permission to contact you for future studies, because we are interested in testing people like you who have good memories."

Following this, all participants completed the *Post-Feedback Questionnaire* as a manipulation check, although they were told it was because the laboratory was in the process of evaluating the performance of the experimenter.

At this point a second experimenter took over administration of this protocol in order to keep the researchers blind to the memory confidence condition of participants, so that this knowledge would not bias the way that data was collected. Then participants were asked to complete our 'laboratory's newer memory tasks' in the laboratory kitchen.

This began with a stove task, where participants were asked to physically turn on, off, and check a functioning stove in a specified manner (for the complete script and instructions, see Appendix F).

Following the completion of the stove task, participants were brought back to the original testing room to answer a few questions about: their anxiety, memory vividness, memory detail, which knobs they had checked, as well as urges to check if their answer

to this question was correct, their urge to check that the stove was actually off, and whether they would like their 'results' for the particular task to be destroyed so they could try again (for exact wording see *Measures* and Appendix B). They then returned to the kitchen to complete the Memory Game™ task.

For the Memory Game™ task participants were told that the objective of the game was to find the matching pair of each card out of an array of cards arranged face down on a table, while only turning over two cards at a time. Then the experimenter left the kitchen to go back to the original testing room, and the participant was asked to shut off the light as they left (this was the light task; for the complete script and instructions for both tasks, see Appendix F).

Following the completion of the light task, participants were brought back to the original testing room to answer the same types of questions about the Memory Game™ task and the light task as they had for the stove task. Exceptions were that instead of asking about the knobs, participants were asked what the first card pair was that they had found (for the Memory Game™ task) and what the last thing they were asked to do was (for the light task; for exact wording see *Measures* and Appendix B).

The rationale for always leaving the laboratory kitchen to answer questions was so that participants would not be influenced in their answers by looking at the stove/Memory Game™/light when answering questions about them.

Participants were fully debriefed (see Appendix F) by the original experimenter (including an explanation for the need for deception about their results and the methods used on the WMS-III) and a second consent form was given (see Appendix E).

Results

Missing Data

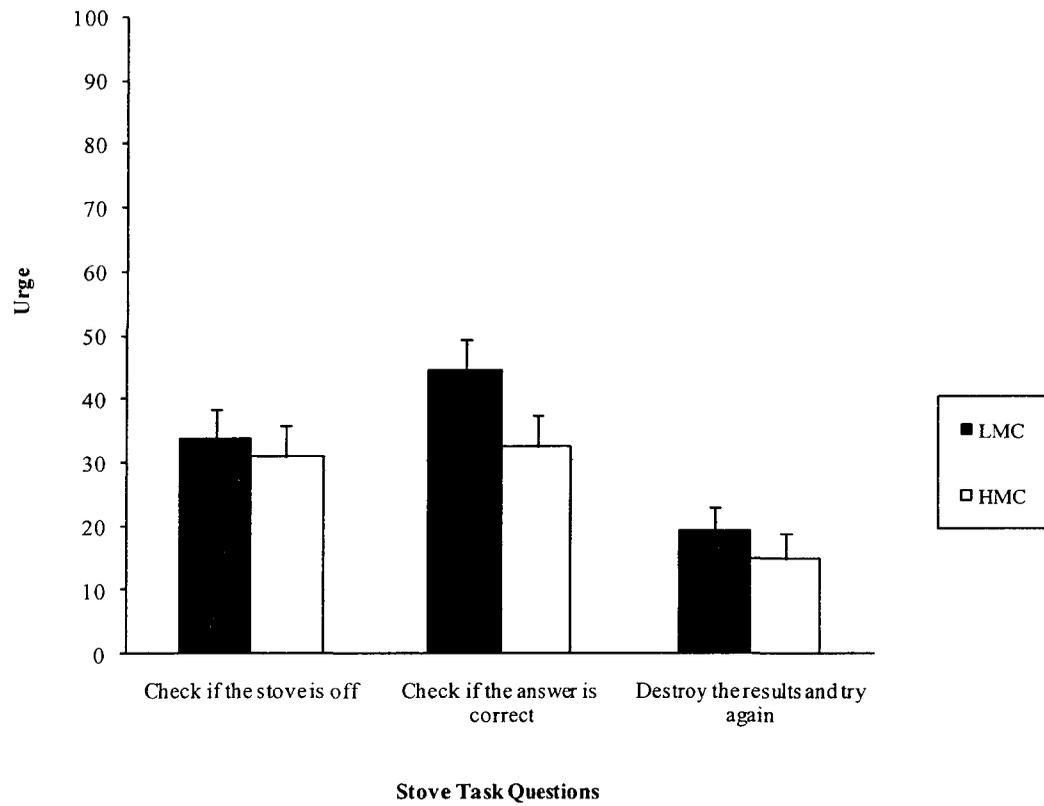
There were very few missing data points. When a value was missing from a questionnaire, the average of that participant's answers to the other questions in that measure was used to replace that missing value (Tabachnick & Fidel, 2007). The few other missing values were separately addressed in each analysis. A missing value on one analysis did not exclude that participant's data from other analyses.

Urges to Check

Following the stove task, a MANOVA with group assignment as the independent variable and urges to check the correct answer, urges to check that the stove was actually off, and urges to destroy the results and try again, as the dependent variables of interest, revealed there was no effect of group assignment on these variables, $F(3, 87) = 1.35$, n.s., partial $\eta^2 = 0.04$ (see Figure 1), although the means appeared to be in the hypothesized direction.

Following the Memory Game™ task, a MANOVA with group assignment as the independent variable and urges to check the correct answer and urges to destroy the results and try again as the outcome variables of interest revealed a main effect of group, $F(2, 87) = 7.19$, $p = .001$, partial $\eta^2 = 0.14$. Follow-up one-way ANOVAs (using Bonferonni's correction to the alpha level: $\alpha = 0.05/2$ tests, new $\alpha = .025$) showed a significant effect of group on urges to check, such that those in the LMC condition had greater urges to check than those in the HMC condition $F(1, 89) = 5.70$, $p = .019$, partial $\eta^2 = 0.06$. The same effect was evident between groups for urges to destroy the results and try again, meaning that those in the LMC condition had greater urges to destroy the

Figure 1: Mean urges scores during the stove task by group



results than those in the HMC, $F(1, 90) = 12.51, p = .001$, partial $\eta^2 = 0.12$ (see Figure 2).

