UNIVERSITY OF SOUTHAMPTON
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THE ASSOCIATION OF MAGICAL THINKING AND OBSESSIVE-COMPULSIVE DISORDER:
AN EXPERIMENTAL INVESTIGATION OF NEUTRALISING BEHAVIOUR

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This thesis is submitted in partial fulfilment of the requirements for the degree of Doctorate in Clinical Psychology

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Disclaimer statement

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Thesis Abstract

Magical thinking is suggested to be a core component in Obsessive Compulsive Disorder (OCD) that underpins the cognitive bias of Thought-Action Fusion (TAF). The literature review considers evidence that TAF is involved in the development and maintenance of OCD, and that TAF-likelihood and magical thinking are associated. It is suggested that magical thinking and OCD are also associated, and a review of the evidence for the centrality of magical thinking in OCD is presented. The limitations of previous research are discussed, highlighting the need for experimental investigation, and controlling for the effect of anxiety and depression. It is hypothesised that magical thinking may also be demonstrated in the neutralising behaviours in response to intrusive thoughts in OCD.

The experimental paper investigates whether the use of neutralising behaviours in response to a TAF-induction experiment is linked to magical thinking. In a sample of 50 undergraduate students, 74.0 % of participants demonstrated at least one form of neutralising behaviour. Individuals that used neutralising strategies demonstrated significantly greater levels of magical thinking, however, there was no difference in the level of OCD symptoms. Magical thinking was significantly associated with OCD symptoms, however it is suggested that the overlap between magical thinking and worry might account for this association. Unexpectedly, no significant association was found between TAF-likelihood and OCD, although, a significant relationship was demonstrated between TAF-moral and OCD symptoms. The effects of the TAF-induction paradigm are discussed, and it is suggested that the paradigm may not be an appropriate model for OCD.

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Is magical thinking a core component of Obsessive-Compulsive Disorder?

A review of the literature

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Is Magical Thinking a Core Component of Obsessive-Compulsive Disorder?

A Review of the Literature

Abstract

Recent research has suggested that magical thinking may be a core component in Obsessive Compulsive Disorder (OCD) that underpins the cognitive bias of Thought Action Fusion (TAF). Considering the current status of the cognitive theory of OCD, this review presents the hypothesised role of TAF and reviews evidence for the specific association of TAF to OCD. A review of the evidence for the centrality of magical thinking in OCD is presented, with a discussion of the possible relationships between TAF and magical thinking. Evidence suggests that TAF is also present in other anxiety disorders and depression. The possibility that TAF and magical thinking are linked to general psychopathology, or are normal psychological phenomena used to establish a sense of control over external events is also considered. Finally, consideration is given to the possible role of magical thinking in neutralising strategies in OCD. The limitations of current research utilising correlational analysis with questionnaire data are briefly discussed, highlighting the need to develop valid experimental methodologies to study aspects of OCD. Overall, there is insufficient evidence to establish whether magical thinking is a core component of OCD, and further replication is required controlling for the effect of anxiety and depression.

Is Magical Thinking a Core Component of Obsessive-Compulsive Disorder?

A Review of the Literature

1. Introduction

Obsessive Compulsive Disorder (OCD) is a debilitating anxiety disorder that has generated considerable research over the past three decades. Sufferers experience recurrent and persistent intrusive thoughts, images and impulses that are experienced at some time during the disturbance as intrusive and inappropriate and cause marked anxiety and distress (*DSM-IV*; American Psychiatric Association [APA], 1994). In the majority of cases of OCD, the sufferer feels driven to perform a voluntary compulsive act in response to these intrusive obsessive thoughts. Defined as repetitive behaviours or mental acts, the goal of which is to prevent or reduce anxiety or distress (APA, 1994), compulsive acts appear to have some kind of neutralising, ameliorative or restorative function (Purdon & Clark, 2002). They are used to attempt to prevent or reduce the anxiety and distress associated with an intrusive thought, or to prevent or reduce some dreaded event or situation (APA, 1994). Compulsions are defined by being either excessive, or not connected in a realistic way with what they are designed to neutralise and/or prevent (APA, 1994), and some compulsions appear to be connected to what they are designed to neutralise in rather 'magical' ways (Lee, Cougle & Telch, in press).

Anxiety disorders, such as OCD, are characterised by the overestimation of the dangerousness of situations, sensations or mental events. Each disorder is hypothesised to demonstrate a domain of overestimation that is characteristic and specific to that disorder (Rachman, 1998; Salkovskis, 1999). Salkovskis's (1985,

1989) cognitive theory of OCD is the most widely accepted cognitive account of the aetiology and maintenance of OCD (Barrett & Healy, 2003). Within this theory, cognitive biases are proposed to account for the link between the appraisal of intrusive thoughts, and the belief that these thoughts are harmful and require a restorative or ameliorative action (a compulsive or neutralising behaviour). One of the proposed overestimated domains in OCD is the overestimation of the importance of thoughts, particularly intrusive thoughts (Obsessive Compulsive Cognitions Working Group [OCCWG], 1997). Different forms of cognitive biases have been proposed to underlie this overestimation (OCCWG, 1997) and one possible candidate for this bias is Thought Action Fusion (TAF). In TAF individuals overvalue the significance of the consequence of one's thoughts.

The purpose of this literature review is to describe Salkovskis's (1985, 1989) cognitive theory of OCD, outlining the hypothesised role of TAF in this current theory, before discussing how magical thinking may relate to OCD, and how the concept of TAF and magical thinking may be associated. Following the description of the cognitive theory, the first section of this review will examine the evidence that TAF is related to OCD. As TAF is hypothesised to contribute to the development and maintenance of obsessions in OCD, the evidence that TAF is a cognitive bias specific to OCD will be reviewed. The review will then consider research from a different area; that magical thinking is associated with OCD, as recently some authors have argued that under the rubric of TAF it is actually the concept of magical thinking that has been applied to OCD (Yaryura-Tobias & McKay, 2002), and that magical thinking is a core component of OCD (Einstein & Menzies, 2000, 2004). The research for the association of magical thinking and TAF, and magical thinking

and OCD, will both be reviewed. Methodological limitations of current research into the area will also be addressed, highlighting the importance of developing valid experimental methods of researching TAF and magical thinking. Consideration will also be given to whether neutralising behaviours, performed in response to intrusive thoughts, are also related to magical thinking.

2. Current cognitive theory of OCD

2.1. The role of responsibility

Over twenty years ago research identified that intrusive thoughts, indistinguishable in form and content to the intrusive thoughts in OCD, are present in the normal population (Rachman & de Silva, 1978; Salkovskis & Harrison, 1984). However, in individuals with OCD these intrusive thoughts, images, and impulses are usually interpreted as "repugnant, unacceptable, egodystonic, senseless and difficult to dismiss" (Salkovskis & Kirk, 2000, p130). What appears to differentiate between the intrusive thoughts of individuals with OCD and normal controls is the interpretation of the intrusive thoughts, and the distress that they cause to the individual.

Salkovskis's (1985, 1989) cognitive theory of obsessive-compulsive disorder is based upon the principle that the symptoms of OCD exist on a continuum from normal, unwanted intrusive cognitions that are experienced by the majority of the general population at one end, to clinical obsessions at the other. For an intrusive thought to become a clinical obsession an individual must have faulty or dysfunctional beliefs relating to the meaning of the intrusive thought. These dysfunctional beliefs are suggested to centre on an overestimation of the personal

responsibility for preventing negative consequences associated with the intrusive thoughts. Responsibility appraisals are defined as "the belief that one has power which is pivotal to bring about or prevent subjectively crucial negative outcomes" (Salkovskis, Rachman, Ladouceur & Freeston, 1992, as cited in Barrett & Healy, 2003). Therefore, when an individual with OCD has an intrusive thought, cognitive theory suggests that the individual believes that they are responsible for any harm that may occur to either themselves or to others, that they failed to prevent. This overestimation of responsibility regarding potential harm results in anxiety and distress, and provokes feelings of guilt (Rachman, 1997).

The beliefs concerning responsibility in OCD are not restricted to being responsible for preventing negative events by not doing something that might cause harm (defined as an error of commission). Individual's with OCD are also reported to endorse beliefs that failing to do something to prevent a negative outcome makes one responsible for that negative outcome (defined as an error of omission) and rate this as equal to errors of commission. Therefore, an individual with OCD may feel equally responsible for smashing a glass bottle on a pavement and leaving the glass there fearful that someone might come to harm because of it (an error of commission), as they would to see broken glass on the pavement and not pick it up (an error of omission). This cognitive bias is not seen in the general population, who rate responsibility for errors of commission as greater than errors of omission (OCCWG, 1997).

Considerable studies employing a variety of research methodologies including idiographic, psychometric and experimental designs, have investigated the

overestimation of responsibility in OCD. The results demonstrate that beliefs regarding obsessions and responsibility are linked to obsessive-compulsive symptoms (Clark & Purdon, 1993; Freeston & Ladouceur, 1993; Rheaume, Ladouceur, Freeston & Letarte, 1994; Steketee & Frost, 1994). Individuals with a diagnosis of OCD show increased perceptions of responsibility compared with control groups (Freeston, Ladouceur, Gagnon & Tibodeau, 1993), and increased perceptions of responsibility lead to increased anxiety and neutralising behaviours (Lopatka & Rachman, 1995). However, following a failure to find significant correlations between inflated responsibility and the subscale scores of the Maudsley Obsessive Compulsive Inventory (MOCI; Hodgson & Rachman, 1977) in a student sample, Rachman, Thordarson, Shafran and Woody (1995) suggest that the relationship between inflated responsibility and obsessional problems may be more idiosyncratic and situation specific than previously thought. Despite the centrality of responsibility in Salkovskis' model, the role of excessive responsibility in the persistence and uncontrollability of cognitive intrusions remains uncertain (Clark, Purdon & Byers, 2000).

2.2. Neutralisation

The cognitive theory of OCD (Salkovskis, 1985) also attaches considerable significance to the role and effects of neutralisation. Neutralisation is considered to be a form of compulsion, mainly covert, that is concerned with undoing the discomforting effects of a person's own action or thought (either an image or impulse) to effectively cancel them out (Rachman, Shafran, Mitchell, Trant & Teachman, 1996). Neutralisation is believed to reduce distress associated with an intrusive thought (Muris, Merckelbach & Clavan, 1997), and in doing so reduces

anxiety and producing a period of (transitory) relief from the obsession (Rachman et al., 1996). When used repeatedly, the anxiety reducing 'corrective' behaviour reinforces the belief that the thought was dangerous or threatening, and that the compulsive act was necessary to reduce anxiety (Freeston & Ladouceur, 1997; Salkovskis, Westbrook, Davis, Jeavons & Gledhill, 1997). An example of this could be a male client with OCD who experiences intrusive thoughts that he might sexually abuse a child. In response to this thought he may compulsively check that he is not aroused by this thought, or similar thoughts, and in doing so he reduces the anxiety experienced with the thought. Repeated checking in response to the intrusion reinforces the belief that this checking is necessary to reduce anxiety associated with the intrusive thought.

The reinforcing effect of neutralising has been experimentally demonstrated with individuals selected from a non-clinical population who are prone to experiencing intrusive thoughts and neutralising. The sample was allocated into two groups and both groups were presented with intrusive thoughts; one group was instructed to neutralise, and the second group to distract themselves, in response to the thoughts. When both groups were instructed not to use either of the previous strategies and were presented with further intrusive thoughts, the group that had previously neutralised reported greater discomfort and urge to neutralise in response to the thoughts (Salkovskis et al., 1997). It has been proposed that neutralising in response to intrusive thoughts constitutes an attempt to avoid or escape responsibility associated with the intrusive thought (Salkovskis, 1996).

