

**TO CHECK OR NOT TO CHECK:  
A TEST OF A COGNITIVE THEORY OF COMPULSIVE CHECKING**

**by**

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## **Abstract**

The purpose of these studies was to provide the first experimental tests of a new cognitive theory of compulsive checking by Rachman (2002). The first part of this theory concerns the impact of hypothesized “multipliers” of checking, perceived responsibility, probability, and severity of harm. Study 1 assessed the impact of these multipliers on a variety of checking-related outcomes. Fifty undergraduate students, 31 participants with anxiety disorders other than obsessive-compulsive disorder (OCD), and 29 participants with OCD responded to a series of vignettes describing situations that implied the possibility of harm. Participants provided ratings of their likely emotional and behavioural responses in these situations. It was hypothesized that the multipliers would make significant independent and combined contributions to checking-related outcomes. The findings of Study 1 offered strong support for part one of the theory and highlighted its explanatory power across the continuum of anxiety and checking behaviour.

Study 2 provided the first exploratory test of the self-perpetuating mechanism described in part two of Rachman’s theory as an explanation for repeated checking. It was hypothesized that repeated checking would be associated with increases in perceived responsibility, probability and severity of harm, and with decreased confidence in memory, consistent with the proposed self-perpetuating mechanism. Study 2 also explored the universality of this mechanism by testing both individuals who routinely check and those who do not, and by including both high and low relevance items. Forty-four undergraduate students and 20 individuals with OCD and primary checking compulsions completed a telephone checking experiment from their homes. Participants performed a series of four checking tasks under the telephone guidance of an experimenter. Two of the tasks involved a single check of the items (high relevance vs. low relevance) and two of the tasks involved repeated checking. Contrary to hypotheses, ratings of responsibility, probability and severity

decreased significantly and memory confidence increased significantly from pre- to post-check across both the single and repeated check conditions and both samples. The findings of Study 2 were not consistent with the operation of a self-perpetuating mechanism. Implications of the findings of these studies for this new cognitive theory of compulsive checking are discussed.

## Table Of Contents

Abstract.....	ii
List of Tables.....	ix
List of Figures.....	xi
Acknowledgements.....	xii
Chapter 1: Introduction.....	1
Purpose.....	1
OCD Is... : Definition and Prevalence of OCD.....	2
The Phenomenology of Checking.....	4
Checking in Non-Clinical Populations.....	6
A Brief History of Modern Psychological Theories of OCD.....	8
Mowrer's Two-Factor Theory of Fear: Towards a Behavioural Theory of Obsessional Problems.....	9
The Behavioural Theory of Obsessive-Compulsive Disorder.....	10
Towards a Cognitive Theory Of OCD: Early Attempts at Cognitive Theories.....	14
Carr's Cognitive Theory of OCD.....	14
McFall and Wollersheim's Cognitive Theory of OCD.....	15
The Revolution Begins: Salkovskis' Cognitive Theory of OCD.....	16
Common Themes in Modern Psychological Theories of OCD.....	20
The Need for a Specific Theory.....	20
Towards a Satisfactory Theory of Compulsive Checking.....	23
Overview of the Cognitive Theory of Checking.....	24
Chapter 2: Why Do People Check? The Multipliers.....	25
Evidence for the Importance of the Multipliers in Checking.....	28
Impact of Responsibility on Checking.....	29
Impact of Risk on Checking.....	32
Impact of Responsibility and Risk on Checking.....	36



Interrelationships among the Multipliers.....	41
Is Responsibility a Function of the Situation, the Person, or Both?.....	43
Purpose of Study 1.....	46
Overview of Study 1 Design and Hypotheses.....	46
Hypotheses Derived from the Cognitive Theory of Checking.....	47
Study 1 Methods.....	48
Participants.....	48
Sample 1: Participants with OCD.....	48
Sample characteristics.....	49
Sample 2: Participants with Other Anxiety Disorders.....	50
Sample characteristics.....	51
Sample 3: Undergraduate Students (Non-clinical Sample).....	51
Sample characteristics.....	52
Procedure.....	52
Materials/Vignettes.....	53
Manipulation Checks.....	54
Measures.....	55
Responsibility Attitude Scale (RAS).....	55
Obsessive-Compulsive Inventory (OCI).....	55
Maudsley Obsessional Compulsive Inventory (MOCI).....	56
Yale Brown Obsessive Compulsive Scale – Self Report Version (Y-BOCS-SR).....	56
Beck Anxiety Inventory (BAI).....	57
Spielberger State-Trait Anxiety Inventory – Form Y (STAI).....	58
Beck Depression Inventory– Second Edition (BDI-II).....	58
Summary of Study 1.....	59
Study 1 Results.....	60
Preliminary Analyses.....	60
Manipulation Checks.....	62
Vividness.....	62
Student sample.....	62
Anxious control sample.....	62
OCD sample.....	62
Multipliers.....	63
Responsibility.....	63

Severity.....	63
Probability.....	64
Primary Analyses: Procedure.....	64
Primary Analyses: Student Sample.....	65
Urge to Check.....	65
Likelihood of Checking.....	66
Discomfort.....	68
Worry.....	69
Reassurance Seeking.....	70
Checking by Other.....	71
Primary Analyses: Anxious Control Sample.....	73
Urge to Check.....	73
Likelihood of Checking.....	74
Discomfort.....	75
Worry.....	77
Reassurance Seeking.....	78
Checking by Other.....	79
Primary Analyses: OCD Sample.....	80
Urge to Check.....	80
Likelihood of Checking.....	81
Discomfort.....	82
Worry.....	83
Reassurance Seeking.....	84
Checking by Other.....	85
Study 1 Discussion.....	86
Findings for Primary Dependent Measures: Urge to Check, Likelihood of Checking, Discomfort, and Worry.....	87
Findings for Secondary Dependent Measures: Reassurance Seeking and Checking by Others.....	95
Limitations.....	99
Conclusions and Implications for the Cognitive Theory of Compulsive Checking....	104
A Continuum of Checking.....	111
Chapter 3: The Puzzle of Repetitive Checking.....	115
Mnestic Deficit Theories of OCD as a Possible Explanation for Repeated Checking....	115
Shortcomings of the Mnestic Deficit Theory as an Explanation for Compulsive Checking.....	122

A Possible Explanation: Part Two of Rachman's Cognitive Theory of Compulsive Checking – The Self-Perpetuating Mechanism.....	124
Support for the Elements of the Self-Perpetuating Mechanism.....	126
Support for the Decreased Confidence in Memory Element of the Self-Perpetuating Mechanism.....	127
Support for the Other Elements of the Self-Perpetuating Mechanism.....	133
Purpose of Study 2.....	134
Overview of Study 2 Design and Hypotheses.....	137
Hypotheses Derived from the Cognitive Theory of Checking.....	138
Study 2 Methods.....	140
Participants.....	140
Sample 1: Participants with OCD and Primary Checking Compulsions.....	140
Sample characteristics.....	141
Sample 2: Undergraduate Students.....	142
Sample characteristics.....	142
Procedure.....	143
Dependent Measures.....	146
Study 2 Results.....	146
Analyses.....	146
Student Sample.....	147
Perceived Responsibility for Harm.....	147
Perceived Severity of Harm.....	147
Perceived Probability of Harm.....	147
Urge to Check.....	148
Discomfort/Anxiety.....	149
Confidence in Memory.....	149
Final State of the Item.....	150
OCD Sample.....	150
Perceived Responsibility for Preventing Harm.....	150
Perceived Severity of Harm.....	150
Perceived Probability of Harm.....	150
Urge to Check.....	151
Discomfort/Anxiety.....	151
Confidence in Memory.....	152
Final State of the Item.....	152
Post-Hoc Analyses on Probability.....	152

Order or Practice Effects.....	154
Study 2 Discussion.....	154
Multipliers and the Self-Perpetuating Mechanism: The Effects of Single and Repeated Checking on the Multipliers.....	158
Possible Explanations for Unexpected Findings for the Multipliers.....	159
Memory Confidence and the Self-Perpetuating Mechanism: The Effects of Single and Repeated Checking on Confidence in Memory.....	169
Possible Explanations for Unexpected Findings for Memory Confidence....	171
Conclusions and Implications for the Cognitive Theory of Compulsive Checking...	183
Chapter 4: General Discussion.....	185
Implications for the Cognitive Theory of Compulsive Checking and Directions for Future Research.....	189
The Self-Perpetuating Mechanism Revisited.....	196
Implications For Clinical Practice.....	201
Themes.....	203
Added Value of the Specific Cognitive Approach.....	203
Threshold Models.....	204
Continuity.....	205
Conclusions.....	206
References.....	207
Appendix 1.....	262
Appendix 2.....	278
Appendix 3.....	279

## List of Tables

Table 1:	Age, Gender, Years of Education and Marital Status for the Three Samples in Study 1.....	227
Table 2:	Clinical Characteristics of the Anxious Control and OCD Samples in Study 1.....	228
Table 3:	Study 1 Means and Standard Deviations on Measures of Depression, Anxiety, Responsibility, and Obsessive Compulsive Symptoms.....	229
Table 4:	Intercorrelations among Mean Ratings on Dependent Variables for Study 1 – Students.....	230
Table 5:	Intercorrelations among Mean Ratings on Dependent Variables for Study 1 – Anxious Controls.....	231
Table 6:	Intercorrelations among Mean Ratings on Dependent Variables for Study 1 – OCD Participants.....	232
Table 7:	Manipulation Check for Responsibility in Study 1.....	233
Table 8:	Manipulation Check for Severity in Study 1.....	234
Table 9:	Manipulation Check for Probability in Study 1.....	235
Table 10:	Summary Table of Repeated Measures ANOVA Findings for Study 1.....	236
Table 11:	Cell Means for Urge to Check for Study 1.....	237
Table 12:	Cell Means for Likelihood of Checking for Study 1.....	238
Table 13:	Cell Means for Discomfort for Study 1.....	239
Table 14:	Cell Means for Worry for Study 1.....	240
Table 15:	Cell Means for Reassurance Seeking for Study 1.....	241
Table 16:	Cell Means for Checking by Other for Study 1.....	242
Table 17:	Cell Means for Student, Anxious Control, and OCD Samples.....	243
Table 18:	Age, Gender, and Years of Education, and Marital Status for the Two Samples in Study 2.....	244
Table 19:	Clinical Characteristics of the OCD Sample in Study 2.....	245
Table 20:	Study 2 Means and Standard Deviations on Measures of Depression, Anxiety, Responsibility, and Obsessive Compulsive Symptoms.....	246

Table 21:	Summary Table of Repeated Measures ANOVA Findings for Study 2.....	247
Table 22:	Cell Means for Responsibility for Study 2.....	248
Table 23:	Cell Means for Severity for Study 2.....	249
Table 24:	Cell Means for Probability for Study 2.....	250
Table 25:	Cell Means for Urge to Check for Study 2.....	251
Table 26:	Cell Means for Discomfort/Anxiety for Study 2.....	252
Table 27:	Cell Means for Confidence in Memory for Study 2.....	253
Table 28:	Intercorrelations among Mean Ratings on Dependent Variables for Study 2 – Students.....	254
Table 29:	Intercorrelations among Mean Ratings on Dependent Variables for Study 2 – OCD Participants .....	255
Table 30:	Percentage of OCD sample reporting 8, 9, or 10 on the multipliers.....	256

## List of Figures

Figure 1:	Effects of Having None, One, Two or All Three Multipliers Elevated on Likelihood of Checking.....	257
Figure 2:	Effect of Different Responsibility and Probability Combinations on Likelihood of Checking .....	258
Figure 3:	Likelihood of Checking among Students Reporting No Responsibility and those Reporting At Least Some Responsibility in the Low Responsibility, High Severity, High Probability Scenario .....	259
Figure 4:	Likelihood of Checking among Anxious Control Participants Reporting No Responsibility and those Reporting At Least Some Responsibility in the Low Responsibility, High Severity, High Probability Scenario .....	260
Figure 5:	Likelihood of Checking among OCD Participants Reporting No Responsibility and those Reporting At Least Some Responsibility in the Low Responsibility, High Severity, High Probability Scenario .....	261

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## CHAPTER ONE: INTRODUCTION

### Purpose

Over the last 20 years, psychologists have gained much ground in the understanding and treatment of anxiety disorders. The influx of cognitive interpretations of anxiety and anxiety-related phenomena, led by Clark (1986) and Salkovskis (1985), has made a major contribution to knowledge in this area. In particular, Salkovskis' (1985, 1989) pioneering work on a cognitive theory of obsessive-compulsive disorder (OCD) has stimulated an explosion of theoretical and empirical work aimed at improving our understanding of this frequently disabling disorder. Salkovskis' cognitive theory proposes a single mechanism (inflated responsibility) underlying the most common OCD subtypes (e.g., checking, washing, ordering/arranging, counting, etc.). However, some researchers (e.g., Rachman, Thordarson, Shafran & Woody, 1995; Jones & Menzies, 1997a) have suggested that the concept of inflated responsibility may be more applicable to some subtypes than to others. In addition, phenomenological differences and differences in treatment responsiveness among the various subtypes have raised questions about the adequacy of any single mechanism to explain the breadth of OCD symptomatology, and have suggested that various subtypes may require separate theoretical explanations (e.g., de Silva, 1986; Summerfeldt, Richter, Antony, & Swinson, 1999).

As knowledge accumulates, there has been a drive to make theoretical explanations of obsessive-compulsive disorder increasingly specific. Recently, more specific cognitive behavioural conceptualisations have been put forth to explain particular subtypes of OCD-related behaviour, such a cognitive theory of obsessions (Rachman, 1997, 1998) and a cognitive behavioural theory of compulsive hoarding (Frost & Hartl, 1996; Frost & Steketee, 1999). Other theories to explain compulsive ordering and arranging (Radomsky, 2001) and compulsive

washing (S. Rachman, personal communication, September 14, 2002) are currently being developed.

The purpose of this series of studies was to provide the first experimental tests of Rachman's (2002) cognitive theory of compulsive checking. This new theory is the first that has been specifically written to explain compulsive checking. It lays out both situational and more enduring, person-related factors that are hypothesized to drive the occurrence of checking behaviours in particular situations, as well as factors that promote the recurrence of these behaviours. Given some of the phenomenological differences between checking and washing compulsions (described below), and the only moderate success of the most commonly used psychological treatment for OCD, exposure and response prevention, the need for a fresh analysis of checking behaviour and for studies that evaluate the utility and explanatory power of such a theory is clear.

### **OCD is ...: Definition and Prevalence Of OCD**

In the current psychiatric nosology, the Diagnostic and Statistical Manual of Mental Disorders, 4<sup>th</sup> edition, Text Revision (DSM-IV-TR; APA, 2000), obsessive-compulsive disorder is characterized by (1) recurrent, unwanted intrusive thoughts, images or doubts (obsessions) and/or (2) repetitive behaviours or mental acts that are intended to reduce distress (compulsions). Obsessions are by definition covert, whereas compulsions may be either overt or covert. Examples of common obsessions include fears of contamination, doubts about actions, and aggressive thoughts or impulses. Common overt compulsions include washing, checking, and repeating actions. Common covert compulsions include thinking certain words or phrases, praying, or counting. In order to merit a diagnosis of OCD, the obsessions and/or compulsions

must consume more than 1 hour per day and cause clinically significant distress or impairment in social or occupational functioning (APA, 2000).

Obsessive-compulsive disorder tends to have a chronic, waxing and waning course over the lifespan (Eisen & Steketee, 1998; Rachman & Hodgson, 1980; APA, 2000). Although estimates vary, it appears that the lifetime prevalence of OCD across studies in North America and Europe is between 2 and 3% (Antony, Downie & Swinson, 1998; Sasson, Zohar, Chopra, Lustig, Iancu, & Hendler, 1997), with a roughly equal gender ratio or possibly slightly more females than males being affected in adulthood (Antony et al., 1998). In Canada, it is estimated that approximately 2.9% of the population will meet diagnostic criteria for obsessive-compulsive disorder at some point in their lifetimes (Kolada, Bland, & Newman, 1994). Obsessive-compulsive disorder is strongly associated with depression (Brown et al., 2001; Crino & Andrews, 1996; Rachman & Hodgson, 1980). It is also commonly associated with other anxiety disorders, including social phobia and specific phobias. Comorbidity with panic disorder (with or without agoraphobia) and with generalized anxiety disorder, though less common, is also sometimes observed (Brown et al., 2001; Clark, 2004; Crino & Andrews, 1996; Rasmussen & Tsuang, 1986). Many studies have suggested that OCD is associated with significant costs to society in terms of direct health care costs and both short and long-term disability benefits (Leon, Portera, & Weissman, 1995; Simon, Ormel, Von Korff, & Barlow, 1995). Other studies have documented the more personal costs of OCD in terms of impaired social and familial functioning (Calvocoressi et al., 1995; Khanna, Rajendra, & Channabasavanna, 1988), marital problems (Emmelkamp, de Haan, & Hoogduin, 1990; Riggs, Hiss & Foa, 1992), and lowered quality of life (Koran, Thienemann, & Davenport, 1996), relative to those without the disorder.

## **The Phenomenology of Checking**

Checking compulsions are the most commonly reported form of compulsion in samples of individuals with OCD, outstripping the next most common form of compulsive behaviour, compulsive washing, at a rate estimated to be between 4:3 and 6:3 (Henderson & Pollard, 1998; Summerfeldt, Antony, Downie, Richter, & Swinson, 1997). Several studies have found that approximately 80% of individuals with OCD report checking compulsions (Rasmussen & Eisen, 1992; Rasmussen & Tsuang, 1986; Summerfeldt, Antony, Downie, Richter, & Swinson, 1999). Checking compulsions are repetitive, stereotyped and intentional. These behaviours are accompanied by a sense of internal pressure to act, and will often provoke attempts to resist this urge (Rachman, 2002). Common forms of checking compulsions include: checking locks, stoves, or appliances (e.g., in order to prevent break-ins or fires), checking that one has not or will not harm others (e.g., retracing a driving route to make sure that one did not hit someone with one's car without noticing), and checking that one has not or will not harm oneself (e.g., checking the expiry date on foods or medications before or after ingestion). Other less commonly seen types of checking compulsions include: checking that nothing terrible did/will happen (e.g., that neighbours are still alive, that one did not commit a crime) and checking that one did not make a mistake (e.g., checking an assignment over and over).

Checking compulsions can be viewed as a type of preventative behaviour that is intended to reduce the likelihood of a future misfortune, thereby protecting others and/or oneself from harm (Rachman, 2002). These actions also serve to temporarily reduce discomfort or anxiety. Most checking occurs in the individual's own home, as this is usually the place where the checker feels most responsible. However, checking may occur in other situations, (e.g., in a hotel room on vacation; at work; on an inpatient ward) if the person develops a sense of responsibility

for that domain. The presence of another person generally dampens the urge to check, presumably because of a partial transfer of responsibility from the compulsive checker to the other person (Roper & Rachman, 1975). As noted by Rachman (1976), checking compulsions “are most intense when the person feels responsible for the act concerned, or put another way if they feel they are not responsible they seldom engage in intense checking compulsions” (Rachman, 1976, p.270).

Checking compulsions are frequently associated with indecisiveness and doubt (e.g., did I turn off the stove properly after using it? Should I go back to check?), and may take up to several hours to complete. At times the person will simply repeat the same check (e.g., of a door lock) over and over again because of doubts that the check was properly or adequately executed. At other times, the person may feel compelled to work through a lengthy checking “circuit” several times before leaving the house or going to bed. Individuals with checking compulsions are typically aware of the excessive nature of their behaviour and wish to disrupt it, but the tension and anxiety associated with resisting the urge to check are often difficult to tolerate. Checking compulsions tend to intensify during periods of depressed mood (Rachman, 1976).

In addition to performing a check oneself, there are other variants of checking behaviour that are commonly seen. For example, individuals with checking compulsions will often ask others to carry out the check on their behalf (“checking by proxy”). Repeatedly asking for reassurance from others is also common among compulsive checkers. For example, individuals with checking compulsions may ask for reassurance that feared consequences will not occur or that they have completed their compulsion appropriately thoroughly and do not need to take further action. This is viewed by some researchers as a “disguised” form of compulsive checking (Rachman, 2002). Both “checking by proxy” and reassurance seeking serve to reduce

responsibility, as the person who checks or offers reassurance is seen as taking on some of the responsibility for any harm that occurs (Salkovskis, 1998).

### **Checking in Non-Clinical Populations**

In the last 20 years, one of the most important advances in our understanding of OCD has come from the recognition that obsessions and compulsions occur not only in individuals with OCD, but are also quite common in non-clinical populations (Rachman & Hodgson, 1980; Salkovskis & Harrison, 1984, Muris, Merkelbach, & Clavan, 1997). For example, it has been found that between 80 and 88% of individuals from non-clinical populations experience intrusive, unwanted thoughts, often about harm coming to the self or others (Rachman & De Silva, 1978; Salkovskis & Harrison, 1984). These intrusive thoughts do not differ from clinical obsessions in form or content; however, they are experienced less frequently and less intensely, and are easier to dismiss, than clinical obsessions. Similarly, approximately 55% of non-clinical individuals reported engaging in compulsive behaviour in a self-report study (Muris et al., 1997). These non-clinical rituals did not differ from clinical compulsions in content; however, they were less frequent, less intense, less distressing and provoked less resistance than clinical rituals (Muris et al., 1997). In light of the parallels between clinical compulsions and normal rituals, the authors of this study concluded that “normal rituals can be studied as analogues of clinical compulsions” (Muris et al., 1997, p. 251). In addition, in a study using more rigorous criteria and a clinical interview, it was found that 22% of a Canadian community sample had clinically significant compulsions, and that the prevalence of subclinical OCD was equal to the prevalence of diagnosable OCD, suggesting that many people have obsessive-compulsive symptoms that fail to meet diagnostic thresholds (Stein, Forde, Anderson & Walker, 1997). Other studies have found similarities between OCD patients and non-patients with OC symptoms in features

associated with OCD, such as symptoms of anxiety and depression (Burns, Formea, Keortge & Sternberger, 1995; Gibbs, 1996). That is, non-clinical participants who score highly on measures of OCD have patterns of comorbidity that closely parallel those found in clinical investigations (Gibbs, 1996). Finally, in an extensive literature review of the comparability of individuals with subclinical obsessions and compulsions, and patients with OCD, Gibbs (1996) concluded that these groups are similar in regards to a number of important characteristics including symptom profile, comorbid psychopathology, and associated personality and psychological characteristics. She further concluded that individuals with subclinical obsessions and compulsions

possess what might be considered a milder variant of OCD. As such, analogue research with [such individuals] appears to be a worthwhile method for examining hypotheses about OCD, given the relatively limited number of OCD patients available for research purposes and the large number of individuals who exhibit low-level obsessive-compulsive symptoms. (Gibbs, 1996, p. 765)

Taken together, these findings suggest that obsessive-compulsive phenomena occur on a continuum from subclinical to clinical levels of frequency and intensity, and that much can be learned from the study of obsessions and compulsions in non-clinical populations (Burns et al., 1995; Gibbs, 1996). In particular, it has been argued that such studies may play an important role in helping us to understand the etiology and basic processes underlying more severe obsessions and compulsions. As a result, studies and experiments examining these phenomena in non-clinical populations have proliferated rapidly.

The study of non-clinical populations may be especially important in our understanding of compulsive checking. In the self-report study by Muris and colleagues (1997) described above, 27% of the non-clinical individuals who engaged in compulsive rituals reported engaging



in compulsive checking behaviour. In other words, approximately 14% of the overall non-clinical sample reported significant, though subclinical, checking behaviour. Similar results were found in the Canadian community-based study described above, in which 15.1% of the total sample reported checking compulsions during a clinical interview by trained staff, making checking by far the most commonly reported compulsion (Stein et al., 1997). Thus, given the relative rarity of OCD, the examination of non-clinical checking behaviour stands to play an important role in our understanding of compulsive checking, both as an analogue for clinical checking compulsions and as an important phenomenon in its own right. Moreover, given that checking occurs in both clinical and non-clinical populations, any adequate theory of checking behaviour must explain its occurrence in non-clinical populations and its persistence and repetitive nature in clinical subjects. The new cognitive theory of compulsive checking tested in this series of studies provides such an explanation. However, prior to describing this new theory and how it was tested, it is necessary to place both test and theory within a historical and theoretical context.

### **A Brief History of Modern Psychological Theories of OCD**

Over the years, many theories have been put forth to account for anxiety in general and obsessive-compulsive disorder in particular. The first modern attempts to derive a psychological theory of obsessive-compulsive phenomena were not specific to checking, or even to OCD. These theories (e.g., Mowrer's two-factor theory of fear, described below) were used to explain obsessional phenomena using principles that are universally applicable. In this way, these classic theories foreshadowed the continuity between obsessions and normal thought processes, and between compulsions and normal rituals, that is so central to current conceptualisations.

## **Mowrer's Two-Factor Theory of Fear:**

### **Towards a Behavioural Theory of Obsessional Problems**

One of the first general theories to be adapted to explain obsessional phenomena was Mowrer's classic two-stage theory of fear and avoidance (1939, 1960). Mowrer's theory was simple and elegant. In the first stage of the theory, he proposed that fear of a neutral stimulus arises through the pairing of this stimulus with an unconditioned stimulus that is inherently anxiety- or fear-provoking. Through this process, the previously neutral stimulus and other stimuli associated with it (e.g., thoughts or objects) develop the ability to evoke the fear response (i.e., classical conditioning). Central to his theory was the idea that fear has strong motivational properties and drives the individual to seek relief. Any action (e.g., escape or avoidance behaviour) that is effective in reducing the fear response is reinforced and strengthened (i.e., operant conditioning through negative reinforcement). Finally, although these fear-reducing responses are effective in the short term, they ultimately prevent extinction of fear.

Although some aspects of Mowrer's theory (1939, 1960) were later shown to be inadequate, especially insofar as the acquisition of fears is concerned (see Rachman, 1990, for a review), his theory was extremely influential in the field of anxiety. For example, Joseph Wolpe (1958) was influenced by Mowrer's theory in the development of systematic desensitization. This first modern behavioural treatment was successful in the treatment of phobias, which prompted Wolpe to apply it to obsessional problems. However, as a treatment for such problems, systematic desensitization was a disappointment and the prognosis for obsessional problems remained extremely poor.

Much changed in 1966, when Victor Meyer reported the successful treatment of two individuals with chronic obsessional problems using a new form of therapy. His treatment

consisted of inpatient treatment with prolonged exposure to feared obsessional cues and deliberate prevention of the associated rituals by hospital staff (e.g., turning off the water supply in the patient's bathroom to prevent excessive washing). A subsequent case series and 5 year follow-up of 15 patients treated with this technique provided support for the effectiveness of this therapy (Meyer & Levy, 1973; Meyer, Levy & Schnurer, 1974). Foreshadowing later cognitive interpretations of exposure and response prevention, Meyer (1966) suggested that the mechanism of change in his treatment was the modification of expectations that occurred when the ritual was prevented and the expected extreme anxiety response and negative outcome (e.g., contamination leading to serious illness) did not transpire. He argued that "a completely successful modification of expectations would lead to a complete elimination of ritualistic behaviour" (Meyer, 1966, p. 280). Meyer's pioneering work marked the beginning of the successful application of psychological models of anxiety to obsessions and compulsions and the beginning of effective behavioural treatments for OCD (Salkovskis, 1998). However, a clearly articulated theoretical rationale for a behavioural approach to the treatment of OCD in particular was still missing.

### **The Behavioural Theory of Obsessive-Compulsive Disorder**

With Mowrer's theory of fear as a backdrop, Meyer's (1966) successful application of learning principles to treating obsessional problems and the research evidence demonstrating the ubiquity of intrusive, unwanted thoughts set the stage for the development of a behavioural theory of obsessive-compulsive disorder.

Drawing upon Mowrer's two-factor theory, the behavioural theory of OCD postulates that normally occurring intrusive and unwanted thoughts, images, or impulses become associated with fear through a process of classical conditioning. After this has happened, any occurrence of the obsession provokes anxiety or discomfort, motivating a search for a behaviour that will

reduce this distress. Any escape or avoidance behaviour, such as compulsive cleaning or checking, that serves to reduce anxiety is then reinforced. The occurrence of this anxiety reducing, compulsive behaviour in turn serves to maintain the obsession. Thus, compulsions serve an anxiety-reducing function and prevent the extinction of the anxiety aroused by obsessions (Rachman & Hodgson, 1980).

A series of studies carried out by Rachman and colleagues at the Maudsley Hospital in London provided support for the behavioural theory of OCD (Rachman & Hodgson, 1980). As summarized in Rachman and Hodgson (1980), these researchers found that, in general: (a) exposure to obsessional cues increases anxiety; (b) carrying out the appropriate compulsive ritual (e.g., checking or cleaning) is associated with a decline in anxiety; (c) if the compulsive ritual is delayed or prevented, there is a spontaneous, gradual decrease in anxiety over the space of approximately 1 hour; and (d) if the person refrains from carrying out the compulsive ritual, the anxiety rating on the next exposure trial is lower.

Together with the theory described above, these findings provided strong support and motivation for a refinement and expansion of Meyer's pioneering treatment for obsessional patients. Meyer's original technique was further developed and refined by Rachman and colleagues (Rachman, Hodgson & Marks, 1971). These authors combined gradual, graded, in vivo exposures to specific feared stimuli with response prevention. Therapeutic modelling was incorporated as a way of providing information and expediting patient willingness to comply with exposure. Rachman and colleagues revised the technique in such a way as to permit outpatient treatment, thus improving accessibility. Exposure and response prevention in this more modern form continues to be used today and remains the single most effective psychological treatment for OCD (Abramowitz, 1997; see Foa, Franklin & Kozak, 1998, for a

review).

While this behavioural theory of OCD was extremely successful, both in terms of its explanatory power and its translation into an effective psychological treatment for OCD, exposure and response prevention, there were clear limitations to the scope of this theory. Several factors indicated the need for a reanalysis of obsessional problems. First, despite its success, there were significant limitations to the use of exposure and response prevention. Although this technique is effective for patients who are able to complete a full course of treatment, the rate of treatment refusal and dropout can be very high (Foa et al., 1998; Stanley & Turner, 1995). Some studies suggest that as many as 30% of individuals initially assigned to exposure and response prevention will refuse to begin treatment, or will drop out before receiving a full course of treatment (Foa, Steketee, Grayson, & Doppelt, 1983; Stanley & Turner, 1995). Moreover, even among those individuals who successfully complete a full course of treatment, significant symptoms levels often remain (Baer & Minichello, 1998, Whittal & McLean, 1999). For example, one long-term follow-up study of behavioural treatment for OCD found that 40% of initial symptoms remained, even after successful treatment (O'Sullivan & Marks, 1991). Others have noted that residual deficits in social and occupational functioning are common following treatment (e.g., Salkovskis, 1998). Thus, there is room for improvement in our ability to treat OCD. A new theory could offer much needed guidance.

Second, as noted by Salkovskis (1998), the behavioural theory of OCD was not adequately discriminating. Mowrer's two-factor theory could just as easily be applied to other anxiety disorders, such as specific phobia, with the minor adjustment that the neutral stimulus be, for example, a spider in the case of a spider phobia. Using the two-factor theory, the specific focus of fear was merely an accident of what neutral stimulus was present at the time the

unconditioned stimulus occurred. However, the distribution of feared stimuli in the population was non-random (see Seligman, 1971, for a discussion of preparedness theory). This inability of the behavioural theory to discriminate between OCD and other anxiety disorders was seen by many as a major shortcoming (e.g., Salkovskis, 1985). Third, the behavioural theory had considerable difficulty in dealing with the non-behavioural aspects of OCD, and with obsessions (which are essentially cognitions) in particular. As obsessions are a key feature of the disorder, this was a serious limitation.

Finally, the behavioural theory of OCD seemed ill-equipped to explain some of the interesting clinical observations that had been made in earlier experiments intended to test the behavioural theory. For example, Roper, Rachman, and colleagues (Roper, Rachman, & Hodgson, 1973) found that it was much more difficult to provoke urges to check among OCD “checkers” than it was to provoke urges to wash among OCD “washers”. The explanation offered by the patients was that the presence of another person during the experiment, who presumably would not allow them to do anything that would put themselves or the hospital at risk, alleviated much of the urge to check. The authors speculated that this might be due to the perception on the part of the patients that any responsibility for harm that occurred as a result of the “act of carelessness”, (e.g., failure to check) would rest on the experimenter and not on the patients. In a later experiment to replicate these findings (Roper et al., 1975), the authors found that it was easier to provoke urges to check when the experimenter was not present (e.g., when the patient was at home alone), and that checking rituals took less time to complete and produced greater reductions in discomfort when the experimenter was present. The behavioural theory could not predict or explain these findings. In sum, the limitations of the exposure and response prevention, the lack of specificity of the behavioural theory, its inability to explain important

cognitive aspects of the disorder, and its inability to explain some of the interesting findings that were accumulating in the literature all signalled the need for new thinking about obsessive-compulsive disorder and its treatment.

### **Towards a Cognitive Theory of OCD: Early Attempts at Cognitive Theories**

Following Beck's revolutionary cognitive theory of depression (Beck, 1976), cognitive formulations of the anxiety disorders began to emerge (see Van Oppen & Arntz, 1994, for a review). Over time, these new cognitive theories would lead to a revolution in our understanding and treatment of many anxiety disorders, including OCD.

### **Carr's Cognitive Theory of OCD**

One of the earliest attempts to apply a cognitive perspective to obsessive-compulsive disorder was made by Carr (1974). Following Lazarus' (1966) concept of "threat appraisal", Carr emphasized the role of unrealistic threat appraisals in OCD. He noted that individuals with OCD overestimate the degree of threat in a situation largely because they make unrealistically high estimates of the probability of potential negative events. He argued that these unrealistically high probability estimates interact with the perceived cost of the negative event to produce extremely high perceived threat. Compulsions serve to lower the probability of the feared negative event, thereby reducing the perceived threat. Although this theory was valuable in its attempt to incorporate cognitive concepts into our understanding of OCD, it suffered from the same problem that had plagued the behavioural theory of OCD, namely that the proposed mechanism (i.e. overestimation of risk) was not specific to OCD, but rather is evident throughout the anxiety disorders (for example, specific phobias and social phobia)<sup>1</sup>.

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<sup>1</sup> Subsequent research has offered support for the idea that anxiety in general is associated with overestimation of threat or risk (e.g., Butler & Mathews, 1983, Foa, Franklin, Perry, & Herbert, 1996; Sookman & Pinard, 2002; Stober, 1997).

### **McFall and Wollersheim's Cognitive Theory of OCD**

A few years later, McFall and Wollersheim (1979) drew upon Carr's (1974) model of OCD and Lazarus' (1966) concepts of primary and secondary appraisal to formulate another cognitive model of OCD. This new model was intended to bridge the gap between psychoanalytic and behavioural explanations of OCD, and to explain OCD in terms that would differentiate it from the other anxiety disorders. McFall and Wollersheim's model emphasized factors that were presumed to underlie the inflated threat appraisals that Carr (1974) had discussed in his theory. They proposed that the perception of threat in OCD is the result of an appraisal process in which the individual evaluates the potential negative outcome associated with an event (primary appraisal) against their resources to cope with the event (secondary appraisal). These appraisals raise the individual's anxiety level and motivate compulsive behaviour based on that individual's secondary appraisal of the likely effects of their efforts to reduce threat. McFall and Wollersheim (1979) proposed that several unreasonable beliefs affect the primary appraisal process and serve to inflate the perception of danger or threat that emerges from this process: (a) one should be perfect; (b) making mistakes should result in punishment and condemnation; (c) one is powerful enough to initiate or prevent the occurrence of disastrous outcomes by magical rituals or obsessive ruminating; and (d) certain thoughts and feelings are unacceptable and could lead to catastrophe. They also proposed a series of beliefs that were hypothesized to influence the secondary appraisal process by making the individual feel that he or she lacked the skills to adequately deal with the threat in a realistic fashion: (a) if something is or may be dangerous, one should be terribly upset by it; (b) magical rituals or obsessional ruminating will circumvent feared outcomes; (c) it is easier and more effective to carry out a magical ritual or to obsess than it is to confront one's feelings or thoughts directly; and (d)



feelings of uncertainty and loss of control are intolerable, should make one afraid, and something must be done about them. Based on their perceptions of extreme threat and their perceived lack of resources to adequately address the threat, individuals with OCD engage in compulsive behaviour in an attempt to prevent the negative outcome. McFall and Wollersheim (1979) argued that the individual with OCD views his symptoms as the best option for reducing perceived threat and associated distress. The authors noted that although the performance of rituals is associated with distress, this distress is viewed as preferable to the distress that would arise if the rituals were not performed and the feared event occurred. Although McFall and Wollersheim's theory went a step further than Carr's by incorporating the idea of underlying beliefs that influence the appraisal process, their theory relied heavily upon the idea of preconscious cognitions, and was unable to specify how these cognitions differed from the cognitions of other anxiety-disordered patients (Salkovskis, 1985). The search for a feature specific to OCD continued.

### **The Revolution Begins: Salkovskis' Cognitive Theory of OCD**

The latter half of the 1980s saw a revolution in modern thinking about OCD. In a pair of insightful papers, Salkovskis (1985, 1989) articulated a new cognitive-behavioural theory of OCD. In his theory, he focused on the role of inflated personal responsibility in creating and driving OCD-related thoughts and behaviour. Salkovskis was critical of previous cognitive theories, such as those of Carr (1974) and McFall and Wollersheim (1979), which did not provide an explanation for obsessional problems that would differentiate them from other anxiety and mood disorders. He also wanted to provide an account of obsessional phenomena that was firmly placed within the now advanced cognitive theory.

The basic assumptions underlying this new theory were the same as those espoused by

many cognitive theorists, namely that (a) emotions result from the appraisal of events (including the appraisal of obsessional thoughts), not the events themselves; (b) pre-existing beliefs and attitudes influence appraisals; (c) appraisals and emotional responses tend to reciprocally influence each other; and (d) behaviour is influenced by appraisals and vice versa. In his formulation of this theory, Salkovskis was also influenced by the earlier work on compulsive checking by Roper, Rachman and colleagues (described above), conducted approximately 10 years earlier, in which they speculated that responsibility for harm might play a central role in determining urge to ritualise among compulsive checkers.

In his theory of OCD, Salkovskis (1985, 1989) proposed that universally occurring intrusive thoughts are the raw material of obsessions. If an individual has an intrusive thought, appraises it as being benign or meaningless, and irrelevant to further action, then further processing of the intrusive thought is unlikely. If on the other hand, an individual has an intrusive thought and appraises it as meaningful, then further processing will ensue. More specifically, if the person interprets the intrusive thought as an indication that he or she might be responsible for harm to the self or others, unless he or she acts to prevent it, then this will provoke both distress and the urge to suppress or neutralize the thought in some manner (e.g., by washing, checking, or performing some kind of mental ritual). Neutralizing behaviour is construed as an attempt both to relieve distress and to reduce the responsibility associated with the occurrence of the thought. Salkovskis noted that reassurance seeking is also common in such situations, and is seen as a way of “spreading” the responsibility onto others so that the self is less uniquely responsible. Once the neutralizing response is established, it is reinforced by its perceived association with reduced responsibility for potential harm and decreased anxiety. However, this neutralizing behaviour, though intended to provide relief, is said to make the intrusive thought more salient,

more frequent, more distressing, and hence more likely to provoke neutralizing behaviour, thus fuelling a vicious cycle of obsessions and compulsions. Moreover, the neutralizing behaviour prevents the disconfirmation of the appraisal or the beliefs that underlie it.

Salkovskis argued that if the appraisal of the thought is merely that it involves threat or loss, then person is likely to have an anxious or depressive response, rather than an obsessional one. In this way, his theory proposes a specific mechanism underlying obsessive-compulsive phenomena (i.e., appraisal of the thought as indicating that the person is, or will come to be, responsible for harm to the self or others).

Salkovskis further argued that some individuals are more vulnerable to developing obsessional problems than others because they hold a number of beliefs that make them more prone to make appraisals of personal responsibility in response to intrusive thoughts. These beliefs include: (a) having a thought about an action is the same as performing that action; (b) failing to prevent (or to try to prevent) harm to self or others is the same as having caused the harm in the first place; (c) responsibility is not attenuated by other factors (e.g., low probability of occurrence); (d) not neutralizing when an intrusion has occurred is similar or equivalent to seeking or wanting the harm involved in that intrusion to actually happen; (e) one should (and can) exercise control over one's thoughts; and (f) any influence one has over a negative outcome confers responsibility for that outcome, even in situations where someone else has a greater influence over the outcome (Salkovskis, 1985, p.579). He proposed that these beliefs are more common in, or more strongly held by, individuals with obsessional problems than by those with other forms of psychopathology. He also noted that the presence of other disturbances, such as depressed mood, would tend to aggravate OCD by making intrusive thoughts more likely and negative appraisals of these thoughts more accessible.

Since its publication over 15 years ago, Salkovskis' theory has fuelled an explosion of theoretical and empirical work on OCD. Much support has been found for many of the basic tenets of his theory, and in particular, much research has demonstrated a link between responsibility-related beliefs and obsessive-compulsive symptomatology. For example, results from studies using self-report questionnaires have been quite consistent in demonstrating links between inflated responsibility beliefs, obsessive-compulsive symptoms, and tendency to neutralize in both clinical and nonclinical samples (e.g., Emmelkamp & Aardema, 1999; OCCWG, 2001, 2003; Rheaume, Freeston, Dugas, Letarte & Ladouceur, 1995; Rheaume, Ladouceur & Freeston, 2000; Salkovskis et al., 2000; Steketee, Frost & Cohen, 1998, Wilson & Chambless, 1999). Moreover, comparative studies have provided evidence that individuals with OCD score higher than anxious and non-clinical controls on measures of inflated responsibility beliefs, and that obsessional patients are more likely to make responsibility-related appraisals of intrusive thoughts about possible harm (e.g., OCCWG, 2001, 2003; Salkovskis et al., 2000; Steketee, Frost & Cohen, 1998). In addition, the results of a handful of studies in which responsibility was experimentally manipulated have shown that increases and decreases in perceived responsibility were associated with increases and decreases in variables such as discomfort and urges to neutralize, as predicted by the cognitive theory, in both non-clinical subjects and OCD patients (e.g., Ladouceur et al., 1995; Lopatka & Rachman, 1995; Shafran, 1997; described below). Finally, recent studies have found therapy approaches that emphasize challenging appraisals of inflated responsibility, rather than the obsessions themselves, to be moderately successful (e.g., Ladouceur, Leger, Rheaume, & Dube, 1996). Thus, a variety of studies using both clinical and non-clinical subjects and both correlational and experimental designs have supported the idea that inflated responsibility is a key variable in obsessive-

compulsive symptomatology.

### **Common Themes in Modern Psychological Theories of OCD**

Although the psychological theories that have been put forth to explain OCD are diverse, there are at least two common themes which have emerged over the last 30 years. First, these theories have emphasized the continuity between non-clinical intrusive thoughts and rituals and clinical obsessions and compulsions. This is evident in the way in which obsessions and compulsions are hypothesized to arise from universally experienced intrusive thoughts and be maintained through operant conditioning processes in which the performance of a compulsion is reinforced through its association with decreased distress. This theme of continuity, which is so central to behavioural and cognitive conceptualizations, clearly sets these theories apart from biological and psychodynamic theories of OCD, which explain obsessive-compulsive phenomena in terms of discontinuous processes.

Second, modern psychological theories of OCD have increasingly emphasized the importance of cognitive processes and structures in influencing how situations are perceived and evaluated, and in influencing the emotional and behavioural responses to these. For example, Carr (1974), McFall and Wollersheim (1979), and Salkovskis (1985, 1989) have all highlighted the major influence of underlying appraisals, beliefs and cognitive biases on the emotional and behavioural responses that drive compulsions. In so doing, these theories have drawn together knowledge from both the study of psychopathology and of normal human cognition to enhance our knowledge of this puzzling disorder.

### **The Need for a Specific Theory**

Existing theories of OCD, and the research inspired by these theories, have done much to extend our knowledge, and have contributed greatly to treatments for this disorder. However, for

some time, there have been suggestions that our understanding and treatment of this disorder may benefit from more specific theories (e.g., DeSilva, 1986). There are several reasons why theories of OCD that are particular to certain subtypes<sup>2</sup> are desirable. First, there are significant phenomenological differences among the various subtypes of compulsions. In addition to overt behavioural differences between subtypes such as checking, cleaning, ordering/arranging and hoarding, there are other significant differences. Some of the differences between checking and cleaning compulsions can be used to illustrate this point.

Checking compulsions are intended to *prevent future harm*, take a long time to complete, and tend to be associated with discomfort, whereas cleaning compulsions are intended to *restore a safe state* (by removing contamination), typically take less time to complete, and are associated with a lesser degree of anxiety (Rachman, 2002). In general, checking compulsions are primarily intended to prevent others from coming to harm, whereas cleaning compulsions are intended to prevent harm to the self. In addition, checking tends to be more closely associated with indecisiveness and doubting than is washing. Existing theories, such as Salkovskis' cognitive theory, can account for the occurrence of an urge to check, but are less readily able to explain the persistence of doubt observed preferentially in compulsive checking.

Second, some researchers have suggested that different subtypes may differ in etiology (see Rachman, 1976, for a discussion of checking and washing), and therefore a single theory may be insufficient to accommodate this. Third, there is evidence to suggest that some subtypes differ in terms of ease of provocation, variables influencing the urge to carry out the compulsion, and the impact of ritualising on distress. For example, early studies of checking and cleaning compulsions conducted in the 1970s by Rachman and colleagues found differences in ease of

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<sup>2</sup> The issue of subtypes of OCD is currently the subject of considerable debate within the literature. For a review of the literature and current thinking regarding subtypes, the interested reader is referred to the recent paper by McKay et al., 2004.

provocation of urges to clean and urges to check in the hospital laboratory setting (Rachman, de Silva & Roper, 1976; Roper, Rachman, & Hodgson, 1973; Roper & Rachman, 1975). It proved much easier to provoke cleaning compulsions in the lab or clinic than to provoke checking compulsions. Whereas compulsive washers typically reported high levels of anxiety following provocation in a lab setting, compulsive checkers were far less responsive to attempts at provocation, and were more likely to report discomfort, rather than anxiety. Moreover, in many cases, the urge to check compulsively cannot be provoked unless the individual is in his own home, and the presence of another person will often substantially reduce the urge to check (presumably because of lowered perceived responsibility outside of one's home or in the presence of an experimenter). These effects are not seen among compulsive washers. Furthermore, in these early studies, the completion of a cleaning ritual among compulsive cleaners invariably led to sharp declines in anxiety. In contrast, following the execution of a checking ritual, some checkers reported a decline in their discomfort, some reported no change, and a few even reported a slight increase. Moreover, doubt about the adequacy of the action to offset harm persisted after checking. This was not the case for washing. Thus checking and cleaning compulsions appear to differ significantly in terms of ease of provocation, the variables influencing the urge to carry out the compulsion, and the impact of ritualising on distress, suggesting that different theoretical explanations may be required for these two subtypes of OCD. Finally, in terms of treatment effectiveness, it appears that some subtypes may be more responsive to particular treatments than others (e.g., McLean et al., 2001), and there is evidence to support the idea that cognitive behavioural treatment procedures must be adapted to fit the particular symptom pattern of particular patients (McKay et al., 2004).

Taken together, the differences between subtypes described above have led some to

suggest that certain explanatory concepts may be more relevant to certain subtypes than others (e.g., Jones & Menzies, 1997; Menzies, Harris, Cumming & Einstein, 2000; Rachman et al., 1995). For example, Rachman and colleagues (1995) and others (e.g., Menzies et al., 2000; Clark, 2004) have suggested that the concept of responsibility for harm may be more applicable to checking compulsions than to cleaning/washing compulsions. In fact, Menzies and colleagues have noted that in washers “inflated personal responsibility is rarely present” (p. 1036).

These differences among the various subtypes have raised questions about the adequacy of any single theory to explain the breadth of OCD symptomatology. Thus, as knowledge accumulates, it becomes increasingly desirable to make explanations of OCD more specific. Several specific theories of particular OCD subtypes have recently been put forth or are under development (cf. Frost & Hartl, 1996; Rachman 1997, 1998); but, until very recently, no theory had been put forth to account specifically for compulsive checking.

### **Towards a Satisfactory Theory of Compulsive Checking**

There are several phenomenological/observational and research findings that should be addressed in the context of a satisfactory theory of compulsive checking. Such a theory should:

- (a) provide an explanation of etiology of checking, including an explanation of factors that make some individuals more susceptible;
- (b) specify factors that influence urge to check and checking behaviour, or in other words, explain under what circumstances checking will occur in both clinical and non-clinical populations;
- (c) explain the continuity between non-clinical and clinical checking;
- (d) explain the repetitive nature of checking behaviour (i.e., why checking an object once is inadequate for compulsive checkers);
- (e) provide an explanation for the persistence of checking behaviour;
- (f) explain why the presence of others mitigates urges to check;
- (g) explain why compulsive checkers report difficulty remembering whether a check has been performed



safely, even minutes after the check has been completed and (h) provide a rationale for what treatments will work, and which ones will fail to work and why.

The new cognitive theory of compulsive checking to be tested in this series of studies provides an explanation for the onset and maintenance of compulsive checking behaviour that is distinct from previous generalist theories of OCD. This theory provides testable hypotheses about individual and situational factors that may influence checking behaviour, and about the mechanisms that may transform occasional checking behaviour into repetitive and disabling checking compulsions. In so doing, this theory continues in the tradition of strong psychological theories that endorse the continuity between normal intrusive thoughts and ritualistic behaviours and clinically significant obsessions and compulsions.

### **Overview of the Cognitive Theory of Checking**

The basic premises of Rachman's (2002) cognitive theory of checking can be summarized as follows:

Compulsive checking occurs when people who believe that they have a special, elevated responsibility for preventing harm, mainly to others, feel unsure that a perceived threat has been adequately reduced or removed. In their attempts to achieve certainty about the absence or unlikelihood of harm occurring, people with high responsibility repeatedly check for safety. Paradoxically, these attempts to check for safety can produce adverse effects that turn the checking behaviour into a self-perpetuating mechanism. (Rachman, 2002, p. 629)

There are two major components to Rachman's theory. The first component of the theory concerns the action of "multipliers", factors that increase or multiply the likelihood, frequency

and duration of checking behaviour. The second component is a “self-perpetuating mechanism”. This mechanism is intended to explicate the repetitive nature of checking behaviour.