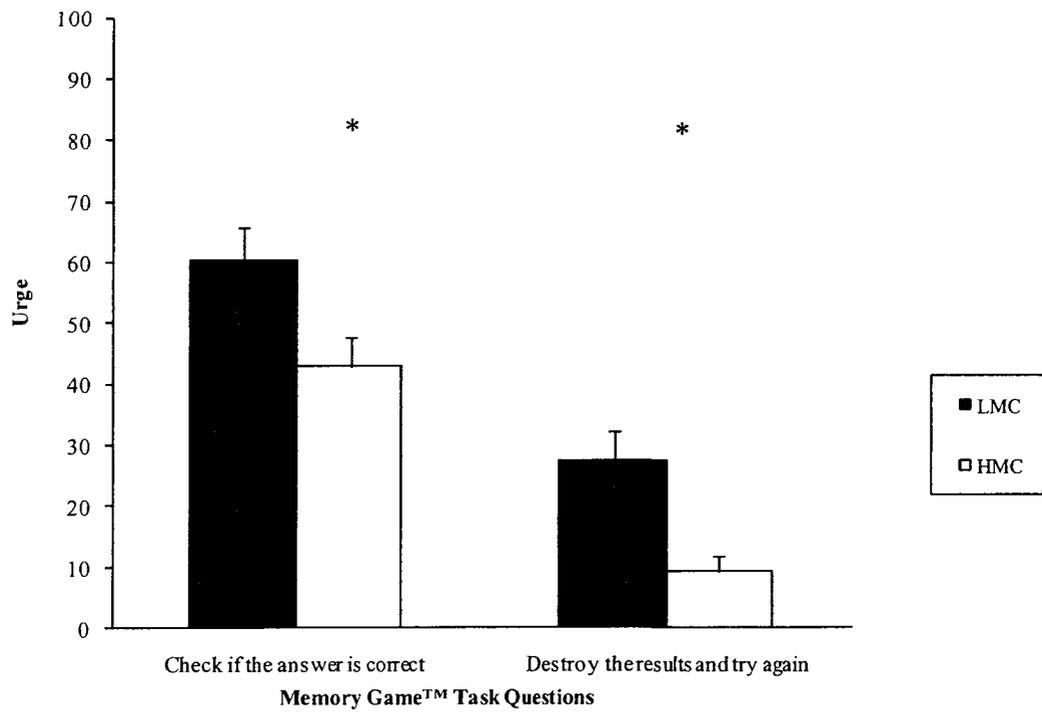
Following the light task, a MANOVA with group assignment as the independent variable and urges to check if the light was off and urges to destroy the results and try again as the outcome variables of interest revealed a main effect of group, $F(2, 88) = 5.13, p = .008$, partial $\eta^2 = 0.10$. Follow-up one-way ANOVAs (using Bonferonni's correction to the alpha level: $\alpha = 0.05/2$ tests, new $\alpha = .025$) showed a marginally significant effect of condition on urges to check, such that those in the LMC condition had greater urges to check than those in the HMC condition, $F(1, 90) = 4.77, p = .032$, partial $\eta^2 = 0.05$. For urges to destroy the results and try again, there was an actual significant difference between the groups, such that those in the LMC condition had greater urges to destroy the results and try again than those in the HMC condition, $F(1, 90) = 8.29, p = .005$, partial $\eta^2 = 0.08$ (see Figure 3).

Meta-Memory (see Table 2)

Following the stove task, a MANOVA with group assignment as the independent variable and memory vividness, and memory detail as the outcome variables of interest revealed a significant effect of group, $F(2, 88) = 5.28, p = .007$, partial $\eta^2 = 0.11$. Follow-up one-way ANOVAs (using Bonferonni's correction to the alpha level: $\alpha = 0.05/2$ tests, new $\alpha = .025$) showed a significant effect of group, $F(1, 90) = 10.42, p = .002$, partial $\eta^2 = 0.10$, such that those in the LMC condition reported less memory vividness than those in the HMC condition. The same was true for memory detail, $F(1, 90) = 6.30, p = .014$, partial $\eta^2 = 0.07$.

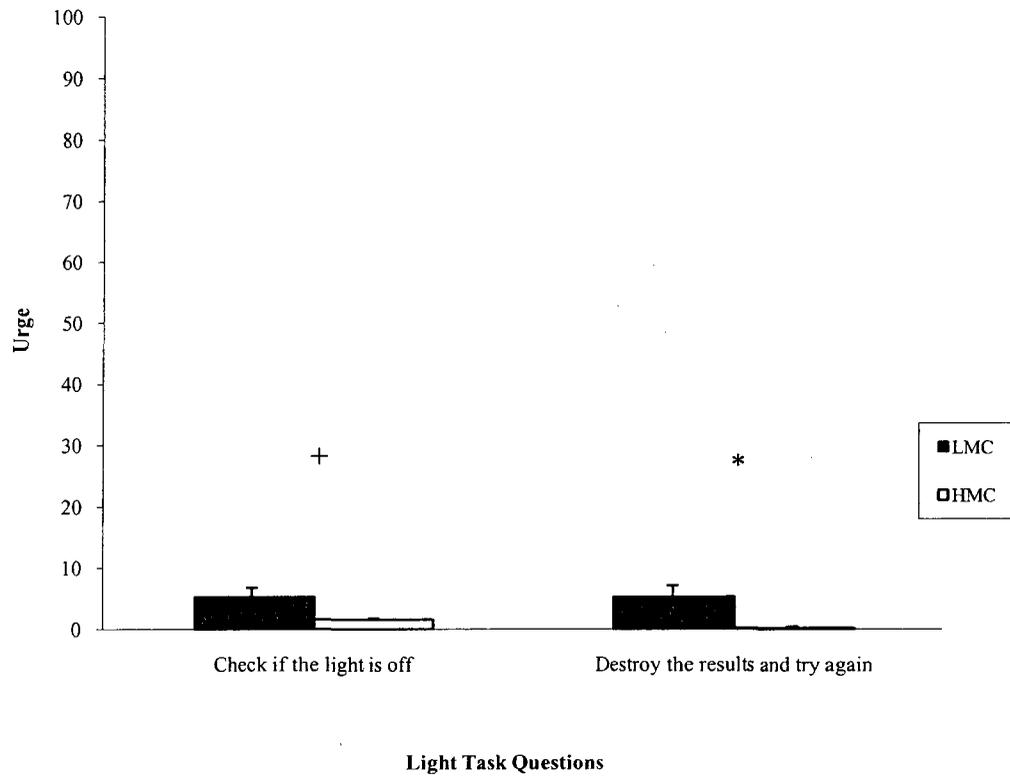
Following the Memory GameTM task, a MANOVA with group assignment as the independent variable and memory vividness, and memory detail as the outcome variables

Figure 2: Mean urges scores during the Memory Game™ task by group



Note. Asterisks denote significant differences between the groups (adjusted p 's < .025)

Figure 3: Mean urges scores during the light task by group



Note. Asterisk denotes a significant difference between the groups (adjusted $p < .025$).

Plus sign denotes a marginally significant difference between groups ($p = .032$)

Table 2: Mean scores (standard deviations in brackets) by group on meta-memory variables for the laboratory tasks

Task	Vividness		Detail	
	LMC	HMC	LMC	HMC
Stove	78.33 (16.66)*	88.06 (11.95)*	75.58 (19.00)*	84.15 (13.31)*
Memory Game TM	75.07 (23.10)	80.21 (21.63)	70.93 (23.91)	77.29 (18.91)
Light	85.30 (26.23)	89.48 (20.03)	81.93 (23.17)	86.67 (20.69)

Note. Asterisks denote significant difference between the groups (adjusted p 's < .025)

of interest revealed that the effect of group was not significant, $F(2, 88) = 1.00$, n.s., partial $\eta^2 = 0.02$, although the means were in the hypothesized direction. The same analysis was run following the light task, and similar null results were found, $F(2, 88) = 0.62$, n.s., partial $\eta^2 = 0.01$, although the means were also in the hypothesized direction.

Memory Ability

Independent-samples *t*-tests scores on the components of the Wechsler Memory Scale-III (WMS-III) were conducted to ensure that pre-manipulation, the groups did not differ on their actual memory abilities. Results were consistent with this, as there were no differences between the groups on their scaled *Faces* scores, $t(89) = -1.04$, n.s., *Letter-Number Sequencing* scores, $t(89) = -0.65$, n.s., or *Spatial Span* scores, $t(89) = 1.23$, n.s..

Furthermore, independent-samples *t*-tests of scores on the answers to the questions posed in the laboratory tasks were conducted to ensure that the groups did not differ on their performance of these tasks either. Groups did not differ on ability to answer the questions “Which are the 3 knobs that I asked you to check?”, $t(42^3) = -1.43$, n.s., “What was the first card pair that you found?”, $t(89) = 0.12$, n.s., “What did I ask you to do as we left the lab kitchen?”, $t(89) = -0.11$, n.s.. They also did not differ on times to complete the Memory Game™ task, $t(89) = 0.44$, n.s..