2.3. Current status of cognitive theory

Drawing together the numerous strands of research into the aetiology and maintenance of obsession in OCD the OCCWG (1997, 2001) have outlined the key domains that are argued to be of central importance in the development and maintenance of OCD. These domains are (1) inflated responsibility, (2) beliefs concerning the over importance of the consequences of thoughts, (3) excessive concern regarding the importance of controlling one's thoughts, (4) overestimating the probability and severity of threat, (5) intolerance of uncertainty, and (6) perfectionism. It is unclear how all of these domains fit together, which hold a primary role in converting normal intrusive thoughts into obsessional thoughts, and which are cognitive process that are observed in response to this. It is possible that some domains overlap (OCCWG, 1997).

Inflated responsibility appears to be a key factor in OCD however, the intermediate steps, or appraisal processes, which underlie the inflated beliefs about responsibility remain unclear. Cognitive biases have been suggested to one of four factors that increase a person's vulnerability to OCD, the other factors being elevated moral standards, depression, and anxiety (Rachman, 1997). As a theoretical precursor to the inflated responsibility appraisals seen in OCD is overvaluing the significance of intrusive thoughts (Rachman & Shafran, 1999), the presence of a TAF cognitive bias that overestimates an individual's responsibility for harm and its prevention is a prime candidate for the cognitive bias in OCD (Rachman & Shafran, 1999), as it inflates a sense of responsibility for an individual, and inflated responsibility is itself a vulnerability factor for OCD (Salkovskis & Kirk, 1997).

3. Thought-Action Fusion (TAF)

3.1. The role of TAF in cognitive theory of OCD

The significance that a person attaches to an unwanted thought is proposed to be one of the major determinants of whether, or not, intrusive thoughts are transformed into obsessions (Rachman, 1997, 1998). Thought-Action Fusion (TAF; Rachman, 1993) refers to a set of cognitive distortions that are suggested to result in a catastrophic misinterpretation that normal intrusive thoughts are personally significant and threatening (Rachman, 1997, 1998; Rassin, Merckelbach, Muris & Spaan, 1999). The overestimation of the threat posed by intrusive thoughts contributes to feelings of responsibility, and concerns about responsibility and harm (Rachman, 1998; Salkovskis, 1999). Overall, current cognitive theory considers TAF to be highly relevant in our understanding of the aetiology and maintenance of obsessional symptoms (Emmelkamp & Aardema, 1999).

TAF can take two forms. One form, TAF-moral, is defined as the "belief that having a repugnant, unacceptable thought is morally equivalent to carrying out the relevant action" (Rachman, 1997). Where an individual believes that an obsessional thought and negative act are morally equivalent, they are more likely to feel distress at having the thought. The second TAF bias, TAF-likelihood, is "the belief that thinking about an unacceptable or disturbing event makes that event more probable, more likely to happen in reality" (Shafran, Thordarson and Rachman, 1996, p.379), for example thinking a hypothetical situation will increase the probability that that situation will occur. In transforming normal intrusive thoughts into abnormal obsessions, TAF is suggested to result in an increase in the distress experienced with the intrusive thought (Rachman, 1998), and also an urge to engage in compulsive

rituals and neutralising in response to the significant (and threatening) intrusive thought to prevent a negative consequence (Amir, Freshman, Ramsey, Neary & Brigidi, 2001; Rachman, 1998). TAF is hypothesised to play a role in both the development and maintenance of OCD.

3.2. Evidence for the association of TAF and OCD

As TAF beliefs are found in analogue samples (Rachman et al., 1996), research into OCD does not need to be limited to individuals with OCD (Gibbs, 1996; OCCWG, 1997). Questionnaire based studies have primarily been used to investigate the TAF biases with OCD, although there have also been some limited experimental studies. The Thought-Action Fusion Scale (TAFS; Shafran et al., 1996) is a questionnaire designed to measure the endorsement of TAF related beliefs, which has been used extensively in OCD research. Although early research suggested that there were two aspects to TAF-likelihood: increasing the likelihood of harm for one's self as a consequence of thoughts (TAF-likelihood self), and increasing the likelihood of harm for others (TAF-likelihood others), factor analytic studies of the TAFS suggest that the subdivision of TAF-likelihood is not valid, and a two factor solution of the TAFS (TAF-likelihood and TAF-moral) should be used (Lee et al., in press; Rassin, Merckelbach, Muris & Schmidt, 2001; Yorulmaz, Yilmaz, & Gencoz, in press).

TAF meta-cognitive beliefs have been reported as related to nearly all obsessive-compulsive behaviour (Emmelkamp & Aardema, 1999), and both TAF-likelihood and TAF-moral have been extensively studied in OCD. The results of these studies are outlined below.

3.2.1. TAF-likelihood

Questionnaire based studies suggest that TAF-likelihood is associated with OCD symptoms, and TAF-likelihood has been found to successfully distinguish between high and low OCD symptom groups. Research has also suggested that TAF-likelihood is a causative factor in the development of obsessions.

Robust correlations have been demonstrated between obsessive-compulsive symptoms and scores on the TAF-likelihood subscale of the TAFS for both analogue (Amir et al., 2001; Einstein & Menzies, 2000; Yorulmaz et al., in press) and clinical samples (Einstein & Menzies, 2004; Shafran et al., 1996). In clinical samples, TAF-likelihood scores are positively correlated with severity of obsessive-compulsive symptoms (Shafran et al., 1996).

Higher levels of TAF-likelihood are also demonstrated in analogue samples with obsessional symptoms (Coles, Mennin & Heimberg, 2001; Shafran et al., 1996). Amir et al. (2001) investigated the association of TAF-likelihood beliefs with OCD symptoms, using a frequency weighted distress cut-off method to identify individuals from an analogue sample who demonstrated a level of OCD symptoms similar to the level demonstrated in a treatment seeking clinical population. These high OCD individuals were compared to individuals who demonstrated no symptoms of OCD. The high OCD group demonstrated significantly higher scores on measures of TAF-likelihood. Other studies have replicated this finding, with TAF-likelihood successfully distinguishing between high and low OCD symptom groups (Yorulmaz et al., in press). High OCD symptom individuals were also reported to rate the cost of

negative events as greater than individuals with low OCD symptoms. However, the exaggerated rating of the likelihood of thoughts causing actions appeared to lead to this exaggerated cost rating (Amir et al., 2001).

Using a structural equation modelling approach to investigate TAF in an undergraduate sample, TAF-likelihood was found to be a primary precursor in the development of obsessions (Rassin, Muris, Schmidt & Merkelbach, 2000), suggesting that TAF-likelihood plays a developmental role in the aetiology of obsessions. However, other cognitive factors, such as beliefs regarding the intolerability of uncertainty, were also found to be precursors to the development of obsessions. The results of the study suggested that thought suppression, previously believed to have a developmental role (Purdon, 1999), was a secondary phenomenon to TAF-likelihood.

The 'psychopathological potential' of the TAF bias has also been demonstrated in an experimental study of TAF (Rassin et al., 1999). The experiment induced TAF in normal participants by using a bogus EEG experiment, which created the perception for participants that there was a threatening consequence to their thoughts. The experimental manipulation to induce TAF involved an experimental group that were instructed to try not to think of the word "apple" as an EEG recording machine they were connected to could sense this thought and it would result in an electric shock being applied to another volunteer. A second control group were also told that the EEG could 'read their mind' but that there were no consequences for any of their thoughts. The experimental group demonstrated increased intrusive thoughts, discomfort, resistance to the thoughts and neutralising

behaviour compared with the control group. Researchers concluded that TAF influenced participant's appraisal of the significance of intrusions (Rassin et al., 1999). The results have been interpreted as consistent with a threat-based account of OCD (Einstein & Menzies, 2004), i.e. following the perception of direct and external threatening consequence to ones' thoughts (i.e. shocks), the neutral thoughts acquire obsessional qualities, and OCD symptomatology increases. However, methodological criticisms could be levied against the experimental design and it is possible that as participants were selected so as not to know about EEG (medical or psychology undergraduates were excluded), during the experiment the experimental group may have believed that there is a real causal link between their thoughts and inflicting harm to others. If this is the case, this experiment is about perceived responsibility for harm rather than TAF.

3.2.2. TAF-moral

Numerous clinical examples have theoretically linked TAF-moral to OCD (Rachman & Shafran, 1999). However, research has found little support for the presence of the bias in OCD. Despite the strong correlations repeatedly found for the relationship between OCD and TAF-likelihood, this has not been replicated with TAF-moral (Amir et al., 2001; Coles et al., 2001; Rassin, Merckelbach et al., 2001). However, one analogue study that had failed to find a correlation between TAF-moral and measures of OCD (Einstein & Menzies, 2000), did report a significant correlation between TAF-moral and OCD symptoms when the study was repeated with a clinical sample (Einstein & Menzies, 2004). Despite this finding, other clinical studies have failed to demonstrate a significant difference between TAF-moral scores of clinical OCD samples and non-anxious controls (Rassin, Diepstraten,

Merckelbach & Muris, 2001; Shafran et al., 1996). Some analogue studies have reported results that show strong correlations between TAF-moral and OCD symptoms (Yorulmaz et al., in press), however, cultural factors (Yorulmaz et al., in press), and religiosity (Rassin & Koster, 2003), are suggested to potentially confound the association of TAF-moral with other factors associated with OCD.

TAF-induction experiments have also failed to show an association between TAF-moral and OCD. One experiment, where participants wrote a sentence hoping that harm befalls another person, and then visualised the content of the sentence (Rachman et al., 1996) found that TAF-moral was not significantly associated with any of the manipulation variables. This included the ratings of the 'morality' involved in writing such a sentence. TAF-moral also failed to demonstrate any predictive validity with TAF-likelihood ratings (Rachman et al., 1996).

Another TAF induction experiment compared the appraisal and thought control strategies associated with upsetting sexual and non-sexual intrusive thoughts. It would be expected that thoughts of this nature would involve TAF-moral, however, TAF-likelihood appeared to play a more important role. TAF-likelihood was the unique predictor in the perceived control of the thoughts, and TAF-moral did not significantly predict the controllability of the thoughts (Clark et al., 2000).

Overall, results suggest that TAF-moral is less pathological than TAF-likelihood, and may therefore be of less relevance to obsessional problems (Clark et al., 2000). TAF-moral has been suggested to be a general cognitive bias in a British population (Shafran et al., 1996).

3.3. Evidence that TAF is not only associated with OCD

The cognitive theory of OCD hypothesises that specific biases operate in OCD to overvalue the significance of intrusive thoughts (Rachman, 1998) and that these biases are responsible for the development and maintenance of obsessions. The evidence for the association of TAF-likelihood with OCD, suggests that TAF-likelihood may be a possible candidate for this bias (Rachman & Shafran, 1999). However, if TAF is not specifically associated with OCD, but instead is associated with a variety of anxiety disorders, then it may be a pervasive bias that occurs in a variety of anxiety disorders.

Whether TAF is a cognitive bias specific to OCD has recently generated considerable research. Evidence is mounting that TAF-likelihood is present in social phobia, panic disorder, and post-traumatic stress disorder (Rachman & Shafran, 1999; Rassin, Diepstraten, et al., 2001), and that TAF-likelihood is related to general levels of psychopathology (Rassin, Diepstraten et al., 2001). Further, recent research into cognitive biases in eating disorders suggests that the bias of Thought Shape Fusion, also shares similarities to TAF (Radomsky, de Silva, Todd, Treasure & Murphy, 2002). TAF-moral does not appear to be related to other anxiety disorders (Abramowitz, Whiteside, Lynam & Kalsy, 2003).

