THESIS

Cognitive Aspects of Obsessive-Compulsive Disorder in Children and Adults: the Role of Inflated Responsibility and Uncertainty

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ABSTRACT

Aims

Experimental work shows that inflated responsibility may be causally related with adult obsessive-compulsive disorder (OCD). The inflated responsibility model has been tested in children, but mixed results have been obtained. The current work aimed to test the role of responsibility in children. However, other cognitions such as uncertainty and intolerance to it may also be relevant for the emergence of OCD. Research testing the causal role of uncertainty in OCD is very sparse. The current work also aimed to test causal effects of inflated responsibility and uncertainty on anxiety and compulsive urges in adults.

Study 1 adapted an experimental task for manipulating responsibility in children and a coding system used to assess obsessive-compulsive-like behaviours. This methodology was used in Study 2, an experiment that aimed to test the effects of inflated responsibility on anxiety, OCD-like behaviours, and experimental task speed in children. Study 3 tested the effect of inflated responsibility and uncertainty on anxiety, compulsive urges, and task duration in adults. Study 4 examined the effect of inflated responsibility, uncertainty, and checking on the same variables, also in adults.

Method

In study 2, responsibility was manipulated in 68 healthy children ages 9 to 12 using a sweet-sorting task. Children were randomly assigned to one of three groups: high responsibility, low responsibility, and control. Dependent variables were anxiety (immediately after the sorting, 10 minutes later, and 24 hours later), checking, hesitating, and time taken to complete the sorting. In experiments 3 and 4 adult participants (N= 64 and 74, respectively; non-clinical samples) completed a pill-sorting task which manipulated responsibility and uncertainty. In Study 3, uncertainty was manipulated via false feedback about accuracy of the sorting. Study 3 was a 2 (high responsibility, no- responsibility) X 2

(high-uncertainty, no-uncertainty) design. In Study 4, all participants had high responsibility. Uncertainty was manipulated via false feedback and by allowing or forbidding checking during sorting. Study 4 was a 2 (uncertainty, no uncertainty) X 2 (checking, no checking) design.

Results

The responsibility manipulation in Study 2 was not successful. Study hypotheses were not supported. In study 3 the responsibility and uncertainty manipulations were successful. Responsibility had no effect on anxiety and compulsive urges. However, participants in the high-uncertainty (i.e., negative feedback) condition reported significantly higher anxiety and urge to seek reassurance than participants in the no-uncertainty (i.e., positive feedback) condition. In Study 4 the responsibility manipulation was successful, but the feedback manipulation for uncertainty was not. However, checking behaviour significantly changed uncertainty. Checking had no effect on anxiety and compulsive urges; however, participants who received positive feedback experienced a constant decrease in anxiety over time, while those who received negative feedback experienced an increase. Also, those who received positive feedback reported a significant decrease in urge to see reassurance over time; this was not observed in participants who received negative feedback.

Conclusion

Study 2 hypotheses were not supported, and this was due to the responsibility manipulation being unsuccessful. It is possible that the responsibility manipulation was not strong enough. A lack of current developmental framework for inflated responsibility may limit experimental work on this cognition in children. Study 3 and Study 4 tested the inflated responsibility model of OCD in adults, but also added uncertainty as a possible causal factor for the disorder. Results showed that confidence and uncertainty can be successfully manipulated via feedback and checking, using a pill-sorting paradigm. Surprisingly, results did not provide support for the inflated responsibility model; only feedback

seemed to have an effect on anxiety and urge to seek reassurance. As these were non-clinical samples, these results show a causal relationship between low-confidence/uncertainty and compulsive urges.

Overall these findings indicate that responsibility may not be sufficient or even necessary to cause the onset of OCD, and that uncertainty may be important. Future work should further test the effects of confidence/ uncertainty on anxiety and obsessive-compulsive like behaviours and urges in adults.

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Declaration

I declare that the research contained in this thesis, unless otherwise formally indicated within the text, is the original work of the author. The thesis has not been previously submitted to this or any other university for a degree, and does not incorporate any material already submitted for a degree.

Sorina Armeanca

PART I: GENERAL ASPECTS OF OBSESSIVE-COMPULSIVE DISORDER

The present document is part of the requirements for the PhD degree. It is an overview of the work I have completed during my doctoral program, under the guidance of my supervisors. It contains background information on Obsessive-Compulsive Disorder (OCD), with a focus on the inflated responsibility model and other cognitive aspects such as uncertainty. In addition, it addresses behavioural elements such as compulsive checking and excessive reassurance seeking. This thesis also describes an object sorting paradigm used for manipulating responsibility in adults (i.e., pills sorting) and in children (i.e., sweets sorting), and an associated behavioural coding system for recording obsessive- compulsive behaviours.

The thesis is composed of four parts. Part I addresses general aspects of OCD, such as symptoms, epidemiology and course of the disorder, comorbidity, and theoretical models. Other aspects such as the importance of this work for our understanding of OCD and for developing effective interventions, and the relevance of conducting research in this area using analogic samples are also discussed here.

Part II reviews developmental aspects of OCD and describes two studies with children – one methodological and one experimental – that were conducted as part of the requirements for this PhD. Relevance of this work for increasing our understanding of OCD aetiology is also discussed here. Study 1 describes the refinement of a sweet-sorting experimental task for inflating responsibility and of an associated coding system for assessing obsessive-compulsive behaviours (i.e., checking, hesitation, and reassurance seeking) in children. The sorting paradigm is used in Study 2 with a sample of children aged 9 to 12. The aim of this study was to test the effects of inflated responsibility on anxiety, obsessive-compulsive-like behaviour, and experimental task duration. The sweet sorting paradigm is an adaptation of a pill sorting task aimed at inflating responsibility in adults. Results are presented and discussed, and implications of these findings are considered.

Part III of this thesis contains a brief review of OCD in adults and introduces new relevant cognitive aspects such as uncertainty and intolerance of uncertainty. Two experimental studies with adults (i.e., Study 3 and Study 4), also conducted as part of the requirements for this PhD, are described in detail. These studies aimed to investigate the effects of inflated responsibility, reassuring feedback / uncertainty, and checking on anxiety, compulsive urges, and experimental task duration. Responsibility was manipulated using a pill sorting task, and uncertainty was manipulated using reassuring vs. non-reassuring feedback about the sorting. Theoretical background for this work and a detailed description of methods and results are also included. Findings from each study are discussed separately and followed by a summary of this section.

Part IV is an overview of the previous sections, and includes a general discussion of how this work fits within the existing OCD literature. Conclusions, clinical implications, and directions for future research are also included in this final section.

Chapter 1: Background

1.1. Introduction

Obsessive-compulsive disorder (OCD) is a chronic and debilitating condition that can lead to severe impairment and distress on an individual level, and can affect functioning of both the patient and others involved (e.g., relatives, carers). Also, there are significant financial and social implications of OCD, as it can lead to prolonged unemployment and costs the health system millions of pounds each year (National Institute for Health and Clinical Excellence [NICE], 2005). Considering the serious consequences for individuals and families and the socio-economic impact OCD can have, it is important to understand how it develops and is maintained, and to design effective prevention and treatment programs to target the disorder.

The main aim of this work was to test the inflated responsibility model of OCD (Salkovskis, 1985). The model proposes that people with OCD believe they have pivotal power to prevent or cause negative consequences for self and others, and that these beliefs cause distress, and trigger anxiety and the use of compulsive behaviour. A considerable body of research has investigated the model in adults, and there are also a few studies with children. Although findings reported in the adult literature are mixed, there is evidence that responsibility plays a central role in OCD. Also, over the last few decades, the inflated responsibility model has been used to develop successful cognitive-behavioural interventions (e.g., Ladouceur, Leger, Rheaume, & Dube, 1996). However, it is still unclear if the model applies to children and adolescents, so Study 2 investigated the role of responsibility in paediatric OCD using a non-clinical sample. Also, other cognitive aspects (e.g., uncertainty) may be important for the development and maintenance of the disorder. The present work also aimed to test this possibility using adult samples (i.e., Study 3 and

Study 4).

This first section of this thesis provides a general overview of the main manifestations in OCD (i.e., obsessions and compulsions), describes the epidemiological and diagnostic aspects of OCD, and discusses the relevance of this body of work to our understanding of the disorder. Implications for treatment and the importance of using analogic samples for investigating the aetiology and maintenance of OCD are also addressed.

1.2. Brief Description of Obsessive-Compulsive Disorder

Obsessive-compulsive disorder is a chronic mental health illness characterized by recurrent obsessions and / or compulsions that are time consuming and cause distress or impair functioning (American Psychiatric Association [APA], 2000). It is one of the top ten most debilitating conditions in the world (World Health Organisation [WHO], 2001), and can cause impairment in all areas of functioning, including social and work related aspects (Palermo et al., 2011). As with most psychiatric conditions, more severe OCD symptoms are associated with higher impairment of personal and professional functioning (Ruscio, Stein, Chiu, & Kessler, 2010). Obsessive-compulsive disorder was previously classified as an anxiety disorder, but more recently the Diagnostic and Statistical Manual of Mental Disorders (DSM-V; APA 2013) has separated it from the anxiety disorders group and included it into a new category of obsessive-compulsive and related disorders along with disorders such as hoarding and body dysmorphic disorder.

Obsessions are unwanted intrusive thoughts, images or impulses that generate anxiety, they are not simple worries about real life problems, and most patients have insight about them being a product of their mind. Obsessive-compulsive disorder is a heterogeneous disorder, so patients can experience intrusions regarding an array of themes, and display a variety of compulsive behaviours. However, several general categories of obsessions have been identified: intrusions about harm to self or others, contamination,

symmetry, and sexual/religious themes.

Up to 90% of the general population experience intrusions similar to those present in OCD (Rachman & de Silva, 1978; Belloch, Morillo, Lucero, Cabedo, & Carrió, 2004). Most people do not pay special attention to intrusions and can easily dismiss them, without making much of them. However, people with OCD see intrusions as having special meanings, and pay special attention to them. They believe these intrusions predict negative events (e.g., thinking of someone being in a car accident would cause that person to actually have an accident) or mean something negative about them as a person (e.g., thinking about someone being in a car crash meaning they want that person to get injured or die). For these reasons, OCD patients see intrusions as unacceptable, threatening, and needing to be controlled. According to cognitive models of OCD, it is the interpretation or meaning that the individual gives these intrusions that leads to obsessional anxiety and to compulsive behaviour. In OCD, obsessions are unwanted, distressing, seen as inappropriate, but meaningful, so the individual constantly tries to ignore or neutralize them by using compulsions (APA, 2000).

Compulsions are repetitive, ritualistic behaviours or mental acts that are time consuming (i.e., more than an hour per day) and aimed at decreasing the anxiety generated by obsessions and at preventing negative events from happening (APA, 2000). They differ from automatic behaviours such as tics in that they are intentional and they often follow certain rules (Abramowitz, Taylor, & McKay, 2009). They also differ from behaviours that are inherently pleasurable, such as pathological gambling (Hollander & Rosen, 2000), in that they aim to reduce or remove a threat. Compulsions can be behaviours such as ordering / arranging, checking, cleaning, reassurance seeking, or mental acts such as counting or neutralizing thoughts (APA, 2000; Rachman, 2002; Bloch, Landeros-Weisenberger, Rosario, Pittenger, & Leckman, 2008). Even though individuals with OCD have a sense of compulsions being excessive and unreasonable, they feel compelled to use them.

1.3. Epidemiology

Estimates of OCD prevalence in the general population vary. In adults, a twelve-month prevalence between 1% and 2.3% has been reported (Voderholzer, Schlegl, & Külz, 2011; Ruscio et al., 2010), and a lifetime prevalence of 0.8% - 3% (Kessler, Berglund, Demler, & Walters, 2005; Fullana et al., 2009; Ruscio et al., 2010; APA, 2000; Torres et al., 2006). In children and adolescents, lifetime prevalence has been found to be between .01% and 4% (Heyman et al., 2001; Zohar, 1999). The differences in these estimates are rather large and may reflect differences in methodology between these studies, such as definition of symptoms and diagnostic tools used, or training level of assessors diagnosing participants, the age of participants in the study, as well as more practical aspects such as access to services in the community.

Several demographic differences have been reported for OCD. In children and in adults aged 65 and older the prevalence of OCD is higher for males than females (Geller et al., 2006; Lochne et al., 2004; Grenier, Preville, Boyer, & O'Connor, 2009). However, among working age adults, higher lifetime prevalence has been reported for women, i.e., 1.3% vs. 0.9% (Torres et al., 2006). According to Torres et al. (2006), the highest prevalence is in the 16-24 year-old group (i.e., 1.4%) and it progressively decreases with age. Also, compared to individuals with other psychiatric diagnoses, OCD patients tend to be younger, live in an urban environment, and are less likely to have a job and be married.

A longitudinal study by Fullana et al. (2009) used semi-structured interviews to assess obsessive-compulsive symptoms in a sample from a longitudinal birth cohort study (i.e., the Dunedin study in New Zealand). A sample of over 900 participants were assessed at ages 11, 26, and 32. Between 13% and 17% of the sample experienced obsessions and compulsions at different ages (even though they did not have any mental health diagnosis). Out of those who experienced OCD symptoms, 15% were bothered by their obsessions and 12% by their compulsions. Ruscio et al. (2010) examined obsessive compulsive symptoms

in a community sample of over 2000 individuals over 2 years. Face-to-face interviews were used to assess obsessive-compulsive symptoms in individuals aged 18 and over. A lifetime prevalence of 28.2% for obsessions or compulsions was found. These studies show that obsessive-compulsive symptoms are present in the general population. However, only some individuals are bothered by them or develop OCD. It is still unclear what causes this difference, but there is indication that cognitions play a role, i.e., the interpretation people with OCD give their obsessions and compulsion. Cognitive models of OCD are discussed in detail in Chapter 2 (see pg. 34).

1.4. Onset and Course of Obsessive-Compulsive Disorder

Obsessive-compulsive disorder has a bimodal distribution in terms of age of onset, with the two peaks in preadolescence and adulthood (Geller et al., 2006). As a result, a distinction has been made between early-onset and a late-onset OCD. A systematic review of early vs. late onset OCD found that mean age for early onset was 11 years, and for late onset, 23 (Taylor, 2011). Similarly, in a sample of 293 adults with OCD, Pinto, Mancebo, Eisen, Pagano, and Rasmussen (2006) found that the mean onset age for the early-onset group was 11 years and for the late onset 26 years. Hemmings et al. (2004) found that 53% of 252 adults with OCD reported the onset of their disorder to have been before the age of 15 years.

Some authors have suggested that early and late onset reflect different types of OCD (e.g., Rosario-Campos et al., 2001). Others suggest that that early onset is a more severe form of OCD than late onset (e.g., Geller et al., 2001) but not a distinct disorder or type. Pinto et al. (2006) found no significant differences in patients with early and late onset of OCD in relation to the severity and onset of the symptoms (i.e., sudden vs. gradual), participants' insight or impairment on functioning, or the course of the disorder. However, the early onset group had higher comorbidity with panic and eating disorders. Other studies have also found differences, with individuals with early-onset OCD reporting

more obsessions and compulsions, more severe symptoms, higher comorbidity and fewer benefits from serotonin reuptake inhibitors (SRIs) treatment compared to those with late-onset OCD (Sobin et al., 2000). Taylor (2011) conducted a systematic review of early vs. late onset OCD and found that early onset was more common in males, associated with more severity and different symptoms, more comorbidity, and poorer treatment response. Further, the two forms differed in symptom development over time. Taylor concluded that early onset is not a more severe form of late onset OCD, but a distinct form of the disorder. He also suggested that the two subtypes may have different aetiology, i.e., early-onset OCD may have a stronger genetic or biological component compared to late-onset OCD. However, there is no empirical evidence for this theory.

Obsessive-compulsive disorder usually has a chronic and continuous course of symptoms (Pinto et al., 2006). Overall, OCD patients experience the disorder for 8.9 years (Ruscio et al., 2010), and the odds of the disorder persisting are higher for women (Ruscio, 2010; Torres, 2006). Ruscio et al. (2010) found that the strongest predictor for lifetime OCD is age, with individuals aged 18 to 29 presenting the highest risk for developing the disorder (Ruscio et al., 2010). Fullana et al. (2009) (see pg. 28) conducted diagnostic interviews at ages 11, 26, and 32. Children who presented obsessive-compulsive symptoms at 11, were five times more likely to have OCD as adults (i.e., at ages 26 and 32). Fullana et al. also found that some OCD symptoms are stable over time with contamination/cleaning and symmetry/ordering being the most stable, and harm/checking and shameful thoughts less so. These symptom dimensions also seem to exist across cultures (Matsunaga et al., 2008) and over the life span (Stewart et al., 2008). Mataix-Cols et al. (2002) explored symptom stability in 117 adults with OCD over two years. Most patients retained their symptoms over time, and sexual/religious and somatic obsessions were the most stable. Aggressive and contamination obsessions, checking, cleaning, hoarding, counting, and ordering were more likely to change over a period of six months, although changes were more common within, rather than between, symptom dimensions

(e.g., obsessions about health may transfer from cancer to AIDS).

1.5. Comorbidity

Epidemiological studies conducted in different parts of the world indicate that OCD is highly comorbid with other mental health disorders and that pure OCD cases are rarer than comorbid cases. For example, in the United States of America (USA), Pinto et al. (2006) investigated the naturalistic course of OCD in 293 patients (mean age 40.49 years, SD = 12.9, range 19–75) over 5 years. DSM-IV criteria were used for diagnosis. Ninety percent of the sample experienced at least one other mental health diagnostic over their lifetime. Similarly, Ruscio et al. (2010) reported that adults in the USA with OCD also met diagnostic criteria for an anxiety disorder (75.8%), mood disorders (63.3%), disorders related to impulse control (55.9%), and substance use disorders (38.6%).

An epidemiological study of 955 adults with OCD in Brazil (Torres et al., 2013) revealed that only 7.7% of the sample presented pure OCD. Comorbidity rates were 36.8% for depression, 31.4 % for GAD, 36.8% for depressive episode, 22.1% for agoraphobia or panic disorder, and 17.3% for social phobia. In Switzerland, Angst et al. (2005) found that of 591 adults with OCD the majority had at least one comorbid mood or anxiety disorder. Patients with OCD and co-morbid mental health diagnoses were more likely to be more impaired and to seek treatment than individuals with pure OCD. Overall, these data support Torres et al. (2013)'s conclusion that in OCD comorbidity is "the rule rather than the exception".

1.6. Heterogeneity in Obsessive-Compulsive Disorder

Obsessive-compulsive disorder is heterogeneous in terms of symptom manifestation. For example, one OCD patient could experience intrusions about someone breaking into the house and thus engage in compulsions of checking the door and window locks, while

another OCD could experience intrusions of contamination and wash their hands excessively. Also, a patient can experience one or more symptoms at any given time, and over 50 obsessions and compulsions have been identified (Goodman et al., 1989).

In spite of the numerous possible manifestations of OCD several major symptom categories have been described in the literature: 1) symmetry obsessions and repeating, counting, and ordering compulsions, 2) hoarding obsessions and compulsions, 3) contamination obsessions and cleaning compulsions, 4) aggressive obsessions and checking compulsions, and 5) sexual/religious obsessions and related compulsions (Leckman et al., 1997). Mataix-Cols et al. (2005) proposed a dimensional conceptualisation of OCD. They suggested that to better understand the disorder, research should investigate the aetiology of each symptom dimension. Similarly, Fontenelle (2005) proposed that OCD is a set of related syndromes that can be differentiated depending on age of onset, comorbidity, neurobiological aspects etc. Also, obsession domains seem to correspond to compulsions as the nature of the obsessions seems to dictate the form that compulsions take. For example, individuals who experience high levels of doubt and obsessions about harming others may engage more in compulsions that ensure safety, such as checking and reassurance seeking.

1.7. Summary of Chapter 1

In summary, OCD is a disorder characterized by obsessions and / or compulsions and can have severe health, social, and economic consequences. It occurs in at least 1% of the general population, and it can have an early onset (i.e., early to mid-teen) or a late onset (i.e., early to mid-twenties). Obsessive-compulsive disorder runs a chronic course and is often comorbid with other psychiatric conditions. Although it is a heterogeneous disorder, several main symptom categories have been identified for both obsessions and compulsions.

Because of its severity and complexity of symptoms, OCD has received considerable attention in the literature. Different theoretical models have been proposed for

how it develops and maintains and, based on these, numerous pharmaceutical and psychological treatments have been developed. However, existing treatments are not effective for all patients, and some treatments such as exposure-response prevention lead to high dropouts because they are aversive (Abramowitz, Braddock, & Moore, 2008). Also, treatments for children are adapted from adult interventions so more developmentally appropriate approaches are needed (Reynolds et al., 2008). Further investigations of OCD models could help us better understand and treat the disorder. The next section describes the main biological and psychological models of OCD.

Chapter 2: Medical and Psychological Models of Obsessive-Compulsive Disorder

2.1. Introduction

Intrusions and compulsive-like behaviours are common in the general population (Fullana et al., 2010), however only a small percentage of individuals meet diagnostic criteria for OCD. Different explanations have been offered for why only certain individuals develop the disorder. Many of these models focus on biological aspects (e.g., genetic vulnerabilities) or psychological aspects (e.g., environmental factors), with most approaches taking into consideration both biological and psycho-social factors and their interplay.

The next section discusses neurobiological, genetic, and psychological models of OCD.

2.2. Biological Models of Obsessive-Compulsive Disorder

Obsessive-compulsive disorder has a strong biological component. Evidence for this comes from medical and pharmaceutical observations. For example, brain imaging studies show differences in neural activity of OCD patients compared to controls (Whiteside, Port, & Abramowitz, 2004) and deep brain stimulation (DBS) can improve OCD symptoms (Greenberg et al., 2010). Also, medication such as serotonin reuptake inhibitors can modify and keep obsessions and compulsions under control (Dell'Osso, Nestadt, Allen, & Hollander, 2006). Furthermore, a considerable body of research on biological models of OCD comes from genetic studies (Nestadt, Grados, & Samuels, 2010). Relevant findings from these areas of research are discussed in this section.

2.2.1. Neurobiological aspects. Neurobiological models of OCD propose that structural and functional anomalies in the brain are responsible for the development of the

disorder. Several aspects have received considerable attention: brain circuitry/functioning, brain anatomy, and neurochemistry.

2.2.1.1. Brain functioning and anatomy. One area where most brain circuitry and structure abnormalities have been observed in OCD patients is the orbitofrontal cortex (Chamberlain et al., 2008; Lazaro et al., 2008). In a meta-analysis, Whiteside et al. (2004) reviewed 13 brain imaging studies that compared brain functions in OCD patients and healthy controls. The studies used positron emission tomography (PET) and single photon emission computed tomography (SPECT) techniques, which allow researchers to observe brain activity (not only structures, as with magnetic resonance imaging – MRI – for example). The conclusion of the meta-analysis was that OCD patients present hyperactivity in the orbitofrontal cortex, and especially in the left orbital gyrus and the caudate nuclei (which are part of the striatum, in the basal ganglia).

The orbito-frontal area is involved in cognitive processing of decision-making (Cavedini, Riboldi, D'Annucci, Belotti, Cisima, & Bellodi, 2002; Sachdev & Malhi, 2005; Manes et al., 2002), inhibitory control (Elliott et al., 2000; Johannes et al., 2003), and emotional processing (Kalin et al., 2007). Decision-making processes affected in these areas are believed to be responsible for chronic doubt in OCD (Greisberg & McKay, 2003). Also, one of the believed consequences of dysfunctional inhibitory control is difficulty with intentionally inhibiting simple motor activity (Huey et al., 2008), which in turn may be responsible for compulsive behaviour (Chamberlain et al., 2006; Morein- Zamir, Fineberg, Robbins, & Sahakian, 2009). Similarly, hyperactivity in the caudate has been linked to increases in anxiety and repetitive behaviour (Meyer & Quenzer, 2005).

It has been proposed that the abnormal activity of the orbito-frontal cortex is part of a larger dysfunctional network between this area and other parts of the brain (Mataix-Cols et al., 2003). There are three frontal-subcortical circuits that originate in the prefrontal cortex (i.e., dorsolateral pre-frontal cortex, lateral orbital cortex, and anterior cingulate cortex), and direct pathways between these areas exist. The interconnection between the

orbito-frontal and the anterior cingulate cortex with the basal ganglia (including the striatum and thus the caudate nucleus) and the thalamus has been named the "OCD-loop" or "OCD-circuit" (Modell, Mountz, & Curtis, 1989; Deckersbach, Dougherty, & Rauch, 2006). Signals go from the orbito-frontal cortex to the thalamus via the caudate nucleus. The latter regulates these signals. The thalamus further sends them to other parts of the brain, but also feeds back to the orbito-frontal cortex, thus forming a loop. In OCD, the caudate nucleus is believed to fail to modulate signals from the orbito- frontal cortex to the thalamus, which leads to hyperactivity in the thalamus. These signals are then further sent back to the orbito-frontal cortex thus over-stimulating it.

Hyperactivity in this loop is believed to affect evaluation of stimuli as positive or negative, executive function, and habit learning/stereotyped behaviours such as obsessions and compulsions (Graybiel et al., 2000). Specifically, the basal ganglia which are part of this loop are believed to be involved with both cognitive and motor pattern generation, which are relevant for obsessive-compulsive manifestations (Abramowitz et al., 2009; Graybiel et al., 2000).

The role of the orbito-frontal cortex for OCD is further confirmed by studies that found pharmacological treatment, such as antidepressant medication, to decrease activity in this area in OCD patients (Lazaro, Caldu, Junque, Bargallo, Sandres et al., 2008; Beucke et al., 2013), and by studies of patients with orbito-frontal brain lesions who displayed inappropriate affect and poor decision-making (similar to OCD patients) after acquiring the lesions (Bechara, Damasio, Damasio, & Anderson, 1994). Also, studies that investigated structural neurological aspects of OCD found white matter abnormalities in frontal regions of the brain, which further confirm that these areas are involved in the disorder (Abramowitz et al., 2009), and a meta-analysis of neuroimaging studies reports concluded that OCD patients have increased grey matter volumes in the basal ganglia and that the likelihood of that was significantly higher in more severe cases (Radua & Mataix-Cols, 2009). This anomaly was interpreted as an indicator of deficits in inhibitory processes of

fear responses in this part of the brain which in OCD patients inhibits extinction to fear stimuli after repeated exposure to them. More evidence for the basal ganglia being important for OCD is that they are also involved in Tourette's syndrome (TS) (Rosenberg & Keshavan, 1998; Graybiel et al. (2000) which presents similarities in symptomatology and is commonly comorbid with OCD. This indicates that these disorders may have common neurological causes.

2.2.1.2. Neurochemistry. In terms of neurochemical aspects involved in OCD, three hypotheses have been proposed: hypersensitivity of post-synaptic serotonin receptors, dysfunctions in the glutamate system, and abnormal dopamine system (Abramowitz et al., 2009). The first hypothesis is the most tested in the literature. Serotonin dysregulation has been linked to OCD based on evidence from studies that investigated the effects of SSRIs on obsessive-compulsive symptoms (March et al., 1998). The fact that these medications can treat or alleviate obsessive-compulsive symptoms suggests that insufficient levels of serotonin are linked to the emergence of these symptoms. Some have proposed that serotonin deficiency is responsible for hyperactivity in the caudate and orbitofrontal cortex (Abramowitz, Whiteside & Deacon, 2005; Beer, Karitani, Leonard, March, & Swedo, 2002). According to this theory, serotonin inhibits anxiety and repetitive behaviour, but in OCD patients this is not possible because of its insufficient levels (Meyer & Quenzer, 2005). Abnormalities in dopaminergic systems have also been observed in OCD patients and in patients with tic disorders indicating a possible common neurochemical cause (Eichstedt & Arnold, 2001). However, Abramowitz et al. (2009) emphasised that the serotonin and dopamine hypotheses have received inconsistent support, while research involving the glutamate system is only preliminary. More work is this needed to test these theories.

Overall, the existence of advanced techniques allows extensive investigations of the brain. Techniques such as functional neuroimaging (e.g., PET and SPECT – single photon emission computerised tomography) provide valuable information and contribute to our

understanding of psychopathology. However, one limitation of this type of research is the use of radiation with these techniques. For example, the risks involved with repeated exposure (e.g., longitudinal studies) or in children are currently unknown (Rosenberg & MacMillan, 2002). Another limitation of this type of work is that most of it was conducted with OCD patients, so it is unclear whether it provides valuable information about the development of OCD. Whiteside et al. (2004) argued that since these studies are conducted *after* the disorder has emerged, these results may indicate that neurological dysfunctions cause OCD, but they may also suggest the reverse, i.e. that OCD causes these dysfunctions. Similarly, Maia, Cooney, and Peterson (2008) argued that while hyperactivity in these structures may be involved in the emergence of OCD, it may also be the result of OCD patients trying to inhibit symptoms (e.g., compulsions). There is evidence that, similar to pharmacological treatment, psychotherapy can change brain activity (Linden, 2006). This suggests that cognitive and behavioural intervention can reverse neurological processes, which could also mean that cognitions and behaviours can initially cause these neurological changes. Longitudinal studies are needed for a better understanding of the role of neurological aspects in OCD.

In summary, relatively little is known about neurological aspects of OCD (Chamberlain et al., 2005). Mataix-Cols et al. (2005) emphasise the difficulty in determining neural correlates of OCD due to heterogeneity of the disorder and to its high comorbidity and overlap with other disorders. Similarly, Graybiel et al. (2000) argue that the fact that OCD patients respond variably to pharmacological treatment suggests that they have different levels of metabolic activity in brain areas believed to be linked to the disorder. They further propose that this is an indicator of the heterogeneity of the disorder, and that a genetic vulnerability to developing the disorder may have a different impact on the OCD-circuit depending on environmental factors. Abramowitz et al. (2009) also emphasize the importance of environment and argued that biological models do not explain why these brain abnormalities manifest as contamination obsessions in one person and as

symmetry obsessions in another, for example. They propose that learning experiences might modulate the specificity of these symptoms, an idea also suggested by genetic work.

2.2.2. Genetic aspects. Studies that have examined genetic factors involved in OCD have used various methodologies, including interviews with and observations of patients and families, twin comparisons, and molecular investigations of specific genes that may be involved in the emergence of the disorder.

Family studies include the OCD patient and their family members, and can involve reviewing existing medical records of the patient and family members to determine whether they ever received a psychiatric diagnosis, or directly interviewing patients and family members to assess past or current psychiatric status. These direct interviews involve the use of diagnostic tools to establish a diagnosis and/or assess other relevant psychological aspects that may be related to OCD, such obsessionality, trait anxiety, etc. (Pauls, 2010). Family studies try to determine the prevalence of OCD and other comorbid disorders among family members, as well as the prevalence of related factors in relatives who do not meet clinical criteria for the disorder. These data can help determine whether OCD runs in families and the importance of genetic versus non-genetic factors. One such family study was conducted by Nestadt et al. (2000) who assessed 80 OCD probands and their first-degree relatives and compared them to 73 control participants and their relatives (i.e., 343 case and 300 control relatives). Patients were recruited from speciality OCD clinics. Participants were individually matched based on age, sex, race, and on whether they received medical care in the past year. Diagnostic interviews based on DSM-IV criteria were used and diagnosticians were blind to whether the subject was a proband or family member, or whether they were in the case or control group. There was a higher prevalence of current OCD among first-degree relatives of patients vs. relatives of controls (i.e., 11.7% vs. 2.7%), and a five-fold higher lifetime prevalence. Relatives were also five-times more likely to experience obsessions and twice as likely to manifest compulsions, than relatives of controls. Nestadt et al., concluded that OCD is a familial disorder, an idea

also supported by more recent similar work (e.g., Fyer, Lipsitz, Mannuzza, Aronowitz, & Chapman, 2005) and by a recent extensive review (Pauls, 2010).

These studies suggest that OCD is common among members of the same family, which may show a genetic cause for the disorder. However, given that families share both genetic and environmental factors, it is unclear from this type of work which factors are more important. Twin studies are more appropriate for determining the impact of each of these aspects because they can estimate the percentage of phenotypic variance, i.e., a gene's susceptibility to respond to environmental influences (Pauls, 2010). Monozygotic twins have identical genes (as they develop from the same egg) and dyzigotic twins share 50% of their genes (as they develop from two different eggs). Therefore higher concordance of OCD among monozygotic compared to dyzigotic twins would indicate a stronger genetic component of the disorder. Conversely, the concordance of OCD amongst twin that were separated at birth compared to twins that grew up together can highlight the relative contribution of environmental and genetic factors in the aetiology of OCD.

Iervolino, Rijsdijk, Cherkas, Fullana, and Mataix-Cols (2011) examined OCD concordance in 4355 monozygotic and dizygotic twins recruited from a UK registry. The twins were assessed using the Obsessive-Compulsive Inventory Revised (OCI-R; Foa et al., 2002). The variance of the total score on this measure was partitioned into additive genetic, and shared and non-shared environmental factors using univariate maximum-likelihood model-fitting analyses. The method involves establishing heritability estimates based on within-pair similarities between monozygotic and dizygotic twins. Effect of each of these categories of factors is typically examined by using structural equation modelling, which involves grouping genetic and environmental factors. Next, data for each phenotypic latent variable is decomposed into variance components attributable to the different categories of genetic (i.e., additive and non-additive) and environmental (i.e., shared and non-shared) effects. Iervolino et al. used multivariate model-fitting analyses to separate the covariances between obsessive-compulsive symptom dimensions into additive

genetic, and shared and non-shared environmental factors. Genetic factors accounted for 50% of the variance of obsessive-compulsive symptoms and shared and non-shared environmental factors accounted for the other 50%.

Similarly, in a review of the literature Abramowitz et al. (2009) reported that genetic factors were responsible for 27- 47% of the variance and environmental factors for 53-73% of the variance in obsessive-compulsive symptoms. Although these ranges of variability are large (which may be due to methodological differences across studies) they indicate that genetic factors are responsible for at least a third and environmental factors for at least half of the variability in OCD symptoms.

A literature review by Grootheest et al. (2005) explored twin research on OCD reported in the last 79 years. Grootheest and colleagues reviewed case studies of twins from the old literature, twin studies that used DSM criteria for diagnosis, studies that used a dimensional approach to compare similarities in monozygotic and disygotic twins, and studies that used a dimensional approach and analysed data with structural equation modelling (i.e., an analysis that models effects of latent genetic and environmental variables that may be responsible for phenotypic differences between individuals). Grootheest et al. concluded that, overall, these studies reported a genetic liability for OCD of 45-56% in children, and 27-47% in adults. The authors did not provide an explanation for this difference, but it can be hypothesised that the small range of liability in children compared to the larger range in adults indicates that genetic influences are stronger predictors of OCD earlier in life, and as the individual advances their influence becomes less consistent.

Further support for the genetic hypothesis of OCD comes from a meta-analysis by Taylor (2010) who reviewed 14 twin studies. Taylor used meta-analyses including subgroup analyses and meta-regressions using the Comprehensive Meta-Analysis software (CMA; Borenstein, Hedges, Higgins, & Rothstein, 2009). Only the additive genetic effects and non-shared environment accounted for a significant amount of variance in obsessive-compulsive symptoms. This suggests that more than one gene is involved in the emergence

of OCD, and that a genetic vulnerability is not sufficient, as environmental factors are also needed. The fact that non-shared environment factors (i.e., environmental factors that are independent of genetic inheritance, such as shared family environment) were relevant indicates that non-biological factors also play a causal role for the disorder.

Molecular genetics has also been used to identify the genetic bases for OCD, and more specifically risk genes (Hemmings & Stein, 2006). This type of research involves drawing blood from family members and probands, or twins, as well as controls, and extracting DNA. The DNA is then used to conduct genome scans which aim to identify and compare gene vulnerabilities (Stewart & Pauls, 2010). Most studies so far focused on genes that function within the serotonergic and dopaminergic systems, and more recently glutamatergic system. The reason why current research focuses on these systems is because they have been linked to neurological dysfunctions believed to be relevant for OCD (see pg. 34). However, only results showing the relevance of the glutamate transporter gene have been successfully replicated so far (Pauls, 2010), so it is unclear if genes related to the other systems are important for OCD.

Although current genome scans are limited as they can only identify broad genetic regions that involve numerous genes (Stewart et al., 2010), they are useful because OCD is a heterogeneous disorder that is most likely determined by a group of genes and interactions between them, rather than a single gene (Hudak & Dougherty, 2011). Although promising, this type of research is still preliminary and inconclusive, thus further investigations in this area are needed.

Overall, genetic studies provide evidence that biological vulnerability plays a causal role in the development of OCD. However, the evidence suggests that genetic factors play only a partial role in the development of OCD and that, therefore, environmental factors are also important. It is also possible that there is a genetic vulnerability for psychopathology in general, but that it is the environment that determines which disorder one develops (Abramowitz et al., 2009). Longitudinal work would be needed to test this possibility.

2.2.3. Autoimmunity theory. About 6% of cases of childhood onset OCD have been attributed to paediatric autoimmune neuropsychiatric disorders (PANDAS) (Mell, Davis, & Owens, 2005), a group of streptococcal infections that lead to inflammation of the basal ganglia that are responsible for voluntary motor control (da Rocha, Correa, & Teixeira, 2008). Mell et al. recruited a sample of 144 children aged 4 to 13, out of which 33 had OCD. Streptococcal infection doubled the risk of OCD within three months and the risk was triple within a year if multiple infections were experienced. However, participants were selected based on physician's diagnosis of OCD and information about OCD symptom onset was estimated based on medical charts which, per authors, may have not coincided with the true timing of disease onset (i.e., there was a delay in collecting these data due to medical procedures).

Other studies have used streptococcal antibody tests conducted with blood drawn from participants (e.g., Murphy et al., 2004), instead of information from existing medical records. These tests aim to identify streptococcal antibody production and its relationship to OCD occurrence and symptom severity. Murphy and colleagues recruited 25 children with OCD aged 6 to 17 (mean age 10.5 years, SD = 2.3) experiencing at least moderately severe symptoms of the disorder. Results showed a positive correlation between severity of symptoms of the disorder and presence of group A streptococcal antibody production. Thus there is a possible relationship between PANDAS and OCD, but it is not clear if causal. It is possible that a third factor influences both. Other studies have found no connection between OCD onset and PANDAs (e.g., Luo et al., 2004; Singer et al., 2004), so further research is needed to test this hypothesis.

Overall, there is evidence that genetic and neurological factors are involved in OCD, and genetic research especially provides evidence for biological models of the disorder. However, the heterogeneous nature of OCD makes it difficult to clearly determine causal factors, as it is possible that different clinical phenotypes have different aetiological pathways (Grisham, Anderson, & Sachdev, 2008). This would explain the existence of

different subtypes of OCD, such as checkers and washers. Most likely, many different factors, both genetic and environmental, contribute to the emergence of obsessive-compulsive symptoms, and their cumulative effects increase the risk of one developing OCD (Cannon & Keller, 2006).

2.3. Cognitive Models of Obsessive-Compulsive Disorder

Cognitive models of OCD have been influential in furthering understanding of OCD and informing effective psychological treatment. The rationale for a psychological / cognitive understanding of OCD as a disorder is based in the fact that around 90% of the general population report intrusions similar to those present in OCD (e.g., the thought of a loved one dying in a car accident), often on a daily basis (Rachman & de Silva, 1978; Belloch et al., 2004). However, most people interpret intrusive thoughts as lacking any meaning or significance and therefore simply ignore or dismiss them. Cognitive models of OCD suggest that what differentiates people with OCD from healthy people is the interpretation they give these intrusions, i.e., people with OCD perceive intrusions as meaningful, unacceptable, threatening, and as needing to be controlled. For example, they may believe that thinking about a bad thing makes it more likely to happen. These intrusions make the person extremely anxious (Rachman, 1997) and thus trigger 'safety' behaviours (i.e., behaviours that aim to prevent negative events) such as compulsions (Salkovskis, Clark, Hackmann, Wells, & Gelder, 1999). Therefore, two elements differentiate OCD patients from healthy individuals: (1) the interpretations they give intrusions and (2) the use of safety behaviours in response to these intrusions.

Six categories of cognitive beliefs have been identified as important for OCD: (1) overestimation of threat; (2) inflated responsibility; (3) over-importance of thoughts; (4) the need to control thoughts; (5) the need for perfection; and (6) intolerance of uncertainty (OCCWG, 1997). However, three models are currently prominent, and they only involve the first four of the six categories. The meta-cognitive model proposes that at the origin of

OCD are thoughts about one's own thoughts as extremely important and needing to be controlled (Wells & Matthews, 1994). Somewhat similarly, the thought-action fusion (TAF) model proposes that OCD is caused by beliefs about thoughts being equivalent to actions and having the power to cause events, usually negative ones (Rachman, 1993). Finally, the inflated responsibility model proposes that responsibility beliefs about causing or not preventing harm for self or others lead to the emergence of obsessions and compulsions (Salkovskis, 1985, 1989). All three theories have been investigated and received mixed support, with the inflated responsibility model being the most tested. The next section describes each model and discusses supporting evidence for each.

2.3.1. The meta-cognitive model. Wells et al. (1994) and later Wells (1997, 2000) proposed that OCD is the result of various meta-cognitions. Meta-cognitions refer to how and what people think about their own thoughts, about thinking, and about how they regulate thoughts. Thus the model identifies two broad belief domains as meta-cognitions: (1) beliefs about the importance of thoughts and (2) beliefs about the need to control thoughts. According to this model, OCD patients believe that thoughts can cause negative consequences (e.g., thinking of someone having a car accident would actually cause it to happen). Because of this they feel the need to control their thoughts and they attempt to do so by using compulsions.

The meta-cognitive model identifies three categories of meta-cognitive knowledge believed to the relevant for OCD: thought-fusion beliefs, beliefs about the need to use compulsions, and criteria for stopping or terminating compulsions (Wells, 1997). Several subcategories of cognitive fusion have been described: thought-action fusion (TAF; i.e., beliefs about obsessions causing unwanted personal actions), thought-event fusion (TEF; i.e., beliefs about obsessions causing negative external events), and thought-object fusion (TOF; i.e., beliefs that thoughts / feelings can be passed onto objects or others). According to Well's model, it is the activation of these cognitive fusions that makes a person interpret intrusions negatively.

Well's model, also known as the self-regulatory executive function (S-REF) model (Wells et al., 1994), has been investigated in the OCD literature to a limited extent. Cross-sectional studies using self-report questionnaires of symptoms and thoughts, show positive relationships between meta-cognitive thoughts and obsessive-compulsive symptoms (e.g., Herman et al., 2003; Wells, 2004; Irak & Tosun, 2008; Myers, Fisher, & Wells, 2009). For example, Gwilliam et al. (2004) explored these relationships using self-report questionnaires with 200 non-clinical participants aged 18 to 69 (mean age 33.46 years, SD = 11.40). Meta-cognitive beliefs were positively associated with obsessive-compulsive symptoms. Similarly, Wells and Papageorgiou (1998) looked at meta-cognitive predictors of OCD symptoms in 105 undergraduate students (mean age 21.1 years, SD = 4.14). After controlling for worry, regression analyses showed that negative beliefs about uncontrollability of thoughts significantly predicted obsessions about harm to self or others.

These studies provide some support for Well's model, however they involve non-clinical samples so it is not clear from these findings whether meta-cognitions are relevant for clinical samples. Several cross-sectional studies with patients have tested this possibility. For example, Solem, Myers, Fisher, Vogel, and Wells (2010) explored the relationship between obsessive-compulsive symptoms and meta-cognitions in 269 non-clinical participants (mean age 30 years, SD = 12) and 57 individuals with OCD (mean age 30 years, SD = 11). The OCD group scored significantly higher on fusion beliefs and beliefs about rituals, than the non-clinical sample. Also, these beliefs predicted and accounted for a large amount of variance of obsessive-compulsive symptoms. These results suggest that meta-cognitions are important for OCD, however the authors pointed out several limitations of their study, e.g., the cross-sectional design and possible order effects due to questionnaires not being randomly administered.

Cucchi et al. (2012) compared 114 individuals with OCD (mean age 35 years) to 119 patients with panic disorder (mean age 37 years) and 101 healthy controls (mean age 31 years). OCD individuals had higher negative beliefs about uncontrollability and danger,

and higher beliefs about the need to control thoughts, than the other two groups. The authors suggested that dysfunctional metacognition is both a vulnerability and maintenance factor for OCD. However this was a correlational study so conclusions about causal relationships could not be drawn. Also, while these results showed higher meta- cognitions in OCD individuals than those with panic disorder, there was also a significant difference between the panic disorder and control groups. This suggests that dysfunctional meta-cognitions may be characteristic of psychopathology in general, and not specific to OCD.

Experimental work on metacognitions and OCD could provide information about causal relationships between the two, however this type of work is very limited. Myer and Wells (2013) manipulated metacognition in 64 university students aged 18 to 50 (mean age 22.3 years). The sample was divided into two groups of 32 each, i.e., participants who scored in the top quartile and participants who scored in the bottom quartile on the Obsessions subscale of the Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002). A 2 X 2 factorial design was used, one factor being condition (i.e., experimental or control) and the other factor being obsessionality level (i.e., high or low). Participants in each group were matched with others who scored within one point of their score on obsessionality. They were also matched on gender. All participants were fake EEG monitored, and told that the device would sense their thoughts about drinking. Participants in the experimental groups were told that such thoughts would trigger an aversive noise, while the control groups were told that they may hear an aversive noise but that it would be unrelated to their thoughts. Those with high obsessionality in the experimental group experienced significantly more drinking intrusions and discomfort, compared to those with high obsessionality in the control group. No significant difference was observed between the experimental and control groups for individuals with low obsessionality. Myers et al. concluded that a pre-existing vulnerability for OCD may be necessary for meta-cognitions to cause OCD symptoms. However, anxiety and worry, which have been shown to play a role for dysfunctional beliefs in OCD (Abramowitz, Whiteside, Lynam, & Kalsy, 2003),

were not controlled in this experiment, so it is not clear whether the effects observed here were caused solely by meta-cognition.

Support for the meta-cognitive model also comes from work showing that interventions targeting meta-cognitions can effectively improve OCD symptoms. One such study was conducted by Fisher and Wells (2005) who aimed to demonstrate that anxiety and urge to neutralise triggered by obsessional thoughts can be decreased by modifying meta-cognitive beliefs. A behavioural assessment test (BAT) and brief exposure-response prevention (ERP) were used in a counterbalanced repeated-measures crossover design. Eight individuals with OCD were exposed to their feared obsessional stimuli for 5 minutes and instructed not to use neutralising during the test. After the test, they were told a second session of exposure was going to follow. Before this second session, depending on group allocation, participants were either provided with a meta-cognitive treatment rationale or a typical ERP treatment rationale. Exposure-response prevention accompanied by a meta-cognitive rationale significantly decreased anxiety and urge to neutralise, while ERP followed by a habituation rationale did not. These results suggest that meta-cognitions can have an impact on obsessive-compulsive symptoms. However, because a clinical sample was used, we cannot exclude the possibility of meta- cognitions being maintenance factors in OCD, and not necessarily causal factors. Also, a control group was not used in this study, so comparisons could not be made. Additionally, the raters were not blind, which may have biased the results.