## **CHAPTER TWO: WHY DO PEOPLE CHECK? THE MULTIPLIERS**

Rachman identifies three multipliers in the theory. The first is perceived responsibility. As the person’s sense of responsibility for preventing harm increases, checking is more likely to occur, to be frequent, and to be repetitive. Rachman and colleagues have noted that this sense of responsibility may arise from external (e.g., situational) or internal (e.g., more enduring, trait-like) sources (e.g., Shafran, Thordarson & Rachman, 1996). The second multiplier is perceived probability of harm. As the perceived likelihood of harm increases, the likelihood, frequency and intensity of checking will increase. The third multiplier is perceived severity of harm – as the perceived severity of potential harm increases, the likelihood, frequency and duration of checking will increase. Thus, in situations where an individual feels relatively high responsibility, feels that harm is relatively likely to occur, and that the potential harm is relatively serious, checking should occur, should be frequent and prolonged. Conversely, in situations where an individual feels less responsible, feels that harm is less likely and that any potential harm would be mild, little checking behaviour is expected to occur.

In sum, as these multipliers increase, the likelihood, frequency and intensity of checking will increase. However, Rachman (2002) proposes that only responsibility is *necessary* for checking to occur. If a person’s responsibility for harm is reduced or removed, then checking will decrease or cease entirely. Finally, based on findings from a seminal study of checking (Lopatka & Rachman, 1995, described below), Rachman proposes that the multipliers influence one another, such that increases in perceived responsibility will tend to inflate perceived probability and severity of harm.

From this analysis of the impact of the multipliers, Rachman (2002) derived several experimental predictions.

1. The frequency, intensity and duration of compulsive checking will increase when any of the multipliers (responsibility for harm, probability of harm, severity of harm) is raised. The frequency/intensity/duration of checking behaviour will decrease when any of the multipliers is lowered. It is proposed that there will be an asymmetry in the relationship between multipliers and checking behaviour. The increase in checking behaviour that will occur when the multipliers are increased will be steeper than the decrease in checking behaviour that will result when the multipliers are decreased. This will be the case even when the percentage change (increase/decrease) in the multipliers is identical.
2. Under controlled conditions, if perceived responsibility is eliminated, the compulsive checking will end.

In singling out perceived responsibility for particular attention, Rachman reiterates the importance of this variable, which he first identified as important to compulsive checking over 30 years ago in his early experiments on compulsive checking (Roper, Rachman & Hodgson, 1973), but also explicitly acknowledges the profound contribution of Salkovskis' cognitive theory of OCD to this theory of compulsive checking. However, there are points of divergence in the way that Salkovskis and Rachman conceptualise responsibility. In response to requests for a precise theoretical definition of his central concept of responsibility, Salkovskis and colleagues offered the following definition: "[responsibility is] the belief that one has power which is pivotal to bring about or prevent subjectively crucial negative outcomes. These outcomes may be actual, that is, having consequences in the real world, and/or at a moral level" (Salkovskis et al., 1996, p. 81).

This definition has been used by many researchers in the field, and has inspired efforts at validation. For example, Rheaume and colleagues (1995) conducted a study to validate an earlier, but very similar definition of responsibility using a large sample of undergraduates. These authors used a series of written scenarios describing situations related to obsessional concerns (e.g., contamination, verification, making errors). Participants described a potential negative outcome that could arise from each situation, and then rated the outcome along several dimensions: (a) probability; (b) severity; (c) influence; and (d) pivotal influence (i.e., the part of the outcome judged to be solely under that person's influence). After making these ratings, the participants rated their perceived responsibility for harm in each situation. These authors examined the contribution of probability, severity, influence, and pivotal influence to the rating of responsibility. It was found that pivotal influence, and to a lesser extent, influence, were the best predictors of perceived responsibility. When these authors compared situations with different levels of responsibility (i.e., compared high and low responsibility situations for each participant), it was found that pivotal influence and influence differed between high and low perceived responsibility, with a small effect for probability and no effect for severity. Thus, influence appeared to be central to the perception of responsibility, while probability and severity were only weakly related. Very similar findings were reported in a later study by same group of researchers (Ladouceur, Rheaume, & Aublet, 1997). These authors have noted that "defining responsibility with requirements for both pivotal power and perception of danger may not be the most parsimonious way to describe the phenomena unless both are required" (Ladouceur et al., 1995, p. 945).

Similarly, in his recent theoretical work, Rachman (2002) has drawn a distinction between responsibility, probability, and severity. His definition of responsibility is considerably

more circumscribed than that of Salkovskis, and is most comparable to the notion of “personal influence”. Rachman (2002) argues that responsibility, probability, and severity of harm are separate constructs, each of which makes individual, important contributions to checking behaviour, although he notes that they may at times overlap and influence one another. It is also important to recognize that the probability, severity, and responsibility estimates hypothesized to be so central to checking behaviour in his theory are subjective estimates made by the individual him- or herself. As clinical experience has repeatedly shown, the “objective” responsibility, probability, or severity of harm is usually ignored or dismissed by the person with OCD. Instead, it is the subjective sense of responsibility, probability and severity that appears to drive the urge to check and actual checking behaviour.

Lastly, it is worth noting that Rachman’s theory incorporates the notion of a continuum of checking behaviour, from the occasional checking performed by most people in the general population to the repetitive, distressing, and disabling checking behaviour displayed by many individuals with severe OCD. Not only are the multipliers hypothesized to influence checking behaviour across the continuum, but in addition, Rachman’s theory proposes a self-perpetuating mechanism that accounts for the transformation of occasional checking behaviour into the more persistent and severe checking behaviour seen in OCD checkers. The self-perpetuating mechanism is described in detail in the second half of this paper.

### **Evidence for the Importance of the Multipliers in Checking**

A number of studies using different methodologies have suggested that the multipliers described by Rachman (2002) are important to checking behaviours.

### **Impact of Responsibility on Checking**

As discussed above, several correlational studies, using both clinical and non-clinical participants, have found relationships between responsibility beliefs and checking behaviour (e.g., Emmelkamp & Aardema, 1999; OCCWG, 2001, Rheaume, Ladouceur & Freeston, 2000; Wilson & Chambless, 1999). In addition, a few studies have manipulated responsibility and examined the impact of relatively higher and lower levels of this factor on checking-related behaviours and emotions. One such study (described briefly above) was conducted by Shafran (1997) using a mixed group of OCD patients. In this study, each participant completed two exposure and response prevention tasks. In one condition, the participant completed an exposure and response prevention task in the presence of an experimenter (lower responsibility), and in the other condition, the participant completed the task while alone (higher responsibility). In each condition, *after* the participant had been exposed to the feared stimulus and 5 minutes of response prevention had been completed, the participant made a number of ratings, including: (a) urge to neutralize; (b) discomfort/anxiety; (c) likelihood of threat; and (d) responsibility for threat (manipulation check). As expected, perceived responsibility ratings were significantly higher when participants completed the task alone than when the task was completed in the presence of the experimenter. Moreover, compared to the low responsibility condition, patients in the high responsibility condition felt significantly more discomfort/anxiety; that the feared consequence was more likely to happen; and reported a stronger urge to perform the compulsion. Further, in correlational analyses, significant positive relationships were found between perceived responsibility for threat, discomfort/anxiety, and urge to neutralize within both the high and low responsibility conditions. As noted above, severity of threat was not assessed in this study. Thus, this study provided experimental evidence that levels of responsibility were

related to urge to neutralize, discomfort, and perceived probability of harm in a mixed OCD sample.

Although the findings of Shafran's (1997) study are certainly consistent with what would be expected on the basis of Rachman's (2002) theory, for the purposes of evaluating the utility of the construct of responsibility for checking compulsions in particular, a study examining the effect of high versus low responsibility in a sample of compulsive checkers would be especially informative. Such a study was conducted by Lopatka and Rachman (1995). In this study, the authors examined the hypothesis that raising and lowering levels of perceived responsibility would result in corresponding changes in a variety of checking-related dependent variables in a sample of OCD patients with primary checking compulsions. The study was conducted as a series of behavioural approach tasks in the participant's home, as previous clinical work had suggested that it was difficult to provoke checking in the laboratory setting, and that checking was most likely to occur in the home.

Each participant was exposed to situations that would normally provoke checking under three conditions: higher responsibility, lower responsibility and control (baseline responsibility). The manipulation of responsibility was accomplished using written contracts. In the higher responsibility condition, the participant assumed all responsibility for all potential negative events following the next exposure. In the lower responsibility condition, the experimenter assumed responsibility for any harm that might occur as a result of not checking. In the control condition, no change in baseline levels of responsibility was attempted. All participants completed the control condition first. In each condition, participants were first asked to go into the triggering situation and to perform an action that would be likely to trigger an urge to check (e.g., turn the stove on and off and then walk into the next room without checking at all).

Participants then made a series of pre-assessment ratings, including (a) urge to check; (b) discomfort; (c) perceived likelihood of threat; (d) perceived severity of threat; and (e) perceived responsibility. The responsibility manipulation instructions were then given, and participants were asked to re-enter the situation and to perform the same action, again without checking. Following this second exposure to the triggering situation, participants completed the same self-report ratings as before as part of the post-assessment.

Analyses revealed that the manipulations were successful. As expected, urge to check, and discomfort/anxiety were lower in the lower responsibility condition than in either of the other two conditions. A trend towards the opposite pattern of results was observed in the higher responsibility condition; that is, there was a trend toward a stronger urge to check, and greater discomfort/anxiety. The authors speculated that the failure to obtain statistically significant results for the higher responsibility condition may have been attributable to a ceiling effect for perceived responsibility.

In addition to these expected results, Lopatka and Rachman (1995) found evidence for two cognitive biases. First, participants endorsed high levels of responsibility for events over which they knew that they had little or no control, suggesting that variations in responsibility are independent of a sense of perceived control. Second, there was a tendency for participants to “confuse” responsibility and probability, such that a decrease in responsibility was followed by a significant decrease in probability. Although not highlighted in the discussion, there was also a trend for a decrease in responsibility to be associated with a decrease in severity of harm. Overall, the results of this study provided suggestive experimental evidence that checking-related emotional and behavioural reactions are influenced by relatively lower and higher levels of responsibility.



It is worth noting that in both the Shafran (1997) and Lopatka and Rachman (1995) studies, the methods used to manipulate responsibility also affected the perceived probability of the negative event, such that higher responsibility was associated with higher perceived probability of harm and lower responsibility was associated with lower probability of harm. As mentioned above, the latter study found that manipulating responsibility affected the perceived severity of the threat in a similar fashion. This makes it somewhat unclear as to whether perceived responsibility, probability, severity, or some combination of the three was responsible for the variations in distress and urge to neutralize. The present study was designed to assess the independent and combined effects of these variables.

### **Impact of Risk on Checking**

Within the anxiety literature, “risk” is usually defined as the likelihood of an event multiplied by the cost (or negative consequences) of that event (Van Oppen & Artanz, 1994). Thus, an event may be unlikely, but if it is perceived as very severe, the perceived risk may still be high. While several studies have found correlational evidence that the tendency to overestimate risk across a variety of situations is related to measures of checking symptomatology (Emmelkamp & Aardema, 1999; OCCWG, 2001; Rheame, Ladouceur & Freeston, 2000; Tolin, Woods & Abramowitz, 2001), to date only a couple of studies have experimentally examined the impact of different levels of perceived risk on OCD-related emotional and behavioural reactions.

Recently, Foa and colleagues (Foa, Amir, Bogert, Molner, & Przeworski, 2001) conducted a vignette study to examine the impact of situations varying in risk and relevance to obsessive-compulsive themes on perceived responsibility, distress, and urge to rectify the situation. In part, these authors sought to determine whether inflated responsibility is a general

characteristic of individuals with OCD (e.g., is detectable across a range of situations) or whether it is specific to OCD-related situations. For this study, these authors developed a measure called the Obsessive-Compulsive Responsibility Scale that consisted of 27 vignettes that involved the possibility of harm to others. Nine of these vignettes were classified as “low risk” (e.g., “You see a piece of string on the ground”), and nine situations were classified as “high risk” (e.g., “You see a person sitting alone in a diner is choking). The final nine situations were classified as “obsessive-compulsive relevant”, meaning that they would be likely to trigger urges to rectify the situation among individuals with OCD (e.g., “You see some nails on the road”). Although not specifically mentioned by the authors, the low risk situations combined lower severity and lower probability of potential harm, whereas the high risk situations combined more severe and more immediate or probable (e.g., a person choking in front of you) potential harm. Participants were asked to imagine themselves in these situations and then to make a series of ratings including: (a) urge to rectify the situation; (b) distress if the situation was left unrectified; and (c) degree of perceived responsibility if the unrectified situation resulted in harm. All of these dependent measures were presumed to reflect different aspects of the general construct of inflated responsibility. Three groups of participants were included in this study: (1) 15 treatment-seeking OCD patients with primary checking compulsions; (2) 15 treatment-seeking generalized social phobia patients; and (3) 15 non-anxious control subjects consisting primarily of university students and hospital staff. It was hypothesized that the OCD patients would report: (a) greater urges to rectify situations involving potential risk; (b) more emotional distress upon leaving the situation unrectified; and (c) more perceived personal responsibility if the unrectified situation later resulted in harm.

These authors found that OCD participants felt significantly higher levels of perceived

responsibility for harm, greater urges to rectify, and more distress in low risk and obsessive-compulsive relevant situations than did either of the other two groups. The groups did not differ significantly on these variables for high-risk situations. Interestingly, the social phobia participants reported significantly higher levels of perceived responsibility in relation to obsessive-compulsive relevant situations and low risk situations than did the non-anxious controls. The social phobia and non-anxious control groups did not differ in urge to rectify or distress for low risk or obsessive-compulsive relevant situations. All groups reported higher levels of perceived responsibility, urges to rectify and distress in the high risk situations than in the obsessive-compulsive relevant or low risk situations, and higher levels of these variables in the obsessive-compulsive relevant situations than in the low risk situations.

It is noteworthy that the social phobia group showed inflated perceived responsibility relative to the non-anxious group, but did not show the same urge to rectify or distress if the situation is not rectified as the OCD group. Based on this finding, the authors speculated that perhaps the tendency to feel overly responsible may not be as specific to OCD as was previously thought, but the distress and the urge to rectify the situation is more specific to individuals with OCD.

Recently, Foa and colleagues published a follow-up study to this earlier study (Foa et al., 2002). The methodology of the follow-up study was largely the same, again using the Obsessive-Compulsive Responsibility Scale. However, in this study, they sought to further explore whether inflated responsibility, as measured by scores on the OCRS, is specific to compulsive checkers, or whether it is characteristic of OCD non-checkers as well, as suggested by the cognitive theory of OCD (Salkovskis, 1999). They included three groups of participants in this study: (1) individuals with OCD and checking compulsions (“OC checkers”), (2) individuals with OCD

without checking compulsions (“OC noncheckers”), and (3) nonanxious controls. They compared these groups on their ratings of (a) perceived responsibility for harm, (b) urge to rectify and (c) relief upon rectifying the situation. It was found that groups did not differ in their responses to the high risk situations, but that OC checkers reported higher perceived responsibility for harm than the nonanxious controls in the low risk scenarios and than nonanxious controls and OC noncheckers in the medium risk scenarios<sup>3</sup>. Similarly, OC checkers reported greater urges to rectify the situation than nonanxious controls and OC noncheckers in the low risk situations, and than noncheckers in the moderate risk situations. Finally, the OC checkers reported greater relief upon rectifying the situation than the nonanxious controls and the OC noncheckers in the low and moderate risk situations. No significant differences were found between the nonanxious controls and the OC noncheckers on any of the measures. The authors concluded that OC checkers have an inflated responsibility for harm relative to OC noncheckers and to nonanxious controls, although they noted that the OCRS did not include items that would be specifically salient to OC noncheckers (e.g., such as washing-related items).

The findings of these studies are broadly consistent with the predictions of Rachman’s (2002) theory, in demonstrating that individuals with OCD show an elevated sense of responsibility across a range of situations, and that such individuals are more likely to report distress and an urge to rectify the situation. The findings are also consistent with his theory in demonstrating that under conditions of higher risk, all participants felt more distress and a greater urge to rectify the situation. However, the results of this study do not clarify the independent contributions of the three multipliers to compulsive behaviour (e.g., responsibility was measured, not manipulated) nor do the results specifically examine urge to check. In addition, other manifestations of urges to neutralize that commonly occur in individuals with

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<sup>3</sup> In this follow-up study, the “obsessive-compulsive relevant” situations were renamed “moderate risk” scenarios.

OCD (e.g., reassurance seeking, asking another to rectify the situation) were not assessed. In the present study, to be discussed shortly, multiple behavioural and emotional reactions to responsibility and “risk” were examined.

### **Impact of Responsibility and Risk on Checking**

In a series of innovative studies of checking behaviour, Ladouceur and colleagues (Ladouceur et al., 1995; Ladouceur et al., 1997), examined the impact of the simultaneous manipulation of both perceived responsibility and perceived risk on checking behaviour in a non-clinical sample. They described their studies as attempts to examine the impact of “responsibility” manipulations on checking behaviour. However, in these studies, they defined responsibility as “belief in pivotal power to prevent or provoke subjectively crucial negative consequences”. Thus, when they manipulated responsibility, they manipulated “pivotal power” or influence (which is closest to Rachman’s definition of responsibility), and “crucial negative consequences”, which was a combination of severity and probability of harm. In other words, rather than manipulating a single construct like Rachman’s responsibility, they were manipulating a complex construct that includes all three multipliers, which makes a clear interpretation of their results somewhat difficult.

Their methods for manipulating “responsibility” were very creative, although they required the use of deception. In the first study, undergraduate student participants were asked to perform a sorting task in which they sorted pills into a series of bottles, from a basket full of an assortment of pills. They were told that they would be timed, and were asked to work as quickly and accurately as possible. Participants were told that if they had any hesitation or doubt, they could check the bottles or change the pills. Participants were assigned to either a lower “responsibility” group or a higher “responsibility” group. Participants in the higher

“responsibility” group were told that the researchers had been hired by a drug company to conduct a study on colour perception that would affect how an important anti-viral drug was distributed in a poor country whose population is uneducated. They were told that their data would be used to develop a system of colours that would make pill distribution safer, and so it was important to complete the task as seriously as possible in order to prevent serious (but remote) harm from occurring. Participants in the lower “responsibility” group were given the same explanation of the purpose of the study, but were told that their phase of the study was only a practice before starting the study, and that their results were of no importance since their data would not be analyzed. It is relevant to note that the higher “responsibility” condition included relatively high levels of responsibility, probability and severity, while the lower “responsibility” condition involved very little probability or severity of harm.

Manipulation checks verified that the high “responsibility” group perceived greater severity, probability, influence and responsibility for the consequences than the low “responsibility” group. The researchers then compared the high “responsibility” group to the low “responsibility” group on a number of objective variables (e.g., number of checks, hesitations, modifications, and errors made during the task) and subjective variables (e.g., doubt, anxiety, and urge to check, and subjective errors made during the task)

Results showed that the high “responsibility” group displayed significantly more hesitations and checks, although there were no significant differences on time required to complete the task, modifications or errors. On the subjective variables, it was found that the high “responsibility” group reported significantly more preoccupation with not making errors and more anxiety during the task than the low “responsibility” group, although there were no differences on doubt, need to check, or amount of additional time desired to complete the check.

The authors concluded that their results suggested that responsibility is related to checking behaviour in a non-clinical sample, and suggested that if these results could be replicated with OCD patients, they would provide strong evidence that elevated perceived responsibility leads to more checking behaviour. These results also provide evidence for continuity between the factors hypothesized to predict checking in clinical populations, and the factors that predict checking in non-clinical populations.

These authors also performed a stepwise discriminant function analysis to examine which of the manipulation check variables differentiated between the high and low “responsibility” groups. Not surprisingly, it was found that perceived severity of outcomes best discriminated between the groups, although all of the other manipulation check variables were also different between the groups. These authors concluded that:

The present study again suggests that perception of threat is a necessary variable in producing compulsive behaviour, but cannot clearly determine whether it is sufficient: the statistical analyses suggest that severity can better account for the variance but does not tell us of the links in the mind of the [subject]. Only a study controlling for perceived danger while manipulating responsibility could answer the question but it is currently difficult to manipulate one without manipulating the other. (p. 944)

This was one of the goals of the present study, discussed below.

In their final and most complex study using this methodology, Ladouceur and colleagues (Ladouceur et al., 1997) again used a pill-sorting paradigm and a student sample, this time in an attempt to clarify the respective roles of “pivotal influence” and “negative consequences” and their interaction in the construct of perceived “responsibility”. The experimental manipulations were somewhat different this time. There were four experimental conditions, an Influence

condition, a Negative Consequences condition, a Combined (Negative Consequences and Influence) condition, and a Control Condition. In the Combined condition, participants were given the same “rationale” for the study used in the high “responsibility” condition in their previous study (negative consequences manipulation). In addition, participants were told that their data would be decisive, since the study was in its final phase, and that their responses would directly influence the making of the drug and thus could prevent serious consequences from taking place (influence manipulation). Thus, the Combined situation included elements of relatively high responsibility (i.e., influence), high severity and high probability of harm. In the Negative Consequences condition, participants were given the same rationale as in the Combined condition; however, to reduce pivotal influence, participants were also told that they were one of 2000 people who would be providing data to formulate the conclusions of the study. In the Influence condition, participants were given the same instructions as in the Combined condition, except that they were told that the purpose of the study at this stage was to learn about colour perception, so the impact of the study was not immediate and the negative consequences of making an error would be minimal. However, influence was increased by telling the participants that they were part of a sample of three people, so their responses would be decisive. Finally, in the Control condition, participants were told that this phase of the study was only a practice before starting the study and that their results were of no importance since their data would not be analyzed. Thus, the Control condition incorporated very low levels of responsibility, probability and severity of harm. The authors compared the four groups on the same objective and subjective measures as in the previous study.

It should be noted that although the interpretation of the Combined and Control conditions is relatively straightforward, the Influence and Negative Consequences conditions are



somewhat more difficult to interpret. For example, in the manipulation of “influence” in the Influence and Negative Consequences conditions, the authors confounded responsibility with probability (i.e., the likelihood of having inaccurate and potentially harmful data is greater with a sample of 3 than a sample of 2000). Thus, the results of this study must be considered within the limitations imposed by the manipulations.

On the manipulation check variables, it was found that participants in the Combined and Negative Consequences conditions perceived the consequences as being significantly more severe and more probable than did participants in the Influence and Control Conditions. Individuals in the Combined and Influence conditions perceived significantly more personal influence than individuals in the Negative Consequences or Control conditions.

In relation to perceived responsibility, it was found that participants in the Combined condition felt significantly more responsible than participants in the other three groups. In addition, participants in the Influence condition felt significantly more responsible than the Control group (but not significantly more responsible than the Negative Consequences group). Influence was found to be the best predictor of perceived responsibility.

On the subjective measures, participants in the Combined condition reported higher levels of doubt and more preoccupation with errors than did participants in the Negative Consequences or Control conditions (but not relative to Influence group). On the objective measures, participants in the experimental conditions demonstrated more hesitations than participants in the Control condition. Participants in the Combined and Negative Consequences conditions displayed more checking behaviour than those in the Control condition. Finally, participants in the Combined condition completed more modifications than participants in the three other conditions. Overall, the authors concluded that the manipulation of perceived

“responsibility” (both influence and negative consequences) produces subjective preoccupation and compulsion-like behaviour.

The authors made an interesting interpretation of their behavioural data. They argued that hesitations, checking, and modification could be viewed along a continuum of increasing severity. They noted that it was possible to provoke hesitations by increasing either component of “responsibility” (i.e., influence or negative consequences). However, in order to produce checking behaviour during the task, only the negative consequences component was necessary. In order to produce what they considered to be the most intense compulsion-like behaviour, modification, neither component of responsibility alone was sufficient, rather, both influence and negative consequences were required. Finally, these authors noted that the combination of perceived influence and negative consequences “produces a stronger effect than each component alone on most behavioural or subjective measures” (p. 426).

The studies by Ladouceur and colleagues provide evidence that is generally congruent with Rachman’s cognitive theory of compulsive checking. More specifically, these authors provide evidence that influence is the central and best predictor of perceived responsibility. Moreover, these studies provide the first experimental evidence that the combination of increased levels of influence and negative consequences is associated with the highest levels of checking behaviour among non-clinical participants.

### **Interrelationships among the Multipliers**

In summary, some studies have examined the effects of manipulating responsibility, others have examined the effects of manipulating “risk”, and at least one group of researchers has attempted to manipulate both responsibility and risk concurrently. However, the relationships

among responsibility, probability and severity of harm, and the extent to which they have an individual or combined impact on checking behaviour remain unclear.

The studies reviewed above provide some information that may be useful in clarifying these interrelationships. In the studies by Ladouceur and colleagues (1995, 1997), using non-clinical samples, the results suggested that responsibility is largely a function of perceived influence, and that severity and probability are closely interrelated, such that high severity events are viewed as more likely. The other studies reviewed above used clinical samples. Foa and colleagues (2001) found that increased risk (i.e., probability and severity) was associated with higher perceived responsibility. Similarly, the studies by Shafran (1997) and Lopatka and Rachman (1995) found that increasing responsibility experimentally was associated with increased perceived probability and increased perceived severity.

Recently, Menzies and colleagues (Menzies et al., 2000) conducted a study in which they examined the relationships between responsibility for a negative outcome, perceived severity of the outcome and perceived likelihood of the outcome in a sample of university undergraduates. Participants were presented with ten brief scenarios describing checking or cleaning relevant situations. Half of the students were assigned to a “personally responsible” or higher responsibility group in which they were the actor in the scenario (e.g., the participant would be driving the car in the scenario); while the other half were assigned to an “other responsible”, or lower responsibility group in which the actor is a close other, and the participant is an observer (e.g., the participant would be a passenger in the car, rather than the driver). Participants were asked to read each scenario and then make ratings of the perceived probability and severity of harm. It was found that the higher and lower responsibility groups did not differ in mean ratings of probability of harm; however, the higher responsibility group made higher ratings of the

severity of harm across all scenarios. Thus, in this study, outcomes were perceived as more severe under conditions of higher responsibility. There were no differences in findings based on whether the situation being rated was washing- or checking-related. The authors suggested that responsibility influences estimates of severity of harm and that these inflated danger or risk estimates are what drives OCD symptoms. In other words, they proposed a mediational model in which responsibility is related to OCD only through its effects on severity of harm, and suggested that responsibility may not have any impact on OCD symptomatology if severity ratings are considered first. These authors called directly for studies that examine the relationships between responsibility for a negative outcome, perceived severity of the outcome, and perceived likelihood of the outcome in clinical OCD samples. The present study helps to clarify this question by testing both the independent and combined effects of the multipliers on checking-related outcomes.

### **Is Responsibility a Function of the Situation, the Person, or Both?**

As is apparent in the review of studies above, the central construct of “responsibility” remains slippery. One important question concerns whether responsibility is a function of the person, a function of the situation, or both. That is, is inflated responsibility best construed as an enduring and stable trait, or as a situation-specific reaction (Lopatka & Rachman, 1995)?

Both theory and empirical data have suggested a role for stable, trait-like responsibility based on enduring beliefs and attitudes. For example, both Salkovskis (1985, 1989, 1999) and Rachman (2002) suggest that some individuals have an enduring tendency to feel responsible across a range of situations<sup>4</sup>. Consistent with this, research studies have found that individuals with OCD are more likely to endorse general responsibility beliefs and attitudes (e.g., “I often

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<sup>4</sup> Note that while Rachman (2002) suggests that inflated responsibility is most relevant to compulsive checkers, and less relevant to other subtypes, such as washers, Salkovskis (1999) maintains that inflated responsibility is a characteristic of all individuals with OCD, including washers.

take responsibility for things that other people don't think are my fault" or "If I can have even a slight influence on things going wrong, I must act to prevent it"), which predispose them to feel responsible across many situations, than anxious or non-anxious controls (e.g., Salkovskis et al., 2000). Similarly, in the study by Foa and colleagues (2001) described above, participants with OCD reported feeling more responsible across the range of situations. However, it has also been noted that even among those who clearly suffer from inflated responsibility, clear boundaries can be observed (Rachman & Shafran, 1998). That is, people with OCD do not feel responsible for all outcomes across all situations. This suggests that features of particular situations must play a role in whether a person feels responsible, and correspondingly, an urge to act.

Several authors have highlighted the role played by such situational factors in perceptions of responsibility (e.g., Rachman et al., 1995). Along these lines, some studies have attempted to manipulate situational responsibility by varying aspects of the situation. In the high situational responsibility condition, the participant is usually the actor, whereas in the low situational responsibility condition, another person will be the actor with the participant being aware of what is happening, or looking on (e.g., Menzies et al., 2000). For example, in a high responsibility condition, the participant may be responsible for locking the door, without anyone else around, whereas in the low responsibility condition, the participant may be required to watch another person lock the door. This approach is often used in studies using non-clinical participants, who might not otherwise be expected to feel responsibility for harm.

In sum, the question of whether inflated responsibility is best construed as a stable personality trait or as a more situation specific reaction remains open (Lopatka & Rachman, 1995; Rachman et al., 1995). It seems likely that both enduring attitudes and environmental cues contribute to an individual's sense of responsibility in a given situation. Thus, it is possible that a

highly trait responsible individual (such as a person with OCD) may feel responsible in a situation in which no one else would view that person as responsible. On the other hand, even individuals who do not tend to feel highly responsible in general may come across a situation in which the circumstances make them feel responsible (e.g., if that person is the last one to leave the house and therefore has the job of locking up). Either way, both the cognitive theory of OCD (Salkovskis, 1985, 1989) and Rachman's theory of checking (2002) would suggest that neutralizing and checking are most likely to occur when individuals feel responsible, irrespective of the origin of that feeling (i.e., internal, enduring tendencies or external, situation-specific cues). And of course, it would be expected that when a highly responsible person encounters a situation that contains a strong element of situational responsibility, checking would be highly likely to occur.

What is clear is that, no matter how responsibility is defined, it is *perceived responsibility*, not actual mathematical or moral responsibility, that is crucial. An individual with OCD could be in a situation in which most people would say that she is not responsible for preventing harm, but if she perceives herself as responsible, then according to these theories, she will become distressed and be motivated to engage in some kind of neutralizing behaviour.

The position taken in this paper is that both the situation and the beliefs or attitudes of the individual contribute to perceived responsibility. Thus, in the present study, both situational responsibility and trait responsibility were considered. Situational responsibility was manipulated (see Methods), while the role of "trait-like" responsibility was considered more indirectly through the inclusion of samples of participants who varied according to their hypothesized level of trait responsibility.

Taken together, the findings on responsibility, risk and checking suggest that both

perceived influence (or responsibility) and perceived negative consequences or “risk” are relevant to checking behaviour. Increases in either seem to be associated with greater distress and urges to act in some way to prevent harm, and lower levels of these variables seem to be associated with less distress and motivation to act. Several authors have confounded influence, probability and severity in their definition of responsibility, and many authors have combined probability and severity in their operational definitions of negative consequences or risk. This has obscured the relationships among these variables and their independent contribution to checking behaviour. One of the aims of the present study, discussed below, was to address this issue.

### **Purpose of Study 1**

The purpose of this first study was to test the independent and combined influence of the multipliers outlined in Rachman’s (2002) theory of compulsive checking on a variety of checking-related dependent variables, including both emotional and behavioural responses (e.g., anxiety, worry, urge to check, reassurance-seeking), and to evaluate the explanatory power of the theory across a continuum of responsibility, anxiety and checking behaviour.

### **Overview of Study 1 Design and Hypotheses**

In order to permit the simultaneous and relatively independent manipulation of all three multipliers, participants were given a series of scenarios that had been written and pilot tested to reflect all eight possible combinations of relatively high and low levels of each multiplier. The scenarios were written to reflect common situations in which some individuals would feel an urge to check. This method was chosen for the study because it allows the independent manipulation of the three multipliers and examination of their effects in a practical, standardized and ethical way. Participants were asked to vividly imagine these scenarios and then make a

series of ratings reflecting their predicted emotional and behavioural reactions if they were to find themselves in each situation. It was expected that participants would report variations in the strength of the urge to check and other dependent measures (e.g., likelihood of checking, distress, worry), based upon the description of the multipliers in each scenario.

### **Hypotheses Derived from the Cognitive Theory of Checking**

1. Relative to the lower responsibility vignettes, in the higher responsibility vignettes, participants will make higher ratings on all dependent variables (i.e., all checking-related emotional and behavioural responses).
2. Relative to the lower probability of harm vignettes, in the higher probability vignettes, participants will make higher ratings on all dependent variables.
3. Relative to the lower severity of harm vignettes, in the higher severity vignettes, participants will make higher ratings on all dependent variables.
4. Ratings on the dependent measures will be lowest in the vignette where all three multipliers are low.
5. Ratings on the dependent measures will be highest in the vignette where all three multipliers are high.
6. Ratings on the dependent measures will be higher in those vignettes in which two of the multipliers are high, relative to vignettes in which only one multiplier is high.
7. When participants report feeling “not at all responsible” for preventing harm in a vignette, they will make extremely low ratings on all of the dependent measures.
8. The above relationships will be observed in all three groups of participants (described below).



## **Study 1 Methods**

### **Participants**

Three separate groups of participants were recruited into Study 1.

#### **Sample 1: Participants with OCD**

Individuals with OCD were recruited into Study 1 in order to examine the impact of the multipliers on checking behaviour in individuals who routinely engage in some form of compulsive behaviour. Based upon previous epidemiological studies of OCD (Rasmussen & Eisen, 1992; Rasmussen & Tsuang, 1986; Summerfeldt, Antony, Downie, Richter, & Swinson, 1999), it was expected that approximately 80% of these individuals would engage in some form of compulsive checking. Participants with OCD were recruited into the study from advertisements (a) placed in the Anxiety Disorders Unit (ADU) at UBC Hospital, (b) placed in other treatment clinics, and (c) given out at community public information talks by the author. The ADU is a tertiary care facility that provides assessment and cognitive-behavioural treatment for a variety of anxiety disorders, including obsessive-compulsive disorder, panic disorder, generalized anxiety disorder, and post-traumatic stress disorder, and some subtypes of specific phobia. All individuals referred to the ADU receive a standard structured diagnostic interview. Individuals referred for treatment of OCD meet with a trained ADU staff member who administers the Structured Clinical Interview for DSM-IV -Axis I (SCID-I; First, Spitzer, Gibbon & Williams, 1996). The SCID is a reliable and valid semi-structured interview that assesses all of the diagnostic criteria for each DSM-IV anxiety disorder, as well as a range of other, frequently comorbid Axis I disorders (e.g., Major Depressive Disorder). Individuals who met DSM-IV diagnostic criteria for OCD and were offered outpatient cognitive-behavioural treatment at the ADU were invited to participate in this study. Participants with OCD who were

recruited from other treatment centres or the community were interviewed by the author using a semi-structured interview based on the SCID-I (included the OCD and depression sections of the SCID-I, a psychosis screener and a few other clinical variables of interest, such as onset of illness, previous psychiatric hospitalisations, etc). In order to meet criteria for inclusion in the study, participants were required to (a) have a previous diagnosis of OCD given by a health professional, (b) meet diagnostic criteria for OCD using the OCD subsection of the SCID-I, and (c) score at least 16 on the self-report Y-BOCS included in the questionnaire package<sup>5</sup>. Participants received a small honorarium for their time.

Sample characteristics. Twenty-nine individuals with OCD participated in Study 1. Basic demographic information is summarized in Table 1. There were no differences on demographic variables or measures of symptomatology based upon recruitment source (treatment centre versus community sample), with the exception that all participants recruited from the treatment centre were currently receiving psychological treatment, whereas only 46.2% of participants recruited directly from the community were currently in treatment. Fifty-eight percent of the OCD sample (n=17) was female. The mean participant age in this sample was 35.9 (SD=10.5 years), with a range from 19 to 56 years old. Sixty-six percent of the sample (n=19) identified themselves as Caucasian, 10.3% identified themselves as Asian, 3.4% identified themselves as East Indian, 10.3% identified themselves as being of another ethnicity and 10.3% did not specify their ethnicity. Forty-five percent of the sample (n=13) was married or cohabiting and 37.9% identified themselves as single. On average, participants had 15 years of education (SD=3.3 years), and 43% of the sample had a post-secondary degree or diploma.

Primary compulsions identified by this sample were: checking 44.8%, washing/cleaning

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<sup>5</sup> A score of 16 or above on the Y-BOCS is commonly used as the clinical cut-off in research studies, including drug studies (Steketee, Frost & Bogart, 1996).

27.6%, mental compulsions 20.7%, symmetry/ordering 3.4% and other compulsions 3.4%. Fifty-nine percent of the sample (n=17) had a current diagnosis of major depressive disorder, with 69% (n=20) reporting at least mild depression on the BDI-II. Twenty-eight percent met diagnostic criteria for another anxiety disorder. Sixty-five percent (n=17) of the sample was currently receiving psychological treatment for OCD. Seventy-three percent (n=22) of the sample were taking psychotropic medication, most typically antidepressant medication. Selected clinical characteristics of this sample are presented in Table 2. Sample scores on measures of symptomatology are presented in Table 3. Comparison of this sample with published norms for measures of symptomatology (described below) suggest that this sample is typical of treatment-seeking outpatients with OCD.

### **Sample 2: Participants with Other Anxiety Disorders**

Individuals with a current diagnosis of an anxiety disorder other than OCD were recruited into the study in order to: (a) control for the possibility that any effects in the OCD sample are attributable to high levels of depression and anxiety or to patient status and (b) in order to explore whether any relationships found in the OCD group are specific to OCD, or whether the underlying mechanisms operate in anxious individuals more generally. Individuals referred to the ADU for treatment of an anxiety disorder other than OCD complete the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Di Nardo, Brown, & Barlow, 1994) with an ADU staff member in order to establish a primary diagnosis. The ADIS is a semi-structured interview that assesses all of the diagnostic criteria of each anxiety disorder, as well as several other Axis I disorders that are often comorbid with clinical anxiety. Individuals who met DSM-IV diagnostic criteria for either panic disorder or generalized anxiety disorder and were offered outpatient cognitive-behavioural treatment at the ADU were invited to participate in this study. Participants

received a small honorarium for their time.

Sample characteristics. Nineteen individuals with a primary diagnosis of panic disorder (61.3%) and twelve individuals with a primary diagnosis of generalized anxiety disorder (38.7%) comprised the anxious control sample. Basic demographic information is summarized in Table 1. None of the participants in the anxious control sample met diagnostic criteria for OCD. Seventy-four percent (n=23) of the sample was female. The mean participant age of this sample was 34.4 years (SD=9.6 years), with a range from 22 to 61 years old. Eighty-one percent of the sample (n=25) identified themselves as Caucasian, 3.2% identified themselves as Asian, 6.5% identified themselves as being of another ethnic background, and 9.7% of the sample did not specify their ethnicity. Sixty-one percent of the sample (n=19) was married or cohabiting. On average, participants had 16.4 years of education (SD=3 years, range 12-25 years), and over two-thirds of the sample had a post-secondary degree or diploma. Thirty-two percent of the sample had a current diagnosis of major depressive disorder, with 65.5% reporting at least mild depressive symptoms on the BDI-II (n=12). Thirty-six percent met diagnostic criteria for another anxiety disorder in addition to their primary diagnosis. All participants were either about to begin treatment or currently in treatment for their anxiety disorder. Eighty-one percent of the sample (n=25) were taking some type of psychotropic medication, most typically antidepressant or anxiolytic medication. Selected clinical characteristics of this sample are presented in Table 2. Sample scores on measures of symptomatology are presented in Table 3. Comparison of this sample with published norms for measures of symptomatology suggest that this sample is typical of treatment-seeking outpatients with anxiety disorders.

### **Sample 3: Undergraduate Students (Non-clinical Sample)**

An undergraduate student sample was recruited into Study 1 in order to examine the idea

that the hypothesized predictors of checking and related emotional and behavioural responses are applicable even to individuals who are not seeking treatment for anxiety and do not routinely engage in checking or some other form of compulsive behaviour. This is predicted by Rachman's (2002) theory of compulsive checking. Undergraduate students participants were recruited through posters placed on the Department of Psychology Human Subject Pool bulletin board. Students were given 1.5 credit points towards their psychology course grade in exchange for their participation.

Sample characteristics. Fifty university undergraduate students enrolled in introductory psychology courses participated in Study 1. Basic demographic information is summarized in Table 1. Eighty-two percent of the sample ( $n=41$ ) was female, with an average age of 20.4 years ( $SD=3.87$  years), with a range of 17 to 45 years old. Sixty-six percent of the sample identified themselves as Asian ( $n=33$ ), 30% identified themselves as Caucasian, and 4% of the sample identified themselves as East Indian. Ninety-four percent of the sample ( $n=47$ ) was single. On average, participants had 15 years of education ( $SD=2.71$ ). Thirty-four percent of the sample reported at least mild depressive symptoms on the BDI-II ( $n=17$ ). Sample scores on measures of symptomatology are presented in Table 2. Comparison of this sample with published norms for measures of symptomatology suggest that this sample is typical of nonanxious controls.

### **Procedure**

Individuals with OCD, panic disorder or generalized anxiety disorder who expressed interest in participating in the study and who met criteria for inclusion were provided with a verbal description of the study. Individuals who expressed a willingness to participate were provided with a questionnaire package. It was clear in the verbal explanation of the study and in the consent form that refusal to participate would not in any way impact current or future care or

contact with staff at the ADU. Undergraduate psychology students who were interested in participating picked up a questionnaire package from the UBC Anxiety Research Lab in the Psychology building. The questionnaire package used in Study 1 takes approximately 60 to 90 minutes to complete. The first half of the questionnaire package consisted of a series of vignettes and rating scales (described below). The second half of the questionnaire package consisted of a variety of standardized questionnaire measures (e.g., measures of obsessive-compulsive symptomatology, current depressive symptomatology, trait anxiety; described below). Clinical participants were asked to return the completed questionnaire package to an ADU staff member at their next appointment or by mail. Student participants were asked to return their completed questionnaires to the UBC Anxiety Research Lab in the Psychology building. Once the completed questionnaire had been received, participants were provided with an information sheet describing the hypotheses of the study, and any questions that they had about the study were answered.

### **Materials/Vignettes**

From a large pool of vignettes developed for this study, eight vignettes were selected which described situations in which some individuals would feel an urge to engage in checking behaviour, and covered a variety of common concerns related to checking (e.g., fears of fire that provoke checking of appliances such as ovens or irons; fears of burglary that provoke checking of windows/doors, and others). The eight vignettes (see Appendix 1) were written to reflect relatively higher and lower levels of the three multipliers outlined in Rachman's (2002) theory. Participants were asked to imagine themselves in the situation described by each vignette and then make a series of ratings of their anticipated emotional and behavioural responses if they were in that situation. These ratings included: (a) urge to check, (b) likelihood of checking, (c)

likelihood of asking another to check (i.e., checking by proxy), (d) likelihood of seeking reassurance from another, (e) degree of anxiety/discomfort if no one checks, and (f) degree of worry if no one checks<sup>6</sup>. Both urge to check and likelihood of checking behaviour were included. These variables are closely related, yet distinct. Compulsive urges have been defined as “the psychological activity that lies between an obsessional thought and the execution of a compulsive act” (Rachman & Hodgson, 1980, p. 211). Compulsive urges are considered to be causally related to compulsive checking, with compulsive urges driving actual checking behaviour (Rachman, 2002). However, these two variables may be desynchronous, as in non-clinical populations, in which an urge to check may be experienced, but the person is capable of resisting the urge. In clinical populations, these variables would be expected to be more closely related, particularly in the later stages of the disorder, when most individuals yield more readily to their urges (Rachman, 2002). In addition, as previous research with compulsive checkers has suggested that a significant subset of these individuals report “discomfort” rather than anxiety following exposure to checking triggers, it was decided to ask participants about their anxiety/discomfort, rather than asking about anxiety alone.

### **Manipulation Checks**

Participants were asked to rate the level of each of the multipliers in each vignette (i.e., responsibility for harm, probability of harm, severity of harm) on a 4-point scale. These ratings served as a manipulation check. They were also asked to rate how vividly they were able to imagine themselves in the situation described by each vignette. This was done in order to provide a check on whether the vignettes were realistic/plausible and therefore more likely to yield valid responses. Extensive pilot testing of a variety of different vignettes was conducted in order to

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<sup>6</sup> Note that these ratings reflect predictions of behaviour. However, for ease of expression, in the remainder of this paper, the term “predicted” (e.g., predicted urge to check) will be omitted.

select vignettes that were rated as vivid and in which the multipliers were perceived in the appropriate ways. That is, considerable care was taken to ensure that, for example, the high responsibility, high probability, low severity vignette was perceived as having relatively high levels of responsibility and probability and a low level of severity.

### **Measures**

Additional measures of symptomatology and attitudes potentially relevant to compulsive checking were also included in the questionnaire package for Study 1. These measures were used to evaluate the comparability of the samples in the Study 1 with samples in previous research studies on OCD.

#### **Responsibility Attitude Scale (RAS: Salkovskis et al., 2000)**

The Responsibility Attitudes Scale (RAS) is a 26-item scale measuring general beliefs about personal responsibility that are characteristic of individuals with OCD. Respondents indicate on a 7-point Likert scale their degree of agreement with a series of statements expressing different beliefs about responsibility. Sample items include “I often feel responsible for things which go wrong”; “If I know that harm is possible, I should always try to prevent it, however unlikely it seems” and “If I don’t act when I can foresee danger, then I am to blame for any consequences if it happens”. Previous work has shown that the RAS has acceptable psychometric properties and differentiates between individuals with OCD, clinically anxious control subjects without OCD and non-anxious adults (Salkovskis et al., 2000).

#### **Obsessive-Compulsive Inventory (OCI; Foa, Kozak, Salkovskis, Coles & Amir, 1998)**

The Obsessive-Compulsive Inventory (OCI) is a 42-item measure of obsessive-compulsive symptomatology. Respondents rate both the severity and frequency of a list of common obsessions and compulsions. The OCI yields separate total frequency and total distress



scores, as well as separate frequency and distress scale scores on each of seven subscales. The subscales are: Washing, Checking, Doubting, Ordering, Obsessing, Hoarding and Neutralizing. The OCI has been shown to have adequate psychometric properties in both clinical and non-clinical (student) populations (Foa et al., 1998; Simonds, Thorpe & Elliott, 2000).

**Maudsley Obsessional Compulsive Inventory (MOCI) (Hodgson & Rachman, 1977).**

The Maudsley Obsessional Compulsive Inventory (MOCI) is a 30-item measure of obsessive-compulsive symptomatology. Respondents rate items as either true or false. The MOCI yields a total score as well as four subscales (checking, cleaning, slowness and doubting). For the purposes of the present study, only the 9-item Checking subscale was used, in order to permit comparability of the present sample with samples used in previous studies of OCD. Previous work has suggested that the Checking subscale has adequate psychometric properties (e.g., Emmelkamp, Kraaijkamp & van den Hout, 1999; Richter, Cox & Dorenfeld, 1994), and can discriminate between people with obsessive complaints, other neurotic complaints (e.g., eating disorders, other anxiety disorders), and nonanxious controls (Emmelkamp, Kraaijkamp & van den Hout, 1999).

**Yale Brown Obsessive Compulsive Scale – Self Report Version (Y-BOCS-SR) (Goodman, Price, Rasmussen, Mazure, Delgado et al., 1989; Goodman, Price, Rasmussen, Mazure, Fleischmann, Hill, Heninger, & Charney, 1989)**

The Yale-Brown Obsessive Compulsive Scale (Y-BOCS) is a 10-item clinician-administered semi-structured interview that provides a measure of the types and severity of obsessive-compulsive symptoms. At the beginning of the interview, the clinician uses a checklist to identify the most prominent obsessions and compulsions. After these have been identified, the clinician rates a series of items on a 5-point scale, with 0 reflecting no symptoms and 4 reflecting

very severe symptoms. The items cover time spent, degree of interference, distress, resistance, and perceived control over the symptom. The first five items concern obsessions, and the last five items concern compulsions. The Y-BOCS yields separate severity scores for obsessions and compulsions, as well as a total severity score. The total Y-BOCS score can range from 0 to 40. Internal consistency for the total score clinician rated Y-BOCS ranges from fair to excellent. Interrater reliability and test-retest reliability are excellent (Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989; Kim, Dysken, & Kukowski, 1990; Woody, Steketee & Chambless, 1995). The Y-BOCS correlates significantly with other measures of OCD. However, it also correlates significantly with measures of anxiety and depression (e.g., Woody et al., 1995). The clinician rated Y-BOCS takes approximately 30 minutes to administer.

Recently, a self-report version of this scale has been developed and has been shown to have good psychometric properties (Steketee, Frost & Bogart, 1996; Warren, Zgourides, & Monto, 1993). This instrument takes approximately 10 minutes to complete and compares very favourably with the clinician-administered version. In a study comparing the clinician rated and self-rated versions, the self-rated version demonstrated good internal consistency and test-retest reliability. The self-rated measure also demonstrated strong convergent validity with the clinician-administered form in both non-clinical and OCD samples. In addition, the self-rated measure discriminated between individuals with OCD and individuals with an Axis I or II diagnosis other than OCD. For the purposes of this study, the self-rated version was used for individuals with OCD and anxious controls only.

### **Beck Anxiety Inventory (BAI; Beck, Epstein, Brown & Steer, 1988)**

The Beck Anxiety Inventory (BAI) is a 21-item self-report scale designed to measure common cognitive and somatic symptoms of anxiety. Respondents indicate on a 4-point scale the

severity of each of a list of 21 symptoms of anxiety over the last week. Sample items include “Nervous” and “Fear of the worst happening”. The BAI has good internal consistency, test-retest reliability, and convergent and divergent validity (Beck, Epstein, Brown & Steer, 1988; Beck & Steer, 1993).

**Spielberger State-Trait Anxiety Inventory – Form Y (STAI) (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983)**

The STAI consists of two 20-item self-report measures of anxiety. One form measures trait anxiety (STAI-T), and the other measures state anxiety (STAI-S). Only the trait measure will be used in this study. According to the authors, the STAI-T has good internal consistency and adequate test-retest reliability, as well as good convergent validity. Clinically anxious individuals score significantly higher on the STAI-T than do non-clinical volunteer participants (Bieling, Antony & Swinson, 1998).