Discussion

Memory Confidence and Urges to Check

Results were mainly consistent with the study hypotheses. It was hypothesized that participants in the low memory confidence condition would have greater urges to check than those in the high memory confidence condition for all of the laboratory-based

³ Levene’s test of homogeneity of variance was significant ($p = .005$), therefore *t* and *df* values reported assume unequal variances.

memory tasks. The results of the Memory Game™ task were consistent with this hypothesis. Participants in the LMC group had significantly greater urges to check (that they had correctly remembered the first card pair they found) than those in the HMC group. They also had significantly greater urges to destroy the results of that task and try again. The results of the light task were also consistent with the hypothesis. Participants in the LMC group had significantly greater urges to check that the light was actually off than those in the HMC group. They also had significantly greater urges to destroy the results of that task and try again. The results of the stove task, however, were not consistent with the urges hypothesis. Participants in the two memory confidence conditions did not significantly differ on their urges to check that they had correctly remembered which stove knobs they had turned, their urges to check that the stove was actually off, or their urges to destroy the results from the task and try again (although the means were in the hypothesized direction).

Taken together, these results generally showed support for our hypothesis that low memory confidence can indeed cause an urge to check. This would imply that the checking cycle could be started by initial low memory confidence. This is in accordance with Rachman's (2002) self-perpetuating cycle, part of his theory of repeated checking behaviour. Previous research had shown that repeated checking leads to decreased memory confidence in student (e.g., van den Hout & Kindt, 2003a; Radomsky et al., 2006) and clinical (Hermanns et al., 2003; Boschen & Vuksanovic, 2007) populations, supporting the beginning of the cycle. It is the first time (to our knowledge) however, that this (low memory confidence leads to more checking) has been shown experimentally. Until now, low memory confidence has been shown to predict OCD symptomatology in

clinical and student populations only in studies using correlational designs (Nedeljkovic & Kyrios, 2007; Nedeljkovic et al., 2009). This confirms that repeated checking and low memory confidence form a vicious cycle through which an OC sufferer would continue to check in hopes of gaining memory confidence, but never be able to do so.

These results are striking as they show the relatively strong and immediate impact that a manipulation of low memory confidence can have on individuals. Despite the fact that participants had turned off the light less than two minutes before answering a question about this basic and straightforward task, many of them then wanted to check that the light was off. The questions about 'destroying the results and trying again' were another, perhaps indirect way, of assessing checking behaviour, and yet significant differences between the groups were seen. It should be noted, however, that no one ever explicitly asked to repeat the task, nor was it ever offered as a possibility that they could *actually* repeat the task.

Both groups showed relatively high urges to check on the stove task. There were a few possible reasons for this finding. The stove task was markedly more complicated than the other tasks, as manipulating a series of three burners by turning them on, off (using a single knob that was moved from burner to burner), and checking them in a specified manner is more difficult than flipping over cards or turning off a light switch. Secondly, this was the only task that required practice. Also the task instructions were provided over the intercom by the experimenter in another room, adding a heightened level of uncertainty to a task that already seemed strange, as although turning on and off a stove is ecologically valid, the specific way in which we instruct it to be done (to ensure that all participants have the same experience) was not necessarily straightforward. These

aspects were originally incorporated to be in keeping with methods used in previous studies using a real stove checking paradigm (Radomsky, Gilchrist, et al., 2006; Radomsky & Alcolado, *in press*). Finally, because of the complicated nature of this task, participants often accidentally did leave the stove on at the end of the task. This meant that the stove would hum or click, and participants occasionally appeared to notice this as they were completing later tasks in the room, creating a possible cue that they may have done something wrong during their operations of the stove.

Memory Confidence and Meta-Memory

The hypotheses about meta-memory were partially supported by the data. We hypothesized that participants in the LMC condition would report lower levels of memory vividness and detail for the laboratory-based tasks, as compared to those participants in the HMC condition. This hypothesis was supported for the stove task; that is, participants in the LMC group reported significantly lower levels of memory vividness and memory detail for the stove task than did those in the HMC group. However, these results were not supported for the Memory GameTM or light tasks. On both of these tasks, participants in the two different memory confidence conditions did not differ significantly in their memory vividness or detail of the tasks (although the means were in the hypothesized direction). These results are somewhat confusing, because they run contrary to the urges to check results reported above. If low memory confidence causes both urges to check and decreased memory vividness and detail, it would be expected that these would co-occur on the same tasks. However, on the one task in this experiment where there were no significantly increased urges to check, a significant reduction in memory vividness and detail was found. The lowered memory confidence and detail may,

however, have been a result of the stove task requiring two trials (a brief, but none the less repeated checking task), or because of its complexity. Previous research has found that repeated checking can cause detriments in meta-memory in as little as two checks (Coles et al., 2006). Other studies though, have found that approximately fifteen (Boschen & Vuksanovic, 2007) to twenty trials were required (van den Hout & Kindt, 2003a; 2004; Radomsky, Gilchrist, et al., 2006). Further work is needed to clarify this association, as stronger conclusions cannot be drawn from the present results.

In sum, therefore, it would seem that the hypothesis that meta-memory variables (i.e., memory vividness and detail) would be affected by manipulations of memory confidence was largely not supported. We had hypothesized that this would be the case because it was previously found that repeated checking caused detriments in meta-memory in experimental work (e.g., Coles et al., 2006; van den Hout & Kindt, 2003b; Radomsky, Gilchrist, et al., 2006), and clinical research has shown that memory confidence and other meta-memory variables are related (Hermans et al., 2003; 2008). Therefore there seems to be an association between repeated checking and meta-memory, but the results of this study might suggest that it is not through manipulations of memory confidence. It is possible that this relationship is independent of memory confidence levels. For example, perhaps memory confidence is a bi-product of other changes in meta-memory. This was postulated as a possibility for the results of van den Hout and Kindt's (2003b) study, however this question awaits further empirical enquiry.

Strengths and Limitations of the Study

One clear strength of the work is that it is the first time that level of memory confidence has been shown to affect urges to check directly, using a straightforward

experimental design, rather than previous correlational work showing this relationship (e.g. Nedeljkovic et al., 2009), clarifying that this relationship is a causal one. It must be noted however, especially since it was a portion of a checking *cycle* that was investigated, that these results do not show definitively that low memory confidence *always* precedes checking urges - merely that it can.

Another strength of the work is that two ecologically valid tasks (i.e., wanting to check to see if a stove and a light are actually off, something that the participants would presumably occasionally do in their own lives), were used to assess urges to check.

Perhaps the most important limitation of the work is that an urge to check is not the same as actual checking behaviour. It can be seen as an approximation, but we cannot conclude from these results that people in the low memory confidence condition would actually have checked more than those in the high memory confidence condition. Participants were asked about how much they *wanted* to check. As they were not actually given the opportunity to carry through with additional checks, we cannot conclude that their urges to check would have matched perfectly with their actual checking behaviour. That said, urges to check have been a common proxy for checking over the years (e.g., Lopatka & Rachman, 1995), and are likely highly associated with real checking behaviour. This question awaits further empirical investigation.

Implications and Future Directions

The results of this study have implications for many domains of OCD-related interests. First of all these results supported the cognitive model of checking behaviour (Rachman, 2002), furthering our knowledge of the aetiology of this compulsion. These results also add to the growing body of literature that demonstrates that checking

behaviour is a product of low memory confidence (e.g., van den Hout & Kindt, 2003a), rather than low memory ability, as some have suggested in the past (see Tallis, 1997, for a review).