It is unclear how meta-cognitions develop, but it has been proposed that problematic-self focus may play a role (Janek, Calamari, Riemann & Heffelfinger, 2003). This tendency towards cognitive self-consciousness (i.e., the tendency to monitor and reflect on thought processes) is higher in OCD patients. Janek et al. compared 80 adults (mean age 40 years, SD = 11.1), 30 with OCD, 25 with other anxiety disorders, and 25 non-clinical participants. The highest level of cognitive self-consciousness was reported by the OCD group. The authors suggested that this tendency to focus on one's own thoughts

may be involved in the development of OCD. They also considered the possibility of cognitive self-consciousness being a risk factor (and not a developmental factor) that only plays a role for OCD when other elements (e.g., a tendency to give a negative interpretation to intrusions) are also present.

Overall, there is support for the meta-cognitive model of OCD. However, correlational studies do not provide support for a causal relationship between the two. It is possible that meta-cognition is a risk or a maintenance factor in OCD. Also, it is unclear if meta- cognition is specific to OCD, as it has been identified in other disorders such as panic disorder (Morrison & Wells, 2003) and may reflect a transdiagnostic process. Further research, especially using longitudinal and experimental designs, is needed to gain a better understanding of its role in OCD.

2.3.2. Thought-action fusion. Thought-action fusion (TAF) is a cognitive phenomenon that refers to beliefs about thoughts being equivalent to actions (Rachman, 1993). Thought-action fusion is considered a cognitive bias believed to bring a unique contribution to OCD and to play a causal role for the disorder. Two types of TAF have been identified by Rachman: TAF morality and TAF likelihood. TAF morality refers to believing that thoughts are equivalent to actions, and it may make people feel responsible and guilty for their intrusive thoughts. TAF likelihood refers to beliefs that having a thought increases the likelihood of a negative event. TAF likelihood tends to be associated with thought suppression and distress. It has been proposed that TAF, and especially TAF likelihood (Hazlett-Stevens & Craske, 2002) may be a type of meta-cognition (Shafran, Thordarson, & Rachman, 1996), and it was included in the meta-cognitive model by Wells (1997) as a type of thought-fusion, along with thought-event and thought-object fusion (see pg. 49). No research has compared TAF and meta-cognitions yet, so the distinction between the two is unclear at this point.

A small number of correlational studies with non-clinical samples have demonstrated a relationship between TAF and obsessive-compulsive symptoms. For

example, Amir, Freshman, Ramsey, Neary, and Brigidi (2001) explored TAF and obsessive-compulsive symptoms in two studies with 126 and 298 undergraduate students, respectively. Each of these samples was divided into two groups: with and without obsessive-compulsive symptoms depending on participants' scores on the Obsessive Compulsive Inventory (OCI; Foa, Kozac, Salkovskis, Coles, & Amir, 1998). In the first study there was no difference in likelihood estimation of negative events for self and in moral equivalence between thought and action. Also, although participants with obsessive-compulsive symptoms made more estimations of harm to others, they did not feel more responsible for that outcome. The groups were also significantly different in their estimation of likelihood of positive events, which the authors interpreted as TAF being a more general concept than OCD specific. Furthermore, Amir et al. suggested that TAF is a form of magical thinking, i.e., thoughts that attribute causal effects to real events by thoughts/actions not physically related to the events (Rothbaum &Weisz, 1988). The second study revealed somewhat different results from the first study. Participants with obsessive-compulsive symptoms reported higher estimation of negative events, as well as higher responsibility for these events. The difference in estimation remained significant after controlling for responsibility. Amir and colleagues interpreted these findings as an indicator of TAF as a more "fundamental factor" (Amir et al., 2001; pg. 775) that impacts responsibility which has been extensively tested in the OCD literature. Amir et al. emphasized that one strength of their two studies was the use of vulnerable participants (i.e., with obsessive-compulsive symptoms), whose scores were comparable to those of a treatment-seeking sample of OCD patients at a treatment centre. However, their data were based only on self-report and were cross sectional so any conclusions about causal relationships between these factors are speculative. Also, findings across the two studies were inconsistent.

While TAF may be involved in the emergence of obsessions, the mechanism through which this may happen is unclear. Based on Rachman (1998)'s theory, Rassin and

colleagues (i.e., Rassin, Merckelbach, Muris, & Spaan, 1999; Rassin, Muris, Schmidt, & Merckelbach, 2000) proposed that TAF has a causal role in the development of obsessions by contributing to the emergence and exacerbation of intrusions. According to this theory, this happens as individuals try to suppress intrusions. In other words, because of a pre-existing TAF bias (e.g., "if I think of someone being in a car accident I increase the possibility of that happening"), one gives intrusions negative interpretations (e.g., "I am causing someone to have a car accident") and thus tries to suppress them to avoid negative consequences (e.g., "if I don't think these thoughts they are safe").

To test this possibility, Rassin et al. (1999) designed an experiment where 45 healthy participants aged 16 to 20 (mean age 17.2 years, SD = 1.1) were assigned to either an experimental or a control group. They were all told that an EEG apparatus would monitor and record the electrical activity of their brain. The control group was told the apparatus records very simple thoughts and were instructed to think of anything, such as an "apple". The experimental group were told that their apparatus was connected to another person in the other room, and that each time they thought of an "apple" that person would receive an unpleasant electric shock. They were then informed that they could press a button to stop the signal (and thus the shock) when having thoughts about an apple. The experimental group reported significantly more intrusions, discomfort, and resistance than the control group at the end of the experiment. Also, the experimental group felt responsible and guilty. However, these items were not assessed in the control group so no comparisons could be made. Further, the experimental group used neutralising behaviour (i.e., button press) in response to approximately 50% of the intrusions. Rassin et al. concluded that TAF may contribute to the emergence of obsessive intrusions. Although this experiment suggests that TAF may play a causal role in the development of obsessive-compulsive symptoms, one major problem is that it may have influenced participants' level of responsibility as it supposedly involved electric shocks being administered to others. Responsibility has been proposed as a causal factor in OCD (Salkovskis, 1985) and

Rassin's study raises the question of whether TAF can be manipulated without manipulating responsibility. Shafran et al. (1996) proposed that TAF is an internal source of responsibility (i.e., responsibility stems from TAF) which would mean that TAF is a primary causal factor for OCD and that responsibility is not. Unfortunately, in Rassin et al.'s study responsibility was only measured in the experimental groups, so comparisons with the control groups could not be made. Little is known at this point about the role of TAF and responsibility and their interplay in OCD, but it is possible that this manipulation reflects the effects of TAF via changes in responsibility rather than direct effects of TAF.

Only small to medium correlations have been reported between TAF and obsessive-compulsive symptoms, and high TAF has also been found in disorders such as anxiety (Hazlett-Stevens, Zucker, & Craske, 2002) and depression (Abramowitz et al., 2003), so it may not be specific to OCD (Berle & Starcevic, 2005). For example, Rassin et al. (2001) compared TAF in 24 individuals with OCD and 20 individuals with other disorders (i.e., 7 with panic disorder, 4 with post-traumatic stress disorder, and 4 with social phobia) who did not have comorbid OCD. All patients received cognitive- behavioural interventions. All participants had similar TAF scores before and after treatment, but pre-treatment TAF was significantly correlated with psychopathology in the non-OCD group. Rassin et al. concluded that TAF is not specific to OCD and is more a feature of anxiety than OCD.

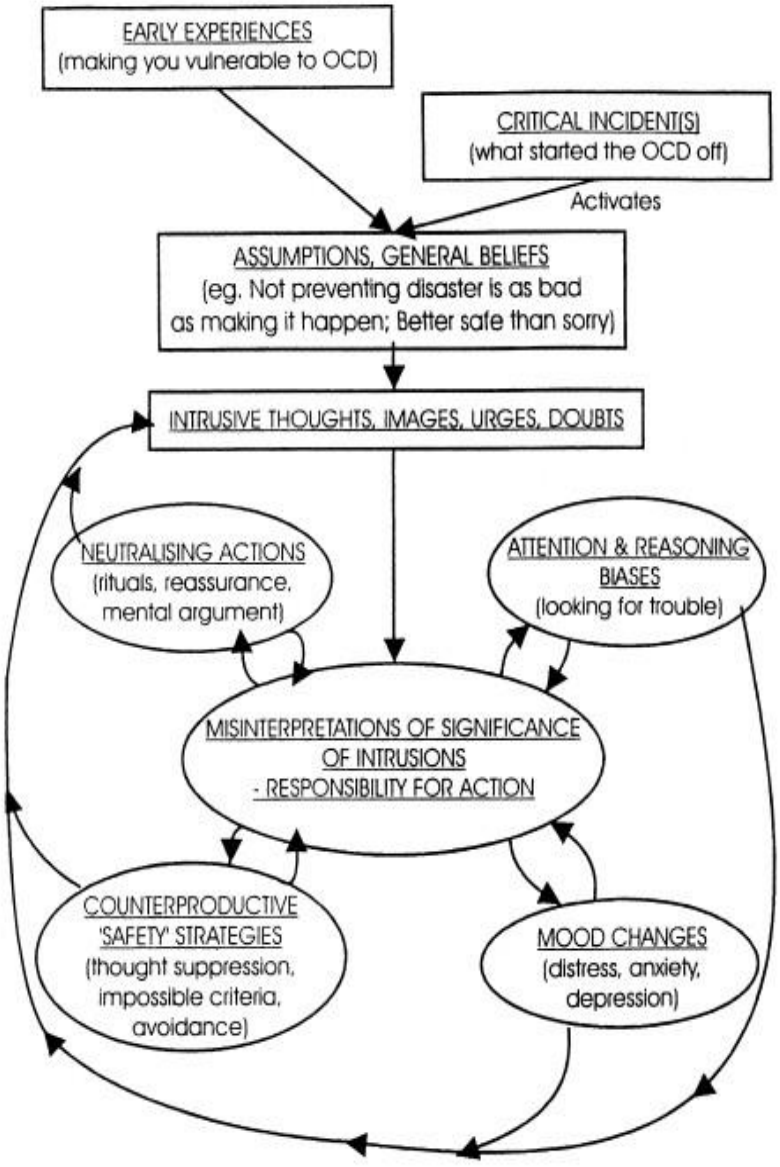
A small body of research suggests that TAF is involved in OCD, however its nature is unclear at this point, as it may be a meta-cognition or a factor that leads to inflated responsibility. Existing data comes mostly from correlational work, so causal effects of TAF for OCD cannot be assumed. Also it may be a generic psychopathological factor, relevant to other disorders as well, not just OCD. Further investigations are needed for any conclusions about TAF to be drawn at this point.

2.3.3. The inflated responsibility model. The inflated responsibility model of OCD (Salkovskis, 1997) suggests that OCD is a disorder driven by beliefs of personal responsibility for negative events and their consequences, and suggests that people with

OCD believe they have pivotal power to produce or prevent negative outcomes. According to the inflated responsibility theory, people with OCD feel compelled to act to ensure safety (e.g., check) when they sense the slightest threat, as they believe that failure to do so would lead to harm to self/others for which they would then be responsible for.

Further, these intrusions about personal responsibility generate anxiety, which then leads to compulsive behaviour. Salkovskis (1985) argued that inflated responsibility is specific to OCD, and that without it, intrusive thoughts about harm or threat would lead to generalised anxiety or depression, but not to clinical obsessions. Figure 1 on page 54 presents Salkovski's model of OCD.

Figure 1. Cognitive model of OCD, from "Understanding and treating obsessive-compulsive disorder" by P. Salkovskis, 1985, *Behaviour Research and Therapy, 37*, p. S29-S52.



Integrated schematic model describing the cognitive hypothesis of the origins and maintenance of obsessional problems.

Rheaume, Ladouceur, Freeston, and Letarte (1995) tested the inflated responsibility model in two studies with 397 non-clinical participants (mean age 23.4 years, SD = 4.7). The purpose of the first study was to develop a semi-idiographic task representing typical obsessive-compulsive situations, and to test Salkovskis' definition of responsibility.

Participants were asked to evaluate responsibility in ambiguous situations involving major OCD themes, i.e., contamination, checking, somatic concerns, loss of control, marking errors, sexuality, and magical thinking. The second study replicated the first but controlled the effect of severity, probability, influence and pivotal dimensions of responsibility. Correlational and multiple regression analyses showed that influence and pivotal influence better predicted responsibility, compared to probability and severity, with pivotal influence being the strongest predictor. These findings provide support for Salkovsis' (1985) definition of inflated responsibility.

Numerous correlational studies with healthy individuals support the inflated responsibility model. For example, Ashbaugh, Gelfand, and Radomsky (2006) used a sample of 201 healthy adults (mean age 23 years) to explore the relationship between responsibility beliefs and obsessive-compulsive symptoms. Responsibility was associated with obsessive-compulsive symptoms. Also, the belief that one is more responsible than other people predicted obsessive-compulsive symptoms beyond general responsibility beliefs. Mancini et al. (2001) explored responsibility in 195 healthy participants (mean age 23 years, SD = 2.95) who were asked to complete self-report questionnaires for obsessive-compulsive symptoms, responsibility, distress caused by thoughts, state and trait anxiety, and depression symptoms. Responsibility was significantly correlated with obsessive-compulsive symptoms and accounted for approximately 20% of their variance.

These correlational studies suggest a relationship between responsibility and obsessive-compulsive symptoms and show that obsessive-compulsive symptoms and responsibility occur in non-clinical samples, suggesting that these phenomena manifest on a continuum (Salkovskis, 1985, 1999). However they do not give us any information about the causal role of responsibility in OCD. It is also not clear if these findings apply to clinical samples.

Studies with clinical samples provide further evidence for the inflated responsibility model. For example, Salkovskis et al. (2000) compared responsibility and obsessive-

compulsive symptoms in 144 non-clinical participants, 49 participants with OCD and 38 anxious control participants (according to DSM-IV criteria). Obsessional patients reported more responsibility appraisals than the other two groups, responsibility was strongly associated with obsessions compulsions and neutralising, and uniquely predicted obsessive-compulsive symptoms. Salkovskis et al. concluded that responsibility cognitions are specific to OCD. Cougle, Lee, and Salkovskis (2007) compared a sample of people with OCD, 39 checkers and 20 non-checkers, to 22 anxious participants, and 69 healthy controls. Diagnoses were established using clinical interviews based on DMS-IV criteria. The OCD groups reported higher responsibility than the other two groups.

These data suggest that inflated responsibility is specific to OCD but this has been contested by other researchers. Foa et al. (2001) compared 15 participants with OCD who had checking compulsions with 15 patients with social phobia and 15 non-anxious controls. Participants completed the Obsessive-Compulsive Responsibility Scale (OCRS) which consists of 27 situations, some of low potential risk, some of high potential risk. The OCD group endorsed higher responsibility for the low-risk and obsessive-compulsive relevant situations than the other groups. However, there were no group differences for responsibility for high-risk situations. There were also no differences in responsibility between the OCD and socially anxious groups. Foa et al. therefore concluded that inflated responsibility is common to all anxiety disorders, with OCD being on the high end of a continuum.

Further evidence that responsibility may not be specific to OCD comes from a study by Yorulmaz, Karanci, Bastug, Kisa, and Goka (2008) who investigated responsibility and TAF in 51 individuals with OCD, 44 with other anxiety disorders, and 50 healthy adults. Self-dangerousness responsibility (i.e., the belief of having the power to cause harmful events) and TAF were significantly higher in the OCD group compared to controls. However, there was no significant difference between the OCD and anxiety groups, which lead the authors to conclude that responsibility and TAF are not specific to

OCD.

Salkovskis et al. (2000) and Cougle et al. (2007) used participants whose clinical diagnoses were determined as part of the study recruitment process, while Foa et al. (2001) and Yorulmaz et al. (2008) used outpatients seeking treatment from anxiety clinics. It is possible that differences in their results are partly due to accuracy of diagnosis and severity of symptoms. Perhaps participants who were already outpatients experienced more severe symptoms and comorbidity (and symptom overlap) and thus the apparent lack of specificity of inflated responsibility. Thus this aspect needs to be further investigated. Also, while inflated responsibility and obsessive-compulsive symptoms are correlated, it is not clear if inflated responsibility precedes OCD or if it develops as a consequence of the disorder. Data from experimental work helps better distinguish the causal role of responsibility in OCD.

Extensive experimental work with non-clinical samples has been done to test the effects of inflated responsibility on obsessive-compulsive symptoms and found that increases in responsibility lead to increases in compulsive behaviour and urges (e.g., Ladouceur et al., 1995; Ladouceur, Talbot, & Dugas, 1997). Ladouceur and colleagues (1995) asked 40 non-clinical participants to complete a pill sorting task and videotaped their behaviours. The task aimed to manipulate responsibility. Participants were randomised to either a high responsibility or a no-responsibility group. The high responsibility group were told that their sorting would influence the development of a pill sorting system to be used in developing countries. The no-responsibility group were told the study was about colour perception and asked to sort the pills by colour. Checking was significantly higher in the inflated responsibility group than the no-responsibility group and increases in responsibility lead to increases in anxiety. This experiment has been replicated numerous times with similar results (e.g., Mancini, D'Olimpio, & Cieri, 2004; Parrish & Radomsky, 2006; Bouchard, Rheaume, & Ladouceur, 1999).

Parrish and Radomsky (2011) used a different manipulation to inflate responsibility

and measured compulsive urges instead of behaviours. Three experimental vignettes were constructed to manipulate threat, responsibility and ambiguity in a non-clinical sample of 176 participants aged 17 to 54 (mean age 22.95 years, SD = 5.37). Participants were asked to read vignettes organised into two sections. The first included hypothetical scenarios involving threats and manipulated threat and responsibility. The second involved hypothetical feedback regarding the potential threat and manipulated ambiguity of feedback. This was a 2 (threat condition) × 2 (responsibility condition) × 2 (ambiguity) design, and participants were randomly assigned. Compulsive urges and anxiety were the dependent variables. Manipulation checks showed that the three factors were successfully increased. Consistent with Salkovskis' model, increases in responsibility increased anxiety and urge to check.

Several studies have tested the inflated responsibility model using Ladouceur et al. (1995)'s methodology with clinical samples. For example, Arntz, Voncken, and Goosen (2007) manipulated responsibility in 77 OCD outpatients, 37 outpatients with another anxiety disorder, and 28 non-clinical controls. Increased responsibility led to new checking compulsions for participants with OCD, but not for the other groups. This lead Arntz et al. to conclude that responsibility has a causal role for OCD and is specific to OCD.

Inflated responsibility in clinical samples has also been manipulated using a behavioural approach test (BAT). Lopatka et al. (1995) manipulated responsibility in 30 OCD outpatients. Half of the sample was taking anxiolytic or anti-depressant medication. The BAT involved exposing participants to objects or situations that usually made them check or wash. The aim was to decrease or increase their perceived responsibility for an anticipated negative event. Participants were assigned to either a high responsibility, low responsibility, or a control group. After the exposure, they were asked to complete measures of urge to check, discomfort, threat, and criticism. Decreases in responsibility were followed by decreases of OCD relevant aspects such as discomfort, urge to check, and probability of harm. Unlike Arntz et al. (2007)'s study, no between-group differences

were observed as a result of increased responsibility. This may be due to differences in methodology. Although the BAT manipulation seemed strong, perhaps the pill sorting manipulation had a stronger effect on responsibility. This would mean that a certain level of responsibility is needed to cause significant differences in anxiety and compulsive behaviours/urges. Also, Arntz et al. measured compulsive-like behaviour while Lopatka et al. measured compulsive urges and perhaps responsibility has slightly different effects on each. Further work is needed to test these possibilities.

Most correlational and experimental work supports the inflated responsibility model, and only few studies found no differences in perceived responsibility between OCD individuals and controls (e.g., Tolin et al., 2006) or no correlation between responsibility and obsessive-compulsive symptoms (e.g., Wells & Papageorgiou, 1998).

While these mixed findings may be due to methodological differences, they may also reflect similarities / overlap between these concepts (e.g., TAF and meta-cognitive fusion; Shafran, Thordarson, & Rachman, 1996). Only a small number of studies have investigated the models together. For example, Gwilliam et al. (2004) reported that responsibility and meta-cognitive beliefs were correlated in a non- clinical sample of 197 participants. Also, responsibility did not significantly predict obsessive-compulsive symptoms once meta-cognitions were controlled, while obsessive- compulsive symptoms were significantly correlated with meta-cognitions after controlling for responsibility. Meta-cognitions regarding the need to control thoughts and TAF morality were consistent predictors for obsessive-compulsive symptoms. These results seem to support the meta-cognitive model which suggests that responsibility is a "side- effect" of meta-cognitions. However, Gwilliam et al. used the Responsibility Appraisal Questionnaire (RAQ 2; Rachman, Thordarson, Shafran, & Woody 1995) to measure responsibility, which contains items such as TAF and "positive outlook toward responsibility" which is closer to a meta-cognition, so overlap between these concepts may have confounded these results. Salkovskis et al. (2000) (see pg. 55) used the Responsibility Attitude Scale (RAS) to

measure responsibility and found it to uniquely predict obsessive-compulsive symptoms, so perhaps this is a more valid measure of responsibility.

Altin and Gençöz (2011) examined relationships between inflated responsibility, TAF and thought suppression. A sample of 283 non-clinical undergraduates was recruited. Inflated responsibility mediated the relationship between TAF morality and obsessive-compulsive symptoms, while thought suppression mediated the relationship between TAF likelihood and obsessive-compulsive symptoms. Altin et al. concluded that TAF morality activates responsibility schemas and subsequently, neutralising behaviour. They suggested that the idea that thinking about something is the same as doing it leads to feelings of responsibility for the negative thoughts and also makes the person think they can prevent harm.

Similarities between TAF and responsibility have also been emphasized by Berle et al. (2005) who reviewed the literature and concluded that TAF likelihood seems closer related to responsibility in general, while TAF morality more to feeling responsible for experiencing intrusions.

Overall, there is evidence to support the inflated responsibility, TAF, and meta-cognitive models of OCD, and there seems to be some overlap between these concepts. While it is still unclear how they are related and if they are specific to OCD, these cognitions seem to play an important role in the disorder. The inflated responsibility model has been investigated the most using a range of designs. However, current models of OCD do not include other cognitive domains (e.g., intolerance of uncertainty) that have been identified as relevant for the disorder, which may explain existing mixed results.

2.4. The Behavioural Model of Obsessive-Compulsive Disorder

The behavioural model of OCD is based on Mowrer's (1960) theory about fear emergence and maintenance, which is explained through classical and operant conditioning mechanisms. According to this model, obsessions result from the association of a neutral

stimulus with an aversive one (i.e., classical conditioning). Based on this idea, Rachman (1971, 1978) described obsessions as conditioned aversive stimuli that lead to avoidance or compulsions. Avoidance and compulsions are two behaviours aimed at eliminating/reducing the anxiety produced by the aversive stimuli. Rachman proposed that compulsions maintain OCD because they are negatively reinforcing (i.e., they eliminate the unpleasant anxiety – operant conditioning), so they continue to be used by patients.

Rachman (2002) also suggested that compulsive checking has an immediate anxiolytic effect, but that over time it triggers more compulsions and thus initiates a self-perpetuating cycle that contributes to the maintenance of OCD. No work has been done to test how long it takes for repetitive behaviour to become compulsive. However, there is experimental evidence that this self-perpetuating cycle exists (Boschen & Vuksanovic, 2007) and that OCD patients identify anxiety reduction as one of the reasons for checking (Parrish & Radmosky, 2010). There is also experimental evidence showing that compulsions decrease anxiety (Foa et al., 2001).

2.4.1. Behavioural Aspects of Obsessive-Compulsive Disorder. Obsessive-compulsive disorder is a heterogeneous disorder and can manifest in many different forms (e.g., washing, checking, ordering etc.). Compulsions typically have corresponding obsessions, so for example contamination obsessions usually lead to cleaning compulsions and symmetry obsessions to ordering compulsions. Cognitions around inflated responsibility have been linked to checking and excessive reassurance seeking (Rachman, 2002).

2.4.1.1. Compulsive checking. Compulsive checking has been defined as repetitive, stereotypical, intentional acts driven by a pressure to take action (APA, 2000). It has also been described as the act of verifying that an action intended to prevent negative consequences has been completed (Rachman & Hodgson, 1980). This behaviour has been widely investigated because it is the most common compulsion in OCD (Ball, Baer, & Otto, 1996; Stein, Forde, Anderson, & Walker, 1997; Lebad et al., 2008) and is experienced by

most patients (as many as 79.3% of patients with lifetime OCD; Ruscio et al., 2010).

Checking differs from tics in that it is not a mechanical act, it has a purpose, and there is a motivation behind it, even though the individual checker may see it as unacceptable, partly acceptable, or even as completely senseless (APA, 2000). Because it is usually aimed at hypothetical and not real threats, compulsive checking has no natural stopping point, so it goes on and on (Rachman, 2002). Several types have been identified: physical (e.g., touching the stove knob), visual (e.g., looking at the stove dials), and mental (e.g., reviewing the memory of a recent stove check). Checking can also be done overtly (e.g., checking the stove), which is done mostly when the person is alone, or covertly (e.g., asking someone if the stove is off), and in person or by proxy. The latter is also known as reassurance seeking (Rachman, 2002; Salkovskis, 1985, 1999) (see pg. 63).

Rachman (2002) suggested that checking is a safety behaviour triggered by anxiety resulting from responsibility intrusions. He identified three multipliers of responsibility: personal responsibility for harm, severity of harm, and probability of harm, and proposed that changes in all or one multiplier will either increase or decrease compulsive checking. According to Rachman, the essential multiplier is perceived responsibility – if the person has no sense of responsibility or a very low feeling of responsibility, compulsive checking does not occur. The more responsible one feels for the potential occurrence of a negative event, the more serious the anticipated consequences, or the higher probability that it will happen, the more likely it is that one will check. Empirical work supports Rachman's idea, as there is a correlation between responsibility and checking (e.g., Cougle et al., 2007) and experimental increases in responsibility lead to increases in anxiety and checking behaviour (e.g., Ladouceur et al., 1995) and urges (Parrish et al., 2011).

It has also been proposed that checking aims to reduce the sense of responsibility as well as the anxiety associated with it (Salkovskis, 1999). However, data collected by Parrish et al. (2010) suggest that his may not be the case. They compared 15 individuals who met DMS-IV criteria for OCD and were not currently depressed, 15 individuals with

major depressive disorder without OCD, and 20 healthy controls. Semi- structured interviews were used to assess factors involved in the onset, maintenance and termination of compulsive reassurance seeking and checking. OCD patients endorsed anxiety reduction and harm prevention as their main reasons for using compulsions. Participants with OCD did not recognise that compulsions were used to reduce responsibility.

More significantly, experimental evidence suggests that checking may, paradoxically, increase responsibility (Oglesby, 2011). For example, van den Hout and Kindt (2004) tested the inflated responsibility model in 39 undergraduates. Participants were randomly allocated to check either a virtual stove (relevant checking, i.e., experimental group) or a light bulb (non-relevant checking, i.e., control). Participants in the relevant checking reported more responsibility after checking. These data suggest that responsibility initially triggers checking and that checking further maintains responsibility intrusions. This cycle then becomes an essential part of the self-maintenance cycle of obsessions and compulsions. Further experimental work is needed to test the causal role of responsibility on checking, and the maintenance role of checking for responsibility.

Very little work has been conducted to test the relationship between checking and meta-cognition or TAF. Cognitive theories suggest that compulsions are maintained because they do not allow disconfirmation of dysfunctional beliefs regarding their protective nature, i.e. they do not allow the person to experience what would happen if not using them and thus to see that no negative consequences would follow (Salkovskis 1985, 1998; Rachman, 2002). According to Wells (1997, 2000), these beliefs about the protective role of thoughts are a type of meta-cognition. However, this possibility is yet to be tested empirically. Also, other aspects overlooked by current models of OCD (e.g., uncertainty) may be relevant for checking. Such aspects are discussed in Part III of this thesis (see pg. 127).

2.4.1.2. Excessive reassurance seeking. Reassurance seeking is a normal behaviour that manifests on a daily basis and is aimed at decreasing anxiety (Rachman, 2002).

However, in the general context of psychopathology, reassurance seeking has been defined as repeated solicitation of safety information in spite of having already received it (Parrish et al., 2010). This behaviour has been documented in various disorders, including obsessive-compulsive disorder (Freeston & Ladouceur, 1997; Rachman, 2000; Parrish et al., 2010), depression (e.g., Joiner & Metalsky, 1998), and health anxiety (Salkovskis, 1986). In OCD, it is seen as a major maintenance factor and is the most common form of family accommodation. In paediatric OCD (Stewart et al., 2008), as many as 56% of parents provide solicited reassurance to their OCD child on a daily basis (Peris et al., 2008; Storch et al., 2007). Adult patients also report high levels of reassurance seeking and of involving other people in their daily rituals (Freeston et al., 1997).

Excessive reassurance seeking has not been explored as much as compulsive checking but has been described as a back-up to it (i.e., used when checking is not possible) (Salkovskis, 1999). Just as checking, it is believed to be aimed at decreasing anxiety (Salkovskis et al., 1986) and may be driven by similar cognitions. However, current data are mixed. For example, Parrish et al. (2006) manipulated reassurance and inflated responsibility in a 2 x 2 design (responsibility: high and low x reassurance: high and low) using a pill-sorting task. The sample consisted of 100 healthy participants. The low responsibility groups experienced decreases in urges to check and to seek reassurance, and an increase in confidence. The high responsibility groups maintained their urges to check and to seek reassurance and their performance related doubt. The authors concluded that checking and reassurance seeking are affected in similar ways by responsibility and feedback. However, more recently, Parrish et al. (2010) explored the two compulsions in 15 individuals with OCD, 15 with major depression (and no OCD), and 20 healthy individuals, using interviews. Parrish et al. found that, in OCD participants, checking was more focused on general threats, while excessive reassurance seeking was more comprehensive and focused on social threats and personal performance as well. Also, reassurance seeking was influenced by the quality of feedback provided, i.e., ambiguous

feedback elicited more reassurance seeking urges.

Furthermore, Parrish et al. (2011) showed that checking is driven by responsibility, while reassurance seeking is not affected by responsibility, but by ambiguity of feedback. The later has been linked to uncertainty and doubt. Based on these findings, the authors concluded that reassurance seeking is not a back-up to checking, as it is driven by different cognitions. Reassurance seeking involves a social exchange, and Parrish et al.'s study suggests that the quality of the reassuring information depends on that exchange, whereas checking is conducted directly by the person and lacks that social component. Given the lack of intermediation, checking may be more effective in alleviating anxiety, which may explain why it is the most common compulsion.

Based on a small body of existing data, inflated responsibility seems causally linked to checking and reassurance seeking. However, cognitive aspects such as TAF and meta-cognition may be important for the emergence and maintenance of these behaviours and related urges, but research in this area is lacking. Investigation of these aspects and further work on inflated responsibility and compulsive urges is granted.

2.5. The Relevance of Experimental Work and Use of Analogic Samples in Testing Cognitive Models of Obsessive-Compulsive Disorder

Different theoretical models try to explain how OCD develops and is maintained, but the complexity of the disorder makes it difficult to determine which of the genetic, behavioural, or cognitive aspects are more important. It is possible that various combinations of any of these factors play a role, but only a small number of them can be isolated and analysed at one time. None of the possible explanations of how OCD works should be dismissed and further exploration is needed before any conclusions are drawn.

The present work was conducted from an inflated responsibility framework, as this model has received the most and consistent support in the literature. Additionally, we took

into consideration developmental aspects of the disorder as it can have an early onset (i.e., in pre-adolescence; Mancebo, Garcia, Steven, & Rasmussen, 2008) and prevalence has been found to be as high as 2.7% in children and adolescents (Rapoport et al., 2000), plus many continue to have the diagnosis as adults. A better understanding of the mechanisms involved could contribute to better interventions that alleviate symptoms in children and could prevent it from becoming severe or carrying on into adulthood. Another advantage of testing cognitive models of the disorder in children is gaining a better understanding of the causal mechanisms involved. Manipulating obsessive-compulsive-like cognitions and behaviours in healthy children may give us clues as to how the disorder emerges and of the risk factors that contribute to it.

Part II of this thesis addresses developmental aspects of OCD, reviews the existing literature with children and adolescents, and describes one methodological study and one experimental study with children that were conducted as part of the requirements for this PhD degree. This work uses analogue samples to test the inflated responsibility model in children. There are a number of significant advantages to using analogic samples, some highlighted in a recent review. Abramowitz et al. (2014) evaluated OCD studies that used nonclinical samples and concluded that overall these studies are valid. The authors used several criteria (e.g., such as presence and intensity of OCD symptoms in non-clinical population) in order to evaluate this body of work and found support for each of them in the literature. Firstly, OCD symptoms are prevalent in the general population (Rachman et al., 1978), so findings from analogue samples are relevant to both healthy individuals, as well as to clinical samples (i.e., they are generalizable). Secondly, OCD symptoms are dimensional, they occur on a continuum, from mild to moderate, to severe; so healthy individuals experience them as well, just not as frequently and intensively as OCD patients do. According to Abramowitz and his colleagues, analogue work can help us better understand the relationship between different levels of symptom severity. It can also shed some light on aetiological processes of the disorder. Experimental work with non-clinical

samples can manipulate aspects such as responsibility or checking and determine causal relationships between them. Such causal effects are more difficult to distinguish in clinical samples, where pre-existence of symptoms can bias results. Also, non-clinical samples allow a better understanding of the temporal occurrence of symptoms (e.g., if responsibility leads to compulsive checking, or if it results from it). Thirdly, OCD symptoms are qualitatively similar regardless of whether they manifest in a healthy individual or in someone with a clinical OCD diagnosis. Neutralising behaviours in healthy individuals have a similar function to compulsions in OCD patients, and clinical and non-clinical obsessions and compulsions have similar content. Finally, the cognitive processes involved in OCD are similar in clinical and non-clinical samples that experience OCD symptoms.

In addition to the theoretical advantages of this type of work, Abramowitz et al. (2014) pointed out practical advantages such as recruitment of clinical samples being time consuming and expensive, and analogic recruitment being faster and relatively convenient. Another benefit is maximised internal validity. These studies mimic real life but while carefully controlling for confounding factors (Reynolds & Streiner, 1998). This work allows studies that might not be possible with clinical samples, such as comparing subgroups of obsessions and compulsions, and also eliminates problems related to comorbidity and medication, which can have confounding effects.

There are however disadvantages to analogic research such as possible limitations in the applicability of results to clinical samples or differences in methodology, such as recruitment methods or psychometric qualities of measures used (Abramowitz et al., 2014). There could also be differences in how (non-clinical) symptoms manifest in healthy individuals versus those with clinical symptoms, especially when severe. A comprehensive research programme would use both methods for a complete picture of the OCD phenomenon.

2.6. Summary of Chapter 2

Rachman and Hodgson (1980) argued that OCD aetiology is complex and most likely involves a combination of factors. Evidence for both biological and psychological models of OCD support a biopsychosocial approach that takes into account the role of various types of factors (Taylor et al., 2011). The strongest evidence for the role of biological aspects comes from genetic studies. Also, experimental work shows that cognitions play an important role, and there is significant evidence for inflated responsibility being a central aspect of the disorder. However it is still unclear if inflated responsibility, meta-cognition, and TAF play causal or maintenance roles in OCD. Also, current cognitive models of the disorder do not include other domains that have also been identified as relevant for OCD, such as intolerance of uncertainty (OCCWG, 1997). Cognitive domains are believed to be highly associated and inter-correlated in psychopathology (Doron et al., 2005), so including under-investigated aspects may contribute to a better understanding the mechanisms involved in the disorder. Also, experimental and longitudinal work testing cognitive models of OCD is needed.

PART II: COGNITIVE AND BEHAVIOURAL ASPECTS OF OBSESSIVE-COMPULSIVE DISORDER IN CHILDREN

Chapter 3: Research on Obsessive-Compulsive Disorder in Children

3.1. Introduction

Obsessive-compulsive disorder is a chronic mental illness and the fourth most common after major depression, phobias, and substance abuse (WHO, 2001). The disorder is characterised by obsessions and compulsions and can develop either in childhood or early adulthood (APA, 2000), with more than half of individuals with lifelong OCD falling in the first category (e.g., Anholt et al., 2014). Also, almost half of children with OCD who receive psychological treatment experience a reduction in symptoms (e.g., Valderhaug, Larsson, Gotestam, & Piacentini, 2006), and these treatments are mainly based on interventions for adults. Research that contributes to a better understanding of the processes involved can help prevent the disorder by identifying risk factors, and alleviate symptoms in children by contributing to developmentally appropriate treatments.

3.2. The Epidemiology of Obsessive-Compulsive Disorder in Children and Adolescents

The average age of onset for OCD in children is between 10 and 12 years (e.g., Chabane et al., 2005; Mancebo et al., 2008; Anholt et al., 2014), and 80% of people with OCD report that the onset was before the age of 18 (Riddle, 1998). Reported prevalence in the community for paediatric OCD varies. Heyman et al. (2003) found prevalence to be as low as 0.25% in 5 to 15 year olds, while Rapoport et al. (2000) found it to be as high as 2.7% in 9 to 17 year olds. Variations in reported rates may be due to OCD being a disorder that patients, including children, tend to keep secret because of its unusual symptoms.

There are also certain aspects that may make it difficult to diagnose OCD in children. For example, some obsessive-compulsive features, such as repetitive behaviours, magical thinking, or reassurance seeking are developmentally normal, so abnormal manifestations of these sometimes they go unnoticed by parents or carers (Kirkcaldy, 2010).

Children with OCD often have co-morbid disorders including other anxiety disorders, major depression, tic disorders, Tourette's, and ADHD (Mancebo et al., 2008; Thomsen & Mikkelson, 1995; Swedo et al., 1998; Fireman, Koran, Leventhal, & Jacobson, 2001). While there are similarities and symptom overlap between OCD and disorders such as tics or Tourette's, and while compulsions may look similar to tics or repetitive behaviours seen in autism, the difference is that in OCD these manifestations are not automatic, they are intentional so there is a motivation that drives them (APA, 2000).

3.3. Clinical Aspects of Obsessive-Compulsive Disorder in Youth

At a first glance, obsessions and compulsions manifest similarly across ages, however closer examinations have revealed differences. One major distinction is that insight into symptoms is not a diagnostic criterion in children (APA, 2000). Adults with OCD perceive their symptoms (i.e., intrusions and compulsions) as being *egodystonic*, i.e., alien to the self. However, children are not necessarily able to make that distinction. Also, the frequency and intensity of symptoms seem to be different in children than adults. For example, Farrell and Barrett (2006) investigated developmental differences in cognitive processes across ages using idiographic cognitive assessment tasks and self-report assessments. Participants were 34 children aged 6 to 11 (mean age 9.62 years), 39 adolescents aged 12 to 17 (mean age 14.13 years), and 38 adults aged 18 to 66 (mean age 32.21 years), all meeting DSM-IV criteria for OCD. The tasks consisted of filling out stem sentences (e.g., "If I think____and don't____then____will happen"; Farrell et al., 2006; pg., 103) meant to capture each participant's most frequent intrusions. Participants were also asked to report what neutralising behaviours they would use, and the expected

consequences of not neutralizing these thoughts. Self-report questionnaires targeted responsibility, TAF, thought suppression, anxiety, and obsessive-compulsive symptoms. The severity of obsessive-compulsive symptoms was comparable for children and adolescents, while adults experienced significantly more severe symptoms than the other two groups. Children reported significantly fewer anxious intrusions than adolescents, and fewer depressive thoughts than adults. Children also reported less perceived responsibility, fewer tendencies to suppress thoughts, and less distress from intrusions.

Differences in symptoms between children and adults with OCD may be due to developmental differences, such as insufficient cognitive development that may limit the extent to which obsessions emerge and manifest. However, these differences may also be due to the way they are assessed. For example, compulsions may be more often diagnosed in children over obsessions as they are easy to observe by carers. Also, children have limited communication abilities compared to adults in reporting their symptoms.

In spite of presentation differences of obsessions and compulsions in children and adults, there are significant similarities in how the disorder manifests across ages. For this reason, cognitive models for OCD in adults have been also tested in children. The next section discusses the inflated responsibility, TAF, and meta-cognitive models of OCD in children, as well as developmental aspects relevant for the disorder.

3.4. Cognitive Aspects of Obsessive-Compulsive Disorder in Childhood and Adolescence

Very little work has tested how maladaptive cognitions relevant for psychopathology develop. Biological (e.g., genetic) and psychological (e.g., learned behaviour) models have been proposed for OCD in adults (see pg. 44). Three cognitive models have received considerable attention in OCD research with adults, i.e., inflated responsibility, TAF, and meta-cognitive, and they seem to also apply to children (Reynolds et al., 2008).

3.4.1. Applicability of Adult Cognitive Models of Obsessive-Compulsive Disorder to Children and Adolescents. Obsessive-compulsive disorder manifests similarly across age groups (March & Leonard, 1996), so cognitive models proposed for the disorder in adults have also been tested in children. Although so far mixed, these results are promising and encourage further investigation.

3.4.1.1. Thought-action fusion in children and adolescents. Thought-action fusion refers to beliefs about thoughts being equivalent to actions (Rachman, 1993). In children, TAF has been linked to magical thinking (Berle et al., 2005) which is considered to be developmentally normal and to decline around the age 4-5 and stop around age 7 when children can clearly distinguish between events possible in the real world versus fantasy (Subbotsky, 1994). However, in individuals with OCD it may maintain beyond childhood and manifest as TAF (West & Willner, 2011).

Evans, Milanak, Madeiros, and Ross (2002) explored magical thinking in 31 children without OCD aged 3 to 8. They assessed magical thinking with hypothetical scenarios, open-ended questions, and conservation tasks, all of which they suggested were more developmentally appropriate than self-report measures. Parents' reports of children's compulsive behaviour were also collected. The intensity of magical thinking in children was significantly related to the frequency of compulsivity and repetitive behaviours. Bolton, Dearsley, Madronal-Luque and Baron-Cohen (2002) tested the relationship between magical thinking and obsessive-compulsive symptom using an older non-clinical sample of 127 children and adolescents aged 5 to 17. A 30-item Magical Thinking Questionnaire (MTQ) was used. There was a significant relationship between obsessive compulsive symptoms and magical thinking and no linear association with age. Magical thinking was highest between ages 14 and 17. This was unexpected, as magical thinking is believed to normally decrease with age. Bolton, Rijsdijk, O'Connor, Perrin, & Eley (2007) considered the possibility of their measure capturing general aspects of magical thinking, and missing negative events, which would be more relevant to TAF. Therefore they suggested one

distinct feature of magical thinking or TAF in OCD may be its focus on negative consequences and on the power of thoughts causing negative events. Moreover, Bolton et al. also reported strong correlations between magical thinking and symptoms of panic-agoraphobia, separation anxiety, and generalised anxiety, which suggests that this type of thinking is not specific to OCD.

Although magical thinking is considered to be the paediatric equivalent of TAF in adults by some authors, TAF has also been tested in children. Several measures have been developed to measure TAF in children. Evans, Hersperger, and Capaldi (2011) developed the Thought-action Fusion Inventory for Children (TAFIC) using a sample of 313 healthy children aged 7 to 14. Relationships between TAF, ritualistic and compulsive-like behaviour, and anxiety were explored. Preteens were less likely to report TAF than younger children. Evans et al. also found that TAF predicted both anxiety and compulsive-like behaviours. However, anxiety was a better predictor of obsessive- compulsive symptoms than TAF.

Muris, Meesters, Rassin, Merckelbach and Campbell (2001) developed the Thought–Action Fusion Questionnaire for Adolescents (TAFQ–A). In a sample of 427 healthy adolescents aged 13-16 two factors were identified: TAF morality and TAF likelihood. In adults, a 3 factor solution was previously found, with TAF likelihood split into likelihood-self (i.e., the likelihood of negative events for self) and likelihood-others (i.e., the likelihood of negative events for others). This may indicate developmental differences, as children may have a less developed sense of self and may differentiate less between the two types of threat. In spite of its more simple structure in children than in adults, Muris et al. found that in children TAF was significantly correlated with OCD symptoms, which is consistent with studies with adult. Thought-action fusion was also significantly correlated with symptoms of other anxiety disorders, but not after trait anxiety was controlled. Thought-action fusion was also significantly correlated with depression symptoms, and this continued to be significant after trait anxiety was controlled, suggesting

that, just as magical thinking, TAF may not be specific to OCD.

3.4.1.2. Meta-cognition in children and adolescents. In adults, meta-cognition is significantly associated with psychopathology (e.g., Cucchi et al., 2012). However, very little research has explored this phenomenon in children. The very few studies that tested its relation to OCD in children have mostly used non-clinical samples. Cartwright-Hatton et al. (2004) developed the Meta-cognitions Questionnaire for Adolescents (MCQ-A) using a sample of 177 healthy adolescents aged 13 to 17. The study explored the prevalence and emotional correlates of meta-cognitions. Five factors emerged from the factor analysis: (1) positive beliefs about worry (e.g., "I need to worry in order to work well"), (2) beliefs about uncontrollability and danger related to worry (e.g., "when I start worrying, I can't stop"), (3) cognitive confidence (e.g., "I have a poor memory"), (4) beliefs about superstition, punishment and responsibility (e.g., "I will get punished for not controlling certain thoughts), and (5) cognitive self-consciousness (e.g., "I monitor my thoughts"). Adolescents in this study endorsed the full range of meta-cognitions experienced by adults, and the degree to which they were endorsed did not increase with age. Therefore Cartwright-Hatton et al. concluded that these concepts may be almost completely formed by age 13. Also, meta-cognitions were significantly related to symptoms of OCD, anxiety, and depression. This study confirms the presence of meta-cognitions in adolescents and shows that they manifest similarly in adolescents and adults. However, it also suggests that meta-cognitions are not specific to OCD. These results are consistent with a follow-up study that used the MCQ-A to explore meta-cognition and other cognitive aspects such as inflated responsibility, and their relationship with obsessive-compulsive symptoms in adolescents (Mather and Cartwright-Hatton, 2004). This study compared several cognitive aspects relevant for OCD and is discussed in more detail on page 87.

Further support for the idea that meta-cognitions are associated with general psychopathology in children comes from a study by Bacow, May, Brody, and Pincus (2010) who investigated it in 98 participants aged 7 to 17. They compared meta-cognition

in children with anxiety disorders and a control group (i.e., 20 children with Generalised Anxiety Disorder, 18 with OCD, 20 with social phobia, 20 with separation anxiety disorder, and 20 healthy participants). Unexpectedly, the children in the control group were more aware of their thoughts than those in the clinical groups. Bacow et al. suggested that children with clinical disorders may use avoidance strategies to manage their distress.

Another possible explanation is that meta-cognition is not important in childhood OCD. This study used a mixed clinical sample and this is both a strength and limitation. Some participants had mixed diagnoses of depression, anxiety and/or behavioural disorders so symptom overlap may have obscured the diagnostic process and thus the results. Also, 40% of the non-clinical sample reported some subclinical symptoms of anxiety, which may explain the unexpected results. Several other studies have investigated meta-cognition in youth in relation to the concepts of inflated responsibility and TAF.

3.4.1.3. The inflated responsibility model of obsessive-compulsive disorder in children and adolescents. The inflated responsibility model is the most investigated cognitive model of OCD in children. A number of correlational studies with non-clinical samples of children and adolescents have demonstrated significant associations between OCD symptoms and inflated responsibility. For example, Magnusdottir and Smari (2004) explored the relationship between responsibility and obsessive-compulsive symptoms in a sample of 202 young people aged 10 to 14 years. Responsibility was significantly correlated with obsessive-compulsive symptoms and significantly predicted obsessive symptoms, after age, gender, and depression were controlled. However, the correlation between responsibility and OCD symptoms was weaker than reported in adult samples, so the authors suggested that the measure they used may be too abstract for this age group.