**Beck Depression Inventory - Second Edition (BDI-II; Beck, Steer, & Brown, 1996)**

The Beck Depression Inventory-II is a 21-item self-report questionnaire designed to assess the intensity of cognitive, affective, and somatic symptoms of depression. Respondents rate the severity of each of 21 symptoms on a 4-point scale. The strong psychometric properties of both the original and the first revision of the BDI (Beck, Ward, Mendelson, Mock, and Erbaugh, 1961; Beck, Rush, Shaw, & Emery, 1979) in a range of samples have been well-documented (see Beck et al., 1988, for a review). Although comparatively little research has been done on the BDI-II at present, there is evidence to suggest that the psychometric properties of this measure are also strong. For example, the authors of BDI-II reported strong coefficient alphas in both outpatient psychiatric and college student samples, and strong test-retest reliability (Beck et al., 1996).

There is also promising evidence to support the construct validity of the BDI-II. In particular, this instrument is highly positively correlated with other measures of depression, including the previous revision of the BDI. The BDI-II also correlates significantly and in the predicted direction with measures of constructs related to depression, such as hopelessness and anxiety. The BDI-II has also been shown to discriminate between individuals with depressive disorders and individuals with nonaffective psychiatric disorders and between depressed and nondepressed individuals (Beck et al., 1996).

### **Summary of Study 1**

In sum, the purpose of Study 1 was to provide a first experimental test of the individual and combined effects of the multipliers set out in Rachman's (2002) theory on checking-related emotional and behavioural responses to situations that imply the possibility of harm. This study builds upon previous theory and research by examining the influence of responsibility and of "risk" (i.e., probability and severity of harm) on these reactions. However, this study differs from previous research in several ways.

First, this study separated out responsibility, probability and severity, variables that have been confounded in previous research, thus obscuring their unique and combined contributions to checking-related emotions and behaviours. Second, this study provided a broad assessment of anticipated checking-related behavioural and emotional responses, by including not only the commonly examined variable of predicted likelihood of checking, but also urge to check (which may be discontinuous with actual likelihood of checking in some cases), and other behaviours that have been identified by Salkovskis and Kirk (1997) and others as alternate means of reducing risk or perceived responsibility (e.g., seeking reassurance from others; having another person check). Lastly, as this theory is intended to explain the continuum of checking behaviour,

the relationships between the multipliers and emotional and behavioural responses to situations that imply the possibility of harm were explored in three populations that reflect a continuum of anxiety, trait responsibility, and checking behaviour.

More broadly, this study addresses some of the shortcomings identified in the literature examining cognitive factors in OCD (Riskind, Williams & Kyrios, 2002): namely, a lack of studies using clinical subjects, a lack of experimental research studies that manipulate different cognitive domains (e.g., perceived responsibility, perceived threat), and examine their impact on obsessive-compulsive responses. It was noted that such research would also permit an evaluation of the utility of differentiating between these domains.

## **Study 1 Results**

### **Preliminary Analyses**

Preliminary analyses comparing samples on demographic characteristics and measures of symptomatology were conducted in order to evaluate the comparability of the samples. A few significant demographic differences were noted. Student participants were significantly younger,  $F(2,107) = 48.28, p < .001$ , and less likely to be Caucasian,  $\chi^2(2) = 21.97, p < .001$ , relative to the two clinical samples, who did not differ significantly from one another (both p-values greater than .05).

The three samples did not differ significantly on gender or years of education (both p-values greater than .05). Comparison of the two clinical samples revealed no differences on number of participants diagnosed with depression or another anxiety disorder, or number of participants taking medication (all p-values greater than .05). However, more anxious control participants (100%) than participants with OCD (65.4%) were currently in psychological treatment for their difficulties,  $\chi^2(1) = 12.37, p < .001$ , which is not surprising given the

recruitment process.

Comparisons of the three samples on measures of symptomatology revealed significant differences in the expected direction. Student participants scored significantly lower than the two samples of clinical participants on measures of trait anxiety (STAI-Trait), cognitive and somatic symptoms of anxiety (BAI), and depression (BDI-II) (all p-values less than .01). The two clinical samples did not differ significantly from one another on these measures.

On measures of obsessive compulsive symptoms, including the checking subscale of the MOCI, the OCI total frequency and distress scores, and the OCI checking subscale frequency and distress scores, the OCD sample scored significantly higher than the other two samples (all p-values less than .001), who did not differ significantly from one another (all p-values greater than .05). On the Y-BOCS, the OCD sample scored significantly higher than the anxious control sample on the obsessions subscale, the compulsions subscale and the total scale (all p-values <.001; the student participants did not complete this measure). On the measure of responsibility beliefs, (RAS), the OCD sample scored significantly higher than the other two samples ( $p < .001$ ), who did not differ significantly from one another ( $p > .05$ ). Overall, the two clinical samples did not differ on general measures of anxious and depressive symptomatology, but did differ on measures of obsessive-compulsive symptomatology. In addition, the OCD sample reported stronger general beliefs about personal responsibility.

Intercorrelations between mean ratings on the dependent variables for each sample are presented in Tables 4 to 6.

## **Manipulation Checks**

### **Vividness**

Participants were asked to rate how vividly they were able to imagine themselves in the situation described by each vignette. Response options were as follows: (1) It was easy to imagine myself in this situation; (2) I was able to imagine myself in this situation; (3) It was somewhat difficult to imagine myself in this situation, but I managed; (4) I found it very difficult to imagine myself in this situation; and (5) I could not imagine myself in this situation.

Student sample (N=50). The mean vividness rating across scenarios was 2.07 (SD=0.66), with a range of 1 to 4. Ninety-two percent of the sample (n=46) reported a mean vividness rating across scenarios of 3 or lower. Mean vividness ratings by scenario ranged from a low of 1.84 for the low responsibility, low severity, low probability scenario to a high of 2.54 for the low responsibility, high severity, high probability scenario.

Anxious control sample (N=31). The mean vividness rating across scenarios was 1.78 (SD=0.74), with a range of 1 to 4.5. Ninety-four percent of the sample (n=29) reported a mean vividness rating across scenarios of 3 or lower. Mean vividness ratings by scenario ranged from a low of 1.61 for the high responsibility, high severity, high probability scenario to a high of 2.06 for the low responsibility, high severity, high probability scenario.

OCD sample (n=29). The mean vividness rating across scenarios was 1.72 (SD=0.85), with a range of 1 to 4.88. Ninety-three percent of the sample (n=27) reported a mean vividness rating across scenarios of 3 or lower. Mean vividness ratings by scenario ranged from a low of 1.59 for the low responsibility, high severity, low probability scenario to a high of 1.90 for the low responsibility, low severity, low probability scenario.

## **Multipliers**

Participants were asked to rate the level of each multiplier for each vignette. Repeated measures ANOVAs for each multiplier were used to test differences between the high and low vignettes on the participants' ratings of the multipliers. For example, the high and low responsibility vignettes were compared to ensure that participants rated the responsibility level in the former as being higher than in the latter. Manipulation checks were performed separately for each sample (i.e., students, anxious controls, OCD patients), as described below.

Responsibility. Repeated measures ANOVAs on responsibility ratings revealed significant main effects of responsibility in all three samples:  $F(1,48) = 171.76, p < .001, \eta^2 = 0.78$  (student sample),  $F(1,30) = 92.396, p < .001, \eta^2 = 0.76$  (anxious control sample),  $F(1,27) = 52.21, p < .001, \eta^2 = 0.66$  (OCD sample). Scenarios that were written to reflect higher levels of responsibility were rated as significantly higher on responsibility than scenarios written to reflect lower levels of responsibility. Mean ratings of responsibility for high and low responsibility conditions for all three samples are listed in Table 7. It is notable that the mean responsibility ratings for higher and lower responsibility scenarios are non-overlapping for all three samples (i.e. the lowest "high" responsibility mean is higher than the highest "low" responsibility mean).

Severity. Repeated measures ANOVAs on severity ratings revealed significant main effects of severity across all three samples:  $F(1,49) = 132.94, p < .001, \eta^2 = 0.73$  (student sample),  $F(1,30) = 43.66, p < .001, \eta^2 = 0.59$  (anxious control sample),  $F(1,28) = 63.38, p < .001, \eta^2 = 0.69$  (OCD sample). Scenarios that were written to reflect higher levels of severity were rated as significantly higher on severity than scenarios written to reflect lower levels of severity. Mean ratings of severity for high and low severity conditions for all three samples are listed in Table 8.



The mean severity ratings for high and low severity scenarios are non-overlapping for all three samples.

Probability. Repeated measures ANOVAs on probability ratings revealed significant main effects of probability across all three samples:  $F(1,49) = 106.16, p < .001, \eta^2 = 0.68$  (student sample),  $F(1,30) = 77.50, p < .001, \eta^2 = 0.72$  (anxious control sample),  $F(1,28) = 29.25, p < .001, \eta^2 = 0.51$  (OCD sample). Scenarios that were written to reflect higher levels of probability were rated as significantly higher on probability than scenarios written to reflect lower levels of probability. Mean ratings of probability for high and low probability conditions for all three samples are listed in Table 9. Mean probability ratings for high and low probability scenarios are non-overlapping for all three samples.

### **Primary Analyses: Procedure**

Main and interaction effects of the multipliers (hypotheses one through three) were examined in each group using a 2 (responsibility: high vs. low) X 2 (severity: high vs. low) X 2 (probability: high vs. low) repeated measures analysis of variance (ANOVA) on the dependent variables described above (i.e., urge to check; degree of anxiety/discomfort if no one checks; degree of worry if no one checks; likelihood of checking; likelihood of asking another to check; and likelihood of seeking reassurance from another)<sup>7</sup>. The findings of the repeated measures ANOVAs for all three samples are summarized in Table 10 and the cell means are in Tables 11 through 16.

One-way repeated measures ANOVAs and follow-up post hoc tests were used to test the hypotheses that the highest scores on the dependent variables would occur in the vignettes in which all three multipliers were high, followed by vignettes in which two multipliers were high,

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<sup>7</sup> Assuming a medium effect size, a total sample size of 20 for each sample (i.e., 20 observations per cell in the within-subjects design) yielded a power of approximately .80.

then vignettes in which one multiplier was high, and finally, vignettes in which all three multipliers were low (hypotheses four through six). Cell means for all dependent variables and all samples are presented in Table 17.

Pearson's chi square was used to test Hypothesis 7, namely that individuals reporting feeling not at all responsible for preventing harm in a vignette would make extremely low ratings on the dependent variables. To provide the most stringent test of this hypothesis and to reduce Type I error inflation, only one vignette was tested – the low responsibility, high severity, high probability scenario. Type I error rate was also controlled by using an adjusted alpha level of .01 for all analyses.

### **Primary Analyses: Student Sample**

#### **Urge to Check**

There were significant main effects of responsibility,  $F(1,49) = 34.61, p < .001, \eta^2 = 0.41$ , severity,  $F(1,49) = 14.69, p < .001, \eta^2 = 0.23$ , and probability  $F(1,49) = 106.45, p < .001, \eta^2 = 0.68$ , on predicted urge to check, all in the expected direction. Overall, students predicted a significantly greater urge to check in scenarios in which the multipliers were higher, relative to scenarios in which the multipliers were lower. The two-way and three-way interactions were not significant using an alpha of .01.

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on ratings of urge to check,  $F(3, 147) = 67.44, p < .001, \eta^2 = 0.58$ . Follow-up tests indicated that ratings of urge to check increased significantly in a stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings of estimated urge to check were significantly lower than when one ( $p < .001$ ), two ( $p < .001$ ), or all three ( $p < .001$ ) multipliers are high. Ratings of urge to

check were significantly higher when two multipliers are high, relative to when only one multiplier is high ( $p = .004$ ). Finally, when one or two of the multipliers are high, ratings of urge to check are significantly lower than when three multipliers are high (both  $p < .001$ ).

Chi-square analyses on the low responsibility, high severity, high probability scenario revealed that the percentage of “not at all responsible” individuals who reported feeling no urge to check (31.3%) did not differ significantly from the percentage of “somewhat responsible” individuals (8.8%) who reported no urge to check,  $p = .044$ .

### **Likelihood of Checking**

There were significant main effects of responsibility  $F(1,49) = 40.30$ ,  $p < .001$ ,  $\eta^2 = 0.45$ , severity  $F(1,49) = 26.70$ ,  $p < .001$ ,  $\eta^2 = 0.35$ , and probability  $F(1,49) = 93.74$ ,  $p < .001$ ,  $\eta^2 = 0.66$ , on predicted likelihood of checking, all in the expected direction. Overall, students predicted a significantly greater likelihood of checking in scenarios in which the multipliers were higher, relative to scenarios in which the multipliers were lower. There was a significant interaction between responsibility and probability,  $F(1,49) = 17.96$ ,  $p < .001$ ,  $\eta^2 = 0.27$ . Simple effects tests revealed that under conditions of low responsibility, perceived probability of harm had a significant impact on likelihood of checking, such that greater perceived probability of harm was associated with a greater estimated likelihood of checking,  $F(1,49) = 29.48$ ,  $p < .001$ ,  $\eta^2 = .38$ . Likewise, under conditions of high responsibility, level of perceived probability had a statistically significant impact on likelihood of checking  $F(1,49) = 92.44$ ,  $p < .001$ ,  $\eta^2 = .654$ , such that likelihood of checking was increased when perceived responsibility was high. However, the magnitude of the difference on likelihood of checking between high and low probability conditions was larger in the high responsibility condition. There was also a significant interaction between severity and probability,  $F(1,49) = 17.36$ ,  $p < .001$ ,  $\eta^2 = 0.26$ . Simple main effects tests

revealed that under conditions of low perceived severity of harm, level of perceived probability had a significant impact on likelihood of checking, such that higher perceived probability was associated with a greater estimated likelihood of checking  $F(1,49) = 30.34, p < .001, \eta^2 = .38$ . Likewise, under conditions of high perceived severity, probability of harm had a significant impact on likelihood of checking, such that higher perceived probability was associated with a greater estimated likelihood of checking  $F(1,49) = 18.60, p < .001, \eta^2 = .28$ . However, the magnitude of the difference on likelihood of checking between high and low probability was greater under conditions of low severity condition than under conditions of high severity. The interaction between responsibility and severity and the three-way interaction were not significant ( $p$  values  $> .05$ ).

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on estimated likelihood of checking,  $F(3, 147) = 63.93, p < .001, \eta^2 = 0.566$ . Follow-up tests indicated that ratings of likelihood of checking increased significantly in a stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings of estimated likelihood of checking were significantly lower than when one ( $p = .002$ ), two ( $p < .001$ ), or all three ( $p < .001$ ) multipliers were high. Ratings of likelihood of checking were significantly higher when two multipliers were high, relative to when only one multiplier was high ( $p < .001$ ). Finally, when one or two of the multipliers were high, ratings of urge to check were significantly lower than when three multipliers were high (both  $p < .001$ ).

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported that they

would not check (50.0%) was significantly greater than the percentage of “somewhat responsible” individuals (11.8%) who reported that they would not check,  $p=.003$ .

### **Discomfort**

There were significant main effects of responsibility,  $F(1,49) = 32.45, p<.001, \eta^2 = 0.40$ , severity  $F(1,49) = 25.23, p<.001, \eta^2 = 0.34$ , and probability  $F(1,49) = 88.22, p<.001, \eta^2 = 0.64$ , on predicted discomfort/anxiety if no one checks, in the expected direction. Overall, students predicted a significantly greater level of discomfort in scenarios in which the multipliers were higher, relative to scenarios in which the multipliers were lower. In additions, the three-way interaction was significant  $F(1,49) = 14.65, p<.001, \eta^2 = 0.23$ . Further analyses revealed a nonsignificant simple interaction effect of severity and probability under conditions of low responsibility,  $F(1,49) = 3.92, p = .053, \eta^2 = 0.07$ , and a significant simple interaction effect of severity and probability under conditions of high responsibility,  $F(1,49) = 16.92, p<.001, \eta^2 = 0.26$ . There was a significant simple main effect of probability under conditions of high responsibility and low severity,  $F(1,49) = 14.23, p<.001, \eta^2 = 0.23$ . There was also a significant effect of probability under conditions of high responsibility and high severity, although this effect was greater in magnitude,  $F(1,49) = 44.56, p<.001, \eta^2 = 0.48$ . Thus, the effect of increased probability on discomfort if no one checks seemed to be most pronounced under conditions of high responsibility and high severity.

The results of the one-way repeated measures ANOVA revealed a significant effect of number of multipliers perceived as high on ratings of discomfort if no one checks,  $F(3,147) = 65.08, p <.001, \eta^2 = 0.57$ . Follow-up tests indicated that ratings of discomfort increased significantly in a stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings of estimated discomfort were

significantly lower than when one ( $p < .001$ ), two ( $p < .001$ ), or all three ( $p < .001$ ) multipliers were high. Ratings of discomfort were significantly higher when two multipliers were high, relative to when only one multiplier is high ( $p = .002$ ). Finally, when one or two of the multipliers were high, ratings of discomfort are significantly lower than when three multipliers are high (both  $p < .001$ ).

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported feeling no discomfort (37.5%) was significantly greater than the percentage of “somewhat responsible” individuals (5.9%) who reported no discomfort,  $p = .004$ .

### **Worry**

There were significant main effects of responsibility,  $F(1,49) = 40.97$ ,  $p < .001$ ,  $\eta^2 = 0.45$ , severity,  $F(1,49) = 16.29$ ,  $p < .001$ ,  $\eta^2 = 0.25$ , and probability  $F(1,49) = 70.70$ ,  $p < .001$ ,  $\eta^2 = 0.59$ , in the expected direction. Overall, students predicted a significantly greater level of worry in scenarios in which the multipliers were higher, relative to scenarios in which the multipliers were lower. In addition, the three-way interaction was significant  $F(1,49) = 8.64$ ,  $p = .005$ ,  $\eta^2 = 0.15$ . Further analyses revealed a nonsignificant simple interaction effect of severity and probability under conditions of low responsibility,  $F(1,49) = 3.46$ ,  $p = .069$ ,  $\eta^2 = 0.07$ , and a significant simple interaction effect of severity and probability under conditions of high responsibility,  $F(1,49) = 7.90$ ,  $p = .007$ ,  $\eta^2 = 0.14$ . There was a significant simple main effect of probability under conditions of high responsibility and low severity,  $F(1,49) = 12.42$ ,  $p = .001$ ,  $\eta^2 = 0.20$ . There was also a significant effect of probability under conditions of high responsibility and high severity, although this effect was greater in magnitude,  $F(1,49) = 28.84$ ,  $p < .001$ ,  $\eta^2$

=0.37. Thus, the effect of increased probability on predicted worry if no one checks seemed to be most pronounced under conditions of high responsibility and high severity.

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on ratings of degree of worry if no one checks,  $F(3, 147) = 54.97, p < .001, \eta^2 = 0.53$ . Follow-up tests indicated that ratings of worry increased in a stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings of estimated worry were significantly lower than when one ( $p < .001$ ), two ( $p < .001$ ), or all three ( $p < .001$ ) multipliers were high. When one or two of the multipliers were high, ratings of worry were significantly lower than when three multipliers were high (both  $p < .001$ ). Mean ratings of level of worry were higher when two multipliers were high, relative to when only one multiplier was high, however, this difference was not statistically significant ( $p = .015$ ).

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported feeling no worry (37.5%) did not differ significantly from the percentage of “somewhat responsible” individuals (8.8%) who reported no worry,  $p = .014$ .

### **Reassurance Seeking**

There were significant main effects of responsibility,  $F(1,49) = 7.92, p = .007, \eta^2 = 0.14$ , and severity,  $F(1,49) = 31.62, p < .001, \eta^2 = 0.39$ , on predicted likelihood of reassurance seeking in the expected direction. There was no significant main effect of probability ( $p > .10$ ). Overall, students predicted a significantly greater level of reassurance seeking in scenarios in which responsibility and severity were higher, relative to scenarios in which responsibility and severity were lower. The interaction between severity and probability was significant  $F(1,49) = 16.57$ ,

$p < .001$ ,  $\eta^2 = 0.25$ . Simple effects tests indicated that under conditions of low severity, perceived probability had a statistically significant impact on likelihood of reassurance seeking,  $F(1,49) = 14.36$ ,  $p < .001$ ,  $\eta^2 = .23$ , such that higher probability was associated with a greater likelihood of seeking reassurance from others. In contrast, when perceived severity was high, perceived probability did not have a statistically significant impact on reassurance seeking ( $p > .10$ ). The interactions between responsibility and severity, responsibility and probability and the three-way interaction were not significant (all  $p$ -values  $> .10$ ).

The results of the one-way repeated measures ANOVA suggested a nonsignificant effect of number of multipliers perceived as high on ratings of likelihood of reassurance seeking,  $F(3, 147) = 4.40$ ,  $p = .012$ ,  $\eta^2 = 0.08$ . However, inspection of means revealed that ratings of likelihood of reassurance seeking increased in a stepwise fashion as the number of high multipliers increased from none to two.

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported feeling no urge to reassurance seek (43.8%) did not differ significantly from the percentage of “somewhat responsible” individuals (35.3%) who reported no urge to check,  $p > .50$ .

### **Checking by Other**

There was no significant main effect of responsibility on predicted likelihood of asking another to check ( $p = .06$ ). There were significant main effects of severity,  $F(1,49) = 15.53$ ,  $p < .001$ ,  $\eta^2 = 0.24$ , and probability  $F(1,49) = 36.26$ ,  $p < .001$ ,  $\eta^2 = 0.42$ , in the expected direction. Overall, students predicted a significantly higher likelihood of asking another to check in scenarios in which severity and probability were higher, relative to scenarios in which severity and probability were lower. The interaction between responsibility and probability was



significant  $F(1,49) = 32.06, p < .001, \eta^2 = 0.40$ . Simple effects tests revealed that under conditions of low responsibility, level of perceived probability of harm had a statistically significant impact on likelihood of asking another to check,  $F(1,49) = 69.10, p < .001, \eta^2 = .581$ , such that higher perceived probability of harm was associated with a greater likelihood of asking another to check. In contrast, under conditions of high responsibility, level of perceived probability did not have a statistically significant impact on likelihood of asking another to check ( $p > .10$ ). The interactions between responsibility and severity, severity and probability, and the three-way interaction were not significant (all  $p$ -values  $> .05$ ).

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on ratings of likelihood of asking another person to check,  $F(3, 147) = 11.85, p < .001, \eta^2 = 0.20$ . Follow-up tests indicated that ratings of likelihood of asking another to check increased in a stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings were significantly lower than when one ( $p < .001$ ), two ( $p < .001$ ), or all three ( $p < .001$ ) multipliers were high. The other pairwise comparisons were not significant ( $p$ -values greater than .01).

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported that they would not ask another person to check (31.3%) did not differ significantly from the percentage of “somewhat responsible” individuals (11.8%) who reported that they would not ask another person to check,  $p = .094$ .

## **Primary Analyses: Anxious Control Sample**

### **Urge to Check**

There were significant main effects of responsibility,  $F(1,30) = 100.34, p < .001, \eta^2 = 0.77$ , severity,  $F(1,30) = 14.47, p = .001, \eta^2 = 0.32$ , and probability,  $F(1,30) = 106.39, p < .001, \eta^2 = 0.78$ , on urge to check in the expected direction. Overall, the anxious control participants predicted a significantly greater urge to check in scenarios in which the multipliers were higher, relative to scenarios in which the multipliers were lower. The two-way and three-way interactions were not significant (all  $p$ -values  $> .05$ ).

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on ratings of urge to check,  $F(3, 90) = 92.57, p < .001, \eta^2 = 0.76$ . Follow-up tests indicated that ratings of urge to check increased significantly in a stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings of estimated urge to check were significantly lower than when one ( $p < .001$ ), two ( $p < .001$ ), or all three ( $p < .001$ ) multipliers were high. Ratings of urge to check were significantly higher when two multipliers were high, relative to when only one multiplier was high ( $p < .001$ ). Finally, when one or two of the multipliers are high, ratings of urge to check were significantly lower than when three multipliers were high (both  $p < .001$ ).

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported no urge to check (44.4%) was significantly greater than the percentage of “somewhat responsible” individuals (4.5%) who reported no urge to check,  $p = .006$ .

### **Likelihood of Checking**

There were significant main effects of responsibility,  $F(1,30) = 57.09$ ,  $p < .001$ ,  $\eta^2 = 0.66$ , severity,  $F(1,30) = 18.60$ ,  $p < .001$ ,  $\eta^2 = 0.38$ , and probability  $F(1,30) = 99.34$ ,  $p < .001$ ,  $\eta^2 = 0.77$ , on likelihood of checking in the expected direction. Overall, the anxious control participants predicted a significantly greater likelihood of checking in scenarios in which the multipliers were higher, relative to scenarios in which the multipliers were lower. There was a significant interaction between responsibility and probability,  $F(1,30) = 13.70$ ,  $p = .001$ ,  $\eta^2 = 0.31$ . Simple main effects tests revealed that under conditions of low perceived responsibility for harm, perceived probability of harm had a statistically significant impact on estimated likelihood of checking,  $F(1,30) = 10.25$ ,  $p = .003$ ,  $\eta^2 = .26$ , with higher perceived probability being associated with a greater likelihood of checking. Similarly, under conditions of high responsibility, higher perceived probability of harm was associated with a greater likelihood of checking,  $F(1,30) = 104.72$ ,  $p < .001$ ,  $\eta^2 = 0.777$ . The magnitude of the difference in likelihood of checking between high and low perceived probability was greater under conditions of high perceived responsibility for harm. There was also a significant interaction between severity and probability,  $F(1,30) = 10.99$ ,  $p = .002$ ,  $\eta^2 = 0.27$ . Simple main effects tests revealed that under conditions of low severity of harm, perceived probability of harm had a statistically significant impact on predicted likelihood of checking,  $F(1,30) = 23.96$ ,  $p < .001$ ,  $\eta^2 = .444$ , such that higher perceived probability was associated with a greater likelihood of checking. Likewise, under conditions of high perceived severity of harm, perceived probability of harm had a statistically significant impact on predicted likelihood of checking,  $F(1,30) = 70.33$ ,  $p < .001$ ,  $\eta^2 = .701$ . However, the magnitude of the increase in likelihood of checking was greater in the high severity conditions. The three-way interaction was not significant ( $p = .023$ ).

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on estimated likelihood of checking,  $F(3, 90) = 112.10$ ,  $p < .001$ ,  $\eta^2 = 0.79$ . Follow-up tests indicated that ratings of likelihood of checking increased in a stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings of estimated likelihood of checking were significantly lower than when two ( $p < .001$ ) or all three ( $p < .001$ ) multipliers were high. Ratings of likelihood of checking were higher when one multiplier is high, relative to when no multipliers were high, however, this difference was not statistically significant ( $p = .016$ ). Ratings of likelihood of checking were significantly higher when two multipliers were high, relative to when only one multiplier was high ( $p < .001$ ). Finally, when one or two of the multipliers were high, ratings of urge to check were significantly lower than when three multipliers were high (both  $p < .001$ ).

Chi-square analyses on the low responsibility, high severity, high probability scenario, revealed that the percentage of “not at all responsible” individuals who reported that they would not check (55.6%) did not differ significantly from the percentage of “somewhat responsible” individuals (18.2%) who that they would not check,  $p = .037$ .

### **Discomfort**

There were significant main effects of responsibility,  $F(1,30) = 52.73$ ,  $p < .001$ ,  $\eta^2 = 0.64$ , severity,  $F(1,30) = 11.61$ ,  $p = .002$ ,  $\eta^2 = 0.28$ , and probability,  $F(1,30) = 78.53$ ,  $p < .001$ ,  $\eta^2 = 0.72$ , on discomfort, in the expected direction. Overall, anxious control participants predicted a significantly greater level of discomfort in scenarios in which the multipliers were higher, relative to scenarios in which the multipliers were lower. In addition, the three-way interaction was significant  $F(1,30) = 13.13$ ,  $p = .001$ ,  $\eta^2 = 0.30$ . Further analyses revealed a nonsignificant simple interaction effect of severity and probability under conditions of high responsibility,

$F(1,30) = 5.03$ ,  $p = .032$ ,  $\eta^2 = 0.14$ , and a significant simple interaction effect of severity and probability under conditions of low responsibility,  $F(1,30) = 9.60$ ,  $p = .004$ ,  $\eta^2 = 0.24$ . There was a significant simple main effect of probability under conditions of low responsibility and low severity,  $F(1,30) = 36.68$ ,  $p < .001$ ,  $\eta^2 = 0.55$ , such that increases in probability were associated with higher ratings of discomfort. There was no significant effect of probability under conditions of low responsibility and high severity,  $F(1,30) = 1.94$ ,  $p > .10$ . Thus, the effect of increased probability on predicted discomfort if no one checks seems to be most pronounced under conditions of low responsibility and low severity.

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on ratings of discomfort if no one checks,  $F(3,90) = 68.49$ ,  $p < .001$ ,  $\eta^2 = 0.70$ . Follow-up tests indicated that ratings of discomfort increased in a stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings of estimated discomfort were significantly lower than when one ( $p < .001$ ), two ( $p < .001$ ), or all three ( $p < .001$ ) multipliers were high. Ratings of discomfort were higher when two multipliers were high, relative to when only one multiplier was high, although this difference was not statistically significant ( $p = .10$ ). Finally, when one or two of the multipliers were high, ratings of discomfort were significantly lower than when three multipliers were high (both  $p < .001$ ).

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported no discomfort (66.7%) was significantly greater than the percentage of “somewhat responsible” individuals (13.6%) who reported no discomfort,  $p = .003$ .

## Worry

There were significant main effects of responsibility,  $F(1,30) = 34.29, p < .001, \eta^2 = 0.53$ , severity,  $F(1,30) = 13.29, p = .001, \eta^2 = 0.31$ , and probability,  $F(1,30) = 52.86, p < .001, \eta^2 = 0.64$ , in the expected direction on predicted worry if no one checks. Overall, the anxious control participants predicted a significantly greater level of worry in scenarios in which the multipliers were higher, relative to scenarios in which the multipliers were lower. Again, the three-way interaction was significant,  $F(1,30) = 7.72, p = .009, \eta^2 = 0.20$ . Further analyses revealed a nonsignificant simple interaction effect of severity and probability under conditions of low responsibility,  $F(1,30) = 6.91, p = .013, \eta^2 = 0.19$ , and a nonsignificant simple interaction effect of severity and probability under conditions of high responsibility,  $F(1,30) = 1.19, p = .285, \eta^2 = 0.04$ .

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on ratings of degree of worry if no one checks,  $F(3, 90) = 60.41, p < .001, \eta^2 = 0.67$ . Follow-up tests indicated that ratings of worry increased significantly in a stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings of estimated worry were significantly lower than when one ( $p < .001$ ), two ( $p < .001$ ), or all three ( $p < .001$ ) multipliers were high. When one or two of the multipliers were high, ratings of worry were significantly lower than when three multipliers were high (both  $p < .001$ ). Mean ratings of level of worry were higher when two multipliers were high, relative to when only one multiplier was high, however, this difference was not statistically significant ( $p = .010$ ).

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of "not at all responsible" individuals who reported no worry

(55.6%) was significantly greater than the percentage of “somewhat responsible” individuals (9.1%) who reported no worry,  $p=.005$ .

### **Reassurance Seeking**

There were no significant main effects of the multipliers on predicted likelihood of reassurance seeking (all  $p$ -values  $>.10$ ) in the anxious control sample. There was a significant interaction of severity and probability  $F(1,30) = 10.80$ ,  $p<.005$ ,  $\eta^2 = 0.26$ . Simple effects tests revealed that under conditions of low severity, level of perceived probability had a statistically significant effect on likelihood of reassurance-seeking  $F(1,30) = 11.04$ ,  $p = .002$ ,  $\eta^2 = .27$ , such that higher probability of harm was associated with an increased likelihood of reassurance seeking. In contrast, under conditions of high severity, perceived probability of harm did not have a statistically significant effect on likelihood of reassurance seeking,  $F(1,30) = 1.54$ ,  $p>.10$ . The other two-way interactions and the three-way interaction were not significant (all  $p$ -values  $>.01$ ).

The results of the one-way repeated measures ANOVA suggested a nonsignificant effect of number of multipliers perceived as high on ratings of likelihood of reassurance seeking,  $F(3, 90) = 1.23$ ,  $p>.10$ . However, inspection of means revealed that the lowest ratings of likelihood of reassurance seeking were given in scenarios in which all three multipliers were low.

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported that they would not reassurance seek (66.7%) did not differ significantly from the percentage of “somewhat responsible” individuals (59.1%) who reported that they would not reassurance seek,  $p>.50$ .

### **Checking by Other**

There was no significant main effect of responsibility ( $p > .10$ ) or severity ( $p = .012$ ) on predicted likelihood of asking another to check. There was a significant main effect of probability  $F(1,30) = 33.17$ ,  $p < .001$ ,  $\eta^2 = 0.52$ , on likelihood of asking another to check in the expected direction. Anxious control participants predicted a significantly higher likelihood of asking another to check in scenarios in which perceived probability was higher, relative to scenarios in which perceived probability were lower. The two-way and three-way interactions were not significant (all  $p$ -values  $> .01$ ).

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on ratings of likelihood of asking another person to check,  $F(3, 90) = 7.64$ ,  $p = .001$ ,  $\eta^2 = 0.20$ . Follow-up tests indicated that ratings of likelihood of asking another to check were highest in scenarios in which two multipliers were high, and differed significantly from scenarios in which none or only one multiplier was high (both  $< .001$ ), but did not differ significantly from scenarios in which all three multipliers were high ( $p > .10$ ). Ratings of likelihood of asking another to check were higher when one multiplier was high, relative to when none of the multipliers were high, although this difference was not statistically significant ( $p > .10$ ). Finally, ratings of likelihood of asking another to check in scenarios in which all multipliers were high were higher than ratings for scenarios in which only one or none of the multipliers were high, though these differences were not statistically significant ( $p = .09$  and  $p = .03$ , respectively).

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported that they would not ask another to check (33.3%) did not differ significantly from the percentage of



“somewhat responsible” individuals (22.7%) who reported that they would not ask another to check,  $p > .50$ .

### **Primary Analyses: OCD Sample**

#### **Urge to Check**

There were significant main effects of severity,  $F(1,28) = 15.47$ ,  $p = .001$ ,  $\eta^2 = 0.36$ , and probability,  $F(1,28) = 54.23$ ,  $p < .001$ ,  $\eta^2 = 0.66$  on urge to check in the expected direction. The main effect of responsibility was nonsignificant ( $p = .02$ ), but in the expected direction. Participants with OCD predicted a significantly greater urge to check in scenarios in which perceived severity, probability, and responsibility were higher, relative to scenarios in which these multipliers were lower. There was also a significant three-way interaction  $F(1,28) = 10.13$ ,  $p = .004$ ,  $\eta^2 = 0.27$ . Further analyses revealed a nonsignificant simple interaction effect of severity and probability under conditions of low responsibility,  $F(1,28) = 4.04$ ,  $p = .054$ ,  $\eta^2 = 0.13$ , and a nonsignificant simple interaction effect of severity and probability under conditions of high responsibility,  $F(1,28) = 6.16$ ,  $p = .019$ ,  $\eta^2 = 0.18$ .

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on ratings of urge to check,  $F(3, 84) = 25.53$ ,  $p < .001$ ,  $\eta^2 = 0.48$ . Follow-up tests indicated that ratings of urge to check increased in a stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings of estimated urge to check were significantly lower than when two ( $p = .004$ ), or all three ( $p < .001$ ) multipliers were high. Ratings of urge to check were also higher when one multiplier was high, relative to when none of the multipliers were high, though this difference was not statistically significant ( $p = .015$ ). Similarly, ratings of urge to check were also higher when two multipliers were high, relative to when only one of the multipliers was high,

though this difference was also not statistically significant ( $p > .10$ ). Finally, when one or two of the multipliers were high, ratings of urge to check were significantly lower than when three multipliers were high (both  $p < .001$ ).

Chi-square analyses on the low responsibility, high severity, high probability scenario, revealed that the percentage of “not at all responsible” individuals who reported no urge to check (50.0%) was significantly greater than the percentage of “somewhat responsible” individuals (4.3%) who reported no urge to check,  $p = .004$ .

### **Likelihood of Checking**

There were significant main effects of responsibility,  $F(1,28) = 9.17$ ,  $p = .005$ ,  $\eta^2 = 0.25$ , severity,  $F(1,28) = 13.73$ ,  $p = 0.001$ ,  $\eta^2 = 0.33$ , and probability  $F(1,28) = 59.89$ ,  $p < .001$ ,  $\eta^2 = 0.68$ , on likelihood of checking in the expected direction. Overall, participants with OCD predicted a significantly greater likelihood of checking in scenarios in which the multipliers were higher, relative to scenarios in which the multipliers were lower. The interaction between responsibility and probability was also significant  $F(1,28) = 29.22$ ,  $p < .001$ ,  $\eta^2 = 0.51$ . Simple effects tests revealed that under conditions of low responsibility, perceived probability of harm did not have a statistically significant effect on likelihood of checking,  $F(1,28) = 1.60$ ,  $p > .10$ . In contrast, under conditions of high responsibility, higher perceived probability of harm was associated with a significantly increased likelihood of checking,  $F(1,28) = 73.08$ ,  $p < .001$ ,  $\eta^2 = .723$ . The other two-way interactions and the three-way interaction were not significant (all  $p$ -values greater than .02).

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on estimated likelihood of checking,  $F(3, 84) = 35.29$ ,  $p < .001$ ,  $\eta^2 = 0.56$ . Follow-up tests indicated that ratings of likelihood of checking increased in a

stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings of estimated likelihood of checking were significantly lower than when all three ( $p < .001$ ) multipliers were high, but did not differ significantly from ratings for scenarios in which only one or two of the multipliers were elevated ( $p > .10$  and  $p = .047$  respectively). Ratings of likelihood of checking were significantly lower when one multiplier was high, relative to when two multipliers were high ( $p = .003$ ). Finally, when one or two of the multipliers were high, ratings of urge to check were significantly lower than when three multipliers were high (both  $p < .001$ ).

Chi-square analyses on the low responsibility, high severity, high probability scenario, revealed that the percentage of “not at all responsible” individuals who reported that they would not check (83.3%) was significantly greater than the percentage of “somewhat responsible” individuals (4.3%) who reported that they would not check,  $p < .001$ .

### **Discomfort**

There were significant main effects of responsibility,  $F(1,28) = 9.33$ ,  $p = .005$ ,  $\eta^2 = 0.25$ , severity,  $F(1,28) = 19.32$ ,  $p < .001$ ,  $\eta^2 = 0.41$ , and probability,  $F(1,28) = 33.84$ ,  $p < .001$ ,  $\eta^2 = 0.55$ , on discomfort, in the expected direction. Overall, participants with OCD predicted a significantly greater level of discomfort in scenarios in which the multipliers were higher, relative to scenarios in which the multipliers were lower. There was a significant interaction effect between responsibility and probability,  $F(1,28) = 11.15$ ,  $p = .002$ ,  $\eta^2 = 0.29$ . Simple effects tests indicated that under conditions of low responsibility, level of probability had a statistically significant impact on discomfort,  $F(1,28) = 8.60$ ,  $p = .007$ ,  $\eta^2 = .24$ , such that higher perceived probability was associated with a greater discomfort. Similarly, under conditions of high responsibility, higher perceived probability was associated with increased discomfort  $F(1,28) = 45.66$ ,  $p < .001$ ,

$\eta^2=0.62$ . However, the magnitude of the effect of probability in the high responsibility condition was larger than in the low responsibility condition. The other two-way interactions were nonsignificant (both  $p$  values greater than .03), as was the three-way interaction ( $p=.013$ ).

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on ratings of discomfort if no one checks,  $F(3,84) = 34.02$ ,  $p < .001$ ,  $\eta^2 = 0.55$ . Follow-up tests indicated that ratings of discomfort increased in a stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings of estimated discomfort were significantly lower than when one ( $p=.008$ ), two ( $p=.001$ ), or all three ( $p<.001$ ) multipliers were high. Ratings of discomfort were higher when two multipliers were high, relative to when only one multiplier was high, although this difference was not statistically significant ( $p = .026$ ). Finally, when one or two of the multipliers were high, ratings of discomfort were significantly lower than when three multipliers were high (both  $p<.001$ ).

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported no discomfort (50.0%) was significantly greater than the percentage of “somewhat responsible” individuals (0%) who reported no discomfort,  $p < .001$ .

### **Worry**

There were significant main effects of responsibility,  $F(1,28) = 7.70$ ,  $p=.010$ ,  $\eta^2 = 0.23$ , severity;  $F(1,28) = 17.69$ ,  $p<.001$ ,  $\eta^2 = 0.39$ , and probability  $F(1,28) = 28.24$ ,  $p<.001$ ,  $\eta^2 = 0.50$ , in the expected direction on predicted worry if no one checks. Overall, participants with OCD predicted a significantly greater level of worry in scenarios in which the perceived multipliers were higher, relative to scenarios in which these multipliers were lower. In addition, the three-

way interaction was significant  $F(1,28) = 10.31, p=.003, \eta^2 = 0.27$ . Follow-up analyses revealed nonsignificant simple interaction effects of severity and probability under conditions of low responsibility,  $F(1,28) = 2.67, p>.10$ , and under conditions of high responsibility,  $F(1,28) = 3.91, p = .058$ .

The results of the one-way repeated measures ANOVA suggested a significant effect of number of multipliers perceived as high on ratings of degree of worry if no one checks,  $F(3, 84) = 26.97, p < .001, \eta^2 = 0.491$ . Follow-up tests indicated that ratings of worry increased significantly in a stepwise fashion as the number of high multipliers increased from none to three. When all three multipliers were low, the mean ratings of estimated worry were significantly lower than when two ( $p=.003$ ), or all three ( $p<.001$ ) multipliers were high. Similarly, ratings of worry were higher when one multiplier was high, relative to when all multipliers were low, however, this difference was not statistically significant ( $p = .016$ ). Ratings of worry were higher when two multipliers were high, relative to when only one multiplier was high, although this difference was also not statistically significant ( $p=.019$ ). When one or two of the multipliers were high, ratings of worry were significantly lower than when three multipliers were high (both  $p<.001$ ).

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported that they would not worry (33.3%) was significantly greater than the percentage of “somewhat responsible” individuals (0%) who reported that they would not worry,  $p=.004$ .

### **Reassurance Seeking**

There was a significant main effect of severity,  $F(1,28) = 14.91, p=.001, \eta^2 = 0.35$ , on predicted likelihood of reassurance-seeking, in the expected direction (e.g., higher perceived

severity of harm associated with greater likelihood of reassurance seeking). There were no significant main effects of responsibility or probability of harm on predicted likelihood of reassurance seeking (both  $p > .10$ ) in the OCD sample nor were the two-way interactions or the three-way interaction significant (all  $p$ -values  $> .01$ ).

The results of the one-way repeated measures ANOVA suggested a nonsignificant effect of number of multipliers perceived as high on ratings of likelihood of reassurance seeking,  $F(3, 84) = .248, p > .10$ . However, inspection of means revealed that the lowest ratings of likelihood of reassurance seeking were given in scenarios in which all three multipliers were low, and the highest ratings of likelihood of reassurance seeking occurred in scenarios in which all three multipliers were high.

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported that they would not reassurance seek (66.7%) did not differ significantly from the percentage of “somewhat responsible” individuals (21.7%) who reported that they would not reassurance seek,  $p = .034$ .

### **Checking by Other**

There were no significant main effects of responsibility or severity on predicted likelihood of asking another to check (both  $p > .05$ ). There was a significant main effect of probability  $F(1, 28) = 21.47, p < .001, \eta^2 = 0.43$  in the expected direction. Participants in the OCD sample predicted a significantly higher likelihood of asking another to check in scenarios in which perceived probability was higher, relative to scenarios in which perceived probability were lower. There was also a significant three-way interaction,  $F(1, 28) = 7.57, p = .010, \eta^2 = 0.21$ . Follow-up analyses revealed nonsignificant simple interaction effects of severity and

probability under conditions of low responsibility,  $F(1,28) = 5.42$ ,  $p = .027$  and under conditions of high responsibility,  $F(1,28) = 2.01$ ,  $p > .10$ .

The results of the one-way repeated measures ANOVA suggested a nonsignificant effect of number of multipliers perceived as high on ratings of likelihood of reassurance seeking,  $F(3, 84) = 1.49$ ,  $p > .10$ .

Chi-square analyses on the low responsibility, high severity, high probability scenario (F), revealed that the percentage of “not at all responsible” individuals who reported that they would not ask another to check (83.3%) was significantly greater than the percentage of “somewhat responsible” individuals (8.7%) who reported that they would not ask another to check,  $p < .001$ .

### **Study 1 Discussion**

The purpose of this study was to provide the first experimental test of part one of Rachman’s new cognitive theory of compulsive checking (2002), which concerns the impact of three hypothesized multipliers, perceived responsibility for harm, perceived probability of harm and perceived severity of harm, on compulsive checking. The study had two main aims: (1) to test the individual and combined effects of the multipliers on a variety of checking-related emotional and behavioural responses to situations that imply the possibility of harm, and (2) to evaluate the explanatory power of part one of the theory across three samples of participants representing a continuum of anxiety and checking behaviour. As this is the first study to test this new theory, in addition to analyses directly testing hypotheses, some exploratory pattern analysis was also undertaken.

In order to test the impact of these multipliers in a practical, standardized and ethical way, a series of vignettes were developed that permitted the simultaneous and independent

manipulation of the multipliers. A within-subjects design was employed to examine individuals' responses to all possible combinations of relatively higher and relatively lower levels of each multiplier, and to provide a more sensitive test of the impact of the multipliers on checking-related responses. Preliminary analyses suggested that, across samples, participants were able to vividly imagine themselves in the situations described in the vignettes, suggesting that this method was a reasonable way to investigate participants' responses to variations in these multipliers. Furthermore, manipulation check analyses suggested that across samples, participants perceived significant and reliable differences between vignettes written to reflect higher versus lower levels of each multiplier. This held even for the OCD participants, who may have been expected to have greater difficulty discriminating between high and low levels of the multipliers, particularly responsibility; although not surprisingly, the mean ratings of the multipliers for each vignette were higher in the OCD sample than in the other two groups.<sup>8</sup> Moreover, despite the previously reported difficulties in separating out responsibility, probability and severity (in part due to conceptual confounding of these constructs), an effort was made in this study to separate out these variables. Manipulation check analyses suggested that multipliers were manipulated relatively independently of one another, thus allowing the first evaluation of their independent effects on checking-related responses.

### **Findings for Primary Dependent Measures:**

#### **Urge to Check, Likelihood of Checking, Discomfort, and Worry**

Based upon the cognitive theory of compulsive checking, several specific hypotheses were formulated in this study. The primary hypothesis was that each multiplier would have a significant independent effect on the checking-related emotional and behavioural responses that were the dependent variables for this study. More specifically, it was hypothesized that relative

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<sup>8</sup> This difference was not tested inferentially.



to situations in which a particular multiplier was low, situations in which that multiplier was high would be associated with higher ratings on the dependent variables. The primary dependent variables for this study were the individual's predictions of urge to check, likelihood of actual checking, anxiety/discomfort if the situation was left unchecked, and worry if the situation was left unchecked. Two additional dependent variables, likelihood of reassurance seeking and of asking another person to check ("checking by proxy") were also included as these behaviours have been conceptualized in previous work as variants or "disguised" forms of compulsive checking. The finding for these secondary dependent variables are described separately below.

The primary hypotheses of Study 1 were generally supported for the main dependent variables. Scenarios in which responsibility was perceived as relatively high were associated with higher ratings on urge to check, likelihood of checking, level of anxiety/discomfort if no one checks, and degree of worry if no one checks, relative to scenarios in which responsibility was perceived as relatively low. The same pattern of results was found comparing the high severity conditions with the low severity conditions, and comparing high probability conditions with the low probability conditions. The effect sizes for each multiplier were large, suggesting a substantial impact of the multipliers on the checking-related emotional and behavioural responses assessed in this study. Moreover, these effects were remarkably consistent across the three samples, suggesting that each of the multipliers plays an independent and important role in the checking-related outcomes not only for individuals with OCD, but also for people with other anxiety disorders and for non-anxious individuals. This is consistent with the cognitive theory of compulsive checking, which suggests a continuum of checking behaviour from those who rarely check to those who check compulsively.

Interestingly, the pattern of effect sizes for the three multipliers was also remarkably consistent across dependent measures and samples. For both the student and anxious control samples, probability was associated with the largest effect sizes on the primary dependent measures, followed by responsibility and then severity. In the OCD sample, probability was also associated with the largest effect sizes, followed by severity and then responsibility. The implications of these findings for the cognitive theory of checking are discussed further below.

Based upon the cognitive theory of compulsive checking, it was also hypothesized that ratings on the primary dependent variables would be highest for situations in which all three multipliers were perceived as relatively high, and lowest for situations in which all three multipliers were perceived as relatively low. This hypothesis was supported. In addition, the magnitude of the discrepancy between ratings in low-low-low and high-high-high scenarios for each checking-related variable was considerable. For example, in the student sample, the mean rating of urge to check in the low-low-low scenario was 1.56 (out of 5), whereas the mean rating of urge to check in the high-high-high scenario was 3.7 – a difference of 2.78 standard deviations. This is a strikingly large response to differences in the multipliers, particularly in a sample of individuals who do not routinely check. In addition, this pattern was consistent across all three samples, suggesting that across the continuum of anxiety and checking behaviours, participants responded in similar ways to the combination of the highest possible and lowest possible values for each multiplier.

A related hypothesis, based upon a logical extension of the predictions of the cognitive theory of compulsive checking, was that there would be an additive effect of the multipliers. More specifically, it was proposed that the lowest ratings on the dependent measures would occur in the scenario in which all three multipliers were low, followed by the scenarios in which

one multiplier was elevated, then the scenarios in which two multipliers were elevated, and the highest ratings would occur in the scenario in which all three multipliers were high. This hypothesis was supported for urge to check, likelihood of checking, anxiety/discomfort if no one checks, and worry if no one checks. For these dependent measures, ratings increased in a stepwise fashion as the number of elevated multipliers increased from zero to three (see Figure 1 for an illustration of this pattern on likelihood of checking across all three samples). Moreover, for most variables, ratings for the low responsibility, low probability, low severity scenario were significantly lower than the ratings for scenarios in which a single multiplier was elevated. Similarly, for all of these dependent measures, ratings for the high responsibility, high probability, high severity scenario were significantly higher than ratings for scenarios in which only two of three multipliers were elevated. Mean differences between scenarios in which one multiplier was high and scenarios in which two multipliers were high were not always statistically significant, but were always in the expected direction. Again, these findings on the additive effects of the multipliers held across all three samples of participants. They are consistent with Rachman's (2002) cognitive theory of compulsive checking, and add to our understanding of the combined effects of the multipliers.