Studies in OCD that have controlled for other anxiety disorders have failed to find evidence that TAF is specifically tied to OCD. Contrary to Shafran et al.'s (1996) original study of the psychometric properties of the TAFS, a later study found that OCD patients did not score significantly higher on the TAFS than patients

suffering from other anxiety disorders (Rassin, Merckelbach et al., 2001). Further, in a treatment study of OCD versus non-OCD anxiety disorder individuals, Rassin, Diepstraten et al. (2001) found no evidence that TAF is specifically tied to OCD. Significant correlations were found between pre-treatment TAF and psychopathology in both OCD and non-OCD anxiety control groups, and both groups demonstrated similar levels of TAF endorsement pre- and post-treatment. However, TAF did appear to show greater temporal stability in the individuals with OCD. The study did not include any follow up measures so it is not clear if there was any differential effect on TAF with time, and the sample was limited to an inpatient sample. However, overall the data does not support the hypothesis that TAF plays a specific maintaining role in OCD.

An adolescent study of OCD has also found TAF-likelihood to be correlated with symptoms of other anxiety disorders and depression (Muris, Meesters, Rassin, Merckelbach & Campbell, 2001). However, when controlling for trait anxiety the majority of these correlations disappeared and TAF remained significantly associated with OCD, and to a lesser extent Generalised Anxiety Disorder (GAD) and depression. The connection between GAD and OCD no longer attained significance when controlling for OCD, although when controlling for anxiety, OCD was still significantly associated with TAF. From these results the authors concluded that although TAF-likelihood is associated with anxiety, when controlling for levels of trait anxiety "TAF is more relevant for OCD than for any other anxiety disorder" (Muris et al., 2001, p851).

One study comparing the levels of TAF demonstrated by individuals with OCD and by individuals from clinical populations with other anxiety disorders, suggested that TAF-likelihood ratings were greater in OCD group than Panic Disorder, Social Phobia, non-patient control and depression groups, with no significant between group differences for moral-TAF (Abramowitz et al., 2003). However, using a mediational model to examine the results, the differing levels of anxiety and depression between the different anxiety groups appeared to be responsible for the difference in the TAF endorsement in the different groups. Higher levels of depression and anxiety appeared to underlie the higher level of TAF-likelihood in the OCD group, as controlling for negative affect the overall group differences disappeared (Abramowitz et al., 2003).

A relationship between anxiety and the erroneous belief that thoughts can influence actual events has been demonstrated by research into other anxiety disorders. Borkovec, Hazlett-Stevens and Diaz (1999) have noted that in Generalised Anxiety Disorder there is a high endorsement of superstitious belief that worrying about something makes it less likely to happen, and Hazlett-Stevens, Zucker, and Craske (2002) suggest that TAF might reflect certain meta-cognitive beliefs regarding the likelihood of negative events seen in pathological worry. The overlap between worry and TAF has been considered in studies of the TAFS. Hierarchical regression analyses have shown that all subscales of the TAFS (Shafran et al., 1996) are significantly related to obsessive features, even after controlling for the effects of worry, however, when obsessive features were controlled for, TAF-likelihood and TAF-moral subscales of the TAFS were not related to worry (Coles et al., 2001). From this study, TAF appears to be more strongly associated to obsessive features,

and intolerance of uncertainty more strongly related to worry (as a component of GAD).

Depression has also been suggested to affect the interpretation of intrusive thoughts and lead to a more pessimistic TAF-like explanation of intrusions (Rachman, 1997). As with the findings for the relationship between TAF and anxiety disorders varied results have been reported. It is suggested that TAF-moral, and not TAF-likelihood, is associated with depression (Abramowitz et al., 2003; Amir et al., 2001). However, another study has reported that TAF-likelihood is significantly associated with depression (despite controlling for the influence of anxiety) when investigating TAF in an adolescent sample (Muris et al., 2001). Overall, in view of the more general nature of TAF-moral, it is suggested that TAF-moral is associated with commonly experienced depressive symptoms, which are not specific to individuals with clinical depression (i.e. general distress) (Shafran et al., 1996).

Finally, the stability of TAF as a cognitive bias has also been called into question. Despite Shafran and colleagues' (1996) original assertion that TAF was a highly reliable construct, further study examining the temporal stability of the TAFS produced results that suggested TAF is an unstable bias and is highly susceptible to change (Rassin, Merckelbach et al., 2001). Correlational analyses do however indicate that TAF exhibits some kind of temporal stability in OCD that was hardly, or not, demonstrated in any other anxiety disorders (Rassin, Diepstraten et al., 2001).

Overall, the weight of evidence suggests that TAF-likelihood is not specific to OCD, but is also a feature of other anxiety disorders. It may be that TAF is

broadly relevant to all anxiety disorders, with a role similar to an attentional bias (a phenomenon which also occurs widely in other anxiety disorders). However, this does not exclude the possibility that TAF is implicated more in the aetiology of OCD than other anxiety disorders (Rassin, Merckelbach et al., 2001). Alternatively, the association between TAF-likelihood and OCD may be a result of pathological anxiety associated with OCD. TAF-likelihood appears to be more persistent in OCD (Rassin, Diepstraten et al., 2001), and controlling for levels of trait anxiety, TAF-likelihood appears to be more relevant to OCD than other anxiety disorders (Muris et al., 2001). Further research to determine the relationship of TAF, OCD symptoms and other anxiety disorders is required.

4. Magical thinking and OCD

4.1. Magical qualities of OCD

An association between magical thinking and OCD has been suggested over many years, however little research has directly addressed the relationship between them (Emmelkamp & Aardema, 1999), and the construct of magical thinking has largely been at the periphery of research into OCD (Einstein & Menzies, 2004). Recently, several research groups have noted the similarity of magical thinking to the prevalent cognitive account of TAF in OCD (Amir et al., 2001; Einstein & Menzies, 2000, 2004).

The term "magic" is difficult to define, as it is culturally determined and is also used to cover a variety of related phenomena (Bolton, Dearsley, Madronal-Luque & Baron-Cohen, 2002). Within Western culture the generally accepted

definition of magical thinking refers to beliefs that involve the attribution of causal effects on real events, by either a thought or an action, that is physically unconnected to these events, and which defy culturally accepted laws of causality (Zusne & Jones, 1989). For example, a person may hold a belief that touching a particular object when talking about the outcome of a particular event, (say an exam) will prevent a bad outcome (failing the exam), despite the action having no causal relationship and being physically unconnected to the event (sitting the exam). Different subtypes of magical thinking can be further defined (Subbotsky, 2001; Zusne & Jones, 1989), however, this is beyond the scope of this review. It is important to note that the definition of magical thinking is distinct from that of normal mental causation. In normal mental causation a thought is connected to an event in a way that is related by a causal relationship (e.g. to think about picking up an object and then picking it up).

Despite early theorists suggesting that magical thinking is found with children and declines with age as they develop a more sophisticated understanding of the world (Piaget, 1929, as cited in Bolton et al., 2002), research has demonstrated that young children are able to distinguish fantasy from reality in many contexts (Bolton et al., 2002). However this awareness may be confined to verbal judgements as children demonstrate a stronger credulity towards magic in their behaviours (Subbotsky, 2004a). Similarly, magical beliefs remain powerful in adults' behaviours, and are demonstrated in highly educated Western individuals (Subbotsky & Quinteros, 2002; Zusne & Jones, 1989), refuting the assumption that magical beliefs are associated with poor science education (Subbotsky, 2004b). Again, in experimental studies, despite adults demonstrating magical beliefs in their behaviour, magical beliefs are often not evidenced verbally (Subbotsky, 2001). This is possibly

because adult participants believe that experimenters expect them to show rational and logical thinking (Subbotsky, 2004b).

Superstitious thought and behaviour also fits the definition of "magical thinking", where thoughts and actions are unconnected to the external events that they are believed to be able to influence. Superstition is a cultural factor suggested to play a possible role in OCD (Sica, Novara & Sanavio, 2002). Both obsessive-compulsive behaviour and superstitious behaviour share the belief that rituals, magical beliefs and thoughts can influence external events (Sica et al., 2002). In clinical situations it has been observed that superstitious behaviour often closely resembles obsessive-compulsive phenomena, and that obsessions and compulsions have some features in common with childhood superstition and rituals (Leonard, 1989). It is reported that superstitious belief is more closely related to obsessions than compulsions (Frost et al., 1993).

One hypothesis to explain the continued use of magical thinking in adult life is that it is used as a coping strategy in situations where little control can be exercised over external events (Zusne & Jones, 1989). Magical thinking is commonly demonstrated under such situations, for example, in games of chance (Weisz, 1981), illness (Taylor, 1983) and death (Persinger & Makarec, 1990). The effect of an experience of a loss of control for an individual is well documented, and where it is lost individuals experience anxiety, helplessness and a consequent giving up of action (Bandura, 1977). Perceived lack of control over life circumstances is also related to the development of psychopathology (Sica et al., 2002). Magical thinking may therefore function as a resource or coping strategy for restoring a sense of

control, in a sense providing an opportunity to provide an "illusion of control" (Bolton et al., 2002) when dealing with problems in personal, social or emotional life (Subbotsky, 2004b). Some theorists have suggested that the illusion of control is a typical feature of the human mind and has an important adaptive function (Zusne & Jones, 1989). Similarly, superstitious belief tends to arise when individuals do not feel fully in control of circumstances, and is correlated with an overestimation of threat (Sica et al., 2002).

Some researchers have noted that the form of high anxiety coping that is apparently most connected with magical thinking is obsessive-compulsive behaviour (Bolton et al., 2002). Clinical observation supports the presence of magical thinking in OCD (Yaryura-Tobias & McKay, 2002). If magical thinking is simply a means of restoring a sense of control where control is otherwise lacking then it is unclear why individuals with OCD should demonstrate a greater degree of magical thinking than other people. Perceived loss of control of thoughts is a particularly key complaint in OCD (Purdon & Clark, 2002), however it is also a component of other anxiety disorders, including Post-Traumatic Stress Disorder (PTSD), Generalised Anxiety Disorder (GAD), trait anxiety, and to some degree in depression (Purdon & Clark, 2002; Sica et al., 2002).

However, in view of the apparent "magical" nature of many of the behaviours in OCD, from the interpretation of the significance of intrusions, to the, at times, bizarre compulsions and rituals that individuals feel compelled to undertake in response to their intrusive thoughts, there appears to be a plausible (if only surface) validity to the association between magical thinking and OCD. It is possible that

magical thinking contributes to the cognitive bias that underlies the overestimation of the importance, and perceived threat of intrusions (Sica et al., 2002). Some researchers even go so far as to suggest that certain cognitive biases described in current cognitive models of OCD may be more specific forms of a more general "magical thinking" (Amir et al., 2001). The overestimation of the Importance of Thoughts cognitive domain identified by the OCCWG (1997, 2001) comprises interpretations and beliefs that have also been described as magical thinking and TAF (Thordarson & Shafran, 2002).

4.2. Magical thinking, TAF, and OCD

Until recently, magical thinking and TAF have been researched as separate areas. The focus of OCD research has been to identify cognitive biases that contribute to the aetiology and maintenance of the disorder. TAF is suggested as one of the main contenders for the cognitive distortion that links the experience of intrusive thoughts to beliefs regarding their significance, resulting in mood disturbance and compulsive behaviour. Magical thinking, conceptualised as a facet of schizotypy, was similarly confined to studies of schizotypy.

However, the definition of TAF: a "tendency to assume incorrect causal relationships between one's own thoughts and external reality" (Rassin et al., 1999, p. 232) can be subsumed by the broader general definition for magical thinking, and recently researchers have noted that although "the relationship between TAF and magical thinking is unclear, the two concepts clearly overlap to some degree" (Wiegartz, Carmin & Pollard, 2002, p345). How this overlap manifests itself is unclear. It has been suggested that TAF-likelihood is a more specific form of general

magical thinking (Amir et al., 2001; Rassin, Diepstraten et al., 2001), and that individuals with OCD may also have beliefs about the magical properties of objects as a consequence of the "general form" of magical thinking (Amir et al., 2001). Others argue that the concept of magical thinking has been applied to OCD under the rubric of TAF (Yaryura-Tobias & McKay, 2002), and that magical thinking is a "particularly strong form of TAF in which the obsessive thought content and/or process has no logical relationships to the feared outcome" (Warren, Gershuny & Sher, 2002, p.345). It is also suggested that TAF is linked to developmentally normal magical thinking (Bolton et al., 2002).