Yorulmaz, Altin and Karanci (2008) explored the relationship between responsibility and OCD subtypes in a non-clinical sample of 380 adolescents aged 16 to 20 (mean age 17.23 years, SD = .68) and 378 young adults aged 18 to 29 (mean age = 20.3 years, SD = 1.66). Two factors of responsibility were examined: danger prevention and

self-dangerousness. Both responsibility factors were moderate predictors of obsessive-compulsive symptoms and significantly predicted checking. Only the self-dangerousness factor predicted obsessive thinking and only the prevention of danger factor significantly predicted washing compulsions. The authors concluded that different domains of responsibility may be relevant to different symptoms of OCD which supports Rachman et al. (1995)'s idea of responsibility being a multi-factorial phenomenon. Yorulmaz et al.'s sample was a non-clinical sample so work with patients is needed to further test this possibility. Also, there was overlap between ages of participants in the two groups, so perhaps the use of more distinct age categories would have been more relevant.

Comparative studies with clinical and non-clinical samples of children also support the inflated responsibility model. For example, Libby, Reynolds, Derisley and Clark (2004) investigated inflated responsibility, TAF, and perfectionism in a sample of 11 to 18 year-olds (28 with OCD, 28 with other anxiety disorders, and 62 non-clinical participants). Young people with OCD reported significantly higher inflated responsibility, more TAF and concern about making mistakes (a feature of perfectionism) than the other two groups. Inflated responsibility was the only independent predictor of OCD. This study supports the inflated responsibility model, however it did not control depression which limits the robustness of these results.

Experimental work adds to these findings, as a causal relationship has been shown between responsibility and OCD. Reeves et al. (2010) manipulated responsibility in 81 children aged 9 to 12 (mean age 10.10 years, SD = 13.15). Participants were randomly allocated to one of three experimental groups: high, moderate, and reduced responsibility. A sweet sorting task was used to manipulate responsibility. Task duration, hesitation and checking behaviours, and anxiety were measured. As responsibility increased participants worked longer on the task, and checked and hesitated more. Responsibility had no effect on anxiety. However, the authors attributed this to the fact that children were allowed to check their sorting during the task, which may have kept their anxiety low. This study

shows a causal relationship between inflated responsibility and obsessive-compulsive symptoms. Also, it used an age appropriate task that has good face validity, and had a good response rate. However it did not include a control group, i.e., a group in which responsibility was not manipulated, which would have made the effects of inflated responsibility clearer.

Parker (2009) conducted a similar study, but included a control group in which responsibility was not manipulated. Control participants were asked to sort sweets by colour and nothing was mentioned about nut content and allergies. Participants were 66 healthy children aged 9 to12 randomly assigned to a high responsibility, reduced responsibility or a control group. There were significant differences in reassurance seeking behaviours between the high responsibility and the other two groups but no differences in checking. It is surprising that the two studies found different results considering that they used similar methodology and samples, however they both showed that inflated responsibility can increase checking and reassurance seeking behaviour in this age group.

Barrett and Healy-Farrell (2003) recruited 43 children and adolescents aged 7 to 17 who met DMS-IV criteria for OCD. High, moderate, and low levels of responsibility were manipulated using a behavioural avoidance task (BAT). The task consisted of exposing each participant to a stressful situation for up to five minutes. Situations in which the child usually engaged in rituals were chosen, e.g., turning electrical appliances on and off without checking. Each participant engaged in the situation three times, so that the three levels of responsibility can be manipulated for each participant. The first exposure also involved response prevention alone, and a signed contract with the experimenter in which the participant assumed full responsibility for harm occurring during the BAT (i.e., high responsibility condition). The second exposure involved response prevention with the parents, and a contract assigning full responsibility for harm to the parents (i.e., low responsibility). The final exposure involved response prevention with the experimenter, and a contract assigning full responsibility to the experimenter (i.e., moderate

responsibility). Increased responsibility did not increase distress, perceptions of probability or severity of harm, avoidance, or ritualising. These results did not support Salkovskis' (1985) model of OCD. However, Barrett et al. did not dismiss the role of responsibility in paediatric OCD and interpreted their results as indicating that certain cognitive aspects involved in OCD are still developing at that age, and may become more established and clear later in adolescence.

The inconsistencies between experimental studies which have manipulated responsibility in children mean that a causal relationship with OCD has not yet been convincingly demonstrated. Possible reasons include the use of different methods. Reeves et al. (2010)'s used a sweet-sorting task which may have been a stronger manipulation for responsibility than the BAT used by Barrett et al. (2003). This would suggest that a certain level of responsibility is needed to elicit obsessive-compulsive manifestations. Also, the two studies differed in terms of sample, as Reeves et al. used a non-clinical sample while Barrett et al.'s was clinical, and different cognitive processes may unfold in healthy children versus children with psychiatric diagnoses. Also, perhaps it is easier to manipulate responsibility in a sample that has a low baseline for them, i.e., in healthy controls, than in a sample that already experiences them, i.e., a clinical sample.

3.4.1.4. Comparing the models. Several studies compared the cognitive models of OCD in children. Barrett et al. (2003) investigated TAF, responsibility, self-doubt, and cognitive control in 28 children with OCD, 17 with another anxiety disorder, and 14 healthy controls. Children with OCD scored significantly higher on responsibility and TAF, and significantly lower on cognitive control than children in the other groups. However, there were no significant differences between OCD and anxious participants on responsibility and TAF, which may indicate that responsibility and TAF are not specific to OCD. Another possible explanation was offered by the authors who suggested that anxious children may experience obsessive-compulsive symptoms to a certain degree, which would also indicate that these manifestations occur on a continuum. The study also suggests that

cognitive control is a relevant element that should be further explored. This study has several strengths including its experimental design which provides relevant information regarding causal relationships between these aspects and the use of a clinical sample which makes these results relevant for patients. However, it also has several limitations, including a small sample size and the fact that anxious children also reported obsessive-compulsive symptoms which may account for similarities in their cognitive appraisals.

Matthews, Reynolds and Derisley (2007) investigated the relationship between obsessive-compulsive symptoms, responsibility, TAF, and meta-cognitive beliefs in 223 non-clinical adolescents aged 13 to 16. Higher levels of obsessive-compulsive symptoms were significantly associated with each type of cognition, and these cognitive aspects accounted for 35% of the variance of symptoms. While this provides support for the models, it also raises the question of what other elements are involved, that account for the rest of that variance. Results also showed that the relationship between obsessive-compulsive symptoms and TAF was fully mediated by responsibility. Responsibility also partially mediated the relationship between obsessive-compulsive symptoms and meta-cognitions. Matthews et al. concluded that responsibility is the most prominent cognitive correlate of OCD in young people. However, these results should be interpreted cautiously as this study had several limitations such as not controlling mood (Calleo, Hart, Bjorgvinsson, & Stanley, 2010). Similarly, Libby et al. (2004) found that responsibility was the only independent predictor of OCD (compared to TAF and perfectionism). However, similarly to Matthews et al., they did not control depression.

Farrell et al. (2006) investigated cognitive aspects of OCD across ages and found that responsibility increases with age while TAF does not change. Similar to Barrett et al. (2003), Farrell and colleagues suggested that responsibility may be less important for childhood OCD and could develop later from having the disorder, whereas TAF is a causal factor. However, given the correlational nature of this study, these conclusions are speculative.

Mather et al. (2004) investigated the relationship between inflated responsibility, meta-cognition, and obsessive-compulsive symptoms in 166 non-clinical adolescents aged 13 to 17. Responsibility and meta-cognitions were significantly correlated with obsessive-compulsive symptoms. When meta-cognitive beliefs were controlled, responsibility did not independently predict obsessive compulsive symptoms. Furthermore, meta-cognitions continued to predict obsessive-compulsive symptoms even after sex, age, depression, and responsibility were controlled. Mather et al. concluded that meta-cognitions were a better predictor of OCD than responsibility. Unlike Matthews et al. (2006) and Libby et al. (2004), this study controlled for depression symptoms. However poor test-retest reliability on one meta-cognitive subscale was reported, which weakens the robustness of these results.Overall, correlational and experimental studies have provided support for each of the main cognitive models of OCD in children (Reynolds et al., 2008). However, it is still unclear which of these aspects is more important either as an aetiological or maintaining factor. It is also unclear how these cognitions develop, and the literature addressing this process is sparse.

3.4.2. Cognitive-developmental aspects relevant for obsessive-compulsive disorder. Dysfunctional cognitions are a main component of OCD and are believed to be a major causal factor. It is still unclear how these cognitions develop. Piaget (1952) proposed four stages of cognitive development: (1) sensory-motor (birth to age 2), (2) pre-operational (ages 2 to 7), (3) concrete operations (ages 7 to 11), and (4) formal operations (ages 11 to 16). According to this theory, in the first stage the child learns about the environment using his senses and based on body movements, and is ego-centric, i.e., is unaware of others' needs or wants and mainly focuses on its own. In the second stage, the child becomes increasingly aware of others and the world (i.e., decentres), uses symbols, and learns rules of conduct (i.e., can distinguish between right and wrong). During stage 3, the child's thinking becomes more logical, but also starts being more abstract to where the child can imagine scenarios, consider "what if" something happened. In the last stage, the

child fully acquires the ability for abstract thinking. This involves abstract reasoning, hypothetical deduction / causal reasoning, and thinking about thinking (i.e., meta-cognition). Meta-cognitive, TAF, and inflated responsibility models of OCD involve the ability to think about one's own thoughts and actions, and their effect on self and others, so based on Piaget's model, OCD may emerge during the formal operations stage, when the child can reflect on his own thoughts. This may be a time of increased vulnerability to psychopathology, given the importance of cognitions for its emergence and maintenance (Reeves et al., 2010). It may, for instance, explain why younger children experience mainly compulsions in the absence of obsessions (Shafran & Somers, 1998) and perhaps why some authors found early-onset OCD to peak between the ages of 10 and 12 (e.g., Geller et al., 1998).There is virtually no research on normal development of responsibility, so extrapolations only can be made based on theories of moral development (Kohlberg & Kramer, 1969) and social cognition (e.g., theory of mind, Premack & Woodruff, 1978; Astington, 1993), which involve concepts similar to responsibility. However, it is unclear if there is overlap between these concepts. Piaget (1930) proposed that thinking in pre-schoolers is *pre-causal*, meaning their understanding of causal relationships is limited. Piaget (1932) also proposed two stages of morality: heteronomous (ages 4 to 10) and autonomous (age 10 and onwards). Before the age of 4, the child is in a pre-moral stage, where there is little concept of morality and rules. However, as early as age 4, the child begins to understand the consequences of his/her own actions. Based on this model Kohlberg (1971) developed a more complex model of moral development involving three levels, each level including two stages. According Kohlberg, children have a basic understanding of rules and punishment/consequences of their actions in their first few years (i.e., pre-conventional morality stage). Further, during the second stage of moral development after the age of 7 years (i.e., the conventional level, which includes helping behaviour and a sense of duty) morality starts to have a social component, and the child begins to take others' welfare into consideration. It is possible that somewhere in this

process they may start overestimating responsibility and eventually develop an inflated sense of responsibility. However, more recent work shows that as early as the age of 5, children understand basic causal concepts (Kalish, 1996). Also, there is evidence that children as young as age 8 can experience guilt (Tangney, 1998), so they should understand the complexity of causal effects of their own actions. Further work is needed to determine when and how responsibility develops.

3.4.2.1. The role of early experiences. It has been proposed that the child's interactions with the environment, especially early interactions with parents and carers, are central in the development of cognitions, including dysfunctional ones that contribute to psychopathology (Chorpita & Barlow, 1998). Very little work has examined the influence of parenting style on the development and maintenance of OCD. The research that exists mostly draws on theories and empirical research work with people who have anxiety disorders. Rapee (1997) proposed two main parental factors that influence child mental health in general: parental control or overprotection / over-involvement (i.e., behaviours aimed at protecting the child from possible harm) and rejection or criticism (i.e., negative /hostile feelings toward the child). Rapee suggested that criticism and rejection seem more related to depression and that overprotection appears to be more related to anxiety and OCD.

Two types of studies have explored the relationship between parenting and childhood OCD: retrospective and observational. Retrospective studies are conducted with adults (usually clinical samples), and ask about childhood experiences in relation to interactions with carers. Alonso et al. (2004) assessed perceived parenting style and OCD symptoms in 40 people with OCD and 40 healthy controls. Individuals with OCD reported significantly higher rejection from their fathers than controls, but did not report more overprotection from their parents than controls. Turgeon, O'Connor, Marchand, and Freeston (2002) compared memory of parental behaviours in 43 people with OCD, 38 with panic disorder (with agoraphobia) and 120 healthy controls. There were no differences

between the two clinical groups in recollection of parental practices. However, compared to the control group, both anxious groups recalled their parents as more protective. Wilcox et al. (2008) tested the association between parenting factors and life time diagnosis of OCD (according to DSM-IV criteria). Data were collected from 1200 adults in 465 families in two epidemiological studies (i.e., OCD Family Study, Nestadt et al., 2000; OCD Collaborative Genetics Study, Samuels et al., 2006). Parenting factors were measured using the Parental Bonding Instrument (PBI; Parker, Tupling, & Brown, 1979) which is a retrospective measure. The PBI assesses participant's perception of their bonding as a child with each of their parents separately. There was a significant association between perceived maternal or paternal overprotection and OCD. Wilcox et al. interpreted these results as indicating that parenting plays an important role in the development of paediatric OCD.

The recall of adults who have OCD about their experience of parenting is different from the recall of adults who do not have OCD. However, the use of retrospective reports introduces problems with potential memory bias and potentially in clinical samples, participants' perceptions of those experiences may be distorted by their current psychopathology. Observational studies may provide a more accurate picture of parent-child interactions relevant for the development of OCD as they involve directly observing families in the home or laboratory. However, very few such studies have been conducted. Barrett, Shortt, and Healy (2002) observed 10-minute discussions about a threat between parents (either the mother or the father) and child with OCD, other anxiety disorders, externalising disorders, or no psychopathology. Children were aged 6 to 14 years. Parental control, warmth, doubt, avoidance, positive problem solving, confidence and rewarding independence were coded by trained and blinded raters using the Macro-coding Schedule for Parent and Child Behaviours (MPCB; Barrett, Shortt, Healy, & Hartman, 2000).

Parents of children with OCD were less confident in the child's ability to problem-

solve and less rewarding of independence compared to the other groups. Mothers of OCD children were more anxious and depressed and less warm than the other mothers. Children with OCD displayed less warmth in interacting with their parents, and were less confident in their own problem solving ability. These results suggest that parents of children with OCD behave differently toward their children.

To our knowledge, this is the only observational study that explored the relationship between parenting and OCD, and most similar research has investigated these aspects in the context of anxiety disorders (e.g., Hudson & Rapee, 2001). Further observational work could provide valuable information about interactions between family members in real time. However, there are limitations to this type of work. For example, observations studies tend to be conducted in laboratory settings and may therefore lack ecological validity, as this artificial environment may change parent-child interactions. Also, these studies rarely control for parents' mental health, which can also influence these interactions. Anxious and OCD parents may be more protective and critical of their children regardless of their children's mental health or behaviour (Hudson et al., 2001; Challacombe & Salkovskis, 2009). Finally, observations of current family interactions do not provide information about the direction of these influences. Parental behaviour may reflect the child's difficulties rather than be a cause of them. Barrett et al.'s (2002) study provides information about parent-child interactions at a given point but does not show causal relationships. Longitudinal or experimental work is needed to examine these relationships (Waters & Barrett, 2000).

3.4.2.2. Developmental pathways for inflated responsibility. Salkovskis et al. (1999) proposed that responsibility beliefs result from a combination of early developed assumptions about responsibility which are latent and get activated by a critical incident or a series of them. He described five developmental pathways for responsibility, three of which involve early interactions with carers: (1) a broad sense of responsibility for preventing negative events, that is promoted early on in life by significant figures (e.g., a

child who has to look after younger siblings); (2) rigid rules of conduct (e.g., religious behavioural codes); (3) a sensitivity responsibility resulting from the child being shielded from it (e.g., children of parents who convey a sense of the world being a dangerous place, and of an inability to cope with it); (4) an incident or series of incidents that actually lead to serious negative consequence (e.g., an accident the person was directly involved in); (5) an incident that was perceived as being caused by one's thoughts or actions and contributed to serious negative consequences (e.g., wishing something bad happened to someone and then it coincidentally happening). According to Salkovskis et al., critical incidents can lead to increased self-blame, make the person hyper-vigilant in responsibility situations, and develop strict criteria to prevent for harm. Assumptions then develop, which can be innocuous early on but later become activated by a critical incident.

Coles and Schofield (2008) used a sample of 562 healthy undergraduate students to develop a self-report measure for developmental pathways of inflated responsibility (the Pathways to Inflated Responsibility Scale; PIRBS). Study 1 involved an exploratory factor analysis of 47 initial items. Four factors resulted from the factor analysis, all pertaining to childhood experiences: heightened responsibility, overprotection, exposure to rigid rules, and incidents of one's actions causing/influencing actual misfortune. This empirically derived factor structure was very similar to Salkovskis' pathways. One key difference was that, two pathways proposed by Salkovskis, i.e., actions that caused misfortune and actions that influenced misfortune, were collapsed. In Study 2, Coles et al. explored the 4 factors using two samples drawn from 458 undergraduates with cognitive vulnerability to OCD (as measured by the Obsessive Beliefs Questionnaire – OCCWG, 2005), and 170 participants from a cross-sectional study of hoarding behaviours. A confirmatory factor analysis further supported the four-factor structure, so the authors concluded that responsibility beliefs are important for OCD and that a better understanding of the role of early experiences for inflated responsibility could inform the development of early interventions. The authors also identified several limitations to their study however, such

as its retrospective nature and the non-clinical nature of the sample.

Smari, Þorsteinsdóttir, Magnúsdóttir, Smári, and Ólason (2010) tested the PIRBS with 300 healthy undergraduate students aged 18 and over. Their confirmatory factor analysis found support for four factors: heightened responsibility, rigid rules, and overprotection as individual factors, and acts caused by misfortune and acts that influenced misfortune as one factor. Inflated responsibility partially mediated the relationship between developmental pathways and obsessive-compulsive symptoms. However, the authors emphasised that this was a cross-sectional study in a non-clinical population and thus no definite conclusions should be drawn.

Lawrence and Williams (2011) also developed a questionnaire (i.e., the Origins Questionnaire for Adolescents; OQA) to assess developmental pathways of responsibility. The sample was 32 adolescents and young adults aged 14 to 21, and their parents (either mother or father; N = 32). Sixteen of the adolescents had a history of OCD and had received treatment for it, and another 16 had no history of the disorder. Interviews and questionnaires with participants and their parents were used to assess adolescents' sense of responsibility and their memories of their early upbrining experiences in terms of rigid rules, being shielded from responsibility, incidents that were followed by negative outcomes, and extremes of responsibility. No significant differences were found between OCD patients and healthy controls on any variables suggesting that inflated responsibility may not be central for the development of OCD. However, this was a small sample and data were collected retrospectively. Also, it is possible that the newly developed measure did not detect different experiences relevant to the development of their disorder.

Pollock and Carter (1999) proposed that parents may model reactions to cognitive and emotional events. For example, they may respond with distress to the child's intrusions which would make the child become more attentive to intrusions and become more distressed by them. Jacobi, Calamari, and Woodard (2006) explored the development of OCD related beliefs and symptoms by comparing these aspects in a non- clinical sample of

parents and their biological children (adolescents mean age 16 years). The sample consisted of 126 parents and 126 of their biological offspring. Responsibility and threat estimation were robust predictors of obsessive-compulsive symptoms in both parents and adolescents. Obsessive-compulsive symptoms in parent and children were positively correlated. Also, there were small correlations for obsessive-compulsive between the two groups. Parent and adolescent meta-cognitive beliefs were not correlated, which suggests that such cognitions may not be learned from parents. However, this was a non-clinical sample so it is unclear if these findings are relevant to patients. Furthermore, the sample was mostly female and Caucasian so it may not be representative of the non-clinical population.

Pietrefesa, Schofield, Whiteside, Sochting, and Coles (2010) explored cognitive vulnerability in relation to OCD in 28 children aged 4 to 8 years (mean age 6 years) with the disorder and their mothers. There was a significant, positive, moderate correlation between youth and mothers' beliefs of inflated responsibility and likelihood of threat. Interestingly, beliefs about importance and control of thoughts (relevant to meta-cognition) were negatively correlated in youth and their mothers and there was no association between perfectionism and certainty beliefs across mothers and their offspring. These results may suggest that only certain cognitions, e.g., inflated responsibility, are learned from parents, or that only certain cognitions present a genetic vulnerability that is transmitted from parent to child.

Taken together, studies that investigated the importance of family aspects for the development of OCD suggest that early experiences may be relevant in the development of cognitions such as inflated responsibility. However, this work is either retrospective or cross sectional and thus there are significant methodological problems as described previously.

3.5. Behavioural Aspects of Obsessive-Compulsive Disorder in Children

Behavioural aspects of childhood OCD have rarely been addressed in the literature. One challenge in investigating obsessive-compulsive behaviours in this age group is that rituals are developmentally normal in young children (Thomsen, 1993). Many children have a preference for symmetry and like arranging objects, so they may experience a "just right". These behaviours generally subside during adolescence and especially adulthood (Evans et al., 1997). Common compulsions in children include contamination and cleaning, symmetry, repetition, aggression, and checking (Geller et al., 2003).

A small number of studies have shown a causal relationship between cognitions and compulsive-like behaviours (e.g., Reeves et al., 2010). Just as in research with adults, the focus so far in children has been on checking compulsions, as they are the most common. However, this type of work is only in its early stages, and more experiments are needed to test these effects.

3.5.1. Compulsive checking in children. Checking is repetitive, stereotypical, intentional acts driven by a pressure to take action (APA, 2000) and differs from tics in that it is not a mechanical act, it has a purpose, and there is a motivation behind it (APA, 2000). Checking is usually aimed at hypothetical threats and because of that it has no natural terminus (Rachman, 2002). According to cognitive models of OCD, checking is triggered by anxiety associated with intrusive thoughts.

Although checking is a common compulsion in children only a very small number of studies have investigated it in this age group. For example, Yorulmaz et al. (2008) looked at the relationship between responsibility and OCD subtypes in non-clinical adolescents. Responsibility was a significant contributor to checking and one aspect of responsibility, i.e., responsibility focusing on prevention of danger, significantly predicted washing compulsions. Yorulmaz et al. suggested that different domains of responsibility may be relevant to different symptoms of OCD. This possibility should be further tested,

as Yorulmaz et al.'s study used a non-clinical sample and was correlational.

There is also experimental work with children showing a causal relationship between inflated responsibility and checking behaviour. For example, Reeves et al. (2010) (see pg. 76) used a sweet-sorting task to manipulate responsibility in children. Checking was a dependent variable and was coded during the experimental task by two independent raters using a coding system developed based on Ladouceur et al. (1995). Increased responsibility led to increases in checking behaviour but not to anxiety. These results were interpreted as reflecting the anxiolytic effect of checking; children in the sample were allowed to check their sorting throughout the task, so this may have decreased their anxiety about the task. Rachman (2002) proposed that the main purpose of checking is anxiety reduction, and Reeves et al.'s results seem to support this idea. However, a similar study by Parker (2009) (see pg. 76) did not find that responsibility increased checking behaviour.

Inconsistent results have been reported so far in support to the inflated responsibility model in children. However, conceptual limitations (e.g., the lack of a developmental framework for inflated responsibility) and related methodological issues (e.g., responsibility measures that are adapted from measured for adults) may explain these differences. Existing findings encourage further exploration of behavioural aspects relevant to OCD in children, especially with clinical samples, and the addition of developmental considerations to existing cognitive models of OCD.

To our knowledge, no research has tested the relationship between other cognitive domains (e.g., meta-cognition, TAF) and checking in children. Based on research with adults future work with children could test the three cognitive models, and perhaps also consider other cognitions that have be found relevant for adult checking such as perfectionism / certainty (Calleo, Hart, Björgvinsson, & Stanley, 2010) and intolerance of uncertainty (Fitch & Cougle, 2013; Tolin, Abramowitz, Brigidi, & Foa, 2003). These aspects and their relevance for OCD will be discussed in more detail in Part III of this thesis (see pg. 127).

3.5.2. Excessive reassurance seeking. Excessive reassurance seeking has received considerable attention in adults as it a common coping strategy across different disorders (Freeston, 1997) and may operate in similar ways to compulsive checking (Rachman, 2002). Excessive reassurance seeking consists of repetitive requests for reassurance when it has already been provided. Reassurance seeking from adults, especially carers, is common during childhood but is seen as less and less normative as the individual advances into adulthood (Abela, 2001, 2006). Because of that, adults can experience negative reactions and rejection when repeatedly asking for reassurance from others (Davila, 2001). However, it is more likely to be tolerated or encouraged, and thus become excessive, in children, e.g., in the context of family accommodation (Peris, 2008). In OCD, excessive reassurance seeking is seen as a key maintenance factor with as many as 56% of parents providing solicited reassurance to their OCD child on a daily basis (Peris et al., 2008; Storch et al., 2007).

A causal relationship has been found between cognitive aspects such as inflated responsibility and ambiguity / uncertainty and reassurance seeking behaviour (Parrish et al., 2006, 2010). However, even in the OCD adult literature this is a recently explored area, and in children it is virtually non-existent. One experiment by Parker (2009) (see pg. 76) found that high responsibility significantly increased reassurance seeking (compared to low responsibility or lack of it). These results are promising, however Parker's study involved a non-clinical sample so similar work with clinical samples is needed to confirm if these data can be generalised to patients.

There is currently no research that tested the relationship between TAF, meta-cognition and reassurance seeking, and in adults other cognitive domains such as uncertainty seem to play an important role for the behaviour (Parrish et al., 2006, 2010). This work is still in its early stages, and perhaps further work with adult samples is needed before testing these aspects in children.

3.*5.2.1. Family accommodation.* Family accommodation refers to family members

assisting, or taking part in the OCD rituals, and / or providing reassurance and support. As many as 96% of families accommodate to OCD (i.e., Stewart et al., 2008), often daily (Peris, 2008), and this is more common in families with children who have OCD (Cooper, 1999). Developmental aspects may play a role here, as children are more dependent on their carers and reassurance seeking is more socially acceptable in children than in adults. Because accommodation is common and is associated with distress and poor functioning it is often targeted in psychological interventions (Barrett et al., 2004).

Reassurance giving, in response to reassurance seeking, is one of the most common forms of accommodation (Peris, 2008). Although its purpose is to support and help the person with OCD, it often contributes to the maintenance of reassurance seeking and other symptoms (Salkovskis et al., 1986). Furthermore, family accommodation is associated with symptom severity and poorer treatment outcomes (Steketee & Van Noppen, 2003; Renshaw, Steketee, & Chambless, 2005) although it could also be that families of children with more severe OCD accommodate them more. Future research could test the direction of this relationship.

3.6. Summary of Chapter 3

Existing research on cognitive models of OCD in children is limited and has mixed support. No specific cognitive aspect has been identified as the main factor for childhood OCD, and the complexity of the disorder may be responsible for that. However, it is also possible that these contradicting results are due to a lack of a developmental framework and differences in definitions and methodology used (Mancini et al., 2001). Cognitive aspects of OCD may not be fully developed in younger children and current measures may not capture developmental aspects as they may be too abstract or difficult for children. Moreover, existing work on cognitive factors of childhood OCD is mostly correlational and with non-clinical samples. Despite these limitations, existing results suggest that cognitions such as inflated responsibility are important for the emergence and maintenance

of OCD in children and adolescents. More work testing cognitive models of OCD in children is needed, and especially experimental work that can capture causal mechanisms involved. The next chapter focuses on inflated responsibility in children and on its effects on anxiety and obsessive-compulsive like manifestations.

Chapter 4: Testing the Inflated Responsibility Model in Children

4.1. Methodological Aspects of Manipulating Responsibility

Very few studies have manipulated inflated responsibility and tested its effects on obsessive-compulsive symptoms in children, but promising results have been reported (e.g., Reeves et al., 2010). The next section will describe two studies which were conducted as part of this PhD. The first describes the refinement of an experimental task for inflating responsibility in children and of a coding scheme for obsessive-compulsive behaviours. The second examines the effects of inflated responsibility on anxiety, obsessive-compulsive-like behaviours, and experimental task duration in children.

A commonly used experimental paradigm for inflating responsibility is a pill-sorting task initially developed by Ladouceur et al. (1995). The task is used in conjunction with a behavioural coding scheme for measuring obsessive-compulsive-like behaviours. This original task and coding scheme, and different variations of the two, have been used in a number of studies with adults (e.g., Ladouceur, Rheaume, & Aublet, 1997; Bouchard, Rheaume, & Ladouceur, 1999; Arntz, Voncken, & Goosen, 2007). The pill sorting task has also been adapted for use with children. Reeves et al. (2010) changed the pill-sorting task into a sweet-sorting task, which they considered was more developmentally appropriate. Reeves and colleagues found that inflated responsibility increased OCD like behaviours. However, subsequent attempts to replicate these data have been inconsistent (e.g., Parker, 2009). The reasons for these mixed findings are not clear, but it is possible that the task and the behavioural coding were not used consistently across these studies. Therefore the aim of the first study in this thesis was to improve the experimental set-up and the coding system used in the sweet sorting task developed by Reeves et al.

4.1.1. A task for inflating responsibility and measuring obsessive-compulsive-like behaviours in adults

4.1.1.1. The original experimental task. Ladouceur et al. (1995) designed a pill sorting task for use with adults. Forty participants were randomly assigned to one of two groups: high responsibility or low responsibility. The high responsibility group were told that the purpose of the sorting task was to develop a safe medication distribution system. The low responsibility group were told that the study was about colour perception and that this task was practice for the actual study that was going to be conducted at a later time. Each participant was asked to sort 200 sugar capsules into 15 semi-transparent pill bottles. Ten colour combinations were used, and there were 20 capsules of each colour. The participants were asked not to look into the container during the sorting, and to only sort one capsule at a time. Each participant was asked to complete the task as quickly and accurately as possible. Participants were allowed to check and/or correct the pills at any time during the task if hesitation or doubt occurred. During the task, the researcher was outside the room. The experimental task was video recorded and then coded by two raters. Inter-rater reliability was 87.4%. No information was provided by the authors about the method used to train raters.

4.1.1.2. The coding system (Ladouceur et al., 1995). The pill-sorting paradigm was used to inflate participants' perceived responsibility. The dependent variables were doubt and urge to check, discomfort, number of estimated errors assessed using self-report measures, actual number of errors as determined by the experimenter, time taken to complete the sorting measured using a stop watch, checking and hesitation. Checking and hesitation were measured using a coding system. Checking/modifications were defined as: (1) stopping the gaze on a particular pill bottle for a minimum of one second; (2) taking the pill bottle in hand to look inside/empty the content into the palm of the hand; (3) any change, addition or withdrawal of one or more capsules from a given pill bottle. Hesitations were defined as: (1) close examination of a pill for more than two seconds; and

(2) hand movement between two bottles for a minimum of two seconds.

4.1.2. An experimental task for inflating responsibility in children. The adaptation by Reeves et al. (2010) involved asking children aged 9 to 12 (N = 81, mean age 10 years) to sort 120 sweets of six different colours. Children were told that the colour of the sweets indicated if they contained nuts or not: brown and white sweets did not contain nuts; blue and green sweets did contain nuts; and orange and gold sweets might contain nuts. Children were randomly assigned to one of three groups: an inflated responsibility group, a moderate responsibility group, or a reduced responsibility group. Children in the inflated responsibility group were told that the sweets would be given to a group of children at their school, one of whom had a nut allergy. They were told that the experimenter would not check the sweets before they were given to the class. Children in the reduced responsibility group were told that the experimenter would check the sweets before they were distributed to the children and that the experimenter would be responsible for any mistakes. Children in the moderate responsibility group received no information regarding subsequent checking or responsibility.

All children were given a colour coded sorting key to help them complete the task. This remained in sight throughout the task so that the children did not have to rely on memory of the instructions. They were asked to work as quickly and as carefully as possible and asked not to look into the big container. They were told that they could move the sweets between the sorting containers if they made a mistake. The experimenter sat in the same room as the participants for the duration of the task, and was positioned away from the table where the participant was sitting, but within sight. She did not interact with the participant during the task and engaged in reading. The children did not receive any instructions about the role of the experimenter. If the children asked a direct question, the experimenter provided minimal feedback. All participants were video recorded during the task. Behaviours were coded from the recordings and 20% of the recordings were randomly selected and rated by a second independent rater who was blind to the

experimental condition.

Following the task, children's behaviours were coded from the video recordings. The variables were: task duration, number of checks, and number of hesitations. Based on the definitions used by Ladouceur et al. checking was defined as: (1) gazing/looking into a container for a second or more; (2) emptying container into hand/container; and (3) looking at the colour key. Hesitation was defined as: (1) close examination of sweet lasting a second or more; and (2) hand movement between two containers for a second or longer.

A manipulation check was conducted by comparing children's perceived responsibility before and after the sorting task using a one-way ANCOVA in which baseline anxiety was controlled. As expected, children in the high responsibility group reported significantly more perceived responsibility than those in the moderate and low responsibility groups. The manipulation check was therefore successful. The hypothesis that inflated responsibility would increase OCD-like behaviours was supported, as children in the high responsibility group checked and hesitated significantly more and took significantly longer to complete the sorting task, compared to the children in the other groups.

Reeves et al. (2010) successfully manipulated responsibility in children. Their study also show that obsessive-compulsive-like behaviours in children can be assessed, as these results were consistent with results obtained with adults samples using a similar behavioural code (Ladouceur et al., 1995). However, several subsequent similar studies conducted by doctoral students at the University of East Anglia (UEA) found inconsistent results. For example, Parker (2009) successfully manipulated responsibility in a group of children aged 9 to 12. Contrary to Reeves et al., the responsibility manipulation did not result in significant differences in checking. However, Parker included reassurance seeking behaviour (i.e., asking questions or looking at the experimenter) as a new dependent variable and found inflated responsibility to increase it, an effect not observed in the low responsibility and control conditions.

Wator (2009) examined the impact of maternal reassurance giving on child OCD-like behaviours within the context of high responsibility in the sweet-sorting task. A non-clinical sample of 36 children aged 9 to 12 and their mothers were recruited. All children were exposed to a high responsibility condition, and their mothers were randomly assigned to a high or low maternal responsibility group. Mothers in the high responsibility group were told their child was going to sort sweets based on nut content and those sweets would be given to a group of children where one had a nut allergy. Mothers in the low responsibility group were told their child received high responsibility instructions but that the manipulation was fictive. Dependent variables were reassurance seeking, reassurance giving, anxiety, checking and hesitations. Mothers in the high maternal responsibility group gave more reassurance than those in the low maternal responsibility group. Also, children in the high maternal responsibility group sought more reassurance, and hesitated more than children in the low maternal responsibility group. Consistent with Reeves et al. (2010) and Parker (2009), there were no significant differences in child anxiety between groups. Also, consistent with Parker but contrary to Reeves et al., there were no significant group differences in children's checking.

The studies mentioned above found inconsistent effects on behavioural variables using the sweet-sorting task to manipulate responsibility in children, in spite of the responsibility manipulation being successful. However, there were differences in the extent to which the manipulation was successful, as Reeves et al. (2010) found differences in responsibility between the all three groups (i.e., high, moderate and low responsibility), whereas Parker (2009) only found differences between the high and reduced responsibility groups (i.e., there were not differences between high responsibility and control group or between the reduced responsibility and control groups). Moreover, in an additional study Burton (2010) used the same design as Wator with a sample of 38 children aged 9 to 12 but the manipulation failed to increase maternal and child perceived responsibility. Mixed findings of these studies using the same method raise questions about the effectiveness of

the sorting manipulation and the psychometric qualities of the coding system. Considering that this methodology was developed based on an experimental task and behavioural code for adults, and that it is relatively new, the aim of the first study in this thesis was to refine the method and coding system to maximise their reliability.

4.2. Study 1: Coding Obsessive-Compulsive-like Behaviours in Children – Refining an Observational Coding System

A sweet-sorting paradigm and associated behavioural coding system have been successfully used to change perceived responsibility in children and to measure obsessive-compulsive-like behaviours (i.e., Reeves et al., 2010). However, other similar studies have failed to replicate the original results consistently (e.g., Parker, 2009). One possible explanation for these differences is that the method was not used in the same way across studies. The behavioural coding system focused on obsessive-compulsive-like behaviours (i.e., checks, hesitations, and reassurance seeking). Checking and hesitations were coded in the original pill-sorting task developed by Ladouceur et al. (1995) and the method of coding was transferred for use with children. Thus, it is possible that further adaptations to the task procedures and methods, as well as to the coding and system, would make the procedure more appropriate and reliable for use with children.

Study 1 aimed to refine the sweet-sorting paradigm task and the behavioural coding system associated with it.

4.2.1. Method. Study 1 used archival data from a previous experiment aimed at testing effects of inflated responsibility on anxiety and compulsive-like behaviours in children aged 9 to 12 (*unpublished data*). The experiment was conducted between June and July 2010 by a research associate at the University of East Anglia (i.e., Joanna Austin). Data were collected at two state primary schools in Norwich, a city in the East of England, UK, and consisted of self-report questionnaires and video recordings of children completing a sweet sorting task developed by Reeves et al. (2010). Children were

randomly assigned to one of three groups, i.e., high-responsibility, low-responsibility, and control. A one-way ANOVA compared mean baseline responsibility scores and revealed no significant between-group differences, $F(2,64) = .705$, $p = .498$. Another one-way ANOVA tested the success of the responsibility manipulation, but found no significant between-group differences for post-task responsibility, $F(2,64) = 2.759$, $p = .071$. This indicates that the responsibility manipulation was not successful in changing children's perceived responsibility.

Study 1 used behavioural data from this previous experiment, in an attempt to improve the responsibility manipulation and behavioural code. Behaviours (i.e., checking, hesitation, and reassurance seeking) were coded by two independent raters: one rater was the research associate who collected the data and the second rater was the current author who was completing a PhD at UEA (i.e., Sorina Armeanca) and who was blind to experimental condition.

4.2.1.1. Sample. Video recordings of sixty-nine children, aged 9 to12, were used. Thirty-six of the participants in the sample were girls, 68 had White British ethnic background, and one participant was of mixed ethnicity. Children were fluent in English and assented to taking part. Consent was obtained from the parents. Children who were colour blind were excluded from the experiment as the task required sorting different colour sweets. Children in treatment for mental health difficulties were also excluded as the task was designed to induce mild anxiety.

4.2.1.2. Ethical considerations. The heads of the two schools involved in the study were contacted and asked for permission to recruit at their schools. After obtaining consent from the schools, parental consent was obtained for each child involved in the study (Appendix A). Each child's assent to participate was also obtained at the time of study (Appendix B). Children were told that they could stop participating at any time. No dropouts or incidents were recorded.

All data, including the video recordings, were kept in a locked filing cabinet in a

locked research office at the University of East Anglia. The files will be kept for five years from the point of data collection, and after that they will be destroyed.

4.2.1.3. Procedure. Modifications to the coding system were made based on previously collected data, previous research (Herbert et al., 1975; Landis & Koch, 1977; Jones et al., 1999; Peterson et al. 2007; Salkovskis, 2000), and relevant theoretical information. Video recordings of children performing the sorting task were used to review the coding instructions, to identify difficulties and ambiguities in the coding scheme, and to generate new, more explicit instructions. Inter-rater reliability was established through training raters before they started the rating task and was checked throughout the process of rating to ensure that reliability was maintained.

4.2.1.3.1. Training procedure. Using the coding system developed by Reeves et al. (2010) 10 videos were rated independently by both raters. Initially, inter-rater reliability was moderate, i.e., $r = .56$. Next, the experimenters viewed and coded five videos together. During the process, these ratings were compared and discussed. As a result, several behaviours and the thresholds for each category of behaviours were redefined (see pg. 101). Ten new recordings from the same data set where then rated independently by both raters. The two experimenters met on three other occasions and similar procedures were employed to further refine to coding system.

Several aspects relevant to coding accuracy and task set-up were identified during the code re-defining process. In relation to how the task was presented and set up, these were:

- The importance of having a clear view of the participants' faces and of other elements involved in the task (e.g., a colour key);
- Correct positioning of the camera and other materials (e.g., the colour key was positioned too close to a sorting container which made coding more difficult and less accurate);
- The quality of the video recording (e.g., being clear enough to allow eye

movement detection).

To ensure consistency in the task, a "map" for positioning the sorting containers/bag and key on the table was developed.

Time frames for defining behaviours were discussed and reviewed (i.e., one second), as well as differences between adult and child speed in performing a sorting task. Given the short time frames for coding behaviours some were watched in slow-motion (i.e., at a fourth of the real speed) for more accurate coding. Following close analyses of the video recordings it was concluded that the original time frames used by Ladouceur et al.'s (1995) (i.e., one second for checks and two seconds for hesitations) were also applicable to checking and hesitating behaviours displayed by children. Several behaviours (e.g., checking the label – previously coded as checking; feeling the sweets – previously coded as hesitation by Reeves et al., 2010) were eliminated as they were difficult to rate reliably.

4.2.2. Results

4.2.2.1. The new code

4.2.2.1.1. Checking. This behaviour was redefined as:

(1) Gazing at one container for at least 1 second;

(2) Tilting the container to look in it or holding it up to see through it inside;

(3) Emptying the content of a container onto hand or table;

(4) Sorting through the container to ensure that no sweets have been misplaced;

(5) Gazing at a sweet for at least 1 second, while holding it;

(6) Looking at the colour key.

4.2.2.1.2. Hesitation. This behaviour was redefined as:

(1) Close examination of a sweet (i.e., turning the sweet over while looking at it) for more than 1 second;

(2) Back and forth hand movement between at least two containers for at least 1 second.

4.*2.2.1.3. Reassurance Seeking.* This behaviour was redefined as:

(1) Verbal reassurance seeking (i.e., asking questions regarding the task);

(2) Visual reassurance seeking (i.e., looking at the experimenter).

4.2.2.1.4. Time taken to complete the task. This behaviour was measured in seconds, using a stop watch. Timing started as soon as the child was told to start the sorting task and ended when the child informed the researcher of having completed the task.

4.2.2.2. Inter-rater reliability. Twenty new videos (i.e., 30% of the same data set) were randomly chosen to assess inter-rater reliability of the new coding system. This percentage was chosen based on Barrett et al. (2005). Videos were rated independently by two raters. One rater was blind to experimental condition. Two-way random intra-class correlation analyses were used to test the inter-rater reliability of the new coding system. This method is recommended when the same raters are used for all ratees, and only a sample of all recruited participants are rated (Chicetti, 1994). In order to determine inter-rater reliability we sought to determine the magnitude of the discrepancy between scores from the two raters, and not absolute agreement between the two; this analysis used the averages of the ratings provided by the two raters, and accounted for the variability in the sample, i.e., the proportion of total variance due to differences between ratees (and not to differences between raters or occasions when behaviour occurred).

Inter-rater reliability was excellent for reassurance seeking (> .75) and adequate for checking (.60-.74; Chicetti, 1994), meaning that each behaviour was rated similarly across the coders, i.e., there was a high degree of agreement between them. However, inter-rater reliability was poor for hesitation which indicates that this behaviour cannot be coded reliability using this behavioural system. Intra-class correlation coefficients for these variables are reported in Table 1 (see pg. 103).

Table 1

ICC for behavioural dependent variables

Variable	ICC	Lower bound	Upper bound
Checking	.704	.56	.807
Hesitation	.357	.131	.548
Reassurance seeking	.772	.654	.853

Note: 95% CI

4.2.3. Discussion. This study aimed to refine an existing experimental task and behavioural code for measuring obsessive-compulsive behaviours in children. Several behaviours were targeted, i.e., checking, hesitating, reassurance seeking, and task duration. Data consisted of video recordings of children aged 9 to 12 who were asked to sort sweets, in an inflated responsibility context. Procedural standards were reviewed and improved. Definitions and time frames for each behavioural variable were discussed and refined. Results revealed that reliability was excellent for checking and good for reassurance seeking; however it was poor for hesitating. Therefore the revised behavioural code can be used to measure checking and reassurance seeking as defined within the new coding system in children aged 9 to 12 in an experimental setting, while coding of hesitating-like behaviours relevant to OCD in this age group requires further exploration and refinement.

The method used to code behaviours was adapted from previous studies (e.g., Reeves et al., 2010; Parker, 2009). Thirty percent of the data set was coded by two separate raters. This percentage was decided based on similar studies that used the same coding system and double-rated between 20% and 25% of the data (e.g., Parker, 2009; Burton, 2012), and on one study that involved a more complex coding system for parent-child interactions and used 30% of the data for inter-rater reliability (Barrett et al., 2005). All these studies used participants of ages similar to our sample (i.e., between 9 and 12,

and between 7 and 13, respectively) and used intra-class correlation coefficients to determine inter-rater reliability. Also, the behaviours targeted by Parker and Burton were the same as the ones targeted by our study, and the theoretical concepts involved in these studies were similar to the ones targeted by the present research (i.e., inflated responsibility and obsessive-compulsive behaviours in children). Studies with adults have measured both obsessive-compulsive like behaviours and compulsive urges. However, children may have limited ability to identify and express internal experiences (such as compulsive-like urges) due to insufficient cognitive development. Therefore direct observations of OCD-like behaviours, including checking, reassurance seeking, hesitation and latency are important alternatives.

Based on intra-class correlation coefficients obtained in this study, this coding system has good inter-rater reliability for checking and reassurance seeking behaviours. Redefining the targeted behaviours and eliminating ambiguous behaviours further increased the reliability of the code. Checking and hesitation definitions were based on those developed by Ladouceur et al. (1995). These definitions were originally designed based on clinical observations, so they have good construct validity. Furthermore, we considered redefining these behaviours while taking developmental aspects such as motor coordination into consideration. After carefully considering these issues, we concluded that the code is as valid for identifying these aspects in children as it is for adults. Also, numerous similar studies with adults used this method successfully and identified significant differences between their experimental and control groups, which confirms that the system has good concurrent validity.

Refining the task and coding scheme was a priority. Previous experimental studies had reported mixed and inconsistent results and one possible reason for this was that the task procedures were inconsistent and/or the coding scheme unreliable. Therefore, before conducting further experimental research it was important to exclude these possibilities as far as possible. It was possible to develop reliable coding and to establish a procedure

which maximised conformity between experimental studies. This work is valuable in that it improves the psychometric qualities of the code for checking and reassurance seeking behaviours, and thus ensures its successful use in an environment where experimental control is limited.

However, low inter-rater reliability was poor for hesitation, which indicates that this behaviour is more difficult to code accurately compared to checking and reassurance seeking. One possible explanation is that hesitation in OCD is less documented than checking and reassurance seeking behaviours which are well documented in the OCD literature in both children and adults, whereas hesitation less so. It is possible that the definitions used here for hesitation do not have good construct/ecological validity and are more difficult to be recognised consistently. Also, hesitation may be more difficult to capture in a simple sweet-sorting task.