Work has been devoted to the development of the OBQ-44 (OCCWG, 2005) in order to be able to better identify cognitions that are specific to OCD. However, some work has suggested that the measure as is, does not distinguish between OCD and other anxiety disorders (Tolin, Worhunsky, & Maltby, 2006). The results of the present study suggest the development of a new questionnaire subscale, that beliefs about memory and memory confidence be added to the OBQ-44, or that questionnaires evaluating meta-memory such as the MCT (Cartwright-Hatton & Wells, 1997) and/or the MACCS (Nedeljkovic & Kyrios, 2007) be incorporated into a screening assessment of OC concerns. Refining a measure for capturing a broader range of OCD-related beliefs will not only help target treatment interventions to the beliefs that are causing the most maladaptive behaviours, but also aid screening for risk factors to developing the disorder, which is important for prevention and early treatment. It is possible that someone who is predisposed to develop OC symptoms under stress, and who already has low memory confidence would be at greater risk than someone who does not have low memory confidence.

Elucidating the causal relationships between thoughts and checking can help to better refine treatments. Although a number of increasingly effective treatments exist (Abramowitz, 2006), a substantial percentage of patients are still symptomatic at the end of treatment (Foa et al., 2005). Elaboration of the cognitive-behavioural model for checking will have direct implications for treatment additions and changes. For example,

education on low memory confidence and its effect on urges to check can help people understand the cycle and perhaps stop it before it begins. Exercises could also be implemented to encourage and enable clients and patients to become more confident in their memory via behavioural experiments and other cognitively-based strategies (e.g., those proposed by Radomsky, Shafran, Coughtrey & Rachman, 2010).

Repeated checking has recently been shown to have additional detrimental effects, not only on memory confidence, but on confidence in attention and perception (Hermans et al., 2003; 2008; van den Hout, Engelhard, de Boer, du Bois, & Dek, 2008). Future investigations of whether these relationships are also cyclical (does initial low confidence in attention/perception cause urges to check?) may prove valuable for further clarifying antecedents to checking behaviour.

More research is needed to elucidate the direction and type of relationship between memory confidence and meta-memory, as the present study had inconsistent results when attempting to clarify whether memory confidence level affected memory vividness and detail. Secondly, as this is the first study of this type, replication is needed to further support the finding that low memory confidence leads to increased checking urges.

Summary

The present study showed that low memory confidence can lead to urges to check, which supports this portion of the self-perpetuating mechanism of repeated checking. Until now, previous work had only supported the other portion of the cycle - that repeated checking led to low memory confidence. The study failed to find that low memory confidence could affect memory vividness and detail of an event. Although further

investigation and replication is required, these results have important implications for cognitive models of OC checking behaviour, as well as for prevention and treatment recommendations.

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Appendix A

Questionnaires:

The Meta-Cognitions Questionnaire

The Memory and Cognitive Confidence Questionnaire

The Vancouver Obsessional Compulsive Inventory

The Obsessional Beliefs Questionnaire-44

The Beck Anxiety Inventory

The Beck Depression Inventory II



META-COGNITIONS QUESTIONNAIRE 30

MCQ-30

Adrian Wells & Samantha Cartwright-Hatton (1999)

This questionnaire is concerned with beliefs people have about their thinking. Listed below are a number of beliefs that people have expressed. Please read each item and say how much you generally agree with it by circling the appropriate number. Please respond to all the items, there are no right or wrong answers.

Gender:..... Age:.....

	Do not agree	Agree slightly	Agree moderately	Agree very much
1. Worrying helps me to avoid problems in the future	1	2	3	4
2. My worrying is dangerous for me	1	2	3	4
3. I think a lot about my thoughts	1	2	3	4
4. I could make myself sick with worrying	1	2	3	4
5. I am aware of the way my mind works when I am thinking through a problem	1	2	3	4
6. If I did not control a worrying thought, and then it happened, it would be my fault	1	2	3	4
7. I need to worry in order to remain organised	1	2	3	4
8. I have little confidence in my memory for words and names	1	2	3	4
9. My worrying thoughts persist, no matter how I try to stop them	1	2	3	4
10. Worrying helps me to get things sorted out in my mind	1	2	3	4
11. I cannot ignore my worrying thoughts	1	2	3	4
12. I monitor my thoughts	1	2	3	4
13. I should be in control of my thoughts all of the time	1	2	3	4

	Do not agree	Agree slightly	Agree moderately	Agree very much
14. My memory can mislead me at times	1	2	3	4
15. My worrying could make me go mad	1	2	3	4
16. I am constantly aware of my thinking	1	2	3	4
17. I have a poor memory	1	2	3	4
18. I pay close attention to the way my mind works	1	2	3	4
19. Worrying helps me cope	1	2	3	4
20. Not being able to control my thoughts is a sign of weakness	1	2	3	4
21. When I start worrying, I cannot stop	1	2	3	4
22. I will be punished for not controlling certain thoughts	1	2	3	4
23. Worrying help me to solve problems	1	2	3	4
24. I have little confidence in my memory for places	1	2	3	4
25. It is bad to think certain thoughts	1	2	3	4
26. I do not trust my memory	1	2	3	4
27. If I could not control my thoughts, I would not be able to function	1	2	3	4
28. I need to worry, in order to work well	1	2	3	4
29. I have little confidence in my memory for actions	1	2	3	4
30. I constantly examine my thoughts	1	2	3	4

Please ensure that you have responded to all of the items - Thank You.

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MACCS

This questionnaire is concerned with beliefs that you have about your own memory, planning, concentration and decision-making abilities, and your confidence in these abilities. Read each statement below, and circle the response that most accurately describes how strongly you agree or disagree with each statement. Please respond to all items even though some may seem repetitive. There are no right or wrong answers.

	Strongly disagree				Strongly agree
1. I have a poor memory.	1	2	3	4	5
2. I expect myself to be 100% certain about the way I plan things.	1	2	3	4	5
3. I experience many doubts after making a decision.	1	2	3	4	5
4. I often doubt my memory for having completed tasks.	1	2	3	4	5
5. I have little confidence in my memory generally.	1	2	3	4	5
6. I never do well at memory tests.	1	2	3	4	5
7. I am easily distracted.	1	2	3	4	5
8. I find it difficult to making decisions on the spot.	1	2	3	4	5
9. My poor concentration interferes with my ability to plan things effectively.	1	2	3	4	5
10. I have doubts about my memory.	1	2	3	4	5
11. I don't feel that I make good decisions.	1	2	3	4	5
12. I have difficulty keeping my mind focused on one task until it is completed.	1	2	3	4	5
13. My memory can mislead me at times.	1	2	3	4	5
14. I have little confidence in my memory for actions.	1	2	3	4	5
15. I am never certain about my memory.	1	2	3	4	5
16. I have little confidence in my memory for words and names.	1	2	3	4	5
17. I have little confidence in my ability to remember how I performed on particular tasks.	1	2	3	4	5
18. I have doubts about my decision-making ability.	1	2	3	4	5
19. I expect myself to be 100% certain about my decisions.	1	2	3	4	5
20. I often doubt my memory for having done things properly.	1	2	3	4	5

21. I have difficulty knowing if I have actually done something, or imagined it.	1	2	3	4	5
22. I have a poor concentration ability.	1	2	3	4	5
23. I often feel that my memory misleads me.	1	2	3	4	5
24. I have little confidence in my decision-making.	1	2	3	4	5
25. I have little confidence in my ability to remember what I did in particular situations.	1	2	3	4	5
26. I try so hard to remember things, that I end up forgetting everything.	1	2	3	4	5
27. I put a lot of pressure on myself to do well on even small tasks.	1	2	3	4	5
28. I must perform tasks perfectly.	1	2	3	4	5

VOCI

Please rate each statement by putting a circle around the number that best describes how much the statement is true of you. Please answer every item, without spending too much time on any particular item.