The major difference in the definition of TAF and of magical thinking is that magical thinking refers to a belief that rationally unconnected thoughts and actions can alter events in reality in both a negative and a positive way (Bolton et al., 2002). However, according to the threat-based account of OCD, the definition of TAF is confined to the disastrous consequences about negative events, and is constrained to applying to disturbing (negative) intrusive thoughts. Positive events, as the focus of TAF, are argued to be of little relevance to obsessive-compulsive symptoms.

During the development of the TAFS, Shafran et al. (1996) found no evidence that individuals with obsessive-compulsive symptoms demonstrated positive skewing for questions concerned with the likelihood of positive events (for example, the belief that thinking about a winning lottery ticket made it more likely to happen), and consequently eliminated them from their research. The TAFS is skewed to the extent that it only appears to apply to negative and untoward events. Situations

where individuals believe that positive thoughts might influence a positive outcome are considered to be indicative of a more general bias than for situations of OCD.

Theoretically, it may be argued there is no basis to suppose that individuals with OCD demonstrate a cognitive bias predisposing them to believe in positive gain from their thoughts (e.g. an increased chance of winning the lottery). However, implicit in compulsive actions (in particular neutralisation) is the positive thought, or belief, about harm prevention as a consequence of the act. In a correlational study Amir et al. (2001) found that high and low OCD groups differed in their ratings of the likelihood of harm prevention resulting from their thoughts. They concluded that this might be related to the high OCD group's beliefs about positive outcomes from their harm prevention efforts. Surprisingly, they also found that high and low OCD groups differed in their ratings of the probability of positive events (such as the example of winning the lottery) happening as a result of their thoughts. This suggests that the fusion of thoughts and actions may not be confined to negative and untoward events in OCD. Instead TAF-like biases or magical thinking may be more general, and relate to situations other than the threat-based account of the interpretation of intrusive thoughts in OCD.

4.3. Evidence for magical thinking in OCD

Research has suggested that there are two separate elements to magical thinking. One element is related to disgust and the other related to the form of magical thinking associated with schizotypy (Gordon, 2003). In psychological studies of disgust (Rozin, Millman & Nemeroff, 1986) and fear of contagion (Rozin, Markwith & Nemeroff, 1992), normal participants demonstrate magical beliefs

regarding the properties of objects (sympathetic magic), where there are perceived threats to their personal welfare (Subbotsky, 2001). However, these magical beliefs do not appear to be related to measures of TAF, OCD symptoms, or schizotypal magical thinking (Gordon, 2003). Schizotypal magical thinking is concerned with superstitious belief, paranormal item, thought fusion, unusual perceptual experiences, thought transmission, and indirect influence (Vyse, 1997).

Magical thinking as a facet of schizotypy does, however, appear to be related to OCD symptoms (Gordon, 2003). In studies of schizotypy, magical thinking has been demonstrated to be associated with OCD (Norman, Davies, Malla, Cortese & Nicholson, 1996) and a number of clinical studies have investigated this association (Kozak & Foa, 1994; Tolin, Abramowitz, Kozak & Foa, 2001). There is debate as to whether OCD is more accurately conceptualised as an anxiety disorder, or a form of schizotypy, however, this is beyond the scope of this review (see Tolin et al., 2001).

A recent study has investigated the association of TAF with schizotypy and with OCD symptoms in an analogue sample (Lee et al., in press). The study used the Schizotypal Personality Scale (Claridge & Broks, 1984), which consists of three subscales: paranoid ideation, unusual perceptual events and magical thinking. Using a multiple regression model only magical thinking significantly predicted TAF-likelihood (none of the indices predicted TAF-moral), and magical thinking was also significantly associated with OCD symptomatology. In contrast to Einstein and Menzies (2004) result, magical thinking was no longer significant in predicting OCD symptoms when TAF-likelihood was entered into the model, and the results suggest that TAF-likelihood has a mediational role in explaining the relationship between

magical thinking and OCD (Lee et al., in press). The study also considered whether elevated anxiety and distress among those displaying schizotypal traits (which included magical thinking) was responsible for the positive association with TAF-likelihood, and found that the positive association remained even after controlling for anxiety and depression. In the regression model schizotypal traits were found to be a potent predictor of OCD symptoms relative to depression or general anxiety (Lee et al., in press).

In another analogue study, Einstein and Menzies (2000) investigated the role of magical thinking in OCD by comparing the strength of relationships between OCD and measures of magical thinking, TAF, and superstitious beliefs and behaviours. The Magical Ideation Scale (MIS; Eckblad & Chapman, 1983) was used as a measure of magical thinking. Significant correlations were reported between the measures of OCD and measures of magical thinking, TAF-likelihood, superstitious beliefs and behaviours, and partial correlations were used to explore these relationships. When the measure of magical thinking was held constant, the correlations between the measures of obsessive-compulsive symptoms, TAF and superstition failed to reach significance, however the relationship between magical thinking and obsessive-compulsive symptoms remained significant when the other measures were held constant. The authors concluded that magical thinking appeared to be a core construct of OCD that underpinned the association of OCD symptoms with TAF and superstitious belief.

Einstein and Menzies replicated their original analogue study (Einstein & Menzies, 2000) with a clinical sample of OCD individuals (Einstein & Menzies,

2004). Again the MIS was found to be most strongly associated with obsessive-compulsive symptoms, and partial correlations suggested that TAF-likelihood and superstitiousness were related to OCD symptoms largely by virtue of their relationship with magical thinking. The association of TAF-moral with magical thinking appeared to be less straightforward. In their earlier study using an analogue sample, no significant association was found between the MIS and TAF-moral or obsessive-compulsive features, however, the clinical sample demonstrated a significant correlation between TAF-moral and both magical thinking and obsessive-compulsive symptoms, although again this association appeared to be mediated by magical thinking (Einstein & Menzies, 2004).

The results reported by Amir and colleagues (2001), that the fusion of thoughts and actions are not confined to the disastrous consequences of thoughts about negative events, also supports the association of magical thinking and OCD, as individuals who scored highly on measures of OCD also believed that their thoughts about positive events were capable of producing positive outcomes.

Results from studies investigating the association of magical thinking to OCD and other anxiety disorders in child and adolescent samples also support the hypothesis that magical thinking is associated with obsessive-compulsive thoughts and behaviours. Significant correlations were reported between OCD symptoms and and a measure of magical thinking that was specifically designed for the population (Bolton et al., 2002). However, whilst the female sample only demonstrated a positive correlation for the measure of magical thinking with obsessive-compulsive symptoms, the male participants also demonstrated strong correlations between the

magical thinking measure and measures of separation anxiety, panic-agoraphobia, and generalised anxiety, in addition to the correlation between magical thinking and OCD symptoms. The male sample also demonstrated a considerable fluctuation in magical thinking with age, which was not found in the analysis of the responses from the female participants. The authors did not expect this result, and were unable to suggest any explanation for the gender effect, although drew attention to the need to replicate the finding before further studies were undertaken.

Unfortunately, as with many of the studies investigating the association of TAF in OCD, both the Einstein and Menzies (2000, 2004), and Amir et al. (2001) research groups failed to included measures of anxiety or depression in their studies. Although TAF is suggested to be of greater relevance to OCD than other anxiety disorders (Muris et al., 2001; Rassin, Diepstraten et al., 2001), as was discussed previously, studies have also demonstrated a strong association between TAF and other anxiety disorders in addition to OCD. TAF-likelihood is also suggested to be associated with depression, although other studies have failed to demonstrate this association (e.g. Lee et al., in press). It is therefore important that anxiety and depression are taken into account when studying the association of magical thinking to OCD.

Further research is required to determine whether magical thinking is specific to OCD. Considering the association of TAF with other disorders, and the theoretical similarity between the concepts of TAF and magical thinking, it is possible that magical thinking is related to anxiety or depression and is not a specific core feature of OCD. In addition, considering the conflicting results of Einstein and Menzies

(2004) and Lee et al. (in press) further research is necessary to determine the relationship of TAF-likelihood, magical thinking and OCD.

5. Discussion

5.1. Magical thinking and Thought-Action Fusion

The literature concerned with magical thinking, TAF and OCD is difficult to integrate. Certainly, considering presentations of OCD, it is intuitively plausible that there is an association between the endorsement of magical beliefs and the development and maintenance of OCD. Yet little research has been conducted to consider if this association truly exists. One suggestion has been that magical thinking is a facet of schizotypy that may put one at greater risk for displaying the cognitive bias of TAF-likelihood, which in turn may increase one's risk for OCD (Lee et al., in press).

Despite considerable research using the concept of TAF, how TAF should be regarded remains unclear. There is mixed evidence for the specificity of TAF as a cognitive bias in OCD. TAF also appears to be present in other disorders, in particular anxiety disorders (Rachman & Shafran, 1999). However, TAF has been found to underlie the cognitive attempts at Thought Suppression (Abramowitz et al., 2003), suggesting that it may have a primary role in OCD. TAF-likelihood, opposed to TAF-moral, appears to be more central in OCD.

Questions remain as to whether there is something different about TAF in OCD compared with other disorders. Despite the reported associations between TAF and anxiety, when controlling for levels of trait anxiety, TAF is suggested to be more

relevant to OCD than other anxiety disorders (Muris et al., 2001). When controlling for the effect of worry, TAF appears to be more strongly associated with obsessional features, whilst worry is more strongly associated with the intolerance of uncertainty (Coles et al., 2001).

It may be that TAF is a cognitive bias that is related to other psychopathology including anxiety disorders, or even that it is a general cognitive bias that we are all prone to. Increased levels of depression and anxiety demonstrated by individuals with OCD may account for the apparent association between TAF and OCD where studies have failed to incorporate measures of mood (particularly anxiety) as control variables. It is vital that research in this area considers the potential confounding impact of anxiety and mood, and controls for this accordingly. Unfortunately a number of key studies that have highlighted the association between OCD and TAF have failed to do this (e.g. Amir et al., 2001; Shafran et al., 1996).

Although there appears to be a close association between the concept of TAF and magical thinking, how the two concepts are associated is unclear. Some researchers consider TAF to be a subset of a broader category of magical thinking (Amir et al., 2001), and others that magical thinking is a very strong form of TAF (Yaryura-Tobias & McKay, 2002). TAF fits the definition of magical thinking; that "the attribution of causal effects on real events, either by thought or action, that is physically unconnected with these events and defy culturally accepted laws of causality" (Zusne & Jones, 1989). Correlational studies have suggested that magical thinking is a core construct in OCD underpinning the association of TAF and OCD (Amir et al., 2001; Einstein & Menzies, 2004). However, these studies failed to

control for the effect of anxiety in their samples. Another study investigating the association of magical thinking (as a component of schizotypy) with TAF-likelihood suggested that TAF-likelihood has a mediational role in explaining the relationship between magical thinking and OCD symptoms (Lee et al., in press).

Where anxiety has been considered (using a child and adolescent sample) correlations were found between magical thinking and other anxiety disorders, in addition to OCD, with the male participants (Bolton et al., 2002). The authors highlighted that in future studies it is important to assess the specificity of magical thinking to OCD by using control groups of other anxiety disorders. Without controlling for anxiety it is unclear whether magical thinking is specific to OCD. Magical thinking may simply be a normal response to certain mood states or situations, for example a product of anxiety or a response to a sense of absence of control over events. The reported association of magical thinking with OCD may be a result of anxiety evoked by the experience of obsessive-compulsive behaviour. Further research is required to investigate whether individuals with OCD have raised levels of magical thinking (Bolton et al., 2002).