A possible limitation of this study was the way inter-rater reliability for checking, hesitation and reassurance seeking was determined. Intra-class coefficients were used, which controlled variability within subjects and tested consistency in rating across the two raters by comparting averages of ratings (and not testing for absolute agreement). This method is different to assessing inter-rater reliability at the item level which would ensure that each raters scores each of occasions. However, this method is limited in that it does not provide information about inter-rater reliability at item level (i.e., if the two raters coded the same occasions).

Another limitation of this work is the use of an analogic sample. Although there is evidence that compulsive-like behaviours are present in the general population and that they are qualitatively similar to compulsions (Fullana et al., 2009), differences may exist. Future work could validate this methodology with a clinical sample. Also, future work could measure both obsessive-compulsive behaviours (using the code) and compulsive urges (using self-report measures) and test the relationship between the two, in both clinical and non-clinical samples of children and adults. A strong positive correlation between

observed behaviours and self-reported urges would be a good indicator of construct validity. Additionally, this would provide interesting information about the interplay between compulsive urges and compulsive behaviours.

4.2.4. Conclusion

Overall, the results of this study indicate that the behavioural coding system described here is a reliable way of measuring checking and reassurance seeking – like behaviours in children aged 9 to 12, and that the changes made here further increase its psychometric qualities. In spite of existing work reporting mixed results, this methodology for use with children is still relatively new and promising and its further improvement and use are granted. Study 2 focuses on the effects of inflated responsibility on delayed anxiety, obsessive-compulsive like behaviours, and task duration in children, using the sweet sorting task and new code.

4.3. Chapter Summary

Several experimental studies with children tested the inflated responsibility model using a sweet-sorting paradigm (e.g., Reeves et al., 2010). This work has proven successful in showing a causal relationship between responsibility and obsessive-compulsive like behaviours in children. However, this is a relatively new area of research, and mixed results have been reported using this paradigm. Study 1 improved the experimental set-up and the reliability of the behavioural coding, which increases the quality of future work with children using this methodology. The next chapter describes Study 2, an experiment that uses this methodology to further test the inflated responsibility model in children.

Chapter 5

Study 2: An Experimental Test of the Inflated Responsibility Model in Children

5.1. Introduction

Responsibility appraisals are positively related with obsessive-compulsive symptoms, in both clinical (Libby et al., 2004; Barrett & Healy, 2003) and nonclinical samples (Matthews, Reynolds, & Derisley, 2007; Magnusdottir & Smari, 2004; Mather & Cartwright-Hatton, 2004) of children and adolescents. Also, responsibility significantly predicts obsessive-compulsive symptoms over and above other variables (e.g., depression symptoms) in healthy children (Magnusdottir et al., 2004) and experimental work (i.e., Reeves et al., 2010) shows a causal relationship between responsibility and obsessive-compulsive-like behaviours in children (see pg. 76).

Surprisingly, inflated responsibility does not seem to affect anxiety in children (e.g., Reeves et al., 2010; Barrett et al., 2003). Specifically, Reeves et al. inflated responsibility using a sweets sorting task and found no changes in anxiety. The authors attributed the lack of significant increases in anxiety to children being allowed to check their sorting throughout the task. This may have kept their anxiety low. Reeves et al.'s assumption was based on Rachman (2000)'s theory of checking decreasing anxiety, which has found support in studies with adults (e.g., Rachman & Shafran, 1998). Rachman also proposed that the anxiety reduction is only temporary, and that sooner or later after compulsions cease, anxiety increases again. In their study, Reeves et al. measured anxiety immediately after the task, when anxiety could have been low due to checking. It is possible that children's anxiety increased shortly after the task was completed, but this delayed effect was not captured.

Study 2 uses a sweet-sorting task (see pg. 107) to test delayed effects of inflated responsibility on anxiety, i.e., 10 minutes and 24 hours after the experimental task. This

study was conducted in collaboration with a research assistant Joanna Austin.

5.2. Hypotheses

Manipulation check: we expected that the experimental manipulation would change children's perceived responsibility; specifically, children in the inflated responsibility group would report significantly higher responsibility than the low-responsibility and control groups.

We hypothesised that:

1. Children in the inflated responsibility group would report higher anxiety immediately after the task, after 10 minutes, and after 24 hours than to the low-responsibility and control groups.2. Children in the inflated responsibility group would check, hesitate, and seek more reassurance than those in the low-responsibility and control groups.

3. Children in the inflated responsibility group would take longer to complete the sorting task than children in the low-responsibility and control groups.

5.3. Method

5.3.1. Design. This was a between-groups randomised experiment. The independent variable was the level of perceived responsibility (i.e., inflated responsibility, low responsibility, and no responsibility).

Dependent measures were as follows:

a. Self-reported anxiety

b. Number of checks

c. Number of hesitations

d. Number of reassurance seeking behaviours

e. Task duration measured in seconds.

Data were collected at 3 time points: baseline, immediately after the task, and 10 minutes after the task. Self-report measures of anxiety and responsibility were assessed before the task (i.e., baseline) and at 3 points after the task (i.e., immediately after, the task

and 10 minutes and 24 hours later). Children were randomly assigned to one of three groups: inflated responsibility, low responsibility, and no responsibility (i.e., control). Randomisation was done by using sealed envelopes and was balanced for gender.

All children were asked to sort 120 sweets based on nut content (i.e., have nuts, might have nuts, no nuts). Children in the high-responsibility and low-responsibility groups were told that the sweets would be given to a group of children where one child had a nut allergy. Children in the control group were asked to sort the sweets according to colour alone and there were not told about nuts or nut allergies.

5.3.2. Participants. Sixty-eight children aged 9 to12 were recruited (mean age 10.5 years, SD = 0.74). All participants were fluent in English. Fifty seven percent were female.

5.3.2.1. Selection criteria. Children with special educational needs (as determined by their teacher or Special Educational Needs Coordinator – SENCO), colour blindness or nut allergies (as determined by their parents) were not included. Inclusion/exclusion criteria were employed in order to ensure that all participants were cognitively and visually able to complete the experimental task.

5.3.2.2. Sample size. The sample size was calculated using the University of California, Los Angeles (UCLA, 2004) department of statistics online power calculator (http://homepage.stat.uiowa.edu/~rlenth/Power). A minimum of 22 participants was required in each of the conditions (i.e., 66 participants in total) to achieve appropriate statistical power. To encourage participation, schools received a £3 book token for each participating child. A total of 77 children were recruited.

5.3.2.3. Recruitment. Participants were recruited from one primary and one junior school in Norfolk. Head teachers were invited to participate via email. If they expressed interest in taking part they were visited at school by the researcher. Following consent from the head teacher at the respective school, parents and children were sent invitation letters (Appendix C), information sheets (Appendix D and E, respectively), and consent

forms were sent to parents. Children's assent to participate was also obtained at school immediately before data collection.

5.3.3. Ethical considerations

5.3.3.1. Consent. Parents received a letter of invitation and information sheets and were asked to complete a consent form if they agreed to their child's participation in the study. Children's written assent to participate was also obtained. The researcher told each child that they could decline participation even if their parents had given consent. Children and parents were also told that they could withdraw from the project at any point, without giving a reason. The experimenter was required to complete a Disclosure and Barring Service (DBS) check.

5.3.3.2. Confidentiality. Data were managed according to the Data Protection Act (1998). Data are kept in a locked cabinet at UEA. They will be retained for five years from the completion of the study and then destroyed. Participant identification numbers were assigned to all children and personally identifying data were not stored. Children and their parents, as well as the schools were made aware of the data protection protocol and informed that participants' identity would be kept confidential.

5.3.3.3. Deception and managing distress. The experimental task had been previously used with children (e.g., Reeves et al., 2010) without negative consequences for the participants. At the end of the study children were fully debriefed. This was based on similar previous studies and had no negative consequences for the children. Children were not debriefed at the end of their individual participation because they could have potentially told their peers who had not yet participated about the deceptive aspect of the study. This would have compromised its validity. No participants showed signs of distress. No participants had elevated anxiety scores at baseline or reported very high anxiety at follow-up.

5.3.4. Measures

5.3.4.1. Demographic Questionnaire. This was completed by parents before the

child took part in the study. It included child's age, gender, ethnicity, allergies, and colour-vision (Appendix F).

5.3.4.2. Baseline measures

5.3.4.2.1. Measures of inflated responsibility (manipulation check; Reeves et al., 2010). This measure assessed changes in perceptions of responsibility, probability of harm, and severity of harm before and after the sorting task. It is a 6 item scale; each on a 5-point Likert scale ranging from 0 (completely disagree) to 4 (completely agree) (see Appendix G1 and G2). Two items measure perception of responsibility, two measure probability of harm and two measure severity of harm.

5.3.4.2.2. The State Trait Anxiety Inventory for Children (STAIC; Spielberger, Edwards, Lushene, Montuori, & Platzek, 1973; Appendix H*).* This measure has two scales: one for state anxiety (20 items) and one for trait anxiety (20 items), using is a 3-point Likert-like system. It has good retest reliability (r = 0.63 to 0.72; Finch, Kendall, Montgomery & Morris, 1975). For the present study only the state anxiety scale was administered.

5.3.4.3. Dependent measures

5.3.4.3.1. Visual analogue scale for anxiety (Appendix I). This measured subjective state anxiety relating to the task and it consisted of an un-numbered line. The scale represents a continuum from "no anxiety whatsoever" to "extreme anxiety", and was used at baseline, immediately after the task, 10 minutes, and 24 hours later. Scores were computed using a ruler and a calculator.

5.3.4.3.2. Behavioural measures. Children's behaviour during the task was assessed using the adapted behavioural coding scheme described above in Study 1 (see pg. 101).

5.3.4.3.2.1. Hesitations, defined as: close examination of a sweet (1 second minimum); or back and forth hand movement between at least two containers (1 second minimum).

5.3.4.3.2.2. Checks, defined as: gazing at one container (1 second minimum); tilting

the container/holding it up to see inside; emptying the container onto hand/table; sorting through the container; gazing at a sweet, while holding it (1 second minimum); or looking at the colour key.

5.*3.4.3.2.3. Reassurance seeking*, defined as: asking questions regarding the task; or looking at the experimenter.

5.3.4.3.3. Duration. This was time taken to complete the experimental task, measured in seconds, using a stop watch.

5.3.5. Procedure. The experimental task was conducted at each school. Children took part individually, in a quiet room (e.g., empty classroom). They were given an information sheet about the study and told that they did not have to take part and that if they did take part that they could stop at any time. If children were happy to take part they were asked to sign an assent form. The experimenter randomly assigned children to a group using sealed envelopes. After randomisation the children were asked to complete the baseline measures. They were then given instructions for the sorting task. The experimenter was present during the experimental task but did not interact with the participants.

During the task children were videotaped. This made it possible to code their behaviours. After they had completed the task, they were asked to complete a visual analogue scale to show if they felt anxious, they then completed a 5-minute filler task (Appendix J) and the high responsibility and low responsibility groups were asked to complete a brief nut allergy quiz (only the experimental groups; Appendix K).

Each child was then left in the room for 5 minutes on their own in order to avoid a reassuring effect due to the experimenter being present. This presence could have decreased their anxiety. When the experimenter returned to the room, participants completed another visual analogue scale for anxiety, the state anxiety, and the inflated responsibility measure.

Children were followed up 24 hours later at school and asked to complete a visual

analogue scale for anxiety.

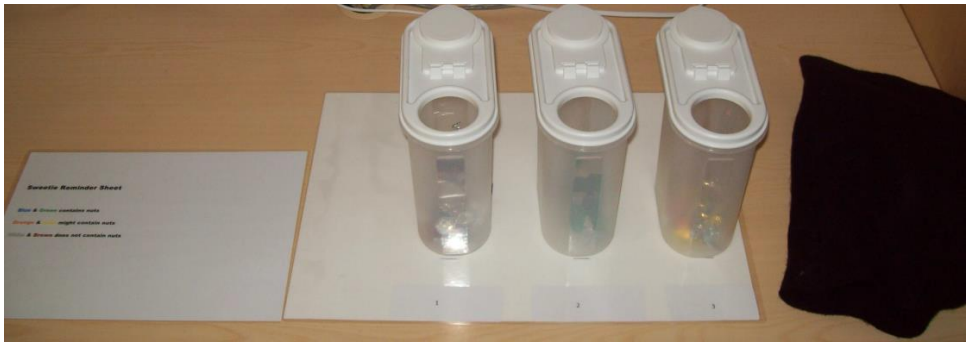
After all measures had been completed, i.e. after 24 hours, all children were fully debriefed as a group at the end of the study and received a certificate of participation. The school received £3 per child for participation. A flow diagram of the study procedure is attached here (Appendix L).

5.3.6. Verbal instructions. To ensure consistency, verbal instructions were read aloud from a script. Children in each of the three randomised groups had different instructions and these are shown verbatim in Appendices O1-O3.

5.3.6.1. All participants. Children were asked to sort 120 sweets (i.e., toffees) individually wrapped in solid colour paper out of a black cloth bag into plastic containers, based on either nut content (i.e., high responsibility and low responsibility groups) or colour (i.e., control group). The sweets and experimental set-up are illustrated below in Figures 2 and 3, respectively.

Figure 2. Sorting sweets

Figure 3. Experimental set-up



Each child was given specific instructions and a "colour key" for sorting (Appendix M). Children in the high-responsibility and low-responsibility groups were told that after the sweets were sorted that they would be given to a class of children.

5.3.6.2. Experimental groups. To assess the relevance of the task children in these groups were asked if they had any allergies or knew anyone who did. They were then given a brief fact sheet about nut allergies (Appendix N) and information about the sweets. They were told that, once sorted, the sweets would be given to a group of children where one child was allergic to nuts.

a) The inflated responsibility group were told that the researcher would not check their sorting before giving the sweets away. There were told that, for that reason, it was very important that they sorted the sweets as accurately as possible (Appendix O1).

b) The low responsibility group were told that the researcher would check and correct any mistakes that they made. Therefore it would not be the child's fault if they made any mistakes (Appendix O2).

5.3.6.3. Control. The control group was asked to sort the sweets according to colour. Nothing was mentioned about nuts or allergies (Appendix O3).

5.4. Results

5.4.1. Overview. The results section presents demographic data for the entire sample, and describes data distribution and treatment, including transformation of non-normally distributed scores. Group differences for baseline scores are explored, and a responsibility manipulation check is conducted. This section also reports inter-rater reliability of behavioural measures, and tests the study hypotheses. Finally, a summary of the results is also included in this section.

5.4.2. Demographic data. Demographic information was collected from the parents. The data were analysed for the sample as a whole, as well as for each

experimental group. The gender and age distribution for the whole sample and each group are illustrated in Table 2. Thirty-three participants were male (42.85%). The mean age of all participants was 10.54 years (SD = .72) and the age range was 9.08 to 11.66 years.

Table 2

Demographic information for the whole sample and for each group

Group	N	Males	Females	Mean age	SD age
Whole Sample	68	33	44	10.54	0.72
Inflated Responsibility	27	12	15	10.53	0.78
Reduced Responsibility	24	10	14	10.53	0.64
Control Group	26	11	15	10.54	0.74

Most participants in this study were of White British ethnicity (85.7%), which is representative of the local area. The rest of the participants were other White ethnicity (3.9%), Asian (3.9%) or of mixed race (2.6%).

5.4.3. Distribution and treatment of data. All the data were entered into an SPSS spreadsheet. Anomalous values were checked against the original questionnaires to ensure that they were not due to data entry errors. Missing data (i.e., 4 values in the entire data set) were coded as 999. Distribution of data was examined by using Levene's test of normality and histograms generated in SPSS. Outliers (i.e., any scores that were 2.5 SD above and below the mean) were identified using box plots and standard deviation (SD) (Field, 2006) and were eliminated. One significant outlier was identified for the STAIC and one for the responsibility measure, and eliminated to improve distribution.

Baseline STAIC scores were normally distributed. Distribution of scores on all other measures (i.e., inflated responsibility, anxiety, behavioural measures, and task speed) was skewed. These were transformed to their square root, which did not normalise the scores. Log10 transformations were also computed, but they did not improve distribution over and above square root transformations. Only square root scores were kept and used in

all statistical analyses.

5.4.4. Between group comparisons for baseline scores. A one-way MANOVA was used to compare the three groups on baseline variables (i.e., Measures of inflated responsibility and STAIC). This was chosen to reduce the possibility of a Type 1 error and to have greater statistical power (Field, 2000). There was a significant between-group difference for baseline state anxiety (measured by the STAIC), $F(2, 71) = 4.261$, $p = .018$. The high-responsibility group reported significantly lower anxiety (M = 5.154, SD =.364) than the control group (M = 5.476, SD =.403). Baseline state anxiety was controlled in all analyses. . There was no significant between-group difference for baseline responsibility. Descriptive statistics for transformed baseline anxiety and responsibility are presented in Table 3 (Appendix AJ).

5.4.5. Manipulation check – post-task responsibility. We expected that the manipulation would successfully change perceived responsibility after the sorting task. To test this we used a univariate ANCOVA with transformed scores. Baseline STAIC was controlled. The responsibility manipulation was partially successful. There was a significant between-group difference for post-task responsibility, $F(2, 72) = 3.54$, $p = .034$, Cohen's $d = 1.008$ (online calculator; http://www.psychometrica.de/effect_size.html). Tests of between-subjects effects showed a significant difference between the low-responsibility and high-responsibility groups, $p = .035$, with the low-responsibility group reporting significantly less responsibility (M = 1.175, SD = 1.120) than the high responsibility group (M = 2.013, SD = 1.305). However, the control group did not significantly differ from the other two groups (M = 3.26, SD = 3.93). Descriptives for transformed pre- and post-task responsibility scores are presented in Table 4 (pg. 117).

Table 4

Transformed pre- and post-task responsibility scores by group

Group	N	Range	Mean	SD	Median	Skew	Kurtosis
Baseline Responsibility							
Whole Group	75	3.61	1.76	.962	2	-.439	-.389
High Responsibility	26	3.61	1.832	.973	2	-.699	.084
Reduced Responsibility	24	2.83	1.566	.887	1.73	-.677	-.671
Control	25	3.61	1.871	1.029	2	-.263	-.499
Post-task Responsibility							
Whole Group	77	3.87	1.564	1.227	1.732	.025	-1.197
High Responsibility	27	3.87	2.012	1.280	2.236	-.450	-.854
Reduced Responsibility	24	2.83	1.175	1.120	1.207	.145	-1.679
Control	26	3.61	1.459	1.159	1.414	.221	-.950

Further visual exploration of mean baseline responsibility scores for each group showed a difference between the high responsibility and low responsibility groups. Although a one-way MANOVA (see section 5.4.4 above) revealed no between-group significant differences for baseline responsibility, it is important to keep in mind that the power calculation for the study was designed to detect significant between-group

differences for the dependent variables; however, it was not designed to capture such differences for the independent variable. For this reason, a subsequent univariate ANCOVA was conducted; this was to compare post-task responsibility between groups, while controlling for both baseline STAIC and mean baseline responsibility. Similar to the previous ANCOVA, results showed a significant overall univariate effect, $F(2, 64) = 2.69$, $p = .074$. However, pairwise comparisons showed that the difference between the high-responsibility and low-responsibility groups was no longer significant once baseline responsibility was controlled, $F(2, 64) = 2.69$, $p = .074$. This suggests that differences observed were due to baseline responsibility scores, and not to the responsibility manipulation.

5.5. Summary of results. Results from Study 2 show that the responsibility manipulation was not successful, as significant differences in perceived responsibility were only found between the high-responsibility and low-responsibility groups, and these differences were no longer significant after baseline responsibility scores were controlled. Given the unsuccessful responsibility manipulation, subsequent analyses to test the study hypotheses were not conducted.

5.6. Discussion

On the basis of the inflated responsibility model of OCD it was hypothesised that children in the high responsibility group would display more OCD like symptoms and report more anxiety than children in the low responsibility and control groups, immediately after the task, and 10 minutes and 24 hours after they completed the task. However, the responsibility manipulation was not successful in changing participants' perceived responsibility, so subsequent analyses to test the study hypotheses were not conducted.

The methods used in this study had been refined to improve consistency and reliability of scoring (see Study 1, pg. 98), however it is possible that other methodological

issues undermined the effectiveness of the manipulation. These will be discussed first, before considering the strengths of the design and methods. Next, the implications of the results for the relevance of the inflated responsibility model for OCD in children will be addressed.

Participants in this study were recruited from schools in Norfolk and the sample was representative of the area in terms of ethnicity. Several schools were contacted and two agreed to take part. Parents of 79 children out of approximately 120 that were contacted agreed to participate, so the study had an overall response rate of 65.8%. Out of the 79 participants recruited for the study, 11 had already participated in a similar study at their school in the previous year. This was a possible threat to the validity of the study, as the 11 participants had been debriefed about the manipulation. All participants were asked if they remembered/had heard anything from their peers about the previous study and what exactly they remembered about it. None of the children recalled any information that could have compromised the credibility of the manipulation; however, it is possible that their previous participation somehow compromised the validity of the responsibility manipulation.

Twenty-seven children were randomly allocated to the high responsibility group, 24 to the low responsibility group, and 26 to the control group. Sample size calculations for this study (based on Reeves et al., 2010) suggested a minimum group size of 22 participants. This was based on effect size of $d = .64$ (medium effect size; Cohen, 1996) therefore the sample was large enough to detect a medium effect.

The sweet-sorting task used had successfully manipulated responsibility beliefs in other studies with children of ages similar to our participants (e.g., Reeves et al., 2010; Parker, 2009). Also, the behavioural coding system associated with the sweet-sorting task was adapted from an adult version and had been used successfully with children. The majority of dependent variables were behaviours, which leaves less room for interpretation or problems associated with self-report in young children. In addition, the method had

been refined in a previous study and had been demonstrated to be reliable. Also, the fact that the task took place in the students' schools may have increased the study's external validity (compared to it being conducted in a laboratory).

Promising results have been obtained using the sweet-sorting paradigm, however a number of experiments have reported mixed results. Burton (2012) did not find it effective in increasing mothers' responsibility, while Reeves et al. (2010) and Parker (2009) found no significant differences in responsibility levels between the high responsibility and the control group. Our data showed a significance level of $p = .74$ for differences in responsibly between the two experimental groups. The sample size calculation for Study 2 aimed to detect differences between groups for the dependent variables, but not for the independent variable. It is thus possible that significant changes in responsibility as a result of the experimental manipulation would have been better captured using a larger sample of children.

Several aspects may be responsible for the failure of the responsibility manipulation in the present study. Firstly, it is possible that it was not strong enough; perhaps the task was too remote in terms of its possible harm to others, and children may have focused on sorting the sweets correctly and thus on task performance, rather than attempting to avoid harm to others (i.e., responsibility). The children in the experimental groups were provided with information about nut allergies and a quiz about allergies during the delay period as reminders of the implications of the task, but perhaps these prompts did not achieve that goal.

Secondly, it is possible that the time when responsibility was measured (i.e., after the task) influenced responsibility scores. There is evidence that checking affects perceived responsibility (e.g., van den Hout et al., 2004), and in the present study we measured responsibility at the end of the sorting task, instead of immediately after the manipulation (i.e., before the child started the task). It is thus difficult to determine if the child's self-rated responsibility scores were influenced directly by the responsibility manipulation, or if

they were also influenced by their engagement in the sorting task. If children attended to the task and felt that they performed well it is possible that any initial feelings of responsibility instilled by the manipulation were reduced by completing the task. Measuring responsibility immediately after the manipulation, but before they engaged in the sorting task, would have provided a more immediate and perhaps accurate measure of perceived responsibility.

Thirdly, the responsibility measure used to assess the effectiveness of the manipulation was the same as the one used by Reeves et al. (2010). However, this measure has not been validated for this age group. Perhaps the development of a validated tool would allow for better detection of differences in responsibility. Future work could focus on this and on developing other similar measures.

Another important methodological aspect is that the researcher was not blind to the experimental condition. Several measures were taken to avoid researcher bias. Scripted instructions were used throughout the experiment, and were read out verbatim to each participant. A second rater who was blind to the experimental condition was used to rate children's behaviours. Inter-rater reliability for all the targeted behaviours was good. Therefore experimenter bias is likely to have been minimal.

A possible confounding factor was the presence of the experimenter during the task. Studies with adults have left participants alone in the room during the sorting tasks, to avoid a reassuring effect of the experimenter's presence. Given the age of our participants, we were unable to leave them alone during the sorting task. It is possible that the presence of the experimenter kept children's perceived responsibility low as they may have felt that their responsibility for the sorting was shared with the experimenter. Salkovskis (1989) proposed that one of the aims of compulsive checking and reassurance seeking is to share perceived responsibility; this has yet to be tested empirically.

Finally, this study involved a non-clinical sample so it is difficult to generalize these findings to clinical populations. However, the study aimed to investigate aetiological

mechanisms of OCD (i.e., that occur prior to the person developing the disorder), so the use of a non-clinical sample was appropriate. The young ages of the participants (i.e., 9 to 11.6) allowed us to observe cognitive and behavioural phenomena that may be involved in the emergence of the disorder. Also, the use of a non-clinical sample allowed for more experimental control, which increased the internal validity of the study, and also allowed for fast recruitment which would have not been possible with a clinical sample (Abramowitz et al., 2014).

Methodological aspects of this study may also account for the failed responsibility manipulation. Reeves et al. (2010) used the sweet-sorting paradigm to manipulate responsibility and found significant group differences for compulsive behaviours. Barrett et al. (2003) used a behavioural avoidance test (BAT) and responsibility contracts to manipulate responsibility and found no effects on anxiety and compulsive behaviours. Reeves et al. attributed the difference between their results of those of Barrett et al. to the strengths of the manipulation, i.e. their sweet-sorting manipulation being stronger and eliciting more responsibility than the BAT. Although we used Reeves et al.'s method in the present study, the same result was not obtained. Reeves et al. found a medium effect size (d = .64) for responsibility is unclear why, but it is possible that the manipulation in the present study was not as strong as in the aforementioned study. This suggests that a certain threshold of responsibility may have to be reached to trigger anxiety and/or compulsions, and that our manipulation did not achieve that.

Reeves et al. (2010) emphasised that the effect size of their responsibility manipulation was smaller than the one reported in studies with adults (Ladouceur et al., 1995). They suggested that these differences may reflect developmental differences between children and adults, which may reduce the impact of the manipulation. However, it is also possible that the inflated responsibility model does not fully apply to younger children if specific "levels of cognitive development are required before certain cognitive processes" can occur (Reynolds et al., 2008, p. 469). For example, understanding cause-

effect relationships may be necessary for the sweet sorting task to be effective.

Participants in the experimental groups were told that the sweets they were about to sort would be given to a group of children, one of whom was allergic to nuts. If they had not grasped cause-effect relationships participants may not have been able to make a connection between their sorting and possible adverse consequences for others. However, children can understand basic causal concepts starting around age 5 (Kalish, 1996). Based on this, our participants, who were older than 5 years, should have been able to understand cause-effect relationships and thus the relationship between the sweet sorting task and the possible impact on someone with a nut allergy.

The lack of success of the manipulation may also be attributed to our participants not having a sufficiently developed sense of responsibility, and thus not feeling fully responsible for possibly causing harm to another person by not sorting the sweets correctly. However, children are expected to have a basic understanding of the consequences of their actions as early as age 4 (Piaget, 1932). Also, they understand rules and punishment, and even develop a sense of duty and responsibility within the first years of their life and before age 7 (Kohlberg, 1971). Our participants were aged 9 to 12, so they should have had some level of understanding of the possible implications of their sweets sorting for another student's health. It is thus possible that other aspects influenced these results.

Secondly, the lack of success of the responsibility manipulation may have been due to our sample being non-clinical. It is well documented that for people with OCD, regardless of the use of compulsions, intrusions and anxiety re-emerge. It is possible that this process is different in healthy children. A pre-existing cognitive vulnerability for inflated responsibility may be needed for OCD to emerge, and perhaps our participants did not have this vulnerability. Also, this study focused on checking behaviour, however not all OCD patients are checkers. Perhaps a specific vulnerability for checking is also needed.

Numerous family studies show that OCD prevalence is higher amongst family probands (e.g., Ruscio et al., 2008; Nestadt et al., 2000; Fyer et al., 2005) and genetic

studies show that genetic factors make a significant contribution to variance of obsessive-compulsive symptoms (e.g., Grootheest et al., 2005; Abramowitz et al., 2009; Iervolino et al., 2011). It is therefore possible (indeed plausible) that biological and environmental factors work together to trigger OCD, and that without a biological vulnerability the disorder does not emerge. This idea could be tested by conducting a study similar to the present one, but with a vulnerable sample, e.g., a sample of participants with high baseline inflated responsibility or those with a first degree relative who has OCD.

Future work on cognitive models of OCD in children should take several aspects into consideration. It is important to gain a better understanding of the developmental aspects of responsibility and to define a clearer theoretical framework of this construct. This would also help construct validated measures for use with children and better methodology for manipulating the construct in this age group. Future work could also test the effect of reassurance on anxiety by testing the effects of the experimenters' presence (i.e., by leaving the child alone in the room). In this setting, children's urge to seek reassurance could also be measured. Furthermore, the effects of checking on anxiety could also be tested, in a design where children are not allowed to check. However, both the absence of the experimenter from the room and the lack of checking could have ethical implications with a sample of children. Possible risks of leaving a child alone in a room for an extended period of time, or asking them to complete a more stressful task should be carefully considered.

Future work could also design similar experiments to test the role of a biological vulnerability for OCD, by selecting non-clinical samples that have high perceived responsibility or obsessionality, or other characteristics that indicate biological vulnerability. This type of work would help us better understand the role of biological factors, and perhaps their interplay with psychological aspects. Further, longitudinal studies exploring the development of responsibility and other cognitive factors relevant for OCD would also help us better understand the disorder.

5.7. Conclusion

Several possible explanations were considered for the findings of this study. Firstly, the manipulation may not have been strong enough to successfully change responsibility perceptions in children and this may be due to developmental factors. These results do not offer enough information for us to draw a conclusion about the role of responsibility in children, and emphasise a gap in the literature in terms of a developmental framework for responsibility. This makes the investigation of this concept and its role in child psychopathology more difficult. Future work should focus on developing a theoretical framework for responsibility across the life-span and on developing more age appropriate ways of experimentally manipulating responsibility.

5.8. Summary of Part II

Study 1 in this thesis described a paradigm used for manipulating responsibility and a behavioural code associated with it. The aim of this study was to refine this methodology and make it easier to use in a consistent manner across studies, and to further improve its psychometric qualities. This methodology was used in Study 2. However, in spite of improvements made in Study 1, the experimental manipulation was not successful in inflating responsibility. These results added to the body of mixed findings from similar studies indicate that developmental aspects may make investigations of responsibility in children difficult. There is currently limited understanding of the concept of responsibility, a lack of a developmental framework, and thus limited methodology including ways to measure this construct. Exploratory research of these aspects and clearer theoretical frameworks are needed to conduct more robust experimental studies in children. Generally, work on cognitive models of childhood OCD is based on work with adults, and inconsistent results are still being reported from the latter. Perhaps further investigating

these cognitive concepts and methodologies with adults and gaining a better understanding of them is granted before further exploring them in younger samples.

PART III: COGNITIVE ASPECTS OF OBSESSIVE-COMPULSIVE DISORDER IN ADULTS

Chapter 6: Background and a New Model of Obsessive-Compulsive Disorder

6.1. Inflated Responsibility and Other Cognitive Aspects Relevant to Obsessive-Compulsive Disorder in Adults

Mixed findings regarding the applicability of cognitive models of OCD have been reported in the literature, so further testing of these models is needed. Two studies described next aimed to test the inflated responsibility model in adults, while taking into consideration other cognitive aspects such as uncertainty. More recent work indicates that uncertainty may be necessary for compulsions to occur, so Study 3 and Study 4 focused on uncertainty and inflated responsibility and on their effects on anxiety and compulsive urges.

The inflated responsibility model of OCD has received considerable attention in the literature and has been generally supported by experimental findings with adults. However, the model does not satisfactorily explain why compulsions are repetitive (Ladouceur et al., 1995). If compulsions were driven mainly by inflated responsibility, they would cease as soon as safety information is received. However, in OCD, checking or receiving reassuring information about a potential threat or danger do not stop compulsions, at least not for long periods of time (Rachman, 2002).

Cognitive models of OCD identified six types of dysfunctional beliefs that are important for the disorder: (1) overestimation of threat; (2) inflated responsibility; (3) over-importance of thoughts; (4) the need to control thoughts; (5) the need for perfection; and (6) intolerance of uncertainty (OCCWG, 1997). Three factors related to these beliefs seem to be particularly important: threat and responsibility overestimation, importance of need to

control thoughts, and perfectionism / need for certainty (OCCWG, 2005). Existing models (see pg. 34) are limited in that they overlook some of these aspects.

6.1.1. Uncertainty. Uncertainty is a normal cognitive state that we all experience at times. However, in OCD it is pathological (Rasmussen & Eisen, 1989). Individuals with OCD constantly doubt safety, regardless of how much reassuring information they receive. The slightest uncertainty is anxiety producing for them, so they need to check, seek reassurance, etc. over and over again. Uncertainty can manifest in relation to a situation or action, one's own perception or memory, the act of checking itself (e.g., doubt about performing the action correctly), etc. (Reed, 1985; Herman et al., 2003; Tolin et al., 2001; van den Hout & Kindt, 2003; van den Hout et al., 2004).

Uncertainty is considered a hallmark of OCD (Dar, 2004) and plays an important role in compulsive behaviour (e.g., van den Hout et al., 2003, 2004), especially in checking (Rasmussen & Eisen, 1992). In the literature, the concept of uncertainty is commonly used interchangeably with that of 'doubt'. However, a distinction has been made between uncertainty as a general state of not knowing what is "out there", and doubt as not believing or not being certain about information that has already been received (O'Conner, 2013). This has not yet been tested empirically.

Overall, there is support in the literature for the role of uncertainty/doubt in OCD, although it is still unclear what the exact role is. Rachman (2002) argues that after compulsions cease the individual starts to question the effectiveness or outcome of the compulsive behaviour and to doubt safety, so s/he begins using compulsions again in order to decrease the doubt. Empirical work provides support for this idea, as Parrish et al. (2010) (see pg. 63) found that compulsions aim to decrease doubt. Further, experimental work shows that repeated checking and viewing of objects paradoxically increase doubt in both healthy and OCD participants (Tolin et al., 2001; Radomsky, 2001; Coles, Radomsky, & Horng, 2006; Harkin & Kessler, 2009), so there is a causal relationship between the two. However, Rachman (2002) also suggested that uncertainty is not a sufficient factor,

and that both uncertainty and responsibility are necessary for OCD to emerge. According to him, compulsive checking occurs when a person feels responsible for preventing negative outcomes but has doubts about having eliminated the threat.

Based on Rachman's (2002) theory, some authors proposed that uncertainty increases in high responsibility circumstances, so it results from inflated responsibility (e.g., Ladouceur et al., 1995). Support for this idea comes from Parrish et al. (2006) who manipulated reassuring feedback and responsibility in a non-clinical sample (N = 100, mean age 22 years, SD = 4.8) using a pill-sorting task developed by Ladouceur et al. (see pg. 93). Parrish et al. randomly assigned participants to one of four conditions: high responsibility-high reassurance, high responsibility-low reassurance, low responsibility-high reassurance, or low responsibility-low reassurance. Repeated-measures ANOVAs showed that participants in the low responsibility group experienced increases in confidence over time. This effect was not observed in the high responsibility group. These results suggest that responsibility can indeed change confidence. However, a reassuring feedback (and thus sorting confidence) manipulation was also used in this study, and even though confidence was reported as a dependent variable (instead of a feedback manipulation check), it is unclear if the observed effects were due to responsibility alone or to responsibility and reassuring feedback combined.

More support for Rachman (2002)'s idea comes from Radomsky, Rachman, and Hammond (2001) which manipulated responsibility alone and explored its effects on memory confidence and certainty. The sample consisted of 11 adults with OCD (as diagnosed based on DSM-IV criteria) (mean age 42.1 years, SD =15.5). Responsibility was manipulated using responsibility contracts for checking acts in the patients' home. All participants were included in both conditions and the order of the responsibility manipulation was randomly assigned. Repeated-measures variance and multivariance analyses showed that under high-responsibility conditions participants were less confident in their memory and more uncertain about their checking than under low-responsibility

conditions. The authors concluded that uncertainty results from inflated responsibility and adds to its effect on compulsions. However, given that this was a clinical group, it is unclear if these processes are involved in the emergence of OCD, or if they are only present in individuals who already have the disorder.

It is unclear if uncertainty is a pre-existing factor in OCD or if it results from inflated responsibility. What we do know is that uncertainty is related to compulsive behaviour. A reciprocal causal relationship between the two has been documented. For example, Parrish et al. (2011) (see pg. 57) manipulated ambiguity of feedback and responsibility in a non-clinical sample. Responsibility significantly increased anxiety and urge to check, while ambiguity of feedback (which solicited uncertainty) significantly increased the urge to seek reassurance. This is consistent with findings of Ladouceur et al. (1997) who reported that uncertainty was associated with high information-seeking when performing moderately ambiguous tasks.

This work indicates that uncertainty can have a causal effect on compulsive urges. There is also experimental evidence that repetitive behaviour (e.g., repeated checking) can increase doubt (e.g., van den Hout et al., 2004) (see pg. 136).

6.1.2. Confidence. It has been proposed that people with OCD have a general memory deficit or a specific memory deficit for OCD-relevant information (Foa et al., 1997). However, experimental work shows that memory ability in OCD patients is intact (McNally & Kohlbeck, 1993; Constans, Foa, Franklin, & Mathews, 1995; McDonald et al., 1997). What seems to characterise OCD patients, compared to healthy controls, is a low confidence in memory ability (Tolin et al., 2001; Cougle, Salkovskis, & Thorpe, 2008; Radomsky et al., 2001; van den Hout et al., 2004; Foa et al., 1997; McDonald et al., 1997). Experimental work shows that repeated checking leads to a decline in memory confidence (Van den Hout et al., 2004; Coles et al., 2006; Radomsky, Gilchrist, & Dussault, 2006). Also, low confidence in OCD patients seems to manifest beyond memory ability, as it generalises to other cognitive domains such as attention, perception, and one's own

judgment (Sher, 1983; Hermans et al., 2008). For example, van den Hout et al. (2008) and van den Hout, Engelhard, de Boer, du Bois, and Dek (2009) found that OCD patients stared at objects (e.g., light switch) for long periods of time because they doubted their perception. This low confidence in cognitive ability is believed to be responsible for pathological doubt in OCD and to maintain compulsions.

6.1.3. Intolerance of uncertainty. People with OCD not only experience high uncertainty and low confidence in their cognitive abilities, they also have low tolerance of uncertainty. Intolerance of uncertainty has been identified as a major cognitive aspect in OCD (OCCWG, 2001, 2005; Steketee et al., 2003; Holaway, Heimberg, & Coles, 2005; Tolin, 2003) and defined as ‘‘beliefs about the necessity of being certain, about the capacity to cope with unpredictable change, and about adequate functioning in situations which are inherently ambiguous’’ (OCWG, 1997; p. 678). People with low tolerance of uncertainty need to be 100% sure something is safe at all times. Needless to say, that is impossible to achieve in the real world, so the slightest doubt makes them anxious (Freeston & Ladouceur, 1994).

Intolerance of uncertainty is associated with repetitive behaviour, it is especially prominent in compulsive checkers, and predicts obsessive-compulsive symptoms (Steketee, 1998; Rachman, 2002; Holaway et al., 2006; Tolin et al., 2003). Steketee (1998) examined responsibility, need to control thoughts, overestimates of threat, intolerance of uncertainty, and beliefs about the consequences of anxiety and capacity to cope in 62 OCD outpatients and 45 with other anxiety disorders (all currently in treatment), and 34 controls (mean age 39.66 years, SD = 12.13). Self- report measures were used for assessment. Participants with OCD reported significantly higher intolerance of uncertainty, responsibility, and threat estimation than controls. They also reported stronger beliefs in these domains than did anxious patients. Steketee concluded that these aspects are particularly relevant to OCD. Furthermore, responsibility, control, risk estimation, and uncertainty were strongly intercorrelated, indicating overlap between these concepts. Steketee suggested that

overestimation of threat may lead to higher uncertainty and need to control, and high responsibility may lead to overcontrol of thoughts and actions. Importantly, only uncertainty predicted obsessive-compulsive symptoms beyond mood and worry. This study provides valuable information about the importance of intolerance of uncertainty in OCD, but considering its correlational nature no conclusion about a causal role can be drawn.

Tolin et al. (2003) also looked at intolerance of uncertainty and its relationship with obsessive-compulsive symptoms in 55 OCD outpatients (43 of whom engaged in compulsive checking) and 14 non-anxious controls (mean age 33.17 years, SD = 11.94). Diagnostic assessment was based on DSM-IV criteria. Repeating and checking rituals were strongly associated with intolerance of uncertainty, and this relationship remained significant when depression symptoms were controlled. Tolin et al. concluded that the nature of compulsions is due to a low tolerance for doubt, which makes people with OCD repeat rituals until it "feels right". Similar to Steketee (1998), this was a correlational study using a clinical sample, so further investigations are necessary to clarify if intolerance of uncertainty is a causal factor in OCD, or results from having the disorder.

Although there is evidence that uncertainty can result from responsibility (e.g., Ladouceur et al., 1995), Lind and Boschen (2009) suggest that intolerance of uncertainty is needed alongside responsibility for OCD to emerge. Lind et al. recruited a sample of 21 individuals aged 16 to 62 presenting OCD symptoms (mean age 35.40 years, SD = 15.46) and 143 healthy individuals aged 16 to 47 (mean age 20.31 years, SD = 5.40). Obsessive-compulsive symptoms were determined using Obsessive-Compulsive Inventory (OCI; Foa, Kozak, Salkovskis, Coles, & Amir, 1998). Linear regression analyses showed that responsibility significantly predicted intolerance of uncertainty, and that intolerance of uncertainty significantly predicted checking. Also, intolerance of uncertainty fully mediated the relationship between responsibility and checking. Lind et al. concluded that responsibility affects checking by making uncertainty more aversive and that,

subsequently, uncertainty triggers checking. This suggests that uncertainty is a necessary factor for OCD. Lind et al. mentioned several limitations of this work, such as the use of self-report questionnaires, and that fact that most of the sample was non-clinical. However, in spite of these limitations, these results are promising and encourage further investigation of the role of intolerance of uncertainty/uncertainty in OCD.

6.2. Behavioural Aspects of Obsessive-Compulsive Disorder

In OCD patients, uncertainty seems to be triggered by low confidence in cognitive abilities. Because they doubt their perception, memory etc., people with OCD constantly seek safety information to help decrease their uncertainty. This information is mostly obtained thorough checking and reassurance seeking.

6.2.1. Checking. Checking has been widely investigated because it is the most common compulsion in OCD (Ball et al., 1996; Stein, Forde, Anderson, & Walker, 1997) and believed to reduce anxiety (Rachman, 2002). The mechanism through which this happens is unclear, but it is possible that checking decreases responsibility and / or doubt. Empirical work has found significant relationships between checking and both cognitions.

6.2.1.1. Responsibility and checking. Salkovskis (1989) proposed that inflated responsibility leads to checking behaviour, and experimental work supports this idea (see pg. 45). Several studies found that increases in responsibility lead to increases in checking behaviour (e.g., Ladouceur et al., 1995; Bouchard et al., 1999) and maintain the urge to check, while decreases in responsibility lead to decreases in urge to check (Lopatka et al., 1995). Furthermore, van den Hout et al. (2004) found that also checking increases responsibility, which most likely contributes to the maintenance of the behaviour.

6.2.1.2. Doubt and checking. Salkovskis (1989) suggested that responsibility triggers compulsions, however Rachman (2002) proposed that both responsibility and doubt are needed for compulsive behaviour to emerge. According to Rachman, by engaging in

checking the person tries to gain certainty that the likelihood of harm has been eliminated or at least significantly reduced. Parrish et al. (2010) found support for this idea. In their study, individuals with OCD identified anxious mood and doubts regarding reduction of general threats as triggers for both their checking and reassurance-seeking behaviour. Furthermore, Rasmussen et al. (1992) suggested that intolerance of uncertainty is particularly characteristic of OCD checkers, and empirical work supports this claim. For example, Tolin et al. (2003) (see pg. 132) found that OCD checkers reported significantly higher intolerance of uncertainty than OCD non-checkers and controls.

There is limited evidence that doubt triggers checking behaviour or urge, however several experiments show that checking paradoxically increases doubt, in both healthy and OCD participants (Coles et al., 2006; Ashbaugh et al., 2006). For example, Tolin et al. (2001) compared 14 healthy controls, 14 anxious outpatients, and 14 OCD outpatients on a memory recall task that involved checking safe and unsafe objects, as determined by participants from a "stimulus bank" of safe, unsafe and neutral objects. There was a progressive decrease in memory confidence with repeated checking in OCD patients, than in the other two groups. Also, follow-up reports showed that, a week later, OCD checkers experienced even lower memory confidence than non-checkers. Tolin et al. concluded that memory confidence problems may be particularly characteristic of checkers. This was an experimental study with clinical participants, and used an idiographic stimulus selection which allowed the use of objects relevant to each participant, so these results are robust.

Consistent with findings of Tolin et al. (2001), van den Hout and colleagues also found that checking increases doubt (2001, 2003a, 2003b, 2004a, 2004b). Van den Hout et al. designed a series of experiments to test the relationships between responsibility, uncertainty, and checking in healthy individuals. For example, van den Hout et al. (2003) used interactive computer animation to manipulate responsibility and checking in a non-clinical sample of 27 undergraduate students. Participants were randomly assigned to either a stove checking group (i.e., relevant checking) or a light bulb checking group (i.e.,

irrelevant checking). Each participant conducted 20 checking trials regarding of group assignment. Measures of memory accuracy, confidence in memory, confidence in outcome, and interpretation of task importance were completed by all participants.

Repeated checking reduced memory vividness as well as memory confidence. Van den Hout et al. concluded that OCD checkers remain uncertain despite repeatedly checking safety due to memory confidence decrease. They also proposed that there is a ceiling effect of checking in healthy individuals, i.e., after they check once or twice, uncertainty no longer increases so checking does not continue. However, in the early stages of OCD, patients may check two or three times, and go over the maximum certainty threshold, which then paradoxically makes them more doubtful which triggers further checking. Van den Hout and colleagues further suggested that an initial intolerance of uncertainty is what makes OCD patients check more in the first place, so intolerance of uncertainty is a risk factor for checking and pathological doubt. Empirical work is needed to test this hypothesis.

Van de Hout et al. (2004) further investigated effects of checking on uncertainty in a responsibility situation in a series of five studies, using methodology similar to the one described above. Healthy adults were recruited for these studies. Measures of memory accuracy and confidence in the checking act (i.e., whether they remembered specifics of their last checking episode), and of outcome confidence (i.e., if the stove was off at the end) were obtained. The relevant-checking group had significantly lower confidence in checking than the irrelevant-checking group. Van den Hout et al. measured confidence as an indicator of uncertainty and used *doubt* and *uncertainty* interchangeably. Their conclusion was that OCD patients feel uncertain about their checking not only after but also during checking. They further argued that uncertainty is a stable trait that in OCD manifests at the top end of a continuum, and that compulsive behaviour is an indicator of extreme uncertainty. Van den Hout and colleagues concluded that general uncertainty can be a risk factor for OCD and may "paradoxically reside in the occurrence of

counterproductive safety strategies" (van den Hout et al., 2004; p. 180). They also suggested that uncertainty can results from checking when the person develops negative beliefs about the uncertainty related to the checking behaviour (e.g., "my doubtfulness means I'm usually irresponsible"). Further work is needed to test these ideas, and especially experimental work manipulating different levels of uncertainty.