How much is each of the following statements true of you?	Not at all	A little	Some	Much	Very Much
1. I feel compelled to check letters over and over before mailing them.	0	1	2	3	4
2. I am often upset by my unwanted thoughts of using a sharp weapon.	0	1	2	3	4
3. I feel very dirty after touching money.	0	1	2	3	4
4. I find it very difficult to make even trivial decisions.	0	1	2	3	4
5. I feel compelled to be absolutely perfect.	0	1	2	3	4
6. I repeatedly experience the same unwanted thought or image about an accident.	0	1	2	3	4
7. I repeatedly check and recheck things like taps and switches after turning them off.	0	1	2	3	4
8. I use an excessive amount of disinfectants to keep my home or myself safe from germs.	0	1	2	3	4
9. I often feel compelled to memorize trivial things (e.g., licence plate numbers, instructions on labels).	0	1	2	3	4
10. I have trouble carrying out normal household activities because my home is so cluttered with things I have collected.	0	1	2	3	4
11. After I have decided something, I usually worry about my decision for a long time.	0	1	2	3	4
12. I find that almost every day I am upset by unpleasant thoughts that come into my mind against my will.	0	1	2	3	4
13. I spend far too much time washing my hands.	0	1	2	3	4
14. I often have trouble getting things done because I try to do everything exactly right.	0	1	2	3	4
15. Touching the bottom of my shoes makes me very anxious.	0	1	2	3	4
16. I am often upset by my unwanted thoughts or images of sexual acts.	0	1	2	3	4
17. I become very anxious when I have to make even a minor decision.	0	1	2	3	4
18. I feel compelled to follow a very strict routine when doing ordinary things.	0	1	2	3	4

How much is each of the following statements true of you?	Not at all	A little	Some	Much	Very Much
19. I feel upset if my furniture or other possessions are not always in exactly the same position.	0	1	2	3	4
20. I repeatedly check that my doors or windows are locked, even though I try to resist the urge to do so.	0	1	2	3	4
21. I find it very difficult to touch garbage or garbage bins.	0	1	2	3	4
22. I become very tense or upset when I think about throwing anything away.	0	1	2	3	4
23. I am excessively concerned about germs and disease.	0	1	2	3	4
24. I am often very late because I can't get through ordinary tasks on time.	0	1	2	3	4
25. I avoid using public telephones because of possible contamination.	0	1	2	3	4
26. I am embarrassed to invite people to my home because it is full of piles of worthless things I have saved.	0	1	2	3	4
27. I repeatedly experience the same upsetting thought or image about death.	0	1	2	3	4
28. I am often upset by unwanted thoughts or images of blurting out obscenities or insults in public.	0	1	2	3	4
29. I worry far too much that I might upset other people.	0	1	2	3	4
30. I am often frightened by unwanted urges to drive or run into oncoming traffic.	0	1	2	3	4
31. I almost always count when doing a routine task.	0	1	2	3	4
32. I feel very contaminated if I touch an animal.	0	1	2	3	4
33. One of my major problems is repeated checking.	0	1	2	3	4
34. I often experience upsetting and unwanted thoughts about losing control.	0	1	2	3	4
35. I find it almost impossible to decide what to keep and what to throw away.	0	1	2	3	4

	0	1	2	3	4
How much is each of the following statements true of you?	Not at all	A little	Some	Much	Very Much
36. I am strongly compelled to count things.	0	1	2	3	4
37. I repeatedly check that my stove is turned off, even though I resist the urge to do so.	0	1	2	3	4
38. I get very upset if I can't complete my bedtime routine in exactly the same way every night.	0	1	2	3	4
39. I am very afraid of having even slight contact with bodily secretions (blood, urine, sweat, etc.).	0	1	2	3	4
40. I am often very upset by my unwanted impulses to harm other people.	0	1	2	3	4
41. I spend a lot of time every day checking things over and over again.	0	1	2	3	4
42. I have great trouble throwing anything away because I am very afraid of being wasteful.	0	1	2	3	4
43. I frequently have to check things like switches, faucets, appliances and doors several times.	0	1	2	3	4
44. One of my major problems is that I am excessively concerned about cleanliness.	0	1	2	3	4
45. I feel compelled to keep far too many things like old magazines, newspapers, and receipts because I am afraid I might need them in the future.	0	1	2	3	4
46. I repeatedly experience upsetting and unacceptable thoughts of a religious nature.	0	1	2	3	4
47. I tend to get behind in my work because I repeat the same thing over and over again.	0	1	2	3	4
48. I try to put off making decisions because I'm so afraid of making a mistake.	0	1	2	3	4
49. I often experience upsetting and unwanted thoughts about illness.	0	1	2	3	4
50. I am afraid to use even well-kept public toilets because I am so concerned about germs.	0	1	2	3	4
51. Although I try to resist, I feel compelled to collect a large quantity of things I never actually use.	0	1	2	3	4
52. I repeatedly experience upsetting and unwanted immoral thoughts.	0	1	2	3	4
53. One of my major problems is that I pay far too much attention to detail.	0	1	2	3	4

54. I am often upset by unwanted urges to harm myself.	0	1	2	3	4
55. I spend far too long getting ready to leave home each day because I have to do everything exactly right.	0	1	2	3	4

Obsessional Beliefs Questionnaire (OBQ-44)

This inventory lists different attitudes or beliefs that people sometimes hold. Read each statement carefully and decide how much you agree or disagree with it.

For each of the statements, choose the number matching the answer that *best describes how you think*. Because people are different, there are no right or wrong answers.

To decide whether a given statement is typical of your way of looking at things, simply keep in mind what you are like *most of the time*.

Use the following scale:

1	2	3	4	5	6	7
Disagree very much	disagree moderately	disagree a little	neither agree nor disagree	agree a little	agree moderately	agree very much

In making your ratings, try to avoid using the middle point of the scale (4), but rather indicate whether you usually disagree or agree with the statements about your own beliefs and attitudes.

- | | |
|--|---------------|
| 1. I often think things around me are unsafe. | 1 2 3 4 5 6 7 |
| 2. If I'm not absolutely sure of something, I'm bound to make a mistake | 1 2 3 4 5 6 7 |
| 3. Things should be perfect according to my own standards. | 1 2 3 4 5 6 7 |
| 4. In order to be a worthwhile person, I must be perfect at everything I do. | 1 2 3 4 5 6 7 |
| 5. When I see any opportunity to do so, I must act to prevent bad things from happening. | 1 2 3 4 5 6 7 |
| 6. Even if harm is very unlikely, I should try to prevent it at any cost. | 1 2 3 4 5 6 7 |
| 7. For me, having bad urges is as bad as actually carrying them out. | 1 2 3 4 5 6 7 |
| 8. If I don't act when I foresee danger, then I am to blame for any consequences. | 1 2 3 4 5 6 7 |