A closer examination of the relative rank ordering of scenarios from lowest to highest according to scores on the primary dependent measures revealed an interesting and remarkably consistent pattern. As noted above, the scenario that combined high levels of each multiplier was associated with the highest scores on dependent measures while the low-low-low scenario was associated with the lowest scores, across all three samples of participants. Interestingly, the second highest scores on the dependent measure were always observed in the scenario that combined high levels of responsibility and probability with low levels of severity (an especially

potent combination of multipliers, as discussed below)<sup>9</sup>. The third highest scores on the dependent measure were always observed in the scenario that combined high levels of severity and probability with low responsibility. This is somewhat surprising as perceived responsibility is considered by many to be the most important determinant of compulsive behaviour (e.g., Salkovskis, 1985, 1989) and is given special status as the only multiplier that is “essential” for the occurrence of compulsive checking. Rachman (2002) notes that “if perceived responsibility is substantially reduced or even removed, little or no checking will take place, regardless of the status of the remaining two multipliers” (p.630). Indeed, based upon the theory, it would be expected that the four scenarios with the highest scores on the dependent measures would be those that included high levels of perceived responsibility. However, in this study, across samples and across the primary dependent measures, the bottom four scenarios were those that incorporated low levels of *probability*. The striking consistency across dependent measures and across samples, in combination with the primary analyses in which probability was consistently associated with larger effect sizes than either responsibility or severity, suggests that probability may be an especially important determinant of checking-related emotional and behavioural responses across the range of anxiety and compulsive behaviours. This is consistent with suggestions by some researchers that the role of other potentially important cognitive factors, such as perception of threat, might be as important in the promotion of compulsive urges (Clark, 2004).

Although not explicitly hypothesized, there was also some evidence for a multiplicative effect of the multipliers on likelihood of checking that held across samples. Specifically, it was found that the effect of probability was much greater (“supercharged”) in scenarios in which perceived responsibility was high, relative to scenarios in which perceived responsibility was

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<sup>9</sup> This difference was not tested inferentially.

low (see Figure 2 for an illustration of this effect on likelihood of checking across all three samples). Thus, the results of this study suggest that when a person does not feel a strong sense of responsibility for preventing harm, probability has some impact on likelihood of checking, such that he is more likely to check if he feels that negative event is relatively likely to occur than if he feels that the event is relatively unlikely to occur. However, when a person feels a strong sense of responsibility for preventing harm, he is especially sensitive to the perceived likelihood of the negative event. Alternatively, these findings may suggest that when a person perceives that harm is relatively likely, then she feels a greater sense of responsibility to act to prevent it. In sum, the combination of high perceived responsibility and high perceived probability appears to be an especially potent combination for driving checking behaviour across levels of severity.

Rachman's prediction that under conditions of no responsibility, little checking would occur, even under conditions of high perceived probability and severity, was partially tested in the present study. Based upon this prediction, it was hypothesized that participants who reported feeling not at all responsible for harm in the low responsibility, high severity, high probability scenario would be more likely to make extremely low ratings across the primary dependent measures than those who reported feeling at least some responsibility. This hypothesis was partially supported (see Figures 3, 4, & 5). In general, across samples, individuals who perceived no responsibility for harm, but high perceived probability and severity, were significantly more likely to report that they would not experience worry, distress, or urges to check or engage in actual checking behaviour than individuals who perceived themselves as at least somewhat responsible. For example, among the minority of participants (21%) in the OCD sample who reported feeling not at all responsible for harm in this scenario, 83.3% reported that they would

not check. In contrast, among those who reported feeling at least somewhat responsible for preventing harm, only 4.3% reported that they would not check. Overall, the findings suggested that across all three samples, the perception of at least some responsibility was almost invariably associated with predicted distress and urges or checking behaviour.

The absence of perceived responsibility was not as reliably associated with the absence of distress and checking-related behaviours as was predicted. For instance, across samples and primary dependent measures, there were generally a few participants who rated themselves as not at all responsible, but still endorsed at least some chance that they would experience distress, an urge to check, or actual checking behaviour when perceived severity and probability of harm were high. For example, for likelihood of checking, across all three samples, a minority of people reported no perceived responsibility for harm, but nevertheless indicated some possibility that they would check. Of the 16 out of 50 people in the student sample who reported feeling “not at all responsible” for harm in the scenario that incorporated low levels of responsibility and high levels of probability and severity, 50% reported that they would not check, while 50% made ratings indicating at least some chance that would check. Similarly, of the 9 out of 31 people in the anxious control sample who endorsed feeling “not at all responsible” in this scenario, 45% endorsed at least some chance that they would check. However, the pattern was somewhat different in the OCD sample. Of the 6 people out of 29 in the OCD sample who reported feeling not at all responsible, only 17% reported that they might check. Thus, relative to the non-OCD samples, it appeared that individuals in the OCD sample were much more likely to equate a lack of perceived responsibility for harm with no need to check: “If I am not responsible, then there is no need to check”.

These findings may suggest that responsibility is a more necessary precondition for checking among those for whom inflated responsibility is a problem. Put differently, under those relatively rare circumstances when a person with generally inflated responsibility feels that he is not responsible for any harm, the likelihood of checking is particularly low. Individuals who are not as sensitive to perceived responsibility of harm may tend to give more weight to other factors (such as probability?) when making decisions about checking behaviour. Overall then the findings of this analysis suggest that perceived responsibility for harm may be a necessary condition for the occurrence of emotional distress and checking-related behaviours for a significant subset, but not all, people. This is consistent with the findings of Ladouceur and colleagues (1997) in their pill sorting study with non-clinical participants, who observed that in order to produce checking behaviour, only “negative consequences” were necessary.

Overall, the findings of the present study for the primary dependent measures are consistent with previous research on the multipliers. For example, perceived responsibility emerged as a key factor influencing emotional distress and checking in situations that imply the possibility of harm, which is consistent with both correlational and experimental research linking this multiplier with urges to neutralize and obsessive-compulsive symptoms in clinical and non-clinical samples (e.g, Emmelkamp & Aardema, 1999; Lopatka & Rachman, 1995; Rheaume, Freeston, Dugas, Letarte, & Ladouceur, 1995; Rheaume, Ladouceur, & Freeston, 2000; Shafran, 1997; Wilson & Chambless, 1999). The findings concerning the influence of probability and severity are also in line with previous experimental work examining “risk” in relation to distress and urges to neutralize (Foa et al., 2001, 2002). However, the findings of the present study also extend our understanding of the relationship between the multipliers and checking-related outcomes in several ways (discussed below).

### **Findings for Secondary Dependent Measures:**

#### **Reassurance-Seeking and Checking by Others**

Likelihood of reassurance seeking, and likelihood of asking another person to check (“checking by proxy”), conceptualized in previous work as variants or “disguised” forms of compulsive checking (Rachman, 2002), were also examined in this study in order to provide a broad assessment of the impact of the multipliers on checking-related responses. The same hypotheses regarding the independent and combined effects of the multipliers were tested. However, the pattern of findings for these other dependent variables was less consistent with the study hypotheses, and much less consistent across samples.

Based on the cognitive theory of compulsive checking, it was hypothesized that each of the multipliers would have a significant independent effect on reassurance seeking and checking by proxy, such that higher levels of each multiplier would be associated with higher ratings on these measures than lower levels of each multiplier. Although this hypothesis was strongly supported for the primary dependent measures, it received limited support for the secondary dependent measures. For reassurance seeking, the only relatively consistent independent effect of the multipliers that emerged was that higher levels of perceived severity were associated with an increased likelihood of seeking reassurance in the student and OCD samples. Neither responsibility nor probability had consistent effects. For checking by proxy, high perceived probability was consistently associated with a higher likelihood of asking another to check, across all three samples. Again, the independent effects of the other two multipliers were either inconsistent or not significant.

Consistent with the cognitive theory of compulsive checking, it was further hypothesized that ratings on the dependent variables would be highest for situations in which all three



multipliers were perceived as relatively high, and lowest for situations in which all three multipliers were perceived as relatively low. This hypothesis was generally not supported for reassurance seeking or checking by proxy, as there were few statistically significant differences related to different patterns of multipliers among scenarios. However, a few interesting patterns did emerge. There was a consistent pattern across three samples for the lowest ratings of reassurance seeking to occur in scenarios that combined low levels of probability and severity. For checking by proxy, there was a consistent pattern across all three samples for the highest ratings to occur in scenarios that combined low responsibility with high levels of severity and probability. This runs counter to the prediction that the highest ratings on all dependent variables would occur in the high-high-high condition. However, given that in this study, the responsibility dimension was manipulated by having another person be the one who may have acted negligently, this finding may suggest that when the risk of harm was high, participants were inclined to ask that particular person to verify that the situation was safe.

Although the hypothesized additive effects were not consistently observed for either reassurance seeking or checking by proxy, there was a consistent multiplicative effect for reassurance seeking in the student and anxious control samples. Under conditions of low severity, probability had a significant effect, such that higher probability was associated with a greater likelihood of reassurance seeking. However, under conditions of high severity, probability did not have a significant impact on likelihood of reassurance seeking, suggesting that if an event is perceived as severe, then probability does not have as great an impact, perhaps because severity alone will lead to a desire to reassurance seek. No consistent multiplicative effect was observed for checking by proxy.

Similarly, the hypothesis that participants who felt not at all responsible for preventing harm in the low responsibility, high severity, high probability scenario would be more likely to make extremely low ratings on the dependent measures than those who perceived at least some responsibility for harm was generally not supported for either reassurance seeking or checking by proxy. The one exception to this pattern was that in the OCD sample, the percentage of individuals reporting no perceived responsibility for harm who also said that they would not ask another to check was significantly greater than the percentage of individuals reporting at least some responsibility for harm and who said that they would not ask another to check. Thus, for these dependent variables, the pattern of findings related to no perceived responsibility and the absence of desire to reassurance seek or ask another to check was not significant nor very consistent across samples.

Overall, the pattern of findings for reassurance seeking and checking by proxy was less consistent with the study hypotheses and with the pattern of findings for the other dependent measures. The results of this study would suggest that these behaviours are less strongly affected by fluctuations in the multipliers than are more directly checking-related emotional and behavioural responses. This is perhaps not surprising as these behaviours differ from actual checking in important ways – by definition, they are social acts that involve contact with another person (and disclosure of concerns), thus making one's concerns public and perhaps risking negative evaluation by the other person. It is notable that OCD is often a very secretive disorder, with many sufferers going to great lengths to prevent others from finding out about their concerns and their compensatory behaviours (Newth & Rachman, 2001). Moreover, these behaviours are also likely to be less effective for accomplishing the hypothesized goals of neutralization, which are to reduce the likelihood of harm or to reduce personal responsibility.

Reassurance seeking, while it may provide short term relief, nevertheless cannot be viewed as altering the objective probability of a negative event, and for this reason may be viewed as undesirable as a stand alone method, or may only be used when no other form of checking is possible. It also does little to offset personal responsibility. Similarly, asking another person to check in one's stead may be effective in reducing probability (if the other person can be trusted to properly execute the check); however, for those individuals who feel that they must ultimately bear responsibility for harm, having another person verify that the situation is safe may feel inadequate to offset responsibility.

Future research should explore further the relationship between reassurance seeking and checking by proxy, and checking performed by the individual him- or herself ("checking by self"). For example, do these behaviours co-occur, and if so, under what circumstances? Future research could also examine the "content" of attempts to reassurance seek – what do people ask about? Do they ask for reassurance about probability of harm? About their level of actual or moral responsibility to act to prevent harm in a particular situation? About the objective "awfulness" of the potential negative outcome? These predictors and structure of these two behaviours warrant further exploration as they often constitute a major part of the family accommodation that is made by the friends and loved ones of the person with OCD (Calvocoressi et al., 1995).

Overall, consistent with the predictions of the cognitive theory of checking and with the specific hypotheses of this study, the findings suggest both independent and combined effects of each of the multipliers on checking-related emotional and behavioural responses. Moreover, as the number of elevated multipliers increased, corresponding increases in these responses were observed. There is also some evidence to suggest that particular combinations are especially

potent determinants of checking-related responses. These effects were most consistent for the primary dependent variables of urge to check, likelihood of checking, worry and discomfort. The pattern of findings for the conceptually related behaviours of reassurance seeking and asking another to check was far less consistent, but still offered support for the role of the multipliers in checking-related responses. Finally, the overall pattern of findings observed in this study was remarkably consistent across three samples of participants, suggesting that the theory has broad explanatory value across the continuum of anxiety and checking behaviour. The broader implications of these findings for the theory of checking and for our understanding of the variables that influence checking related responses are discussed further below.

### **Limitations**

The findings of this study must be considered within the context of certain limitations. Several of these limitations reflect the balance that was struck between internal and external validity. First, this study used a small number of vignettes to represent all possible combinations of relatively high and relatively low levels of each multiplier. Thus, although the results were very consistent with the predictions of the first part of the cognitive theory of compulsive checking, the generalizability of the findings beyond the situations described in these vignettes is unknown. Future research incorporating other situations representing the different combinations of the multipliers would help to extend the generalizability of these findings.

Second, all of the potentially harmful situations described in the vignettes involve concerns or doubts that most people experience from time to time (e.g., is the car door locked?), and represent situations in which even those without checking compulsions might feel some distress and/or urge to act. This was done so that the same vignettes could be used across all three samples. Some of the other, more bizarre manifestations of compulsive checking (e.g.,

checking food for shards of glass, retracing a driving route to check if one has hit a pedestrian without noticing it) were not represented in the present study. Thus, the findings of this study regarding the impact of the multipliers may not be generalizable to some of the more bizarre types of checking rituals that are particular to individuals with OCD. An examination of the impact of the multipliers on these types of checking rituals may need to take a more idiographic approach in which vignettes are written to specifically reflect the concerns of a particular individual with OCD (e.g., multiple vignettes in which checking food for glass would be the likely compulsion, but in which the multipliers have been manipulated).

Third, participants in this study were asked to make predictions of how they would feel or what they would do in the situations described in the vignettes. While this appeared to be the only ethical and standardized way to accomplish the goal of manipulating the multipliers independently and simultaneously, it is possible that participant ratings of their likely emotional and behavioural responses may not correspond to what they would do if actually faced with that particular situation. In order to examine the independent and combined impact of the multipliers on actual checking-related emotional and behavioural responses, either the use of deception or a considerably more idiographic, case-series approach (with the attendant loss of internal validity entailed by such a design) would likely be required. Although difficult to design and carry out, such a creative study could make a significant contribution to our understanding of the relationships between the multipliers and checking-related emotional and behavioural responses.

Fourth, it is difficult to know to what extent the “intervals”, or disparity between the high and low levels of each multiplier were similar in size. That is, if the interval between high and low probability were greater than the interval between high and low responsibility, this might account for the larger effect of probability, and could potentially bias inferences about the

relative contributions of each multiplier to checking-related responses. However, examination of the effect sizes of the multipliers on the manipulation check variables argues against this explanation. In both the student and OCD samples, probability had the *smallest* effect size and mean difference between high and low conditions. In the anxious control sample, probability had the second smallest effect size. This suggests that probability may have a higher “potency” than has been reported in earlier work, such that relatively small changes in perceived probability lead to a greater change in relation to checking-related responses than do changes of similar magnitude in the other multipliers.

Fifth, in testing the hypothesized multipliers of checking behaviour, this study manipulated aspects of situations to evaluate the impact of appraisals/perceptions of these multipliers (e.g., perceived probability of harm) on checking-related outcomes. However, more distal or enduring tendencies that might influence these appraisals were not directly assessed. The Obsessive Compulsive Cognitions Working Group (OCCWG, 1997, 2001) has identified several belief domains that would likely be important in this regard, and have developed a measure, the Obsessional Beliefs Questionnaire (OBQ), to tap these beliefs. For example, the enduring tendency to overestimate probability and severity of harm across a range of situations that is often observed in anxious individuals, including those with OCD (e.g., Butler & Mathews, 1983, Foa, Franklin, Perry, & Herbert, 1996; Sookman & Pinard, 2002; Stober, 1997), was not assessed in this study<sup>10</sup>. Similarly, other cognitive factors like likelihood thought-action fusion (likelihood TAF; Shafran & Rachman, 2004), in which intrusive thoughts about a negative outcome are believed to make that negative outcome more likely (and which would therefore likely influence estimates of probability) were not addressed in this study, although there is some

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<sup>10</sup> However, the inclusion of an OCD sample, an anxious control sample and nonanxious sample in this study provides some information about whether the multipliers have the same impact on dependent measures across a continuum of anxiety (and correspondingly, overestimation of threat).

evidence to suggest that intrusive thoughts in the context of likelihood TAF are particularly likely to result in compulsions or other neutralizing behaviour (Rachman et al., 1996; Shafran & Rachman, 2004). Another common factor that may be important in OCD, and particularly in checking compulsions, intolerance of uncertainty (McFall & Wollersheim, 1979; OCCWG, 1997, 2001; Tolin et al., 2003) was also not assessed. That is, people may go back to check (even if they think harm is unlikely) because they cannot stand “not knowing”. Finally, the role of perfectionism, which some have suggested may influence perceptions of responsibility (Bouchard, Rheaume & Ladouceur, 1999; Frost, Novara & Rheaume, 2002), was not addressed in this study<sup>11</sup>. Future research could examine how these more enduring tendencies influence or interact with the appraisals of situational factors as assessed/manipulated in this study to influence checking-related outcomes.

In a related vein, this study examined the influence of perceived responsibility, as rated by study participants on checking-related emotional and behavioural responses. Ratings of perceived responsibility were presumed to be affected by the manipulation of responsibility for that particular vignette. However, it is likely that ratings of perceived responsibility were also influenced by enduring tendencies to perceive personal responsibility for prevention of harm across a range of situations (i.e., trait responsibility). Although this study cannot completely disentangle the relative contributions of these two sources of perceived responsibility, the use of three samples of participants who differed on their baseline levels of trait responsibility does allow for some cautious inferences regarding the impact of the different sources of perceived

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<sup>11</sup> It is worth noting that, on the basis of work by the OCCWG, as is the case for overestimation of threat, both intolerance of uncertainty and perfectionism have been conceptualised as general vulnerability factors for OCD, rather than being specific to OCD, in light of the fact that anxious individuals without OCD tend to score highly (and not significantly differently from those with OCD) on measures of these constructs as well (Sookman & Pinard, 2002; Frost, Novara & Rheaume, 2002, Salkovskis & Forrester, 2002, Taylor, Kyrios, Thordarson, Steketee, & Frost, 2002).

responsibility on responses to the situations described in the vignettes. Within each sample, levels of trait responsibility were relatively homogeneous, thus minimizing its impact on ratings of perceived responsibility. Any observed differences between high and low situational responsibility vignettes on ratings of perceived responsibility were therefore more likely attributable to the manipulation of situational factors than to marked differences among individuals in trait responsibility. In addition, despite differences in trait responsibility, all three samples responded in similar ways to the manipulation of situational factors related to responsibility. Thus, even those who are hypothesized to have inflated trait responsibility (i.e., the OCD sample) were not impervious to fluctuations in “situational” responsibility, as they made higher ratings of perceived responsibility in the high situational responsibility vignettes and lower ratings of responsibility in the low situational responsibility vignettes. However, the OCD sample had the lowest effect size of situational responsibility of any of the samples on ratings of perceived responsibility, suggesting that situational responsibility may play less of a role in perceived responsibility for these individuals.

Taken together, the findings on trait versus situational responsibility suggest that trait responsibility may set a starting point on perceived responsibility, and that situational factors may then operate to either increase perceived responsibility, thus moving the person towards greater distress and likelihood/intensity of checking, or, under particular circumstances, to decrease perceived responsibility and move the individual away from distress and checking. In the case of individuals with relatively lower levels of baseline trait responsibility, the impact of these situational factors will be more significant, whereas for those with relatively higher levels of baseline responsibility (i.e., individuals with OCD), the impact of situational factors, while still significant, will be somewhat less. Overall, the findings of the present study suggest a role



for both trait and situational responsibility in influencing the perceived responsibility that appears to be so important in driving checking related responses.

Finally, while the present study suggested a strong relationship between the multipliers, anxiety and urge to check, it was not able to clarify the nature of this relationship. From a strictly behavioural perspective, the argument would likely be made that the multipliers are epiphenomenal. That is, the multipliers could be construed as by-products of anxiety that do not have any meaningful connection to the urge to check (i.e., anxiety produces both the multipliers and urge to check). Previous work finding that people tend to overestimate the likelihood and severity of harm when anxious (e.g., Butler & Mathews, 1983, Foa, Franklin, Perry, & Herbert, 1996; Sookman & Pinard, 2002; Stober, 1997; Tripp, Tan, & Milne, 1995) could be viewed as supportive of this perspective. However, the results of this study argue against the suggestion that the multipliers are merely epiphenomenal as experimental manipulation of the multipliers was associated with the predicted changes in anxiety and urge to check.

The observed relationship between the differences in the levels of the multipliers and corresponding differences in levels of anxiety and urge to check warrants further exploration in future research. This study did not provide information that would help to clarify whether the relationship between the multipliers and urge to check is direct (multipliers → urge to check) or mediated by anxiety (multipliers → anxiety → urge to check). Future research should examine further the nature of this relationship.

### **Conclusions and Implications for the Cognitive Theory of Compulsive Checking**

This study provides the first experimental test of part one of a new cognitive theory of compulsive checking (Rachman, 2002). The findings have a number of important implications

for our understanding of the factors that influence checking-related responses to situations that imply the possibility of harm and for the theory itself.

First, this study draws an important distinction between the three hypothesized multipliers of compulsive checking, perceived responsibility, perceived severity and perceived probability. Previous research has confounded these constructs both conceptually and empirically. For example, much previous work has lumped together perceived probability and severity of harm under the concept of “risk” or “negative consequences” (e.g., Foa et al., 2001, Ladouceur et al., 1995; Ladouceur et al., 1997), thus obscuring any independent effects of severity or probability on distress and checking behaviour. In addition, based partly upon an earlier definition of the construct of “responsibility” (Salkovskis et al., 1996), many previous studies have defined responsibility very broadly, incorporating aspects of both probability and severity in their definition and by extension, in their “responsibility” manipulations (e.g., Ladouceur et al., 1995; Ladouceur et al., 1997). Even in the few studies that have used a more narrow definition of responsibility (e.g., Lopatka & Rachman, 1995; Shafran, 1997, Menzies et al., 2000), covariation between responsibility and one or more of the other multipliers has compromised our ability to draw unambiguous conclusions about the direct and independent contribution of these factors. Along the same lines, several groups (e.g., Ladouceur et al., 1995; Ladouceur et al., 1997; Menzies et al., 2000) have noted the difficulties inherent in attempting to manipulate one or more of these multipliers independent of the others (e.g., manipulating severity independently of probability). Again, this conceptual and empirical confounding of the different multipliers has obscured their independent contributions to distress, urge to check, and checking-related behaviours.

Drawing upon Rachman's (2002) conceptualization of the multipliers, in which probability and severity are viewed as separate constructs, and responsibility is defined more narrowly, the present study used vignettes that enabled the independent and simultaneous manipulation of these factors. This permitted an examination of both the independent and combined effects of these multipliers on checking-related outcomes.

Each of the multipliers was found to have independent effects on urge to check, likelihood of checking, likelihood of worry and discomfort (if no one checks). Thus, this study is the first to demonstrate experimentally the unique importance of each of these factors to checking-related outcomes. The conceptual and empirical disentanglement of responsibility from probability and severity offers a fresh perspective on this construct. At an empirical level, the findings suggest that even when narrowly defined, this factor is a potent determinant of checking-related responses. Moreover, the finding that responsibility makes an independent contribution to checking across both clinical and non-clinical samples runs counter to the suggestion of Menzies and colleagues (2000) that perceived responsibility for harm may only exert its influence through its effects on perceived severity, as part of a mediational model. More specifically, Menzies and colleagues proposed that responsibility increases the perceived awfulness or unacceptability of the outcome, and that when severity is controlled for, the relationship between responsibility and compulsive behaviour disappears<sup>12</sup>. The present findings suggest that, even controlling for perceived severity *and* probability of harm, responsibility is still significantly and reliably associated with checking-related outcomes. And while the present study does not address the issue of whether responsibility is more important to checking than to other types of compulsive behaviour (such as compulsive washing or cleaning) as has been

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<sup>12</sup> The authors note that this is particularly true for compulsive washing, presenting data from their own work to support this assertion.

suggested by several authors (e.g., Menzies et al., 2002; Rachman, 1993), the findings do suggest a strong and independent role for responsibility on checking-related outcomes.

At a conceptual level, the findings of this study suggest that a more narrow and parsimonious definition of responsibility may be appropriate, at least in relation to checking-related outcomes. The use of “narrow” responsibility in future research on compulsive behaviour offers several advantages over the broader definition. First, as in the present study, it allows for greater clarity in the interpretation of experimental designs in which multiple situational features have been manipulated in order to understand their impact on distress and compulsive behaviour (cf. Foa et al., 2001, Ladouceur et al., 1995). This in turn serves to advance our understanding of the individual contributions of the multipliers to these outcomes.

Second, defining responsibility with requirements for both influence and harm may make the concept less applicable to some subtypes of OCD. This is potentially problematic if one accepts Salkovskis’ assertion that inflated responsibility exists in all individuals with OCD, including those with washing and covert compulsions (Salkovskis, 1999). For example, individuals with primary obsessions may feel an inflated sense of responsibility for the content of their thoughts (as in moral thought-action fusion), even if they do not feel that having an intrusive thought makes a negative outcome more likely. Thus, defining responsibility more narrowly across different research studies may allow for greater comparability of research across different subtypes of OCD.

Third, one of the criticisms levelled at earlier cognitive theories of OCD, such as those of Carr (1974) and McFall and Wollersheim (1979) was that the proposed underlying mechanism (overestimation of threat or risk) is not specific to OCD, but rather is evident throughout the anxiety disorders (for example, specific phobias and social phobia; Salkovskis, 1985, 1989).

Salkovskis (1985, 1989) proposed that inflated responsibility is the unique mechanism of OCD; however, the concept of risk or threat seems to be implied in the most commonly used definition of responsibility (Salkovskis et al., 1996). As a result, a mechanism related to all anxiety disorders is included within the definition of a concept that is intended to separate OCD from other anxiety disorders. Defining responsibility more narrowly serves to better differentiate the proposed core psychopathology of OCD from these other disorders.

Finally, at a more general level, the use of parsimony in the definition of important constructs is desirable (Occam's Razor). Simply because the perception of potential harm (probability and severity) is usually considered to be necessary for distress or compulsive behaviour does not mean that such constructs need to be included in the definition of responsibility. For example, most people would agree that a person can feel responsible for outcomes that involve trivial or unlikely negative events, even if that person does not choose to act to prevent that outcome. Thus, responsibility as a construct need not include aspects of probability and severity.

In addition to suggesting a strong independent contribution of perceived responsibility, the findings of this study also suggest a very strong influence of probability (as separate from severity) on checking-related emotional and behavioural responses. As mentioned above, probability was consistently associated with the largest independent effect sizes across the main dependent measures in this study, and scenarios that incorporated higher levels of probability consistently received higher ratings on the main dependent measures than scenarios incorporating lower levels of probability. In fact, in this study, probability could even be construed as "outperforming" even responsibility. Why might this be?

In his description of the characteristics of checking compulsions, Rachman (2002) notes that checking compulsions are carried out in order to (1) reduce the distress associated with intrusive thoughts of harm, (2) reduce the likelihood of a future negative event, (3) reduce the harmful effects of the future negative event, and (4) reduce the person's responsibility for the future negative event. Thus, in situations in which there is a possibility of harm (that is, perceived probability and severity of harm are greater than nil), many people will experience distress and some urge to act to prevent harm. This will be especially true of individuals who have a special inflated sense of responsibility for preventing harm (i.e., those with OCD). Most people likely encounter and pass by dozens of situations each day in which we could potentially foresee harm occurring (e.g., seeing children playing ball near a street, seeing a dog running ahead of its owner not on a leash, parking on a steep hill, seeing a old person waiting to cross a busy street, walking away from our parked car with others around); however, we do not experience distress or check to ensure that no harm will occur in the majority of these situations. What then seems to determine which of these situations are sufficient to mobilize distress, urges to act or actual action? The findings of this study suggest that across different situations that vary in their respective levels of the multipliers, we respond most strongly (or are most sensitive) to situations in which we perceive that the likelihood of harm is relatively high. In support of this "enhanced sensitivity" idea, it was found that although probability was associated with the smallest mean differences between high and low conditions on the manipulation checks, small changes in perceived probability were associated with the largest differences on the dependent measures, across all three samples. One possible reason for this strong reaction to probability may be that of the multipliers, probability is necessarily the most closely related to the occurrence of harm. Heightened sensitivity to probability is likely to be more adaptive in terms

of enabling people to prevent/avoid harm than heightened sensitivity to the other multipliers (although the findings of this study suggest that levels of all three multipliers influence distress and action in situations that imply the possibility of harm). In addition, if a person notices and makes decisions about whether to check in a given situation based upon probability, and is able to achieve some confidence that the situation is safe (i.e., that harm is unlikely to occur/will not occur), then responsibility for harm and severity of harm become irrelevant.

Despite the inherent logic of attending to and having especially strong reactions to probability, the finding that responsibility was not associated with the largest impact on checking-related outcomes is somewhat surprising and runs counter to what would be expected on the basis of previous theoretical work on OCD (and with the predictions of the cognitive theory). In fact, in the OCD sample, responsibility was associated with the lowest effect sizes – lower than both probability and severity. One possible explanation for this finding is that it reflects the overarching importance of trait responsibility in influencing checking-related outcomes in this sample. That is, the elevated level of trait responsibility in this sample may make these individuals less sensitive to differences between situations in terms of “situational” responsibility (which was manipulated in this study). Moreover, when a person feels responsible for preventing harm across many different situations, then perceived responsibility loses its value to some extent in terms of signalling the need for distress or action, while probability becomes a more salient dimension in this regard.

In addition to clarifying the important individual contributions of the multipliers outlined by Rachman’s (2002) theory, the present study also draws attention to the combined effects of the multipliers. Rachman proposed that checking behaviour would be most intense in situations where all three multipliers are high, and lowest in situations where all three multipliers are low.

However, the results of this study extend the theory by revealing the additive effects of each multiplier to distress and other checking-related outcomes. As the number of elevated multipliers increased in a stepwise fashion from zero to three, corresponding increases in urge to check, likelihood of checking, worry and distress were noted across all three samples of participants. Moreover, this study also provided some evidence for multiplicative effects of the multipliers. In particular, across samples, the combination of high perceived probability and high perceived responsibility was found to have a “supercharged” effect on likelihood of checking. That is, this combination had greater effects on likelihood of checking than would be expected solely on the basis of the additive effects of each.

The additive effects, and to a lesser extent the multiplicative effects, lend support to the idea of a critical “threshold” for checking-related variables such as urge to check and actual checking behaviour. That is, the addition of relatively high levels of each multiplier in a given situation may move the individual closer to a critical threshold or point at which distress and checking will occur. The higher the level of each multiplier, the closer the person gets to her threshold. This threshold model would also provide an explanation for the “oversensitivity” or “overresponding” of individuals with OCD to situations that imply the possibility of harm. Individuals with OCD bring high levels of trait responsibility to every situation, and this trait responsibility may mean that they have a “head start” in terms of reaching the threshold. Thus, relatively lower levels of probability, severity, and situational responsibility would be required in order to provoke distress, urges to check and checking-related behaviour.

### **A Continuum of Checking**

One of the major strengths of this study is that it is the first to examine the independent and combined effects of the multipliers across three samples of participants ranging from a



nonanxious control sample of students to a clinical sample of individuals with anxiety disorders other than OCD, to a sample of individuals with OCD. And one of the most striking findings to emerge from this study was how consistent the pattern of effects of the multipliers was across these samples. Despite differences between samples in levels of anxiety, trait responsibility, and checking behaviour, participants responded in remarkably similar ways to the manipulation of these multipliers. This offers strong support for the potency of the multipliers in checking-related outcomes and for the explanatory value of this new cognitive theory across a continuum from those who rarely check to those who check compulsively.

Perhaps the most important message from this study is that under the right conditions, even people who are not generally anxious, do not have high levels of trait responsibility, and do not routinely check, will tend to experience levels of distress and display behaviours that are remarkably similar to those observed in individuals with checking compulsions. This parallels suggestions by other authors that under certain conditions people without OCD will behave “obsessionally” (e.g., Foa et al., 2002; Ladouceur et al., 1997; Wroe & Salkovskis, 2000). Based upon the present study and previous work, it appears that the necessary conditions for the occurrence of checking-related emotions and behaviours are: (1) a situation in which there is the possibility of harm (i.e., the perceived probability and severity of harm are greater than nil)<sup>13</sup>, (2) the occurrence of an intrusion or doubt about whether proper steps have been taken to ensure that no harm will occur<sup>14</sup> and possibly (3) a belief in one’s ability to influence the occurrence or

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<sup>13</sup> All scenarios in this study included the potential for at least some “harm”, defined as an event that would have at least some mild negative impact on another person. Moreover, as noted above, this theory is probably best construed as a theory of harm checking.

<sup>14</sup> All scenarios in this study included mention of a concern/doubt about the “safety” of the situation. This is consistent with work by Salkovskis and colleagues suggesting that the occurrence of an intrusion transforms a neutral situation into one that requires some action on the part of the individual lest that person risk being responsible for harm. Further, these authors found that in situations where harm is possible, given an intrusion about harm, even non-anxious controls will experience distress and a desire to act to forestall harm (Forrester, Wilson, & Salkovskis, 2002; Wroe & Salkovskis, 2000; Wroe, Salkovskis & Richards, 2000).

severity of harm in that situation<sup>15</sup>. Interestingly, and contrary to the predictions of the theory, a sense of perceived responsibility for preventing harm, whether based upon aspects of the situation itself or reflecting a more general tendency towards feeling responsible across situations, did not appear to be necessary for the evocation of distress or urges to check. That is, across all three samples, a minority of people in this study reported no perceived responsibility for harm, but nevertheless indicated some distress, urges to check and actual checking behaviour. However, the findings of this study are clear in demonstrating that a sense of perceived responsibility for harm makes a significant contribution to checking-related outcomes, particularly in circumstances where probability is also elevated.

The findings of this study would suggest that when these basic conditions are met, perceived high levels of any of these multipliers will tend to increase urges to check, likelihood of checking and level of discomfort/worry. Moreover, the more multipliers that are perceived as elevated, the greater the likelihood/intensity of distress and checking-related behaviours. Finally, these emotional and behavioural reactions to the multipliers appear to hold across a continuum of anxiety, trait responsibility, and checking behaviour. These experimental data are consistent with the observation that checking occurs in non-clinical populations, and with psychological theories that emphasize continuity between non-clinical intrusive thoughts and rituals and clinical obsessions and compulsions as seen in OCD (e.g., Salkovskis, 1985, 1989, 1999). The findings serve to support the idea that harm checking as seen in individuals with OCD, rather than being an abnormal process, may be an exaggeration of a normal tendency that we all have to attempt to ensure that foreseeable harm will not occur.

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<sup>15</sup> All scenarios included in this study left open the possibility of the participant taking action to ensure that the situation was safe, even if the participant was not primarily responsible for preventing harm in that situation.

Overall, the findings of this first test of part one of Rachman's theory of compulsive checking offer strong support for the majority of the predictions of the theory, attesting to the individual and combined effects of the multipliers on checking-related outcomes. This study highlights the impact of perceptions of particular characteristics of potentially harmful situations in influencing emotional and behavioural responses to these. The findings of this study also suggest that the theory has broad explanatory power across a continuum of checking behaviour from those who rarely check to those who check compulsively.

More broadly, this first part of the theory meets some of the requirements outlined earlier for a satisfactory theory of compulsive checking, by specifying factors that influence distress, urge to check and checking behaviour and by offering an explanation of the circumstances under which checking will occur in both clinical and non-clinical populations. In so doing, it also helps to explain some of the continuity between clinical and non-clinical checking. However, another key question remains to be addressed. What accounts for the repetitive nature of compulsive checking?

### CHAPTER THREE: THE PUZZLE OF REPETITIVE CHECKING

Understanding what initiates a desire to check is an important question. However, some researchers (e.g., Toates, 1990) have suggested that understanding why individuals check in the first place may be less important than understanding what it is that prevents them from stopping. That is, a second crucial issue that must be addressed by any adequate theory of compulsive checking is what accounts for repetitive checking? Why is it that these individuals check not just once, but over and over again and still feel uncertain about whether the item is safe?

#### **Mnemonic Deficit Theories of OCD as a Possible Explanation for Repeated Checking**

Given the nature of compulsive checking, and in particular the oft-repeated complaint of checkers that they “can’t remember”, or doubt whether they performed an action (e.g., locking the door) safely or not, it is perhaps not surprising that many researchers and theorists have proposed that these individuals may have some type of neuropsychological deficit, usually in the area of memory<sup>16</sup>. Over the years, numerous studies have examined the question of whether some type of primary memory deficit could explain the counterintuitive, repetitive checking behaviour displayed by so many individuals with OCD. A brief overview of this theory and some of the evidence for and against it is presented here in order to allow the reader to evaluate the explanatory value of such a theory in accounting for the phenomenology of compulsive checking. Special attention is given to studies using samples of compulsive checkers, rather than mixed OCD samples, as these studies are most germane to the current discussion<sup>17</sup>.

Much of the early work examining memory in relation to checking was carried out by Sher and colleagues (Sher, Frost, & Otto, 1983; Sher, Mann & Frost, 1984; Sher, Frost, Kushner,

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<sup>16</sup> For a discussion of other hypothesized neuropsychological deficit or neurotransmitter-based theories of OCD, the interested reader is referred to works by Gross, Sasson, Chopra, and Zohar (1998) and Tallis (1997) or a recent review by Greisberg and McKay (2003).

<sup>17</sup> For a more detailed review of memory in OCD, the interested reader is referred to Amir and Kozak (2002), Greisberg and McKay (2003), and Tallis (1997).

Crews & Alexander, 1989) using non-OCD samples. In their first study, these authors divided groups of undergraduate students into groups based upon elevated scores on the cleaning or checking subscales of the Maudsley Obsessive-Compulsive Inventory (MOCI). The groups consisted of participants who checked and cleaned (“cleaning checkers”); participants who checked but did not clean (“non-cleaning checkers”); participants who cleaned but did not check (“cleaning non-checkers”) and participants who did not clean or check (“noncleaning noncheckers”). Participants were asked to complete seven different “tasks” over the course of the experiment. These “tasks” included pencil-and-paper inventories and subtests from memory inventories. At the end of the last task, they were asked to name and briefly describe each task. Their responses were considered to be an index of “memory for prior actions”. It was found that checkers had significantly poorer recall of prior actions, and less confidence in their memories relative to the other groups.

In a similar study using university students, Sher and colleagues (1984) used the MOCI Checking subscale to divide participants into four groups: frequent checkers, occasional checkers, infrequent checkers, and noncheckers. Participants completed the Wechsler Memory Scale (WMS), a measure of memory for actions performed during the experiment, and measures of depression and state anxiety. Consistent with previous findings, there was a trend for more frequent checkers to have poorer recall for past actions than non-checkers. On the Wechsler Memory Scale, frequent checkers had significantly lower memory quotients than non-checkers. Further analyses showed that these findings of poorer memory in the checking group could not be attributed to anxiety or depression. However, it is important to note that despite the finding of poorer memory for checkers, all participants scored within the normal range on the WMS. More recently, Rubenstein and colleagues (Rubenstein, Peynircioglu, Chambless, & Pigott, 1993)

found similar deficits in recall for prior actions using a non-clinical sample of “subclinical checkers” (as defined by the MOCI).

In a later study, Sher and colleagues (1989) used a mixed psychiatric outpatient sample and MOCI scores to form groups of checkers and noncheckers. Participants completed a series of nine tasks, including the Wechsler Memory Scale (WMS) after which their memory for the tasks was assessed. Consistent with previous findings, checkers had significantly lower memory quotients on the WMS. However, the subtests that were significantly associated with memory status were different from those identified in previous work (Sher et al., 1984). In addition, checkers scored significantly lower than noncheckers on recall of prior actions, but not recognition of prior actions, consistent with earlier studies using student samples.

The studies described above, although suggestive, had several major shortcomings (Rachman, 2002; Tallis, 1999). First, none of these studies used participants with OCD. Although the Sher and colleagues (1989) study used psychiatric outpatients, none of the outpatients in this study met diagnostic criteria for OCD. Furthermore, although the “checkers” in the studies by Sher and colleagues tended to score lower on the WMS, their memory quotients fell within the normal range, raising questions about a general memory deficit explanation of compulsive checking.

Since these early studies, a number of studies have explored the possibility of general memory deficits in OCD. A handful of studies using OCD patients with primary checking compulsions have found evidence of various memory deficits in patients with OCD when compared to controls, including poorer recall of prior actions (e.g., relative to a mixed clinical sample of noncheckers; Ecker & Engelkamp, 1995), poorer visual memory (e.g., relative to washers and nonclinical controls; Bouvard, Dirson, & Cottraux, 1997), and poorer nonverbal and

verbal memory (e.g., relative to normal controls; Zitteryl et al., 2001). Similarly, Tallis and colleagues (Tallis, Pratt, & Jamani, 1999) gave measures of non-verbal memory (visual memory recall, visual memory recognition, immediate visual-spatial memory) and memory confidence to a group of OCD patients with primary checking compulsions and a group of matched nonanxious controls. They found that the OCD patients performed significantly worse than the nonanxious controls on two of the measures of visual memory (visual memory recall and visual memory recognition). However, there were no differences between groups on a test of immediate memory for actions (immediate visual-spatial memory), which presumably would be most pertinent to compulsive checking behaviour. In addition, there was no significant relationship between severity of checking symptoms and performance on the neuropsychological tests. The authors concluded that this pattern of results “is a considerable embarrassment to mnestic deficit accounts of compulsive checking” (p. 165).

There are reasons to be cautious in the interpretation of findings from studies finding evidence of memory deficits in individuals with OCD. First, as noted by Shafran (1995), in some cases, individuals with low memory confidence (such as OCD checkers) may receive lower test scores on neuropsychological tests of memory, even in the absence of real memory deficits. More specifically, Shafran notes that during neuropsychological testing, responses that are delayed, withheld or uncertain (“I’m not sure”), perhaps due to low confidence in memory, will often result in lower test scores and may give the appearance of memory deficits when there are none (Shafran, 1995, as cited in Radomsky, Rachman & Hammond, 2001). A similar observation was made by Radomsky and Rachman (2004), who noted that if a person has weak metamemory (low confidence, vividness, detail, etc., in memory), it can be very difficult to ascertain memory accuracy because doubt and uncertainty can lead a person to state that they cannot remember

something when in fact they may have recalled it correctly with additional effort or encouragement. Moreover, individuals who doubt their memories are probably much less likely to report their recollections than are individuals without this doubt (Radomsky & Rachman, 2004). Second, the lack of an anxious control group in most of the studies finding memory deficits among OCD checkers (see Bouvard et al., 1997 for an exception) leaves open the possibility that the observed memory deficits are attributable to anxiety levels or clinical status (Tallis, 1999). This is consistent with previous research demonstrating that patients with social phobia and panic disorder perform poorly on a variety of neuropsychological tests relative to nonanxious controls (e.g., Asmundson, Stein, Larsen, & Walker, 1995; Lucas, Telch, & Bigler, 1991; for a review of memory biases in the anxiety disorders, see Coles & Heimberg, 2002). It is also possible that poor memory performance could be secondary to obsessive thoughts that distract the participant and interfere with encoding or retrieval. Furthermore, in a recent review of the literature on neuropsychological findings in OCD, Greisberg and McKay (2003) noted that none of the memory studies included in their review controlled for depression, leaving open the possibility that depression may also contribute to the inconsistent findings of memory deficits in OCD.

In contrast to the studies finding mnemonic deficits, many other studies have found no evidence of memory problems among OCD patients with primary checking compulsions (e.g., Constans, Foa, Franklin & Mathews, 1995; MacDonald, Antony, MacLeod, & Richter, 1997; McNally & Kohlbeck, 1993; Radomsky, Rachman, & Hammond, 2001). Many of these studies have included anxious control groups, and several have used OCD washers as anxious controls<sup>18</sup>,

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<sup>18</sup> It is noteworthy that in other subtypes of OCD, such as compulsive washing, patients rarely report that they cannot recall whether they have performed the compulsion or not, rather they doubt whether they have performed the ritual adequately (e.g., enough handwashing to remove the contaminant), or perform the ritual until they feel that it has been done "just right".



which provides a particularly rigorous test of the mnestic deficit theory as an explanation for compulsive checking. For example, MacDonald and colleagues (1997) investigated episodic memory using a word task in three samples: (1) a sample of OCD patients with primary checking compulsions; (2) a sample of OCD patients without primary checking compulsions; and (3) non-clinical control participants. No differences were found between groups in recall or recognition episodic memory. However, the OCD checking group reported less confidence in their recognition memory judgements. In addition, OCD checkers took more time to respond to previously seen words than did the other two groups, which the authors considered to be a more objective measure of memory confidence. The authors concluded that OCD checking may not be related to memory deficits per se, but rather that repetitive, compulsive checking may reflect low memory confidence, an aspect of metamemory. This possibility is discussed further below.

Perhaps the most damning evidence for a mnestic deficit theory of compulsive checking comes from a landmark study by Constans and colleagues (1995). Noting that many studies of memory in OCD use stimuli that are not relevant to the specific concerns of the participants, these researchers conducted a study to examine memory using more ecologically valid stimuli in a sample of 12 OCD compulsive checkers and 7 non-clinical control subjects. Participants in this study completed a series of “action sequences” that involved repeating a series of actions on a number of items (e.g., lighting and blowing out a candle; turning a lamp on and off). Some of the items and action sequences were chosen to be relevant to checking concerns (e.g., plugging and unplugging an iron); others were chosen to be irrelevant to checking concerns (e.g., capping and uncapping a pen). Following each action sequence, participants provided ratings of the degree of anxiety provoked by the action sequence, thereby allowing researchers to make a list of relatively more anxiety-provoking and relatively less anxiety provoking actions for each

participant. After completion of all action sequences, participants were asked to answer a number of questions, including the final resting state of the item from each sequence (e.g., was the candle lit or unlit?); and the desired level of memory vividness required for each sequence in order for the participant to feel satisfied. The results of the study were unexpected. Rather than detecting impaired memory for the final state of anxiety-provoking objects, OCD participants showed *enhanced memory* for these items, relative to non-anxiety provoking items and relative to control participants. These findings are difficult to reconcile with a mnestic deficit explanation of compulsive checking.

Similarly, in a recent study of memory in 11 OCD checkers, Radomsky and colleagues (2001) found that these participants recalled significantly more threat-relevant information (e.g., “how many times did you touch the stove”) than threat-irrelevant information (e.g., “did the experimenter cough during the experiment?”) following a checking task in the home. This effect was most pronounced under conditions of high responsibility, was attenuated under conditions of low responsibility, and disappeared under conditions of no responsibility. Interestingly, their sample of OCD checkers reported significantly less confidence in their memories under conditions of high responsibility than under conditions of low or no responsibility, although accuracy of recall was unchanged between conditions, suggesting that responsibility may have a greater influence on confidence in memory than on actual memory for checking acts. Obviously, the within-subjects nature of the design precluded inferences about whether OCD checkers have a relative memory deficit in relation to individuals without OCD, but the results are consistent with the intrapersonal enhanced memory bias reported by Constans and colleagues (1995).

It is also noteworthy that by far the vast majority of studies of memory in OCD have tended to use standard memory tasks or stimuli which while well validated, are not very closely

tied to the concerns or experience of individuals with OCD and in particular to those with primary checking compulsions. It is perhaps not surprising that the few studies that have used more ecologically valid settings (i.e., the home, Radomsky, Rachman & Hammond, 2001), tasks (i.e., checking tasks, Radomsky, Rachman & Hammond, 2001), or stimuli (i.e., idiosyncratically chosen threatening stimuli, Constans, Foa, Franklin & Mathews, 1995; Radomsky, Rachman & Hammond, 2001, Tolin, Abramowitz, Brigidi, Amir, Street, & Foa, 2001) have tended to yield the most rich and illuminating data. It seems likely that in order to better understand the relationship between memory, doubt and repetitive checking, studies which employ settings, tasks and stimuli that are ecologically valid and more closely approximate the recall conditions under which pathological doubt in memory and associated checking behaviour arises will be required (Radomsky & Rachman, 2004). The present study, described shortly, aims to follow these recommendations.

### **Shortcomings of the Mnestic Deficit Theory as an Explanation for Compulsive Checking**

In sum, there are several reasons why a mnestic deficit theory of compulsive checking behaviour is unsatisfactory. First, as noted above, the evidence for a general memory deficit among OCD compulsive checkers is mixed at best. While some studies find evidence of a mnestic deficit relative to controls, others find no differences in memory abilities between OCD checkers and anxious control or nonanxious control subjects. Moreover, even when deficits are found, they often do not correlate with severity of checking, suggesting that “mnestic deficits should not be considered causal with respect to compulsive checking” (Tallis, 1997, p. 12). Second, mnestic theories cannot explain findings of enhanced memory for threat-relevant information in OCD patients with primary checking compulsions (e.g., relative to less threatening material and to anxious controls; Constans et al., 1995), nor can these theories

explain why enhanced memory for threat relevant information should be most apparent under conditions of high perceived responsibility (Radomsky, Rachman & Hammond, 2001). Mnestic deficit theories cannot explain why the inflation and deflation of perceived responsibility is related to changes in checking behaviour (e.g., Lopatka & Rachman, 1995), nor can they explain the effectiveness of psychological therapies such as exposure and response prevention in the treatment of OCD (Salkovskis & Kirk, 1997). Presumably inflating or deflating responsibility should not have an impact on the memory deficits that are hypothesized to drive checking behaviour, nor should repeated instances of exposures to feared situations followed by response prevention alter memorial ability (Salkovskis & Kirk, 1997). Furthermore, it is noteworthy that not all individuals with impaired memory develop compulsive checking, suggesting that at most, memory problems may contribute to the development or maintenance of compulsive checking in concert with other factors (Woods, Vevea, Chambless & Bayen, 2002). Finally, mnestic deficit theories of compulsive checking in OCD cannot explain clinical observations that many compulsive checkers are high functioning in their daily lives – many of them work, remember appointments and telephone numbers, and fulfil their various responsibilities with little difficulty. That is, any memorial deficits appear to be highly domain specific (memory for prior actions on objects of concern, under conditions of high perceived responsibility and threat, etc). If these individuals had a general memory deficit, it would seem likely that their general daily functioning would show impairment. Thus, there is little evidence to support the idea that memory impairment causes the repetitive checking behaviour displayed by so many individuals with OCD. It is necessary to look elsewhere in order to find a satisfactory answer to the question of why compulsive checkers check not just once, but over and over again<sup>19</sup>.