Uncertainty increase was also observed in a study that manipulated compulsive-like staring. Van den Hout, Engelhard, de Boer, du Bois, and Dek (2008) used a sample of 40 healthy participants to test the effects of staring on obsessive-compulsive symptoms and perceptual uncertainty. Participants were asked to look at an object for 10 seconds (i.e., a gas stove for the experimental group, or a light bulb for the control group) at two different time points. A perseveration period was included in between, during which participants were asked to stare at the gas stove (experimental group) or at another object than the light bulb (control group) for 10 minutes. The longer participants (including those in the control group) stared at an object, the more uncertain they became of its state. Also, participants in the experimental group (i.e., relevant perseveration) experienced significantly higher uncertainty about their perception of that object than participants in the control group (i.e., irrelevant perseveration). These results suggest that checking can increase uncertainty, which may explain the self-maintenance cycle of compulsions. Also, an important aspect of this study is that it showed a causal relationship between the two, outside of a responsibility context. However, although these results show that checking increases uncertainty, they do not exclude the possibility of uncertainty initially triggering the checking behaviour.

6.2.2. Excessive reassurance seeking. It has been proposed that, just as checking, excessive reassurance seeking is a safety behaviour aimed at avoiding harm and at reducing anxiety associated with responsibility beliefs (e.g., Rachman, 1976, 2002; Salkovskis, 1985, 1991; Parrish et al., 2010). More specifically, Salkovskis refers to reassurance seeking as a checking by proxy and a way of sharing responsibility for harm by making

others aware of the threat. Parrish et al. (2010) found that patients endorsed anxiety decrease and harm prevention as aims of both compulsive behaviours, which shows that they have the same function in OCD. This also suggests that doubt is a trigger for checking and reassurance seeking. A study by Parrish et al. (2011) looked at the effects of threat, responsibility and feedback ambiguity on anxiety and compulsive urges and found that responsibility influenced urge to check, but not urge to seek reassurance. What seemed to increase the need to seek reassurance was ambiguity of feedback. Further work testing this effect is granted in a design where uncertainty or doubt is explicitly measured. In Parrish et al.'s study, the manipulation check for feedback was reported as level of ambiguity, i.e. participants were asked to rate how ambiguous they perceived the feedback to be. We can only speculate that the underling state that the ambiguity aimed to solicit was uncertainty or doubt. Further work that explicitly measures these aspects when manipulating ambiguity is granted.

Finally, it is believed that excessive reassurance seeking is driven by an uncertain attributional style (Joiner, Metalsky, Katz, & Beach, 1999), and can manifest in other mental health disorders, so it is not specific to OCD. In depression, uncertainty mediates the relationship between depressive symptoms and reassurance seeking (Jacobson & Weary, 1999), while in health anxiety, patients doubt that they are healthy regardless of how much reassurance they receive (Abramowitz, Schwartz, & Whiteside, 2002). Reassurance seeking seems to be a trans-diagnostic phenomenon, and in OCD it seems related to uncertainty or doubt rather than responsibility. However, this area of research is still in its early stages, and further investigations are needed to clarify these relationships.

6.3. Maintenance Processes in Obsessive-Compulsive Disorder

Compulsions are triggered by anxiety, and aim to decrease anxiety (Salkovskis, 1985; Parrish et al., 2010). However, this effect is short lived (Rachman, 2002) and sooner or later after compulsions have ceased intrusions reoccur and anxiety rises again, which

leads to more compulsions. The cycle repeats itself over and over again thus paradoxically maintaining and exacerbating the compulsive behaviour (Rachman, 2002; Van den Hout et al., 2003; Boschen & Vuksanovic, 2007). This cycle is maintained partially because compulsions are negatively reinforcing in that they reduce or eliminate anxiety. Another reason is that compulsions do not allow disconfirmation of dysfunctional beliefs regarding their protective nature, i.e. they do not allow the person to experience what would happen if not using them (Salkovskis 1985, 1998; Rachman, 2002).

There is evidence of a causal relationship between responsibility and anxiety and between responsibility and compulsions (Ladouceur et al., 1995, 1997; Arntz et al., 2007; Lopatka et al., 1995; Shafran, 1997; Parrish et al., 2010) and there is also some evidence that uncertainty leads to compulsions (Parrish et al., 2011). Additionally, compulsions such as checking can also increase responsibility and doubt (van den Hout et al., 2004). Moreover, there seems to be a relationship between responsibility and uncertainty (Parrish et al., 2010). In conclusion, these aspects seem to be interrelated and influence each other, and they all seem to play a role in a self-maintaining cycle of OCD that becomes very strong and difficult to break. While it is still unclear which of these factors are causal and which are solely maintaining the disorder, promising results so far grant further work, especially experimental and longitudinal.

6.4. A New Model of Obsessive-Compulsive Disorder

Uncertainty has been described as causal factor for compulsions (Rachman, 2002), a mediator between responsibility and compulsions (Lind et al., 2009), and a maintenance factor for compulsive behaviour (Rachman, 2002; van den Hout et al., 2004). However, no coherent theoretical model of OCD including uncertainty has been developed. Building on Salkovsis' (1995) model of inflated responsibility, Rachman (2002) proposed a model of compulsive checking. Rachman briefly mentioned that uncertainty is also needed for compulsions to emerge. According to him, compulsive checking occurs when a person

feels responsible for preventing negative outcomes but has doubts about having eliminated the threat. This describes uncertainty / doubt as causal factor for OCD. However, Rachman also suggested that after compulsions cease the individual starts to question the effectiveness or outcome of the compulsive behaviour and to doubt safety, so s/he begins using compulsions again in order to decrease the doubt.

This could mean that uncertainty is not a causal factor for compulsion, but the result of compulsive behaviour, and that the initial compulsions are triggered by responsibility alone. These ideas were not fully elaborated by Rachman. There is no empirical evidence showing that uncertainty leads to checking, but there is evidence that ambiguity of feedback increases compulsions (Parrish et al., 2010). There is no clear description of ambiguity and how it relates to uncertainty, but we can speculate that uncertainty is higher in ambiguous situations. This would mean that ambiguous feedback increases uncertainty and thus compulsions. Experimental work has yet to test this possibility. There is however evidence of checking increasing doubt (van den Hout et al., 2003), which means that doubt / uncertainty is at least a maintenance factor for OCD. Furthermore, intolerance of uncertainty has been proposed as a mediator between responsibility and compulsions (Lind et al., 2009). According to Lind et al., responsibility triggers checking by making uncertainty more aversive. Intolerance of uncertainty is a trait and uncertainty is a state related to it, so this mediating relationship may apply to uncertainty. This is yet to be tested using an experimental design.

Intrusions increase anxiety which further triggers compulsions (Rachman, 2000). Initially, compulsions successfully reduce anxiety, which is why they are used again. However, how compulsions reduce anxiety is unclear. Two mechanisms have been proposed: 1) negative reinforcement, as they eliminate unpleasant anxiety; and 2) intrusions reduction. There is empirical evidence for the first (Bouchard et al., 1999), however empirical support for the second is lacking. Salkovskis (1999) proposed that compulsions reduce anxiety by reducing perceived responsibility. According to him, by

checking the person feels less responsible because they know they have done everything they could to prevent a negative event. Salkovskis also proposed that reassurance seeking reduces anxiety and responsibility as it allows the individual to share the responsibility with others. Similarly, we could speculate that compulsions reduce uncertainty or doubt. Checking is useful because it is a way of directly reducing uncertainty (by making the person sure that a threat has been eliminated) and therefore anxiety. In addition, other people can reduce the immediate anxiety by giving reassurance. Reassurance can temporarily reduce uncertainty and therefore anxiety.

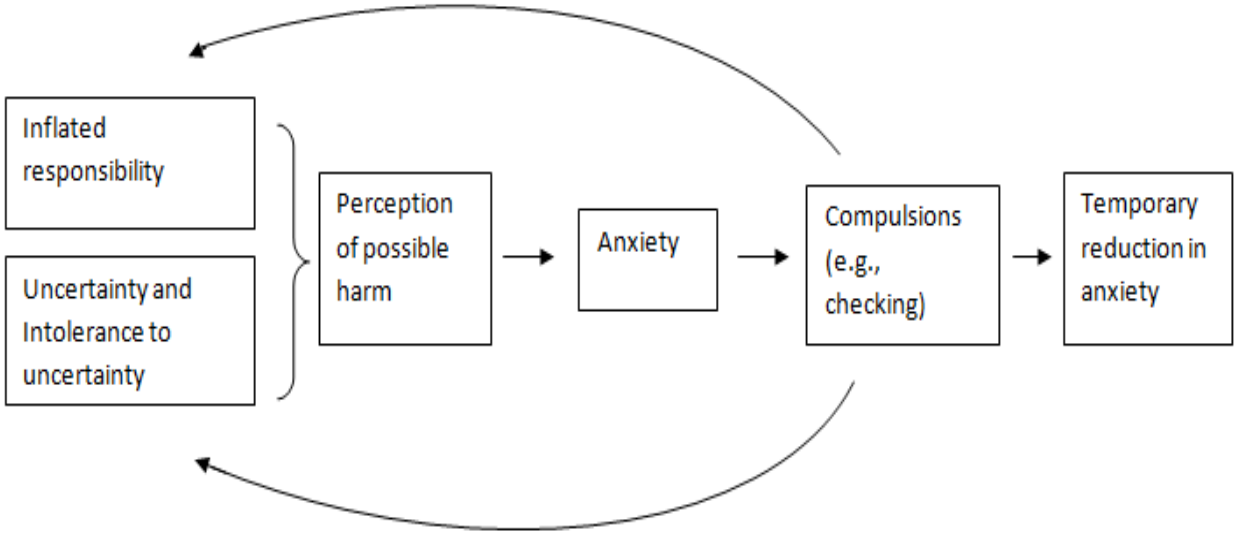
There is no empirical evidence that compulsions reduce intrusions. However, there is evidence that they paradoxically increase them, so a causal relationship between compulsions and intrusions does exist. Experimental studies show that checking increases responsibility and doubt (e.g., van den Hout et al., 2003, 2004). This is consistent with the idea of compulsions creating a self-perpetuating cycle.

Building on these ideas, a new model of OCD was proposed and tested in Study 3 and Study 4. The hypothesis is that individuals who have a pre-existing sense of inflated responsibility become anxious in situations when they are not certain about the outcome or results of their actions. The combination of being uncertain and having inflated responsibility is critical because it means they cannot be certain that their actions will not lead to harm to either self or others. This is very anxiety provoking. As a result, they use compulsions such as checking and reassurance seeking in an attempt to reduce the anxiety, and possibility the responsibility intrusions and uncertainty. While this is initially successful and anxiety and intrusions are reduced, over time with repeated use of compulsions, anxiety and responsibility and uncertainty paradoxically further increase and maintain, which leads to further compulsions. The cycle repeats itself over and over and becomes very strong and difficult to break.

In summary, the present model proposes that inflated responsibility and uncertainty increase anxiety, which triggers compulsions. In an attempt to manage anxiety, the

individual uses compulsions which reduce anxiety, and perhaps intrusions, temporarily. However, sooner or later intrusions re-emerge (possibly dues to a biological vulnerability) and the temporarily alleviated anxiety increases again, leading to more compulsions which further increase intrusions. A counter-productive self-maintaining cycle develops. A diagram of this model is presented in Figure 4.

Figure 4. A new model of OCD.



Inflated responsibility, uncertainty, reassuring feedback, and compulsions seem to influence each other. Taking these aspects into consideration, Study 3 focused on the effects of responsibility and reassuring feedback on anxiety and compulsive urges in adults.

Chapter 7: Testing an New Model of Obsessive-Compulsive Disorder in Adults

Study 3: The Role of Responsibility and Uncertainty for Anxiety and Compulsive Urges

7.1. Rationale for Research Study

A combination of uncertainty and responsibility may be necessary for the emergence of anxiety and compulsive behaviours or urges (Rachman, 2002). Study 3 attempted to test a new model of OCD (see previous page) and to test the causal effects of uncertainty and inflated responsibility on anxiety and obsessive-compulsive urges. A pill-sorting task similar to one developed by Ladouceur et al. (1995) (see pg. 94) was used to manipulate responsibility. False feedback adapted from a study by Parrish et al. (2006) (see pg. 142) was used to manipulate uncertainty. Participants were randomly assigned to one of five groups: high-responsibility / high-uncertainty, high-responsibility / low-uncertainty, high-responsibility / no-uncertainty, no-responsibility / high-uncertainty, and no-responsibility / no-uncertainty. Similar to Parrish et al.'s study, checking was not allowed during the sorting task. This was to control for any possible confounding effect of checking on uncertainty, which would have compromised the feedback manipulation.

This study aimed to address the following questions:

Does inflated responsibility lead to anxiety and compulsive urges in the absence of uncertainty (i.e., when reassuring feedback is provided)? Or is uncertainty necessary for these anxiety and compulsive urges to occur? Does uncertainty alone lead to anxiety and compulsive urges, in the absence of inflated responsibility? Does reassuring feedback reduce uncertainty?

7.2. Hypotheses

Manipulations checks – we expected that:

1. That the responsibility experimental manipulation would successfully change participants' perceived responsibility; high-responsibility groups would report higher levels of responsibility than the no-responsibility groups.
2. The experimental manipulation would successfully change participants' confidence in sorting; high-uncertainty groups would report lower confidence than the no-uncertainty groups.

The hypotheses were:

i) 1) Participants in the combined high-responsibility and high-uncertainty group would report more urges to check and to seek reassurance, report higher anxiety, and take longer to complete the experimental task than participants in the other groups.

ii) 2) Participants in the combined high-responsibility and no-uncertainty group and participants in the no-responsibility and high-uncertainty groups would report higher anxiety, more urges to check and to seek reassurance, and take longer to complete the experimental task, compared to participants in the no-responsibility and no-uncertainty group.

iii) 3) Participants in the high-responsibility/no-uncertainty group would report higher anxiety, urges to check and to seek reassurance, and take longer to complete the experimental task, compared to participants in the no-responsibility/high-uncertainty group.

iv) 4) Participants in the high-responsibility/high-uncertainty group would report higher anxiety, urges to check and to seek reassurance, and take longer to complete the experimental task, compared to participants in the high- responsibility/low-uncertainty group.

7.3. Method

7.3.1. Design. This was a 2 (responsibility) X 2 (uncertainty), between-groups randomised experiment, with four groups:

- High responsibility, high uncertainty (i.e., false *error* feedback)
- High responsibility, no uncertainty (i.e., false *correct* feedback)
- No responsibility, high uncertainty (i.e., false *error* feedback)
- No responsibility, no uncertainty (i.e., false *correct* feedback).

7.3.2. Participants

7.3.2.1. Inclusion and exclusion criteria. Students and staff from the University of East Anglia (UEA), who were 18 years of age and over, and fluent in English were recruited for this study. Colour blind individuals were not able to participate, as the sorting task required colour perception.

7.3.2.2. Sample size. Sixty-four eligible participants (44 female) were recruited. Detailed demographic information for the entire sample is presented in the Results section (see pg. 151).

7.3.2.3. Recruitment. After approval was obtained from the ethics committee at UEA (AppendixP), participants were recruited by placing posters (Appendix Q) about the study on campus. The experimenter's contact information along with brief information about the study was included. Those who contacted the researcher were offered an appointment on campus, in an experimental room. Potential participation and forms completion (see *Procedure* section, pg. 146) including the Consent Form (Appendix R) were discussed. Eligible participants who consented were randomised, completed baseline measures, and proceeded with the experimental task. As compensation, each participant was given a free-lunch voucher.

A flow chart of Study 3 is attached to this document (see Appendix S).

7.3.3. Measures. All participants in this study were asked to complete the following measures:

7.3.3.1. Demographic Questionnaire. Each participant was asked to complete a demographic questionnaire which included age, gender, and ethnic origin (Appendix T).

7.3.3.2. Baseline measures

7.3.3.2.1. Responsibility Attitude Scale (RAS; Salkovskis et al., 2000) (Appendix U). The RAS is a 26-item questionnaire which measures general beliefs or assumptions related to inflated responsibility. It has good test-retest reliability (r = .94) and high internal consistency (alpha=.92) (Salkovskis et al., 2000). In this study it was used to control for inflated responsibility beliefs across the four experimental groups.

7.3.3.2.2. Perception of responsibility, probability of harm and severity of harm (Reeves et al., 2010) (pre-task) (Appendix W). This is a six item, 5-point Likert scale ranging from 0 (completely disagree) to 4 (completely agree). This scale was completed before and after the sorting task. This measure has been previously used in a similar study (Reeves et al., 2010) and has good internal consistency (Cronbach alpha = .73).

7.3.3.2.3. Intolerance of Uncertainty Scale (IUS; Buhr & Dugas, 2002) (Appendix X). The IUS measures several aspects of intolerance of uncertainty. Twenty seven items are rated on a 5-point scale. Higher scores on this scale indicate greater intolerance. The measure has great internal consistency (α = .94) and good test-retest reliability (*r* = .74) (Buhr & Dugas, 2002).

7.3.3.2.4. The State Trait Anxiety Inventory (STAI; Spielberger et al., 1983) (Appendix Y). This is a 40-item questionnaire that measures general anxiety. Twenty items focus on state anxiety, while the other 20 target trait anxiety. The STAI has high reliability and validity.

7.3.3.2.5. Visual analogue scale for anxiety (Appendix V-1*).* This is a single 0-100 scale aimed at measuring state anxiety regarding the sorting task. Here 0 represents "no anxiety whatsoever" and 100 represents "extreme anxiety". This measure was used before

and after the entire sorting task, as well as between trials.

7.3.3.2.6. Visual analogue scale for confidence in outcome of sorting scale (manipulation check) (Appendix V-2). This is a scale of 0 ("not at all confident") to 100 ("extremely confident") used to measure how confident participants feel about the outcome of their checking. This measure was used before and after the entire sorting task, as well as between trials.

7.3.3.3. Dependent measures

7.3.3.3.1. Perception of responsibility, probability of harm and severity of harm (post-task) (as described above) (Appendix W). This measure was completed post-task.

7.3.3.3.2. Visual analogue scales (Parrish et al., 2006) (Appendix V 1-4). Participants were asked to complete visual analogue scales (0 to 100) for anxiety, confidence in sorting, urge to check, and urge to seek reassurance. These measures were administrated at the end of each sorting trial.

7.3.3.3.3. Duration. The time taken by each participant to complete the task, in seconds, was measured using a stop watch. The timing began as soon as the sorting started, and stopped immediately after the last pill was placed in a sorting bottle.

7.3.4. Procedure. The experimenter met each potential participant in an experimental room on campus. Participants were asked to read the Participant Information Sheet and complete the Demographic Questionnaire. Study aims and procedure were explained to them, as well as their rights as potential participants. They were informed that their participation was completely voluntary and that they could withdraw from the study at any time without giving an explanation and without being penalised in any way. Those who agreed to participate were asked to sign a Consent form. Participants were tested individually, in a quiet experimental room at UEA.

7.3.4.1. Randomisation. Randomisation took place as soon as the consent form was signed. It was done by using sealed envelopes and was stratified by gender.

Participants were randomly assigned to one of five groups:

- High-responsibility / high-uncertainty (responsibility and uncertainty were experimentally manipulated; high-uncertainty was manipulated via false negative feedback about sorting accuracy; see pg. 150)

- High-responsibility / no-uncertainty (certainty was manipulated via fictive positive feedback about sorting)
- No-responsibility / high-uncertainty (fictive negative feedback was given)
- No-responsibility / no-uncertainty (fictive positive feedback was given). The diagram below displays the study design.

7.3.4.2. Ethical considerations

7.3.4.2.1. Consent. Potential participants were sent an email with information about objectives and procedures of the study, their rights as participants, and a short form that assessed eligibility. If eligible, they were asked to meet the experimenter on campus. The experimenter clarified any questions with them and asked them to complete a consent form.

7.3.4.2.2. Deception. The British Psychological Society (BPS, 2006) ethical guidelines state that in order to study some psychological processes, it is necessary to withhold some details of the hypothesis. Participants were randomised to one of four different experimental groups and given different information about the task and their level of responsibility. During the task they received different types of feedback on their performance and this feedback was not related to their actual performance (i.e., false feedback). Implications of deception for participants' distress were carefully considered, and each participant was debriefed at the end of their participation. The deceptive nature of the experimental manipulation, and the real aims of the study were revealed. This was well received by all participants.

7.3.4.2.3. Managing distress. Participants were adult volunteers and it was expected that the level of anxiety experienced during the experimental task was similar to anxiety

experienced in daily life. This experimental task and variations of it have been successfully used before with adults and children (e.g., Ladouceur, et al. 1995, 1997; Parrish et al., 2006; Reeves et al., 2010) without negative consequences for the participants. In addition, participants were fully debriefed at the end of their participation and given the opportunity to discuss their experience and ask any questions they had. For some participants (i.e., in the high-responsibility/high-uncertainty group) we expected that the task would lead to a brief period of mild anxiety and that this would reduce before the experiment has ended. All participants were monitored throughout the task and given the chance to discuss the task and to debrief with the researcher at the end of their participation. None of the participants reported difficulties during or after their participation. Also, none of them reported scores that indicated concerning anxiety levels.

7.3.4.2.4. Confidentiality. Data were managed in accordance with the Data Protection Act (1998). Each participant was assigned an identification number and personal identifying information was not stored. Participants were informed that their identity would remain confidential. Video recording was used for this study, for monitoring purposes. Only the experimenter had access to these data. Data are kept in a locked cabinet at UEA, where they will be retained for five years from the completion of the study and then destroyed.

7.3.5. The experimental task. All participants were given initial information and instructions (Appendix Z). They were presented with 35 sorting pills and received a standardised demonstration of the sorting. They were asked to sort pills of 10 different shapes, colours, and sizes from a container into seven opaque pharmaceutical bottles. Participants were instructed not to look into the bottles at any time throughout the task.

To make the task more believable, participants were asked to wear latex gloves during sorting. They were also told that the pills will be scanned by a computer to determine if they were sorted correctly (this was not true and the pills were not sorted for accuracy). Each participant completed four sorting trials (i.e., trial1, trial2, trial3, and

trial4). At the end of each trial the experimenter came into the room, removed the sorted pills, and sent (fictitious) feedback about the sorting to the participant via telephone text (see pg. 150), before bringing in a new set of pills to be sorted. Participants were told that the first three trials (i.e., trial1 - trial3) were "practice" trials. These trials were used to manipulate feedback about sorting accuracy (see pg. 150). Also, all sorting tasks were video recorded; participants were made aware of the fact that they will be recorded and their consent was obtained. This was not only to increase the credibility of the manipulation, but also to ensure that participants followed instructions, i.e., that participants did no check their sorting during the task.

Participants were told that the last trial (i.e., trial4) was the actual sorting trial. No feedback was provided after this final trial.

After each trial, participants were asked to complete four visual analogue scales:

- Confidence in sorting outcome scale (uncertainty manipulation check)
- Visual analogue scale for anxiety
- Urge to check
- Urge to seek reassurance

7.3.6. The experimental manipulations

7.3.6.1. Responsibility manipulation. Instructions described in this section were adapted from several studies that used similar manipulations (i.e., Ladouceur et al., 1995; Arntz et al., 2007; Parrish et al., 2006).

7.3.6.1.1. High-responsibility. Participants in the high-responsibility groups were told that a charitable organisation had asked the university to develop a reliable sorting system for pills. They were told that their individual performance in the task was important to ensure that the results would lead to the safe distribution of pills in third- world countries. To maximise credibility and increase participants' perceived responsibility, the experimenter wore a lab coat throughout the experiment. A poster of a fictive charitable organisation (Appendix AA) was displayed on the wall of the testing room.

7.3.6.1.2. No-responsibility. The no-responsibility groups were told that the study was investigating colour perception and accuracy. Nothing was mentioned about the charitable organisation or personal responsibility for the development of a pill sorting system. Also, no poster was displayed on the wall, participants were not asked to wear gloves, and the experimenter did not wear a lab coat.

7.3.6.2. Uncertainty manipulation. With the exception of participants in the high-responsibility/low-uncertainty group (who received no feedback) all other participants were given fictitious feedback about their sorting accuracy after trials 1, 2, and 3. Feedback differed as follows:

7.3.6.2.1. High-uncertainty groups. Participants in the high-uncertainty groups received standardised feedback about their sorting accuracy after each of the first three trials. All participants in these groups were given the same information regardless of their actual performance on the task. They were sent a text message on a study telephone that indicated that they had made one or more errors during the sorting task. The text simply displayed the word "ERROR".

7.3.6.2.2. No-uncertainty groups. Participants in the no-uncertainty groups received standardised feedback after each of the first three sorting trials. These participants were given the same information regardless of their actual performance. Feedback was provided via text on a study telephone, indicating that they had sorted the pills correctly. The text simply displayed the word "CORRECT".

Feedback was provided via text to eliminate a possible reassuring effect of the physical presence of the experimenter. The experimenter remained outside of the room during the sorting trials. After feedback was given, the experimenter prompted the participant to complete the next trial.

No feedback regarding sorting performance was given after trial 4 to any participants.

7.3.7. Post-task measures. After trial 4, all participants completed the following

measures:

- Confidence in sorting outcome scale
- Visual analogue scales for anxiety, urge to check, urge to seek reassurance
- Perception of responsibility – post-task.

7.3.8. Debriefing. All participants were fully debriefed at the end of their participation (Appendix AF). Questions and concerns they had were addressed and discussed.

7.4. Results

7.4.1. Treatment of Data. Data was entered in a SPSS spreadsheet and investigated for missing or inaccurate entries. Missing data were coded as "999". Distributions for each variable were examined for normality using histograms and box plots generated in SPSS, and the Kolmogorov-Smirnov (K-S) test. Significance level for all analyses was set at alpha < .05.

The Responsibility Attitudes Scale and the Intolerance of Uncertainty Scale were normally distributed. All other data were positively skewed (K-S test significant at < .001). Raw skewed scores were transformed to their square root, however this did not improve distribution. Further Log10 transformations for raw scores were computed. This was successful for several measures (i.e., State and Trait Anxiety Inventory, both baseline and post-task; and Duration1 and 4). Raw scores for the Intolerance of Uncertainty Scale and Responsibility Attitudes Scale, and transformed scores for all other variables were used in all analyses, with cases excluded pairwise. Parametric analyses using transformed scores were conducted. Additional non-parametric analyses using raw scores were also conducted as scores on several measures continued to have a skewed distribution after transformation.

Data were also explored for outliers. Three significant outliers were identified for duration, and for post-task confidence. Eliminating these outliers slightly improved but did

not normalise distribution.

7.4.2. Demographic data. Demographic data for the entire sample (N=64) and for each experimental group were explored. The mean age was 31.85 years (SD = 11.117), range 18 to 61 years (see Table 5).

Table 5

Demographics

	N	Males	Females	Age M	SD
Whole Sample	64	20	44	31.58	11.117
High responsibility/No uncertainty	16	5	11	35.94	12.331
High responsibility/High uncertainty	16	5	11	28.23	11.952
No responsibility/No uncertainty	15	6	11	28.38	7.320
No responsibility/High uncertainty	17	4	11	34.33	11.242

Over half of the sample (51%) was White British, reflecting the demographic of the local area. 39.1% identified themselves as Other White, 6.3% Asian, and 3.1% as being from other ethnic groups.

7.4.3. Descriptive data. After transforming the data and eliminating several outliers the following measures were normally distributed: Responsibility Attitudes Scale, Intolerance of Uncertainty Scale, baseline State and Trait Anxiety Inventory, and post-task State and Trait Anxiety Inventory. All other measured continued to be positively skewed.

7.4.4. Between-group comparisons at baseline. A one-way MANOVA was used to compare the three groups on all baseline variables (i.e., Responsibility Attitudes Scale, Intolerance to Uncertainty Scale, and baseline State and Trait Anxiety), with ‘Group’ as a factor. This was chosen to reduce the possibility of a Type 1 error and to have greater

statistical power (Field, 2000). Significance was set at < .05. There was no significant multivariate effect, Wilks' Lambda = .942, $F(9,141) = 0.390$, $p = .938$. Test of between-subjects effects showed no significant differences for baseline responsibility, $F(3,60) = .388$, $p = .762$, intolerance of uncertainty, $F(3,60) = .243$, $p = .866$, and anxiety, $F(3,60) = 1.017$, $p = .391$.

Baseline anxiety was not normally distributed so an additional non-parametric Kruskal-Wallis one-way analysis of variance was used to compare the four experimental groups (i.e., high-responsibility / no-uncertainty, high-responsibility / high-uncertainty, no-responsibility / no-uncertainty, and no-responsibility / high-uncertainty). There were no significant between-group differences, $H = 3.224$, $p = .358$. Also, between-group differences for gender were tested using Pearson's Chi Square test. These were not significant, $\chi 2(3) = 276$, $p = 6$.

Overall, there were no significant between-group differences at baseline, so further analyses did not control baseline scores. Descriptive statistics for raw baseline RAS and IUS, and for transformed baseline STAI are presented in Tables 6, 7, and 8, respectively (Appendix AK).

7.4.5. Manipulation Checks. Two independent variables were manipulated: responsibility and uncertainty. Two factorial ANOVAs were used to test if the experimental manipulations were successful.

7.4.5.1. Responsibility manipulation check. The two high-responsibility groups were combined into one high-responsibility group and the two no-responsibility groups were combined into one no-responsibility group. Post-manipulation responsibility scores were compared using a one-way ANCOVA, with responsibility as a 2-level factor (i.e., high-responsibility and no-responsibility) and controlling for 'Feedback' (this was to isolate the effect of each independent variable).

If the manipulation was successful participants in the high-responsibility groups would report significantly higher perceived responsibility than the no-responsibility groups. As expected there were significant between-group differences after the manipulation, $F(1,60) = 8.40$, $p = .005$, Cohen's $d = .738$, indicating that, participants who received high-responsibility instructions reported feeling significantly more responsible for the task (M = .329, SD = .345) than participants who received no-responsibility instructions (M = .112, SD = .232). Descriptive statistics for transformed pre- and post-manipulation responsibility scores for high-responsibility and no-responsibility groups are presented in Table 9.

Table 9

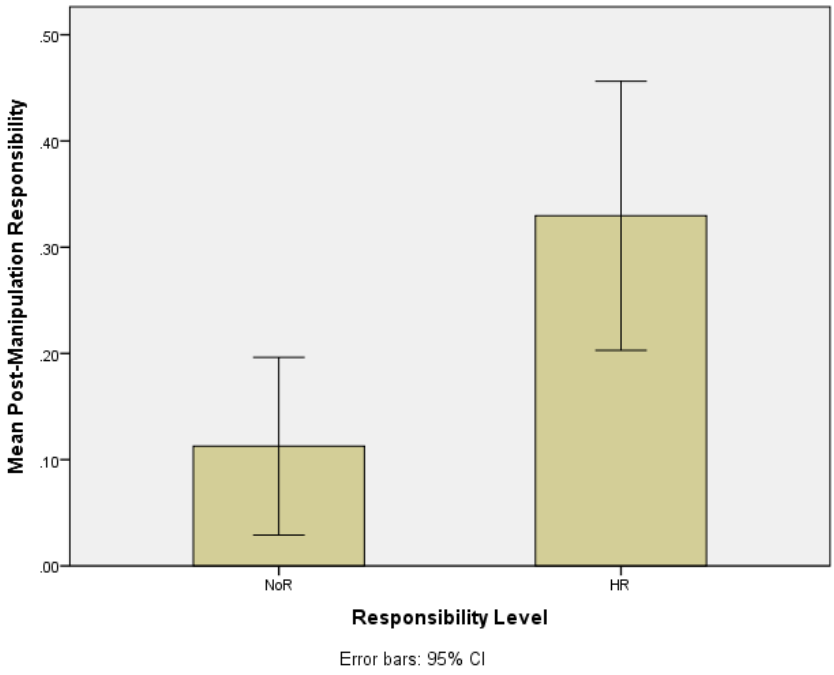
Responsibility scores

Group	N	Range	Mean	SD	Median	Skew	Kurtosis
Baseline Responsibility							
Whole Group	63	.70	.142	.224	0	1.199	-.064
High Responsibility	31	.70	.117	.228	0	1.597	.902
No responsibility	32	.70	.166	.220	0	.908	-.503
Post-manipulation Responsibility							
Whole Group	63	.95	.219	.310	0	1.047	-.326
High Responsibility	31	.95	.329	.345	.301	.462	-1.265
No responsibility	32	.85	.112	.232	0	1.932	2.685

The power calculation conducted to determine sample size for this study was not designed to detect baseline differences between groups for the independent variables, so another ANCOVA – similar to the one described above – was conducted; however, this time both 'feedback' and baseline responsibility were controlled. Results revealed that between-group differences (between the high-responsibility and no-responsibility groups) for post-manipulation responsibility were still significant, $F(1,59) = 12.388$, $p = .001$, $\square_p^2 = .174$, which further indicates that the responsibility manipulation was successful.

Figure 5 displays post-task manipulation means and confidence intervals for responsibility.

Figure 5. Responsibility



Post-manipulation responsibility scores were not normally distributed even after transformations were used, so an independent samples Mann-Whitney U test was also used to test the effectiveness of the responsibility manipulation. Consistent with result of the parametric test, a significant between-group difference was observed for post-manipulation responsibility, $U = 672$, $p = .006$. This further confirmed that the responsibility manipulation was successful.

7.4.5.2. Uncertainty manipulation check. To check the uncertainty manipulation, the no-uncertainty groups (i.e., high-responsibility/no-uncertainty and no-responsibility/no-uncertainty) were combined into one no-uncertainty group, and the high-uncertainty groups (i.e., high-responsibility/high-uncertainty and no-responsibility/high-uncertainty) into one high-uncertainty group.

It was predicted that the no-uncertainty group would report higher confidence in sorting compared to the high-uncertainty group. Post-task confidence scores for the two resulting groups were compared using a univariate ANCOVA, with feedback as a two-level factor (i.e., no-uncertainty, high-uncertainty) and controlling for 'Responsibility' (as two independent variables were manipulated in this study – i.e., responsibility and feedback). No significant between-group differences were observed for post-task confidence, $F(1,61) = 3.322$, $p = .073$; although the no-uncertainty groups reporting higher confidence in sorting (M = .977, SD = .199) than the high-uncertainty groups (M = .876, SD = .233), this difference was not statistically significant. A similar ANCOVA was conducted for overall uncertainty (i.e., the mean of the sum of Confidence1, Confidence2, and Confidence3). A significant univariate effect was observed, $F(1,59) = 5.737$, $p = .020$, Cohen's $d = -0.548$, indicating that the high-uncertainty group reported feeling significantly less confident about their sorting (M = 1.46, SD = .151) than the no-uncertainty group (M = 1.539, SD = . 099).

Descriptive statistics for overall transformed confidence scores are presented in Table 10. These results indicate that the feedback manipulation was successful in changing participants' confidence in their sorting.

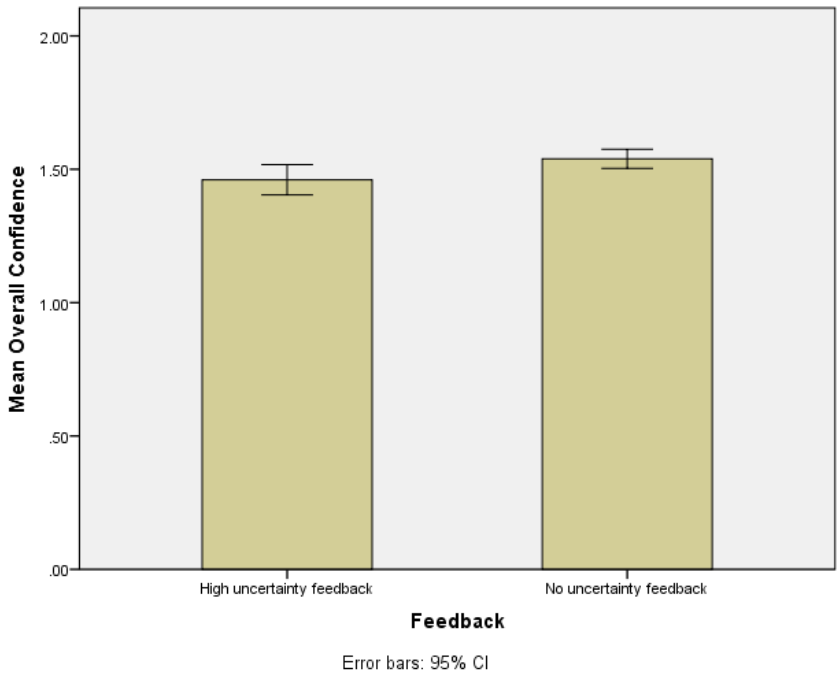
Table 10

Confidence

Group	N	Range	Mean	SD	Median	Skew	Kurtosis
			Overall Confidence				
High uncertainty	30	.76	1.460	.151	1.491	-2.420	8.549
No uncertainty	32	.49	1.539	.099	1.579	-2.887	10.516

Figure 6 displays overall Confidence scores and confidence intervals for high-uncertainty and no-uncertainty groups.

Figure 6. Post-task confidence by feedback



Confidence data were not normally distributed so a Mann-Whitney U test was also used to test the effect of the feedback manipulation using raw scores, with 'feedback' as a 2-level factor (i.e., high-uncertainty and no-uncertainty) for post-task confidence. Significant between-group differences were observed for post-task Confidence, $U = 795$, $p = .000$. A similar test was conducted for overall confidence, which also was significant,

U = 681.5, p = .004. This further confirmed that the feedback manipulation was successful in changing participants' confidence in their sorting as predicted.

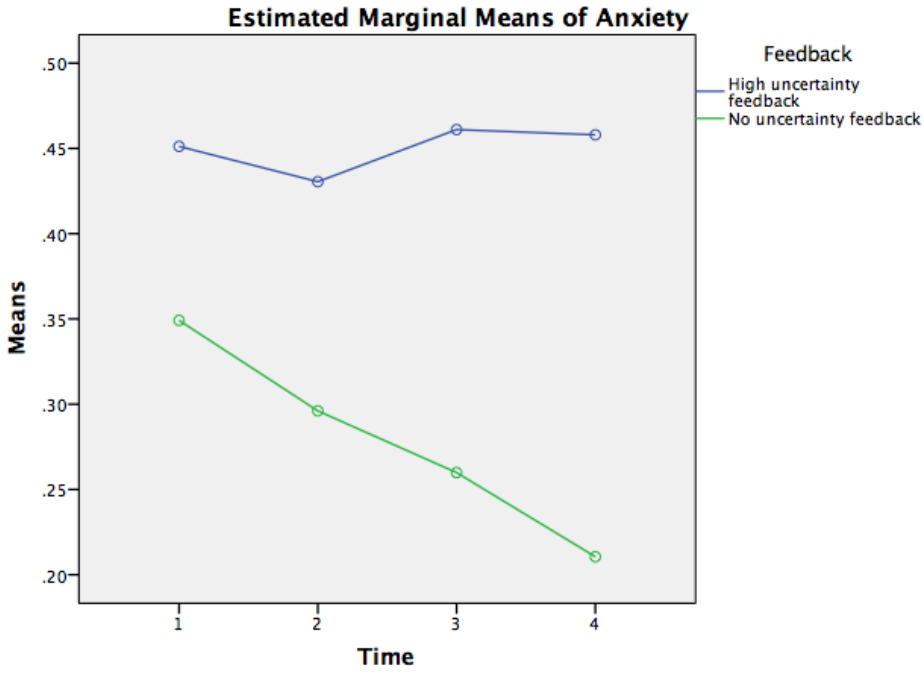
7.4.5.3. Checking behaviour manipulation check. All participants in the study were asked not to check the bottles during sorting. This was meant to avoid confounding the effect of the feedback manipulation. In order to ensure that participants followed this instruction, video recordings of all participants completing the experimental task were reviewed. The video recordings revealed that 15 out of the 64 participants checked their sorting (i.e., they looked in the sorting bottles during sorting). Of the 15 participants who checked, 6 only checked once, 1 checked twice, 6 checked between 3 and 9 times, and 2 checked 10 times or more. Also, out of the 15 who checked, 6 were in were in groups where they received positive feedback, and 5 in groups where they received negative feedback. Our dependent variables were anxiety and urge to check and to seek reassurance. We expected participants who received negative feedback to experience an increase on these measures, so it is possible that checking during sorting had an effect on anxiety and compulsive urges for the 5 participants in the negative feedback groups. This is less of a concern in the case of the 6 participants who received positive feedback. A new variable was created to reflect actual checking behaviour and was used in all the analyses as a covariate.

7.4.6. Testing the hypotheses – Between- and within-subjects comparisons for dependent variables.

7.4.6.1. Anxiety. A 2 X 2 X 4 repeated-measures ANOVAs was conducted to test differences between- and within-subjects for Anxiety. Time was entered as a within-participants factor (i.e., Anxiety1, Anxiety2, Anxiety3, and Anxiety4) and Responsibility and Feedback were entered as between-participants factors; polynomial contrasts were applied. Checking behaviour was entered as a covariate. There was no significant main effect of Time or Responsibility, and there were no significant interaction effects between Responsibility and Feedback. However, there was a significant between-

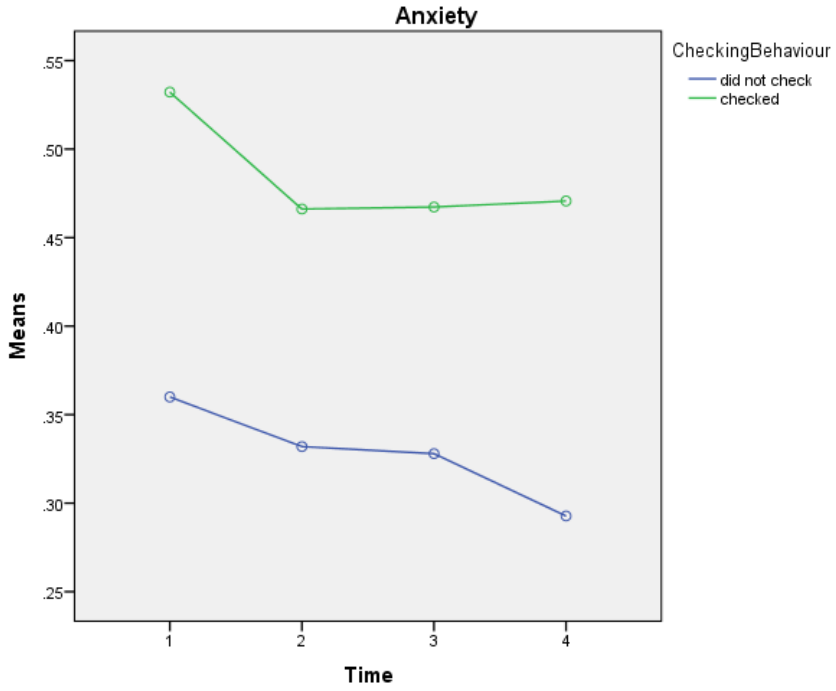
subjects main effect of Feedback, $F(1,55)= 5.833$, $p = .019$, $\eta_p^2 = .096$, with participants who received positive feedback reporting significantly less anxiety than participants who received negative feedback (Figure 7).

Figure 7. Anxiety by feedback



There was also a significant Checking behaviour effect, $F(1,55) = 4.646$, $p = .036$, $\eta_p^2 = .078$. Participants who checked reported higher anxiety than those who did not check (Figure 8; pg. 160).

Figure 8. Anxiety by checking



A similar 2 X 2 X2 X4 repeat-measures ANOVA was conducted where Checking behaviour was entered as a factor, and not as a covariate; this was to further test any possible interaction effects of Checking behaviour with the other factors involved (i.e., Responsibility and feedback). No significant main or interaction effects were found.

Table 11 (pg. 161) contains descriptives for anxiety, for each time point, by feedback.

Table 11

Anxiety by feedback

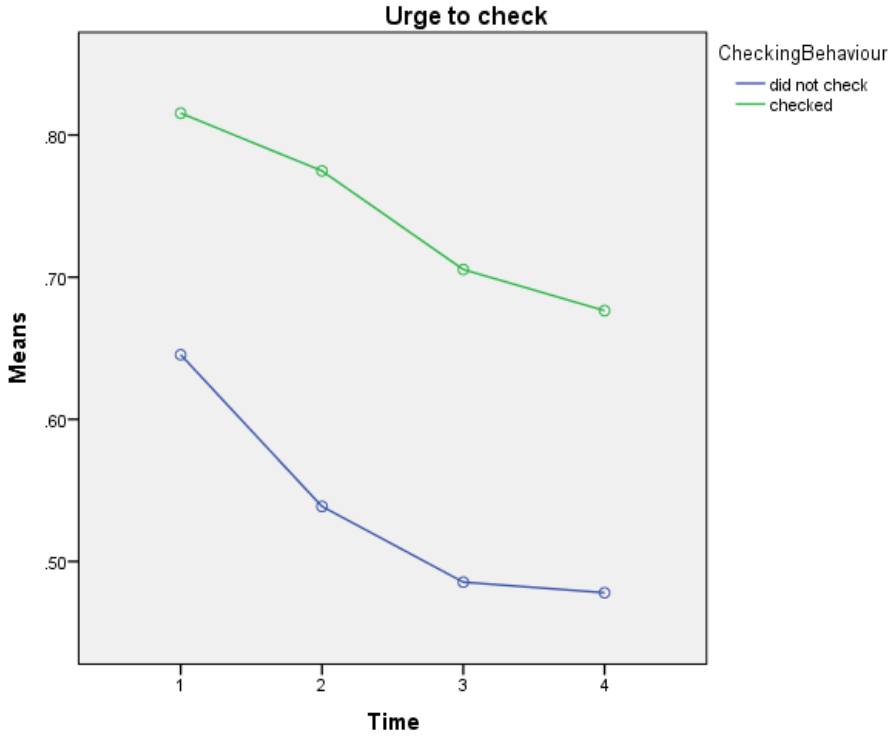
Negative Feedback	N 32	Range	Mean	SD	Median	Skew	Kurtosis
				Anxiety			
Anxiety 1		.95	.447	.312	.477	-.074	-1.016
Anxiety 2		1	.431	.35	.477	-.071	-1.519
Anxiety 3		1	.457	.323	.602	-.296	-1.225
Anxiety 4		1	.454	.346	.477	-1.27	-1.337

Positive Feedback	N 31	Range	Mean	SD	Median	Skew	Kurtosis
				Anxiety			
Anxiety 1		.9	.363	.311	.301	.276	-1.194
Anxiety 2		.9	.287	.298	.301	.517	-1.065
Anxiety 3		.95	.254	.277	.238	.665	-.495
Anxiety 4		.78	.219	.238	.15	.68	-.615

7.4.6.2. Urge to check. A 2 X 2 X 4 ANOVA was conducted for Urge to check, with Time (i.e., Check1, Check2, Check3, Check4) as within-subjects variable, and Responsibility and Feedback as independent variables. Checking behaviour was entered as a covariate. There was a significant within-subjects effect of Time, $F(3,52) = 5.286$, $p = .003$, $\eta_p^2 = .234$. There was no significant main effect of Responsibility or Feedback, and no significant interaction effects. However, there was a significant between-subjects main effect of Checking behaviour, $F(1,54) = 5.532$, $p = .022$, $\eta_p^2 = .093$, with those who checked reporting significantly higher urge to check than those who did not check (Figure

9).