There is some limited evidence that there is a positive relationship between the extent of people's belief in magical causation and certain symptoms associated with psychopathology. People who experience higher levels of psychopathology are reported to be more likely to believe in the reality of causal connections that are not, according to generally accepted concepts, causally connected, and this has been demonstrated in depression (in addition to other disorders) (Presson & Benassi, 2003). One proposed explanation for this finding is that there is a link between

symptoms of psychopathology, and attempts at establishing a sense of control over situations that are not under a person's control. Establishing an illusion of control has also been suggested as a coping mechanism that operates under conditions of high anxiety, and in particular has been suggested to operate in OCD to maintain a sense of control, and this may be a possible explanation for why magical compulsive behaviour and neutralisation is seen in OCD (Bolton et al., 2002). However, from this explanation one would expect that same behaviour in response to anxiety to be demonstrated in both anxious individuals and normal controls.

5.2. Neutralisation

The considerable research into TAF in OCD has considered it to be a bias that has a negative focus and that is relevant only to the development and maintenance of intrusive thoughts. However, the definition of magical thinking is not restricted to negative events. Nor does it apply only to mental events and the interpretation of thoughts. Amir et al. (2001) found that individuals scoring highly on measures of OCD not only endorsed beliefs concerned with the probability of negative and untoward events increasing as a consequence of their thoughts (as with the definition of TAF), but also demonstrated beliefs that their thoughts could influence the likelihood of positive outcomes and harm avoidance. They concluded that magical beliefs "may be more general than relating only to [the interpretation of intrusions in] OCD" (Amir et al., 2001, p775). A measure of magical thinking designed for a child and adolescent sample that was not restricted to negative events was also found to correspond closely to TAF-likelihood (Bolton et al., 2002). However, if Amir et al.'s (2001) suggestion that TAF is a specific form of more 'general' magical thinking demonstrated by individuals with OCD is correct, then it

is unclear how this might relate to the hypothesis about magical thinking being used to maintain an illusion of control.

There often appears to be a 'magical' quality to the clinical presentation of compulsions, rituals and neutralising behaviour demonstrated by individuals with OCD. The definition of a compulsion, according to the *DSM-IV*, clearly states that the behaviours and mental acts are not connected in any realistic way to what they are designed to neutralise or prevent (APA, 1994). It may be that individuals with OCD, in addition to endorsing negative beliefs concerning threats from intrusive thoughts, are also more likely to endorse beliefs involving magical thinking than non-OCD individuals. It has been noted that individuals with OCD may hold beliefs that they can do something to counter the negative outcome from an intrusive thought (Rachman & Shafran, 1999). Magical beliefs often appear to be demonstrated in behaviour to avoid harm (possibly the potential harm from the TAF of their intrusions). Examining neutralisation, compulsions, and harm avoidance behaviour may be informative in considering whether TAF is actually a specific form of magical thinking, and that other forms (e.g. neutralisation behaviour and physical rituals) are also specific forms of the same general concept.

Despite the key role that neutralisation is hypothesised to play in the maintenance of OCD (Rachman et al., 1996; Salkovskis, 1985) there has been little research conducted concerning the beliefs that are associated with neutralisation. Using the same methodology that compared normal and abnormal intrusive thoughts in Rachman and de Silva's (1978) classic study, research has compared normal compulsions in non-OCD individuals with abnormal compulsions of individuals with

OCD (Muris et al., 1997). Similar to the results for intrusions, the majority of normal subjects reported rituals and compulsive behaviours the content of which closely corresponded to the content of abnormal compulsive behaviour seen in OCD. Abnormal compulsions were, however, experienced as more frequent, more intense and elicited more discomfort and resistance, and were more often associated with a distressing thought or mood than their 'normal' counterparts (Muris et al., 1997). It is unclear why this should be the case, but as for intrusions, it may be due to the beliefs that are associated with the compulsive behaviour.

5.3. Experimental paradigms

One of the difficulties with investigating the role of magical thinking and TAF is the accessibility of such beliefs. Most studies rely on questionnaire methods, accessing beliefs through verbal self-report. This is not helped by the paucity of available measures that are often not well established, validated, nor the psychometric properties well established. One experimental investigation into the presence of magical beliefs in adults reported that participants often exhibited more magical strategies in their behaviours than they alluded to in their verbal report (Subbotsky, 2001). This highlights the difficulty of relying on verbal self-report measures when investigating magical beliefs.

The correlational nature of the majority of studies has also limited the conclusions that can be drawn. Despite the difficulty of inducing TAF in an experimental setting, a few limited experimental paradigms have been developed, most notably that of Rachman and colleagues (1996), which, despite its limitations, has been the most widely used experimental paradigm to study the effect of TAF

(van den Hout, Kindt, Weiland & Peters, 2002; van den Hout, van Pol & Peters, 2001; Rachman et al., 1996; Zucker, Craske, Barrios & Holguin, 2002). The experiment involves participants writing out a sentence designed to induce TAF, namely hoping that harm befalls a close friend or relative. The majority of studies have used samples that are pre-selected as demonstrating high levels of TAF (Rachman et al., 1996; Zucker et al., 2002). The paradigm has been used with samples that were not selected as predisposed to endorsing TAF, and it appeared to evoke an increase in anxiety and the emergence of an urge to neutralise (van den Hout et al., 2002; van den Hout et al., 2001). However, none of these studies considered the contribution of anxiety in the success of TAF induction. If the apparent association between OCD and TAF is in fact mediated by trait (or state) anxiety then it is important to examine this in the use of the paradigm.

5.4. Further Research

It is unclear how magical thinking and TAF relate to each other, and further research is required to investigate this relationship. It is important that this research controls for the influence of anxiety when considering the relationship of magical thinking with OCD, to determine whether magical thinking is specific to OCD or whether it is a more general response to state or trait anxiety.

As the majority of results to date are reliant on questionnaire measures it is important to develop valid experimental methods to investigate both TAF and magical thinking. A few paradigms do exist, most notably that of Rachman et al. (1996), but whether these paradigms truly model phenomena associated with OCD warrants further research.

In addition, considering the theoretical importance of neutralising behaviour, there is sparse research in this area (Freeston & Ladouceur, 1997). The use of experimental paradigms to investigate neutralising behaviour may further increase our understanding of the phenomenology of OCD. In particular, investigating the forms of neutralising (both overt and covert) behaviour may give clues as to whether some form of magical thinking, perhaps similar to that demonstrated in the TAF bias, is also involved in the development and maintenance of neutralising behaviour in response to intrusive thoughts.

6. Conclusion

In conclusion, despite Einstein and Menzies (2000, 2004) suggestion that magical thinking is a central cognitive feature of OCD, this literature review has highlighted that currently there is insufficient evidence to support this hypothesis.

It appears that the extensively studied cognitive bias of TAF-likelihood may be related to magical thinking, however, how this relationship manifests itself is unclear. Studies to date suggest that although TAF may be more relevant to OCD, it does not appear to be specific to it. However, there is evidence that TAF has a primary role in OCD. As subsequent studies into the relationship of magical thinking with OCD have failed to control for the effect of anxiety, it is not clear whether magical thinking is specific to OCD, or is a more general cognitive bias that may occur in response to anxiety or under conditions of uncertainty.

Finally, the literature review considered whether magical thinking might be associated with compulsive or neutralising behaviour performed in response to intrusive thoughts. There is some sparse evidence from Amir et al. (2001) that individuals with OCD endorse positive TAF beliefs concerned with positive outcomes and most importantly harm avoidance although again the study failed to control for anxiety. This would be an important area for further study.

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Empirical Paper

The Association of Magical Thinking and Obsessive-Compulsive Disorder:

An Experimental Investigation of Neutralising Behaviour

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(see appendix B for Notes to Contributors)

The Association of Magical Thinking and Obsessive-Compulsive Disorder:

An Experimental Investigation of Neutralising Behaviour

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The Association of Magical Thinking and Obsessive-Compulsive Disorder: An Experimental Investigation of Neutralising Behaviour

Abstract

It is suggested that magical thinking is a core concept of Obsessive Compulsive Disorder (OCD), and may underpin the cognitive bias of Thought-Action Fusion (TAF) in OCD. Magical thinking is also suggested to be associated with harm avoidance and neutralising behaviour in response to OCD. This study investigates whether the use of neutralising behaviours in response to a TAF-induction experiment is related to magical thinking. In a sample of 50 undergraduate students, 74.0 % of participants demonstrated a least one form of neutralising behaviour in response to the TAF-induction. The individuals that neutralised demonstrated significantly greater levels of magical thinking, however there was no difference in the level of OCD symptoms. Magical thinking was positively associated with OCD symptoms, although the magnitude of the correlation was smaller than reported in previous studies. This association was no longer significant when controlling for the effect of anxiety. Magical thinking also appeared to be more relevant for certain subtypes of OCD. Unexpectedly, TAF-likelihood was not associated with OCD symptoms, but there was a significant association between TAF-moral and OCD symptoms. The results are critically discussed in the context of whether the TAF-induction experiment is a suitable model of OCD.

The Association of Magical Thinking and Obsessive-Compulsive Disorder: An Experimental Investigation of Neutralising Behaviour

1. Introduction

1.1. Cognitive theory of Obsessive-Compulsive Disorder (OCD)

A number of recent studies have suggested that magical thinking may be related to both obsessions and harm avoidance behaviour in OCD (Einstein & Menzies, 2000, 2004; Amir, Freshman, Ramsey, Neary & Brigidi, 2001). This study explores magical thinking as a characteristic of obsessive-compulsive symptomatology in a non-clinical sample. Obsessions and compulsions that are indistinguishable in content to those seen in Obsessive-Compulsive Disorder (OCD) are demonstrated in the general population (Freeston, Ladouceur, Thibodeau & Gagnon, 1991; Muris, Merckelbach, & Clavan, 1997; Rachman & de Silva, 1978; Salkovskis & Harrison, 1984). According to cognitive theory what appears to distinguish the experience of normal intrusive thoughts from clinical intrusions is the significance that individuals with OCD ascribe to the content of the thoughts. In OCD cognitive biases are hypothesised to operate on the normal intrusive thoughts. These biases overestimate the threat posed by the intrusive thoughts, and contribute to feelings of responsibility, and concerns about responsibility and harm (Rachman, 1998; Salkovskis, 1999). As a result of these catastrophic appraisals, individuals with OCD interpret intrusive thoughts as important, personally relevant and threatening (Rachman, 1997).

There is a general consensus in cognitive theory that neutralising behaviour plays an important role in maintaining intrusive thoughts. The definition for neutralisation used in this study is that described by Freeston and Ladouceur (1997); that neutralisation is "a voluntary, effortful cognitive or behavioural act that is directed at removing, preventing and attenuating the intrusive thought and the associated discomfort" (Freeston & Ladouceur, 1997, p344). A distinction is made between neutralisation and general coping responses, with coping responses to intrusive thoughts considered to be less specific and concerned with addressing the thought's presence and associated discomfort (for example, to deal with the anxiety associated with the thought) (Freeston & Ladouceur, 1997). One of the hypothesised roles of neutralisation in OCD is that neutralising activities are connected to the subjective meaning of the intrusive thought and are believed to be able to prevent the consequence foreseen by the thought's content in some causal way (Rachman & de Silva, 1978; Freeston & Ladouceur, 1997). Performing an action that is not realistically connected to an event to undo a different action appears to be a normal phenomenon and is not restricted to individuals with OCD (Freeston et al., 1991; Muris et al., 1997; Rachman, Shafran, Mitchell, Trant & Teachman, 1996). Key to both the misinterpretation of intrusive thoughts and the use of neutralising behaviours in OCD are the beliefs that accompany both aspects of the disorder.