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<sup>19</sup> It is noteworthy that many of the same objections raised here can be applied to other neuropsychological and/or biologically-based theories of OCD.

## **A Possible Explanation: Part Two of Rachman's Cognitive Theory of Compulsive Checking – The Self-Perpetuating Mechanism**

Rachman's (2002) cognitive theory of compulsive checking provides a possible answer to the question of why individuals check repetitively by proposing the existence of a self-perpetuating mechanism. This mechanism is composed of four elements.

The first element relates to the difficulty that checkers encounter in making absolutely sure that the threat of harm has been removed. Given that the harm to be prevented in compulsive checking concerns a future event (which is often vague and poorly defined in time or space), it is virtually impossible to be certain that the possibility of potential future harm has been eliminated. In other words, checking behaviour has "no natural terminus"; there is no signal for the checker that all threat of harm has been removed, and therefore, the checking is performed repeatedly. For ease of expression, this first element will be referred to as "no natural terminus" in the rest of this paper.

The second element of the self-perpetuating mechanism is that repeated checking tends to diminish the person's confidence in her memory for the check. Thus, the more a person checks, the less certain she is that she has performed the check correctly or at all. Along these lines, Salkovskis and Forrester (2002) have noted that the frequency with which ordinary activities are carried out likely results in difficulties remembering any particular instance. Tallis (1997) suggested that this may result from the effects of proactive interference (Underwood, 1957), in which earlier learning disrupts later learning on an item. That is, the recollection of a final, successful check on an item may be impaired due to the proactive interference of earlier checks on that item. According to the theory, this uncertainty leads to more checking in an attempt to be certain that the threat of harm has been removed. Rachman (2002) suggests that in the

circumstances that provoke compulsive checking, the multipliers increase anxious arousal to the point that encoding and subsequent recall of the check is impaired, largely because the person is focused on the threat and her own negative emotional reaction, rather than on the specific details of what she is doing. This second element will be referred to as “decreased confidence in memory”,<sup>20</sup>.

The third element of the self-perpetuating mechanism consists of a cognitive bias found among compulsive checkers in which the sense of being responsible for preventing harm leads to an increase in the perceived probability of harm. That is, the checkers believe that harm is more likely to occur when they are “on duty”. This third element will be referred to as “responsibility-probability bias”.

The fourth element of the self-perpetuating mechanism concerns the impact of repeated checking on the multipliers that are hypothesized to provoke the urge to check in the first place. This final element of the theory is another cognitive bias that has been observed in previous work in which checkers experience an increase in their feelings of responsibility following a check. Thus, checking increases the individual’s sense of responsibility, and as responsibility increases, the urge to check increases (see section on multipliers above). This final element will be referred to as “post-check responsibility increase”.

In sum, according to Rachman’s theory, increases in the multipliers should provoke the urge to check, and associated checking behaviour in an attempt to prevent potential harm. This constitutes part one of the theory. Once an individual completes a checking act, this will be associated with an increase in perceived responsibility (post-check responsibility increase), which will further stimulate the desire to check. At the same time, this increase in perceived

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<sup>20</sup> This in turn gives rise to another significant cognitive element in compulsive checking – the individual’s maladaptive interpretation of the significance or meaning of their impaired memory and repetitive checking behaviour as being signs that one is losing one’s mind or out of control.

responsibility will be accompanied by an increase in perceived probability (responsibility-probability bias), which will also stimulate a desire to check. The combination of these factors, which increase with (each?) check, should provoke additional checks. In turn, these additional checks will lead to decreased confidence in memory (decreased confidence in memory), and this uncertainty should provoke further checking behaviour. Finally, as it is difficult to determine at what point the possibility of future harm has been completely eliminated, there is no signal for the checker that it is safe to stop checking (no natural terminus). This also enhances the likelihood that the checking behaviour will be repeated. Thus, all elements of the self-perpetuating mechanism are proposed to work in concert to drive repetitive checking behaviour.

From this analysis of the self-perpetuating mechanism, Rachman (2002) derived two experimental predictions. First, increases in the frequency, intensity, or duration of checking will result in (a) increased perceived responsibility; (b) increased perceived probability of harm; (c) increased perceived seriousness of harm; and (d) decreased confidence in memory for the check. Second, decreases in frequency, intensity, or duration of checking will result in (a) decreased perceived responsibility; (b) decreased perceived probability of harm; (c) decreased perceived seriousness of harm; and (d) increased confidence in memory for the check.

### **Support for the Elements of the Self-Perpetuating Mechanism**

Although this new theory had yet to be empirically tested, a considerable body of clinical experience and a number of empirical studies offer preliminary support for several elements of the self-perpetuating mechanism.

## **Support for the Decreased Confidence in Memory Element of the Self-Perpetuating**

### **Mechanism**

The second proposed element of the self-perpetuating mechanism, “decreased confidence in memory” has received support from a number of studies. Previous work, some of which was described above, has provided evidence that OCD checkers report less confidence in their memories than anxious or nonanxious control subjects (e.g., Constans et al, 1995; Hermans, Martens, DeCort, Pieters, & Eelen, 2002, MacDonald et al., 1997; McNally & Kohlbeck, 1993; Zitteryl et al., 2001). That is, it appears that the “problem” with memory in OCD, may be a meta-memory problem, rather than a problem with memory ability/accuracy per se. Moreover, some research has suggested that decreased confidence in memory may be especially apparent under conditions of high perceived responsibility, relative to conditions of low or no perceived responsibility (Radomsky et al., 2001). And of course, based upon previous work, including the findings of Study 1, these are exactly the circumstances under which checking would be most likely to occur.

While these findings are intriguing and are in line with what would be expected according to Rachman’s (2002) theory, none of the studies reviewed above examined memory confidence in situations where the stimuli to be remembered are presented repeatedly, which would more closely parallel repeated checking behaviour (Tolin, Abramowitz, Brigidi, Amir, Street & Foa, 2001). Moreover, as noted above only two of these studies (Constans et al., 1995; Radomsky et al., 2001) examined memory confidence in relation to ecologically valid stimuli for OCD populations. Given the disparate findings between studies using ecologically valid stimuli and studies using more typical memory tasks, this issue bears further consideration.



In a more recent study, Tolin and colleagues (Tolin et al., 2001) examined memory accuracy and memory confidence for idiosyncratically selected safe, unsafe, and neutral items in 14 individuals with OCD (five of whom had primary checking compulsions), anxious controls, and nonanxious controls using a repeated trials paradigm. Repeated trials were used as they more closely approximate the recall conditions under which individuals with OCD attempt to remember an action after engaging in repetitive compulsive behaviour. Each OCD participant was “yoked” to an anxious control and a non-anxious control. These “yoked” controls were exposed to the same stimuli as one OCD participant.

During the experiment, participants were exposed to an array of 24 safe, unsafe, and neutral objects randomly arranged on a table. After a 10 second exposure, participants were taken into another room and asked to recall as many objects from the array as they could remember (free recall). After the participant had recalled as many objects as possible, the experimenter asked the participant to rate their level of confidence that each object that they recalled had actually been presented on the table. The experimenter then rearranged the items on the table prior to the next trial. Participants were told that items may have been added or removed between trials. This process of presentation followed by free recall and confidence ratings was repeated five times. Finally, 1 week after the experiment, the participants were telephoned at home and completed a delayed recall test.

The results for memory confidence over repeated trials were particularly intriguing and of the greatest relevance to the present discussion. The mixed OCD group showed a significant and marked decrease in memory confidence for unsafe objects over time, compared to the anxious control and nonanxious control groups. That is, over repeated exposures to unsafe objects, the memory confidence of the anxious control and nonanxious control groups showed a slight, yet

significant decline, while the memory confidence of the OCD group showed a steep decline. It is worth noting that in this study, the “yoked” anxious control subjects were not exposed to stimuli that they themselves viewed as “unsafe”, but rather were subjected to the same stimuli that were chosen by one of the OCD participants as being “unsafe”. Thus, the results of this study cannot provide much information about difference between OCD patients and other groups in confidence in memory for threatening stimuli (Van den Hout & Kindt, 2003). However, Van den Hout and Kindt (2003) noted that a careful reading of the results suggests a small yet significant effect of trial on confidence across all groups and across all stimuli, such that memory confidence decreased across trials.

The authors observed that their results may be analogous to real life checking situations in which the individual with OCD becomes progressively more doubtful of whether or not he has performed a check properly, leading to a desire to check repeatedly. Thus, these results seem to parallel clinical observations suggesting that repeated checking tends to decrease, rather than increase confidence in memory, which fuels continuing checking behaviour. These results also offer initial support for the second element of the self-perpetuating mechanism, in which repeated exposures to an object are followed by decreased confidence in memory.

Although the study by Tolin and colleagues (2001) provides some support for the self-perpetuating mechanism, it does not address several important issues that would be helpful in evaluating the potency and possible limits of the reduced confidence in memory element of the self-perpetuating mechanism. First, the task used in this study, while it has certain parallels to checking behaviour, involved repeated exposure to an assortment of stimuli, rather than repeated exposure to, and action on, one particular object (or a small set of objects). In an actual checking episode, rather than remembering the existence or exposure to a number of stimuli, the task is

usually to remember the act of checking itself, or the final state of the object that was checked. In addition, in a checking episode, the individual has usually performed some type of motor action upon the object that is being checked, thus introducing an element of memory for motor activities. Thus, this study, while certainly suggestive, still differs from the memory demands made upon an individual who is checking in some important ways.

Second, it is worth noting that the number of exposures (six) and the duration of exposure (10 seconds) is considerably less than the amount of time or number of checks that many compulsive checkers spend on an item that they are concerned about. It would be helpful to know whether checking behaviour of a duration and intensity that more closely parallels compulsive checking weakens or strengthens this effect. Finally, it would also be useful to know whether this decrease in memory confidence following repeated exposures to an object is specific to participants with OCD. In their interpretation of results, Tolin and colleagues (2001) suggest that this phenomenon of decreased memory in relation to repeated exposures to unsafe items is specific to OCD. However, as noted above, there was a trend towards a similar pattern across all groups and all types of items in their study. If this mechanism is more broadly applicable, such that repeated exposures to an object (as in the case of compulsive checking of an object) always leads to decreases in memory, then this may shed light on a universal cognitive factor that may contribute to the genesis of compulsive checking. This in turn would support the continuity between normal checking and compulsive checking (Rachman, 2002).

Recently, a study conducted in Holland addressed some of these issues in a very creative way. Van den Hout and Kindt (2003) conducted a series of experiments in an attempt to better understand why compulsive checkers have such poor confidence in their memory, despite repeated checking. They outlined a mechanism to help explain this puzzling clinical

phenomenon, which they suggested is part of a normal, universally experienced cognitive process. In brief, they proposed that repeated checking of an object leads to increased familiarity with that object, that this increased familiarity leads to increased conceptual processing and decreased perceptual processing, and that this decreased perceptual processing leads to less vivid and detailed memories. They argued that this relative decrement in vividness and detail for memory of the checked object promotes memory distrust. In order to test this explanation, these researchers developed an interactive computer task in which participants were required to turn on, turn off, and “check” a virtual stove with six elements and six virtual light bulbs using a computer mouse. In the first phase of the experiment, student participants were shown a graphic representation of the stove elements indicating which of the three elements to turn on. They were then presented with the virtual stove and they turned on the three appropriate elements. Next, a text page appeared telling the participants to turn off the gas elements that they had lighted. The stove was presented and the participants turned the elements off. Next, the participants were instructed to check to make sure that the elements were turned off. The stove appeared, and the participants checked the elements. Finally participants answered a series of questions tapping: (a) memory accuracy (e.g., “which elements did you check during the last trial?”); (b) vividness and detail of their memory for the last check; (c) memory confidence (e.g., how confident are you that you checked the elements that you just indicated?”); and (d) outcome confidence (e.g., “how confident are you that all elements are turned off?”). Following this pre-test, half of the participants were assigned to a “relevant checking” group and half were assigned to an “irrelevant checking” group. The relevant checking group completed a series of 20 trials of the stove completed during the pretest (i.e., turn on three elements, turn them off, then check that they are off), but with no questions in between trials. Following the 20<sup>th</sup> trial, the participants

completed a post-test in which they were asked the same questions as during the pre-test. The irrelevant checking, or control group completed a series of twenty trials on the virtual lightbulbs. Following the 20<sup>th</sup> check, these participants were asked to complete a trial on the stove, after which they completed the post-test. The elements and lightbulbs to be checked varied unpredictably from trial to trial.

Results revealed that memory accuracy was high and did not differ significantly between the relevant checking and irrelevant checking groups. However, repetitive checking of the relevant object made recollections less vivid and detailed, and eroded confidence in memory for the check. These effects were not observed in the irrelevant checking group. Outcome confidence did not differ between the relevant and irrelevant checking groups. These authors concluded that in compulsive checkers, “memory distrust may persist *as a result* of repeated checking” (p. 12, original emphasis). They noted that while repeated checking of a particular object is intended to reduce uncertainty, this strategy paradoxically *increases doubt*, leading these individuals to want to check over and over again.

Thus, the results of this study offer initial support for the second element of the self-perpetuating mechanism, in which the act of repeated checking itself erodes confidence in memory for the check. The fact that this effect was detected in undergraduate students, who were not selected on the basis of checking scores, provides support for the idea that this mechanism is part of a normal and universal cognitive process.

Although the creative studies mentioned above offer some initial support for the decreased confidence following repeated checking element of the self-perpetuating mechanism, many questions regarding this element remain. None of the studies reviewed above have directly examined the phenomenon of primary interest – that is, the impact of repeated checks of a

personally chosen threat-relevant object by a compulsive checker on confidence in memory. Many elements of this phenomenon have been examined, but generally not in combination with each other. That is, some studies have examined repeated exposures (e.g., Tolin et al., 2001), some studies have incorporated threat-relevant stimuli (e.g., Constans et al., 1995; Radomsky et al., 2001; Tolin et al., 2001), some studies have involved some form of “checking” (e.g., Radomsky et al., 2001; Van den Hout & Kindt, 2003) and some studies have used samples of OCD participants (e.g., Radomsky et al., 2001; Tolin et al., 2001). However, all of these elements have never been brought together in a single study. In addition, no study has directly compared the impact of single versus repeated checks on confidence in memory. The experimental studies described above also differ in some important ways from the conditions under which checking occurs<sup>21</sup> (e.g., in the individual’s own home, when the individual is alone, on personally chosen threat relevant items, when the person feels personally responsible for preventing harm). It seems likely that a study that incorporates all of these elements, and therefore more closely approximates the conditions under which compulsive checking actually occurs, would assist in the evaluation of the “decreased confidence in memory” element of the self-perpetuating mechanism. Such a study would also enhance our understanding of the phenomenon of compulsive checking more generally. The present study, discussed below, aims to contribute to knowledge in both of these ways.

### **Support for the Other Elements of the Self-Perpetuating Mechanism**

The foundation of the other proposed elements of the self-perpetuating mechanism (i.e., no natural terminus, responsibility-probability bias and post-check responsibility increase) rests

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<sup>21</sup> The study by Radomsky and colleagues (2001) that was conducted in participants’ homes is a notable exception. However, the presence of an experimenter in the participant’s home (so that the participant was not alone while checking), and the experimental manipulation of perceived responsibility made the conditions of this study quite different from the circumstances under which compulsive checking normally occurs.

primarily on clinical observations and limited empirical evidence. The evidence for the responsibility-probability bias comes primarily from the studies by Lopatka and Rachman (1995) and Shafran (1995) in which experimentally-induced conditions of high and low perceived responsibility were associated with corresponding high and low ratings of perceived probability of harm in samples of OCD participants.

It is unclear whether this same bias would be found in non-clinical populations. In the one study that specifically investigated the interrelationships among the multipliers, Ménzies and colleagues (2000) found that higher responsibility was not associated with higher probability, but instead was associated with higher perceived severity in a student sample. However, Rheaume and colleagues (1995) found a moderate association between perceived responsibility and perceived probability in one of their studies using non-clinical participants. Thus, the evidence for the responsibility-probability bias in both clinical and non-clinical samples is limited.

The proposed increase in perceived responsibility following a check rests primarily on post-hoc clinical observations from the study by Lopatka and Rachman (1995). In this study, the researchers observed that compulsive checkers experienced an increase in perceived responsibility following an act of checking.

Finally, the “no natural terminus” element of the self-perpetuating mechanism rests primarily on the logical argument that it is difficult to ever be certain that a feared future event will not occur and that one has done enough to forestall disaster/harm. Further evidence comes from clinical observations of compulsive checkers by Rachman and colleagues, who noted that “one or two checks can give satisfaction, but if a few checks do not suffice then increasing difficulty is encountered in deciding when to stop (Roper, Rachman & Hodgson, 1973, p. 271).

Thus, while one or two checks may not be harmful (and are likely normative in some

situations – see Study 1), Rachman’s theory suggests that repeated checking “backfires”, leading to increases in the multipliers of compulsive checking, and decreases in memory confidence, thus motivating even more checks. However, to date, no studies have empirically examined the impact of checking on the multipliers or the possible differential impact of single versus repeated checks on the multipliers or memory confidence, both of which are of particular relevance for the evaluation of the self-perpetuating mechanism proposed in the cognitive theory of compulsive checking.

In sum, at the present time, few studies have been conducted that would permit evaluation of the proposed self-perpetuating mechanism. Although there is one set of studies that supports the notion that repetitive checking decreases confidence in memory for a check (Van den Hout & Kindt, 2003, 2004), the other elements of the self-perpetuating mechanism rest primarily on logical argument and extensive clinical observation (which is in keeping with the interplay between clinical work and theory that has always been so central to cognitive-behavioural theories). Thus, a study that explores the impact of checking behaviour on the multipliers and memory confidence, particularly within an ecologically valid experimental paradigm encompassing factors that are particularly relevant to individuals with OCD, could greatly enhance our understanding of the phenomenology of compulsive checking and help us to evaluate the explanatory value of the self-perpetuating mechanism.

### **Purpose of Study 2**

Study 2 was designed to accomplish the objectives described above. More specifically, the primary purpose of Study 2 was to provide an initial test of the three main elements of the self-perpetuating mechanism described in Rachman’s (2002) cognitive theory of compulsive checking. This study tested the predictions that repetitive checking leads to increases in



perceived responsibility (post-check responsibility increase) and that these increases in perceived responsibility are associated with increases in perceived probability of harm (responsibility-probability bias). In addition, this study examined the impact of repeated checking on confidence in memory (decreased confidence in memory).

While the cognitive theory of compulsive checking is silent on the question of the timeline over which the self-perpetuating mechanism operates, both within-session and between-session effects are possible. However, most of the empirical evidence supporting the existence of this mechanism is based upon observations over a single session (e.g., Lopatka & Rachman, 1995; Shafran, 1997, Tolin et al., 2001, Van den Hout & Kindt, 2003, 2004). For this reason, and for practical reasons, including the desire to have greater control over the number of provocations and amount of checking that participants are exposed to over the course of the experiment (thus improving internal validity), this study explored the possible within-session effects of the self-perpetuating mechanism.

A secondary purpose of Study 2 was to examine whether the elements of the self-perpetuating mechanism are *universally applicable*. By testing particular elements of the self-perpetuating mechanism in individuals who do not routinely check, this study provides information about whether these elements are uniquely applicable to those who engage in compulsive checking or whether they correspond to more general cognitive processes.

A second way of testing the universality of these elements was to have participants check two objects during the experiment. One of these objects was “high relevance” in the sense that the participant had previously reported concern about the possibility of a negative outcome if the object is left unchecked (after being used). The other object was “low relevance” in the sense that the object was related to the possibility of a negative outcome that is not of particular

concern to the participant. This permitted an examination of whether the mere act of checking any object activates the elements of the self-perpetuating mechanism, or whether the mechanism is only activated in relation to objects related to possible feared outcomes for the participant. The usage of personally selected relevant items in this study is in line with the recommendation that OCD researchers incorporate stimuli that are particularly relevant and important to individuals with OCD (Radomsky & Rachman, 2004).

In sum, the self-perpetuating mechanism suggests that repetitive checking of an item produces increases in the multipliers, and decreases in memory confidence. The primary questions addressed in this second study are: (1) what is the impact of single versus repeated checks of a high relevance item on the multipliers (i.e., perceived responsibility, probability, and severity), memory confidence, and on urge to check?; (2) what, if any, impact does checking a low relevance item have on the multipliers, memory confidence, and urge to check?; and (3) if there are any changes in the multipliers, memory confidence, and urge to check following repeated checking, are these effects specific to individuals with checking compulsions, or are these processes universally experienced (i.e., applicable to those who do not have checking compulsions)? An additional goal of Study 2 was to investigate these questions under conditions that closely approximate the circumstances under which compulsive checking occurs.

### **Overview of Study 2 Design and Hypotheses**

Previous research with individuals with checking compulsions has demonstrated that it is very difficult to elicit authentic checking behaviour in situations where the individual does not feel responsible (i.e., outside the home or when accompanied by others; Rachman & Hodgson, 1980; Roper & Rachman, 1975; Roper et al., 1973). Thus, studies attempting to study checking behaviour in a laboratory context in the presence of an experimenter have typically been only

moderately successful at best. As checking behaviour conducted in the home has the greatest ecological validity, and as checking behaviour is most easily provoked in situations where individuals feel responsible (e.g., the home), this study of checking behaviour was designed as a checking experiment that the participant completed from home under an experimenter's telephone guidance. The experimenter provided guidance over the telephone to avoid the diffusion of responsibility that would occur if the experimenter were actually in the participant's home.

As noted above, a secondary goal of this study is to examine the limits of the self-perpetuating mechanism in terms of the types of stimuli that will activate the mechanism. In order to accomplish this, both a higher relevance and a lower relevance item were checked by each participant during the telephone experiment. In order to enhance ecological validity and the likelihood that the checking task would resemble naturally occurring checking behaviour, both higher and lower relevance items were selected idiographically in collaboration with each participant prior to the day of the experiment.

Finally, in order to explore whether the elements of the self-perpetuating mechanism are applicable only to those who check compulsively, or whether they are more universally applicable, participants who do not routinely check were recruited into the study.

In brief, Study 2 was conducted as a telephone experiment in which the participant performed a series of four checking tasks under the guidance of an experimenter. Both a higher relevance and a lower relevance item were checked by each participant. Each item was checked in two separate tasks. Two of the tasks involved a single check of the item and two of the tasks involved checking the item ten times in succession. Prior to each checking task (but following provocation, see below), the participant was asked to provide ratings on a number of dependent

variables. These ratings were repeated following each checking task. A within-subjects design was employed to provide a more sensitive and powerful test of the impact of single versus repeated checks of an item on the multipliers, memory confidence, anxiety and urge to check.

### **Hypotheses Derived from the Cognitive Theory of Checking**

1. Repetitive checking will lead to increased ratings of responsibility, such that:
  - a. Responsibility ratings for the repeated checking tasks will increase from pre to post.
  - b. Responsibility ratings will be higher after repeated checking than after a single check.
2. The increases in perceived responsibility in the repetitive check conditions will be accompanied by increased perceived probability and severity of harm, such that:
  - a. Probability and severity ratings for the repeated checking tasks will increase from pre to post.
  - b. Probability and severity ratings will be higher after repeated checking than after a single check.
3. Repetitive checking will lead to decreased confidence in memory, such that:
  - a. Memory confidence for the repeated checking tasks will decline from pre to post.
  - b. Memory confidence will be lower following repetitive checking than following a single check.
4. The effects described above will be most apparent for checking of the high relevance item and will appear to a lesser degree in the checking of the low relevance item.
5. The effects described above will be apparent in both the clinical and non-clinical samples.

## **Study 2 Methods**

### **Participants**

The primary purpose of Study 2 was to examine the impact of repeated versus single checks of an item on an individual's ratings of the multipliers, memory confidence, anxiety, and urge to check. As discussed above, checking behaviour occurs along a continuum, and the cognitive theory of checking is intended to explicate the occurrence and persistence of checking behaviour along the length of the continuum, from individuals who rarely check to those who check frequently and intensely (as in OCD patients with primary checking compulsions). In this study, we were interested in learning whether the cognitive processes hypothesized to occur with repeated checking are universally experienced (and therefore would be apparent even in individuals who do not routinely check), or whether these mechanisms are specific to compulsive checkers. For this reason, two separate groups of participants were recruited into Study 2.

#### **Sample 1: Participants with OCD and Primary Checking Compulsions**

Participants with OCD and primary checking compulsions were recruited from the Anxiety Disorders Unit, other therapy clinics and the community using the same procedure as for Study 1. In addition, for practical reasons, participants were also recruited from the Montreal area through the Anxiety Lab of Dr. Adam Radomsky at Concordia University. These participants were recruited from advertisements placed in local newspapers and through a local obsessive-compulsive disorder support group. The seven participants from the Concordia site were required to meet the same criteria for inclusion as those from the UBC site. In order to meet criteria for inclusion in the study, participants were required to (a) meet diagnostic criteria for OCD using the OCD subsection of the SCID-I, (b) score at least 16 on the self-report Y-BOCS included in the questionnaire package, (c) have compulsive checking as a primary compulsion,

and (d) score at least 4 on the Checking subscale of the MOCI<sup>22</sup>. In addition, the checking behaviour had to be intended to prevent catastrophic outcomes (e.g., fire, flood, burglary, etc) and occupy at least 30 minutes a day. The inclusion of this group allowed an examination of the impact of single versus repeated checks on relevant items in individuals who routinely engage in compulsive checking behaviour. Participants received a small honorarium for their time.

Sample characteristics. Twenty individuals with OCD and primary checking compulsions participated in Study 2. Basic demographic information is summarized in Table 18. There were no differences on demographic variables or measures of symptomatology based upon recruitment source (Vancouver treatment centre sample versus Vancouver community sample versus Montreal community sample). Sixty-five percent of the sample (n=13) was female. The mean participant age in this sample was 38.75 (SD=11.0) years, with a range from 22 to 59 years old. Seventy percent of the sample (n=14) identified themselves as Caucasian, 10% identified themselves as Asian, 3% identified themselves as being of another ethnicity and 5% did not specify their ethnicity. Fifty percent of the sample (n=10) was married or cohabiting and 30% identified themselves as single. On average, participants had 15 years of education (SD=3.3 years), and 45% of the sample had a post-secondary degree or diploma.

Secondary compulsions identified by this sample were: washing/cleaning 45%, symmetry/ordering 15%, other compulsions 15%, and 25% reported no other significant compulsions. Fifty-five percent of the sample (n=11) had a current diagnosis of major depressive disorder, with 60% (n=15) reporting at least mild depressive symptoms on the BDI-II. Twenty percent met diagnostic criteria for another anxiety disorder. Forty-five percent of the sample was currently receiving psychological treatment for OCD. Sixty percent (n=12) of the sample were

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<sup>22</sup> A score of 4 or greater on the MOCI Checking subscale has been used in numerous studies to establish "checking" subgroups (e.g., MacDonald et al., 1997; Rubenstein et al., 1993; Sher et al., 1989).

taking psychotropic medication, most typically antidepressant medication.

Selected clinical characteristics of this sample are summarized in Table 19. Sample scores on measures of symptomatology are presented in Table 20. Comparison of this sample with published norms for measures of symptomatology suggest that this sample is typical of treatment-seeking outpatients with OCD.

### **Sample 2: Undergraduate Students**

A sample of undergraduate students was also recruited into the study in order to (1) serve as an analogue for compulsive checkers and (2) permit an examination of whether the simple act of checking an item repeatedly will cause the hypothesized increases in the multipliers and urge to check even in a sample of individuals who do not routinely check. If this is the case, it may provide important information about universal cognitive mechanisms that may contribute to the genesis of compulsive checking behaviour. Students were given 2 credit points towards their psychology course grade in exchange for their participation.

Sample characteristics. Forty-four university undergraduate students enrolled in introductory psychology courses participated in Study 2. Basic demographic information is summarized in Table 18. Eighty-two percent of the sample ( $n=36$ ) was female, with an average age of 20.6 years ( $SD=2.24$  years), with a range of 17 to 29 years old. Fifty-nine percent of the sample identified themselves as Caucasian ( $n=26$ ), 30% identified themselves as Asian, and 7% of the sample identified themselves as East Indian. Seventy-seven percent of the sample ( $n=34$ ) was single. On average, participants had 15 years of education ( $SD=2.02$ ). Twenty-five percent of the sample reported at least mild depressive symptoms on the BDI-II ( $n=11$ ). Sample scores on measures of symptomatology are presented in Table 20. Comparison of this sample with published norms for measures of symptomatology suggest that this sample is typical of

nonanxious controls.

### **Procedure**

Participation in Study 2 involved three stages. In the first stage, participants were asked to complete and return a questionnaire package. The questionnaire package consisted of the same standardized questionnaire measures (e.g., measures of obsessive-compulsive symptomatology, current depressive symptomatology, trait anxiety) as in Study 1 and took approximately 30 to 45 minutes to complete. Clinical participants returned the completed questionnaire package to an ADU staff member or to the author by mail. Community members returned completed questionnaire packages to the research laboratory in the Department of Psychology.

In the second stage, participants completed a brief pre-experiment interview. During this interview, the details of the checking tasks to be completed during the experiment were developed in collaboration with the participant. Two items were chosen for each participant. One item was selected to be a “high relevance” item taken from the participant’s normal checking routine (see below for how this item was determined for students). The other item was selected to be “low relevance” in the sense that it was an item that the participant did not usually check and which was not associated with a negative outcome that usually worries the participant. The specific behavioural guidelines for completing a brief but thorough check of each item were also established during this interview. For practical reasons, the checking procedure for each item was kept in the range of 30 seconds to 2 minutes. In the case of the low relevance item, elements of repetition, counting, or detail were added as necessary so that the length of time required to check the low relevance object was approximately equal to the length of time required to check the high relevance object. Finally, the procedure for the telephone experiment was reviewed. This pre-experimental telephone interview took approximately 30 minutes to complete.



In the case of undergraduate students, many of whom did not have clinically significant checking compulsions, a “high relevance” checking task was created based upon their responses to a “Student Checking Survey”. In addition to asking about the presence of common subclinical checking compulsions, this instrument asks respondents to rank order from most distressing/worrisome to least distressing/worrisome a series of possible negative outcomes that could occur in the home and could possibly be forestalled by timely checking (e.g., fire, flood, burglary). A checking ritual related to this outcome (e.g., checking the taps if flooding is viewed as the most distressing possible outcome) was created in collaboration with the participant. If the student already had routine subclinical checking behaviour intended to prevent a potentially serious negative outcome, then part of their actual checking routine around this object was used instead. The low relevance task was created in relation to whichever outcome they endorsed as being the least fearful (e.g., if the participant reports that she rarely worries about the possibility of fire in her home, then a ritual was created around turning off the stove elements).

In the third and final stage, participants were contacted by telephone at a pre-arranged time to complete the telephone experiment. The experimental procedure for this study closely paralleled the procedure used by Roper, Rachman and colleagues in their classic checking experiments in the early 1970s. At the beginning of this call, the researcher who completed the telephone screen with that participant reviewed the agreed-upon procedures for a “proper” check of both the high and low relevance items. The researcher also provided a general overview of the telephone experiment and answered any questions that the participant may have had. After this had been accomplished, an experimenter who was blind to the hypotheses of the study and to differences in the relevance of the items greeted the participant and then began the telephone experiment. During the experiment, the participant was asked to complete four specific checking

tasks (two on each item). The experiment was divided into four separate blocks. For the purposes of illustration, assume that the high relevance item is the door lock and the low relevance item is the stove element. One of the items was designated item “A”, in this example, the door lock, and the other was designated item “B”, in this example, the stove element. In the first block, the participant would be asked to perform a series of actions on either item A or item B (determined randomly); in this example, the participant would be asked to put down the telephone, go to the door, open and then shut and lock it quickly, and then return to the telephone without checking in any way. As soon as the participant returned, he or she would be asked to make a series of pre-check ratings (see description below). Next, the participant would be asked to go back to the door, and perform a single check of the door lock according to the guidelines established during the pre-experimental interview and then return to the telephone. The participant would then be asked to make a series of post-check ratings. As the last step in the block, the participant would be asked to perform a brief filler task consisting of a simple math task (e.g., counting forwards by sevens from 0 for 1 minute). The second block followed a similar procedure to the first, except that the participant would be working with and checking the other item, in this example, the stove element. In the third block, the participant would perform a series of ten checks on either item A or item B (determined randomly). In the fourth and final block, the participant would perform a series of ten checks on the other item. See Appendix 2 for a description of a sample telephone experiment and Appendix 3 for an abridged version of the telephone instructions.

In this study, ten checks were chosen as the number of repetitions for the repeated checking conditions as (1) it seemed that this would be in line with, or slightly greater than the number of checks that participants would typically perform in their naturally occurring checking

sessions, and (2) given the time required to execute ten checks, and the fact that each participant needed to complete four separate checking tasks, it was judged that having more than ten checks would result in an excessively long time away from the phone and would extend the duration of the experiment to the point that it might negatively influence participants' willingness to participate.

### **Dependent Measures**

Prior to and following each checking task, participants were asked to make a series of ratings on a 0 to 10 scale of the following variables that are central to the self-perpetuating mechanism: (a) perceived responsibility for preventing harm in that situation; (b) perceived severity of harm; (c) perceived probability/likelihood of harm if participant does not check; (d) urge to check; (e) anxiety/discomfort and (f) confidence in memory. Participants were also asked to give a yes/no opinion as to whether the item in question is properly and safely turned off, closed or unplugged, and a rating of their confidence that the item is as desired. The telephone experiment took approximately 45-60 minutes to complete.

## **Study 2 Results**

### **Analyses**

Main and interaction effects of the hypothesized self-perpetuating mechanism were examined in each group using a 2 (pre- vs. post-check) X 2 (one check vs. multiple checks) X 2 (high relevance versus low relevance item) repeated measures analysis of variance (ANOVA) with ratings of the multipliers, anxiety, urge to check, and confidence in memory as dependent variables.<sup>23</sup> Type I error rate was controlled by using an alpha level of .01 for all analyses. Findings for both samples are summarized in Table 21 and the cell means are in Tables 22

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<sup>23</sup> Assuming a medium effect size, a total sample size of 20 for each group (i.e., 20 observations per cell in the within-subjects design) yielded a power of approximately .80.

through 27. Intercorrelations between mean ratings on the dependent variables for each sample are presented in Tables 28 and 29.

### **Student Sample**

#### **Perceived Responsibility for Harm**

There was a significant main effect of relevance,  $F(1,43) = 50.07, p < .001, \eta^2 = .538$ , such that the high relevance condition was associated with higher ratings of responsibility. There was also a significant main effect of time,  $F(1,43) = 13.21, p = .001, \eta^2 = .235$ , with ratings of responsibility dropping significantly from pre- to post-check. The main effect of number of checks was nonsignificant,  $F(1,43) = 4.80, p = .034, \eta^2 = .100$ . The two-way and three-way interactions were not significant (p-values greater than .10). Perceived responsibility decreased significantly in both high and low relevant conditions following any checking.

#### **Perceived Severity of Harm**

There was a significant main effect of relevance  $F(1,43) = 63.96, p < .001, \eta^2 = .598$ , such that ratings of severity were higher in the high relevance condition than in the low relevance condition. There was also a significant effect of time,  $F(1,43) = 9.46, p = .004, \eta^2 = .180$ . There was no main effect of number of checks ( $p > .10$ ), and the two-way and three-way interactions were not significant (p-values greater than .10). Perceived severity decreased significantly in both high and low relevance conditions following any checking.

#### **Perceived Probability of Harm**

There was a significant main effect of relevance  $F(1,43) = 29.55, p < .001, \eta^2 = .407$ , such that ratings of probability were higher in the high relevance condition than in the low relevance condition. There was also a significant main effect of time,  $F(1,43) = 33.51, p < .001, \eta^2 = .438$ , with ratings of probability dropping significantly from pre- to post-check. There was no main

effect of number of checks ( $p > .10$ ). There were nonsignificant two-way interactions between number of checks and time,  $F(1,43) = 6.00$ ,  $p = .018$ ,  $\eta^2 = .122$ , relevance and time  $F(1,43) = 4.71$ ,  $p = .036$ ,  $\eta^2 = .099$ , and number of checks and relevance,  $F(1,43) = .258$ ,  $p > .10$ ,  $\eta^2 = 0.006$ . The three-way interaction was also nonsignificant,  $F(1,43) = 5.30$ ,  $p = .026$ ,  $\eta^2 = .614$ . Perceived probability of harm decreased significantly in both high and low relevance conditions following any checking.

### **Urge to Check**

There was a significant main effect of relevance on urge to check,  $F(1,43) = 36.47$ ,  $p = .001$ ,  $\eta^2 = .465$ , such that participants reported stronger urges to check in the high relevance condition than in the low relevance condition. There was a significant main effect of time  $F(1,44) = 46.15$ ,  $p < .001$ ,  $\eta^2 = .524$ , such that urge to check decreased from pre- to post-check. There was also a significant main effect of number of checks,  $F(1,43) = 11.59$ ,  $p = .001$ ,  $\eta^2 = .216$ , with more checks being associated with a lower urge to check. Urge to check decreased significantly in both high and low relevance conditions following any checking. There was a significant three-way interaction,  $F(1,43) = 8.08$ ,  $p = .007$ ,  $\eta^2 = .161$ .

Further analyses revealed a nonsignificant simple interaction effect of time by relevance,  $F(1,43) = 0.79$ ,  $p > .10$ ,  $\eta^2 = .002$  in the single check conditions. In contrast, there was a significant simple interaction effect of time by relevance in the repeated check conditions,  $F(1,43) = 25.09$ ,  $p < .001$ ,  $\eta^2 = .369$ . Further analyses revealed a significant simple simple main effect of time in the lower relevance repeated check condition,  $F(1,44) = 16.12$ ,  $p < .001$ ,  $\eta^2 = 0.273$ , such that ratings of urge to check dropped significantly from pre- to post-check. Similarly, there was a significant simple simple main effect of time in the higher relevance

repeated check condition,  $F(1,44) = 49.06$ ,  $p < .001$ ,  $\eta^2 = 0.533$  such that the drop in ratings of urge to check was greater in magnitude in this condition.

### **Discomfort/Anxiety**

Analyses revealed significant main effects of relevance,  $F(1,43) = 24.49$ ,  $p < .001$ ,  $\eta^2 = .363$ , such that participants reported higher levels of anxiety in the high relevance condition than in the low relevance condition. There was also a significant main effect of time,  $F(1,43) = 55.46$ ,  $p < .001$ ,  $\eta^2 = .563$ , such that anxiety ratings decreased significantly from pre- to post-check. There was no main effect of number of checks ( $p > .10$ ). Anxiety decreased significantly in both high and low relevance conditions following any checking. There was a significant relevance by time interaction  $F(1,43) = 15.42$ ,  $p < .001$ ,  $\eta^2 = .264$ . Simple effects tests revealed that under conditions of lower relevance, anxiety decreased significantly from pre- to post-check,  $F(1,44) = 22.91$ ,  $p < .001$ ,  $\eta^2 = 0.348$ . Similarly, under conditions of higher relevance, anxiety decreased significantly from pre- to post-check,  $F(1,44) = 48.98$ ,  $p < .001$ ,  $\eta^2 = 0.532$ . However, the magnitude of the decrease in anxiety from pre- to post-check was greater in the high relevance condition. The other two-way interactions and the three-way interaction were not significant (all  $p$ -values greater than .10).

### **Confidence in Memory**

There was a significant main effect of relevance  $F(1,43) = 7.37$ ,  $p = .01$ ,  $\eta^2 = .146$ , such that confidence in memory for security of the item was higher in the low relevance condition than in the high relevance condition. There was also a significant main effect of time  $F(1,43) = 40.63$ ,  $p < .001$ ,  $\eta^2 = .486$ , such that confidence in memory for security of the item was higher following a check. There was no main effect of number of checks ( $p > .10$ ). The two-way and three-way interactions were also not significant ( $p > .05$ ).

### **Final State of the Item**

Inspection of frequencies for these variables revealed that less than 10% of the sample answered negatively when asked if the item was secure following the provocation. Following a check, none of the students answered negatively when asked if the item was secure. For this reason, no inferential statistics were performed for these variables.

### **OCD Sample**

#### **Perceived Responsibility for Preventing Harm**

There was no significant main effect of relevance,  $F(1,19) = 7.58$ ,  $p = .013$ ,  $\eta^2 = .285$ . There was a significant main effect of time,  $F(1,19) = 8.14$ ,  $p = .010$ ,  $\eta^2 = 0.300$ , with ratings of responsibility dropping from pre to post-check. There was no main effect of number of checks ( $p > .10$ ). The two-way and three-way interactions were not significant (p-values greater than .10).

#### **Perceived Severity of Harm**

There was a significant main effect of relevance  $F(1,19) = 12.48$ ,  $p = .002$ ,  $\eta^2 = 0.396$ , such that ratings of severity were higher in the high relevance condition than in the low relevance condition. There was no significant main effect of time,  $F(1,19) = 4.50$ ,  $p = .047$ ,  $\eta^2 = 0.192$ , although post-check ratings of severity tended to be lower than pre-check ratings of severity. There was no main effect of number of checks ( $p > .10$ ). The two-way and three way interactions were not significant (all p-values greater than .10).

#### **Perceived Probability of Harm**

There was a significant main effect of relevance  $F(1,19) = 46.60$ ,  $p < .001$ ,  $\eta^2 = 0.710$ , such that ratings of probability were higher in the high relevance condition than in the low relevance condition. There was also a significant effect of time,  $F(1,19) = 37.36$ ,  $p < .001$ ,  $\eta^2 = .663$ , with ratings of probability decreasing significantly from pre- to post-check. There was no

main effect of number of checks ( $p > .10$ ). The interaction between number of checks and time  $F(1,19) = 5.38$ ,  $p = .032$ ,  $\eta^2 = .221$  was also nonsignificant. The remainder of the two-way interactions and the three-way interaction were not significant (p-values greater than .10). Perceived probability decreased significantly in both high and low relevance conditions following any checking. Further post-hoc analyses are described below.

### **Urge to Check**

There was a significant main effect of relevance on urge to check,  $F(1,19) = 48.12$ ,  $p < .001$ ,  $\eta^2 = .717$  such that participants reported stronger urges to check in the high relevance condition than in the low relevance condition. There was a significant main effect of time  $F(1,19) = 26.60$ ,  $p < .001$ ,  $\eta^2 = .583$ , such that urge to check decreased from pre- to post-check. The main effect of number of checks was not statistically significant,  $F(1,19) = 3.48$ ,  $p = .078$ ,  $\eta^2 = .155$ . The two-way and three-way interactions were not significant (all p-values greater than .10). Urge to check decreased significantly in both high and low relevance conditions following any checking.

### **Discomfort/Anxiety**

Analyses revealed significant main effects of relevance,  $F(1,19) = 40.05$ ,  $p < .001$ ,  $\eta^2 = 0.678$ , such that participants reported higher levels of anxiety in the high relevance condition than in the low relevance condition. There was also a significant main effect of time,  $F(1,19) = 13.02$ ,  $p < .002$ ,  $\eta^2 = 0.407$ , such that anxiety ratings decreased from pre- to post-check. There was no main effect of number of checks ( $p > .10$ ). The two-way and three-way interactions were not significant ( $p > .10$ ). Anxiety decreased significantly in both high and low relevance conditions following any checking.



### **Confidence in Memory**

There was a significant main effect of relevance  $F(1,17) = 15.47$ ,  $p = .001$ ,  $\eta^2 = 0.476$ , such that confidence in memory for security of the item was higher in the low relevance condition than in the high relevance condition. There was a significant main effect of time  $F(1,17) = 8.40$ ,  $p = .010$ ,  $\eta^2 = 0.331$ , such that confidence in memory for security of the item was higher following a check. There was no main effect of number of checks ( $p > .10$ ). The two-way and three-way interactions were also not significant ( $p > .10$ ).

### **Final State of the Item**

Inspection of frequencies for these variables revealed that, depending upon the block, between 10% ( $n=2$ ) and 30% ( $n=6$ ) of the OCD sample answered negatively when asked if the item was secure following provocation. Following a check, fewer participants answered negatively when asked if the item was secure (0-15%). For this reason, no inferential statistics were performed for these variables.

### **Post-Hoc Analyses on Probability**

Given that a similar pattern of interactions was observed in both the student and OCD samples in this study, and given that this might be related to the use of a more conservative alpha, post-hoc analyses were conducted for explanatory purposes to follow-up the “marginally” significant findings.

In the student sample, there was a nonsignificant three-way interaction,  $F(1,43) = 5.30$ ,  $p = .026$ ,  $\eta^2 = 0.110$ . Further analyses revealed a nonsignificant simple interaction effect of time by relevance,  $F(1,43) = 0.034$ ,  $p > .10$ ,  $\eta^2 = .001$  in the single check condition, and a significant simple interaction effect of time by relevance,  $F(1,43) = 10.59$ ,  $p = .002$ ,  $\eta^2 = .198$  in the repeated check condition. There was a significant simple main effect of time on perceived

probability in the lower relevance repeated check condition,  $F(1,49) = 12.01$ ,  $p = .001$ ,  $\eta^2 = 0.218$ , such that ratings of probability dropped from pre- to post-check. Similarly there was a significant simple main effect of time on perceived probability in the higher relevance repeated check condition,  $F(1,49) = 27.11$ ,  $p < .001$ ,  $\eta^2 = 0.387$ , such that ratings of probability dropped from pre- to post-check although this effect was greater in magnitude. Thus, the decrease in perceived probability from pre-check to post-check appears to be most pronounced under conditions of higher relevance and repeated checking.

In the OCD sample, there was a nonsignificant interaction effect between relevance and time,  $F(1,19) = 4.46$ ,  $p = .048$ ,  $\eta^2 = 0.190$ . Simple main effects tests revealed a nonsignificant effect of time on perceived probability under conditions of lower relevance,  $F(1,19) = 6.45$ ,  $p = .020$ ,  $\eta^2 = 0.254$ , although mean ratings of perceived probability were lower at post-check. However, there was a significant effect of time on perceived probability under conditions of higher relevance,  $F(1,19) = 27.93$ ,  $p < .001$ ,  $\eta^2 = 0.595$ , with ratings of perceived probability dropping from pre- to post-check.

There was also a nonsignificant interaction effect between number of checks and time in the OCD sample,  $F(1,19) = 5.377$ ,  $p = .032$ ,  $\eta^2 = 0.221$ . Simple main effects tests revealed that in the single check conditions, there was a significant decrease in perceived probability of harm from pre-check to post-check,  $F(1,19) = 10.17$ ,  $p = .005$ ,  $\eta^2 = 0.349$ . Similarly, in the repeated checking condition, there was a significant decrease in perceived probability of harm from pre-check to post-check,  $F(1,19) = 38.51$ ,  $p < .001$ ,  $\eta^2 = 0.670$ . However the magnitude of the decrease in perceived probability was much greater in the repeated check condition.

### **Order or Practice Effects**

A series of between-groups ANOVAs on the dependent measures (anxiety, responsibility, probability of harm, severity of harm, confidence in memory and urge to check) was conducted to examine potential order effects associated with the repeated measures experimental design. No significant differences emerged between the two possible orders of the single check blocks ( $A_1B_1$  and  $B_1A_1$ ), between the two possible orders of the repeated check blocks ( $A_{10}B_{10}$  and  $B_{10}A_{10}$ ), or between the four possible orders of all blocks ( $A_1B_1A_{10}B_{10}$ ,  $A_1B_1B_{10}A_{10}$ ,  $B_1A_1A_{10}B_{10}$ , and  $B_1A_1B_{10}A_{10}$ ; all  $p$ 's > .05), suggesting that order effects were not present.

To examine potential carryover effects from the repeated measures design, a series of paired samples  $t$ -tests was conducted comparing the pre-assessment levels of the dependent variables across time. The reasoning behind this was that carryover effects would likely manifest in a systematic increase or decrease in these levels over successive blocks (e.g., from  $A_1$  to  $A_{10}$ ). Analyses were conducted on low and high relevance items separately, given the mean differences between the two types of items (described above). Results of these analyses revealed no significant increases or decreases in pre-assessment levels of the dependent variables across blocks (all  $p$ 's > .05), suggesting that systematic carryover effects were not present in this study.

### **Study 2 Discussion**

One of the most puzzling aspects of compulsive checking is its recurrency. That is, why do compulsive checkers check an item not just once, but over and over again and yet still feel uncertain about whether the item is safe? Any adequate theory of compulsive checking must explain not only what initiates a checking episode, but also what accounts for repetitive checking behaviour. Part two of Rachman's cognitive theory of compulsive checking (2002) provides an explanation for repetitive checking by proposing the existence of a self-perpetuating mechanism.

This mechanism is composed of four elements; (a) the absence of a “natural terminus” for checking behaviour, given that it is difficult to ever be certain that the possibility of future harm has been eliminated, (b) a post-check responsibility increase, such that individuals feel more responsible for preventing harm following checking behaviour, (c) a responsibility-probability bias in which the sense of being responsible for preventing harm leads to an increase in the perceived probability of harm, and (d) a decrease in memory confidence following repeated checking. These elements are proposed to work together to drive the puzzling repeated checking behaviour observed in individuals with OCD and primary checking compulsions.

To date, few studies have been conducted that would allow for an evaluation of the hypothesized self-perpetuating mechanism as an explanation for repeated checking behaviour. No studies have empirically examined the impact of checking on the multipliers and memory confidence or the possible differential impact of single versus repeated checks, both of which are of particular relevance for evaluating the self-perpetuating mechanism. This study sought to provide a first exploratory test of the self-perpetuating mechanism as an explanation for repeated within-session checking. More specifically, this study examined the impact of repeated checking on perceived responsibility (post-check responsibility increase), probability and severity (responsibility-probability bias), and confidence in memory (decreased confidence in memory), as well as anxiety/discomfort and urge to check. This study also explored whether the self-perpetuating mechanism is part of a general cognitive process by testing not only participants with OCD and primary checking compulsions, but also individuals who do not routinely check. And finally, this study explored whether repetitive checking of any object activates the elements of the self-perpetuating mechanism, or whether the mechanism is only activated by objects that relate to possible feared outcomes for the participant by using both high and low relevance items.