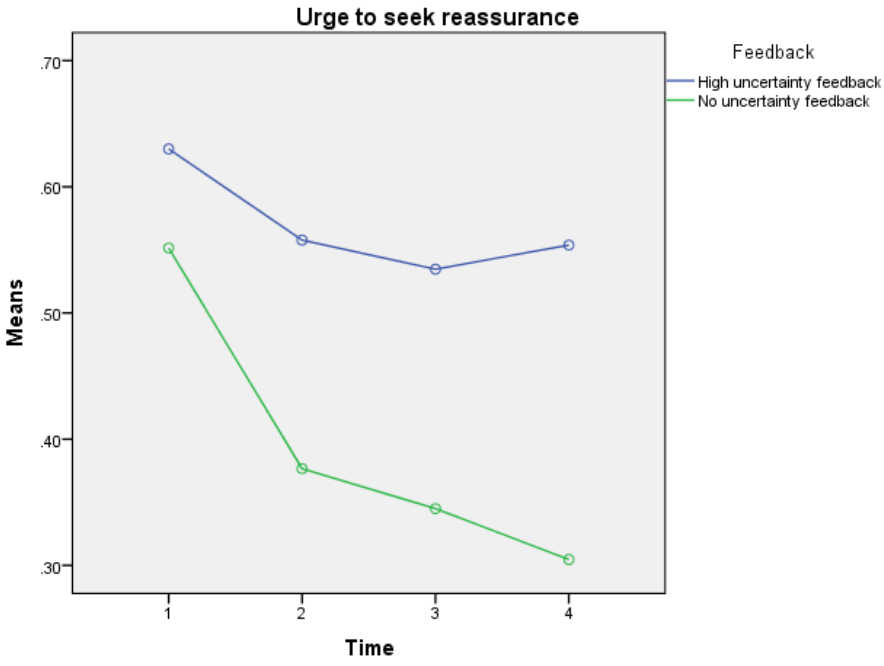
Figure 9. Urge to check by checking behaviour



A 2 X 2 X2 X4 repeat-measures ANOVA was conducted where Checking behaviour was entered as a factor, and not as a covariate; this was to further test any possible interaction effects of Checking behaviour with the other factors involved (i.e., Responsibility and feedback). No significant main or interaction effects were found.

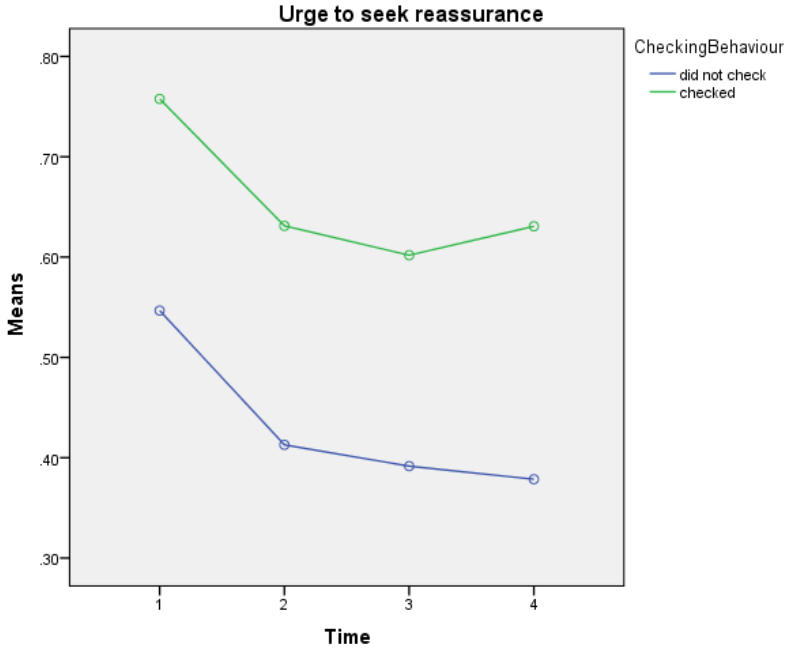
7.4.6.3. Urge to seek reassurance. A 2 X 2 X 4 ANOVA was conducted for Urge to seek reassurance, with Time (i.e., Reassurance1, Reassurance2, Reassurance3, Reassurance4) as within-subjects variable, and Responsibility and Feedback as independent variables. Checking behaviour was entered as a covariate. There was a significant within-subjects effect of Time, $F(3,52) = 5.218$, $p = .003$, $\eta_p^2 = .231$. There was also a significant between-subjects main effect of Feedback, $F(1,54) = 4.248$, $p = .044$, $\eta_p^2 = .073$, showing that participants who receive negative feedback felt significantly higher urge to seek reassurance than those who received positive feedback (Figure 10; pg. 163).

Figure 10. Urge to seek reassurance by feedback



There was also a significant between-subjects main effect of Checking behaviour, $F(1,54) = 4.59$, $p = .037$, $\eta_p^2 = .078$ (Figure 11). There was no significant main effect of Responsibility and no significant interaction effects.

Figure 11. Urge to seek reassurance by checking



A 2 X 2 X2 X4 repeat-measures ANOVA was conducted where Checking behaviour was entered as a factor, and not as a covariate; this was to further test any possible interaction effects of Checking behaviour with the other factors involved (i.e., Responsibility and feedback). There was a significant Time X Feedback interaction effect, $F(3,49) = 3.297$, $p = .028$, $\eta_p^2 = .168$; there were no other significant interaction effects.

Table 12 contains descriptives for urge to seek reassurance, for each time point, by feedback.

Table 12

Urge to seek reassurance by feedback

Negative Feedback	N 30	Range	Mean	SD	Median	Skew	Kurtosis
			Urge to seek reassurance				
Anxiety 1		1	.632	.347	.738	-.86	-.578
Anxiety 2		1	.415	.389	.65	-.378	-1.505
Anxiety 3		1	.538	.397	.699	-.287	-1.593
Anxiety 4		1.04	.556	.395	.65	-.286	-1.556
Positive Feedback	N 32	Range	Mean	SD	Median	Skew	Kurtosis
			Urge to seek reassurance				
Anxiety 1		1.04	.543	.364	.602	-.335	-1.27
Anxiety 2		1	.366	.37	.301	.338	-1.455
Anxiety 3		.95	.335	.353	.301	.514	-1.235
Anxiety 4		1.04	.298	.344	.301	. 098	-.634

7.4.7. Relationships between variables. A relationship, including a causal relationship, had been found between responsibility and checking (e.g., Ladouceur et al., 1995; Reeves et al., 2010). However, data Study 3 revealed no effect of responsibility on checking. Also, the nature of the relationship between uncertainty and compulsive urges is unclear. To further explore relationships between variables, correlational analyses were conducted. Several variables (i.e., responsibility, anxiety, urge to check, and urge to seek reassurance) were not normally distributed so two-tailed non-parametric g Spearman correlations were conducted. Significant correlation values are highlighted in Table 13 (Appendix AK).

The Responsibility Attitudes Scale at baseline was positively correlated with post-task anxiety, $r = .21$, $p = .04$, overall anxiety (i.e., collapsed across tasks), $r = .22$, $p = .03$, post-task urge to check, $r = .35$, $p = .001$, overall urge to check, $r = .37$, $p = .000$, post-task urge to seek reassurance, $r = .35$, $p = .001$, and overall urge to seek reassurance, $r = .403$, $p = .000$. The Intolerance of Uncertainty Scale was positively associated with overall anxiety, $r = .22$, $p = .03$ and overall urge to seek reassurance, $r = .25$, $p = .016$. Surprisingly, it was not related to urge to check or confidence in sorting, $r = 0.15$, $p = .165$, and $r = -.1$, $p = .359$, respectively. None of the baseline measures were associated with the time it took to complete the task.

These results suggest that anxiety is related to both responsibility and intolerance of uncertainty. Also, responsibility is related to both urge to check and urge to seek reassurance, while intolerance of uncertainty is only associated with the latter. This may suggest that different cognitions are relevant for different compulsions.

7.5. Discussion

The present study aimed to test the effects of inflated responsibility and confidence (as manipulated by feedback) on anxiety, urge to check, urge to seek reassurance, and task duration. Repeat-measures analyses showed that feedback had a significant effect on

anxiety. As expected, participants who received negative (i.e., low confidence) feedback reported more anxiety than those who received positive (i.e., high confidence) feedback. Surprisingly, responsibility did not have a significant effect on anxiety; there was also no significant interaction effect of responsibility and feedback.

Participants' urge to check significantly changed over time; however there was no significant main effect of responsibility or feedback, and no significant interaction effects. Participants' urge to seek reassurance significantly changed over time as well. Also, as expected, urge to seek reassurance was significantly higher in participants who received negative (i.e., low confidence) feedback reported more anxiety than those who received positive (i.e., high confidence) feedback. Additionally, there was a significant time and feedback interaction effect, so we can conclude that significant changes in urge to seek reassurance, over time, were due to the feedback participants were given throughout the experimental task. There were no other significant interactions and there was no significant main effect of responsibility.

Furthermore, although all participants were asked not to check their sorting, 15 of the entire sample did check. Repeat-measures analyses showed that participants who checked reported more anxiety and more compulsive urges than participants who did not check. This explains why they engaged in more checking throughout the task.

Our sample consisted of 64 adult nonclinical participants with ages ranging from 18 to 62 (mean age 32 years, SD = 11). They were older than the sample recruited by Parrish et al. (2006) whose average age was 22 years (SD = 4.80). Many of the participants in this study were postgraduate research students or research staff. Parrish et al.'s participants were mainly undergraduate students.

In the experiment responsibility and uncertainty were manipulated to test their effects on anxiety, compulsive urges, and the time taken to complete the experimental task. Participants completed four pill sorting trials, and received feedback about their performance (accuracy) after the first three trials. Some participants were assigned to the

high responsibility condition and some received high uncertainty feedback, and some reassuring feedback. Participants were not allowed to check their sorting at any time during the trials. The responsibility manipulation was adapted from previous research (e.g., Ladouceur et al., 1995) and has been extensively and successfully used with non-clinical (e.g., Ladouceur et al., 1997) and clinical samples (e.g., Arntz et al., 2007). To avoid possible confounding effects of the sorting task on responsibility, responsibility was measured at baseline and immediately after the manipulation, instead of post-task (as in Study 2; see pg. 107). This allowed to more accurately determine the success of the responsibility manipulation. Responsibility perceptions were successfully changed. Participants in the high responsibility group reported significantly higher responsibility than participants in the no-responsibility group.

The uncertainty manipulation used was adapted from Parrish et al. (2006). Participants in Parrish et al.'s study were assigned either low or high responsibility (equivalent to no-responsibility and high-responsibility, respectively, in Study 3). They also manipulated reassurance by giving participants extensive feedback about how accurate they were on a pill-sorting task. Their participants completed five sorting trials. High reassurance feedback was provided after each of the first four trials. Low reassurance feedback was given after each of the first three trials. Parrish et al. reported the success of the responsibility manipulation. Participants' confidence in sorting accuracy was a dependent variable; therefore there was no separate evaluation of the uncertainty manipulation.

Parrish et al. (2006)'s method was adapted in Study 3. Feedback on accuracy was used to manipulate participants' perceptions of uncertainty. Confidence in sorting was used as a measure of uncertainty, which was used as an independent variable.

Another major difference between Study 3 and Parrish et al. (2006)'s study is that all their participants received different *levels* of reassuring feedback (i.e., feedback after three or four trials). In Study 3 participants received 2 different *types* of feedback (i.e.,

error or *correct* throughout). These types of feedback were expected to correspond to different levels of uncertainty:

i) Participants who received 'error' (i.e., high-uncertainty) feedback would feel more confident about their ability to sort correctly, compared to the other participants;

ii) Participants who received no-uncertainty feedback to feel confident that they could sort the pills correctly, more so than all the other participants in the study.

The confidence in sorting manipulation check showed that the certainty/confidence manipulation was successful. The majority of studies that have manipulated responsibility using the pill sorting task allowed participants to check their sorting during the task (e.g., Ladouceur et al., 1995). A small number of studies have restricted checking during the task (e.g., Parrish et al., 2011). In Study 3, checking was restricted throughout the experimental task. This was to avoid confounding effects on the uncertainty feedback manipulation, i.e., checking could have increased participants' confidence in sorting and thus decreased uncertainty. The restriction on checking behaviour during the task ensures that the observed differences in confidence were due to the feedback participants received. However, in spite of the 'no-checking' instructions, 15 participants checked during the sorting. This was addressed and controlled in the analyses.

During debriefing, several participants reported having doubts about the purpose of the experiment and the feedback (especially in the high-responsibility/high- uncertainty groups) However, they reported that they behaved "as if" they had believed the manipulations. Given that this was an experimental set-up it was expected that participants would have some doubts regarding the real purpose of the study so this was not a surprise. Manipulation checks showed that, in spite of their doubts, the responsibility and uncertainty experimental manipulations were successful.

One potential limitation of this study was the way uncertainty was measured.

Previous experiments have used a visual analogue scale to measure uncertainty. For example, Parrish et al. (2006) used the pill-sorting paradigm to manipulate responsibility and reassurance / doubt, and used a *confidence* in sorting scale to measure participants' doubt. Similarly, van den Hout et al. (2004) used a virtual stove task to test the effects of repeated checking on uncertainty, and used a *confidence* measure as an indicator of uncertainty. They assessed two types of confidence: (1) confidence in checking (i.e., confidence about remembering the act of checking itself), and (2) confidence about the outcome of the checking (i.e., if the stove was off). In Study 3 the measure of confidence was similar to van den Hout et al.'s second measure. Furthermore, both Parrish et al. and van den Hout et al. used *confidence*, *uncertainty*, and *doubt* interchangeably in discussing findings of their work. This confusion and overlap of constructs is also evident elsewhere. Confidence and uncertainty have often been linked (e.g., Fischhoff, Slovic, & Lichtenstein, 1977; Juslin, & Olsson, 1997; Moreno-Bote, 2010; Sanders, & Kepecs, 2010). However, the exact relationship between these concepts has not been explored and the degree of overlap between them is unclear. Study 3 could have more accurately measured uncertainty by asking participants to report how *certain* they were about their sorting, instead of how *confident* they were.

Another limitation of the current study is that a pure control group was not included, i.e., a no-responsibility / low-uncertainty (i.e., no feedback) group. One reason was that the study focused on the effect of the presence of high responsibility and high uncertainty. Other reasons were the study timeline and difficulties with recruitment. A pure control group would have possibly allowed for more refined comparisons between different levels of responsibility and uncertainty.

Unlike Parrish et al. (2006), the current study included high-uncertainty feedback. It was hypothesised that participants who were in the high uncertainty conditions, especially those in the high-responsibility / high-uncertainty group, would experience the highest levels of anxiety and compulsive urges. In the context of completing a repetitive

task (equivalent to a checking act in an OCD patient), repeated *error* feedback was expected to create doubt (similar to an OCD patient who would doubt his / her ability to safely complete a checking act). This was expected to directly reflect as an increase in compulsive urge to check, especially because checking was restricted. As expected, high high uncertainty increased both anxiety and the urge to seek reassurance; surprisingly, responsibility did not have a significant effect on these aspects. This suggests that uncertainty alone is sufficient to produce significant effects and that responsibility is not a necessary factor. This does not provide support for Salkovskis' (1985) inflated responsibility model of OCD.

The premise of this study was that inflated responsibility is a necessary factor in OCD, and that uncertainty may or may not be needed for anxiety and compulsive urges to manifest. This would mean that regardless of feedback received, participants in high responsibility groups would have felt more anxious and would have reported more compulsive urges compared to the no-responsibility groups. However, responsibility alone did not produce significant effects; unexpectedly, uncertainty alone led to significant differences. These data suggest that responsibility is not a necessary factor for anxiety and compulsive urges to emerge; however, they suggest that uncertainty may be necessary.

Checking was restricted so the hypothesis was that the urge to check would be high in all the groups, and especially in the high-responsibility / high-uncertainty groups. However, 15 participants did not follow instructions and did check their sorting; analyses showed that those who checked experienced higher anxiety and compulsive urges than those who did not check. It has been proposed that checking is a self-perpetuating mechanism (Rachman, 2002); it is possible that participants who broke the no-checking rule felt more anxious and more urges to check and seek reassurance, which led them to check in the first place. Possibly, the anxiety and urges were paradoxically maintained by the checking behaviour, instead of being decreased.

Checking and reassurance seeking have been described as safety behaviours in

OCD (Rachman, 2002), and reassurance seeking is considered as checking by proxy or a backup to checking (Salkovskis, 1985). According to this theory, when checking is possible it is the safety behaviour of choice (e.g., if one obsesses about the stove being left on, s/he may go check it to ensure that it is safely turned off), and when checking reassurance seeking is used as a substitute (e.g., if outside of the house they may call their housemate and ask them to check the stove). It is unclear why feedback had a significant effect on the urge to seek reassurance but not on the urge to check. One possibility is that the urge to seek reassurance is impacted by uncertainty but not by responsibility (which did not have a significant effect). This would confirm Rachman's (2002) proposal that the function of compulsions, including reassurance seeking, is to reduce doubt. It would also support Parrish et al.'s (2011) hypothesis that checking is more related to responsibility and that reassurance seeking is more related to uncertainty.

Future work could focus on further defining the concept of uncertainty, as well as related concepts such as doubt and confidence. A clearer theoretical framework for these concepts would also allow the development of better measures and methodology. Future work could test the effects of uncertainty alone on anxiety and compulsive, in a similar design that does not inflate responsibility. A possible design could include three groups, i.e., high uncertainty, low uncertainty, and no uncertainty, and use a task similar to the pill sorting task used here.

Parrish et al. (2011) found three variables to be significantly associated with anxiety and compulsive urges in individuals with OCD; these were: responsibility, high perceived threat, and ambiguity of feedback. Future research could focus on the quality of the feedback. Because most people with OCD request reassurance from close relatives, over weeks, months, and even years, they may receive feedback that is increasingly vague or dismissive. Ambiguity of feedback has been linked to uncertainty (Parrish et al., 2011), and patients with OCD seem to seek more reassurance when the feedback received is not clear. They are also more likely than healthy individuals to interpret feedback as being

ambiguous (Parrish et al., 2011). A study similar to the present one, but providing participants with different types of feedback (e.g., ambiguous instead of very clear) could test this possibility.

Also, responsibility and feedback may have a different impact in a clinical or a vulnerable sample. People with OCD have an increased sense of uncertainty (Dar, 2004; Tolin et al., 2003) and tend to be less confident in their cognitive abilities (Rachman, 2002; Cougle et al., 2007) than healthy individuals. Lack of feedback (i.e., experienced by our low-uncertainty group) may have significantly increased anxiety and compulsive urges in these samples, which may have a lower ability to self-reassure than healthy participants. Similar work with clinical samples is needed.

7.6. Conclusion

Study 3 tested the effects of inflated responsibility and uncertainty on anxiety, compulsive urges, and task duration using a pill sorting paradigm. The results suggested that responsibility had no significant effect on anxiety and compulsive urges, but that uncertainty/low-confidence alone produced significant changes; this indicates that responsibility is not a necessary factor for OCD, and that uncertainty/low-confidence is necessary for anxiety and compulsive urges to emerge. These findings do not support the inflated responsibility model and indicate that other cognitive domains may be more important for the aetiology of OCD. If responsibility alone were sufficient, compulsive behaviour would cease after one check or after the person receiving reassurance. However, compulsions are perpetuated behaviours, and uncertainty seems to play a causal role in that process. Obsessive- compulsive disorder is a very heterogeneous disorder, so perhaps different cognitive domains play different roles for different symptoms. It is possible that responsibility is relevant to checking, and that other cognitive aspects are more relevant to reassurance seeking and other compulsive manifestations.

Chapter 8: Further Testing the New Model

Study 4: The Role of Responsibility, Uncertainty, and Checking for anxiety and compulsive urges

8.1. Introduction

Inflated responsibility and uncertainty / intolerance to it have been identified as major cognitive components of OCD (OCCWG, 2005). People with OCD feel responsible for possible negative outcomes for self or others and struggle with the uncertainty of a situation being safe. These cognitions seem to elicit compulsive behaviours such as checking and reassurance seeking (Salkovskis, 1985; Parrish et al., 2010). In Study 3 (see pg. 142), the effects of inflated responsibility and uncertainty on anxiety, obsessive-compulsive urges, and experimental task duration were examined. Non-clinical participants were randomly assigned to one of five experimental groups: high-responsibility / high-uncertainty, high-responsibility / no-uncertainty, high-responsibility / low-uncertainty, no-responsibility / high-uncertainty, and no-responsibility / no-uncertainty. A pill-sorting paradigm was used to manipulate responsibility (as indicated by self-reported perceived responsibility) and uncertainty (as indicated by self-reported confidence in sorting). The manipulations were successful. Participants were not allowed to check their sorting throughout the experimental task.

The combination of inflated responsibility and high uncertainty led to increased anxiety and urge to seek reassurance compared to either variable alone and the absence of both inflated responsibility and uncertainty. These results were promising, as previous studies that used the pill-sorting paradigm have reported mixed results for anxiety. Since most previous studies allowed their participants to check their sorting throughout the task, it was hypothesised that the lack of checking in our study added to the effects of feedback

to increase uncertainty, and thus anxiety and urge to seek reassurance. Study 4 was designed to test this. All participants were exposed to the inflated responsibility manipulation and were randomly allocated to a checking or to a no-checking condition.

Study 4 aimed to further test the effects of uncertainty and inflated responsibility on anxiety, compulsive urges, and task duration. It also aimed to examine the role of checking in this context.

8.2. Rationale for research study

The current study attempted to address the following questions:

In a context of high responsibility does high uncertainty (further) increase participants' anxiety and urge to check? What is the effect of checking on anxiety, in the presence or absence of uncertainty as manipulated by feedback, in an inflated responsibility situation? Does checking interfere with the uncertainty generated by feedback?

Uncertainty and checking were manipulated using a pill-sorting paradigm. Dependent variables were: anxiety, urge to check, urge to seek reassurance, and experimental task duration. Adult participants were randomly allocated to one of four groups: no-uncertainty / checking, no-uncertainty / no-checking, uncertainty / checking, and uncertainty / no-checking. Responsibility was inflated for the entire sample.

8.3. Hypotheses

Manipulations checks – we expected that:

- All participants will report higher perceived responsibility after the responsibility manipulation, compared to baseline.
- Participants in the high-uncertainty groups will report higher uncertainty compared to participants in the no-uncertainty groups.
- Participants in the 'checking' groups will check their sorting during the task, while participants in the 'no-checking' groups will not check their sorting.

We hypothesised that:

1. Participants in the high-uncertainty groups would report higher anxiety, more urges to check and to seek reassurance, and would take longer to complete the experimental task than participants in the no-uncertainty groups.

2. Participants in the uncertainty/no-checking group would report higher anxiety, more urges to check and to seek reassurance, and would take longer to complete the experimental task, than participants in the other groups.

3. Participants in the uncertainty/checking group, would report higher anxiety, more urges to check and to seek reassurance, and would take longer to complete the experimental task than participants in the no-uncertainty/checking group.

8.4. Design

This was a 2 (checking) X 2 (uncertainty), between-groups randomised experiment, with four groups:

- High-responsibility, no-uncertainty, checking
- High-responsibility, no-uncertainty, no-checking
- High-responsibility, uncertainty, checking
- High-responsibility, uncertainty, no-checking.

A flow-chart of the study is attached in Appendix AD.

8.5. Method

8.5.1. Participants

8.5.1. 1. Inclusion and exclusion criteria. Students and staff aged 18 and over and fluent in English were recruited for this study. Colour-blind individuals were not able to participate, as the sorting task required colour perception. Also, individuals who have previously participated in a similar study were excluded. The reason was that former participants received debriefing information that would have compromised the credibility

of the manipulation in the new study.

8.5.1.2. Sample size. Seventy-four participants (53 female) were recruited and asked to sign a consent form. Demographic information for the entire sample is presented in the Results section (see pg. 182).

8.5.1.3. Recruitment. After approval was obtained from the ethics committee at UEA (Appendix AB), participants were recruited by placing posters (Appendix AA) about the study on campus and adverts in the university's news bulletin. The experimenter's contact information along with brief information about the study was included. Those who contacted the researcher were offered an appointment on campus, in an experimental room. Potential participation and forms completion (see *Procedure* section) including the Consent Form (Appendix R) were discussed at that time. Eligible participants who were willing to take part proceeded with the experimental task. As compensation, each participant was given a free-lunch voucher.

8.5.2. Measures. All participants were asked to complete the following measures:

8.5.2.1. Demographic Questionnaire. Each participant was asked to complete a demographic questionnaire which included age, gender, and ethnic origin (Appendix T).

8.5.2.2. Baseline measures

8.5.2.2.1. Intolerance of Uncertainty Scale (IUS; Buhr et al., 2002) (Appendix X). The IUS has twenty-seven items rated on a 5-point scale and measures several aspects of intolerance of uncertainty. Higher scores on this scale indicate greater intolerance. The measure has great internal consistency ($\alpha = .94$) and good test-retest reliability ($r = .74$) (Buhr et al., 2002).

8.5.2.2.2. Responsibility Attitude Scale (RAS; Salkovskis et al., 2000) (Appendix U). The RAS is a 26-item questionnaire that measures general beliefs and assumptions related to inflated responsibility. It has good test-retest reliability (r = .94) and high internal consistency (alpha=.92) (Salkovskis et al., 2000). Here it was used to control for

inflated responsibility beliefs across the four experimental groups.

8.5.2.2.3. Perception of responsibility, probability of harm and severity of harm (pre-task) (Appendix W). This is a six item, 5-point Likert scale ranging from 0 (completely disagree) to 4 (completely agree). This scale will be completed before and after the sorting task. This measure has been previously used in a similar study (Reeves et al., 2010) and has good internal consistency (Cronbach alpha = .73).

8.5.2.2.4. Visual Analogue Scale of Responsibility (Parrish et al., 2006) (Appendix AE). This is a 0 –100 scale that measures the extent to which participants feels that their performance would affect the well-being of others.

8.5.2.2.5. The Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) (Appendix AG). This is a 20-item measure of negative and positive affect. Is has good internal reliability (Cronbach alpha = .83) and construct validity.

8.5.2.3. Dependent measures

8.5.2.3.1. Perception of responsibility, probability of harm and severity of harm (post-task) (as described above) (Appendix W).

Participants were also asked to complete visual analogue scales (Parrish et al., 2006) as follows:

8.5.2.3.2. Certainty regarding sorting accuracy measure (manipulation check) (Appendix AF). Participants were asked to indicate how *certain* they were that they sorted correctly. This was different from Study 3 where participants were asked to rate how *confident* they felt in their sorting (see pg. 142) and aimed to increase the validity of the scale. This measure was administered after the sorting task.

8.5.2.3.3. Visual Analogue Scale for Urge to Check (Appendix V-3*).* This is a single 0-100 scale aimed at measuring urge to check. Here 0 represents "no urge whatsoever" and 100 represents "extreme urge". This measure was used before and after the sorting task.

8.5.2.3.4. Visual Analogue Scale for Urge to Seek Reassurance (Appendix V-4*).* This is a single 0-100 scale aimed at measuring urge to seek reassurance. Here 0 represents "no urge whatsoever" and 100 represents "extreme urge". This measure was used before and after the sorting task.

8.5.2.3.5. Visual Analogue Scale for Anxiety (Appendix - V1*).* This is a single 0-100 scale aimed at measuring state anxiety. Here 0 represents "no anxiety whatsoever" and 100 represents "extreme anxiety". This measure was used before and after the sorting task.

8.5.2.3.6. Duration. Time taken by each participant to complete the task, in seconds, was measured using a stop watch. The timing began as soon as sorting started, and stopped immediately the last pill was placed in a sorting bottle.

8.5.2.4. Post-task measures. After all the sorting trials were completed, all participants filled out the following measures:

- Visual analogue scales for anxiety, certainty of sorting, urge to check, urge to seek reassurance (see above)

- PANAS post-task

- Perception of responsibility – post-task.

8.5.3. Procedure. The experimenter met with each potential participant in an experimental room on campus. Participants were asked to read the Participant Information Sheet and complete the Demographic Information Form. Study aims and procedure were explained to them, as well as their rights as potential participants. They were informed that their participation was completely voluntary and that they could withdraw from the study at any time without giving an explanation or being penalised in any way. Those who agreed to participate signed a Consent form (Appendix R). Participants were tested individually, in a quiet experimental room at UEA.

8.5.3.1. Randomisation. Randomisation took place as soon as the consent form

was signed. Block randomisation, stratified by gender was used.

Participants were randomly assigned to one of four groups:

i) High-responsibility/uncertainty/checking (responsibility was experimentally inflated; high-uncertainty was manipulated via fictive negative feedback – see pg. 181; checking was allowed)

ii) High-responsibility/uncertainty/no-checking (responsibility was experimentally inflated; fictive negative feedback was given; checking was not allowed)

iii) High-responsibility/no-uncertainty/checking (responsibility was experimentally increased; participants received fictive positive feedback; checking was allowed)

iv) High-responsibility/no-uncertainty/no-checking (responsibility was experimentally increased; participants received fictive positive feedback; checking was not allowed).

8.5.3.2. Ethical considerations

8.5.3.2.1. Consent. Potential participants were sent an email with information about objectives and procedures of the study, their rights as participants, and an eligibility form. If eligible, they were offered an appointment with the experimenter. The experimenter discussed any questions with them and they completed a consent form.

8.5.3.2.2. Deception. Participants were asked to help with the development of a pill sorting system. This was conveyed in the recruitment material and in the information they received about the study. This manipulation was important to increase the level of responsibility felt by participants in the study. The aim was that all participants completed the experimental task in a context of inflated responsibility. As this was not the actual aim of the study, deception was used. In addition, during the task, participants received false feedback about their performance, i.e., they were told either: a) that they had sorted all the pills correctly; or b) that they had made mistakes, regardless of their actual performance). At the end of the task, all participants were fully debriefed and the deceptive nature of the

experiment and the fictive nature of the feedback were revealed.

The role of deception in this study was carefully considered and the study was designed in concordance with ethical guidelines from the British Psychological Society (BPS, 2006). The guidelines state that, when deception is necessary, the reaction of participants in similar studies should be used as a guide to practice. In previous research at UEA and elsewhere, similar manipulations have been used with children (e.g., Reeves et al., 2010) and adults (e.g., Ladouceur et al., 1995). No distress was reported or recorded. Adult participants at UEA appeared to enjoy the experimental process and found the debriefing interesting. Several participants encouraged their friends and colleagues to take part in the experiment.

8.5.3.2.3. Managing distress. Participants were healthy adult volunteers. This experimental task and variations of it have been successfully used before with adults and children (e.g., Ladouceur et al., 1995, 1997; Parrish et al., 2006; Reeves et al., 2010) without negative consequences for the participants. The level of anxiety induced by the experimental task was similar to that experienced in daily life. It was expected that the task would lead to a brief period of mild anxiety which would completely reduce shortly after the experiment. Participants were monitored throughout the task and given the chance to discuss the task and debrief with the researcher as needed.

8.5.3.2.4. Confidentiality. Data were managed in accordance with the Data Protection Act (1998). Each participant was assigned an identification number and personal identifying information was not stored. Participants were informed that their identity would remain confidential. Video recording was used for this study, for monitoring purposes. Only the experimenter had access to these data. Data are kept in a locked cabinet at UEA, where they will be retained for five years from the completion of the study and then destroyed.

8.5.3.3. The Experimental Task. Participants were given initial information and instructions (Appendix AH). They were presented with the pills and received a

standardised demonstration of the sorting. They were asked to sort 35 pills of 10 different shapes, colours, and sizes from a large container into seven opaque pharmaceutical bottles, according to 7 predetermined four-pill combinations. To make the task more believable, they were asked to wear latex gloves during the task. All sorting tasks were video recorded.

Participants completed four sorting trials (i.e., trial1, trial2, trial3, and trial4). They were told that the first three trials (i.e., trial1 – trial3) were "practice" trials. These trials were used to manipulate uncertainty, by providing false feedback about the accuracy of their sorting.

Participants were told that the last trial (i.e., trial 4) was the actual sorting trial. No feedback was provided after trial 4 to any of the groups. After each trial, all participants were asked to complete visual analogue scales for:

- Certainty of sorting accuracy (manipulation check)
- Anxiety
- Urge to check
- Urge to seek reassurance.

8.5.3.3.1. The manipulations

8.5.3.3.1.1. Responsibility manipulation. Instructions (Appendix AH) described in this section are adapted from several studies that used similar manipulations (i.e., Ladouceur et al., 1995; Arntz et al., 2007; Parrish et al., 2006). All participants received high responsibility instructions, i.e., they were told that a charitable organisation had asked the university to develop a reliable sorting system for pills. They were told that their individual performance was important to ensure safe distribution of pills in third-world countries. To maximise credibility and increase participants' perceived responsibility, the experimenter wore a lab coat throughout the experiment. A poster of a fictive charitable organisation was displayed on the wall of the testing room.

8.5.3.3.1.2. Uncertainty manipulation

8.5.3.3.1.2.1. No-uncertainty groups. Participants in the no-uncertainty groups received '*correct'* feedback about their sorting accuracy after trials 1, 2, and 3. Standardised feedback was provided via phone text, on a study telephone. Regardless of their actual performance the text simply displayed the word "CORRECT". No other information about their sorting was provided at this time.

No feedback regarding sorting performance was given after trial4.

8.5.3.3.1.2.2. Uncertainty groups. Error feedback was given to participants in uncertainty groups after trials 1, 2, and 3. Standardised feedback was provided via phone text, on a study telephone. Regardless of their actual performance the text simply displayed the word "ERROR". No other information about their sorting was provided at this time.

No feedback regarding sorting performance was given after trial4.

8.5.3.4. Post-task measures. After trial4, all participants completed the following measures:

- Visual analogue scales for anxiety, certainty of sorting, urge to check, urge to seek reassurance
- PANAS
- Perception of responsibility – post-task.

8.5.3.5. Debriefing. All participants were fully debriefed at the end of their participation (Appendix AI). Questions and concerns they had were addressed and discussed. Upon leaving, each participant was offered a free-lunch voucher.

8.6. Results

8.6.1. Treatment of data. Data were entered into SPSS and investigated for missing or inaccurate entries. Missing data were coded as "999". Distributions for each variable were examined for normality using the Kolmogorov-Smirnov test and histograms. Significance level for all analyses was set at alpha < .05.

Data were also explored for outliers. Significant outliers were identified for pre-task urge to check and certainty, and for post-task certainty. Eliminating these outliers slightly improved but did not normalise distribution for these measures.

Skewed scores were transformed using Log10 transformations. This improved but did not normalize distribution. Raw scores for the normally distributed variables and Log10 transformed scores for the skewed variables were used in all the analyses, with cases excluded pairwise.

8.6.2. Demographic data. Demographic data for the whole sample and for each experimental group were explored. The mean age of the entire sample was 30.19 years (SD = 10.89), with ages ranging from 18 to 65 years. Fifty-one percent of the sample was White British, 17% Other White, and 12% Asian. The rest of the sample was from other ethnic groups or of mixed ethnicity. These data are reported in Table 14.

Table 14

Demographics

Group	N	Males	Females	Mean age	SD age
Whole Sample	74	21	53	30.19	10.89
Uncertainty/No-Checking	18	6	12	28.76	10.82
Uncertainty/Checking	17	5	12	30.29	10.07
No uncertainty/No-Checking	20	5	15	30.61	10.52
No uncertainty /Checking	19	6	11	31.06	12.83

8.6.3. Descriptive Data

The Responsibility Attitudes Scale, Intolerance of Uncertainty Scale, Positive PANAS (both baseline and post-task), and Collapsed urge to check (i.e., overall urge to check across all trials) were normally distributed. All other variables were positively

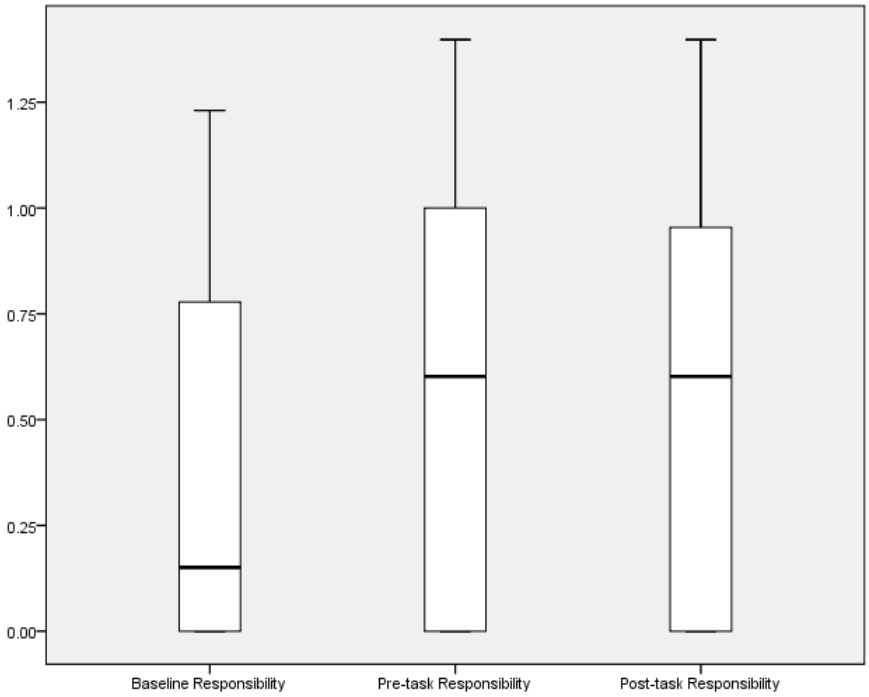
skewed, with the exception of Certainty of Sorting which was negatively skewed. Anxiety, urge to check, and urge to seek reassurance were measured using visual analogue scales at four different time points, i.e., after each of the four sorting trial. The four scores for each measure were collapsed into one, resulting in Collapsed anxiety, Collapsed urge to check, and Collapsed urge to seek reassurance. The resulting scores reflect overall anxiety, urge to check, and urge to seek reassurance. The duration of each of the four sorting trials was recorded in seconds. These were collapsed into one overall task duration score. Study hypotheses were tested with between-group comparisons of resulting collapsed scores for each dependent variable. Between-group comparisons for all variables were also conducted for post-task scores.

8.6.4. Baseline scores. Baseline variables for each group were compared using MANOVA (i.e., Responsibility Attitudes Scale, Intolerance to Uncertainty Scale, baseline PANAS, and baseline Anxiety as measured by the visual analogue scale). A two-way ANOVA was used to reduce the possibility of a Type 1 error and to have greater statistical power (Field, 2000). 'Group' and 'gender' were entered as factors. Significance was set at <.05. A significant between-group difference was found for baseline Positive Affect, $F(3,74) = 4.39$, $p = .007$, with the high-uncertainty/no-checking group (M = 34.61, SD = 7.35) reporting significantly higher scores than the no-uncertainty/no-checking group (M = 27.25, SD = 6.85). Positive Affect was used as a covariate in all subsequent between group analyses. Untransformed descriptive data for the baseline variables are presented in Table 15 (Appendix AL).

8.6.5. Manipulation check. Two independent variables were manipulated in this experiment: responsibility and uncertainty. All participants received high responsibility instructions. Half of the sample received *correct* feedback while the other half received *error* feedback. Also, half of participants were allowed to check their sorting during the experimental tasks, while the other half were not allowed to check.

8.6.5.1. Responsibility manipulation check. After completing baseline variables all participants received the high responsibility manipulation. To test the effect of the manipulation paired-samples *t*-tests were used to compare perceived responsibility at baseline, after the manipulation (pre-task) and after the experimental tasks (post-task). There was a significant difference between baseline and pre-task ratings, $t(73) = -4.14$, $p = .000$, and between baseline and post-task ratings, $t(73) = -3.46$, $p = .001$. As predicted, participants reported significantly higher perceived responsibility at the pre-task (M = 0.56, SD = 0.47) and post-task (M = 0.54, SD = 0.45) than at baseline (M = 0.37, SD = 0.42). Figure 12 presents the means and confidence intervals for each group on each of these measures.

Figure 12. Baseline, pre-task and post-task responsibility for the entire sample



Descriptives for baseline, pre- and post-task transformed responsibility scores for the entire sample are presented in Table 16. These results indicate that the responsibility manipulation was successful.

Table 16

Responsibility

	Responsibility					
	Number	Mean	SD	Median	Skew	Kurtosis
Baseline	74	0.37	0.42	0.15	0.54	-1.24
Pre-task	74	0.56	0.47	0.6	-0.01	-1.53
Post-task	74	0.54	0.45	0.6	0	-1.48

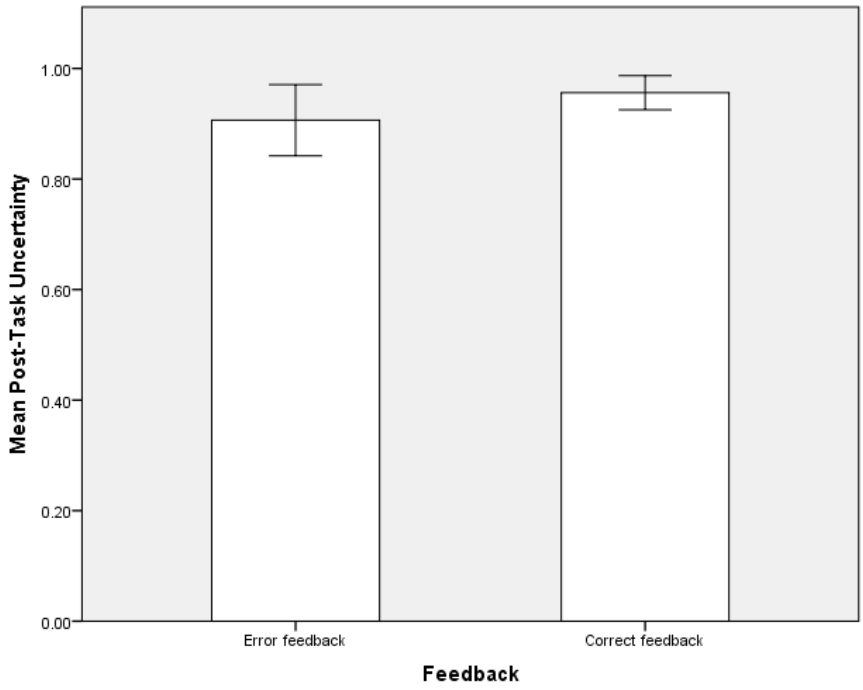
Responsibility scores were not normally distributed even after being transformed, so a Wilcoxon Signed Ranks test was also conducted to test the effectiveness of the responsibility manipulation. Consistent with result of the parametric tests, a significant difference was observed between baseline responsibility and pre-task responsibility, z = -3.55, p = .000, and between baseline responsibility and post-task responsibility, z = -3.15, p = .002.

8.6.5.2. Uncertainty manipulation check. At the end of each of the first three sorting trials participants received either *error* (i.e., uncertainty/checking and uncertainty/no-checking groups) or *correct* feedback (i.e., no-uncertainty/checking and no-uncertainty/no-checking groups) irrespective of their actual performance on the task. The aim of this manipulation was to manipulate (up and down) participants' certainty in their sorting accuracy.

To check the effectiveness of the uncertainty manipulation, an one-way ANCOVA was conducted with post-task 'Certainty' as dependent variable, baseline positive PANAS as a covariate, and 'feedback' as a factor. This methodology was adapted from a study by Parrish et al. (2006) who measured post-task confidence, as in Study 3. To be consistent

with Parrish et al., post-task 'Certainty' score was used to check the success of the uncertainty manipulation. There were no significant between-group differences in 'Certainty', $F(1,73) = 1.16$, $p = .284$. Figure 13 displays the means and confidence intervals for post-task uncertainty by group.

Figure 13. Post-task uncertainty by type of feedback



Error Bars: 95% CI

Self-reported 'Certainty' was measured after each sorting trial using visual analogue scales. The four resulting scores were added into one overall certainty score. An ANCOVA was conducted using overall Certainty as dependent variable, baseline positive PANAS as a covariate, and 'feedback' as a factor. There was no significant between-group difference in overall Certainty. Therefore the uncertainty feedback had no effect on post-task and overall certainty in sorting. This contradicts Hypothesis 2.

Further, an ANCOVA using 'checking' as a factor and baseline positive PANAS as a covariate was conducted to test differences between checking and no-checking groups for post-task uncertainty. No significant differences were found. A similar one-way ANCOVA was conducted to examine between-group differences in overall uncertainty scores. There was a significant between-groups difference, $F(1,74) = 5.15$, $p = .02$. Participants who were

allowed to check felt more certain that they had sorted correctly (M = 1.51, SD = .10), than participants who were not allowed to check (M = .14, SD = .12). There was no significant checking X feedback interaction; therefore certainty was manipulated by checking alone, and not by feedback.

Scores on the certainty measures were not normally distributed even after Log10 transformations, so non-parametric analyses were also conducted. An Independent-Samples Mann-Whitney U test using 'feedback' as a factor was conducted. Similar to the parametric tests, there were no significant differences in uncertainty between those who received *error* feedback and those who received *correct* feedback.

A similar Independent-Samples Mann-Whitney U test was conducted using 'checking' as a factor. Similar to the parametric tests, there were no significant results for post-task uncertainty. Surprisingly, there was a significant difference between participants who could check and participants not allowed to check for Collapsed Certainty, U = 902, p = .018. Table 17 presents the main collapsed certainty scores for participants who were allowed to check versus participants who were not allowed checking.

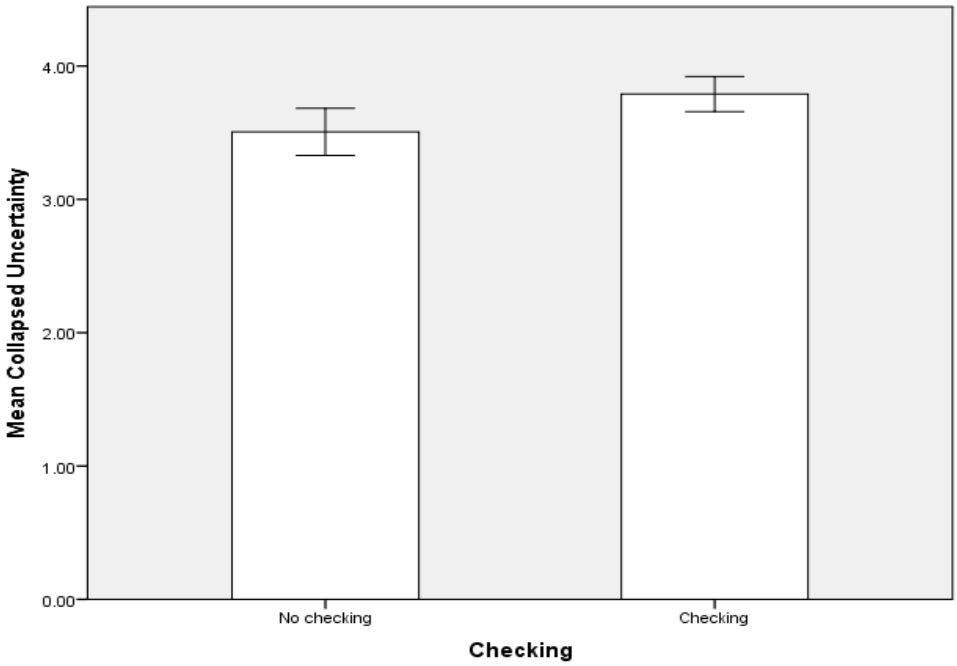
Table 17

Certainty scores

	Number	Mean	Collapsed Certainty SD	Median	Skew	Kurtosis
Checking	36	1.516	0.101	1.537	-2.65	9.24
No Checking	38	1.457	0.12	1.484	-0.758	-0.357

Figure 14 (pg. 189) shows means scores and confidence intervals for collapsed uncertainty for checking versus non-checking groups.