One of the candidates for the cognitive bias that underlies the catastrophic misinterpretation of intrusive thoughts in OCD is Thought-Action Fusion (TAF; Rachman, 1993). TAF can take two forms, the first that a thought and action is morally equivalent (TAF-moral) and the second that that having a thought about an unacceptable or disturbing event makes it more likely to happen in reality (TAF-

likelihood). Early research further divided TAF-likelihood into the likelihood of harm for one's self increasing as a consequence of an intrusive thought (TAF-likelihood-self) and an increased likelihood of harm happening to others (TAF-likelihood-others) (Rachman, Thordarson, Shafran & Woody, 1995). The Thought-Action Fusion Scale (TAFS; Shafran, Thordarson & Rachman, 1996) was developed to measure TAF beliefs and is composed of subscales measuring TAF-moral, and the two TAF-likelihood subscales. Subsequent factor analysis of this measure has suggested that a two-factor solution for the TAFS is more appropriate (Shafran et al., 1996; Yorulmaz, Yilmaz & Gencoz, in press) comprising TAF-moral and the two TAF-likelihood scales combined into a single factor. Support for the two-factor solution of the TAFS has been reported for samples of OCD, other anxiety disorders, in student samples and in normal control groups (Lee, Cougle & Telch, in press; Rassin, Diepstraten, Merckelbach & Muris, 2001; Rassin, Merckelbach, Muris & Schmidt, 2001).

There is empirical support for the association of TAF-likelihood in both clinical and analogue samples (Amir et al., 2001; Rassin, Deipstraten et al., 2001; Rassin, Merckelbach et al., 2001; Shafran et al., 1996; Yorulmaz et al., in press). TAF-likelihood has been demonstrated to be a primary precursor in the development of obsessions (Rassin, Muris, Schmidt & Merckelbach, 2000), and has also been demonstrated to exacerbate intrusive thoughts (Rassin, Merckelbach, Muris & Spaan, 1999). Individuals with high levels of OCD symptoms demonstrate higher levels of TAF-likelihood than individuals with low levels of symptoms (Amir et al., 2001; Shafran et al., 1996). TAF-likelihood is also reported to be associated with other anxiety disorders (Rachman & Shafran, 1999) and a similar cognitive distortion,

Thought Shape Fusion, has been identified in eating disorders (Radomsky, de Silva, Todd, Treasure & Murphy, 2002). TAF-likelihood, therefore, does not appear to be a cognitive bias specific to OCD but may be a general feature common to anxiety disorders (Rassin, Merckelbach et al., 2001) and associated with pathological worry (Hazlett-Stevens, Zucker & Craske, 2002), although it appears to have a greater relevance in OCD than other anxiety disorders (Muris, Meesters, Rassin, Merckelbach & Campbell, 2001). The majority of studies concerned with TAF have failed to find significant correlations between TAF-moral and OCD (Amir et al., 2001; Coles, Mennin & Heimberg, 2001; Rassin, Diepstraten et al., 2001; Rassin, Merckelbach et al., 2001), although contrary results have also been reported (Yorulmaz et al., in press). It has been suggested that TAF-moral may be less pathological and is therefore of less relevance to OCD (Abramowitz, Whiteside, Lynam & Kalsy, 2003; Clark, Purdon & Byers, 2000).

1.2. Magical thinking in OCD

Research into the cognitive theory of OCD has focussed on identifying cognitive biases that operate in the disorder and TAF has been well researched over the past decade. Amongst the other areas of investigation, a number of studies have reported that schizotypal traits are associated with OCD symptoms (Lee et al., in press; Norman, Davies, Malla, Cortese & Nicholson, 1996; Sobin et al., 2000; Tolin, Abramowitz, Kozak & Foa, 2001), and it has been noted that TAF-likelihood and schizotypy share similar cognitive distortions, in particular magical thinking (Bolton, Dearsley, Madronal-Luque & Baron-Cohen, 2002; Emmelkamp & Aardema, 1999; Muris & Merckelbach, 2003). Magical thinking refers to a belief system that is defined as the attribution of causal effects on real events, either by a thought or an

action, that is physically unconnected to these events, and which defies culturally accepted laws of causality (Zusne & Jones, 1989). Recently researchers have suggested that TAF-likelihood is a specific form of a more general "magical thinking" that is demonstrated by individuals with OCD (Amir et al., 2001; Einstein & Menzies, 2000, 2004), and that magical thinking has been studied under the rubric of TAF (Yaryura-Tobias & McKay, 2002). Magical thinking is an under researched area of OCD (Yaryura-Tobias & McKay, 2002) and has primarily received attention in studies of schizoypy. Unlike TAF, magical thinking is not constrained to only applying to negative and untoward events.

It is difficult to determine the relationships between magical thinking, TAF-likelihood, and OCD from schizotypy research. Magical thinking is identified as only one of the facets of schizotypy and the majority of studies combine magical thinking with other schizotypy indices. Where studies have investigated the association of magical thinking and OCD conflicting results have been reported. Correlational studies from one research group (Einstein & Menzies, 2000, 2004) have suggested that magical thinking is a central construct in OCD underpinning the associations of OCD with TAF-likelihood and superstitiousness. In both analogue and clinical samples the Magical Ideation Scale (MIS; Eckblad & Chapman, 1983) used to measure magical thinking demonstrated the strongest correlation with obsessive-compulsive symptoms, and these correlations remained significant when controlling for TAF-likelihood and superstitiousness. However, the associations between TAF-likelihood and OCD, and superstition and OCD were no longer significant when controlling for magical thinking. Other results (Lee et al., in press) have suggested that magical thinking might be a facet of schizotypy that puts one at a greater risk for

displaying the cognitive bias of TAF-likelihood, which in turn may increase one's risk for OCD. Investigating the association between TAF-likelihood and schizotypal traits, significant positive associations were found between magical thinking and OCD symptoms and between magical thinking and TAF-likelihood, and these associations remained significant after controlling for anxiety and depression. However, the relationship between magical thinking and OCD symptoms was no longer significant after controlling for TAF-likelihood. Therefore, although evidence suggests that TAF-likelihood, magical thinking and OCD are associated, it is unclear exactly how they relate to each other.

Research suggests that in OCD magical thinking is more associated with obsessional thoughts than compulsive behaviours (Tolin, Abramowitz, Kozak & Foa, 2001) and the majority of research into magical thinking has examined its association with obsessions. However, in the fourth edition of the Diagnostic and Statistical Manual for Psychiatric Disorders (*DSM-IV*) compulsions are defined as not realistically connected to the concern that they attempt to neutralise or prevent (American Psychiatric Association [APA], 1994) and Yaryura-Tobias and McKay (2002) suggest that magical thinking may be present in both obsessions and compulsions in OCD. Individuals with OCD have been noted to hold beliefs that they can do something to counter the negative outcome from an intrusive thought (Rachman & Shafran, 1999). Normal individuals with high levels of OCD symptoms endorse beliefs that both negative and positive outcomes (including the prevention of harm) are more likely as a consequence of their thoughts, which suggests that in OCD the fusion of thoughts and actions is not confined to disastrous consequences of thoughts about negative events (Amir et al., 2001). As magical thinking appears to be

associated with efforts to prevent harm, in OCD magical thinking may be associated with neutralising behaviour in response to intrusive thoughts.

To summarise, previous research suggests that magical thinking is of relevance to OCD; TAF-likelihood is associated with magical thinking, and magical thinking may be involved in response to intrusive thoughts. However, a number of questions arise. To begin with, it is unclear if magical thinking is specific to OCD. Considering the reported association of TAF-likelihood with anxiety, it is important to control for anxiety when investigating the association of magical thinking and OCD (Bolton et al., 2002). Magical thinking has been reported to be associated with other anxiety disorders in addition to OCD in a child and adolescent sample, although these associations were only demonstrated for the male sample (Bolton et al., 2002). Neither Einstein and Menzies (2004) or the Amir et al. (2001) research groups have considered the effect of anxiety in examining the association of magical thinking and OCD. Einstein and Menzies (2004) did note that the greatest associations between magical thinking and OCD occurred with the original Padua Inventory (PI; Sanavio, 1988) as a measure of OCD symptoms. The PI shares a considerable variance with worry (Wells & Papageorgiou, 1998; Burns, Keortge, Formea & Sternberger, 1996), and the Importance of Thoughts subscale of the PI, that demonstrates the greatest overlap with worry (Burns et al., 1996), demonstrated the strongest association with magical thinking. Magical thinking may therefore be involved to some extent with worry (Einstein & Menzies, 2004). Without considering the specificity of magical thinking to OCD and the potentially mediating role of anxiety, the suggestion made by Einstein and Menzies (2004) that magical thinking might be a core component of OCD is premature.

1.3. Experimental investigation of magical thinking and TAF

The majority of research into magical thinking and TAF has generally relied on self-report questionnaire based studies, as it is difficult to produce reliable and replicable demonstrations of unusual phenomena in experimental settings (de Silva, Menzies & Shafran, 2003). The use of verbal self-report in research has been criticised, and verbal report is particularly problematic with research into magical thinking, as a number of studies have demonstrated that even when magical beliefs are demonstrated in participant's behaviour, they are seldom evidenced in participant's verbal report (Subbotsky, 2001). In experimental settings participants may believe that they are expected to show rational and logical thinking and so are less likely to report magical beliefs (Subbotsky, 2004). Rather than relying on verbal report of magical thinking, experimental studies investigating participant's behaviours may be more appropriate to identify magical beliefs.

In an area where experimental methodologies for studying aspects of OCD are lacking, Rachman and colleagues (1996) developed a paradigm to experimentally induce TAF-likelihood to enable the study of obsessive neutralising. The paradigm involved participants writing out and visualising the sentence "I hope X is in a car accident" where X referred to a friend or relative who was close to the participant, and used Visual Analogue Scales (VAS) to measure anxiety and the urge to neutralise following the experimental task. According to the cognitive theory of OCD one would expect that TAF individuals who demonstrate increased levels of TAF are more likely to respond to a manipulation designed to generate an obsession like thought and urge to neutralise, therefore Rachman et al. (1996) used a high TAF sample in their original experiment. These participants demonstrated increases in

anxiety and an urge to neutralise in response to the experimental task. Participants who were instructed to neutralise following the induction demonstrated an immediate decrease in anxiety whilst participants who were instructed to do nothing demonstrated a spontaneous reduction in their anxiety, but over a longer time course. The authors concluded that as the results paralleled the experimental effect of exposure and response prevention with overt compulsive behaviour (Hodgson & Rachman, 1977), the paradigm provided a valid means of investigating OCD behaviour in an analogue population (Rachman et al., 1996).

Using Rachman et al.'s (1996) paradigm in a high TAF analogue sample, 63% of participants demonstrated at least one example of spontaneous neutralising behaviour (Zucker, Craske, Barrios and Holguin, 2002). Individuals who spontaneously used neutralising behaviours reported significantly greater guilt about writing out the sentence, rated writing out the sentence as morally more wrong, and felt that they would be more responsible should an accident occur prior to neutralising. Providing participants with an educational message about TAF prior to the TAF induction reduced the anxiety and urge to neutralise, however, it did not reduce the frequency of neutralising behaviours. The study did not examine whether the groups differed in degree of OCD symptoms, TAF or magical thinking, nor did it determine what effects the neutralising had on the inflated beliefs in the spontaneous neutralising group.