In so doing, this study aimed to provide information that would assist in the evaluation of the self-perpetuating mechanism described in the cognitive theory of checking, and to increase our understanding of cognitive factors that may underlie the phenomenology of compulsive checking.

As the purpose of this study was to understand the phenomenology of compulsive checking, it was designed to capture many factors that appear to be germane to naturally occurring checking episodes, thus enhancing the ecological validity of the study. First, this study was conducted in the participant's home, as previous work has demonstrated that most checking behaviour occurs in the home and that it is difficult to elicit authentic checking behaviour in situations where the individual does not feel responsible (e.g., in the laboratory; Rachman & Hodgson, 1980; Roper & Rachman, 1975; Roper et al., 1973). Second, the experiment was conducted as a telephone experiment in which the experimenter provided instructions and collected ratings over the telephone in order to avoid the diffusion of responsibility that would occur if the experimenter were actually present in the participant's home. In addition, other members of the participant's household were not at home during the experiment. Again, this was intended to heighten the participant's perceived responsibility for preventing harm and to more closely approximate the conditions under which checking normally occurs (i.e., most checking is done when the individual is alone; Rachman, 1976). Third, this study utilized idiographically selected items, with the high relevance items reflecting either items that the participant routinely checks (in the case of the OCD participants) or which related to outcomes that were of concern for that individual (student participants). Fourth, whenever possible, the mutually agreed upon guidelines for checking items incorporated the individual's own checking ritual (e.g., high relevance item for OCD participants) or their ideas for how to properly and thoroughly check the

item (e.g., low relevance item for the OCD participants, both types of item for the student participants). This was done in order to increase the similarity of the checking actions performed during the experiment to naturally occurring checking behaviour. Finally, in contrast to most other studies examining memory in OCD, this study incorporated repeated motor action on the objects of concern, thus more closely paralleling what occurs in a checking episode than previous work that has involved less ecologically valid exposures (e.g., visual presentation of a variety of stimuli, Tolin et al., 2001). Overall, this study attempted to follow the recommendation that experimental paradigms in OCD research “capture what is critically important to the individuals with OCD being tested” (Radomsky & Rachman, 2004, p.148).

Preliminary examination of the findings suggested that the experimental design was able to appropriately simulate some of the characteristics of a naturally occurring checking episode. In particular, the experimental protocol was successful in provoking urges to check, discomfort/anxiety, a sense of responsibility, and a sense that significant harm was possible. Not surprisingly, these provocations were more potent for the OCD sample, and were more potent for the high relevance items than for the low relevance items. For example, in the OCD sample, the provocations associated with the high relevance item were effective in provoking fairly significant urges to check (7-8 out of 10). The provocations for the lower relevance items provoked smaller urges to check (3-4 out of 10) and the effects of the provocation were less for students, even for the higher relevance item where the urge to check was more in line with the lower relevance item for the OCD sample (3 out of 10). Moreover, during debriefing, many of the OCD participants spontaneously reported that although they knew they were participating in an experiment, their urges and behaviour closely resembled what would have occurred naturally if they were to use that item.

Analyses suggested that the idiographically selected high relevance items differed from the low relevance items in the expected ways. That is, in both samples, the higher relevance items were associated with higher levels of perceived severity and probability (and interestingly, responsibility) than the lower relevance items. Higher relevance items were also associated with higher levels of anxiety and urges to check. Thus, it appears that participants did distinguish between the two items in the expected ways, thereby permitting an examination of any differential effects of the self-perpetuating mechanism according to the relevance of the item.

### **Multipliers and the Self-Perpetuating Mechanism:**

#### **The Effects of Single and Repeated Checking on the Multipliers**

Based upon the cognitive theory of compulsive checking, it was hypothesized that repetitive checking would lead to increased perceived responsibility, such that (a) responsibility ratings would increase from pre- to post-check in the repeated checking condition, and (b) responsibility ratings would be higher after repetitive checking than after a single check. This corresponds to the “post-check responsibility increase” component of the self-perpetuating mechanism. It was further hypothesized that the increased responsibility in the repeated check condition would be associated with increased probability and severity, such that (a) probability and severity ratings would increase from pre to post check in the repeated checking condition, and (b) probability and severity ratings would be higher after repetitive checking than after a single check. This corresponds to the “responsibility-probability bias” component of the self-perpetuating mechanism. It was predicted that these effects would be apparent in both the student and OCD samples and in both the higher and lower relevance conditions.

Contrary to expectations, on average, responsibility, probability and severity all showed significant *decreases* from pre- to post-check in both the single check and repeated check

conditions. This pattern was observed in both the OCD and student samples, and was also apparent for both the higher and lower relevance items. In addition, there was no interaction with relevance, suggesting that the decreases were similar in both conditions.

A closer examination of the data revealed that the majority (70-75%) of the OCD participants gave pre-check ratings of responsibility or severity that were close to the maximum possible rating for the high relevance item (8, 9 or 10 out of 10), suggesting the possibility of a ceiling effect (see Table 30). However, even if there were a ceiling effect, in order to be consistent with the theory, the multipliers should at least have remained at the same high level in the repeated check condition (or increased, for ratings of 8 or 9 out of 10), rather than decreasing after checking. As it turned out, among those who made extremely high ratings on responsibility or severity, more than half remained at the same high level in *both* the single check and repeated checking conditions, which is not consistent with the theory (discussed further below). Most of the others decreased, with a small number (0 to 10%) showing an increase. Thus, the decreases in the multipliers following checking were by no means uniform across participants in the OCD sample in the high relevance condition.

Thus, overall the results of this study do not appear to support either the hypotheses of the study or the predictions of the cognitive theory of compulsive checking. While one possibility is that the multipliers are generally effectively reduced through repeated checking, in direct contradiction of the hypotheses of this study, other alternative explanations for the observed pattern of results must also be considered.

### **Possible Explanations for Unexpected Findings for the Multipliers**

It is possible that particular aspects of the methodology of the study may account for the observed pattern of findings. For example, inherent in any repeated measures design is the



possibility of “carryover effects” or order effects or both. However, the pattern of findings (discussed above under post-hoc analyses) suggests that these were not a factor in this study.

It is also possible that the unexpected findings may stem from differences between the experimental context (and in particular, participants’ awareness that they were participating in a study) and the context of naturally occurring checking. That is, while efforts were made to approximate as much as possible the circumstances under which checking occurs (described above), it may be that the inherently contrived nature of the study may have led to differences in the cognitive or emotional effects of repeated checking on the multipliers. For example, as the checking behaviour of the participants was “controlled” by the experimenter, participants knew that the experiment was of limited duration, and that they would be able to complete whatever checking or other action they deemed necessary once the experiment was over, typically in about an hour. Also, while participants were required to leave the room in which the object of concern was located following the provocation and any checking behaviour, they were not required to leave their homes during the experiment. This may have affected their views of the probability of serious harm occurring. Participants may also have reacted differently to having the provocation and a certain number of checks “imposed” upon them by the experimenter, which may have influenced their perceived responsibility for any harm. More broadly, despite the fact that the experimenter was not physically present, perceptions of the multipliers may have been affected by the fact that the participant was not the only person aware of the possible “risk” involved in the provocation activities. It is notable, however, that participants reported relatively high levels of perceived responsibility for preventing harm following provocation, despite this awareness and the fact that they were “following orders”.

Alternatively, it may be the case that participants may not have had access to or awareness of their perceptions of the multipliers during checking or post-check periods. That is, although in Study 1, participants from all three samples recognized distinctions between higher and lower levels of each multiplier and corresponding effects on their emotional and behavioural responses, it is possible that in murkier real life situations, participants are simply aware that they are anxious, and are unaware of or unable to track potential changes in their perceptions of these multipliers as a function of checking behaviour. They may therefore provide responses that seem to make sense (demand characteristics) or that they believe will fulfil the experimenter's expectancies/hypotheses. However, the fact that the experimenters were blind to the purposes and hypotheses of the study and the consistency of the findings across two samples and multiple experimenters argues against such an explanation.

Another possibility is that the self-perpetuating mechanism only applies to a particular subset of individuals, and these were not part of the samples collected for this study. It would make sense that the self-perpetuating mechanism, if it indeed operates within a single session to promote repeated checking, should most likely be observable in a sample of compulsive checkers acting on items of concern for them using their usual checking rituals. However, it is possible that the sample of compulsive checkers in this study, collected from outpatient clinics and the community may not be representative of compulsive checkers in general.

Another possible explanation for the absence of the expected increases in the multipliers could be that the number of repeated checks, which was standardized to ten in the present study, may not have been sufficient to provoke or observe the effect. That is, perhaps a larger number of repetitions of the checking act would be necessary or a certain threshold must be passed in order to "trigger" the self-perpetuating mechanism and provoke the predicted increases in the

multipliers. Along similar lines, it is possible that a more complex or lengthier ritual than those performed in the study may be necessary in order to activate the self-perpetuating mechanism.

Conversely, it may be that participants in our study completed too many checks, that is, that completing ten checks in succession may have taken them past some unknown “satiation” threshold. Having participants “overcheck” may have disrupted the usual effects of repeated checking to satiation. However, the finding that at least 40% of the OCD participants still reported an urge to check of 5/10 or greater for the high relevance item, even after ten checks, argues against this explanation for the findings.

Finally, it is possible that repeated checking had an impact on the multipliers, and perhaps even led to temporary increases in the multipliers, but that the time points used in this study did not enable us to capture this effect. For example, it is possible that the multipliers began to increase either right away or after three or four checks, but then began to fall after a few more checks, leading to lower ratings at the end of the repetitive checking condition. Although this would seem to run counter to the findings, in which the multipliers fell after a single check, it may be the case that the multiplier ratings following the single check are not representative of the ratings of the multipliers that would occur after the first check in a series of repeated checks. Alternatively, it may be the case the multipliers reached their lowest point somewhere between the first check and the final tenth check, and were beginning to increase, but this pattern was not detectable on the basis of the time points that were used. In order to evaluate these possibilities (i.e., that the relationship between the multipliers and number of checks is non-linear), future research could assess the multipliers at multiple time points in a series of repeated checks (e.g., after the third check, the sixth check, the tenth check).

Thus, it possible that the decline in the multipliers represents an artifact of the experimental design or sampling process. If subsequent research reveals that these methodological factors are important for detection of the self-perpetuating mechanism, then the theory would need to be qualified to reflect its more limited applicability to circumstances fitting within those parameters (e.g., only detectable after > 20 checks). However, given the consistency of the decline across multipliers, conditions, and samples, the possibility that these results are accurate reflections of the impact of repeated checking on the multipliers cannot be ignored. As such, it is important to consider how these findings fit within the larger context of previous research and theory.

The findings of the present study on the effects of checking on the multipliers are particularly interesting when considered in light of the proposed functions or purposes of checking behaviour outlined by theorists such as Salkovskis (1985,1989) and Rachman (2002). It has been variously proposed that checking behaviours (or compulsive acts more generally) serve to reduce (a) responsibility for any harm which may occur, (b) the likelihood and/or severity of potential harm, and (c) to reduce distress associated with intrusive thoughts about harm. While classic research studies by Rachman and colleagues in the 1970s provided information about checking in relation to anxiety and urge to check, it would appear that since the cognitive revolution of the 1980s, no study has specifically examined the impact of checking on cognitive factors such as perceived probability, responsibility and severity of harm. Moreover, although checking is theoretically intended to reduce the multipliers, this does not necessarily mean it is an effective means of achieving this end. It is quite possible that, as is the case for many other safety behaviours, repetitive checking serves to exacerbate, rather than ameliorate these factors,

or alternatively, that it may not be that effective in altering these factors. The results of this study enable us to shed some light on how effectively checking serves some of its purposes.

As noted above, the present findings suggested that any checking (single or repeated) was associated with significant decreases in all three multipliers. The observed relative pattern of change on the multipliers was interesting and may deserve closer examination. Of all of the multipliers, probability dropped most sharply following any checking. Responsibility showed less of a decline than probability, but more than severity, which changed the least following any checking across both samples. This suggests that the act of checking may be more effective at reducing some multipliers than others.

The observed decreases in responsibility following checking were not consistent with the predictions of the cognitive theory of checking or with the clinical observations of Lopatka and Rachman (1995), who noted increases in this multiplier following a checking session. By contrast, these findings were consistent with a study of subclinical thought-action fusion in students that found decreases in perceived responsibility and probability following a single act of neutralization (Rachman, Shafran, Mitchell, Trant & Teachman, 1996). The post-check reduction in responsibility is also consistent with Salkovskis' idea that the purpose of compulsions is to avoid being responsible for harm. Logically, as the last person to have contacted that item (e.g., used the stove), one would still ultimately bear responsibility for any harm that could occur associated with that item. However, the act of checking may be perceived as discharging some of that responsibility, with any harm occurring after checking being simply viewed as unfortunate luck. It is also noteworthy that although decreases in responsibility were observed following checking, significant levels of responsibility remained at post-check. Thus it appears that checking cannot entirely alleviate perceived responsibility. It may be the case that while

“situational” responsibility can to some extent be reduced by checking, the general sense of responsibility attributable to more trait-like sources is not as easily discharged.

In a recent replication of their earlier studies, Van den Hout and Kindt (2004) attempted to assess the impact of repeated checking on participants’ subjective sense of having “acted responsibly”. These authors proposed that repeated checking of an item makes the behaviour a familiar and automatic routine and therefore dilutes the sense of having expended effort. This in turn diminishes the sense that one has acted in a responsible manner. In their sample of undergraduate students, they found that repeated checking of an item reduced the sense that one had put in a good effort and had acted responsibly. However, this question is very different from the question asked in the present study, which tapped the sense of being responsible for preventing harm. Moreover, the methodology of the Van den Hout and Kindt (2004) study differs markedly from the methodology of the present study (e.g., lab context, student sample only, use of only “irrelevant” stimuli, etc.). For example, in their study using a virtual stove and virtual lightbulbs, there was no real responsibility for harm as there was no possibility of real harm, making these two studies difficult to compare. These differences are discussed further below.

The distinction between the operationalization of responsibility in the present study and in the study by Van den Hout and Kindt (2004) again raises the issue of how best to define responsibility in the context of compulsive checking. Recently, Mancini and Gangemi (2004) suggested that compulsive activity in OCD, rather than being primarily intended to prevent harm, might instead be primarily intended to avoid the negative emotional state of guilt engendered by the sense of not having acted in a way that is consistent with one’s moral values (i.e., responsibly). It is likely that both functions are important; perhaps the purpose of checking is to

reduce or discharge one's personal responsibility for preventing harm (perhaps in part through reducing the probability and severity of harm) and to increase one's sense of having acted responsibly, thus avoiding feelings of guilt. Future research may wish to examine the impact of repeated checking on both aspects of responsibility.

The findings of this study also suggest that perceived severity of harm decreases following any checking behaviour (single or repeated). This is consistent with the suggestion by Rachman (2002) that one of the purposes of checking is to reduce the "effects" of a potential adverse event. However, as mentioned above, this finding is not consistent with the increase in severity that was hypothesized to occur. In addition, the drop in severity appears somewhat counterintuitive logically, as it would seem that the severity of the feared outcome (e.g., fire, flood, burglary) if it were to occur would not be influenced by whether one had checked. It may be the case that ratings of severity are being "pulled" down by decreases in one of the other multipliers, responsibility or probability. It is also possible that perceptions of severity are being pulled down by decreases in anxiety, which is known to inflate estimates of probability and severity of harm (e.g., Sookman & Pinard, 2002).

Ratings of perceived probability also declined following checking. The findings also suggested that the decrease in probability was most apparent for the high relevance items and following repeated checking. Again, this is in line with the proposal that one of the functions of checking is to reduce the likelihood of harm (Rachman, 2002). It is also consistent with the findings of the study of thought-action fusion described above (Rachman, Shafran, Mitchell, Trant & Teachman, 1996). However, it is not consistent with the predictions of the cognitive theory of compulsive checking, which suggests that repeated checking will be followed by increases in perceived probability, as part of the responsibility-probability bias.

Thus, overall it appears that any checking behaviour on either a high relevance or low relevance item, in both the OCD and student samples served to decrease the multipliers, and as such the findings are consistent with the hypothesized purposes of compulsions as they relate to cognition. The other purpose of checking behaviour, which was highlighted in the behavioural theory of OCD, is to decrease anxiety and, by extension, the urge to check. The findings suggest that anxiety and urge to check declined from pre- to post-check in both the single check and repeated check conditions. Interestingly, the effect sizes for anxiety, urge to check and probability were much larger than the effect sizes for responsibility and severity, suggesting that checking may be more effective at decreasing some checking-related factors than others. However, in the present study, both the multipliers and anxiety and urge to check generally followed the same overall pattern of significant decreases from pre to post check across both samples, with larger effects being observed in the OCD sample relative to the student sample.

The finding that the multipliers and anxiety and urge to check on average ended up lower at post-check than they were at pre-check does not necessarily mean that they followed the same linear path downwards, or that the rate of change was similar. Future studies could include more “online” ratings of anxiety, urge to check and the multipliers in order to elucidate their relative patterns of change (from the pre-check through the post-check periods).

Of particular relevance for the evaluation of the self-perpetuating mechanism is the observation that repeated checking was not associated with a different pattern of results when compared with the single check condition<sup>24</sup>. The similarity of pattern between the single and repeated checking conditions, and the absence of increases in the multipliers following repeated checking is not consistent with the cognitive theory, which suggests that repeated checking of an

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<sup>24</sup> The one possible exception to the similarity of pattern between the single and repeated check conditions was found for the high relevance post check scores on anxiety in the OCD sample. Following repeated checking, 30% of the sample reported an increase in anxiety as compared to 0% following a single check.



item leads to increases in the multipliers that in turn contribute to further checking. Given that this pattern was not observed, the question of what motivates compulsive checkers to check the same item over and over again remains unanswered.

Although the present study did not find evidence of the operation of a self-perpetuating mechanism within a checking session, some clues about what drives repeated checking may be found in the most ecologically valid part of the study – that is, in the observations of the effects of repeated checking by a sample of compulsive checkers on items that are especially relevant and important to them.

As discussed above, on average, checking decreased ratings of the multipliers, anxiety and urge to check in the OCD sample. However, this pattern was not uniform across these variables. Checking appeared to be more effective at decreasing probability, anxiety and urge to check than responsibility and severity. For example, in the repeated check condition, 80% of the OCD sample reported decreases in perceived probability of harm following checking, whereas only 45% reported a decrease in perceived responsibility and 45% reported a decrease in perceived severity. Moreover, for a significant subset of the sample, checking did not change responsibility and severity at all (although interestingly it did change probability, urge and anxiety for these people). In particular, in the repeated check condition – 45% and 55% reported no change in responsibility and severity, respectively.

Thus, while multipliers, anxiety and urge to check tend to be concordant at the onset of checking (when a decision is made about whether to check – see Study 1), in that all are high, there seems to be a fundamental discordance between responsibility and severity on the one hand and probability, anxiety and urge to check on the other following checking. That is, it may be the case that responsibility and severity will decline with repeated checking, but that their response

is delayed and more gradual than the decline of probability, anxiety and urge to check. Future research incorporating more points of measurement would help to clarify this pattern.

Although the implications of this discordance require further exploration, it is possible that the lack of responsiveness or more gradual decline of responsibility and severity acts to slow the decline of anxiety and/or urge to check, functionally attenuating the impact of checking behaviour. If this were the case, more checking would be required to bring anxiety and/or urge to check down to a level where checking would cease. As such, it may be that some of the factors that initiate checking behaviour in the first place (responsibility and severity of harm) may also serve to initiate subsequent checks.

In sum, the findings of the present study in relation to the multipliers suggest that checking is effective in serving some of its purposes, as it helps to decrease perceived probability of harm, anxiety and urge to check. However, it appears to be less effective in decreasing the subjective sense that one is at risk for being responsible for significant harm, which may help to partially explain why people check over and over again. This explanation for the persistence of checking within a session suggests an important role for the multipliers, and is consistent with the behavioural theory of OCD, previous research on anxiety, urge to check and the multipliers, and the findings of Study 1.

### **Memory Confidence and the Self-Perpetuating Mechanism:**

#### **The Effects of Single and Repeated Checks on Confidence in Memory**

In his description of the self-perpetuating mechanism that drives repeated checking, Rachman (2002) also highlighted the impact of repetitive checking on individuals' confidence in their memory for the check. More specifically, Rachman proposed that the act of repeated

checking serves to decrease confidence in memory for the check, and that this in turn fuels additional checking behaviour.

Based on the cognitive theory of compulsive checking and limited previous research, it was hypothesized that repetitive checking would lead to decreased confidence in memory, such that memory confidence would decline from pre- to post-check in the repeated checking tasks, and thus be lower following repeated checking than following a single check. It was further hypothesized that these effects would be observable in both the student and OCD samples, and that they would be most apparent for the high relevance items.

Overall, most of the hypotheses related to the impact of repeated checking on confidence in memory were not supported. Contrary to hypotheses, it was found that confidence in memory for the outcome of checking *increased* from pre-check to post-check in both the single and repeated checking conditions. This effect was observed for both the high relevance and low relevance items and across both samples.

The absence of a difference between the single and repeated check conditions and the increase in confidence following any checking are somewhat surprising and are not consistent with the predictions of the cognitive theory of compulsive checking. These findings are also not generally consistent with previous research, which has found that confidence in certain aspects of memory tends to decrease over repeated exposures (Tolin et al., 2001; Van den Hout & Kindt, 2003); however, given the paradigmatic differences between the present study and previous studies, the apparent lack of consistency with previous research is perhaps not unexpected (discussed below). It is also possible that the observed increase in memory confidence following checking (even repeated checking) may be attributable to particular aspects of the methodology of the study.

### **Possible Explanations for Unexpected Findings for Memory Confidence**

For example, one possible explanation for the lack of differences between the single check and repeated check conditions could be that the number of checks in the repeated checking condition in this study was not sufficient to activate the self-perpetuating mechanism and the associated decline in memory confidence. For example, in the Van den Hout and Kindt (2003, 2004) studies, which found decreases in memory confidence with repeated checking, student participants in the repeated checking condition completed 22 separate checks of the item, compared with only ten checks in the present study. However, it is notable that in the earlier study by Tolin and colleagues (2001), decreased confidence in memory (for whether an item was presented or not) was observed for “unsafe” items within five exposures in a mixed OCD sample.

As mentioned above, it could also be the case that the unexpected findings stem from differences between the experimental context and the context of naturally occurring checking. That is, while efforts were made to approximate as closely as possible the circumstances under which checking occurs (described above), it may be that the inherently contrived nature of the study somehow influenced the participants’ memory confidence. For example, the fact that the experiment was time-limited (so that they could do whatever checking they wanted to at the end – typically within an hour), the fact that another “responsible” person was aware of the situation, that participants may have realized after a couple of “blocks” that they would be asked to check the item after each provocation, and that participants never left the house may have decreased the level of arousal experienced by participants or attenuated the perceived importance of recalling the check or both. As Rachman (2002) suggested that arousal experienced in the checking situation may interfere with encoding and subsequent recall of the check, thus decreasing

memorial confidence, if participants experienced lowered arousal due to these aspects of the experimental design, this could help to partially explain why memory confidence was higher than expected. However, it is notable that even within the experimental context, OCD participants made high ratings of their pre-check levels of both anxiety and urge to check, particularly within the high relevance conditions, suggesting that arousal levels were high and that they perceived the tasks as important. In addition, Van den Hout and Kindt (2003, 2004) found a decrease in memory confidence in a checking task in which the item (a virtual stove) was of no real importance (i.e., there was no possibility of real harm) and likely did not provoke any significant anxiety.

It may also be the case that counting aloud at the end of each check in the repeated check condition (as part of the experimental protocol) may have served to make each individual act of checking more salient, separable and memorable, thus helping to increase confidence that the item was secure. More broadly, it may be that checking in the context of an experimental protocol, which was highly novel, may have affected confidence in memory. Along these lines, Tallis (1993) found that pairing an action that usually led to checking with a distinctive stimulus (a coloured shape) helped to reduce checking behaviour, presumably because a vivid recollection of the novel stimulus decreased doubt. However, it is worth noting that any checking which occurs in the context of an experiment could be vulnerable to this same pitfall. However, decreased confidence in memory effects were detected in both the Tolin (2001) and Van den Hout and Kindt (2003, 2004) studies.

Another possibility is that asking participants to provide a rating of confidence in memory for the final state of the item following the first provocation may have alerted them that memory was a key variable of interest in this study. This may have motivated participants to pay

greater attention to their memory for the final state of the item than they otherwise would have, and may partially explain the finding of enhanced confidence in memory following checking. However, given the levels of anxiety and urge to check, particularly in the OCD sample, it appears that recalling the final state of the item may have been viewed as important even if specific questions about memory had not been asked. Moreover, Van den Hout and Kindt (2003, 2004) reran their memory experiment without a pre-test and compared their findings to the same experiment with a pre-test, and found no differences, suggesting that asking about memory does not necessarily alter later responses.

Another possible explanation for the finding of enhanced confidence in memory following checking may be related to the predictability of the final check before the post-check assessment. Before the checking phase of each block, participants were given instructions to go back into the situation and check either one time or ten times in succession that the item was properly and safely secured (e.g., locked, off, etc.). Given that the last check in the series was predictable, it is possible that participants paid particular attention to the final check, thus improving their confidence for the final state of the item. One way of circumventing this possible bias would be to “interrupt” the checking sequence before “completion” (for example, asking for ratings following the eighth check in an anticipated series of ten), so that participants would be less likely to be “trying” to remember. However, there are drawbacks to this approach in terms of ecological validity. In a naturally occurring checking situation individuals typically are not interrupted or forced to end unpredictably, but rather check until they achieve some sense of completion or satiation (which is predictable in the sense that they know it is coming on, perhaps because anxiety is falling and they are feeling more comfortable, or they have completed their pre-specified number of checks, etc). Thus, an interruption paradigm would differ in some

significant ways from the context of naturally occurring checking. It is also worth considering that in naturally occurring checking situations in which individuals are completing a check to their satisfaction, it is likely that they are making efforts to remember and be confident of the final check. In this sense, any increased effort to remember the final state of the item in this study may have paralleled the natural process. In order to further explore this possibility, it may be useful to conduct a study similar to this one in which the urge to check is provoked and memory is assessed, and then participants are allowed to check to satiation, after which their memory is reassessed. More broadly, future studies incorporating repeated assessments of memory confidence would be useful in determining if there are variations in confidence in memory depending on where the person is in her natural checking process (e.g., pre-satiation or post-satiation). Of course, such studies would be especially vulnerable to any sensitization effects of knowing that memory was a variable of interest.

Although the methodological factors described above could account for some of the unexpected findings for confidence in memory, it is also possible that the observations of this study accurately reflect what happens within a naturally occurring session of repeated checking. Although the findings are not generally consistent with previous research, it is noteworthy that to date, very few studies have incorporated methodological features that would enable an evaluation of the decreased confidence in memory component of the self-perpetuating mechanism. Thus, it is likely that the significant methodological differences between the present study and previous studies account for the discrepancies in findings.

In the first study of memory in OCD to present the stimuli to be remembered repeatedly, Tolin and colleagues (2001) examined memory accuracy and memory confidence for idiosyncratically selected safe, unsafe, and neutral items in individuals with OCD, anxious

controls, and nonanxious controls using a laboratory-based repeated trials paradigm. Participants were exposed to an array of 24 stimuli randomly arranged on a table for 10 seconds. Participants were then asked to recall the items that had been presented and to rate their confidence that each item had been presented. This process was repeated five times. After each trial, the items were rearranged and participants were told that items may have been added or removed between trials. The main finding of the study was that memory confidence for unsafe items decreased significantly across trials in the OCD group, in comparison to the anxious and nonanxious control groups. There also appeared to be a small but significant effect of trial on confidence across all groups and stimuli, such that memory confidence decreased across trials (Van den Hout & Kindt, 2003, 2004).

There are marked methodological differences between these studies that may help to explain why Tolin and colleagues (2001) found decreased confidence in memory across trials for all samples, while *increased* confidence in memory was observed in the present study for both samples. Most notably, the study by Tolin and colleagues (2001) placed significant demands on memory abilities. Participants were given only brief visual exposures to 24 items, the items were rearranged between trials, and participants were told that items might be added or removed between trials. No checking of the items was performed. In contrast, in the present study there was only one item to pay attention to in each “block”, all of the items were perceived as “relevant” to some extent, exposure to the item was considerably longer (particularly in the repeated checking condition), and the task was simply to recall the final state (secure or not secure) of that item. Moreover, in the present study, participants were required to touch the item while checking it, thus introducing an aspect of memory for action. Thus, the present study made less rigorous, but perhaps more naturalistic, demands upon memory. Taken together, these



methodological differences may in part account for the very different pattern of findings in these two studies.

To date, the creative studies conducted by Van den Hout and Kindt (2003, 2004) have offered the strongest support for the decreased confidence in memory component of the self-perpetuating mechanism. To review, these researchers developed an interactive computer task in which student participants were required to turn on, turn off, and “check” a virtual stove with six elements and six virtual light bulbs using a computer mouse. In the first phase of the experiment, participants turned on, turned off and checked three of the six stove elements. Participants then answered a series of questions tapping: (a) memory accuracy (e.g., “which rings did you check during the last trial?”); (b) vividness and detail of their memory for the last check; (c) memory confidence (e.g., how confident are you that you checked the rings that you just indicated?”); and (d) outcome confidence (e.g., “how confident are you that all rings are turned off?”). Following this pre-test, half of the participants were assigned to a “relevant” checking group and half were assigned to an “irrelevant” checking group<sup>25</sup>. The relevant checking group completed a series of twenty trials of the stove (i.e., turn on three elements, turn them off, then check that the elements are off) with no questions in between trials. The rings to be used varied unpredictably from trial to trial. Following the 20<sup>th</sup> trial, the participants completed a post-test in which they were asked the same questions as during the pre-test. The “irrelevant” checking (i.e., control) group completed a series of twenty trials on the virtual lightbulbs. Following the 20<sup>th</sup> check, these participants were asked to complete a trial on the stove, after which they completed the post-test.

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<sup>25</sup> Note that the term “relevance” is defined very differently in these two studies. In the Van den Hout and Kindt studies (2003, 2004), even in the “relevant checking” condition, all checking is done on the same item, whereas in the present study, all checking is done on the same item in both the high relevance and low relevance conditions. In addition, in the Van den Hout and Kindt studies, both items were “irrelevant” in the sense that there was no possibility of actual harm, and the items were not idiomatically chosen to match the concerns of the participant.

Their results were very consistent across all five replications of the experiment. Memory accuracy was high and did not differ significantly between the relevant checking and irrelevant checking groups. However, repetitive checking of the relevant object made recollections less vivid and detailed, and eroded confidence in memory details of the check (e.g., which elements were checked on the last trial). These effects were not observed in the irrelevant checking group. Interestingly, however, no change was observed for confidence in memory about the final state of the item following repetitive checking of the same item<sup>26</sup>. Memory confidence for the final state of the item remained high from pre-test to post-test in both groups. Based upon the results of these analogue studies, these authors concluded that in compulsive checkers, “memory distrust may persist *as a result* of repeated checking” (p. 12, original emphasis).

The apparent discrepancies between the findings of Van den Hout and Kindt (2003, 2004) and the findings of the present study highlight two key issues that merit further consideration and exploration in future work examining memory confidence in compulsive checkers. One issue is the distinction between memory for aspects of the check and memory for the *outcome* of checking. The other is the broader issue of relevance in memory research in OCD.

The cognitive theory of compulsive checking states that with repeated checking, the person’s confidence in his recall of the checking and its effects declines. The first part of this statement refers to details of the check – for example, did you check the top left element or how many times did you turn the doorknob? For ease of expression, this concept will be referred to as “process memory” as it pertains to aspects of the checking procedure or process. The second part of this statement refers to the outcome of the checking – for example, at the end of the sequence,

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<sup>26</sup> In fact, in one of the three replications in which confidence in outcome memory was assessed, confidence increased significantly following relevant checking.

was the stove turned off or was the door locked? This will be referred to as “outcome memory”.

In the studies by Van den Hout and Kindt (2003, 2004), confidence in both process memory and outcome memory were examined. In their discussion of the findings of their study, they highlighted the decrease in process memory that was associated with repeated checking of the same item, and noted that this finding was consistent with the decreased confidence for recall of the checking proposed in the cognitive theory of compulsive checking. As was the case in the earlier study by Tolin and colleagues (2001), their findings are perhaps not surprising in light of their methodology. First, the observed decline in memory process confidence may in part reflect the significant memory demands imposed by their design. As noted above, for each trial, participants were instructed as to which three elements to check, and the elements to be checked varied from trial to trial, resulting in a highly variable checking pattern. This checking pattern likely differs significantly from the highly streamlined and systematized checking that takes place during a naturally occurring checking episode. Second, in their design, the post-test was unpredictable in the sense that participants did not know that they should be paying special attention to the 22nd check of the stove. Both of these methodological features would likely make the task of remembering what was done in the previous trial more difficult, and may have served to exacerbate any decrease in process memory that would have occurred in a more ecologically valid design.

The main focus of the present study was to tap confidence in the *outcome* of checking, which was thought to be the issue of greatest import for a compulsive checker who is fearful of being responsible for harm and wishes to achieve a high level of confidence or certainty that the situation is safe. Logically, it would seem that remembering specific details of the check (e.g., “Did I check the top left element?”) would be less important and relevant to a compulsive

checker than remembering whether he had in fact successfully turned the item off (e.g., “Is the stove off?”)<sup>27</sup>. One could ask whether remembering the details of the check is at all important if one is confident that the item is secure. The possible relationship between these two forms of memory is discussed further below.

In the present study, it was found that confidence in memory outcome increased from pre-check to post-check, although surprisingly, there were no differences in level of confidence based upon number of checks. Although Van den Hout and Kindt (2003, 2004) did not have ratings of confidence in the final state of the item before any checking occurred (i.e., their pre-test occurred following a single check), they found that outcome confidence was high even in the “irrelevant” checking condition (which involved only a couple of checks of the item with an intervening provocation) and did not increase from pre-test (following a single check) to post-test (following 22 checks) in the “relevant” checking condition. Although the methodologies of the two studies are very different, the absence of an effect of number of checks on outcome memory confidence in the present study and the absence of a difference in the relevant condition between pre-test and post-test outcome memory confidence in the Van den Hout and Kindt (2003, 2004) studies is somewhat consistent in suggesting that repetitious checking does not decrease outcome memory confidence. Moreover, the findings of the present study suggest that while a single check may serve to increase outcome memory confidence, further checking beyond the first check neither improves nor impairs outcome memory confidence.

At this point, it is unclear how the decline in process memory outcome observed in the Van den Hout and Kindt (2003, 2004) studies can explain the occurrence of repeated checking of the same item, particularly against a backdrop of high outcome memory confidence. This raises

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<sup>27</sup> In addition, given the methodology of the present study in which participants completed a particular number of checks in each block according to agreed upon guidelines rendered questions about the process of checking somewhat meaningless.

the important question of the nature of the relationship between memory for process and outcome. For example, do people check repeatedly in an attempt to “solidify” their memory of the checking process – even if they are confident of the security of the item – in order to inoculate themselves against later doubt about the outcome of checking? This issue is discussed further below in the general discussion.

The second issue highlighted in the present study that may merit further consideration and exploration in future work examining memory confidence in compulsive checkers is that of relevance. In a narrow sense, relevance can be applied to the types of items that participants are asked to interact with and recall as part of the experimental design. The present study explored the universality of the proposed “decreased confidence in memory” aspect of the self-perpetuating mechanism in part by having participants check two items that varied according to their level of relevance to the individual’s concerns. As predicted, in the present study, there was a main effect of item relevance, such that confidence in memory for the final state of the item was lower in the high relevance condition relative to the low relevance condition. This effect was observed in both the student and the OCD samples across both the single and repeated check conditions. Thus, it appeared that the more relevant or important the item (as reflected by the perceived probability and severity of harm associated with that item if it is used and left unchecked), the lower the person’s confidence in their memory for the “safety” of that item. An examination of the relative effect sizes in the OCD and student samples suggests that relevance may have an especially potent effect on confidence among individuals with a high need for certainty and lower overall confidence in memory.

The finding that memory confidence was lower for both samples for the high relevance item is generally consistent with the findings of Radomsky, Rachman and Hammond (2001),

who found that confidence in memory<sup>28</sup> tended to be lower in the high responsibility condition than in a low responsibility or no responsibility condition. In the present study, the high relevance item was associated with higher ratings of responsibility, probability and severity of harm than the low relevance item. However, it is noteworthy that in the study by Radomsky and colleagues (2001), memory for the final state of the item was assessed only at post-check, and the number of checks was not controlled; therefore, it was not possible to compare the relative effects of single checks versus repeated checks on confidence in outcome memory.

The study by Tolin and colleagues (2001) also highlighted the importance of using items that are of relevance to participants with OCD<sup>29</sup>. Although on close examination a similar pattern of decline in memory confidence was observed across for all items and across all samples, the pattern of findings was much stronger for the unsafe items. In the present study, all of the items were relevant in the sense that the participant had previously identified the items as potentially associated with harm if they were to be used and then not properly secured (turned off, locked, etc.); however, even within the category of “relevant” items, more relevant items were associated with lower outcome confidence. Thus, it would seem likely that studies that use relevant items are likely to yield the strongest and most meaningful effects.

The concept of relevance in memory research in OCD can also be applied more broadly to describe how closely various aspects of the experimental design correspond to the demands made upon the person’s memory in a natural context (one aspect of the ecological validity of the study). The studies by Van den Hout and Kindt (2003, 2004) finding decreased process memory confidence are an excellent example of this. While the experimental methodology used in these

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<sup>28</sup> The authors of this study did not report separate findings for the final state of the item and the process of checking.

<sup>29</sup> However, it is worth noting that in the study by Tolin and colleagues (2001), the items were not linked to the possibility of real harm.

studies was novel and highly creative, the design differed markedly from the actions and context of naturally occurring checking behaviour. For example, these studies used a virtual stove, and therefore there was no actual likelihood of harm involved and no real responsibility for preventing harm. Thus, it seems reasonable to suppose that there was no actual anxiety or drive/urge to check associated with the protocol (except perhaps when participants realized that they were being tested on their memory), and that participants were simply following the instructions presented on the screen. Participants may therefore have been less motivated to remember the process or outcome of checking. Moreover, participants did not actually perform the motor actions associated with checking a stove, and were not in the home context, where checking is most likely to occur. Thus, the memory effects observed in these studies may be different from the memory effects that would occur in a naturally occurring checking episode. In this respect, studies such as the present study, which incorporated repeated checks of a personally chosen, threat-relevant item by a compulsive checker in the appropriate context (in the home, when the individual is alone, when the person feels responsible for preventing harm and anxious), may allow for stronger inferences about the effects of checking on memory and, by extension about the role of memory confidence in repetitive checking.

Thus, in a broader sense, the present study highlights the importance of other dimensions of relevance, including relevance of action (e.g., visual presentation versus touching a computer mouse versus touching a real stove), relevance of question (confidence in final state of the item versus confidence in the process of checking) and relevance of context, both environmental (in the home versus in the laboratory), and emotional (e.g., in a situation where the individual feels anxious or compelled to check versus a situation where the individual is not anxious and has no drive to act). Future research incorporating stimuli, situations, and contexts that are important to

compulsive checkers, as well as repeated measurement of memory confidence and urge to check, will likely lead to significant advances in our understanding of basic processes which underlie and perpetuate doubt and repeated checking.

Overall, the findings of this study suggest that repeated checking does not lead to the expected decreases in outcome memory confidence that were hypothesized to perpetuate checking as part of a self-perpetuating mechanism. While the act of checking an item once appears to increase confidence that the item is secure, additional checking does not serve to either increase or decrease outcome confidence. However, the perceived relevance of the item to be checked appeared to have a significant impact on the level of confidence in the final state of the item, with more important items being associated with more doubt. This pattern held across both a student and a clinical sample. Thus, the results of the present study converge with the results of Van den Hout and Kindt (2003, 2004) to suggest that outcome memory is not affected by repeated checking of the same item. However, given the dearth of studies in this area, additional research examining both process and outcome memory in samples of OCD checkers taking into account the important issue of relevance is required before more definitive conclusions can be drawn. It is possible that memory confidence may play a greater role in motivating repeated episodes of checking. This possibility is discussed below.

### **Conclusions and Implications for the Cognitive Theory of Compulsive Checking**

The purpose of Study 2 was to test the self-perpetuating mechanism put forth in Rachman's (2002) cognitive theory of compulsive checking as an explanation for repeated checking. In order to do this, the present study examined the impact of single versus repeated checks on the multipliers and confidence in memory. More specifically, this study was designed to answer three primary questions: (1) what is the impact of single versus repeated checks of a



high relevance item on the multipliers, memory confidence, and urge to check?; (2) what, if any, impact does checking a low relevance item have on the multipliers, memory confidence, and urge to check?; and (3) if there are any changes in the multipliers, memory confidence, and urge to check following repeated checking, are these effects specific to individuals with checking compulsions, or are these processes universally experienced (i.e., applicable to those who do not have checking compulsions)?

Overall, the findings of this study did not offer support for the proposed self-perpetuating mechanism. Both the multipliers and memory confidence were affected by checking, though the impact of repeated checking was not significantly different in either direction or degree from the impact of a single check. Moreover, the direction of these changes was opposite to what was predicted by the theory (i.e., decreases in the multipliers and an increases in outcome memory confidence from pre-check to post-check, followed by no further changes with repeated checking). Interestingly, the results of the present study suggest that checking is not as effective at reducing perceived responsibility and severity as probability, urge to check and anxiety. Should this finding be replicated in future research, it would shed further light on the relationship between repeated checking and the multipliers.

The effects of checking on memory and the multipliers were remarkably consistent across both high and low relevance items, and across both an OCD sample with primary checking compulsions and a non-clinical sample of individuals who do not routinely check. The differences that were observed were quantitative rather than qualitative in nature (e.g., larger effects for high relevance items and larger effects in the OCD sample). Thus, the phenomena observed in this study appear to be universal, but differ in magnitude according to item relevance and sample. This offers strong support for a model of checking behaviour that emphasizes

continuity between the type of checking that all of us engage in from time to time and more significant, compulsive checking.

Therefore, the question of what perpetuates repeated checking within a session remains unclear. The findings of the present study suggest that the multipliers may be important in the perpetuation of repeated checking within an episode, although perhaps not in the way outlined in the cognitive theory of compulsive checking. More specifically, it may be that checking is repeated until the factors that instituted the check (e.g., the multipliers, doubt about the safety of the item) reach a certain threshold representing some unique combination of anxiety, urge to check, memory confidence and the multipliers that feels “just right” to the individual. More research on the impact of repeated checking on both the multipliers and memory, and on the interaction between the multipliers and memory, using clinical samples and “relevant” methodology is needed to further clarify how these factors may relate to repeated checking.

#### **CHAPTER FOUR: GENERAL DISCUSSION**

Obsessive-compulsive disorder is a puzzling and often highly disabling disorder. The pioneering work of Salkovskis (1985, 1989) on a cognitive theory of OCD fueled an explosion of theoretical and empirical work aimed at improving our understanding of, and ability to treat, this disorder. While Salkovskis’ classic work highlighted the importance of inflated responsibility in driving compulsive behaviour, as knowledge has accumulated, there has been increasing recognition of important phenomenological differences between subtypes of OCD compulsions. These differences have raised questions about the adequacy of a single/unitary cognitive explanation to explain the breadth of OCD symptomatology and have led to a movement towards increasingly specific theoretical explanations for particular subtypes of OCD-related phenomena.

Repetitive checking is the most common form of compulsion in both OCD and non-clinical samples. Beginning with the classic studies by Rachman and colleagues in the 1970s, much information has accumulated about the phenomenology of compulsive checking, and how it differs from other forms of compulsions, most notably compulsive washing or cleaning. Given these differences, and the only moderate success of the most commonly used psychological treatment for OCD, exposure and response prevention (ERP), the need for a fresh cognitive analysis of checking behaviour is clear.

As discussed earlier in this paper, any satisfactory theory of compulsive checking would need to address several important phenomenological/observational and research findings related to checking. More specifically, such a theory should: (a) provide an explanation of etiology of checking, including an explanation of factors that make some individuals more susceptible; (b) specify factors that influence urge to check and checking behaviour, or in other words, explain under what circumstances checking will occur in both clinical and non-clinical populations; (c) address/explain the continuity between non-clinical and clinical checking; (d) explain the repetitive nature of checking behaviour (i.e., why checking an object once is inadequate for compulsive checkers); (e) provide an explanation for the persistence of checking behaviour; (f) explain why the presence of others mitigates urges to check; (g) explain why compulsive checkers report difficulty remembering whether a check has been performed safely, even minutes after the check has been completed and (h) provide a rationale for what treatments will work, and which ones will fail to work and why.

The first cognitive theory specific to compulsive checking was put forth by Rachman in 2002. Broad in scope, it aims to answer all of these questions<sup>30</sup>. The purpose of the present study

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<sup>30</sup> While the theory describes how “normal” checking may develop into more compulsive checking, it does not in its current form, specify the origin of the “inflated responsibility” that is thought to be central to the development of

was to provide the first experimental tests of the theory's account of (b), (c), and (d), and in so doing, to evaluate how well this theory meets some of the above criteria for a satisfactory account of compulsive checking.

The first part of Rachman's (2002) theory is intended to delineate the conditions under which checking will occur, in both clinical and non-clinical populations. Rachman proposed a series of three "multipliers" of checking behaviour: perceived responsibility, probability, and severity of harm. Increases in any of these multipliers are thought to increase the likelihood, frequency and intensity of checking behaviour.

In Study 1, the first part of Rachman's theory was tested using a within-subjects vignette methodology that allowed for the simultaneous and relatively independent manipulation of these factors and an examination of the impact of these factors on a variety of checking-related emotional and behavioural responses. In addition, three separate samples of participants were recruited, reflecting a continuum of anxiety, responsibility and checking behaviour in order to evaluate the explanatory value of the theory. Participants were able to picture themselves in the situations described by the vignettes, and perceived significant and reliable differences between high and low levels of each multiplier.

The findings of this study offered strong support for the major predictions of part one of the theory, attesting to the individual and combined effects of the multipliers on a variety of checking-related outcomes. In addition, the findings demonstrated the broad explanatory power of the theory across a continuum of anxiety, responsibility and checking behaviour.

The second part of Rachman's (2002) theory provides an explanation for repetitive checking by proposing the existence of a self-perpetuating mechanism. This mechanism is

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compulsive checking. However, the issue of the origins of inflated responsibility has been addressed in earlier works by Rachman and colleagues (cf., Salkovskis, Shafran, Rachman & Freeston, 1999).

composed of four main components: (a) the absence of a “natural terminus” for checking behaviour, given that it is difficult to ever be certain that the possibility of future harm has been eliminated, (b) a post-check responsibility increase, such that individuals feel more responsible for preventing harm following checking behaviour, (c) a responsibility-probability bias in which the sense of being responsible for preventing harm leads to an increase in the perceived probability of harm, and (d) the decrease in memory confidence following repeated checking. In essence, repeated checking leads to increases in the multipliers and decreased memory confidence, which in the absence of a definitive signal that it is safe to stop checking, leads to further checking.

Study 2 was conducted to provide the first exploratory test of the self-perpetuating mechanism as an explanation for repeated within-session checking (i.e., question (c) from the “characteristics of a satisfactory theory” above). More specifically, this study examined the impact of single versus repeated checks on perceived responsibility (post-check responsibility increase), probability and severity (responsibility-probability bias), and confidence in memory (decreased confidence in memory), as well as anxiety/discomfort and urge to check. This study also explored whether the self-perpetuating mechanism is part of a general cognitive process by testing not only participants with OCD and primary checking compulsions, but also individuals who do not routinely check. And finally, this study explored whether checking any object activates the elements of the self-perpetuating mechanism, or whether the mechanism will only be activated in relation to objects that relate to possible feared outcomes for the participant. In order to enhance ecological validity, Study 2 was conducted as a telephone experiment in which participants performed a series of four checking tasks in their home on idiographically selected items under the guidance of an experimenter. Preliminary examination of the findings suggested

that the experimental design was able to appropriately simulate some of the characteristics of a naturally occurring checking episode (e.g., discomfort/anxiety, urges to check, a sense of responsibility and a sense that significant harm was possible), particularly for the OCD participants and for the high relevance items. The high and low relevance items also differed from one another in the expected ways, thus permitting an examination of the differential effects of the self-perpetuating mechanism according to the relevance of the item.

The findings of Study 2 did not offer support for the existence of a self-perpetuating mechanism. Contrary to expectations, the multipliers decreased from pre- to post-check and memory confidence increased, and there were no differences between the single and repeated check conditions. These findings were remarkably consistent across both the student and the OCD samples, and across both high relevance and low relevance items, suggesting significant continuity in the way that checking affects these variables.

### **Implications for the Cognitive Theory of Compulsive Checking and Directions for Future Research**

Thus, while Rachman's cognitive theory of compulsive checking offers a good account of the conditions under which people will begin to check, the issue of why they check repeatedly is not well addressed by this theory and remains something of a mystery. It may be that a different self-perpetuating mechanism is responsible for repeated checking or that the act of checking itself is not what is driving further checking. For example, one alternate explanation for repeated checking that is consistent with earlier behavioural models of OCD and with part one of Rachman's theory, is that checking is initiated when an individual surpasses a certain threshold and, by extension, checking ceases when the individual falls below a certain "threshold", likely reflecting some combination of discomfort (as described in the behavioural theory) as well as

perceived responsibility, probability and severity of harm (see Study 1). The act of checking may serve to bring about decreases in the levels of all of these factors (see Study 2), thus moving the person closer to the point where checking will cease. The multipliers, whose centrality to the initiation and intensity of checking was described in Rachman's theory and supported by the findings of Study 1, may serve to prolong checking in two ways. First, upon being confronted with a potentially harmful situation, perceptions of the multipliers likely serve to "set" a level of discomfort, perception of danger and personal responsibility from which the person must "recover" in order for checking to end. To the extent that this level is high (as is likely the case for people with OCD, who tend to have inflated personal responsibility and perceptions of probability and severity of harm), the person is pushed farther away from the threshold where he can cease checking. Secondly, while perceived probability appears to decline relatively rapidly following any checking, it appears that the other two multipliers (responsibility and severity) may not decline as rapidly, particularly in compulsive checkers. As such, the speed at which the person reaches the "stopping threshold" is likely slowed, functionally attenuating the impact of checking behaviour and making more checking necessary before the threshold is reached.