Figure 14. Overall uncertainty by checking



Error Bars: 95% CI

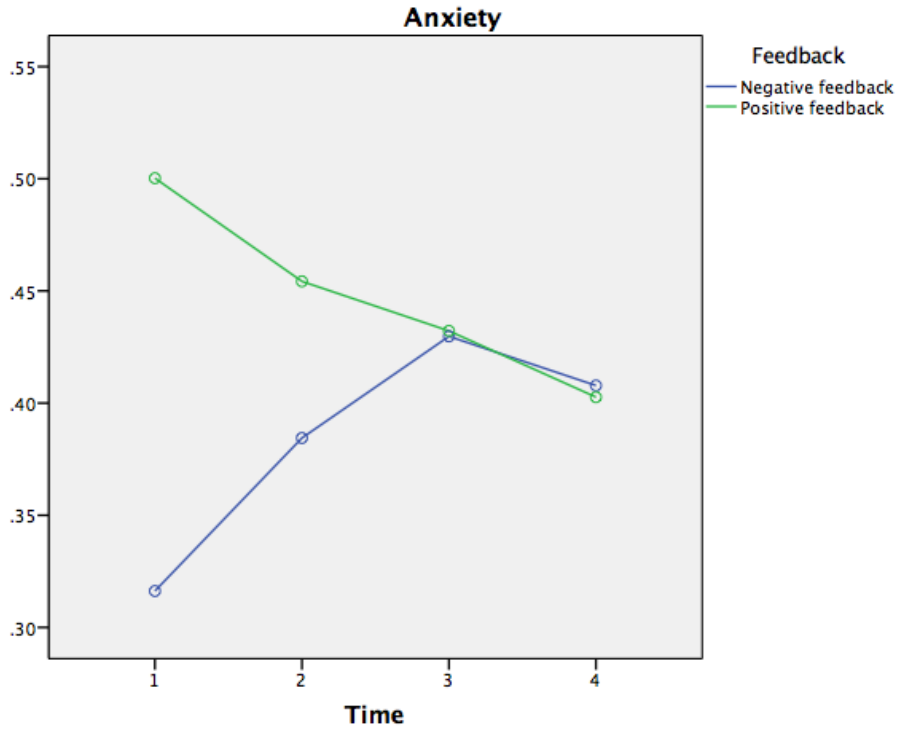
A univariate ANOVA was conducted to test interaction effects between feedback and checking for uncertainty. There was no significant interaction effect. This shows that the significant differences in uncertainty were the effect of the checking behaviour alone, and that the feedback did not affect uncertainty.

8.6.5.3. Checking manipulation check. Half of the sample were allowed to check their sorting during that task (i.e., participants in the uncertainty/ checking and in the no-uncertainty/checking groups). In order to determine if participants did not check when not allowed to (as well as if they chose not to check when allowed to), video recordings of participants completing the sorting task were examined. The video recordings revealed that four participants in the no-checking groups did check (i.e., looked in the bottles during the sorting task); three of these were in the no-uncertainty/no-checking group (i.e., they were participants who received positive feedback) and they checked once, twice, and three times, respectively. As these three participants received positive feedback throughout their sorting, it is unlikely that their checking behaviour affected their scores on dependent variable measures. One of the four participants who checked was in the uncertainty/no-

checking group (i.e., this was a participant who received negative feedback), and only checked once. It is also unlikely that one check, across 4 sorting trials, affected this participant's overall scores in a significant manner. So all these observations were included in the analyses.

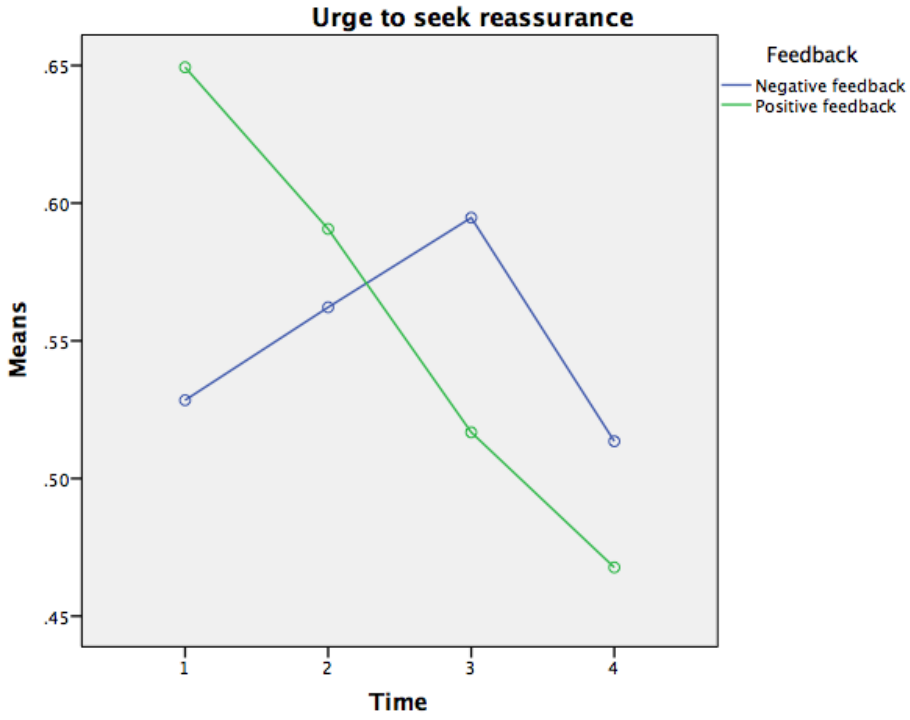
8.6.6. Repeated-measures analyses – testing the hypotheses. All dependent variables were measured at 4 different time points throughout the experimental task. A series of repeated measures 2 X 2 X 4 ANOVAs was conducted, in which time and scale were treated as within-subjects factors, and Checking and Feedback as between-subject factors. There was a significant Time X Feedback within-subjects interaction effect for Anxiety, $F(3,69) = 4.622$, $p = .006$, $\eta_p^2 = .063$. This is illustrated in Figure 15. No significant main effects of Feedback and Checking were observed, and no other significant interaction effects. These results indicate that participants' ratings for Anxiety were differentially influenced by the Feedback manipulation across time, i.e., participants who received high-uncertainty feedback experienced increases in anxiety from Time1 to Time2 and Time3, while those who received no-uncertainty reported constant decreases in anxiety; however, according to the pairwise comparisons, these within-subjects differences were not significant, $p = .372$.

Figure 15. Anxiety



There were no significant main effects of Time, Feedback, or Checking, and no significant interaction effects between these factors on Urge to check. There was a significant interaction effect of Time X Feedback on Urge to seek reassurance, $F(3,67) = 3.389$, $p = .023$, $\eta_p^2 = .132$, and a within-subjects main effect of Time, $F(2,69) = 4.682$, $p = .011$, $\eta_p^2 = .064$. However, there was no significant main effect of Feedback, $F(1,69) = .006$, $p = .938$. There was no significant main effect of Checking and no significant Feedback X Checking interaction effect on Urge to seek reassurance. These results indicate that participants' ratings for Urge to seek reassurance were differentially influenced by the Feedback manipulation across time (Figure 16). Pairwise comparisons revealed significant differences in Urge to seek reassurance between measurement times 2 and 4, $p = .025$. Further data exploration showed that participants who received no-uncertainty feedback experienced a significant decrease in urge to seek reassurance from Time2 to Time4.

Figure 16. Urge to seek reassurance



Taking into consideration the significant time X feedback interactions, a repeat-measures ANOVA was conducted for certainty, with time as within factor (Certainty1-Certainty4) and checking and feedback as between-subjects factors. A significant time X feedback interaction was observed, $F(3, 67) = 3.291$, $p = .026$, $\eta_p^2 = .128$, which indicates that participants' uncertainty changed over time depending on the feedback they received. This explains the significant time X feedback interaction effects of anxiety and urge to seek reassurance.

8.6.7. Correlations. Studies have shown relationships, including causal relationships, between dependent and independent variables in Study 4 (e.g., Ladouceur et al., 1995; van den Hout et al., 2004). However, hypotheses in Study 4 were not supported. Several variables were not normally distributed (i.e., responsibility, anxiety, urge to check, and urge to seek reassurance), so to further test relationships between variables, we ran two-tailed non-parametric correlations using Spearman's g correlation coefficient. The Responsibility Attitudes Scale was strongly and positively correlated with post-task anxiety and compulsive urges (see Table 18, Appendix AL), which indicates that pre-existing perceived responsibility may relate to anxiety and compulsions. Similarly, there was a strong positive relationship between intolerance of uncertainty and overall anxiety and overall urge to seek reassurance. Surprisingly, intolerance of uncertainty was not correlated with urge to check or confidence in sorting. This suggests that responsibility may be related to anxiety and compulsions in general, but intolerance of uncertainty may be more specifically related to reassurance seeking. Baseline anxiety was significantly correlated with post-task and overall urge to check, which supports the idea that anxiety triggers compulsions. None of the baseline measures were significantly associated with experimental task duration.

8.7. Discussion

It was predicted that, in a high responsibility context, participants who had low uncertainty and were able to check their sorting would report less anxiety and compulsive urges, and would take less time to sort pills than participants who had high uncertainty and were not allowed to check their sorting. Manipulation checks analyses showed that the responsibility manipulation successfully changed participants' perceived responsibility. However, the uncertainty manipulation check showed that feedback did not change uncertainty; surprisingly, uncertainty was however significantly changed by checking.

Repeat-measures analyses indicated mixed support for our hypotheses. This was not surprising, considering that the feedback manipulation was not successful in producing between-subjects differences for uncertainty. There were no significant main effects of feedback on anxiety and compulsive urges, and no significant interaction effects between checking and feedback. Also, there were no significant main effects of checking on anxiety and compulsive urges, in spite of checking having changed uncertainty.

Surprisingly, there was a significant time X feedback interaction effect on anxiety and urge to seek reassurance. Participants who received positive feedback experienced a constant decrease in anxiety over time, while those who received negative feedback experienced a constant increase between times 1 and 3. Also, those who received positive feedback reported a significant decrease in urge to see reassurance from between times 2 and 4. This was not observed in participants who received negative feedback. There were no significant effects on urge to check.

The significant time X feedback interaction on uncertainty indicates that participants' uncertainty changed over time depending on the feedback they received. This explains the significant time X feedback interaction effects of anxiety and urge to seek reassurance. This is consistent with results from Study3, which showed that feedback significantly changed anxiety and urge to seek reassurance, and further confirms that uncertainty plays a role for anxiety and compulsive urges.

Unlike in Study3, there were no significant main effects of feedback and of checking on anxiety and on urge to seek reassurance. Several explanations were considered.

First, different measures were used in Study 3 and Study 4. In Study 3, baseline anxiety was measured using the STAI. As these samples were non-clinical, in Study 4 baseline anxiety was measured with the PANAS, which is a less clinical measure. However, no significant effects on anxiety were observed using this measure. However, significant main effects of feedback and checking were found for anxiety in Study 3 but not in Study 4, even though anxiety was measured the same way in both studies (i.e., using visual analogue scales). This suggests that the differences in results across the two studies were not due to how anxiety was measure.

The feedback manipulation check also differed across the two studies. In Study 3, participants were asked to rate how *confident* they were in their sorting. In Study 4 participants were asked to rate how *certain* they were in their sorting. This was to increase validity, as the manipulation aimed to change certainty (and its relationship to confidence is not clear). In Study 3 the feedback successfully changed confidence. It is unclear how much the two concepts overlap, so it is possible that the two studies manipulated and measured different concepts.

O'Conner (2013) has distinguished between doubt and uncertainty. He proposed that doubt involves not believing information one receives, whereas uncertainty is a more general and vague concept referring to lack of or little information about a situation. Participants in Study 4 could have doubted the feedback or their ability to perform the task correctly. However, they might not have felt uncertain given that it was a very specific task and they also received feedback about their performance (even when the feedback told them they made mistakes). It is therefore possible that uncertainty is a general concept, and that confidence (measured in Study 3) better captured the sense of doubt that the study aimed to manipulate.

Deception was used in Study 4 and participants in the uncertainty groups may have not believed the manipulation. However, the sample and manipulation were very similar to Study 3 where the feedback manipulation was successful. Also, participants from Study 3 were not included in Study 4 because of similarities in methodology. Moreover, in Study 4, during debriefing, participants were asked if they believed the feedback. Similar to Study 3, several participants who received *error* feedback said they had doubts about its accuracy but acted *as if* they believed it. Similar comments were obtained from participants in Study 3, and this did not affect the credibility of the feedback. Another aspect worth mentioning is self-reassurance, which may play an important role for doubt and uncertainty. Perhaps healthy individuals can self-reassure even in high responsibility situations where they feel uncertain and cannot check as long as they do not receive feedback telling them otherwise. However, they cannot self-reassure if they receive non-reassuring feedback from others. It is also possible that checking enables one to self-reassure, and positive feedback gives reassurance when self-reassurance is not possible. However, when the feedback is negative the ability to self-reassure decreases. n Study 4 between-subjects differences in uncertainty were the result of checking; feedback had an effect on uncertainty over time, i.e., within subjects. In Study 3 feedback had a significant between-subjects main effect on confidence. It is possible that the feedback manipulation was stronger in Study 3 than in Study 4. This may explain the different results in Study 3 and suggests that a certain level of uncertainty is needed for anxiety and compulsions to occur. To test this mean scores for *confidence* and *uncertainty* in Study 3 and Study 4, respectively, were compared. Feedback in Study 3 (where the feedback manipulation was successful and checking was not allowed) solicited more than twice as much uncertainty compared to checking in Study 4 (where the feedback manipulation was ineffective). This confirms the idea that anxiety and compulsive urges occur when uncertainty reached a certain threshold.

Study 3 found significant between-subjects effects of feedback on both anxiety and urge to seek reassurance. Participants who received positive feedback reported signficiantly

less anxiety and urge to seek reassurance compared to participants who received negative feedback. Also, correlations showed that participants who had high anxiety at baseline also had high urge to seek reassurance and low confidence post-task. The urge to seek reassurance and confidence were not correlated. This may suggest that low confidence increased anxiety, which further triggered urge to seek reassurance. In Study 4, positive feedback led to significant decreases in anxiety and urge to seek reassurance over time, and these effects were not observed with negative feedback. Future work could focus on the intermediating role of anxiety between intrusions and compulsions, which would provide empirical evidence for the idea of compulsions being triggered by anxiety.

Another possibility would be to use the pill-sorting task to manipulate uncertainty (i.e., asking participants to sort by colour/shape/size, with no mentioning of responsibility), and allowing half of the sample to check their sorting. To avoid possible confounding effects responsibility could be measured at baseline and controlled. It would also be interesting to manipulate uncertainty only in half of a sample and to allow the entire sample to check, but instead of measuring compulsive urges, to record actual compulsive behaviours. This would be similar to Study 2 with children (pg. 116) and similar to studies of inflated responsibility, but would instead manipulate uncertainty alone and test its effects on compulsions.

Future work could also focus on disentangling the effects of feedback and checking on uncertainty. Different processes may be involved. Also, more clear definitions and measures for constructs such as confidence and doubt could provide a better understanding of the cognitive factors involved in OCD. Furthermore, correlational studies with OCD and anxiety patients could provide helpful information about levels, characteristics, and role of uncertainty for these disorders.

Finally, the manipulation used here to change levels of confidence and uncertainty has only been previously used for this purpose in one experimental study (i.e., Parrish et al., 2006, who manipulated confidence via feedback). Considering the novelty of this area

of research, further experimental work should focus on improving the methodology for manipulating and testing these variables.

8.8. Chapter Summary and Conclusion

In summary, Study 4 found that, in a high responsibility context, receiving positive feedback keeps anxiety and urge to seek reassurance low, an effect not observed if receiving negative feedback. Study 4 also demonstrated that uncertainty can be successfully manipulated via checking, in the context of a pill-sorting task aimed at inflating responsibility. Future research could focus on testing the effects of uncertainty alone on anxiety and compulsive urges. This could be done by comparing effects of feedback and checking on uncertainty and confidence. Effective methodology for manipulating responsibility and uncertainty would help us better understand them and their role in OCD. This type of work would also contribute to a better understanding of compulsive checking and its role in the disorder.

PART IV: FINAL DISCUSSION AND CONCLUSION

Chapter 9: Summary of Studies and Recommendations for Future Work

The final chapter of this thesis provides a brief overview of my experience conducting this research. It also includes a summary of the main findings from the four studies described in the previous chapters. The findings from all the studies are interpreted together within existing theoretical models. Implications for treatment of the findings are also discussed, and recommendations for future work are made. A general conclusion on the findings reported in this thesis is also included in this final section.

9.1. My Experience Conducting This Work

I conducted the studies described in this thesis as part of the requirements for my PhD degree. The initial focus of this work was testing the inflated responsibility model of OCD in children. An extensive literature review revealed a lack of a developmental framework of responsibility, methodological limitations, and mixed results. In preparation for this work, I first refined the existing methodology for manipulating responsibility in children (i.e., a sweet-sorting paradigm developed by Reeves et al., 2010). Changes were made to the experimental setting and to a behavioural code associated with the experimental paradigm. The aim of the study was to reduce methodological limitations of this work. Using the improved methodology, I conducted an experiment that replicated that of Reeves et al. and extended it by testing possible delayed causal effects of responsibility on anxiety. However, the study hypotheses were not supported.

I considered several possible explanations, including the possibility of responsibility not being relevant for childhood OCD. However, since other experimental work had found a causal relationship between responsibility and obsessive-compulsive like

behaviours, I dismissed this hypothesis. A more likely explanation was that current insufficient understanding of responsibility and OCD aspects in children is limiting this work.

I considered the possibility that checking behaviour confounded the effects of responsibility on anxiety and OCD-like behaviours in my first experiment. There was also the possibility that the presence of the experimenter during the sorting task had been reassuring children and inadvertently kept their anxiety low. However, restricting checking in a sample of children could lead to significant increases in anxiety. Also, leaving children alone in the experimental room for long periods of time could also have ethical implications that would make the experiment difficult or impossible. For these reasons, I designed the next study for an adult sample. Another reason for using an adult sample was the sparse number of experiments that tested the causal role of responsibility combined with reassurance in anxiety and OCD-like behaviours.

Existing literature repeatedly described checking as a way of temporarily decreasing anxiety in OCD, but empirical evidence testing the mechanisms involved is lacking. Further readings reinforced the idea that, although checking may decrease responsibility (which is believed to cause it in the first place), it may also be linked to doubt or uncertainty (which has been identified as an important aspect in OCD, but has so far been neglected). This challenged the inflated responsibility model and introduced the idea of other cognitive aspects being as important for OCD.

I designed two experiments for adult samples to test the role of responsibility and uncertainty on anxiety and compulsive urges, using Ladouceur et al. (1995)'s pill-sorting manipulation for responsibility and Parrish et al. (2006)'s manipulation for feedback (and thus for uncertainty). Results from one study provided valuable information about responsibility and uncertainty as important and perhaps necessary factors for OCD. However, results across the two studies were inconsistent as yielded Study 4 hypotheses were not supported. With hindsight, this was not surprising because, similar to the lack of a

developmental model for inflated responsibility, there is also a lack of theoretical model of uncertainty. It is unclear how the concept of uncertainty relates to doubt and confidence, and how much overlap there is between these concepts. In the literature these three concepts are used interchangeably.

Overall, this work is promising and encourages further investigations of these concepts in both adults and children. In my future work I hope to improve methodology for testing cognitive models of OCD and contribute to coherent theoretical frameworks for these concepts.

9.2. Summary of Findings

This thesis describes four studies, one methodological and three experimental, designed to test cognitive models of OCD. Both biological and cognitive etiological models have been proposed for the disorder and one of the most explored is the inflated responsibility model (Salkovskis, 1985, 1989). Although mixed results have been reported, overall there is a consensus that responsibility plays a role in OCD. However, it is not clear if its role is a causal or a maintenance one. Also, it is unclear if inflated responsibility is the most important or a necessary cognitive aspect in OCD, or if it is only one of several cognitions important for the disorder.

Even less is known about these cognitive aspects in children. Only a few studies have tested the inflated responsibility theory in this age group, with mixed findings. Also, there is a significant gap in the literature in terms of a developmental model of responsibility. There is some overlap with the theory of mind (Premack et al., 1978) and the moral development model (Kohlberg, 1971) however, it is unclear how inflated responsibility fits in with these concepts.

The present work aimed to test the inflated responsibility model in children and to test the role of other cognitions relevant for OCD in adults. Study 2 aimed to inflate

responsibility in children aged 9 to 12 using a sweet-sorting paradigm (see pg. 107). In preparation for the experimental study, a behavioural coding system was refined to code behaviours during the sorting task (i.e., Study 1; see pg. 98). The code measures obsessive-compulsive-like behaviours, checking, hesitating, and reassurance seeking. These were dependent variables in Study 2. Other dependent variables were anxiety (measured using self-report scales) and experimental task completion speed (measured in seconds). What made this experiment different from previous work was the fact that anxiety was measured not only immediately after the sorting task, but also 10 minutes later, and 24 hours later. The aim was therefore to test the immediate effects of inflated responsibility on anxiety, compulsive behaviours, and task duration, as well as its delayed effects on anxiety. Children were randomly assigned to either a high-responsibility, low-responsibility, or control group. Surprisingly, the experimental manipulation was unsuccessful.

Given the lack of a developmental model for OCD and the current limitations in testing these aspects in children, and the fact that even research with adults is limited, Study 3 was designed for an adult sample. The aim of the study was to further test the effects of inflated responsibility on anxiety and compulsive urges, and to also test the role of uncertainty and checking. A pill-sorting paradigm (see pg. 148) was used to manipulate responsibility and uncertainty. To control for possible anxiolytic effects of checking, participants were not permitted to check their sorting.

The pill sorting task is a robust way of manipulating responsibility. However, only one previous experiment has used this task to manipulate confidence / doubt (Parrish et al., 2006). The feedback manipulation was successful in changing confidence in sorting in participants in Study 3, so this work confirmed the effectiveness of the pill-sorting task in manipulating confidence. There was a significant main effect of feedback on anxiety and urge to seek reassurance, however responsibility did not significantly change these variables. Also, there were no significant interactions between responsibility and feedback, which

suggest that responsibility may not be needed for compulsions to emerge, but that uncertainty/low-confidence may be a necessary factor.

In Study 4 (see pg. 173) responsibility was inflated for the entire sample. Uncertainty was manipulated using feedback. Half of the sample was allowed to check their sorting. The aim was to further test the effects of inflated responsibility and uncertainty on anxiety and compulsive urges, and to also clarify the role of checking behaviour for uncertainty. The outcome of the feedback was measured using an *uncertainty* (instead of *confidence*) visual analogue scale. Surprisingly, the feedback manipulation had a within-subjects effect on uncertainty over time, but did not produce significant differences between participants who received negative feedback versus those who received positive feedback. What did produce significant between-group differences in uncertainty was checking. Unlike in Study 3, there were no significant main effects of any of the factors on dependent variables; however, positive feedback led to constant decreases in anxiety throughout the experimental task, and effect no observed with negative feedback. . Several possible explanations were considered for the different findings across Study3 and Study4 were considered:

(1) Confidence and certainty are not equivalent. In Study 3 participants were asked to report their level of *confidence*, and in Study 4 to report their levels of *uncertainty*. The terms (along with *doubt*) are used interchangeably in the literature, however there are no clear definitions and no clear understanding of overlap between them and their relationships. Also, perhaps different types of uncertainty exist, i.e., uncertainty manipulated via feedback from others, versus uncertainty manipulated via checking.

Moreover, perhaps Study 3 and Study 4 manipulated different concepts, i.e., doubt versus uncertainty. Doubt is considered a more specific state, and involves not being sure about received information (e.g., from feedback here), whereas uncertainty is a more general and vague state where one has no information and is not sure what to believe (i.e., lack of feedback here) (O'Conner, 2013).

(2) Checking as a method of manipulating uncertainty. This confirms Rachman (2000)'s proposal that checking may aim to reduce uncertainty rather than responsibility. This would suggest that the function of compulsions is to reduce anxiety via reducing uncertainty.

(3) The uncertainty manipulation was weaker in Study 4 than in Study 3. Feedback had no effect on uncertainty, and half of the sample was allowed to check. Possibly, this was due to checking cancelling the effect of the feedback manipulation for uncertainty. This would explain the lack of differences between participants who could check and those not allowed to check. Here, feedback was ineffective due to checking, and checking alone was not a strong enough manipulation for uncertainty. In Study 3 the feedback successfully changed confidence, and the lack of checking possibly added to that, resulting in a strong uncertainty / confidence manipulation. This means that a certain level of uncertainty is needed for anxiety and obsessive-compulsive urges to emerge, and thus an optimal level of uncertainty is needed for OCD.

(4) Checking takes priority over feedback when it comes to uncertainty, and in Study 4 it confounded the effects of the feedback manipulation. This confirms that feedback was secondary to checking, and here feedback was reassuring or non-reassuring. This has implications for reassurance (i.e., through feedback from others) and self-reassurance (i.e., thorough checking). Checking could increase the ability to self-reassure, which is stronger than reassuring feedback from others. This is in agreement with theories of checking as a primary compulsion, and reassurance seeking as secondary or back-up compulsive behaviour (Salkovskis, 1985).

9.3. Theoretical Implications of These Findings

The present work adds to the body of research that has tested cognitive models of OCD in both children and adolescents. Consistent with results reported in the literature, the findings are mixed. This work aimed to test the inflated responsibility model in children. Responsibility could not be successfully manipulated. Methodological

limitations such as an experimental paradigm not developmentally appropriate, or the use of a responsibility measure that has not been validated for children may explain the manipulation not being successful. Also, perhaps a biological vulnerability is needed for OCD-like behaviours to be elicited in experimental work. The inflated responsibility model was further tested in adults, and uncertainty was added to the model. Surprisingly, responsibility had no significant effect on anxiety and compulsive urges, but uncertainty alone led to differences in anxiety and urge to seek reassurance. High-uncertainty/ low confidence significantly increased anxiety and urge to seek reassurance, compared to no-uncertainty/confidence. This indicates that responsibility may not be a necessary factor for OCD, and that uncertainty may be important for the disorder. Obsessive-compulsive disorder seems to have a strong genetic component, so there may be a biological vulnerability for certain cognitions (e.g., inflated responsibility and intolerance of uncertainty) to develop, and for certain behaviours (e .g., checking) to emerge. There is evidence that cognitions influence behaviours, and that vice versa is also possible. This raises the question: which occur first in OCD, obsessions or compulsions? Cognitive models of OCD propose that once these beliefs emerge, they trigger anxiety, and that this is followed by compulsions which emerge to reduce anxiety. The use of compulsions temporarily alleviates anxiety, but because intrusions about responsibility and uncertainty reoccur, anxiety increases again and the same cycle repeats over and over (Salkovskis, 1985; Rachman, 2002).

Previous experimental work supports this idea (e.g., Ladouceur et al., 1995, 1997; Parrish et al., 2011), and so does the present work. In Study 3, participants who had high low confidence / high uncertainty reported higher anxiety and urge to seek reassurance than participants who had were confident in their sorting/had no uncertainty about it. Study 3 and Study 4 used non-clinical samples, so it can be concluded that uncertainty has causal effects on anxiety and compulsive urges. Differences in results between Study3 and Study 4 suggest that the methodology of manipulating

uncertainty/confidence has to be further improved and that the role of checking should be taken into consideration when investigating cognitive-behavioural mechanisms of OCD. Difference in results across the two experiments may also suggest that uncertainty/confidence has to be manipulated at a certain level, as it manifests on a continuum, i.e., it is generally a normal manifestation, but in psychopathology it is are excessive. OCD is described as characterised by chronic doubt, however there is no clear definition of doubt/uncertainty or of what an 'optimal' level of uncertainty is for anxiety or compulsive urges to occur, and this may differ from person to person. However, *confidence* in Study 3 was three and a half times lower after the experimental task than at baseline, whereas in Study 4 uncertainty was only twice as high after the task than at baseline. This suggests that low confidence/uncertainty has to be high enough to elicit anxiety and compulsive urges. Perfecting experimental paradigms that manipulate cognitive aspects relevant for OCD at the optimal / minimum level is essential. This would allow for a better understanding of the role different levels of uncertainty have in OCD.

9.4. Brief Summary

In summary, the present work contributes to our understanding of the cognitive mechanisms involved in the development of OCD. These data suggest that:

- Responsibility may not be an important factor for OCD;
- Uncertainty plays a causal role for the disorder;
- Uncertainty and confidence can be successfully manipulated via checking and / or feedback.

Furthermore, several assumptions can be made based on these data:

- Uncertainty has to reach a certain threshold in order to trigger anxiety and compulsive urges;
- Obsessions trigger compulsions via anxiety.

9.5. Implications for Treatment

The current work contributes to the identification of important cognitive elements involved in the development of OCD and that can be targeted when treating the disorder. These findings suggest that it might be beneficial to target uncertainty (and perhaps intolerance to it) in cognitive therapy for OCD.

These findings can also have implications for other disorders. For example, uncertainty is a key aspect in generalised anxiety disorder (GAD). Knowing more about the causal effect of uncertainty on anxiety could help us better understand how GAD works, and how to design better treatments for it. Also, reassurance seeking is a transdiagnostic behaviour present in depression, health anxiety, etc., while checking can be found in body dysmorphia (e.g., body checking; Rosen & Reiter, 1996). A good understanding of cognitions related to these behaviours could contribute to better psychological interventions.

9.6. Future Work

The current work provides promising directions for further testing cognitive models of OCD in children and adults. Future work should focus on designing a developmental framework for responsibility and better ways to test this it in children. The role of uncertainty can also be tested in children. A design similar to Study 2 but in which children would not be allowed to check and in which uncertainty would be measured could provide valuable information about the role of uncertainty in the development of OCD. Also, reassuring effects of the presence of the experimenter (as in Study 2) can be tested by leaving the children alone in the room during the sorting task. However, increasing responsibility and uncertainty, and thus anxiety in children, and leaving children unsupervised during an experiment can have ethical implication that should be carefully considered.

To further test the causal role of responsibility or uncertainty in OCD, future work could manipulate uncertainty alone and test its effects on anxiety and compulsive urges /

behaviours in the absence of responsibility. Experimental work could also test the role of checking and reassurance seeking in decreasing both responsibility and uncertainty.

Exploring the effect of the order of the feedback and checking manipulation on uncertainty could also provide valuable information. One design could involve manipulating uncertainty using feedback first, in the entire sample, and then splitting the sample into a checking and a no-checking group. This would be different from Study 3 and Study 4 where feedback and checking were manipulated throughout the sorting task, at the same time. These designs could include inflated responsibility, but they could also exclude it and test the causal effects of uncertainty alone. Also, uncertainty could be manipulated via quality of feedback (i.e., vague vs. clear). This would allow testing the effects of ambiguity on anxiety and compulsions, and its relationship with uncertainty. Moreover, testing the causal effects of feedback on uncertainty in a study that does not involve checking (and vice versa) could provide important information about the role of each in uncertainty.

Finally, because of a possible biological vulnerability being necessary for OCD to develop, using vulnerable samples (e.g., high baseline uncertainty) would be valuable. This would help us better understand the role of biological versus cognitive etiological factors for the disorder. It would also help avoid ethical issues involving the use of clinical samples to experimentally manipulate aspects such as anxiety. However, the use of clinical samples would still be important for understanding maintenance mechanisms involved in the disorder, so cross-sectional studies exploring the relationships between responsibility, uncertainty, and compulsions in people who already have the disorder could provide valuable information.

9.7. Final Conclusion

Findings from the four studies described in this thesis increase our understanding of the cognitive and behavioural mechanisms involved in the emergence and maintenance of

OCD. Overall, these results suggest that our limited understanding of inflated responsibility may make it difficult to test it in children, and that inflated responsibility may not be important for OCD in adults, but that uncertainty may play a role for the disorder.

This work is original in that it experimentally tested delayed effects of inflated responsibility on anxiety in children, and tested the effects of responsibility and uncertainty / confidence on anxiety and OCD-like urges in adults. Also, a pill-sorting task designed to manipulate responsibility and reassurance was adapted to manipulate confidence and uncertainty. Existing cognitive etiological models of OCD were integrated into a new, more comprehensive model. Overall, inconsistent results were obtained, but Study 3 and Study 4 provided support for the importance of confidence/uncertainty in OCD. Furthermore, this work shows that uncertainty and confidence can be successfully manipulated via feedback and/or checking within a pill-sorting task. Another novel finding of this work is that, in a high responsibility situation, checking took priority over feedback in increasing uncertainty.

This allows for future experimental investigations of causal cognitive mechanisms of OCD. Future research should further test etiological cognitive models in both children and adults, and particularly the effects of inflated responsibility and uncertainty. It is also important to establish a developmental framework for inflated responsibility within which paediatric OCD can be further explored. Finally, having more clear definitions for confidence, uncertainty / doubt, and ways of measuring them would contribute to a better understanding of the disorder and to more effective treatments for it.

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Appendix A

Parent/guardian consent form

Participant Identification Number:

PARENT/GUARDIAN CONSENT FORM

Title of Project: The effect of responsibility on children's mood, beliefs and behaviour.

Name of Researcher: Sorina Zielinski **Please initial box**

1. I confirm that I have read and understood the information sheet for the above study. ☐

2. I understand that my child's participation is voluntary and that I am free to withdraw my child at any time without giving any reason and without my child's medical care or legal rights being affected. ☐

3. I understand that the research meeting with my child will be recorded on video tape and that my child's name will not be identified on the tape. Tapes will be destroyed at the end of the project. ☐

4. I agree that my child may take part in the above study. ☐

Please complete the following:

_____	_____	_____
Name of Child	Child's Date of Birth	Name of School
_____	_____	_____
Name of Parent / Guardian	Date	Signature
_____	_____	_____
Home Telephone Number	Mobile Number	Work Tel Number

Thank you for your help.

Please return this consent form to the school office in the envelope provided.

_____

Office use only

Name of Researcher	Date	Signature

Appendix B

Child assent form

Participant Identification Number:

ASSENT FORM FOR CHILDREN

Title of Project: The effect of responsibility on children's mood, beliefs and behavi

Name of Researcher: Sorina Zielinski

Please circle 'Yes' if you agree with the statements:

Have you read (or had read to you) about this project?	Yes / No
Do you understand what this project is about?	Yes / No
Have you asked all the questions you want?	Yes / No
Have you had your questions answered in a way you understand?	Yes / No
Do you understand it is OK to stop taking part at any time?	Yes / No
Are you happy to take part?	Yes / No

If you do want to take part, please write your name and today's date

Name of child _____

Date _____

Researcher Name _____

Signature _____

Date _____

Thank you for your help

Appendix C

Parent/guardian invitation letter

UEA headed paper

Date

Dear Parent

Title of Project: The effect of responsibility on children's mood, beliefs and behaviour.

As your child is a pupil at (name of school), we are writing to ask let you know about a research project we are carrying out at (name of school) and to invite your child to take part. The aim of the project is to test the short term effect of giving children different levels of responsibility for a task. In previous research children have enjoyed taking part.

Enclosed with this letter is some information about the research project. I would be grateful if you would take the time to read this, discuss it with your child and think about taking part. If you have any questions you can contact us at the number above. If you would like your child to take part, please sign the consent form and return this to the school office in the envelope provided. For every child who takes part in the research, a £3 book voucher will be donated to their school.

With best wishes,
Yours faithfully

Sorina Zielinski
PhD Student

Shirley Reynolds
Professor of Clinical Psychology

Appendix D

Parent/guardian information sheet

Title of Project: The effect of responsibility on children's mood, beliefs and behaviour.

Parent/Guardian Information Sheet

We would like to invite your child to take part in a research project. Before you decide you need to know why we are doing this research and what it will involve. Please take time to read this information to help you decide whether or not you would like your child to take part. I have also included some information for your child; it would be helpful if you would pass it to them and discuss it with them. If you or your child have any questions about taking part please let us know
– our contact details are at the end of this sheet. Thank you.

What is this project about?

We want to find out if giving children different levels of responsibility for a task affects their thoughts, feelings and behaviours. The aim is to help us understand more about the effect of responsibility in normal children.

We want to test these ideas with children aged 9 to 12 years old, who do not *have psychological difficulties. This is why your child has been invited to take part.*

How will my child and I be involved?

If you decide that you would like your child to take part, this is what will happen:

1. *You fill in the enclosed consent form and brief questionnaire about your child and return these to the school in the envelope provided.*
2. *Joanna will visit your child during the school day and talk to them about the study so they can decide what to do.*
3. *If they are happy to take part she will ask them to answer some questions about how they are feeling (their current mood).*
4. *Joanna will then ask your child to complete a short task, sorting sweets into containers, based on their colour or on whether they contain nuts or not. This task will take about 10 minutes to complete.*
5. *While they are sorting the sweets, joanna will take a video-recording of your child, she will time how long they take and count the number of times they check the sweets or hesitate or change their mind. The video tape means that another person can check the reliability of the data. After we have recorded the data the tapes will be destroyed.*
6. *After the task, your child will be asked the same questions about their current mood.*

Are there any risks to my child?

This is very unlikely. We have tried this task in a previous study with children of the same age. Most children enjoyed the task and none were upset. However, if your child did become upset in any way, we would stop the task immediately, comfort your child and distract them with a different activity (e.g. toys or colouring). If your child seems to be experiencing higher than usual levels of anxiety or worry we would let you know.

What are the potential benefits?

There are no direct benefits for you or your child. However, this is an opportunity to get involved in research that could help improve our understanding of psychological difficulties and development in children. For every child that participates in the study, a £2 book voucher will be given to their school.

Will it affect my child's care or education?

No, your child's care or education will not be affected in any way. This research is being carried out with the permission and co-operation of your child's school.

Can I change my mind?

Yes. It is up to you and your child to decide whether or not to take part. You are both free to withdraw from the research at any time, without giving a reason. Your decisions about this will not affect the standard of care your child will receive.

Who will have access to the results?

We will follow the Data Protection Act at all times. Written records and the video tapes will be kept in a locked cupboard at the University of East Anglia and destroyed at the end of the study. All children will be identified by unique identity number. We will not keep any information about you or your child that could identify you to someone else.

Who has reviewed the study?

The Institute of Health Ethics Committee, at the University of East Anglia has reviewed and approved this research project.

Who do I speak to if problems arise?

If there is a problem please let Professor Shirley Reynolds (Chartered Clinical Psychologist) know. You can contact her at the following address:

School of Medicine, Health Policy and Practice University of East Anglia

NORWICH NR4 7TJ

Tel 01603 593310

OK, I want to take part – what do I do next?

You need to fill in the enclosed consent form and questions and return them to the school office in the envelope provided. Your child can only take part if you return this form to the school office.

Appendix E

Child information sheet

Information for children

We are doing a research project – would you like to take part? Before you decide we would like you to read this information and talk about this with your mum or dad/ If you want to take part Joanna will visit you at school and you can also ask her as many questions as you like before you decide to take part.

What is research? Why is this project being done?

Research tries to find out the answers to questions. This project is to see if giving children different levels of responsibility affects how they feel and behave.

Why have I been asked to take part?

We want to work with children aged between 9 and 12 years old, which is why you have been asked to take part.

What would I have to do?

If you and your parents/guardians decide that you would like to take part, this is what will happen:

- Joanna will come and see you at school.
- She will ask you some questions about your feelings.
- You will complete a task, which involves sorting sweets, which is not difficult. The task will take about 10 minutes for you to finish.
- During the task, you will be video recorded. This is to check that Joanna is recording things properly. The video tapes will be destroyed after we have finished with them.
- After the task Joanna will ask you some more questions about your feelings.

Do I have to take part?

No. You do not have to take part in this project and you can change your mind at any time, without giving a reason.

Who will know what I said?

Only people involved in the project will know what you say. If you tell me something that is worrying you then I might share it with your parents or guardians.

Appendix F

Demographic questionnaire for parents

Participant Identification Number:

Title of Project: The effect of responsibility on children's mood, beliefs and behaviour

Name of Researcher: Sorina Zielinski

Please complete the following information about your child by circling the appropriate response.

1. Is your child a boy or a girl? Boy / Girl

2. How old is your child? _____ years

3. How would you describe your child's ethnic group? (Please circle)

White	**Mixed**	**Asian or Asian British**	**Black or Black British**	**Chinese or otl ethnic group**
British	White & Black Caribbean	Indian	Caribbean	Chinese
Irish	White & Black African	Pakistani	African	Other Ethnic Group
Other White	White & Asian	Bangladeshi	Other Black	
	Other Mixed	Other Asian		

4. Is your child colour blind? Yes / No

(We ask this as the task involves sorting things based on their colour)

5. Does your child have any allergies? Yes / No

(We are interested in whether this will impact on the sorting task)

If yes, what are they allergic to?

_____

6. Does anyone in your family have any allergies? Yes / No

If yes, what are they allergic to?

_____

Thank you for your help.

Appendix G1

Baseline measure of perception of responsibility, probability of harm and severity of harm

I am interested in how you feel and what you think about the task you are about to do. Please read the following statements carefully and circle the number that shows how much you agree or disagree with the statements.

1. **Completely disagree**
2. **Mostly disagree**
3. **Neither agree or disagree**
4. **Mostly agree**
5. **Completely agree**

	Completely disagree	**Mostly disagree**	**Neither agree or**	**Mostly agree**	**Completely agree**
It's likely that something bad will happen					
Something really bad will happen now					
It will be my fault if bad things happen					
Other people are likely to be harmed in some way					
Something really bad will happen to other people					
I could cause something bad to happen to others					

Appendix G2

Post-task measure of perception of responsibility, probability of harm and severity of harm

I am interested in how you feel and what you think about the task you have just finished. Please read the following statements carefully and circle the number that shows how much you agree or disagree with the statements.

1. **Completely disagree**
2. **Mostly disagree**
3. **Neither agree or disagree**
4. **Mostly agree**
5. **Completely agree**

	Completely disagree	**Mostly disagree**	**Neither agree or**	**Mostly agree**	**Completely agree**
It's likely that something bad will happen					
Something really bad will happen now					
It will be my fault if bad things happen					
Other people are likely to be harmed in some way					
Something really bad will happen to other people					
I could cause something bad to happen to others					

Appendix H

The State Trait Anxiety Inventory for Children (STAIC; Spielberger et al., 1973)

DIRECTIONS: a number of statements which boys and girls use to describe themselves are given below. Read each statement carefully and decide how you feel *right now*. Then put an X in the box in front of the word or phrase which best describes how you feel. There are no right or wrong answers. Do not spend too much time on any one statement. Remember, find the word or phrase which best describes how your feel right now, *at this very moment*.

1. I feel	very calm	☐	calm	☐	not calm	☐
2. I feel	very upset	☐	upset	☐	not upset	☐
3. I feel	very pleasant	☐	pleasant	☐	not pleasant	☐
4. I feel	very nervous	☐	nervous	☐	not nervous	☐
5. I feel	very jittery	☐	jittery	☐	not jittery	☐
6. I feel	very rested	☐	rested	☐	not rested	☐
7. I feel	very scared	☐	scared	☐	not scared	☐
8. I feel	very relaxed	☐	relaxed	☐	not relaxed	☐
9. I feel	very worried	☐	worried	☐	not worried	☐
10. I feel	very satisfied	☐	satisfied	☐	not satisfied	☐

11. I feel	very frightened	☐	frightened	☐	not frightened	☐
12. I feel	very happy	☐	happy	☐	not happy	☐
13. I feel	very sure	☐	sure	☐	not sure	☐
14. I feel	very good	☐	good	☐	not good	☐
15. I feel	very troubled	☐	troubled	☐	not troubled	☐
16. I feel	very bothered	☐	bothered	☐	not bothered	☐
17. I feel	very nice	☐	nice	☐	not nice	☐
18. I feel	very terrified	☐	terrified	☐	not terrified	☐
19. I feel	very mixed-up	☐	mixed-up	☐	not mixed up	☐
20. I feel	very cheerful	☐	cheerful	☐	not cheerful	☐

Appendix I

Visual Analogue Scale For Anxiety

Please place a cross on the line below to show how you are feeling at this moment in time about the sorting.