The paradigm offers an opportunity to study the kinds of neutralising behaviours performed in response to the TAF-induction, and whether any of these neutralising behaviours are associated with magical thinking and OCD symptoms. If

the experiment does induce TAF, and by its association magical thinking, then one would predict that it would be more successful in individual's demonstrating high levels of TAF-likelihood/magical thinking. The paradigm has been used with a normal sample, and the same pattern for anxiety and urge to neutralise was demonstrated as in Rachman et al.'s (1996) high TAF sample. However, it was unclear whether TAF scores relate to the success of the TAF-induction effect, as contradictory results have been reported (van den Hout, Kindt, Weiland & Peters, 2002; van den Hout, van Pol & Peters, 2001). Previous studies (Rachman et al., 1996; Zucker et al., 2002) have noted that participants use a range of strategies in response to the TAF-likelihood induction.

This study is concerned with identifying strategies that participants use in response to the TAF-induction, and whether the use of spontaneous neutralising responses is related to magical thinking in an analogue sample. Considering the findings of Einstein & Menzies (2004), that magical thinking is a core component of OCD this study is also concerned with the influence of anxiety and depression on the association between magical thinking, TAF-likelihood and OCD. The hypotheses and research questions for both aspects of the study are outlined below.

1.4. Hypotheses and research questions

The TAF-induction paradigm developed by Rachman et al. (1996) has been demonstrated to produce an increase in anxiety and urge to neutralise in a normal sample. Using this paradigm the following hypotheses and research questions were investigated.

1.4.1. Hypotheses:

1. Individuals will demonstrate neutralising behaviours in response to TAF-induction.
2. Magical thinking is significantly associated with OCD symptoms after controlling for the effect of trait anxiety and depression; replicating the results of Einstein & Menzies (2000, 2004) that magical thinking is a core feature of OCD.

1.4.2. Research Questions:

1. According to the cognitive theory of OCD it is predicted that levels of TAF will be related to the success of writing out a sentence to evoke TAF, resulting in an increased anxiety and an urge to neutralise. Therefore, is the increase in anxiety and urge to neutralise associated with the level of magical thinking, TAF-likelihood, and OCD symptoms?
2. As magical thinking is hypothesised to be associated with harm avoidance behaviour, do people who use neutralising strategies show more magical thinking, TAF-likelihood, and symptoms of OCD?
3. Is there a difference between the beliefs of people who use neutralising strategies, and people who do not use neutralising strategies with the TAF-induction?
4. Is magical thinking associated with some subgroups of OCD but not others?

2. Method

2.1 Participants

51 participants, 5 male and 46 female, completed the measures. All participants were undergraduate psychology students at the University of Southampton and received course credits in return for their participation in the study. One participant (female) was removed from the analysis according to exclusion criteria. Participants ranged in age from 18 to 38 years, the mean age of the sample was 20.7 years (S.D. = 4.3).

2.2. Exclusion criteria

Participants were excluded from the analysis of the TAF paradigm where the seriousness of the imagined accident and distress at imagining the experiment was rated at less than 50% on Visual Analogue Scales (VAS). The score of 50% on VAS was suggested by Rachman et al. (1996) to prevent a flooring effect on VAS. These exclusion criteria were selected for practical reasons as it was assumed that participants who did not imagine serious accidents and consequently were not distressed after generating an obsession-like thought, were not fully engaged in the TAF induction.

2.3. Measures

See appendix C for all measures used in this study (with the exclusion of the BDI and STAI).

2.3.1.The Thought-Action Fusion Scale-Revised (TAFS; Shafran, Thordarson & Rachman, 1996).

The TAFS is a 19-item self-report measure that assesses the tendency to fuse thoughts and actions. It consists of 19 items arranged into three subscales. Each item is rated on a 5-point scale ranging from 0 (disagree strongly) to 4 (agree strongly). Twelve items assess TAF-moral (e.g., Having violent thoughts is almost as unacceptable to me as violent acts); four items assess TAF-likelihood pertaining to others (e.g., If I think of a relative or a friend being involved in a car accident this increases the risk that he/she will have a car accident), and three items assess TAF-likelihood for oneself (e.g., If I think of myself becoming ill, this increases the risk of myself becoming ill). The total scores for TAF-moral, TAF-likelihood-others and TAF-likelihood-self are 48, 16 and 12 respectively. Principle components analysis has suggested a two-factor solution for the TAFS; the two factors being moral and likelihood TAF (composite score of TAF-likelihood for self and for others subscales) (Shafran et al., 1996) and this is supported by a number of studies (Lee et al, in press; Rassin, Diepstraten et al., 2001; Rassin, Merckelbach et al., 2001; Yorulamaz et al, in press). This study bases analyses on the two-factor model.

Psychometric properties of the TAFS have been investigated in student, adult and obsessional samples. Internal consistency coefficients for all three subscales is high with Cronbach's alpha coefficients ranging from .85 to .96 (Shafran et al., 1996). The scale has been demonstrated to have good reliability, concurrent and criterion validity (Rassin, Diepstraten et al., 2001; Rassin, Merckelbach et al., 2001; Shafran et al., 1996; Yorulamaz et al, in press). However, the temporal stability of the measure over a 3-month interval has been reported to be somewhat disappointing

with a drop in the mean scores (test-retest correlation of .52) suggesting that TAF is unstable and susceptible to change (Rassin, Merckelbach et al., 2001).

2.3.2. Magical Ideation Scale (MIS; Eckblad & Chapman, 1983).

The MIS consists of 30 dichotomous true-false items exploring magical beliefs based on a definition of magical thinking as 'belief in forms of causation that by conventional standards are invalid'. The scale was originally developed with a normative sample to assess magical ideation in schizotypy (Eckblad & Chapman, 1983) by assessing the subjective interpretation of personal experience. The majority of items have some sub-cultural support (e.g. concerned with astrology, good luck charms, telepathy) although some items included are not supported by sub-cultural factors (e.g. presence of secret messages in the behaviour of others). The scale has been demonstrated to show construct validity as a measure of schizotypy and is reported to have good internal consistency with coefficients ranging from .82 to .87 (Tolin et al., 2001; Norman et al., 1996). With normal samples highly skewed scores on the MIS are reported (Eckblad & Chapman, 1983).

The MIS was included in the Combined Schizotypal Traits Questionnaire (CSTQ; Bentall, Claridge & Slade, 1989) which was found to differentiate between individuals with OCD and those with other anxiety disorders, although there have been mixed findings on the sensitivity of the MIS component within the CSTQ in discriminating between these two groups (Enright & Beech, 1990; Enright, Claridge, Beech & Kemp-Wheeler, 1993). Used with the Perceptual Aberration Scale (Chapman, Edell & Chapman, 1980) as a composite index of schizotypy, the combined scale demonstrated statistically significant correlations with the Maudsley

Obsessive Compulsive Index (MOCI; Hodgson & Rachman, 1977) and the Padua Inventory (Sanavio, 1988).

2.3.3. The State-Trait Anxiety Inventory (STAI; Speilberger, Grosuch, Lushene, Vagg & Jacobs, 1983).

The STAI is a 40 item self-report measure of state and trait anxiety. This study employed only the trait version, which consists of 20 items assessing trait anxiety. The STAI-Trait has been demonstrated to show good internal consistency on student samples with a Cronbach's alpha coefficient of .92 (Ramanaiah, Franzen & Schill, 1983).

2.3.4. The Beck Depression Inventory 2nd edition (BDI-II; Beck, Steer & Brown, 1996).

A 21-item scale widely used to assess associated features of depression. Each item consists of 4 evaluative statements (scores 0-3). The reliability of the original BDI has been comprehensively validated and reviewed (Beck & Steer, 1984; Beck et al., 1996). BDI-II is the latest version of the measure, revised to make its symptom content consistent with the DSM-IV diagnostic criteria for major depressive disorder.

2.3.5. The Padua Inventory Washington State University Revised Edition (PI-R; Burns, Keortge, Formea & Sternberger, 1996).

The PI-R is a revision of the original Padua Inventory (PI; Sanavio, 1988). The original inventory was revised to reduce overlap with worry. According to a theoretical distinction between obsessions and worries the revision process eliminated items that lacked content (and thus could be responded to on the basis of

either worry or obsession/compulsion) and organises 39 of the 60 items of the original PI into 5 content categories relevant to obsessions and compulsions. These 5 categories are: (1) obsessional thoughts about harm to oneself or others; (2) obsessional impulses to harm oneself or others; (3) contamination obsessions and washing compulsions; (4) checking compulsions; and (5) dressing/grooming compulsions. Validated on an analogue sample, the 5 subscales show discriminant validity from a measure of worry as well as from the other content categories of OCD, and this is maintained over time. Each of the five subscales showed high levels of internal consistency and stability over a 6-7 month interval, with test-retest correlation for the total PI-R of .76. The reported overlap with worry of the PI-R varies from 12% (Burns et al., 1996) to 20% (Wells & Papageorgiou, 1998). This version of the PI was selected due to the hypothesised relationship between TAF and meta-cognitive beliefs regarding the likelihood of negative events seen in pathological worry (Haslett-Stevens, et al., 2002).

2.3.6. Visual Analogue Scales (VAS; Rachman, Shafran, Mitchell, Trant & Teachman, 1996).

Participants visually rate items on a 14.5cm scale ranging from 0 (*not at all*) to 100 (*the most they possibly could have*). Scores were converted into percentages according to the position on the scale. Visual analogues correlate with other mood scales and are particularly sensitive to short-term fluctuations of mood (Lindsay & Powell, 1994), and provide valid and sensitive estimates of the nature and intensity of experienced mental states (McCormack, Horne & Sheather, 1988).

VAS have been used to study beliefs associated with this experimental paradigm (Zucker et al., 2002) and from a review of the literature identifying beliefs and cognitive biases hypothesised to be important in OCD, in conjunction with the VAS measures used by Zucker et al. (2002) the following variables were measured using VAS: (1) guilt, (2) perceptions of likelihood as a consequence of thoughts, (3) distress, (4) responsibility, (5) urge to neutralise or undo thoughts, and (6) beliefs that actions can influence likelihood of a threatening situation, in addition to (7) state anxiety (see response sheets, appendix D).

VAS were also used to check that participants had engaged in the TAF-induction, and the following VAS manipulation checks were used: (1) seriousness of accident (2) vividness of the accident imagined, and (3) the proportion of time spent visualising the accident (see appendix D).

2.4. Procedure

Before beginning the study, each participant was individually checked for recently experienced traumatic events, and any that were raised were discussed privately with the experimenter to check that the individual would not be adversely affected by the experimental procedure. The experimenter did not allude to the content of the experiment. However, where the experimenter was concerned about the potential effect of the procedure they reiterated that the participant should not continue with the experiment if they found it very distressing. This instruction was only given to two participants and neither felt the need to stop the experiment.

All participants were given an information sheet (appendix E) and asked to sign a consent form before completing the questionnaires: the TAFS, MIS, STAI-trait, BDI-II and PI-R. Following this participants were explicitly reminded that they had the right to withdraw from the experiment at any time and did not have to do anything that they did not want to do, even if asked by the experimenter (British Psychological Society [BPS], 2000; point 6 of Code of Conduct for Psychologists).

The experimental procedure was conducted with groups of participants ranging in size from 1 to a maximum of 6 participants. The mode for group size was 3. Participants were spaced as widely as the experimental room permitted and were asked to try to ignore the experimenter and other participants in the room. The experimenter read the instructions for the experimental procedure from a script (see appendix F) and the instructions were paced according to the speed of the group.

The procedure used was based on Rachman and colleagues original paradigm (see Rachman et al., 1996). Participants were provided with a single written sentence intended to evoke TAF-likelihood that read 'I hope _____ is in a car accident'. They were instructed to write the name of someone close to them into the sentence and then copy out the sentence before visualising the situation depicted in the sentence (for full instructions see appendix F).