	1	2	3	4	5	6	7
	Disagree very much	disagree moderately	disagree a little	neither agree nor disagree	agree a little	agree moderately	agree very much
9. If I can't do something perfectly, I shouldn't do it at all.	1	2	3	4	5	6	7
10. I must work to my full potential at all times.	1	2	3	4	5	6	7
11. It is essential for me to consider all possible outcomes of a situation.	1	2	3	4	5	6	7
12. Even minor mistakes mean a job is not complete.	1	2	3	4	5	6	7
13. If I have aggressive thoughts or impulses about my loved ones, this means I may secretly want to hurt them.	1	2	3	4	5	6	7
14. I must be certain of my decisions.	1	2	3	4	5	6	7
15. In all kinds of daily situations, failing to prevent harm is just as bad as deliberately causing harm.	1	2	3	4	5	6	7
16. Avoiding serious problems (for example, illness or accidents) requires constant effort on my part.	1	2	3	4	5	6	7
17. For me, not preventing harm is as bad as causing harm.	1	2	3	4	5	6	7
18. I should be upset if I make a mistake.	1	2	3	4	5	6	7
19. I should make sure others are protected from any negative consequences of my decisions or actions	1	2	3	4	5	6	7
20. For me, things are not right if they are not perfect.	1	2	3	4	5	6	7
21. Having nasty thoughts means I am a terrible person.	1	2	3	4	5	6	7
22. If I do not take extra precautions, I am more likely than others to have or cause a serious disaster.	1	2	3	4	5	6	7
23. In order to feel safe, I have to be as prepared as possible for anything that could go wrong.	1	2	3	4	5	6	7
24. I should not have bizarre or disgusting thoughts.	1	2	3	4	5	6	7
25. For me, making a mistake is as bad as failing completely.	1	2	3	4	5	6	7

	1	2	3	4	5	6	7
	Disagree very much	disagree moderately	disagree a little	neither agree nor disagree	agree a little	agree moderately	agree very much
26. It is essential for everything to be clear cut, even in minor matters.	1	2	3	4	5	6	7
27. Having a blasphemous thought is as sinful as committing a sacrilegious act.	1	2	3	4	5	6	7
28. I should be able to rid my mind of unwanted thoughts.	1	2	3	4	5	6	7
29. I am more likely than other people to accidentally cause harm to myself or to others.	1	2	3	4	5	6	7
30. Having bad thoughts means I am weird or abnormal.	1	2	3	4	5	6	7
31. I must be the best at things that are important to me.	1	2	3	4	5	6	7
32. Having an unwanted sexual thought or image means I really want to do it.	1	2	3	4	5	6	7
33. If my actions could have even a small effect on a potential misfortune, I am responsible for the outcome.	1	2	3	4	5	6	7
34. Even when I am careful, I often think that bad things will happen.	1	2	3	4	5	6	7
35. Having intrusive thoughts means I'm out of control.	1	2	3	4	5	6	7
36. Harmful events will happen unless I am very careful.	1	2	3	4	5	6	7
37. I must keep working at something until it's done exactly right.	1	2	3	4	5	6	7
38. Having violent thoughts means I will lose control and become violent.	1	2	3	4	5	6	7
39. To me, failing to prevent a disaster is as bad as causing it.	1	2	3	4	5	6	7
40. If I don't do a job perfectly, people won't respect me.	1	2	3	4	5	6	7
41. Even ordinary experiences in my life are full of risk.	1	2	3	4	5	6	7
42. Having a bad thought is morally no different than doing a bad deed.	1	2	3	4	5	6	7

1	2	3	4	5	6	7
Disagree very much	disagree moderately	disagree a little	neither agree nor disagree	agree a little	agree moderately	agree very much
43. No matter what I do, it won't be good enough.					1 2 3 4 5 6 7	
44. If I don't control my thoughts, I'll be punished.					1 2 3 4 5 6 7	

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B.A.I.

Below is a list of common symptoms of anxiety. Please read each item in the list carefully. Indicate how much you have been bothered by each symptom during the PAST WEEK, INCLUDING TODAY by placing an X in the corresponding space in the column next to each symptom.

		Not at all	Mildly. It did not bother me much	Moderately. It was very unpleasant but I could stand it	Severely. I could barely stand it
1	Numbness or tingling				
2	Feeling hot				
3	Wobbliness in legs				
4	Unable to relax				
5	Fear of worst happening				
6	Dizzy or lightheaded				
7	Heart pounding or racing				
8	Unsteady				
9	Terrified				
10	Nervous				
11	Feelings of choking				
12	Hands trembling				
13	Shaky				
14	Fear of losing control				
15	Difficulty breathing				
16	Fear of dying				
17	Scared				
18	Indigestion or discomfort in abdomen				
19	Faint				
20	Face flushed				
21	Sweating (not due to heat)				

BDI-II

This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the one statement in each group that best describes the way you have been feeling during the past two weeks, including today. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for each group.

1) Sadness

- 0 I do not feel sad.
- 1 I feel sad much of the time.
- 2 I am sad all the time.
- 3 I am so sad or unhappy that I can't stand it.

2) Pessimism

- 0 I am not discouraged about my future.
- 1 I feel more discouraged about my future than I used to be.
- 2 I do not expect things to work out for me.
- 3 I feel my future is hopeless and will only get worse.

3) Past Failure

- 0 I do not feel like a failure.
- 1 I have failed more than I should have.
- 2 As I look back, I see a lot of failures.
- 3 I feel I am a total failure as a person.

4) Loss of Pleasure

- 0 I get as much pleasure as I ever did from the things I enjoy.
- 1 I don't enjoy things as much as I used to.
- 2 I get very little pleasure from the things I used to enjoy.
- 3 I can't get any pleasure from the things I used to enjoy.

7) Self-Dislike

- 0 I feel the same about myself as ever.
- 1 I have lost confidence in myself.
- 2 I am disappointed in myself.
- 3 I dislike myself.

8) Self-Criticalness

- 0 I don't criticize or blame myself more than usual.
- 1 I am more critical of myself than I used to be.
- 2 I criticize myself for all the faults.
- 3 I blame myself for everything bad that happens.

9) Suicidal Thoughts or Wishes

- 0 I don't have any thoughts of killing myself.
- 1 I have thoughts of killing myself, but I would not carry them out.
- 2 I would like to kill myself.
- 3 I would kill myself if I had the chance.

10) Crying

- 0 I don't cry any more than I used to.
- 1 I cry more now than I used to.
- 2 I cry over every little thing.
- 3 I feel like crying but I can't.

5) Guilty Feelings

- 0 I don't feel particularly guilty.
- 1 I feel guilty over many things I have done or should have done.
- 2 I feel quite guilty most of the time.
- 3 I feel guilty all the time.

6) Punishment Feelings

- 0 I don't feel I am being punished.
- 1 I feel I may be punished.
- 2 I expect to be punished.
- 3 I feel I am being punished.

13) Indecisiveness

- 0 I make decisions about as well as ever.
- 1 I find it more difficult to make decisions than usual.
- 2 I have much greater difficulty in making decisions than I used to.
- 3 I have trouble making any decision.

14) Worthlessness

- 0 I do not feel I am worthless.
- 1 I don't consider myself as worthwhile and useful as I used to.
- 2 I feel more worthless as compared to other people.
- 3 I feel utterly worthless.

15) Loss of Energy

- 0 I have as much energy as ever.
- 1 I have less energy than I used to have.
- 2 I don't have enough energy to do very much.
- 3 I don't have enough energy to do anything.

11) Agitation

- 0 I am no more restless or wound up than usual.
- 1 I feel more restless or wound up than usual.
- 2 I am so restless or agitated that it's hard to stay still.
- 3 I am so restless or agitated that I have to keep moving or doing something.

12) Loss of Interest

- 0 I have not lost interest in people or activities.
- 1 I am less interested in other people or things than before.
- 2 I have lost most of my interest in other people or things.
- 3 It's hard to get interested in anything.