Not at all worried — extremely worried

Appendix J

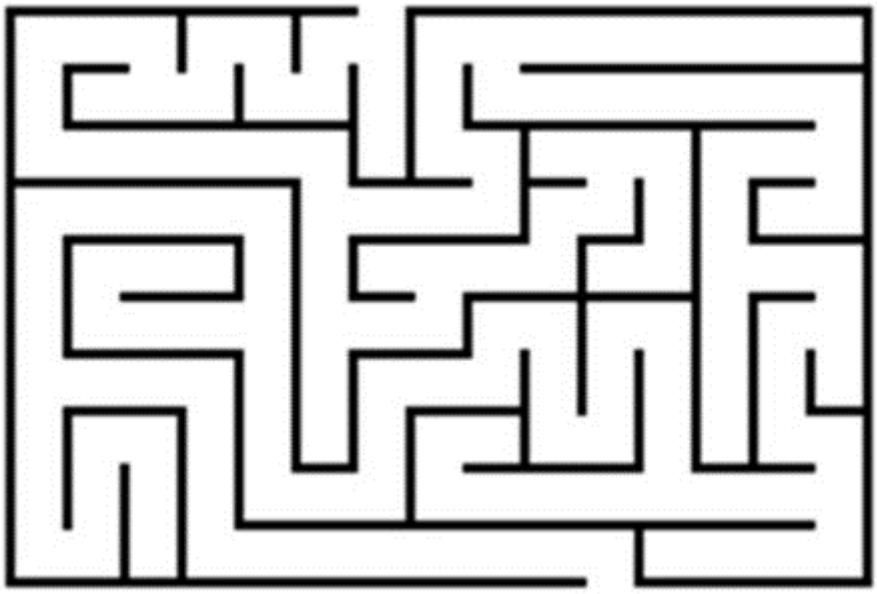
Filler task for all groups

Please circle the blue H's and the green A's

		P	A	H						P	A		H	
A			S						H					S
	S				Q			S				A		A
	H		P		H						H		A	
		S		Q		H		S		P			S	
		H				A			H		Q	S		A
			A	S				A		S	H			
		Q					Q						P	
	A				P		H			A		H		

Appendix J1

Additional filler task for control group only



Appendix K

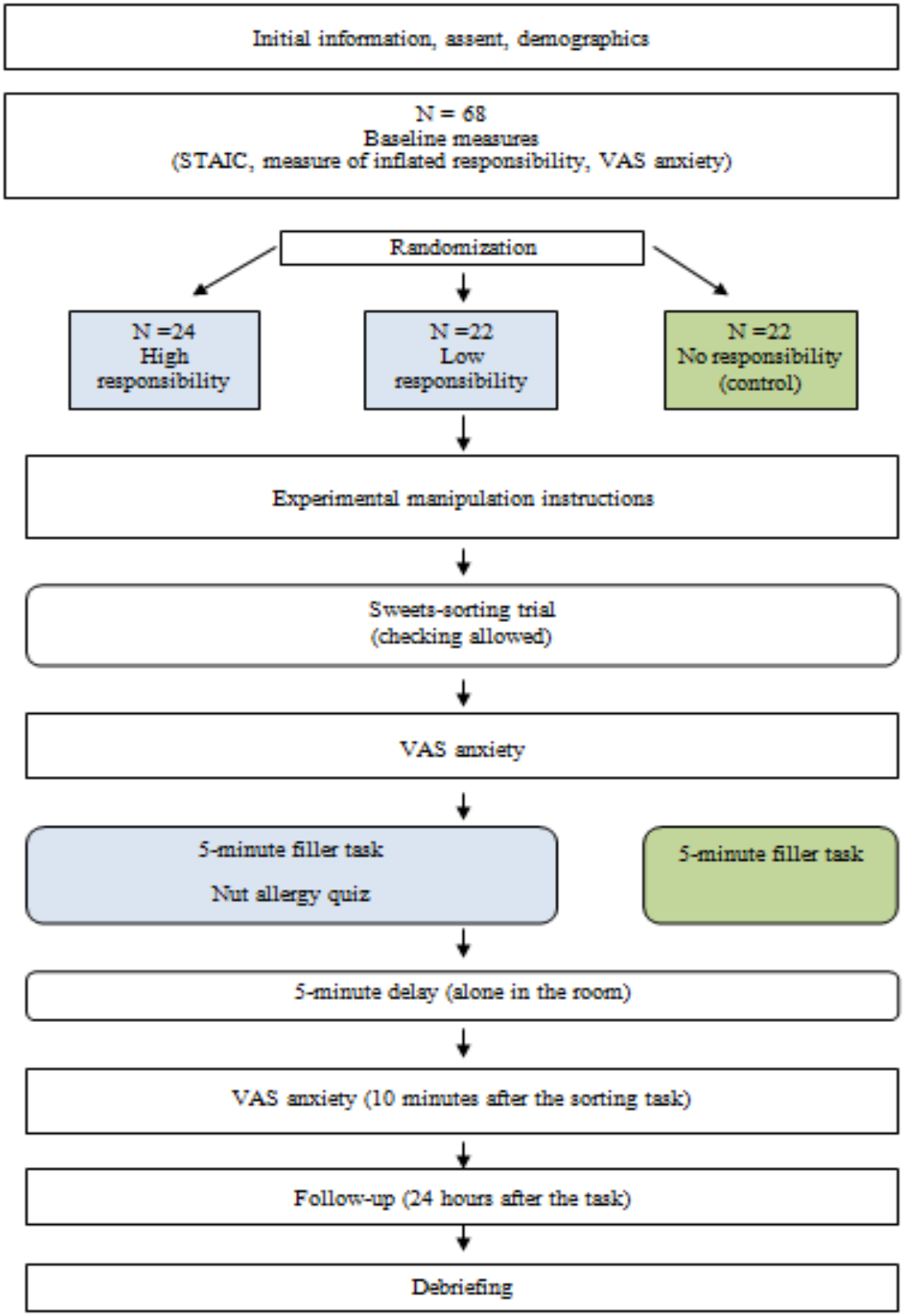
Nut allergy quiz – for experimental groups only

See if these sentences are true or false (please circle the appropriate word):

1. People with nut allergies feel sick if they eat or even touch nuts. TRUE FALSE
2. Peanuts grow in trees. TRUE FALSE
3. Stomach ache and vomiting are symptoms of nut allergy. TRUE FALSE
4. People can die from nut allergies. TRUE FALSE
5. People with nut allergies should eat nuts. TRUE FALSE

Appendix L

Study 2 flow-chart



Appendix M

Sorting key

Appendix N

Nut allergy facts sheet

- **What is a nut allergy?**
  - It is a reaction which occurs soon after eating nuts or nut products
  - The body treats this food as foreign
  - Usually the reaction occurs within minutes (but occasionally up to 2 hours)
- **What is the difference between tree nut allergy and peanut allergy?**
  - **Tree nut allergy is a reaction to nuts that grow in trees**
    - Tree nuts include almonds, cashews, hazelnuts, pistachios, walnuts
  - **Peanut allergy is a reaction to peanuts**
    - **Peanuts are groundnuts – they grow in the ground**
- **How common are nut allergies?**
  - About 1 in 50 children are allergic to nuts
  - Peanut allergy is the most common
- **Symptoms include:**
  - Hives around the mouth or on other parts of the body
  - Swelling of lips, tongue and face
  - Stomach ache and nausea, vomiting
  - Itchy eyes and runny and itchy nose
  - Cough and difficulty breathing and swallowing
  - Dizziness, collapse and loss of consciousness
  - Very rarely death
- **What to do if you are allergic to nuts**
  - Do not eat/touch nuts or nut products
  - Do not share food with other children
  - Read food labels for nut content

Appendix O1

High responsibility group instructions

Information given to children in the increased responsibility and reduced responsibility groups

- The child will be asked if they know what a nut allergy is. They will then be given the following information about nut allergies:

"At least 1 in 50 children are allergic to nuts. If a child has a nut allergy and they eat a nut or even touch one, they will have an allergic reaction. This means that will have a reaction such as sickness, swelling of the mouth, difficulties in swallowing, or they might collapse. It is very important that children with nut allergies do not eat or come into contact with nuts".

- The child will be asked if they know anyone who has a nut allergy and whether they have ever seen anyone have an allergic reaction to either nuts or anything else.

- The child will then be given information about the sorting task. They will be told that all instructions for the task will be outlined on the tape. The tape contains the following transcript:

Please listen carefully to the following instructions. In front of you, there are 120 sweets that have all got mixed up. The blue and green sweets contain nuts. The pink and black sweets might contain nuts. The red and the gold sweets do not contain nuts. Later on the sweets will be given to some children where one child has a nut allergy. It is very important that children with nut allergies do not eat any nuts. Your task is to sort the sweets based on whether they have nuts in them or not.

Sort the sweets by putting them in the bowls in front of you. Put all the sweets with nuts (blue and green sweets) into bowl 1, all the sweets that might contain nuts (pink and black sweets) into bowl 2 and all the sweets without nuts (red and gold sweets) into bowl 3. The sheet in front of you will remind you which bowl to place each sweet in. Take one sweet at a time without looking in the bag. Work as quickly and as carefully as you can If you are not sure, you can check the bowls and change the sweets as many times as you want. Please begin the task.

The group will then receive the following information:

High responsibility group *No one else will be able to check how you have sorted the sweets before giving them to the children. Therefore, it is very important that you sort the sweets as carefully as you can.*

Appendix O2

Low responsibility group instructions

Information given to children in the increased responsibility and reduced responsibility groups

- The child will be asked if they know what a nut allergy is. They will then be given the following information about nut allergies:

"At least 1 in 50 children are allergic to nuts. If a child has a nut allergy and they eat a nut or even touch one, they will have an allergic reaction. This means that will have a reaction such as sickness, swelling of the mouth, difficulties in swallowing, or they might collapse. It is very important that children with nut allergies do not eat or come into contact with nuts".

- The child will be asked if they know anyone who has a nut allergy and whether they have ever seen anyone have an allergic reaction to either nuts or anything else.

- The child will then be given information about the sorting task. They will be told that all instructions for the task will be outlined on the tape. The tape contains the following transcript:

Please listen carefully to the following instructions. In front of you, there are 120 sweets that have all got mixed up. The blue and green sweets contain nuts. The pink and black sweets might contain nuts. The red and the gold sweets do not contain nuts. Later on the sweets will be given to some children where one child has a nut allergy. It is very important that children with nut allergies do not eat any nuts. Your task is to sort the sweets based on whether they have nuts in them or not.

Sort the sweets by putting them in the bowls in front of you. Put all the sweets with nuts (blue and green sweets) into bowl 1, all the sweets that might contain nuts (pink and black sweets) into bowl 2 and all the sweets without nuts (red and gold sweets) into bowl 3. The sheet in front of you will remind you which bowl to place each sweet in. Take one sweet at a time without looking in the bag. Work as quickly and as carefully as you can If you are not sure, you can check the bowls and change the sweets as many times as you want. Please begin the task.

The group will then receive the following information:

Reduced responsibility

When you have finished, Jo will check the sweets and change any mistakes before giving the sweets to the children. So, it won't be your fault if there are any mistakes.

Appendix O3 Control group instructions

Information given to children in the control group

Children in the control group will not be given any information concerning nuts or nut allergies. They will be asked to listen to the tape, outlining the task instructions. The tape contains the following transcript:

Please listen carefully to the following instructions. In front of you, there are 120 sweets that have all got mixed up. Sort the sweets by putting them in the bowls in front of you. Put all the blue and green sweets into bowl 1, all the pink and black sweets into bowl 2 and all the sweets red and gold sweets into bowl 3. The sheet in front of you will remind you which bowl to place each sweet in.
Take one sweet at a time without looking in the bag. Work as quickly and as carefully as you can. If you are not sure, you can check the bowls and change the sweets as many times as you want. Please begin the task.

The child will be asked if they have any questions and if they are ready to begin the task. They will be told to tell the researcher when they have finished sorting all of the sweets. At the end, they will be asked if they want to change any of the sweets into other bowls.

Appendix P

UEA Ethics committee approval letter for Study 3

Faculty of Medicine and Health Sciences Research Ethics Committee

University of East Anglia

Sorina Zielinski
Room 1.33,
Elizabeth Fry Building
University of East Anglia
Norwich Research Park
Norwich
NR4 7TJ

Research & Enterprise Services
REN West (SCI)
University of East Anglia
Norwich
NR4 7TJ

Email: fmh.ethics@uea.ac.uk
Direct Dial: +44 (0) 1603 59 1566

Web: http://www.uea.ac.uk

2nd March 2012

Dear Sorina

Title: Effects of inflated responsibility and uncertainty on anxiety and compulsive checking.
Reference 2011/2012 - 32

The submission of your research proposal was discussed at the Faculty Research Ethics Committee meeting on Thursday 23rd February.

The Committee were happy to approve your application in principle but have the following concerns which they would like you to address and amend accordingly:

1. The committee noted that you have two Participant Information Sheets (PIS) and felt that this was unnecessary, as you could make one generic PIS and send out with a "Thank you for responding to our poster" letter after initial enquiries, and then give more specific details after each person has been allocated a group.
2. It was noted that in your PIS, in What are the potential benefits? you have put 'entered in a drawing' when it should be 'entered into a draw' for a free iPod. You may also wish to mention this on the Poster in order to get more applicants.
3. On page 8 of 18 of your application, under 'Recruitment' you mention that if the applicant is 'eligible' to take part, they will proceed with the task, but it may be helpful to put in the PIS what happens if they are not eligible, and why.
4. In Section 3 of your Consent Form, it was suggested that you change 'research meeting' to 'session'.
5. In your invitation to take part letter, you may wish to clarify 'we' as your 'PhD Supervisor and I'.

Please write to me once you have resolved/clarified the above issues. I require documentation confirming that you have complied with the Committee's suggestions. The Committee have requested that you detail the changes below the relevant point on the text in this letter and also include your amendments as a tracked change within your application/proposal. The revisions to your application can be considered by Chair's Action rather than go to a committee meeting, which means that the above documentation can be resubmitted at any time. Please could you send your revisions to me as an attachment in an email as this will speed up the decision making process.

Appendix Q

Recruitment poster – Study 3

Appendix R Participant

Consent form

Department of Medicine, Health Policy and Practice

Participant Identification Number:

Title of Project: The effect of a sorting task on mood, beliefs and behaviour.

Name of Researcher: Sorina Zielinski, PhD Student

Please initial box

1. I confirm that I have read and understood the information sheet for the above study and that I had the opportunity to ask any questions that I may have. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without my medical care/legal rights being affected. ☐
3. I understand that the research session will be video recorded and that my name will not be identified on the recordings. Recordings will be destroyed at the end of the project. ☐
4. I agree to take part in the above study. ☐

Please complete the following:

_____	_____	_____
Name of Participant	Date	Signature
_____	_____	_____
Home Telephone Number	Mobile Number	Work Tel Number

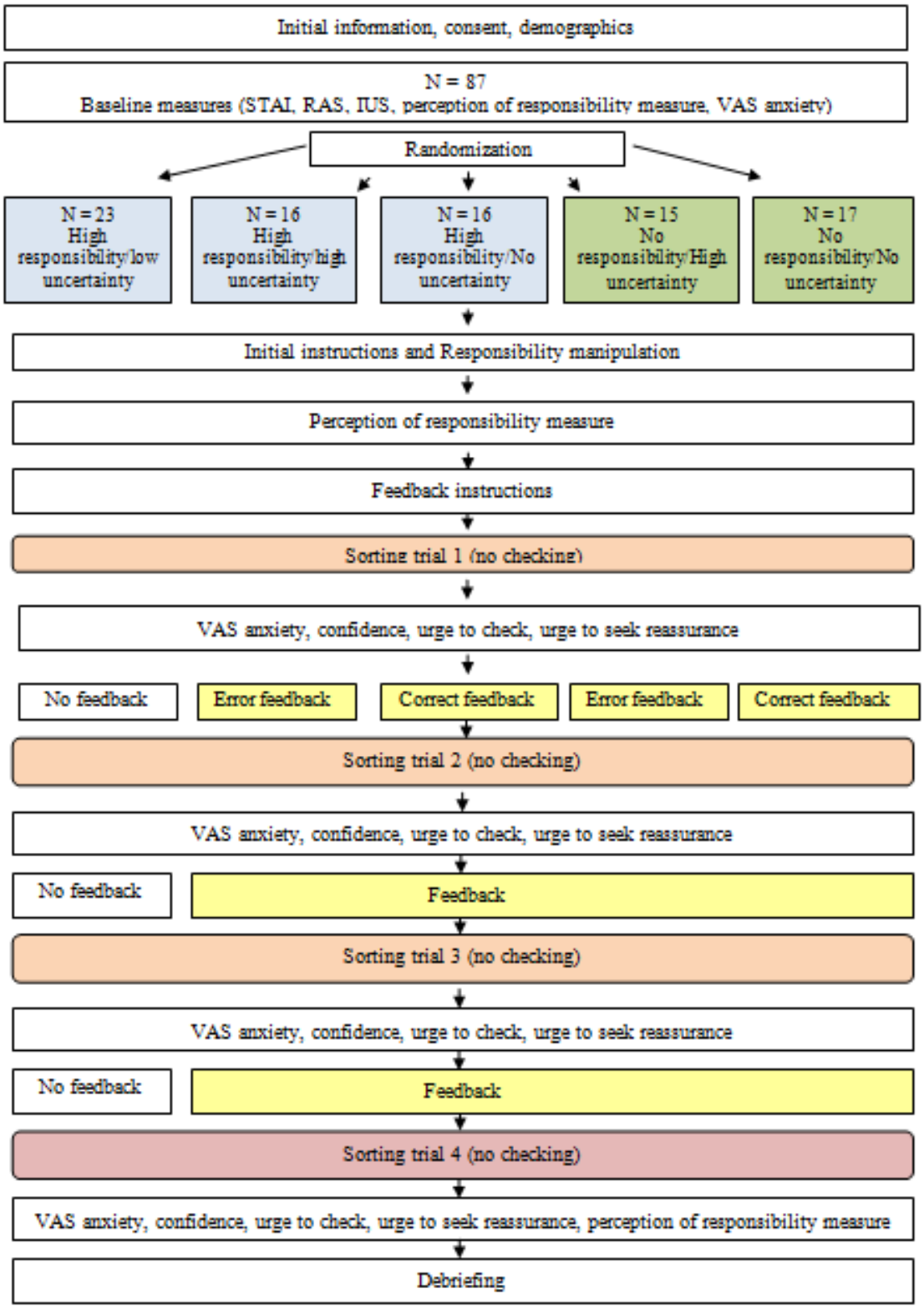
Thank you for your help.

Office use only

_____	_____	_____
Name of Researcher	Date	Signature

Appendix S

Study 3 flow-chart



Appendix T

Demographic questionnaire

Participant Identification Number:

Title of Project: The effect of responsibility on mood, beliefs and behaviour

Name of Researcher: Sorina Zielinski, PhD Student

Please complete the following information.

1. Date of birth (DD/MM/YYYY): _____

2. Gender (please circle): Male / Female

3. Ethnic group (please circle all that apply):

White	Mixed	Asian or Asian British	Black or Black British	Chinese or other ethnic group
British	White & Black Caribbean	Indian	Caribbean	Chinese
Irish	White & Black African	Pakistani	African	Other Ethnic Group
Other White	White & Asian	Bangladeshi	Other Black	
	Other Mixed	Other Asian		

4. Are you colour blind? (please circle) Yes / No

(We ask this as the task involves sorting things based on their colour)

Thank you for your help.

Appendix U

Responsibility Attitudes Scale (Salkovskis et al., 2000)

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

For each of the attitudes, show your answer by putting a circle around the words which BEST DESCRIBE HOW YOU THINK. Be sure to choose only one answer for each attitude. Because people are different, there is no right answer or wrong answer to these statements.

To decide whether a given attitude is typical of your way of looking at things, simply keep in mind what you are like MOST OF THE TIME.

1. I often feel responsible for things which go wrong.

TOTALLY AGREE | AGREE VERY MUCH | AGREE SLIGHTLY | NEUTRAL | DISAGREE SLIGHTLY | DISAGREE VERY MUCH | TOTALLY DISAGREE

2. If I don't act when I can foresee danger, then I am to blame for any consequences if it happens.

TOTALLY AGREE | AGREE VERY MUCH | AGREE SLIGHTLY | NEUTRAL | DISAGREE SLIGHTLY | DISAGREE VERY MUCH | TOTALLY DISAGREE

3. I am too sensitive to feeling responsible for things going wrong.

TOTALLY AGREE | AGREE VERY MUCH | AGREE SLIGHTLY | NEUTRAL | DISAGREE SLIGHTLY | DISAGREE VERY MUCH | TOTALLY DISAGREE

4. If I think bad things, this is as bad as doing bad things.

TOTALLY AGREE | AGREE VERY MUCH | AGREE SLIGHTLY | NEUTRAL | DISAGREE SLIGHTLY | DISAGREE VERY MUCH | TOTALLY DISAGREE

5. I worry a great deal about the effects of things which I do or don't do.

TOTALLY AGREE | AGREE VERY MUCH | AGREE SLIGHTLY | NEUTRAL | DISAGREE SLIGHTLY | DISAGREE VERY MUCH | TOTALLY DISAGREE

6. To me, not acting to prevent danger is as bad as making disaster happen.

TOTALLY AGREE | AGREE VERY MUCH | AGREE SLIGHTLY | NEUTRAL | DISAGREE SLIGHTLY | DISAGREE VERY MUCH | TOTALLY DISAGREE

7. If I know that harm is possible, I should always try to prevent it, however unlikely it seems.

TOTALLY AGREE | AGREE VERY MUCH | AGREE SLIGHTLY | NEUTRAL | DISAGREE SLIGHTLY | DISAGREE VERY MUCH | TOTALLY DISAGREE

8. I must always think through the consequences of even the smallest actions.

TOTALLY AGREE | AGREE VERY MUCH | AGREE SLIGHTLY | NEUTRAL | DISAGREE SLIGHTLY | DISAGREE VERY MUCH | TOTALLY DISAGREE

9. I often take responsibility for things which other people don't think are my fault.

TOTALLY AGREE | AGREE VERY MUCH | AGREE SLIGHTLY | NEUTRAL | DISAGREE SLIGHTLY | DISAGREE VERY MUCH | TOTALLY DISAGREE

10. Everything I do can cause serious problems.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

11. I am often close to causing harm.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

12. I must protect others from harm.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

13. I should never cause even the slightest harm to others.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

14. I will be condemned for my actions.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

15. If I can have even a slight influence on things going wrong, then I must act to prevent it.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

16. To me, not acting where disaster is a slight possibility is as bad as making that disaster happen.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

17. For me, even slight carelessness is inexcusable when it might affect other people.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

18. In all kinds of daily situations, my inactivity can cause as much harm as deliberate bad intentions.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

19. Even if harm is a very unlikely possibility, I should always try to prevent it at any cost.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

20. Once I think it is possible that I have caused harm, I can't forgive myself.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

21. Many of my past actions have been intended to prevent harm to others.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

22. I have to make sure other people are protected from all of the consequences of things I do.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

23. Other people should not rely on my judgement.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

24. If I cannot be certain I am blameless, I feel that I am to blame.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

25. If I take sufficient care then I can prevent harmful accidents.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

26. I often think that bad things will happen if I am not careful enough.

TOTALLY AGREE	AGREE VERY MUCH	AGREE SLIGHTLY	NEUTRAL	DISAGREE SLIGHTLY	DISAGREE VERY MUCH	TOTALLY DISAGREE

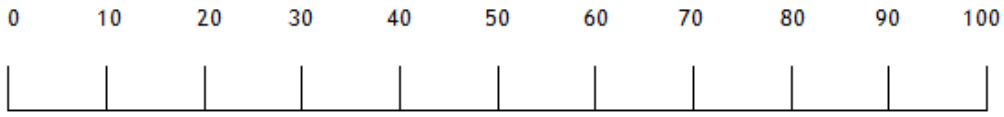
Appendix V-1

Anxiety scale

Please circle the number that shows how you feel right now about the sorting.

Not-at-all anxious

Extremely anxious

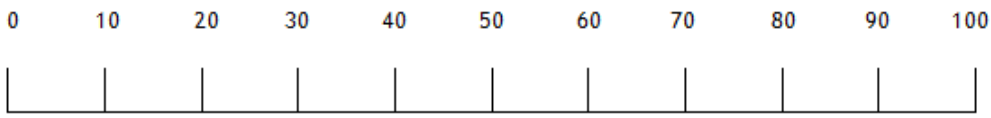


Appendix V-2 Confidence in sorting outcome

Please circle the number that shows how confident you are that you sorted accurately during this sorting trial.

Not at all confident

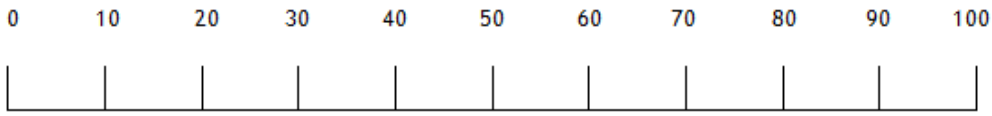
Extremely confident



Appendix V-3 Urge to check

Please circle the number that shows your urge to check your performance during this sorting trial.

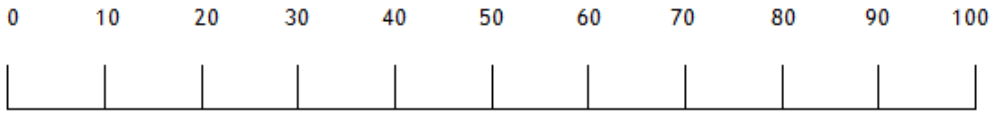
No urge whatsoever — Extreme urge to check



Appendix V-4 Urge to seek reassurance

Please circle the number that shows your urge to seek additional reassurance regarding your sorting during this sorting trial.

No urge whatsoever — Extreme urge to seek reassurance



Appendix W

Pre/Post Task Responsibility Assessment

I am interested in how you feel and what you think about the sorting task you are about to do/you just did. Please read the following statements carefully and circle the number that shows how much you agree or disagree with the statements.

1. **Completely disagree**
2. **Mostly disagree**
3. **Neither agree or disagree**
4. **Mostly agree**
5. **Completely agree**

	Completely disagree	**Mostly disagree**	**Neither agree or disagree**	**Mostly agree**	**Completely agree**
It's likely that something bad will happen					
Something really bad will happen now					
It will be my fault if bad things happen					
Other people are likely to be harmed in some way					
Something really bad will happen to other people					
I could cause something bad to happen to others					

Appendix X

Intolerance of uncertainty (IUS; Buhr et al., 2002)

Instructions:

You will find below a series of statements which describe how people may react to the uncertainties of life. Please use the scale below to describe to what extent each item is characteristic of you. Please circle a number (1 to 5) that describes you best.

	Not at all characteristic of me		Somewhat characteristic of me		Entirely characteristic of me
1. Uncertainty stops me from having a firm opinion.	1	2	3	4	5
2. Being uncertain means that a person is disorganized.	1	2	3	4	5
3. Uncertainty makes life intolerable.	1	2	3	4	5
4. It's unfair not having any guarantees in life.	1	2	3	4	5
5. My mind can't be relaxed if I don't know what will happen tomorrow.	1	2	3	4	5
6. Uncertainty makes me uneasy, anxious, or stressed.	1	2	3	4	5
7. Unforeseen events upset me greatly.	1	2	3	4	5
8. It frustrates me not having all the information I need.	1	2	3	4	5
9. Uncertainty keeps me from living a full life.	1	2	3	4	5
10. One should always look ahead so as to avoid surprises.	1	2	3	4	5

11. A small unforeseen event can spoil everything, even with the best of planning. .....1.....2.....3.....4.....5.....

12. When it's time to act, uncertainty paralyses me. .....1.....2.....3.....4.....5.....

13. Being uncertain means that I am not first rate. .....1.....2.....3.....4.....5.....

14. When I am uncertain, I can't go forward. .....1.....2.....3.....4.....5.....

15. When I am uncertain I can't function very well. .....1.....2.....3.....4.....5.....

16. Unlike me, others always seem to know where they are going with their lives. .....1.....2.....3.....4.....5.....

17. Uncertainty makes me vulnerable, unhappy, or sad. .....1.....2.....3.....4.....5.....

18. I always want to know what the future has in store for me. .....1.....2.....3.....4.....5.....

19. I can't stand being taken by surprise. .....1.....2.....3.....4.....5.....

20. The smallest doubt can stop me from acting. .....1.....2.....3.....4.....5.....

21. I should be able to organize everything in advance. .....1.....2.....3.....4.....5.....

22. Being uncertain means that I lack confidence. .....1.....2.....3.....4.....5.....

23. I think it's unfair that other people seem sure about their future. .....1.....2.....3.....4.....5.....

24. Uncertainty keeps me from sleeping soundly. .....1.....2.....3.....4.....5.....

25. I must get away from all uncertain situations. .....1.....2.....3.....4.....5.....

26. The ambiguities in life stress me.....1.....2.....3.....4.....5.....

27. I can't stand being undecided about my future. .....1.....2.....3.....4.....5.....

Appendix Y

STAI (Spielberger et al., 1983)

Read each statement and circle the appropriate number to indicate how you feel right now, that is, at this very moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

		Not at all	**A little**	**Somewhat**	**Very much so**
I feel	calm	1	2	3	4
I feel	secure	1	2	3	4
I feel	tense	1	2	3	4
I feel	strained	1	2	3	4
I feel	at ease	1	2	3	4
I feel	upset	1	2	3	4
I am	presently worrying over possible misfortunes	1	2	3	4
I feel	satisfied	1	2	3	4
I feel	frightened	1	2	3	4
I feel	uncomfortable	1	2	3	4
I feel	self confident	1	2	3	4

I feel	nervous	1	2	3	4
I feel	jittery	1	2	3	4
I feel	indecisive	1	2	3	4
I feel	relaxed	1	2	3	4
I feel	content	1	2	3	4
I feel	worried	1	2	3	4
I feel	confused	1	2	3	4
I feel	steady	1	2	3	4
I feel	pleasant	1	2	3	4

Appendix Z

Instructions

Initial verbal instructions

All participants will be told:

"What you are going to do today is sort some pills. I have 200 pills of different colors, shapes and sizes and you have to sort them out of this big container and into these small containers. I will demonstrate to you how to sort them. After that, you will have three practice trials, before the actual sorting trial. You will receive feedback on your performance for the practice trials. Also, after the three practice trials you will complete a few very brief questionnaires. After that you will move on to doing the actual sorting trial; no feedback will be provided to you after that. You will also complete another set of questionnaires after this final trial.

I will be outside of the room during all trials, which will all be video recorded. I will turn on the video camera before leaving the room. After you complete each trial I will then take the containers and we will use a machine to check your sorting; you will then be given feedback regarding the accuracy of your sorting.

Do you have any questions so far?"

Next experimenter demonstrates the sorting procedure.

Responsibility manipulation

High responsibility groups

"Now that you have seen the sorting procedure, it is your turn to complete the practice trials. But before we get started I will give you some information about the purpose of this task.

Our laboratory had been asked by a charitable organization to develop a reliable sorting system for pills. This system will be used for pill distribution in a third-world country where many people are illiterate. Because people can't read there is a high incidence of mistakes with medication use, some of which have been fatal. So the results of your individual performance are important for safe distribution of these pills and preventing serious consequences from happening, which is why is so important that you sort the pills correctly.

In front of you there is a large container and seven small containers. The aim is to sort the pills from the large container into the small containers according to colour, size, and shape. Please take only one pill each time and do not look into any of the containers, including the big container that you sort out of. Once you placed a pill into a small container do not remove it. Do not move any of the containers around, just leave them on their place. Please remain seated during the task and do not stand or walk around. After putting all the pills from the large container into the small ones come and let me know. Do not throw the pills back into the large container; just let them stay in the small containers. It is important that you complete the whole task.
Work as quickly and as accurately as you can. Any questions?

Okay, I will now start the video camera and walk out; you can start as soon as I close the door. Please notify me once you are done".

No responsibility groups

"Now that you have seen the sorting procedure, it is your turn to complete the practice trials. But before we get started I will give you some information about the purpose of this task.

This study has been designed to investigate colour, size, and shape perception, and how quickly and accurately people can sort pills according to these attributes.

In front of you there is a large container and seven small containers. The aim is to sort the pills from the large container into the small containers according to colour, size, and shape. Please take only one pill each time and do not look into any of the containers, including the big container that you sort out of. Once you placed a pill into a small container do not remove it. Do not move any of the containers around, just leave them on their place. Please remain seated during the task and do not stand or walk around. After putting all the pills from the large container into the small ones come and let me know. Do not throw the pills back into the large container; just let them stay in the small containers. It is important that you complete the whole task.
Work as quickly and as accurately as you can. Any questions?

Okay, I will now start the video camera and walk out; you can start as soon as I close the door. Please notify me once you are done".

Appendix AA

Fictive study poster

Appendix AB

UEA Ethics committee approval letter for Study 4

Faculty of Medicine and Health Sciences Research Ethics Committee

University of East Anglia

Sorina Zielinski
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Norwich Research Park
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Norwich
NR4 7TJ

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7th December 2012

Dear Sorina

Effects of inflated responsibility and reassuring feedback on anxiety and compulsive urges

Our Ref: 2012/2013-21

The submission of your research proposal was discussed at the Faculty Research Ethics Committee meeting on Thursday 29th November 2012.

The Committee were happy to approve your application in principle but have the following concerns which they would like you to address and amend accordingly:

1. Confirm that you have gatekeeper consent prior to recruiting participants and supply a copy of the consent to the Committee.
2. Provide a copy of the debrief information.
3. Maintain consistency throughout the documentation - for example the free lunch or vouchers for lunch are inconsistently referred to throughout the protocol and on the flyer.
4. Clarify that the telephone text feedback will be done via the study telephone and not via the participants' own telephones.
5. Rephrase the introductory sentence in the invitation letter in order to achieve more clarity.
6. In relation to the Participant Information Sheet:
    a. This should be amended to present information in a more succinct and clear manner.
    b. Clarify at what stage the screening for mental health difficulties takes place.
    c. Correct the rationale of the video recording.
    d. Set up a suitable procedure to support participants in case distress occurs.
    e. Amend the stipulated 20 minutes timeframe necessary for filling in the questionnaire as it does seem likely to take longer to complete it.
    f. In the confidentiality section, make reference to the fact that the results published will contain no personally identifying information.
    g. On page 20, amend the sorting tasks number from "2" to "4".
7. In relation to the Consent Form:
    a. Remove the work telephone number request.
    b. Insert the appropriate version number and date.
8. The Committee suggested that on the flier, among the inclusion criteria, you insert a sentence such as "you don't perceive yourself having high levels of anxiety".

Appendix AC

Recruitment poster

UEA
University of East Anglia

Norwich School of Medicine

Help us design a new way of sorting medication for use in developing countries

and get FREE LUNCH

You might be able to participate if you

Are 18 or older

Are not colour blind

Have not already participated in a similar study

Participation will involve

Completing questionnaires

Sorting pills by hand

For more information please contact Sorina at S.Zielinski@uea.ac.uk

For more information please contact Sorina at S.Zielinski@uea.ac.uk
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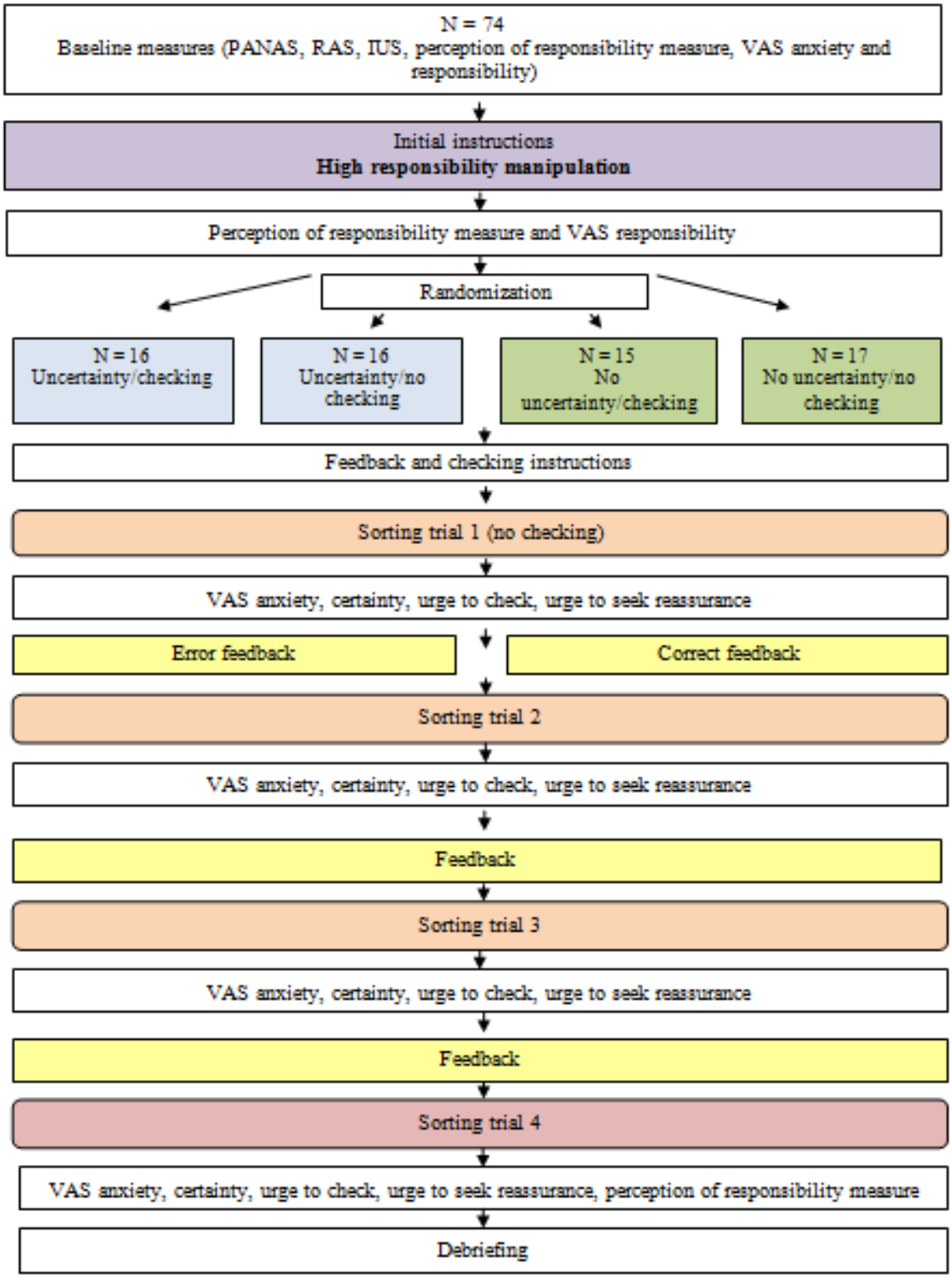
Appendix AD

Study 4 flow-chart

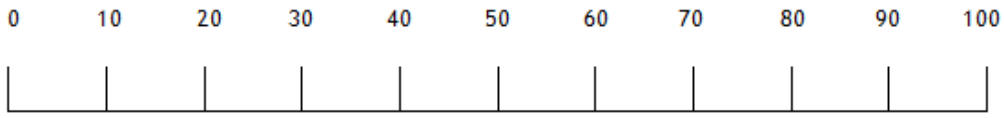


APPENDIX AE

Visual Analogue Scale of Responsibility

Please circle the number that shows how much you think your performance would affect the well-being of others.

Not at all Extremely

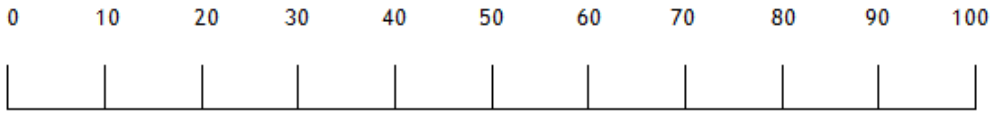


Appendix AF

Uncertainty scale

Please circle the number that shows how certain you are that you sorted correctly during this sorting trial.

Not at all Extremely



APPENDIX AG

PANAS

(Watson et al., 1988)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. Indicate to what extent you feel this way right now, that is, at the present moment *OR* indicate the extent you have felt this way over the past week (circle the instructions you followed when taking this measure).

1	2	3	4	5
Very Slightly	A Little	Moderately	Quite a Bit	Extremely or Not at all

_____ 1. Interested	_____ 11. Irritable
_____ 2. Distressed	_____ 12. Alert
_____ 3. Excited	_____ 13. Ashamed
_____ 4. Upset	_____ 14. Inspired
_____ 5. Strong	_____ 15. Nervous
_____ 6. Guilty	_____ 16. Determined
_____ 7. Scared	_____ 17. Attentive
_____ 8. Hostile	_____ 18. Jittery
_____ 9. Enthusiastic	_____ 19. Active
_____ 10. Proud	_____ 20. Afraid

Appendix AH

Instructions

Initial verbal instructions

All participants were told:

"What you are going to do today is sort some pills. You will do four sorting trials; the first three trials are for practice. At the end of each trial, I will take the pills and use a computer scanning system to check your sorting. Then, you will do the actual sorting trial. At the end, you will complete another brief set of questionnaires.

I will be outside of the room during all trials, which will all be video recorded. I will turn on the video camera before leaving the room. Do you have any questions so far?"

Feedback manipulation

"Error" feedback groups

"After each practice trial, you will receive feedback on your sorting. Feedback will be sent automatically by the computer to this phone here. When you hear the phone beep, check the message on the screen. If the text message reads "ERROR" it means you made one or more mistakes; if it reads "CORRECT" it means you sorted correctly".

Participants in the reassuring feedback groups will receive positive feedback only.

"Correct" feedback groups

*"*After each sorting trial, you will receive feedback on your sorting. Feedback will be sent automatically by the computer to this phone here. When you hear the phone beep, check the message on the screen. If the message reads "ERROR" it means you made one or more mistakes; if it reads "CORRECT" it means you sorted correctly".

Participants in negative feedback groups will receive negative feedback only.

Checking manipulation

Next experimenter demonstrates the sorting procedure.

"Next, I will demonstrate the sorting to you. I have 50 pills of different colours, shapes and sizes and you have to sort them out of this big tin and into these small pill bottles. Behind each bottle there is a cap containing 4 pills; those are to show you which pills go in each bottle. Please take only one pill at a time, and sort one bottle at a time. Start with the first bottle here, and only after you have the four correct pills in it you can move on to the next bottle, and so on".

Checking groups

"During the sorting you can look in the tin and bottles, take pills out and move them if you think they have been misplaced".

No checking groups

"During the sorting, you can look in the tin, but not in the bottles. Once you placed a pill into a bottle do not remove it. Do not move any of the containers around, just leave them on their place".

Responsibility manipulation

High responsibility – all groups

"Before you get started on the sorting, I will give you some information about the purpose of this task. Our laboratory has been asked by a charitable organization to develop a reliable sorting system for pills. This system will be used for pill distribution in a third-world country where many people are illiterate. Because people can't read bottle lables, there is a high incidence of mistakes with medication use, some of which have been fatal. So the results of your individual performance are important for safe distribution of these pills and preventing serious consequences from happening, which is why it is so important that you sort the pills correctly".

Additional instructions

All groups

"Please remain seated during the task and do not stand or walk around. After putting all the pills from the tin into the bottles come and let me know. Do not throw the pills back into the tin; just let them stay in the bottles. It is important that you complete the whole task. Also, I will time you during the task, so work as quickly, but also as accurately, as you can.

Any questions?

Okay, I will now start the video camera and walk out; you can start as soon as I close the door. Please notify me once you are done".

Appendix AI

Debriefing

After all the sorting trials and post-task measures are completed, each participant will receive the following information:

"Now that you have completed your participation, I would like to take a few minutes to give you more information about this study. We are using deception for this experiment; the charitable organization you heard about in the beginning is fictitious, as well as the feedback you received throughout the sorting. We are not working with a charitable organization, and your performance today will not impact pill distribution. This fake information was aimed at increasing your sense of perceived responsibility and at increasing uncertainty about the task. Inflated responsibility and uncertainty are believed to contribute to and maintain obsessive-compulsive disorder, so the aim of the study is to investigate cognitive aspects of OCD.

Do you have any questions or comments?"

Appendix AJ – Study 2

Table 3

Transformed baseline scores by group

Group	N	Range	Mean	SD	Median	Skew
			Baseline STAIC			
Whole Group	76	1.69	5.330	.406	5.385	-.446
High Responsibility	26	1.61	5.169	.403	5.196	.014
Reduced Responsibility	24	1.69	5.346	.410	5.385	-.447
Control	26	1.61	5.476	.357	5.522	-1.085
			Baseline Responsibility			
Whole Group	75	3.61	1.76	.962	2	-.439
High Responsibility	26	3.61	1.832	.973	2	-.699
Reduced Responsibility	24	2.83	1.566	.887	1.732	-.677
Control	25	3.61	1.871	1.029	2	-.263

Appendix AK – Study 3

Baseline scores

Table 6

Descriptives for raw baseline RAS scores

Group	N	Range	Mean	SD	Median	Skew	Kurtosis
			RAS				
Whole Group	87	43-175	103.98	22.4	104.00	-.049	.920
High responsibility/High uncertainty	16	75-150	104.13	18.28	103.00	.908	1.75
High responsibility/No uncertainty	16	43-137	109.67	23.5	112.50	-1.57	3.20
High responsibility/Low uncertainty	23	49-121	96.41	20.49	102.00	-.891	.079
No responsibility/High uncertainty	15	84-142	111.23	19.30	110.00	.254	-1.17
No responsibility/No-uncertainty	17	63-175	103.65	28.60	98.00	.856	1.03

Table 7

Descriptives for raw baseline IUS scores

Group	N	Range	Mean IUS	SD	Median	Skew	Kurtosis
Whole Group	87	13-96	61.69	15.86	60.00	-.072	-.089
High responsibility/High uncertainty	16	31-89	63.44	18.24	61.00	-.151	-1.20
High responsibility/No uncertainty	16	43-93	62.38	14.92	56.50	.575	-.680
High responsibility/Low uncertainty	23	39-96	62.43	13.48	61.00	.572	.508
No responsibility/High uncertainty	15	13-90	58.47	18.65	60.00	-.569	1.59
No responsibility/No-uncertainty	17	35-88	61.24	16.21	62.00	-.158	-1.22

Table 8

Descriptive statistics for transformed baseline STAI

Group	N	Range	Mean	SD	Median	Skew	Kurtosis
			Baseline STAI				
Whole Group	87	1.30 – 1.87	1.49	.104	1.50	.284	.771
High responsibility/High uncertainty	16	1.30-1.66	1.50	.100	1.52	-.484	-.401
High responsibility/No uncertainty	16	1.30-1.87	1.49	.137	1.47	1.30	2.84
High responsibility/Low uncertainty	23	1.30-1.69	1.51	.097	1.51	-.383	.267
No responsibility/High uncertainty	15	1.30-1.61	1.45	.104	1.43	.095	-1.35
No responsibility/No-uncertainty	17	1.38-1.70	1.51	.081	1.51	.495	.149

Table 13

Relationships between variables

		RAS	IUS	Baseline Anxiety
Post-task anxiety	Spearman C.	.218*	0.188	.487**
	Sig.	0.043	0.08	0
Overall anxiety		.225*	.224*	.656**
		0.036	0.037	0
Post-task urge to check		.350**	0.15	.246*
		0.001	0.165	0.021
Overall urge to check		.370**	0.199	.213*
		0	0.064	0.031
Post-task urge to seek reassurance		.356**	0.207	.297**
		0.001	0.055	0.005
Overall urge to seek reassurance		.403**	.257*	.288**
		0	0.016	0.007

**$p < .01$ (2-tailed), *$p < .05$ (2-tailed)

Appendix AL – Study 4

Table 15

Descriptives for raw baseline scores

Measure	Number	Mean	SD	Median	Skew	Kurtosis
			RAS			
Whole Group	74	101.64	20.83	105	-.24	.67
Uncertainty (No-checking)	38	99.66	21.33	101	-.33	.98
No-uncertainty (Checking)	36	103.72	20.37	109.5	-.12	.49
			IUS			
Whole Group	74	59.93	17.13	57	.73	1.48
Uncertainty (No-checking)	38	61.26	19	57	.79	2.05
No-uncertainty (Checking)	36	58.53	15.04	58	.45	-.67
			PANAS Positive			
Whole Group	74	31.47	6.98	32	-.139	-.15
Uncertainty (No-checking)	38	30.74	7.93	30.5	-.01	-.49
No-uncertainty (Checking)	36	32.25	5.83	32	-.10	.24
			PANAS Negative			
Whole Group	74	16.07	7.04	13	1.61	2.23
Uncertainty (No-checking)	38	16.55	7.5	13	1.52	2.08
No-uncertainty (Checking)	36	15.56	6.6	13	1.78	2.84

Table 18

Non-parametric correlations between baseline measures and dependent variables

Measure		RAS	IUS	Baseline Anxiety
Post-task anxiety	Spearman C.	.21*	0.18	.48**
	Sig.	0.04	0.08	0
Overall anxiety		.22*	.22*	.65**
		0.03	0.03	0
Post-task urge to check		.35**	0.15	.24*
		0	0.16	0.02
Overall urge to check		.37**	0.19	.21*
		0	0.06	0.03
Post-task urge to seek reassurance		.35**	0.20	.29**
		0	0.05	0
Overall urge to seek reassurance		.40**	.25*	.28**
		0	0.01	0

Note. **$p < .01$ (2-tailed), *$p < .05$ (2-tailed)