Though the multipliers likely play a role in the onset of a checking episode, they are not necessarily what keeps checking going. Other factors have been identified that may also contribute to repetitive within-session checking. For example, several authors (e.g., Beech & Liddell, 1974, Foa et al., 2003) have highlighted the role that indecisiveness, or problems in decision-making, may play in prolonging compulsive behaviour. These authors have noted that people with OCD desire more time and information to help them arrive at decisions, particularly when these decisions are perceived as involving significant risk and when the individual feels anxious at the time of decision-making (Foa et al., 2003). Given that in situations that provoke

compulsive checking, individuals perceive significant risk and feel highly anxious, this difficulty making decisions may be one factor that contributes to repeated checking as the person seeks more and more information (through checking) before making the subjectively crucial decision about whether risk has been averted or whether an action has been performed properly. Indeed, some early work in OCD (Beech & Liddell, 1974) suggested that compulsive checkers in particular hold themselves to a higher standard of evidence for safety, and that this high standard is not met by normal processes of checking, leading to repetitive checking behaviour.

Another factor that has recently been highlighted as a possible explanation for compulsive behaviour, and repetitive checking in particular, is intolerance of uncertainty (e.g., Tolin, Abramowitz, Brigidi & Foa, 2003). Intolerance of uncertainty refers to the tendency to respond to uncertainty with strong emotional distress that one is motivated to reduce, for example through behavioural means. Tolin and colleagues (2003) have suggested that intolerance of uncertainty may motivate repeated checking in an attempt to achieve certainty that one has acted appropriately so that no harm will occur. That is, individuals with OCD may not experience more doubt about the safety of a situation, but rather may be less able to tolerate the uncertainty/doubt (no matter how small) that is inherent in situations involving the possibility of future harm, leading to repeated checking. This explanation is consistent with earlier accounts of OCD that have suggested that compulsive ritualizing (including checking) may be conceptualized as an attempt to alleviate uncertainty (Carr, 1974; Guidano & Liotti, 1983; Reed, 1985).

In sum, it may be the case that other factors such as problems with decision making or intolerance of uncertainty fuel repetitive checking, rather than a self-perpetuating mechanism in



which the act of checking itself drives more checking. However, it is also possible that the key to repeated checking lies not in what drives checking, but in what acts to stop it.

In its current form, Rachman's (2002) theory does not specify the factors that would lead to the end of a checking episode (i.e., the stop mechanisms). The "no natural terminus" component of the self-perpetuating mechanism highlights the fact that there is no naturally occurring signal for the checker that all threat of harm has been removed – that is, there is no negative feedback loop that can act to "shut off" the checking behaviour. This raises an important question, namely, if there is no natural signal that all danger has been removed and that it is safe to stop, then how do compulsive checkers decide when to stop? Answering this question is important for all theories that attempt to explain compulsive checking, but may be particularly challenging for accounts of compulsive behaviour that attribute repeated ritualising to a positive feedback loop, such as those proposed by Rachman (in which repeated checking leads to increases in the multipliers and decreases in memory confidence, which in turn motivate further checking) and by Van den Hout and Kindt (2004; in which memory distrust brought about by repeated checking engenders further checking).

One of the reasons it is so important to address the question of "what stops checking" is that several authors have suggested that checking is repeated over and over again because of a problem with the mechanism that acts to end checking. That is, perhaps neither the act of repeated checking nor other factors, such as problems with decision making or intolerance of uncertainty, are creating any additional momentum or drive to continue checking; but rather repeated checking within a session is due to a failed or impaired stopping mechanism. In other words, maybe checking is repeated within a session because the "brakes" are not working as effectively as they should, rather than because one's foot remains on the "gas".

Along these lines, Szechtman and Woody (2004) recently suggested that the core pathology in OCD may not be one of a “pathological intensity of excitation” of certain thoughts, ideas or actions (as in the threshold model described above), but rather that it may be better construed as a failure of the stop mechanisms that normally serve to terminate these thoughts, ideas or actions. In support of their assertion, they point to a narrative analysis of descriptions of the compulsive experience of OCD patients that found that the majority of patients indicated a difficulty in stopping their repetitive behaviour, rather than a sense of being forced to continue (Reed, 1985). They also cite a description of OCD behaviour by Neziroglu and Yaryura-Tobias (1991), which suggests that “most patients engage in few but extended bouts of compulsive behaviour during the day ... as opposed to bouts of behaviour that are relatively normal in duration but repeated excessively often throughout the day” (p.112). They suggest that such a profile is more consistent with a dysfunctional stop mechanism than with one that is involved in the activation of behaviour.

The idea that repeated ritualising in OCD is related to problems with the mechanism that is intended to terminate these behaviours is not new. Several authors, dating as far back as the early 1900s (Janet, 1903, see Pitman, 1987; Rasmussen & Eisen, 1992; Summerfeldt, 2004; Summerfeldt, Antony & Swinson, 2002), have highlighted the role of subjective feelings of “incompleteness”, or the sense that actions or intentions have not been satisfactorily achieved in driving repetitive ritualising. For example, Reed (1985) has suggested that perseverative behaviours in OCD are the result of a cognitive inability to “close off” or end an experience. Some authors have referred to this as a “failure in the sense of task completion” (e.g., Pitman, 1989). Other authors, such as Rapoport (1991), have noted that people with OCD lack the “feeling of knowing” that an action has been appropriately completed, which in turn, fuels

repetitive behaviours. Szechtman and Woody (2004) have proposed the existence of a similar feeling of knowing called “yedasentience”, a satiety signal that turns off thoughts or actions motivated by concerns of harm to self and others (stemming from the operation of a hard-wired “security motivation” system). This satiety signal feedback loop is proposed to be dysfunctional in people with OCD (including compulsive checkers), fueling repeated ritualising in an attempt to dampen the driving motivation.

In a similar vein, multiple authors (Coles, Frost, Heimberg & Rheaume, 2003; Salkovskis & Forrester, 2002) have recently highlighted the fact that individuals with OCD often report uncomfortable sensations of things being “not just right” and a need to perform an action (such as checking) until this sensation is reduced and replaced by a subjective sense of “rightness”. Usually, these individuals are unable to specify the factors that make up this sense of rightness; however, they likely reflect some combination of affective states. Salkovskis and Forrester (2002) suggest that this use of mood states to signal or confirm one’s decision to stop checking parallels the manner in which people without OCD make important life decisions (e.g., “Does it feel like the right thing to do?”). They also note that the desired mood state is likely especially difficult to achieve in the context of a pre-existing negative mood state (e.g., depression or anxiety), thus contributing to perseverative behaviour.

Taken together, these various authors have highlighted the role that subjective, internal criteria (e.g., a sense of “rightness”, “completeness” or particular mood state) may play in enabling people with OCD to end particular behaviours. These criteria may be particularly important for actions intended to prevent harm (which are perceived as crucial) and for which natural ending signals (natural terminus) are unavailable, such as checking behaviour. Any impairment in this subjective “stopping mechanism” would contribute to repetitive checking, and

may lead to the imposition of rigid and artificial stop rules as a means of compensation. Along these lines, Van den Hout and Kindt (2004) have proposed that “in the absence of a natural ending of the safety act, arbitrary stop rules need to be made up, and this is what typically happens” (p.180). They note that many people will count the number of repetitive acts until they reach a “good” number, using this to limit the amount of time spent checking. However, over time, this strategy may also become more complex and less effective; moreover, many checkers do not appear to use stop rules concerned with numbers.<sup>31</sup> Alternatively, practical concerns such as pressure from loved ones or needing to leave to avoid missing the bus may help to end a checking episode. Thus, there is much still to be understood about how compulsive checkers decide when to stop.

Clearly the question of what stops an episode of repeated checking is an important one that deserves attention in future theory and research and has strong implications for treatment. At present, there is little empirical research on stopping mechanisms – most of the work described above is based on logical argument or clinical observation. Additional research is needed to clarify what the mechanisms are, whether they are impaired in individuals with OCD, and how they relate to other important factors in compulsive checking, such as the multipliers. Future research exploring how compulsive checkers “know” when to stop may be especially helpful. In particular, ecologically valid, observational studies using samples of compulsive checkers in which the urge to check is provoked, participants are allowed to check to satiation, and then

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<sup>31</sup> Interestingly, recent experimental work using a nonclinical sample and an analogue checking task (checking a prose passage for errors) has suggested that the combination of induced negative mood at the beginning of checking in combination with “as many as I can” stopping rules may contribute to more sustained checking behaviour than other combinations of mood and stopping rules (i.e., positive mood, or “until you feeling like stopping” stop rules, MacDonald & Davey, 2005a). Two additional studies by this group using the same type of sample and task have also found that high perceived responsibility (trait or situationally-induced) combined with induced negative mood leads to greater persistence in the checking task (MacDonald & Davey, 2005b). These findings, which require replication with a clinical sample, may provide a useful direction for further research aiming to understand repeated within session checking.

questioned about their “reasons” for stopping would be useful. Asking participants about their reasons for stopping in an open-ended way, followed by more specific questions about their perceptions of some of the factors that are known or hypothesized to be important in the initiation or maintenance of checking (e.g., the multipliers) would be especially helpful. Moreover, conceptual and empirical clarification of what ends a checking episode would be helpful in refining Rachman’s theory of compulsive checking.

### **Self-Perpetuating Mechanism Revisited**

Whereas Study 2 failed to find evidence of the operation of a within-session self-perpetuating mechanism, as mentioned above, the cognitive theory of compulsive checking is silent on the question of the timeline over which the self-perpetuating mechanism operates. Thus, it is possible that the self-perpetuating mechanism may provide a better explanation for the occurrence of recurrent episodes of compulsive checking. That is, it may be that the proposed increases in the multipliers and decreases in memory confidence may occur following multiple cycles of repeated checking and act to ‘raise’ the person’s resting level of perceived responsibility, probability and severity and to decrease the person’s confidence in their memory.

This possibility was not explored in the present study for two reasons; first, most of the empirical evidence supporting the existence of this mechanism is based upon observations in a single session (e.g., Lopatka & Rachman, 1995; Shafran, 1997, Tolin et al., 2001, Van den Hout & Kindt, 2003, 2004). Second, the present study sought to have greater control over the number of provocations and amount of checking that participants were exposed to over the course of the experiment (thus improving internal validity).

The possibility of a between-session self-perpetuating mechanism raises a number of areas that would benefit from clarification in both the theory and future research. First, a timeline

over which the effects of a between-session self-perpetuating mechanism would be observable would need to be specified. It is unclear whether observations would need to be taken over a period of days, weeks or even months. If the self-perpetuating mechanism operates between sessions, it would presumably be detected by measuring “baseline” levels of the multipliers and of memory confidence at several time points over the course of a developing case of OCD. Moreover, given that in Study 2, no evidence of the self-perpetuating mechanism was found to occur within a session of checking, this may imply that if a between-session self-perpetuating mechanism were to operate, it would take the form of changes in perception of the multipliers occurring between sessions (e.g., an upward “drift” from Thursday night’s post-check perception of the multipliers to Friday morning’s pre-check perception of the multipliers?). This would be consistent with some research suggesting that most of the cognitive change that occurs in cognitive behavioural therapy occurs between, rather than within, therapy sessions.

One way in which the multipliers might increase gradually over time, without a detectable within-session effect, would be if repeated checking were “ineffective” in fully resolving the inflation of the multipliers that occurred following provocation, resulting in “carryover” of higher levels of the multipliers from session to session. To illustrate, imagine that a person’s pre-check, resting level of perceived responsibility for harm is 30. In order to initiate an episode of checking, this person needs to reach a threshold of 60. This person gets “provoked” by using the stove and then attempting to leave the house when no one else is home, causing her perceived responsibility for harm to rise to 80. She checks several times, and her responsibility eventually falls to 40, enabling her to leave the house. Thus, the act of checking repeatedly was not wholly successful in returning her perceived responsibility to the baseline pre-provocation level. If her perceived responsibility were to remain unchanged (i.e., did not further decline) over

the time interval until she next had to use the stove and then leave the house, less “provocation” would be required to trigger her checking behaviour in that next instance. Over repeated cycles of checking, this small but incremental increase in responsibility from one checking episode to the next would serve to promote recurrency of sessions. In order to test this idea, future research would need to employ a longitudinal design and collect both pre-provocation, post-provocation/pre-check, and post-check data over a longer period of time.

A second question that would benefit from clarification in future theory and research would be the cognitive mechanism through which the upward shift in the multipliers occurs. In this regard, an information processing perspective may be helpful. For example, does repeated checking of an item serve to highlight or elaborate the degree of threat and personal responsibility associated with not checking that item, thus making the perception of threat more accessible the next time the person uses that item? Or does repeated checking of an item lead to a cognitive dissonance type reaction that then leads to increases in the multipliers (e.g., “I would not have checked the stove repeatedly if there was not a real and significant threat of serious harm for which I might be held responsible”), in turn increasing the likelihood and intensity of future checking?<sup>32</sup>

The cognitive theory of compulsive checking offers somewhat more direction concerning a mechanism through which the downward shift in memory confidence occurs over time. In particular, it states that if a person concludes that her difficulty remembering and her out of control checking behaviour means that she has a poor memory and is losing her mind, then this will serve to fuel the problem of repeated checking over time (likely both within- and between-

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<sup>32</sup> Further elaboration of the cognitive mechanisms underlying the hypothesized shifts, particularly in the multipliers would be helpful for a within-session self-perpetuating mechanism as well.

sessions) as the person checks more to try to achieve a good enough memory trace that no doubt will occur and no checking will be necessary.

The suggestion made by Van den Hout and Kindt (2003, 2004) that repeated checking, and hence increased familiarity with an item, leads to less vivid and detailed memories may offer another plausible explanation for the changes in memory confidence. However, as noted above, it is unclear how decrements in process memory would promote repeated checking within or between sessions if the final state of the item is the variable of greatest interest to a person wanting to prevent harm. This presumes that people are checking because they cannot remember the final state of the item, rather than because they cannot vividly recall checking aspects of the check (process memory). One possibility, suggested by the findings of the present study (in which outcome confidence increases from pre to post check, but does not increase further with additional checks) in concert with the findings of Van den Hout and Kindt (2003, 2004; in which process memory declines within session), could be that at the end of a session, individuals tend to be fairly confident that the item that they have been checking is secure. That is, it may be that part of the reason that people check is that they are trying to reach some personal threshold of comfort/confidence that the item is secure. For individuals with OCD and for items that are perceived as more important (of higher relevance), the required level of comfort/confidence will be higher (cf. Constans et al., 1995), and may necessitate a few more checks than for people without OCD. However, after they leave the situation, people with OCD (and occasionally others if the item is important enough) will likely begin to have intrusions about whether the item is secure and whether they performed the check adequately to ensure safety (e.g., did I lock the door properly?). As the intrusions induce anxiety, they may begin to try to remember details of the check or “replay” the check in their minds (e.g., did I twist and pull on the door handle before



leaving, as I should have?) as a means of reassuring themselves about the final state of the item. If these details seem fuzzy or indistinct (likely as a result of proactive interference or over-familiarity of the action), they may become doubtful that the item was in fact left in a secure state, and this may provoke urges to return to the situation to verify that it is safe. This would help to provide an explanation for why individuals are able to initially leave a situation following repeated checking (resulting in high outcome memory confidence), and also why they feel compelled to return (low process memory confidence, leading to doubt about the outcome of checking). Research designs asking about both forms of memory confidence and incorporating a naturalistic design in which individuals check to satiation and then are followed up at a few predetermined points thereafter (e.g., 10 minutes later, 20 minutes later, 1 hour later) would help to evaluate this possibility. This explanation helps to tie together one of the “purposes” of repeated checking (i.e., to achieve certainty about the state of the item) and would help to explain both the memory-related phenomenon that helps to stop an episode (high confidence in the final state of the item) and what would motivate a return to the item to recheck it (intrusions, coupled with low process memory confidence and resulting doubts about the safety of the item).

Future research should explore the possibility of a between-session self-perpetuating mechanism, however, such research would pose a number of methodological challenges and would make fairly heavy demands upon research participants. First, such a study would require a more complex, longitudinal design and would have to contend with the inherent loss of experimental control. That is, it would be difficult to exert much control over what occurs either within or between checking episodes and as such, even if effects were to be observed, it would be difficult to conclude with any high degree of confidence that the changes were due to the repeated checking of that item rather than other factors (e.g., maturation effects, reactance, etc.).

Finally, such a study would place considerable logistical demands on participants as they would need to keep detailed records of all checking on the item in question (e.g., using a daily diary methodology).

### **Implications for Clinical Practice**

The findings of the present studies offer additional support for the proposed components of a specific cognitive treatment for compulsive checking (Rachman, 2002). Rachman outlines four major components of a specific treatment for compulsive checking based upon the cognitive model. These include: (1) a didactic component that explains why checking occurs, highlighting the role of the multipliers, (2) the “deflation” of responsibility through behavioural experiments and cognitive restructuring techniques (e.g., responsibility pie charts), (3) correction of catastrophic misappraisals of the memory difficulties and one’s repeated checking behaviour, and (4) response prevention. Rachman provides a justification for each component that is described in relation to the cognitive model.

The findings of Study 1 offer some firm evidence that can be used during the didactic component to help to buttress the tenets of the cognitive theory. In particular, the observed continuity or universality of responding to perceived inflations of the multipliers with distress and checking behaviour across three samples (including a “non-clinical” sample) would likely help to normalize the person’s emotional and behavioural responses in situations that imply the possibility of harm and help to “depathologize” their behaviour. This information would also likely be helpful in correcting the catastrophic misappraisals of checking behaviour. The therapist could explain that a large part of the problem is that the client perceives many situations as having extremely high levels of probability of harm, and tends to overestimate her own personal responsibility in those situations. A major focus of treatment would therefore involve

helping her conduct some behavioural and cognitive experiments to test out other views of the same situation that would be less likely to result in repetitive checking. In addition, it is possible that the threshold model described earlier in this paper may be a useful heuristic tool in helping clients to understand the combined roles of “trait-like” and “situational” responsibility cues in instigating checking behaviour.

More broadly, the findings of Study 1 suggest that perceived probability will likely need to be energetically addressed in treatment in order to reduce this potent instigator of checking behaviour. Cognitive techniques such as cumulative odds ratios (cf. Whittal & McLean, 1999) would likely be helpful in this regard. In addition, as noted elsewhere, response prevention would likely be effective in helping the client to disconfirm the hypothesis that not checking in a given situation will inevitably lead to catastrophic outcomes.

The results of Study 2 did not provide evidence of a within-session self-perpetuating mechanism; however, they did provide evidence of diminishing returns accruing from repeated checking. More specifically, the results strongly suggest that while one check (such as we all do from time to time) may serve to deflate the multipliers and increase outcome memory confidence from their pre-check levels, additional checking beyond the first check is substantially less effective at either of these. In the case of process memory, other research suggests that repeated checking may in fact lead to further decrements in confidence (cf. Van den Hout & Kindt, 2003, 2004). Providing this information to the client may also be helpful.

The findings of Study 2 also highlight the importance of taking an active approach to reducing perceived responsibility, as it appeared that repeated checking did very little to reduce the sense that one may be responsible for harm. It remains to be seen whether a period of response prevention would serve to reduce perceived responsibility (either within or between

sessions), but this offers an interesting direction for future research. At the present time, it seems most likely that responsibility will need to be deflated more effortfully through cognitive restructuring or behavioural experiments (e.g., responsibility transfers, “holidays”, etc.). Overall, the findings of the present studies offer some empirical support for the proposed components of a specific cognitive treatment for compulsive checking.

## **Themes**

### **Added Value of the Specific Cognitive Approach**

Several themes emerged from this dissertation and the theory more broadly. First, strong support was obtained for the “added value” of considering the importance of cognitive factors or appraisals of situations that imply the possibility of harm. More specifically, this research highlights the impact of perceptions of particular characteristics of potentially harmful situations in influencing emotional and behavioural responses to these. Drawing upon a new cognitive theory of compulsive checking (Rachman, 2002), the present studies tested the importance of specific cognitive appraisals in the form of “multipliers” (and to a lesser extent, memory confidence) on the initiation and perpetuation of repeated checking.

The findings of Study 1 offered strong support for the role of the multipliers in the initiation of checking. The findings suggested that high levels of any of these multipliers are associated with increased urges to check, likelihood of checking and levels of discomfort/worry. Moreover, the more multipliers that are perceived as elevated, the greater the likelihood/intensity of distress and checking-related behaviours. The magnitude and consistency of these effects across a variety of checking-related outcomes and three different samples offered strong support for the potency of the multipliers in the initiation of distress, urges to checking and checking behaviour.

Although less conclusive, the findings of Study 2 suggested that the multipliers may play a role in repeated checking within sessions. That is, it may be that the relative lack of effectiveness of checking in reducing responsibility and severity in comparison with probability, anxiety and urge to check is one factor motivating additional checks (although the additional checks yield little additional benefit).

On a related note, the results of both studies highlight the importance/value of treating the multipliers as individual factors. Defining responsibility more narrowly and separating out probability and severity revealed the independent effects of each of the multipliers on checking-related outcomes as well as the importance of particular combinations of multipliers (e.g., the especially potent combination of high perceived responsibility and high perceived probability). Separating out the multipliers also highlighted different trajectories of change following checking.

Thus, while a strictly behavioural approach to OCD contributed greatly to our understanding and ability to treat people with OCD, including compulsive checkers, the findings of the present study suggest that adopting a more specific, cognitive analysis of checking behaviour may yield further benefits for our understanding and treatment of this disorder.

### **Threshold Models**

Another theme to emerge from the present studies is the possible utility of a threshold model for addressing two of the major questions examined in this research, namely, what initiates a checking episode, and what perpetuates (or stops) checking within an episode. Although not explicitly addressed in the cognitive theory, a threshold perspective, likely incorporating the role of the multipliers (and perhaps memory confidence) would be a natural fit with the existing tenets of the theory and would provide a direction for future research examining

these questions. More specifically, a threshold model would propose that a person needs to exceed a personal threshold before he will feel an urge to check and initiate checking, and that the purpose of checking is to move him back below that idiosyncratic threshold. By extension, anything that delays or impedes one's progress towards getting below the threshold "perpetuates" checking. Moreover, it may be that a threshold model could also be useful in understanding the recurrency of checking sessions. That is, it could be the case that repeated cycles of compulsive checking lead to a "drift" in the multipliers, as described above. Thus, a threshold perspective could offer considerable explanatory and heuristic power while also offering the advantage of parsimony, by suggesting that three important questions about checking behaviour can be understood in reference to a single basic process (moving past the threshold that "turns on" checking behaviour, or moving back towards the threshold that "turns off" checking behaviour).

### **Continuity**

Perhaps one of the most important conclusions to emerge from these studies concerns the continuity across both clinical and non-clinical samples. The findings of Study 1 suggested that across three samples reflecting very different levels of anxiety, trait responsibility, and checking behaviour, participants responded in remarkably similar ways to the manipulation of the multipliers. This very consistent pattern of findings offers strong support for the explanatory value of the cognitive theory across a continuum from those who rarely check to those who check compulsively. Put simply, under the right "cognitive conditions", anyone will check.

The findings of Study 2 also support continuity in terms of the impact of checking behaviour on the multipliers, memory confidence, discomfort and urge to check. Any differences in response appear to be a matter of degree, rather than kind. As such, the findings of these two

studies suggest continuity between non-clinical and clinical OCD populations in terms of the factors that promote the urge to check and checking behaviour, and in terms of the function or effect of checking behaviour on these factors. The findings are highly consistent with psychological theories that emphasize continuity between non-clinical intrusive thoughts and rituals and clinical obsessions and compulsions as seen in OCD. And finally, the findings of the present studies serve to support the idea that checking as seen in individuals with OCD, rather than being an abnormal process, may be an exaggeration of a normal tendency that we all have to attempt to verify that foreseeable harm will not occur.

### **Conclusions**

The studies comprising this dissertation offered the first experimental tests of a new cognitive theory of compulsive checking. Study 1, which tested the impact of the proposed “multipliers” of checking, provided strong empirical support for the predictions of part one of the theory, attesting to both the independent and combined effects of the multipliers on a variety of checking related outcomes across three different samples. Study 2, which evaluated the proposed self-perpetuating mechanism as an explanation for repeated within-session checking, did not generally support the predictions of the theory, but suggested several possible avenues for future research (e.g., perhaps repeated checking reflects the ineffectiveness of a stop mechanism rather than the presence of a self-perpetuating mechanism). Thus, it appears that Rachman’s (2002) theory provides an excellent account of the factors that influence the initiation of non-bizarre, harm-related checking; however, the factors that perpetuate repeated checking within a session require further investigation and elaboration. It is hoped that this research and future research examining the factors that initiate and maintain compulsive checking will ultimately prove of benefit to those suffering from obsessive-compulsive disorder.

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Table 1

*Age, Gender, Years of Education and Marital Status for the Three Samples in Study 1*

Characteristics	Group					
	Student ( <i>n</i> = 50)		Anxious Control ( <i>n</i> = 31)		OCD ( <i>n</i> = 29)	
	Mean	SD	Mean	SD	Mean	SD
Age	20.40	3.87	34.42	9.62	35.93	10.52
Percentage Female	82.0%	--	74.2%	--	58.6%	--
Percentage Single	94.0%	--	23.3%	--	37.9%	--
Years of Education	14.90	2.72	16.35	3.01	15.17	3.32

*Note.* *SD* = standard deviation; OCD = Obsessive Compulsive Disorder.

Table 2

*Clinical Characteristics of the Anxious Control and OCD Samples in Study 1*

Characteristics	Sample	
	Anxious Controls (N=31)	OCD (N=29)
Primary Diagnosis		
Percentage GAD	38.7%	--
Percentage Panic Disorder	61.3%	--
Additional Diagnoses		
Percentage none	48.4%	34.5%
Percentage depression	32.3%	58.6%
Percentage another anxiety disorder	35.5%	27.6%
Percentage on medication	79.3%	73.1%
Percentage in treatment now	100%	65.4%

*Note.* GAD was a secondary diagnosis for participants with Panic Disorder, but no participants with GAD also had a secondary diagnosis of Panic Disorder. *SD* = standard deviation; OCD = Obsessive Compulsive Disorder; GAD = Generalized Anxiety Disorder.

Table 3

*Study 1 Means and Standard Deviations on Measures of Depression, Anxiety, Responsibility, and Obsessive Compulsive Symptoms*

Measures	Group					
	Student (N=50)		Anxious Controls (N=31)		OCD (N=29)	
	Mean	SD	Mean	SD	Mean	SD
BDI-II	10.52	8.40	18.43	11.20	25.41	15.15
BAI	11.12	9.63	22.65	10.61	22.51	11.43
STAI – Trait	42.5	9.52	51.57	11.24	59.44	11.25
OCI						
Total Frequency	34.88	26.21	30.48	25.53	83.63	29.62
Total Distress	25.13	28.75	24.01	23.36	78.41	27.06
Checking Frequency <sup>a</sup>	0.83	0.67	0.72	0.69	2.31	1.00
Checking Distress <sup>a</sup>	0.54	0.73	0.57	0.63	2.09	0.95
MOCI-Checking	1.80	1.96	1.97	2.02	5.55	1.91
YBOCS – SR						
Obsessions	--	--	4.42	4.25	11.17	2.56
Compulsions	--	--	2.29	3.50	10.83	2.63
Total	--	--	6.71	6.96	22.00	4.61
RAS (reversed) <sup>a</sup>	3.94	0.85	3.86	0.93	5.18	0.78

*Note.* BDI-II = Beck Depression Inventory – Second Edition; BAI = Beck Anxiety Inventory; STAI-Trait = State-Trait Anxiety Inventory – Trait score, OCI = Obsessive Compulsive Inventory; RAS = Responsibility Attitude Scale; YBOCS - SR = Yale-Brown Obsessive Compulsive Scale, Self-Report Version; *SD* = standard deviation; OCD = Obsessive Compulsive Disorder

<sup>a</sup> For these scales, the value reported is the mean of the scale score. For the RAS, the mean score ranges from 1 to 7, with higher scores represented greater responsibility. For the OCI Checking Subscales, the subscale mean ranges from 0 to 4.

Table 4

*Intercorrelations among Mean Ratings on Dependent Variables for Study 1 – Students*

	Likelihood of checking	Discomfort	Worry	Other checking	Reassurance seeking
Urge to check	.77***	.56***	.65***	.40**	.10
Likelihood of checking		.66***	.79***	.40**	.12
Discomfort			.82***	.46**	.25
Worry				.54***	.20
Other checking					.36

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

Table 5

*Intercorrelations among Mean Ratings on Dependent Variables for Study 1 – Anxious Controls*

	Likelihood of checking	Discomfort	Worry	Other checking	Reassurance seeking
Urge to check	.90***	.92***	.89***	.54**	.53**
Likelihood of checking		.83***	.80***	.59***	.49**
Discomfort			.93***	.58**	.52**
Worry				.56**	.50**
Other checking					.60**

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .



Table 6

*Intercorrelations among Mean Ratings on Dependent Variables for Study 1 – OCD participants*

	Likelihood of checking	Discomfort	Worry	Other checking	Reassurance seeking
Urge to check	.92***	.92***	.93***	.81***	.72***
Likelihood of checking		.89***	.88***	.78***	.73***
Discomfort			.97***	.81***	.78***
Worry				.79***	.75***
Other checking					.77***

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

Table 7

*Manipulation Check for Responsibility in Study 1*

		Group					
		Student (N=50)		Anxious Control (N=31)		OCD (N=29)	
		Mean <sup>a</sup>	SD	Mean <sup>a</sup>	SD	Mean <sup>a</sup>	SD
High Responsibility Scenarios							
	High R, High S, High P	3.20	0.79	3.29	0.86	3.79	0.56
	High R, High S, Low P	2.90	0.90	2.55	1.09	3.38	0.86
	High R, Low S, High P	3.33	0.85	2.97	0.88	3.62	0.68
	High R, Low S, Low P	2.98	0.99	2.45	1.09	3.17	0.93
Low Responsibility Scenarios							
	Low R, Low S, Low P	1.31	0.65	1.16	0.37	1.93	1.02
	Low R, Low S, High P	1.82	0.70	1.77	0.76	2.41	1.09
	Low R, High S, Low P	1.84	0.69	1.74	0.77	2.38	1.12
	Low R, High S, High P	1.77	0.65	1.81	0.65	2.41	1.02

*Note.* R = responsibility, S = severity, P = probability, *SD* = standard deviation; OCD = Obsessive Compulsive Disorder.

<sup>a</sup> Response options ranged from 1 = “not at all responsible” to 4 = “totally responsible”.

Table 8

*Manipulation Check for Severity in Study 1*

		Group					
		Student (N=50)		Anxious Control (N=31)		OCD (N=29)	
		Mean <sup>a</sup>	SD	Mean <sup>a</sup>	SD	Mean <sup>a</sup>	SD
High Severity Scenarios							
	High S, High P, High R	3.56	0.76	3.39	0.92	3.79	0.49
	High S, High P, Low R	3.14	0.88	2.79	1.06	3.38	0.78
	High S, Low P, High R	2.58	0.93	2.66	1.14	3.21	0.86
	High S, Low P, Low R	2.58	1.01	2.64	1.28	3.28	0.88
Low Severity Scenarios							
	Low S, Low P, Low R	1.36	0.66	1.48	0.77	2.07	0.92
	Low S, Low P, High R	1.60	0.76	1.74	0.73	2.17	0.97
	Low S, High P, Low R	2.16	0.82	2.03	0.80	2.66	0.90
	Low S, High P, High R	1.84	0.82	2.16	0.78	2.55	1.06

*Note.* R = responsibility, S = severity, P = probability, *SD* = standard deviation; OCD = Obsessive Compulsive Disorder.

<sup>a</sup> Response options ranged from 1 = "trivial" to 5 = "severe".

Table 9

*Manipulation Check for Probability in Study 1*

		Group					
		Student (N=50)		Anxious Control (N=31)		OCD (N=29)	
		Mean <sup>a</sup>	SD	Mean <sup>a</sup>	SD	Mean <sup>a</sup>	SD
High Probability Scenarios							
	High P, High R, High S	2.66	0.89	2.71	0.86	3.62	0.78
	High P, High R, Low S	2.18	0.92	2.26	0.77	2.69	1.04
	High P, Low R, High S	2.26	0.85	2.16	0.86	2.79	1.01
	High P, Low R, Low S	2.26	0.88	2.00	0.82	2.83	1.00
Low Probability Scenarios							
	Low P, Low R, Low S	1.42	0.73	1.29	0.59	2.34	1.14
	Low P, Low R, High S	1.62	0.78	1.48	0.81	2.52	1.24
	Low P, High R, Low S	1.50	0.71	1.58	0.76	2.28	1.07
	Low P, High R, High S	1.64	0.72	1.77	1.02	2.52	1.02

*Note.* R = responsibility, S = severity, P = probability, SD = standard deviation; OCD = Obsessive Compulsive Disorder.

<sup>a</sup> Response options ranged from 1 = “unlikely” to 4 = “likely”.

Table 10

*Summary Table of Repeated Measures ANOVA Findings for Study 1*

Dependent Measure	Group		
	Student (N=50)	Anxious Control (N=31)	OCD (N=29)
Urge to Check	Main Effect of R Main Effect of S Main Effect of P	Main Effect of R Main Effect of S Main Effect of P	Main Effect of S Main Effect of P R X S X P
Likelihood of Checking	Main Effect of R Main Effect of S Main Effect of P R X P Interaction S X P Interaction	Main Effect of R Main Effect of S Main Effect of P R X P Interaction S X P Interaction	Main Effect of R Main Effect of S Main Effect of P R X P Interaction
Discomfort	Main Effect of R Main Effect of S Main Effect of P  R X S X P Interaction	Main Effect of R Main Effect of S Main Effect of P  R X S X P Interaction	Main Effect of R Main Effect of S Main Effect of P R X P Interaction
Worry	Main Effect of R Main Effect of S Main Effect of P R X S X P Interaction	Main Effect of R Main Effect of S Main Effect of P R X S X P Interaction	Main Effect of R Main Effect of S Main Effect of P R X S X P Interaction
Reassurance Seeking	Main Effect of R  Main Effect of S S X P Interaction	  S X P Interaction	Main Effect of S
Checking by Other	Main Effect of S Main Effect of P R X P Interaction	Main Effect of P	Main Effect of P

*Note.* R = responsibility, S = severity, P = probability, OCD = Obsessive Compulsive Disorder.

Table 11

*Cell Means for Urge to Check for Study 1*

	Low Probability		High Probability	
	Low Severity Mean (SD) <sup>a</sup>	High Severity Mean (SD) <sup>a</sup>	Low Severity Mean (SD) <sup>a</sup>	High Severity Mean (SD) <sup>a</sup>
Students				
Low Responsibility	1.56(0.88)	2.18(0.92)	2.78(1.07)	2.78(1.15)
High Responsibility	2.18(0.85)	2.18(0.83)	3.20(1.07)	3.70(0.99)
Anxious Controls				
Low Responsibility	1.54(0.77)	1.87(1.02)	2.45(0.92)	2.67(1.05)
High Responsibility	2.16(1.04)	2.39(1.02)	3.10(0.94)	3.84(0.73)
OCD				
Low Responsibility	2.69(1.39)	3.31(1.31)	3.34(1.45)	3.41(1.24)
High Responsibility	2.90(1.14)	3.14(1.33)	3.51(1.12)	4.38(0.62)

<sup>a</sup> Response options ranged from 1 = “no urge to check” to 5 = “strong urge to check repeatedly”.

Table 12

*Cell Means for Likelihood of Checking for Study 1*

	Low Probability		High Probability	
	Low Severity Mean (SD) <sup>a</sup>	High Severity Mean (SD) <sup>a</sup>	Low Severity Mean (SD) <sup>a</sup>	High Severity Mean (SD) <sup>a</sup>
Students				
Low Responsibility	1.38(0.83)	1.78(0.93)	1.90(1.02)	2.60(1.16)
High Responsibility	1.84(1.13)	1.54(0.71)	2.70(1.11)	3.40(1.07)
Anxious Controls				
Low Responsibility	1.41(0.62)	1.58(0.92)	1.81(0.91)	2.16(1.00)
High Responsibility	1.84(0.90)	1.94(1.00)	2.58(0.99)	3.74(0.86)
OCD				
Low Responsibility	2.41(1.40)	2.72(1.36)	2.59(1.43)	2.93(1.25)
High Responsibility	2.28(1.28)	2.38(1.54)	3.34(1.20)	4.31(0.60)

<sup>a</sup> Response options ranged from 1 = "I would not check" to 5 = "I would check repeatedly".

Table 13

*Cell Means for Discomfort for Study 1*

	Low Probability		High Probability	
	Low Severity Mean (SD) <sup>a</sup>	High Severity Mean (SD) <sup>a</sup>	Low Severity Mean (SD) <sup>a</sup>	High Severity Mean (SD) <sup>a</sup>
Students				
Low Responsibility	1.32(0.79)	1.88(0.75)	2.34(0.92)	2.48(0.99)
High Responsibility	2.06(0.77)	2.08(0.80)	2.52(1.05)	3.36(1.16)
Anxious Controls				
Low Responsibility	1.36(0.55)	1.90(1.01)	2.52(1.06)	2.19(1.01)
High Responsibility	1.94(0.89)	2.16(0.90)	2.61(0.88)	3.52(1.12)
OCD				
Low Responsibility	2.52(1.45)	3.07(1.44)	3.21(1.18)	3.31(1.26)
High Responsibility	2.69(1.26)	3.10(1.37)	3.45(1.33)	4.45(0.83)

<sup>a</sup> Response options ranged from 1 = “not at all anxious/uncomfortable” to 5 = “extremely anxious/uncomfortable”.



Table 14

*Cell Means for Worry for Study 1*

	Low Probability		High Probability	
	Low Severity	High Severity	Low Severity	High Severity
	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>
Students				
Low Responsibility	1.42(0.78)	2.06(1.03)	2.76(1.20)	2.82(1.26)
High Responsibility	2.36(1.08)	2.38(1.12)	2.98(1.49)	3.76(1.51)
Anxious Controls				
Low Responsibility	1.36(0.66)	2.19(1.42)	2.74(1.39)	2.64(1.40)
High Responsibility	2.16(1.21)	2.61(1.41)	3.03(1.33)	3.87(1.38)
OCD				
Low Responsibility	3.03(1.92)	3.79(1.78)	3.96(1.61)	4.06(1.69)
High Responsibility	3.27(1.73)	3.86(1.60)	4.10(1.76)	5.24(1.02)

<sup>a</sup> Response options ranged from 1 = "I would not worry" to 6 = "I would worry constantly".

Table 15

*Cell Means for Reassurance Seeking for Study 1*

	Low Probability		High Probability	
	Low Severity Mean (SD) <sup>a</sup>	High Severity Mean (SD) <sup>a</sup>	Low Severity Mean (SD) <sup>a</sup>	High Severity Mean (SD) <sup>a</sup>
Students				
Low Responsibility	1.52(0.81)	2.26(0.83)	2.08(0.97)	2.14(1.10)
High Responsibility	1.46(0.73)	2.20(1.04)	1.58(0.88)	1.96(1.08)
Anxious Controls				
Low Responsibility	1.45(0.72)	1.58(0.89)	1.97(1.13)	1.52(0.72)
High Responsibility	1.42(0.84)	1.94(1.00)	1.81(0.87)	1.68(0.98)
OCD				
Low Responsibility	2.41(1.52)	3.10(1.45)	2.59(1.32)	2.55(1.33)
High Responsibility	1.97(1.05)	2.66(1.32)	2.41(1.40)	2.62(1.50)

<sup>a</sup> Response options ranged from 1 = "I would not ask another person for reassurance" to 5 = "I would repeatedly ask another person for reassurance".

Table 16

*Cell Means for Checking by Other for Study 1*

	Low Probability		High Probability	
	Low Severity Mean (SD) <sup>a</sup>	High Severity Mean (SD) <sup>a</sup>	Low Severity Mean (SD) <sup>a</sup>	High Severity Mean (SD) <sup>a</sup>
Students				
Low Responsibility	1.56(0.88)	1.86(1.01)	2.66(1.00)	2.80(1.18)
High Responsibility	1.70(1.05)	2.16(1.11)	1.82(1.04)	2.44(1.09)
Anxious Controls				
Low Responsibility	1.36(0.71)	1.42(0.72)	2.19(1.20)	2.42(1.12)
High Responsibility	1.26(0.63)	1.84(1.07)	2.16(0.93)	1.90(1.16)
OCD				
Low Responsibility	2.34(1.42)	1.90(0.90)	2.52(1.21)	2.93(1.33)
High Responsibility	1.72(1.00)	2.10(1.18)	2.38(1.27)	2.31(1.31)

<sup>a</sup> Response options ranged from 1 = "I would not ask another person to check" to 5 = "I would repeatedly ask another person to check".

Table 17

*Cell Means for Student, Anxious Control, and OCD Samples*

Dependent variable	No high multipliers	One high multiplier	Two high multipliers	Three high multipliers
<b>Students</b>				
Urge to check	1.56 <sup>a</sup>	2.38 <sup>b</sup>	2.72 <sup>c</sup>	3.70 <sup>d</sup>
Likelihood of checking	1.38 <sup>a</sup>	1.84 <sup>b</sup>	2.28 <sup>c</sup>	3.40 <sup>d</sup>
Discomfort	1.32 <sup>a</sup>	2.09 <sup>b</sup>	2.36 <sup>c</sup>	3.36 <sup>d</sup>
Worry	1.42 <sup>a</sup>	2.39 <sup>b</sup>	2.73 <sup>b</sup>	3.76 <sup>c</sup>
Reassurance seeking	1.52	1.93	1.97	1.96
Other check	1.56 <sup>a</sup>	2.07 <sup>b</sup>	2.26 <sup>b</sup>	2.44 <sup>b</sup>
<b>Anxious controls</b>				
Urge to check	1.54 <sup>a</sup>	2.16 <sup>b</sup>	2.72 <sup>c</sup>	3.84 <sup>d</sup>
Likelihood of checking	1.42 <sup>a</sup>	1.74 <sup>a</sup>	2.27 <sup>b</sup>	3.74 <sup>c</sup>
Discomfort	1.36 <sup>a</sup>	2.12 <sup>b</sup>	2.32 <sup>b</sup>	3.52 <sup>c</sup>
Worry	1.36 <sup>a</sup>	2.37 <sup>b</sup>	2.76 <sup>b</sup>	3.87 <sup>c</sup>
Reassurance seeking	1.45	1.66	1.75	1.68
Other check	1.36 <sup>a</sup>	1.62 <sup>a</sup>	2.14 <sup>bc</sup>	1.90 <sup>ac</sup>
<b>OCD</b>				
Urge to check	2.69 <sup>a</sup>	3.18 <sup>ab</sup>	3.36 <sup>b</sup>	4.38 <sup>c</sup>
Likelihood of checking	2.41 <sup>ab</sup>	2.53 <sup>a</sup>	2.89 <sup>b</sup>	4.31 <sup>c</sup>
Discomfort	2.52 <sup>a</sup>	2.99 <sup>b</sup>	3.29 <sup>b</sup>	4.45 <sup>c</sup>
Worry	3.03 <sup>a</sup>	3.68 <sup>ab</sup>	4.01 <sup>b</sup>	5.24 <sup>c</sup>
Reassurance seeking	2.41	2.55	2.54	2.62
Other check	2.35	2.05	2.47	2.31

Note: OCD = Obsessive Compulsive Disorder.

<sup>a,b,c,d</sup> Different superscripts represent significant differences.

Table 18

*Age, Gender, and Years of Education, and Marital Status for the Two Samples in Study 2*

Characteristics	Group			
	Students ( <i>n</i> = 44)		OCD ( <i>n</i> = 20)	
	Mean	SD	Mean	SD
Age	20.59	2.24	38.75	11.01
Percentage Female	81.8%	--	65.0%	--
Percentage Single	77.3%	--	30%	--
Years of Education	15.17	2.02	15.29	3.29

*Note.* *SD* = standard deviation; OCD = Obsessive Compulsive Disorder.

Table 19

*Clinical Characteristics of the OCD Sample in Study 2*

Characteristics	OCD Sample (N=20)
Secondary Diagnosis	
Percentage none	35.0%
Percentage depression	55.0%
Percentage other anxiety disorders	20.0%
Percentage on medication	60.0%
Percentage in treatment now	45.0%

*Note.* OCD = Obsessive Compulsive Disorder.

Table 20

*Study 2 Means and Standard Deviations on Measures of Depression, Anxiety, Responsibility, and Obsessive Compulsive Symptoms*

Measures	Group			
	Students (N=44)		OCD (N=20)	
	Mean	SD	Mean	SD
BDI-II	9.80	9.15	25.45	14.28
BAI	10.57	8.64	19.22	10.36
STAI-Trait	41.98	11.58	58.95	9.73
OCI				
Total Frequency	31.54	23.58	94.10	22.78
Total Distress	22.80	22.59	90.45	22.60
Checking Frequency <sup>1</sup>	0.87	0.76	2.85	0.65
Checking Distress <sup>1</sup>	0.61	0.64	2.63	0.76
MOCI-Checking	2.13	1.90	6.15	1.27
YBOCS – SR				
Obsessions	--	--	11.05	2.84
Compulsions	--	--	11.20	2.14
Total	--	--	22.25	4.59
RAS (reversed) <sup>1</sup>	3.84	0.66	5.29	0.80

*Note.* BDI-II = Beck Depression Inventory – Second Edition; BAI = Beck Anxiety Inventory; OCI = Obsessive Compulsive Inventory; RAS = Responsibility Attitude Scale; YBOCS-SR = Yale-Brown Obsessive Compulsive Scale, Self-Report Version; *SD* = standard deviation; OCD = Obsessive Compulsive Disorder.

<sup>1</sup> For these scales, the value reported is the mean of the scale score. For the RAS, the mean score ranges from 1 to 7, with higher scores represented greater responsibility. For the OCI Checking Subscales, the subscale mean ranges from 0 to 4.

Table 21

*Summary Table of Repeated Measures ANOVA Findings for Study 2*

Dependent Measure	Group	
	Student (N=44)	OCD Checkers (N=20)
Responsibility	Main Effect of Relevance Main Effect of Time	Main Effect of Time
Severity	Main Effect of Relevance Main Effect of Time	Main Effect of Relevance
Probability	Main Effect of Relevance Main Effect of Time	Main Effect of Relevance Main Effect of Time
Urge to Check	Main Effect of Relevance Main Effect of Time Main Effect of # of Checks 3 Way Interaction	Main Effect of Relevance Main Effect of Time
Anxiety	Main Effect of Relevance Main Effect of Time Relevance X Time Interaction	Main Effect of Relevance Main Effect of Time
Confidence in Memory	Main Effect of Relevance Main Effect of Time	Main Effect of Relevance Main Effect of Time

*Note.* OCD = Obsessive Compulsive Disorder.



Table 22

*Cell Means for Responsibility for Study 2*

	Low Relevance		High Relevance	
	Pre	Post	Pre	Post
	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>
Students				
Single check	4.17(.50)	3.52(.52)	5.81(.49)	4.81(.51)
Multiple Check	3.84(.49)	3.18(.54)	5.02(.55)	4.25(.58)
OCD				
Single check	5.95 (3.52)	5.65(3.99)	8.50(2.25)	7.70(2.83)
Multiple Check	5.73(4.11)	5.18(4.19)	8.30(2.64)	6.95(3.07)

<sup>a</sup> Response options ranged from 0 = “not at all responsible” to 10 = “totally responsible”

Table 23

*Cell Means for Severity for Study 2*

	Low Relevance		High Relevance	
	Pre	Post	Pre	Post
	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>
Students				
Single check	2.78(2.10)	2.47 (2.00)	5.30(2.00)	4.93(2.18)
Multiple Check	2.83(2.20)	2.26(2.04)	5.41(2.29)	4.59(2.52)
OCD				
Single check	4.75(3.56)	4.53(3.51)	8.50(1.87)	7.78(2.24)
Multiple Check	4.83(3.79)	4.53 (3.80)	7.83(2.53)	6.55(3.10)

<sup>a</sup> Response options ranged from 1 = “not at all severe or really trivial harm” to 10 = “extremely severe or catastrophic harm”.

Table 24

*Cell Means for Probability for Study 2*

	Low Relevance		High Relevance	
	Pre	Post	Pre	Post
	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>
Students				
Single check	1.33(1.47)	0.63(1.24)	2.56(2.33)	1.78(1.87)
Multiple Check	1.26(1.51)	0.64(1.34)	2.90(2.69)	1.15(1.99)
OCD				
Single check	2.28(2.88)	1.50(2.31)	6.33(2.78)	4.68(2.15)
Multiple Check	2.48(2.75)	1.13(1.67)	6.83(2.51)	3.50(2.44)

<sup>a</sup> Response options ranged from 0 = “not at all likely” to 10 = “it will definitely happen”.

Table 25

*Cell Means for Urge to Check for Study 2*

	Low Relevance		High Relevance	
	Pre	Post	Pre	Post
	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>
Students				
Single check	1.78(1.90)	0.40(0.89)	3.07(2.68)	1.55(2.38)
Multiple Check	1.38(1.86)	0.38(1.14)	3.32(3.09)	0.56(1.21)
OCD				
Single check	3.60(3.14)	2.18(2.56)	7.63(2.86)	5.00(2.90)
Multiple Check	3.05(3.15)	1.38(2.36)	7.03(3.04)	4.25(3.48)

<sup>a</sup> Response options ranged from 0 = “absolutely no desire to check” to 10 = “feel that you absolutely must check”.

Table 26

*Cell Means for Discomfort/Anxiety for Study 2*

	Low Relevance		High Relevance	
	Pre	Post	Pre	Post
	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>
Students				
Single check	1.50(1.95)	0.77(1.34)	2.42(1.91)	1.16(1.50)
Multiple Check	1.27(1.42)	0.75(1.29)	2.53(2.39)	0.94(1.35)
OCD				
Single check	2.73(2.39)	1.85(2.04)	5.90(1.91)	3.63(1.85)
Multiple Check	3.20(2.50)	2.43(2.29)	5.53(2.94)	4.48(3.16)

<sup>a</sup> Response options ranged from 0 = “not at all anxious/uncomfortable or completely calm” to 10 = “the worst anxiety/discomfort you could experience”.