18) Changes in Appetite

- 0 I have not experienced any changes in my appetite.
- 1a My appetite is somewhat less than usual.
- 1b My appetite is somewhat greater than usual.
- 2a My appetite is much less than usual.
- 2b My appetite is much greater than usual.
- 3a I have no appetite at all.
- 3a I crave food all the time.

19) Concentration Difficulty

- 0 I can concentrate as well as usual.
- 1 I can't concentrate as well as usual.
- 2 It's hard to keep my mind on anything for very long.
- 3 I find I can't concentrate on anything.

20) Tiredness or Fatigue

- 0 I am no more tired or fatigued than usual.
- 1 I get more tired or fatigued more easily than usual.
- 2 I am too tired or fatigued to do a lot of the things I used to do.
- 3 I am too tired or fatigued to do most of the things I used to do.

16) Changes in Sleeping Pattern

- 0 I have not experienced any changes in my sleeping pattern.
- 1a I sleep somewhat more than usual.
- 1b I sleep somewhat less than usual.
- 2a I sleep a lot more than usual.
- 2b I sleep a lot less than usual.
- 3a I sleep most of the day.
- 3b I wake up 1-2 hours early and can't get back to sleep.

17) Irritability

- 0 I am no more irritable than usual.
- 1 I am more irritable than usual.
- 2 I am much more irritable than usual.
- 3 I am irritable all the time.

21) Loss of Interest in Sex

- 0 I have not noticed any recent change in my interest in sex.
- 1 I am less interested in sex than I used to be.
- 2 I am much less interested in sex now.
- 3 I have lost interest in sex completely.

Appendix B

Oral responses on the 100-point and Subjective Units of Distress Scale:

Baseline Ratings

Post-Stove Ratings

Post-Memory Game™ Ratings

Post-Light Ratings

Post-Debriefing Ratings

Baseline Ratings

Please rate how anxious you feel on a scale of 0-100, where 0 is “not anxious whatsoever” and 100 is “extremely anxious, the most you’ve ever felt in your life”.

Please rate how confident you are that you remember the tasks you just completed, on a scale of 0-100, where 0 is “not confident at all” and 100 is “extremely confident”.

Please rate how vivid (e.g. the clarity & intensity) your memory is of the tasks you just completed, on a scale of 0-100, where 0 is “not vivid at all” and 100 is “extremely vivid”.

Please rate how detailed (e.g. the particular visual features) your memory is of the tasks you just completed, on a scale of 0-100, where 0 is “not detailed at all” and 100 is “extremely detailed”.

Post-Stove Ratings

Please rate how anxious you feel on a scale of 0-100, where 0 is “not anxious whatsoever” and 100 is “extremely anxious, the most you’ve ever felt in your life”.

Please rate how vivid (e.g. the clarity & intensity) your memory is of the task, on a scale of 0-100, where 0 is “not vivid at all” and 100 is “extremely vivid”.

Please rate how detailed (e.g. the particular visual features) your memory is of the task, on a scale of 0-100, where 0 is “not detailed at all” and 100 is “extremely detailed”.

Which are the 3 knobs that I asked you to check and in what order?

(correct answer for scoring: 2,5,1)

Bearing in mind the feedback that you received earlier, please rate your urge to check that those are the knobs that you turned off, on a scale of 0-100, where 0 is “no urge whatsoever” and 100 is “an extreme urge to check”.

Bearing in mind the feedback that you received earlier, please rate your urge to check that the stove is actually off, on a scale of 0-100, where 0 is “no urge whatsoever” and 100 is “an extreme urge to check”.

Bearing in mind the feedback that you received earlier, please rate how strong your urge is for me to destroy the results from this exercise and to redo the task again, on a scale of 0-100, where 0 is “no urge whatsoever” and 100 is “an extreme urge to destroy the results and try again.”

Post-Memory Game™ Ratings

Please rate how anxious you feel on a scale of 0-100, where 0 is “not anxious whatsoever” and 100 is “extremely anxious, the most you’ve ever felt in your life”.

Please rate how vivid (e.g. the clarity & intensity) your memory of the task is, on a scale of 0-100, where 0 is “not vivid at all” and 100 is “extremely vivid”.

Please rate how detailed (e.g. the particular visual features) your memory of the task is, on a scale of 0-100, where 0 is “not detailed at all” and 100 is “extremely detailed”.

What was the first card pair that you found? _____

Bearing in mind the feedback that you received earlier, please rate your urge to check that that is the correct answer, on a scale of 0-100, where 0 is “no urge whatsoever” and 100 is “an extreme urge to check”.

Bearing in mind the feedback that you received earlier, please rate how strong your urge is for me to destroy the results from this exercise and to redo the task again, on a scale of 0-100, where 0 is “no urge whatsoever” and 100 is “an extreme urge to destroy the results and try again”.

Post-Light Ratings

What did I ask you to do as we left the lab kitchen?

Please rate how anxious you feel on a scale of 0-100, where 0 is “not anxious whatsoever” and 100 is “extremely anxious, the most you’ve ever felt in your life”.

Please rate how vivid (e.g. the clarity & intensity) your memory of the task (i.e., turning off the light) is, on a scale of 0-100, where 0 is “not vivid at all” and 100 is “extremely vivid”.

Please rate how detailed (e.g. the particular visual features) your memory of the task (i.e., turning off the light) is, on a scale of 0-100, where 0 is “not detailed at all” and 100 is “extremely detailed”.

Bearing in mind the feedback that you received earlier, please rate your urge to check that the light is actually off, on a scale of 0-100, where 0 is “no urge whatsoever” and 100 is “an extreme urge to check”.

Bearing in mind the feedback that you received earlier, please rate how strong your urge is for me to tear up the results from this exercise and to redo the task again, on a scale of 0-100, where 0 is “no urge whatsoever” and 100 is “an extreme urge to destroy the results and try again”.

Post-Debriefing Ratings

Please rate how much you believed the feedback at the time it was given, on a scale of 0-100, where 0 is “not at all” and 100 is “completely believed”.

Appendix C

Post-Feedback Questionnaire

Post-Feedback Questionnaire

1. Were you pleased with the feedback you received?
 - a. Completely pleased
 - b. Very pleased
 - c. Moderately pleased
 - d. Not very pleased
 - e. Not pleased at all

2. Were you upset with the feedback you received?
 - a. Completely upset
 - b. Very upset
 - c. Moderately upset
 - d. Not very upset
 - e. Not upset at all

3. Based on this feedback, I believe my memory is
 - a. Excellent
 - b. Good
 - c. Average
 - d. Fair
 - e. Poor

4. Based on this feedback, would you like to repeat this test?
 - a. Definitely repeat
 - b. Most likely repeat
 - c. Maybe repeat
 - d. Likely not repeat
 - e. Definitely not repeat

5. Would you recommend this test to others?
 - a. Definitely recommend
 - b. Most likely recommend
 - c. Maybe recommend
 - d. Likely not recommend
 - e. Definitely not recommend

6. Was the assessor courteous while administering the feedback?
 - a. Completely courteous
 - b. Mostly courteous
 - c. Somewhat courteous
 - d. A little courteous
 - e. Not at all courteous

7. Did the assessor explain the feedback in a way that was clear and understandable?
 - a. Completely understandable
 - b. Mostly understandable
 - c. Somewhat understandable
 - d. A little understandable
 - e. Not at all understandable

8. Would you choose this assessor again in the future?
 - a. Definitely
 - b. Most likely
 - c. Maybe
 - d. Not likely
 - e. Definitely not

Appendix D

Memory Card Layout

HANDS	GIRL	YELLOW FLOWER	TREE	LEAF	TREBLE CLEF
LADYBU G	GROUP	SUB MARINE	BUTTER FLY	TRUMPET BOY	SPACE SHIP
PURPLE FLOWER	HANDS	LEAF	TREBLE CLEF	WAND BOY	GROUP
YELLOW FLOWER	MUSIC NOTE	GIRL	LADYBUG	PURPLE FLOWER	SUB MARINE
BUTTER FLY	TRUMPET BOY	SPACESHIP	MUSIC NOTE	TREE	WAND BOY

Appendix E

Informed Consent Forms:

First Consent Form

Second Consent Form

CONSENT FORM TO PARTICIPATE IN RESEARCH

This is to state that I agree to participate in a program of research being conducted by Dr. Adam S. Radomsky in the Psychology Department of Concordia University.

A. PURPOSE

I have been informed that the purpose of this study is to examine memory in various validated and new memory tasks.

B. PROCEDURES

If you agree to participate in this study, you will first be asked to complete a questionnaire package. You will then be asked to complete tasks from a validated memory scale. Afterwards, you will be asked to complete memory tasks that we are trying to validate in our lab. During the course of the study you will be periodically asked some questions. When we are finished all the tasks, we will fully explain the hypotheses of the study and we will answer any questions you may have about the experiment. The study should take approximately 90 minutes to complete, and will take place in SP-215. For your participation, you will be entered in draw for a chance to win a cash prize ranging from 50\$ to 300\$, OR you will receive course credit if you are part of the Psychology Department Participant Pool.

C. CONDITIONS OF PARTICIPATION

I understand that I am free to withdraw my consent and discontinue my participation in this study at any time, without any negative consequences whatsoever. I understand that all information obtained will be kept strictly confidential and will be stored under lock and key for a period of seven years after which they will be shredded. Access to this information will be made available only to restricted members of Dr. Radomsky's research team. I understand that to ensure my confidentiality all data will be coded by number only and will be kept separate from my name. I understand that data from this study may be published, but that no identifying information will be released.

If you have any questions concerning the study, please feel free to ask the experimenter now. If other questions or concerns come up following the study, please feel free to contact our laboratory at (514) 848-2424, ext. 5965.

Adam S. Radomsky, Ph.D., Associate Professor
Gillian M. Alcolado, B.Sc., Masters Student

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. I FREELY CONSENT AND VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY.

NAME (please print) _____ AGE _____

SIGNATURE _____ GENDER M / F

WITNESS SIGNATURE _____

If at any time you have questions about your rights as a research participant, please contact Adela Reid, Research Ethics and Compliance Office, Concordia University, at 514-848-2424, ext. 7481 or by e-mail at Adela.Reid@concordia.

CONSENT FORM TO PARTICIPATE IN RESEARCH

As you have just been informed, the use of deceptive information was essential in this study in order to determine if beliefs about memory confidence would affect urges to check.

By signing below you indicate that you have been informed of this minor deception and allow us to include your results in our analyses.

Signature _____

Witness _____

Date _____

If you have any questions concerning this study, please feel free to ask the researcher or call the lab at 848-2424, ext. 5965.

Adam S. Radomsky, Ph.D., Associate Professor.
Gillian M. Alcolado, B.Sc., Master's Student.

Appendix F

Scripts:

Laboratory-Based Memory Tasks

Debriefing

Laboratory-Based Memory Tasks

Now we're going to run through the memory tasks that we're specifically interested in continuing to validly use in our lab to assess memory in anxiety disorders. We're going to see how well your scores on these tasks match up to what we know your scores should approximately be, based on the validated test battery that we ran you through earlier.

1. The first thing I'm going to do is to train you how to use our lab stove, and then we will do a task based on that. Let's move into the lab kitchen. (*Go to the kitchen*)

(*Pointing to knobs*) There are six knobs that you may be asked to operate. We will refer to them as numbers 1,2,3,4,5, and 6 (*point at drawing*). You will be asked to physically operate knobs in sets of threes. For example, if I asked you to turn on knobs numbered 1,4, and 2 in this sequence, you would turn the corresponding knobs halfway to the right, like this (*demonstration*). When asked to turn them off, you simply turn them counter-clockwise back to the off-mark, again in the same sequence (*demonstration*). When asked to check them, you will turn the knobs a quarter to the right and then back to the start, and then you should wiggle the knob to make sure it is in place properly, again in the same sequence (*demonstration*).

This stove is not entirely reliable and the lights are kind of faint, so it is important to go through the procedure of wiggling and checking the knobs properly because the knobs are sometimes easily mistaken as off when they really are not. The lights are also kind of faint; also this is a fully operating stove so I advise you to take care not to burn yourself. (*If they have a long sleeve shirt or one that hangs, ask them to roll it up or tuck it in.*)

Great, now I will leave you here to practice. I will give you directions through the intercom. Please let me know when you have completed each task by coming over the intercom, pressing this button, and saying okay. Then I will know to give you further instructions. *(Leave the room)*

(Through the intercom) Please turn on burners 1 through 6. Please turn them off. Please check them. *(Go back to the kitchen)* Now we're ready to do a real trial. I will again give instructions over the intercom. *(Go back to the storage room)* Please turn on burners 2,5,1. Please turn them off. Please check them. *(Go back to the kitchen and bring participant back to the storage room)*

Now I'm going to ask you a few more questions.

Get the post-stove ratings

2. Let's go back to the kitchen for the next exercise. (Do so). Now you're going to play the memory game. Are you familiar with this children's card game? When I say start, I would like you to flip over two cards. Your task is to find all the pairs. You can flip over two cards at a time, and if they match, you've got a pair and you can place them in the box. If not, you must flip them back over again, and you can now flip over two more cards. They can be new cards, or some of the same cards. Work as quickly as you can, until you have found all the card pairs. I will be timing you. Do you have any questions? Please begin.

****Note the first pair that is turned over and record it on the post-memory game rating sheet. This will allow for them to conceivably be able to check which was the first pair they found, when asked later.***

3. Now we're going to go back to the other testing room. (*Make a show of tidying up and checking that the room is in order. Carry the memory game materials and clip board in your arms so that they are full*). Would you mind turning off the light for me? Thanks.

Now I'm going to ask you a few more questions.

Get post-memory game and the post-light ratings

Great! We're all done now. I'm going to go get Gillian/Jesse and they will debrief you about the experiment.

Debriefing

The experiment is over. I would like to thank you for participating in this experiment today. At this time I would like to provide you with some general information about the study. This study was designed to examine the effects of beliefs about memory confidence on urges to check. Previous research has shown that participants who repeatedly check have decreased memory confidence for what actually happened when they were checking. We are now investigating the opposite side of this effect, to see if, conversely, beliefs about memory confidence can affect urges to check.

Because of this, the study involved a little bit of deception. We gave half of the participants the false information that they had performed much lower than their peers on the memory task, and that they therefore should not have confidence in their memory, and we gave the other half of the participants the false information that they had performed much better than their peers on the memory task, and that they can therefore have confidence in their memory.

In reality however, we did not administer the full test, and we therefore cannot make any statements about how good or bad your memory is. This deception was necessary in order to examine the effects of beliefs about memory confidence on urges to check.

Because deception was necessary, we have a second consent form for you to sign. Signing this consent form means you allow us to have access to the results you provided us with today. You are in no way obligated to sign this consent form. If you do not sign this consent form, we will not look at the results you provided us with today. (*Administer second consent form*)

Thank you again for your participation. Do you have any questions?