Table 27

*Cell Means for Confidence in Memory for Study 2*

	Low Relevance		High Relevance	
	Pre	Post	Pre	Post
	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>	Mean (SD) <sup>a</sup>
Students				
Single check	8.52(1.97)	9.68(0.55)	7.85(1.93)	9.35(1.00)
Multiple Check	8.60(1.62)	9.50(1.46)	7.88(2.22)	9.53(1.06)
OCD				
Single check	7.35(2.76)	8.15(2.35)	5.16(3.11)	6.17(2.59)
Multiple Check	6.85(3.20)	8.50(2.01)	4.66(2.87)	6.55(2.71)

<sup>a</sup> Response options ranged from 0 = “not at all confident” to 10 = “absolutely, 100% confident”.

Table 28

*Intercorrelations among Mean Ratings on Dependent Variables for Study 2 – Students*

	Severity	Probability	Anxiety	Checking	Memory Confidence
Responsibility	.55***	.50**	.28	.46**	-.23
Severity		.64***	.41**	.65***	-.41**
Probability			.49**	.82***	-.64***
Anxiety				.63***	-.50**
Checking					-.74***

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

Table 29

*Intercorrelations among Mean Ratings on Dependent Variables for Study 2 – OCD participants*

	Severity	Probability	Anxiety	Checking	Memory Confidence
Responsibility	.51*	.42	.17	.36	-.24
Severity		.34	.26	.14	-.20
Probability			.54*	.87***	-.72***
Anxiety				.59**	-.47*
Checking					-.80*

---

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .



Table 30

*Percentage of OCD sample reporting 8, 9, or 10 on the multipliers*

Condition	Multiplier		
	Responsibility	Probability	Severity
High relevant			
Single check	75%	40%	75%
Multiple check	75%	45%	70%
Low relevant			
Single check	40%	10%	30%
Multiple check	50%	10%	35%

Figure 1

*Effects of Having None, One, Two or All Three Multipliers Elevated on Likelihood of Checking*

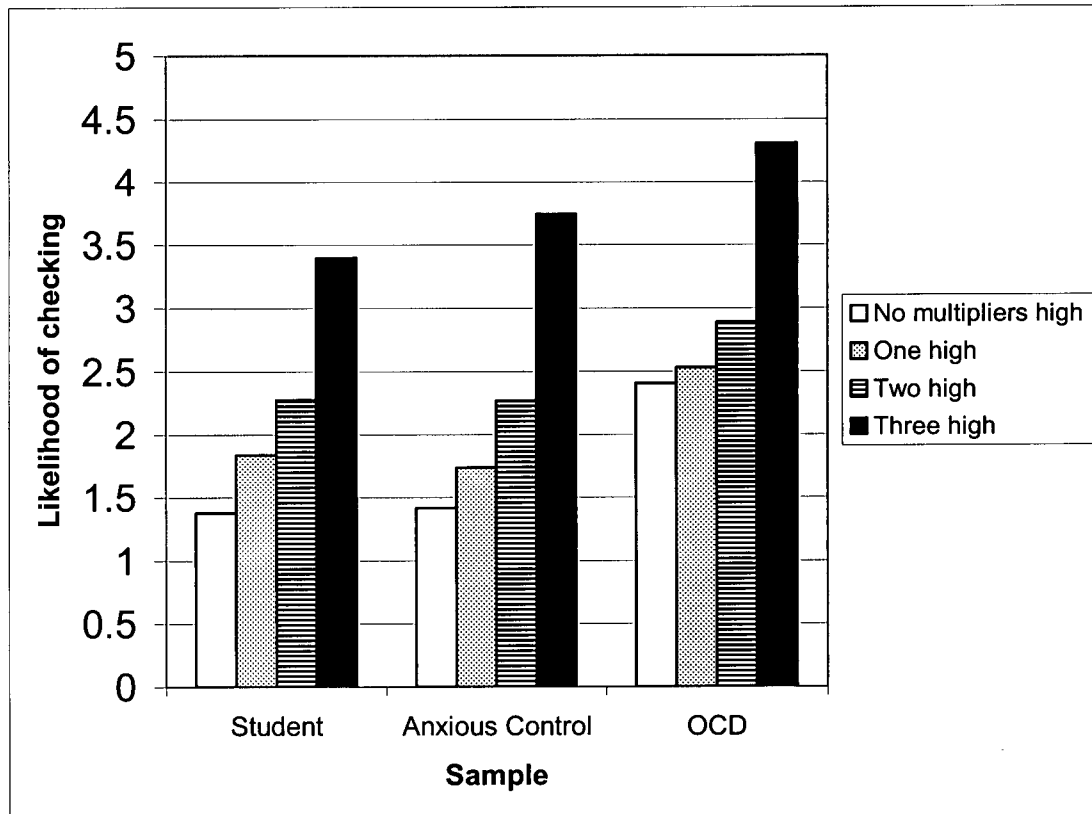


Figure 2

*Effect of Different Responsibility and Probability Combinations on Likelihood of Checking*

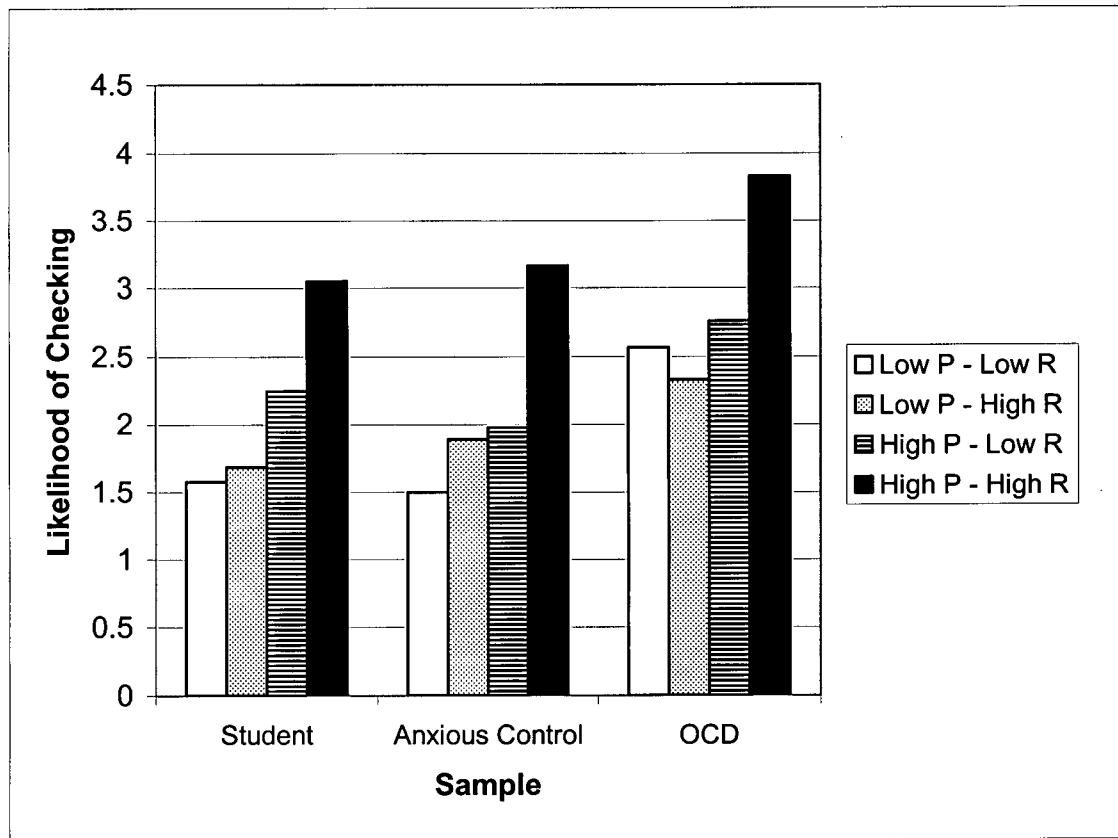


Figure 3

*Likelihood of Checking among Students Reporting No Responsibility and those Reporting At Least Some Responsibility in the Low Responsibility, High Severity, High Probability Scenario*

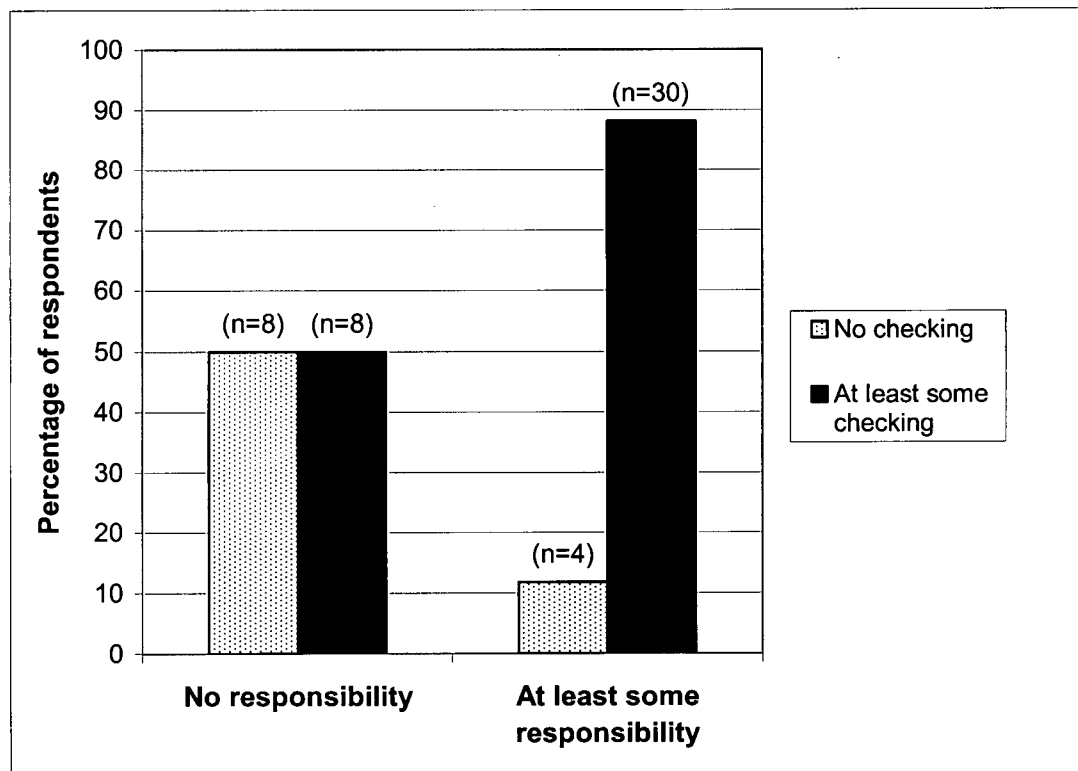


Figure 4

*Likelihood of Checking among Anxious Control Participants Reporting No Responsibility and those Reporting At Least Some Responsibility in the Low Responsibility, High Severity, High Probability Scenario*

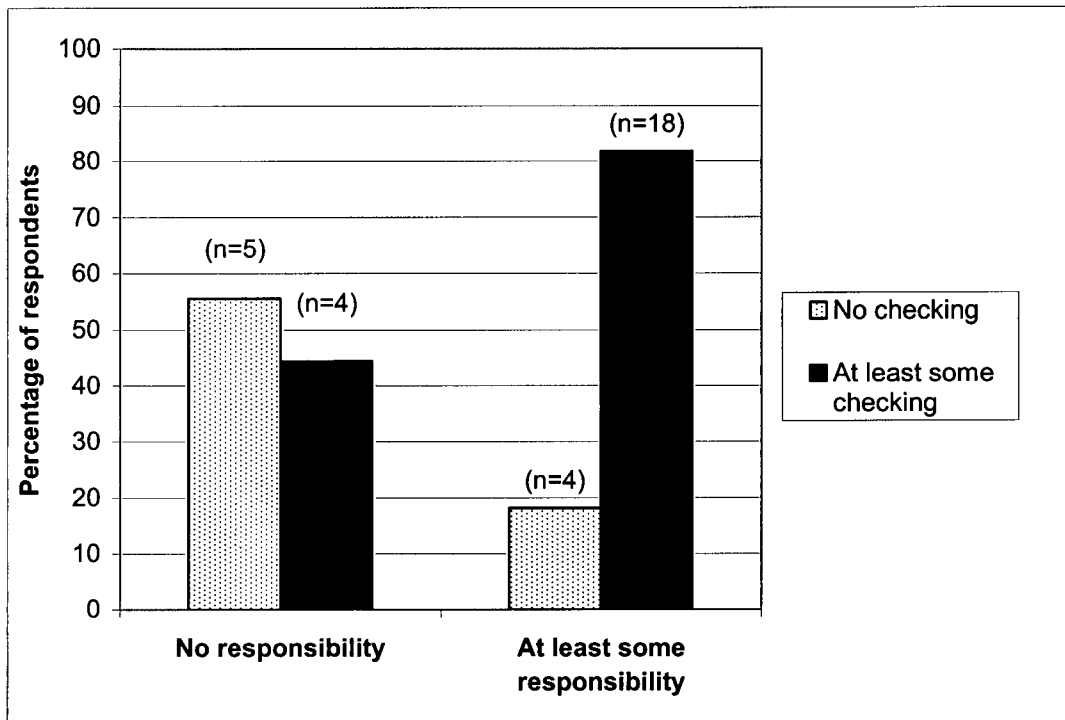
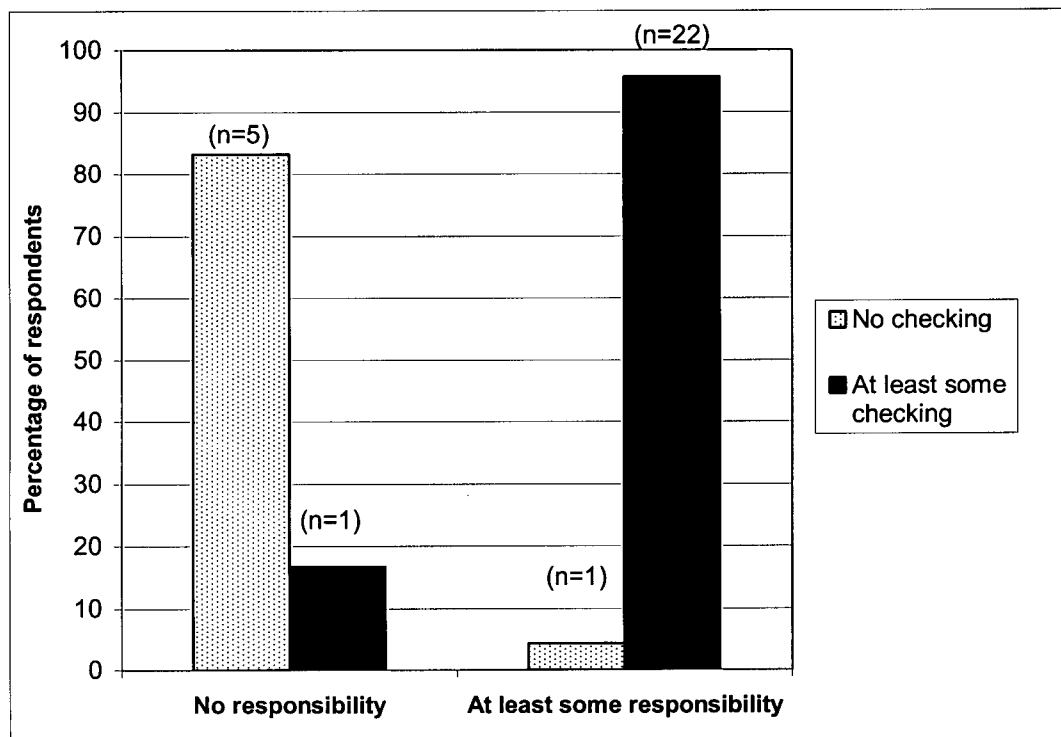


Figure 5

*Likelihood of Checking among OCD Participants Reporting No Responsibility and those Reporting At Least Some Responsibility in the Low Responsibility, High Severity, High Probability Scenario*



## Appendix 1

### Study 1 Vignettes

**A. You are out of town for the weekend visiting with an old friend. The central heating in your friend's place is not very good, but your friend has a new electric heater that works very well. That night is especially cold so your friend plugs in the heater before she goes to bed. The next morning you get a phone call from some friends who invite the two of you over for lunch. You go out to get the car while your friend goes upstairs to change. As you walk out the door, you call out to your friend to remind her to unplug the heater. Later, as you are on your way to lunch, you suddenly wonder if your friend remembered to unplug the heater before she left. You do not know if she has home insurance in case of fire. You ask her whether she unplugged the heater or not and she says she can't remember, but that the heater has an automatic shut-off function. (Low Responsibility, High Severity, Low Probability)**

**1. How much of an urge to check the heater would you have in this situation?**

- ☐ no urge to check
- ☐ slight urge to check
- ☐ moderate urge to check
- ☐ strong urge to check at least once
- ☐ strong urge to check repeatedly

**2. How likely would you be to actually go back to check to make sure that your friend unplugged the electric heater?**

- ☐ I would not go back to check
- ☐ I might go back to check
- ☐ I would probably go back to check
- ☐ I would definitely go back to check once
- ☐ I would go back to check repeatedly

**3. How likely would you be to ask another person to check for you (e.g., by calling a neighbor or landlord who has keys)?**

- ☐ I would not ask another person to check
- ☐ I might ask another person to check
- ☐ I would probably ask another person to check
- ☐ I would definitely ask another person to check
- ☐ I would repeatedly ask another person to check

**4. How likely would you be to ask others to reassure you that the situation is not dangerous/risky and/or does not require any action by you (e.g., asking your friends "I don't know if the electric heater was turned off or not, do you think I should go back to check?")?**

- ☐ I would not ask another person for reassurance
- ☐ I might ask another person for reassurance
- ☐ I would probably ask another person for reassurance
- ☐ I would definitely ask another person for reassurance
- ☐ I would repeatedly ask another person for reassurance

5. How anxious/uncomfortable would you feel if you did not check on the heater yourself, or have someone check for you?

- ☐ not at all anxious
- ☐ slightly anxious
- ☐ moderately anxious
- ☐ very anxious
- ☐ extremely anxious

6. How much would you worry about the heater (i.e., how much would you continue to think about the heater) if you did not check on it yourself, or have someone check for you?

- ☐ I would not worry
- ☐ I might worry
- ☐ I would probably worry
- ☐ I would definitely worry at least briefly
- ☐ I would worry repeatedly
- ☐ I would worry constantly

*Please make the following ratings based on how you would feel if you found yourself in this situation (AND NO ONE HAD CHECKED, not what you think is "logical").*

7. How likely does it feel that harm will occur in this situation?

- ☐ it feels *unlikely*
- ☐ it feels *somewhat unlikely*
- ☐ it feels *somewhat likely*
- ☐ it feels *likely*

8. How responsible would you feel for preventing any harm in this situation?

- ☐ not at all responsible
- ☐ somewhat responsible
- ☐ mostly responsible
- ☐ totally responsible

9. If harm were to occur in this situation, how severe do you feel the harm would be?

- ☐ trivial
- ☐ mild
- ☐ moderate
- ☐ severe

10. How vividly were you able to imagine yourself in this situation?

- ☐ It was easy for me to imagine myself in this situation
- ☐ I was able to imagine myself in this situation
- ☐ It was somewhat difficult to imagine myself in this situation, but I managed
- ☐ I found it very difficult to imagine myself in this situation
- ☐ I could not imagine myself in this situation



**B. Your partner's alarm clock didn't go off this morning so you woke him/her up just before you left for work. Your partner was the last one to leave. You haven't had a chance to renew your home insurance and you live in a high crime neighborhood. There have recently been a number of break-ins on your block and in fact, last week you noticed that your door had been tampered with. As you are turning out of the driveway, you notice a group of rough-looking guys that you don't recognize hanging around in the alley close to your place. As you arrive at work, you wonder if your partner remembered to lock the door before he or she left. Your partner has forgotten to lock the door several times in the past. Your landlord is in the process of making some renovations to your place so you have only a few pieces of furniture at home. Most of your valuables are in temporarily in storage.**

(Low Responsibility, Low Severity, High Probability)

**1. How much of an urge to check the door would you have in this situation?**

- ☐ no urge to check
- ☐ slight urge to check
- ☐ moderate urge to check
- ☐ strong urge to check at least once
- ☐ strong urge to check repeatedly

**2. How likely would you be to actually go back to check to make sure that your partner locked the door?**

- ☐ I would not go back to check
- ☐ I might go back to check
- ☐ I would probably go back to check
- ☐ I would definitely go back to check once
- ☐ I would go back to check repeatedly

**3. How likely would you be to ask another person to check for you (e.g., by calling a neighbor, friend or your landlord)?**

- ☐ I would not ask another person to check
- ☐ I might ask another person to check
- ☐ I would probably ask another person to check
- ☐ I would definitely ask another person to check
- ☐ I would repeatedly ask another person to check

**4. How likely would you be to ask others to reassure you that the situation is not dangerous/risky**

**and/or does not require any action by you (e.g., asking a friend or coworker "I don't know if my partner locked the door or not, do you think I should go back to check?")?**

- ☐ I would not ask another person for reassurance
- ☐ I might ask another person for reassurance
- ☐ I would probably ask another person for reassurance
- ☐ I would definitely ask another person for reassurance
- ☐ I would repeatedly ask another person for reassurance

5. How anxious/uncomfortable would you feel if you did not check on the door yourself, or have someone check for you?

- ☐ not at all anxious
- ☐ slightly anxious
- ☐ moderately anxious
- ☐ very anxious
- ☐ extremely anxious

6. How much would you worry about the door (i.e., how much would you continue to think about the door) if you did not check on it yourself, or have someone check for you?

- ☐ I would not worry
- ☐ I might worry
- ☐ I would probably worry
- ☐ I would definitely worry at least briefly
- ☐ I would worry repeatedly
- ☐ I would worry constantly

*Please make the following ratings based on how you would feel if you found yourself in this situation (AND NO ONE HAD CHECKED, not what you think is "logical").*

7. How likely does it feel that harm will occur in this situation?

- ☐ it feels *unlikely*
- ☐ it feels *somewhat unlikely*
- ☐ it feels *somewhat likely*
- ☐ it feels *likely*

8. How responsible would you feel for preventing any harm in this situation?

- ☐ not at all responsible
- ☐ somewhat responsible
- ☐ mostly responsible
- ☐ totally responsible

9. If harm were to occur in this situation, how severe do you feel the harm would be?

- ☐ trivial
- ☐ mild
- ☐ moderate
- ☐ severe

10. How vividly were you able to imagine yourself in this situation?

- ☐ It was easy for me to imagine myself in this situation
- ☐ I was able to imagine myself in this situation
- ☐ It was somewhat difficult to imagine myself in this situation, but I managed
- ☐ I found it very difficult to imagine myself in this situation
- ☐ I could not imagine myself in this situation

**C. You are sitting in the living room doing working on some bills when your friend parks his old truck outside the apartment and hurries in. He was planning to work at your place for a while until the rest of your friends arrive to take you out to a movie. He says that he is in a rush to complete an assignment that is due early tomorrow morning before your friends arrive. His truck is the only vehicle parked on your reasonably busy street with a very steep slope, and there is an elementary school just down the hill from his parking spot. He has forgotten to pull the brake on a few occasions in the past, and once his truck started to roll slowly down the hill, but stopped when it bumped into a parked van. He notes that the school has just let out and that there were children everywhere as he was trying to park. As you begin to work on some schoolwork, you wonder whether your friend pulled the parking brake or not. (Low Responsibility, High Severity, High Probability)**

**1. How much of an urge to check the parking brake would you have in this situation?**

- ☐ no urge to check
- ☐ slight urge to check
- ☐ moderate urge to check
- ☐ strong urge to check at least once
- ☐ strong urge to check repeatedly

**2. How likely would you be to actually go back to check that your friend has pulled the parking brake?**

- ☐ I would not go back to check
- ☐ I might go back to check
- ☐ I would probably go back to check
- ☐ I would definitely go back to check once
- ☐ I would go back to check repeatedly

**3. How likely would you be to ask another person to check for you (e.g., by asking your friend)?**

- ☐ I would not ask another person to check
- ☐ I might ask another person to check
- ☐ I would probably ask another person to check
- ☐ I would definitely ask another person to check
- ☐ I would repeatedly ask another person to check

**4. How likely would you be to ask others to reassure you that the situation is not dangerous/risky and/or does not require any action by you (e.g., asking a friend "I don't know if the parking brake is pulled or not, do you think I should go back to check?")?**

- ☐ I would not ask another person for reassurance
- ☐ I might ask another person for reassurance
- ☐ I would probably ask another person for reassurance
- ☐ I would definitely ask another person for reassurance
- ☐ I would repeatedly ask another person for reassurance

5. How anxious/uncomfortable would you feel if you did not check on the parking brake yourself, or have someone check for you?

- ☐ not at all anxious
- ☐ slightly anxious
- ☐ moderately anxious
- ☐ very anxious
- ☐ extremely anxious

6. How much would you worry about the parking brake (i.e., how much would you continue to think about the parking brake) if you did not check on it yourself, or have someone check for you?

- ☐ I would not worry
- ☐ I might worry
- ☐ I would probably worry
- ☐ I would definitely worry at least briefly
- ☐ I would worry repeatedly
- ☐ I would worry constantly

*Please make the following ratings based on how you would feel if you found yourself in this situation (AND NO ONE HAD CHECKED, not what you think is "logical").*

7. How likely does it feel that harm will occur in this situation?

- ☐ it feels *unlikely*
- ☐ it feels *somewhat unlikely*
- ☐ it feels *somewhat likely*
- ☐ it feels *likely*

8. How responsible would you feel for preventing any harm in this situation?

- ☐ not at all responsible
- ☐ somewhat responsible
- ☐ mostly responsible
- ☐ totally responsible

9. If harm were to occur in this situation, how severe do you feel the harm would be?

- ☐ trivial
- ☐ mild
- ☐ moderate
- ☐ severe

10. How vividly were you able to imagine yourself in this situation?

- ☐ It was easy for me to imagine myself in this situation
- ☐ I was able to imagine myself in this situation
- ☐ It was somewhat difficult to imagine myself in this situation, but I managed
- ☐ I found it very difficult to imagine myself in this situation
- ☐ I could not imagine myself in this situation

**D. You and one of your coworker friends are heading out to have lunch. As your friend grabs her purse, a different coworker you don't know very well asks your friend to drop off a package into the overnight courier service pile in the mailroom, since you will be passing by the company mailroom on your way out of the building. He says that the package contains some copies of new glossy brochures that need to get to the branch office in Calgary by tomorrow evening. Your friend says she'd be happy to drop it off, and as you pass by the door to the mailroom, she pops into the doorway of the mailroom and drops the package onto one of the outgoing courier service piles. A little while later, as you are having lunch, you wonder whether your friend slipped the paper into the overnight courier service pile or whether she put it into the 1-2 business days courier service or 3-5 business days courier service piles instead.**

(Low Responsibility, Low Severity, Low Probability)

**1. How much of an urge to check the overnight courier pile would you have in this situation?**

- ☐ no urge to check
- ☐ slight urge to check
- ☐ moderate urge to check
- ☐ strong urge to check at least once
- ☐ strong urge to check repeatedly

**2. How likely would you be to actually go back to check to make sure that the package was put into the right pile?**

- ☐ I would not go back to check
- ☐ I might go back to check
- ☐ I would probably go back to check
- ☐ I would definitely go back to check once
- ☐ I would go back to check repeatedly

**3. How likely would you be to ask another person to check for you (e.g., by asking a friend or calling the secretary)?**

- ☐ I would not ask another person to check
- ☐ I might ask another person to check
- ☐ I would probably ask another person to check
- ☐ I would definitely ask another person to check
- ☐ I would repeatedly ask another person to check

**4. How likely would you be to ask others to reassure you that the situation is not dangerous/risky and/or does not require any action by you (e.g., asking a friend "I don't know if the package was put onto the right pile or not, do you think I should go back to check?")?**

- ☐ I would not ask another person for reassurance
- ☐ I might ask another person for reassurance
- ☐ I would probably ask another person for reassurance
- ☐ I would definitely ask another person for reassurance
- ☐ I would repeatedly ask another person for reassurance

5. How anxious/uncomfortable would you feel if you did not check on the package yourself, or have someone check for you?

- ☐ not at all anxious
- ☐ slightly anxious
- ☐ moderately anxious
- ☐ very anxious
- ☐ extremely anxious

6. How much would you worry about the package (i.e., how much would you continue to think about the package) if you did not check on it yourself, or have someone check for you?

- ☐ I would not worry
- ☐ I might worry
- ☐ I would probably worry
- ☐ I would definitely worry at least briefly
- ☐ I would worry repeatedly
- ☐ I would worry constantly

*Please make the following ratings based on how you would feel if you found yourself in this situation (AND NO ONE HAD CHECKED, not what you think is "logical").*

7. How likely does it feel that harm will occur in this situation?

- ☐ it feels *unlikely*
- ☐ it feels *somewhat unlikely*
- ☐ it feels *somewhat likely*
- ☐ it feels *likely*

8. How responsible would you feel for preventing any harm in this situation?

- ☐ not at all responsible
- ☐ somewhat responsible
- ☐ mostly responsible
- ☐ totally responsible

9. If harm were to occur in this situation, how severe do you feel the harm would be?

- ☐ trivial
- ☐ mild
- ☐ moderate
- ☐ severe

10. How vividly were you able to imagine yourself in this situation?

- ☐ It was easy for me to imagine myself in this situation
- ☐ I was able to imagine myself in this situation
- ☐ It was somewhat difficult to imagine myself in this situation, but I managed
- ☐ I found it very difficult to imagine myself in this situation
- ☐ I could not imagine myself in this situation

**E. One morning you are rushing to get ready for work because you slept through your alarm. You are upset because you have a meeting with your supervisor and you don't want to miss it. Your partner sees that you are upset and tells you to take his/her old car, as he/she doesn't have any appointments until later in the afternoon. You rush to work and just barely make it on time. As you settle more comfortably into your seat and begin the meeting, you suddenly realize that while you definitely put the lock on the steering wheel, you can't remember whether or not you locked the car door. To your knowledge you've never forgotten to lock a car door in the past. Your partner doesn't have anything valuable in his/her old car, just some change and a couple of old CDs. You are going to be away from the car for a couple of hours.  
(High Responsibility, Low Severity, Low Probability)**

**1. How much of an urge to check the car door would you have in this situation?**

- ☐ no urge to check
- ☐ slight urge to check
- ☐ moderate urge to check
- ☐ strong urge to check at least once
- ☐ strong urge to check repeatedly

**2. How likely would you be to actually go back to check to make sure that you locked the car door?**

- ☐ I would not go back to check
- ☐ I might go back to check
- ☐ I would probably go back to check
- ☐ I would definitely go back to check once
- ☐ I would go back to check repeatedly

**3. How likely would you be to ask another person to check for you (e.g., by calling a neighbor, friend or family member)?**

- ☐ I would not ask another person to check
- ☐ I might ask another person to check
- ☐ I would probably ask another person to check
- ☐ I would definitely ask another person to check
- ☐ I would repeatedly ask another person to check

**4. How likely would you be to ask others to reassure you that the situation is not dangerous/risky and/or does not require any action by you (e.g., asking a friend "I don't know if I locked the car door or not, do you think I should go back to check?")?**

- ☐ I would not ask another person for reassurance
- ☐ I might ask another person for reassurance
- ☐ I would probably ask another person for reassurance
- ☐ I would definitely ask another person for reassurance
- ☐ I would repeatedly ask another person for reassurance

5. How anxious/uncomfortable would you feel if you did not check on the situation yourself, or have someone check for you?

- ☐ not at all anxious
- ☐ slightly anxious
- ☐ moderately anxious
- ☐ very anxious
- ☐ extremely anxious

6. How much would you worry about the car door (i.e., how much would you continue to think about the car door) if you did not check on it yourself, or have someone check for you?

- ☐ I would not worry
- ☐ I might worry
- ☐ I would probably worry
- ☐ I would definitely worry at least briefly
- ☐ I would worry repeatedly
- ☐ I would worry constantly

*Please make the following ratings based on how you would feel if you found yourself in this situation (AND NO ONE HAD CHECKED, not what you think is "logical").*

7. How likely does it feel that harm will occur in this situation?

- ☐ it feels *unlikely*
- ☐ it feels *somewhat unlikely*
- ☐ it feels *somewhat likely*
- ☐ it feels *likely*

8. How responsible would you feel for preventing any harm in this situation?

- ☐ not at all responsible
- ☐ somewhat responsible
- ☐ mostly responsible
- ☐ totally responsible

9. If harm were to occur in this situation, how severe do you feel the harm would be?

- ☐ trivial
- ☐ mild
- ☐ moderate
- ☐ severe

10. How vividly were you able to imagine yourself in this situation?

- ☐ It was easy for me to imagine myself in this situation
- ☐ I was able to imagine myself in this situation
- ☐ It was somewhat difficult to imagine myself in this situation, but I managed
- ☐ I found it very difficult to imagine myself in this situation
- ☐ I could not imagine myself in this situation



**F. You are at a friend's house getting ready to go out to dinner at a nice restaurant with some friends. You notice that your shirt is wrinkled and you ask your friend if you can use her iron to quickly smooth out the wrinkles before you leave. She tells you to go ahead and goes into the bathroom to get changed. Her ironing board is already set up in her room. Her iron is nice and new. You notice a sticker on the side of the iron indicating that the iron has an automatic shut-off function, which is an excellent safety feature. You shove the other clothes on the ironing board to the side so you have room to spread out your shirt. A short while later, as you are on your way to the restaurant, you realize that you don't remember shutting the iron off. You don't know if your friend has fire insurance coverage.**

(High Responsibility, High Severity, Low Probability)

**1. How much of an urge to check the iron would you have in this situation?**

- ☐ no urge to check
- ☐ slight urge to check
- ☐ moderate urge to check
- ☐ strong urge to check at least once
- ☐ strong urge to check repeatedly

**2. How likely would you be to actually go back to check to make sure that you shut off the iron?**

- ☐ I would not go back to check
- ☐ I might go back to check
- ☐ I would probably go back to check
- ☐ I would definitely go back to check once
- ☐ I would go back to check repeatedly

**3. How likely would you be to ask another person to check for you (e.g., by calling a neighbor or landlord who has keys)?**

- ☐ I would not ask another person to check
- ☐ I might ask another person to check
- ☐ I would probably ask another person to check
- ☐ I would definitely ask another person to check
- ☐ I would repeatedly ask another person to check

**4. How likely would you be to ask others to reassure you that the situation is not dangerous/risky**

**and/or does not require any action by you (e.g., asking a friend "I don't know if I shut off the iron or not, do you think I should go back to check?")?**

- ☐ I would not ask another person for reassurance
- ☐ I might ask another person for reassurance
- ☐ I would probably ask another person for reassurance
- ☐ I would definitely ask another person for reassurance
- ☐ I would repeatedly ask another person for reassurance

5. How anxious/uncomfortable would you feel if you did not check the iron yourself, or have someone check for you?

- ☐ not at all anxious
- ☐ slightly anxious
- ☐ moderately anxious
- ☐ very anxious
- ☐ extremely anxious

6. How much would you worry about the iron (i.e., how much would you continue to think about the iron) if you did not check on it yourself, or have someone check for you?

- ☐ I would not worry
- ☐ I might worry
- ☐ I would probably worry
- ☐ I would definitely worry at least briefly
- ☐ I would worry repeatedly
- ☐ I would worry constantly

*Please make the following ratings based on how you would feel if you found yourself in this situation (AND NO ONE HAD CHECKED, not what you think is "logical").*

7. How likely does it feel that harm will occur in this situation?

- ☐ it feels *unlikely*
- ☐ it feels *somewhat unlikely*
- ☐ it feels *somewhat likely*
- ☐ it feels *likely*

8. How responsible would you feel for preventing any harm in this situation?

- ☐ not at all responsible
- ☐ somewhat responsible
- ☐ mostly responsible
- ☐ totally responsible

9. If harm were to occur in this situation, how severe do you feel the harm would be?

- ☐ trivial
- ☐ mild
- ☐ moderate
- ☐ severe

10. How vividly were you able to imagine yourself in this situation?

- ☐ It was easy for me to imagine myself in this situation
- ☐ I was able to imagine myself in this situation
- ☐ It was somewhat difficult to imagine myself in this situation, but I managed
- ☐ I found it very difficult to imagine myself in this situation
- ☐ I could not imagine myself in this situation

**G. You are house-sitting for a friend and taking care of her dog while she's on vacation. She has a nice townhouse and a small fenced backyard for her dog to run around in. She asks you to be sure to lock the front gate when you leave so that the dog can't run off the property. She says that the first thing the dog does whenever he goes into the front yard is to jump up against the gate and because of this, her dog has gotten out of the front yard before and ran into the enclosed courtyard of her townhouse complex. Her dog has gotten into the courtyard before and dug up a few of the garden plants . One Monday, before you leave, you receive a very upsetting phone call from your parents that leaves you disoriented. As you drive to work, you suddenly wonder whether you remembered to lock the front gate or not.**  
(High Responsibility, Low Severity, High Probability)

**1. How much of an urge to check the front gate would you have in this situation?**

- ☐ no urge to check
- ☐ slight urge to check
- ☐ moderate urge to check
- ☐ strong urge to check at least once
- ☐ strong urge to check repeatedly

**2. How likely would you be to actually go back to check to make sure that you locked the front gate?**

- ☐ I would not go back to check
- ☐ I might go back to check
- ☐ I would probably go back to check
- ☐ I would definitely go back to check once
- ☐ I would go back to check repeatedly

**3. How likely would you be to ask another person to check for you (e.g., by calling a neighbor, friend or family member)?**

- ☐ I would not ask another person to check
- ☐ I might ask another person to check
- ☐ I would probably ask another person to check
- ☐ I would definitely ask another person to check
- ☐ I would repeatedly ask another person to check

**4. How likely would you be to ask others to reassure you that the situation is not dangerous/risky and does not require any action by you (e.g., by asking a friend "I don't know if I remembered to lock the front gate or not, do you think I should go back to check?")?**

- ☐ I would not ask another person for reassurance
- ☐ I might ask another person for reassurance
- ☐ I would probably ask another person for reassurance
- ☐ I would definitely ask another person for reassurance
- ☐ I would repeatedly ask another person for reassurance

5. How anxious/uncomfortable would you feel if you did not check on the front gate yourself, or have someone check for you?

- ☐ not at all anxious
- ☐ slightly anxious
- ☐ moderately anxious
- ☐ very anxious
- ☐ extremely anxious

6. How much would you worry (i.e., continue to think) about the front gate if you did not check on it yourself, or have someone check for you?

- ☐ I would not worry
- ☐ I might worry
- ☐ I would probably worry
- ☐ I would definitely worry at least briefly
- ☐ I would worry repeatedly
- ☐ I would worry constantly

*Please make the following ratings based on how you would feel if you found yourself in this situation (AND NO ONE HAD CHECKED, not what you think is "logical").*

7. How likely does it feel that harm will occur in this situation?

- ☐ it feels *unlikely*
- ☐ it feels *somewhat unlikely*
- ☐ it feels *somewhat likely*
- ☐ it feels *likely*

8. How responsible would you feel for preventing any harm in this situation?

- ☐ not at all responsible
- ☐ somewhat responsible
- ☐ mostly responsible
- ☐ totally responsible

9. If harm were to occur in this situation, how severe do you feel the harm would be?

- ☐ trivial
- ☐ mild
- ☐ moderate
- ☐ severe

10. How vividly were you able to imagine yourself in this situation?

- ☐ It was easy for me to imagine myself in this situation
- ☐ I was able to imagine myself in this situation
- ☐ It was somewhat difficult to imagine myself in this situation, but I managed
- ☐ I found it very difficult to imagine myself in this situation
- ☐ I could not imagine myself in this situation

**H. You and a friend are camping in the woods. The weather has been very dry and very windy during your trip. One night, your friend goes to bed early with a headache. She reminds you to put the fire out before you go to bed because it is an open fire and sparks have blown from it onto the grass before. You stay up very late, reading by the campfire and drinking beer until you feel fairly drunk and can barely keep your eyes open. Half an hour later, you wake up in your tent and realize that you can't remember whether you put out the fire or not.**

(High Responsibility, High Severity, High Probability)

**1. How much of an urge to check the fire would you have in this situation?**

- ☐ no urge to check
- ☐ slight urge to check
- ☐ moderate urge to check
- ☐ strong urge to check at least once
- ☐ strong urge to check repeatedly

**2. How likely would you be to actually check to make sure that the fire is out?**

- ☐ I would not check
- ☐ I might check
- ☐ I would probably check
- ☐ I would definitely check once
- ☐ I would check repeatedly

**3. How likely would you be to ask another person to check for you (e.g., your friend)?**

- ☐ I would not ask another person to check
- ☐ I might ask another person to check
- ☐ I would probably ask another person to check
- ☐ I would definitely ask another person to check
- ☐ I would repeatedly ask another person to check

**4. How likely would you be to ask others to reassure you that the situation is not dangerous/risky and does not require any action by you (e.g., asking your friend "I don't know if I remembered to put out the fire or not, do you think I should check?")?**

- ☐ I would not ask another person for reassurance
- ☐ I might ask another person for reassurance
- ☐ I would probably ask another person for reassurance
- ☐ I would definitely ask another person for reassurance
- ☐ I would repeatedly ask another person for reassurance

**5. How anxious/uncomfortable would you feel if you did not check the fire yourself, or have someone check for you?**

- ☐ not at all anxious
- ☐ slightly anxious
- ☐ moderately anxious
- ☐ very anxious
- ☐ extremely anxious

**6. How much would you worry (i.e., continue to think) about the fire if you did not check it yourself, or have someone check for you?**

- ☐ I would not worry
- ☐ I might worry
- ☐ I would probably worry
- ☐ I would definitely worry at least briefly
- ☐ I would worry repeatedly
- ☐ I would worry constantly

***Please make the following ratings based on how you would feel if you found yourself in this situation (AND NO ONE HAD CHECKED, not what you think is "logical").***

**7. How likely does it feel that harm will occur in this situation?**

- ☐ it feels *unlikely*
- ☐ it feels *somewhat unlikely*
- ☐ it feels *somewhat likely*
- ☐ it feels *likely*

**8. How responsible would you feel for preventing any harm in this situation?**

- ☐ not at all responsible
- ☐ somewhat responsible
- ☐ mostly responsible
- ☐ totally responsible

**9. If harm were to occur in this situation, how severe do you feel the harm would be?**

- ☐ trivial
- ☐ mild
- ☐ moderate
- ☐ severe

**10. How easily were you able to imagine yourself in this situation?**

- ☐ It was easy for me to imagine myself in this situation
- ☐ I was able to imagine myself in this situation
- ☐ It was somewhat difficult to imagine myself in this situation, but I managed
- ☐ I found it very difficult to imagine myself in this situation
- ☐ I could not imagine myself in this situation

## Appendix 2

### *Overview of Procedure for Telephone Checking Experiment in Study 2*

Procedure	Example
<b>BLOCK 1 (A)</b>	
Provocation of urge to check	Open door then close and lock it, return to the telephone without checking.
Obtain ratings on premeasures	
Check <i>one</i> time	Check door lock <i>one</i> time according to guidelines.
Obtain ratings on postmeasures	
Filler task	
<b>BLOCK 2 (B)</b>	
Provocation of urge to check	Turn the stove element on then turn it off, return to the telephone without checking.
Obtain ratings on premeasures	
Check <i>one</i> time	Check stove element <i>one</i> time according to guidelines.
Obtain ratings on postmeasures	
Filler task	
<b>BLOCK 3 (B)</b>	
Provocation of urge to check	Turn the stove element on then turn it off, return to the telephone without checking.
Obtain ratings on premeasures	
Check <i>ten</i> times	Check stove element <i>ten</i> times according to guidelines.
Obtain ratings on postmeasures	
Filler task	
<b>BLOCK 4 (A)</b>	
Provocation of urge to check	Open door then close and lock it, return to the telephone without checking.
Obtain ratings on premeasures	
Check <i>ten</i> times	Check door lock <i>ten</i> times according to guidelines.
Obtain ratings on postmeasures	

*Note.* For this example, the door was determined to be the high relevance item, while the stove element was determined to be the low relevance item. Using a coin toss, the door was designated item 'A', while the stove element was designated item 'B'. The order of the experiment was determined randomly to be 'ABBA'.

## Appendix 3

### *Abridged Instructions for Telephone Checking Experiment*

#### **General Orientation**

The interviewer (who is not blind to the hypotheses of the study and to item relevance) reviews with the participant the items to be checked, the guidelines for a "proper check" of the high and low relevance items, and the previously reported feared consequences associated with each item, then introduces the experimenter (who is blind to the hypotheses of the study and to the idea of item relevance).

#### **Experimenter Script**

Hi <participant's name>. I'm <experimenter's name>. How are you? <Insert supportive comment here> and I'll be doing the experiment with you today.

Now what I'd like to do is give you an overview of the plan for today's experiment. I'm going to ask you to do four different checking tasks on the two items that you and <interviewer's name> have talked about.

Before each task, I'll explain to you exactly which object we'll be working with for that block and what I'd like you to do.

There will be five steps in each block, but don't worry about remembering all of the steps, because before each step I'll give you detailed instructions so that you'll know exactly what to do. Let me give you a quick run down of what each block will look like.

At the beginning of each block, I'll first ask you to go into the room with the item and (turn it on/open it/plug it in/<other>), leave it that way for a minute or two based on my instructions and then (turn it off/close it/unplug it/<other>) and come right back to the telephone **WITHOUT CHECKING IT IN ANY WAY.** <PAUSE>

Second, once you're back on the telephone, I'll ask you to make some ratings for me on a 0 to 10 scale. When you are making these ratings, keep in mind that you can use any point on the scale, so for example, you can say 4.5 or 4 and a half if that seems right to you. <PAUSE>

Third, I'll ask you to go back into the room and check (according to the guidelines we've gone over) a specific number of times that the item is properly and safely secured and then come back to the telephone. <PAUSE>

Fourth, once you're back on the telephone, I'll ask you to make some more ratings for me. <PAUSE>

The last portion of each block will consist of a brief, non-checking task that will take about one minute. <PAUSE>

There will be four blocks like this in the experiment. And as you can see, in each block, you'll complete some checking of the item.



Do you feel that you understand the procedure? *<If not, repeat instructions in different words until participant indicates that he/she understands>.*

During the experiment, when it comes time to make the ratings, as you and *<interviewer's name>* discussed, I'll ask you to make the ratings from a different room than the rooms where your item is located, so that you're not looking at it while you make the ratings. Does that sound OK?

Finally, as you discussed with *<interviewer's name>*, it is important that no one else is around during the experiment. Can you make arrangements for that now?

## **BLOCKS #1 and #2**

Please go and (turn on/plug in/open/*<other>*) the *<item A or B>* and *<insert special guidelines here>*. After you've done this, please come back to the telephone immediately **WITHOUT CHECKING IN ANY WAY.**

## **PROVOCATION**

*<After participant returns>* You're back. Thanks for doing that. What I'd like you to do now is make some ratings for me on a 0 to 10 scale. You can use half points if necessary. Please make these ratings based on how you feel currently, not based on what would seem "logical".

## **PRE-CHECK RATINGS**

1. The first question is: Do you feel anxious right now? Could you please rate your current level of anxiety, if any, on a 0 to 10 scale, where 0 means not at all anxious or completely calm and 10 is the worst anxiety that you could experience. *<Participant's rating>*
2. The second question is: How likely does it *feel* that harm will occur in this situation if you don't check? Please make your rating on a 0 to 10 scale where 0 means not at all likely and 10 means it will definitely happen. *<Participant's rating>*
3. The third question is: How responsible do you *feel* for preventing harm in this situation? Please make your rating on a 0 to 10 scale where 0 means not at all responsible for harm and 10 means completely responsible for any harm. *<Participant's rating>*
4. The next question is: If harm were to occur in this situation, how severe do you *feel* it would it be? Please make your rating on a 0 to 10 scale where 0 means not at all severe or really trivial harm and 10 means extremely severe or catastrophic harm. *<Participant's rating>*
5. The next question is: How much would you like to check that the *<item A or B>* is (off/closed/unplugged/*<other>*) properly and safely? Please make your rating on a 0 to 10 scale where 0 means you have absolutely no desire to check and 10 means you feel that you absolutely must check. *<Participant's rating>*

6. The next question is: Is the <item A or B> (turned off/closed/unplugged/<other>) properly and safely?

YES

NO (circle one)

7. The next question is: How confident are you that you (turned off/closed/unplugged/<other>) the <item A or B> properly and safely? Please make your rating on a 0 to 10 scale where 0 means not at all confident and 10 means absolutely, 100% confident. <Participant's rating>

Great! Now I'd like you to go back into the room with the <item A or B> and check **ONE TIME ONLY** that it has been (turned off, closed/unplugged/<other>) properly and safely following the guidelines that we have agreed upon. Then I'd like you to come back to the telephone right away.

### **CHECKING TASK**

<After participant returns> You're back. Thanks for doing that. Now I'd like you to make some ratings for me on a 0 to 10 scale. You can use half points if necessary. Please make these ratings based on how you feel currently, not based on what would seem "logical".

**POST-CHECK RATINGS** (same as for precheck above)

### **FILLER TASK**

### **BLOCKS #3 and #4**

Please go and (turn on/plug in/open/<other>) the <item A or B> and <insert special guidelines here>. After you've done this, please come back to the telephone immediately **WITHOUT CHECKING IN ANY WAY.**

### **PROVOCATION**

<After participant returns> You're back. Thanks for doing that. Before we move on, I'd like you to make some ratings for me on a 0 to 10 scale. You can use half points if necessary. Please make these ratings based on how you feel currently, not based on what would seem "logical".

### **PRE-CHECK RATINGS**

Great! Now I'd like you to go back into the room with the <item A or B> and **CHECK TEN TIMES** that it has been (turned off, closed/unplugged/<other>) properly and safely following the guidelines that we have agreed upon. So what that means is that I'd like you to do a check, then turn away and count aloud what number that check is and then turn back and check again, then turn away and say aloud what number that check is and so on until you have checked **TEN TIMES**. When you're done I'd like you to come back to the telephone right away.

### **CHECKING TASK**

Thanks! Now I'd like you to make some ratings for me on a 0 to 10 scale. You can use half points if necessary. Please make these ratings based on how you feel currently, not based on what would seem "logical".

***POST-CHECK RATINGS***

***FILLER TASK***