A number of modifications were made to the original procedure. As the experimental procedure relied on participants visualising an internal image to increase the impact of the visualisation the experimenter used verbal prompts to encourage clear and vivid visualisation of the scene. A number of participants

commented on the usefulness of this on completion of the experiment. Participants visualised the scene for 30 seconds. As in the original experiment a 2-minute period followed the visualisation of the sentence and completion of VAS, allowing participants to do anything they wished in connection with the sentence, or in response to their feelings about it. In the original experiment Rachman and colleagues (1996) explicitly instructed all participants to do something in response to the TAF-induction. As this study was concerned with participant's spontaneous strategies, participants were explicitly told that they did not have to do anything if they did not want to, but if they did wish to do something, it could be anything, and could involve the sheet of paper.

At the end of the experiment participants were debriefed about the nature of the study (BPS, 2000; point 5) and the experimenter verbally checked with each participant that they were not feeling distressed or anxious. No participants reported this. Considering the potentially upsetting nature of the stimulus, a contact number for the experimenter was provided with the debriefing information (see appendix G) but no participants used this.

3. Results

3.1. Statistical analyses

SPSS version 12 was used for all quantitative analysis. Data from questionnaire measures were tested for normality with the Kolmogrov-Smirnov statistic. The scores for the MIS, PI-total score, STAI-trait were not normally distributed, however square-root transformations normalised the data for all scores. The means and standard deviations for the transformed data are shown in Table 1.

Table 1: Mean and standard deviation for raw and transformed scores for measures

Measure ($N = 50$)	*M* (raw)	*SD* (raw)	*M* (transformed)	*SD* (transformed)
MIS[a]	6.6	4.6	2.4	1.0
TAFS - Moral	20.1	8.9	4.3	1.2
Likelihood	6.4	5.5	2.2	1.3
PI-R - Total	17.4	11.7	3.9	1.4
STAI trait	42.0	10.5	6.4	.8
BDI-II	10.3	8.6	2.9	1.3

Note:

MIS: Magical Ideation Scale; TAFS-Moral: Thought Action Fusion Scale (TAFS)-moral subscale; TAFS-Likelihood: TAFS-likelihood subscale; PI-R: Padua Inventory Revised; BDI-II: Beck Depression Inventory-2nd edition; STAI-trait: State Trait Anxiety Inventory-trait version.

[a]Due to missing data $N = 49$ for this scale.

TAF-likelihood for self and TAF-likelihood for others subscales of the TAFS did not differ in the pattern of association with other measures, with the exception of TAF-moral (Table 2). Both subscales were collapsed into a TAF-likelihood scale throughout the study, and the normal distribution of the scores allowed for parametric analysis. The majority of VAS scores were not normally distributed[1] and transformations to the data did not restore normality, so non-parametric statistics were applied with the VAS data throughout.

[1] Kolmorogrov-Smirnov test results for VAS: pre-TAF induction: anxiety: $Z(49) = .211$, p = .000. Post-TAF-induction: wrongness: $Z(49) = .207$, p = .000; likelihood: $Z(49) = .175$, p = .001; distress: $Z(49) = .178$, p = .000; responsibility: $Z(49) = .148$, p = .009; cancelling urge: $Z(49) = .159$, p = .003. Post-neutralisation: likelihood: $Z(49) = .161$, p = .003; reduction in likelihood: $Z(49) = .152$, p = .006; urge to cancel: $Z(49) = .159$, p = .003; responsibility: $Z(49) = .147$, p = .010; wrongness: $Z(49) = .216$, p = .000.

Table 2: Person's product moment correlations between measures

	TAFS-M	TAFS-LS[a]	TAFS-LO[a]	TAFS-L	BDI-II	STAI-trait	PI-R total
MIS	.25	.34*[a]	.28*[a]	.35*	.38**	.45**	.36*
TAFS-M		.13[a]	.44**[a]	.21	.07	.23	.39**
TAFS-LS[a]			.50**[a]	.89**[a]	.32*[a]	.43**[a]	.11[a]
TAFS-LO[a]				.82**[a]	.30*[a]	.40**[a]	.27[a]
TAF-L					. 35*	.39**	.21
BDI-II						.75**	.33*
STAI-trait							.32**

Note:

MIS: Magical Ideation Scale; TAFS-M: Thought Action Fusion Scale (TAFS)-moral subscale; TAFS-LS: TAFS likelihood-for-self subscale; TAFS-LO: TAFS likelihood-for-others subscale; TAFS-L: TAFS likelihood total subscale; PI-R: Padua Inventory Revised; STAI-trait: State-Trait Anxiety Inventory trait version; BDI-II: Beck Depression Inventory-2nd edition.

[a] As scores for these scales not normally distributed and could not be transformed, r_s values for the non-transformed data for correlations involving these measures are reported.

* $p < .05$. ** $p < .01$.

3.2. Analysis of TAF paradigm

3.2.1. The pattern of anxiety and urge to neutralise for the TAF induction paradigm in a non-selected sample.

A Friedman's test indicated that there were significant differences in the level of anxiety at baseline, post-TAF induction and post-neutralisation opportunity (χ^2_F = 74.737, $df = 2$, $p = .000$, $N = 50$) for all participants. Post-hoc Wilcoxon Signed Ranks tests, with Bonferroni corrected alpha level .01 indicated that anxiety significantly increased from baseline to post-TAF induction ($Z = -6.125$, $p = .000$, two-tailed test, $N = 50$), and then significantly decreased after an opportunity to neutralise ($Z = -5.322$, $p = .000$). However, the level of anxiety remained significantly greater post-neutralising opportunity than at baseline ($Z = -5.362$, $p =$

.000, two-tailed test, $N = 50$). A Wilcoxon Signed Ranks test also indicated that there was a significant difference in the urge to neutralise immediately after the TAF-induction and following the neutralising opportunity ($Z = 5.695$, $p = .000$, two-tailed test, $N = 50$). See Table 3 for the median, mode and range of VAS scores.

Table 3: Median, mode and score range for VAS scores

	Pre-TAF induction			Post-TAF induction			Post- neutralisation		
Variable	median	mode	range	median	mode	range	median	mode	range
Anxiety	17.2	11.7	0 - 76.6	61.4	61.4	13.1 - 100	39.0	23.4[a]	7.6-84.1
Wrongness				89.9	100	0.7 - 100	85.2	100	0 - 100
Likelihood				15.2	0	0 - 89.7	16.3	0	0 - 72.4
Distress				88.3	100	10.0 - 100	76.9	100	2.0 - 100
Responsibility				63.1	100	0 - 100	53.8	100	0 - 100
Urge to cancel				80.0	100	0 - 100	48.3	0	0 - 100
Reduced likelihood as consequence of cancelling							27.3	2.1	0 - 78.6

Note:

[a]multiple modes exist, the smallest value is shown.

3.2.2. Is the increase in anxiety and urge to neutralise associated with the level of magical thinking, TAF-likelihood, and OCD symptoms?

Using a less conservative uncorrected alpha .05 there were no significant correlations between any of the TAF subscale scores and the increase in anxiety from baseline to immediately after writing and visualising the sentence (TAFS-Moral: r_s = .12; TAFS-Likelihood: r_s = -.16). Following the opportunity to neutralise, there were no significant correlations between any of the TAF subscale scores and the drop in

anxiety (TAFS-Moral: r_s = .02; TAFS-Likelihood: r_s = .08) or the drop in the urge to neutralise (TAFS-Moral: r_s = -.19; TAFS-Likelihood: r_s = .07).

Similarly there was no significant association between the scores on the MIS and increase in anxiety with the TAF induction (r_s = -.02), or decrease in anxiety (r_s = .06) or urge to neutralise (r_s = .20) following the opportunity to neutralise.

There were no significant associations between OCD symptoms and the increase in anxiety (r_s = .04), decrease in anxiety (r_s = -.13) or decrease in urge to neutralise (r_s = -.13).

3.3. Neutralising

3.3.1. Individuals from a normal sample will demonstrate neutralising behaviours in response to TAF-induction.

A total of 131 different neutralising and coping strategies were used by the 50 participants in response to the TAF-induction. The modal number of strategies used by the participants was 3. Only 2 participants did not do anything in response to the TAF induction. Participants described a range of overt and covert strategies that were used in response to the TAF-induction, and a thematic analysis was applied to these idiosyncratic descriptions as outlined by Boyatzis (1998). From this analysis 13 classes of strategies emerged and a code for classifying the strategies was developed (appendix H). An independent rater was asked to classify the participant's responses on the basis of the classification code, and the code demonstrated an interrater reliability of 92.4 %.

According to Freeston and Ladouceur's (1997) definition, the overt and covert strategies that were recorded were considered to be spontaneous neutralising behaviour if the behaviour (1) did not connect to the intrusive thought in a manner explained by normal causation and (2) could not be accounted for by a normal coping response (Freeston & Ladouceur, 1997). This definition was applied to the classification categories (Table 4). Several strategies were classified as ambiguous as the experimenters were unsure of the motivations underpinning them (strategies 10 - 14).

Table 4: Strategies used post TAF induction in response to the TAF induction stimulus

Strategy	Proportion of overall strategies used (%)	No. of participants using this strategy ($N = 50$)
a) Spontaneous neutralising strategies		
1. Do something to destroy the sentence on the paper	26.0	26
2. Alter the sentence to change the meaning	9.9	13
3. Visualise the/an accident, but with a less serious/positive outcome	6.1	8
4. Do something to destroy the image imagined	2.3	3
5. Superstitious act	1.5	2
b) Other coping strategies		
6. Rationalise about writing out the sentence	9.2	10
7. Clear minding mind/ distraction.	3.8	5
8. Relaxation techniques	0.8	1
9. Plan to do something following experiment for reassurance	0.8	1
c) Ambiguous strategies		
10. Imagine the person involved in the accident as okay	16.8	20
11. Unclassifiable	16.0	14
12. Do something so no longer look at the sentence without destroying the sentence	3.8	5
13. Religious strategy	1.5	2
14. Do nothing	1.5	2

74.0 % of participants used one strategy in response to writing out and visualising the sentence that could be classified as neutralising. These individuals

were ascribed to a neutralising group, and individuals using other coping responses (including ambiguous responses) or no response were ascribed to a non-neutralising group. The modal number of strategies used by the neutralising and non-neutralising groups was 3 and 1 respectively.

3.3.2. Do participants who show spontaneous neutralising demonstrate more magical thinking, TAF-likelihood and OCD symptoms?

The mean and standard deviations for the scores on the measures for the group who neutralised and did not neutralise are shown in Table 5. *T*-tests were used

Table 5: Comparison of the raw and transformed scores for the neutralising and non-neutralising groups on all measures prior to neutralisation

	Neutralisers (n = 37)				Non-neutralisers (n = 13)			
	Raw scores		Transformed		Raw scores		Transformed	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
MIS[a]**	7.7	4.7	2.6	1.0	3.9	3.4	1.8	.9
TAFS-Moral	22.0	7.2	4.6	.8	16.2	10.9	3.7	1.6
TAFS-Likelihood[b]	8.8	7.2	2.6	1.5	4.4	5.5	1.6	1.4
STAI-trait	43.3	10.9	6.5	.8	39.5	8.4	6.3	.6
BDI-II	10.8	8.4	3.0	1.3	9.4	9.7	2.7	1.5
PI-R total	18.8	11.7	4.1	1.4	13.8	10.2	3.5	1.3

Note:

MIS: Magical Ideation Scale; TAFS-Moral: Thought Action Fusion Scale (TAFS)-moral subscale; TAFS-Likelihood: TAFS-likelihood subscale; STAI trait: State-Trait Anxiety Inventory-trait version; BDI-II: Beck Depression Inventory-2nd edition; PI-R: Revised Padua Inventory.

[a]Due to missing data, n = 36 in the non-neutralising group.

[b] approaching significance at $p < .05$.

** $p < .01$.

to examine for significant differences between those that neutralised and those that demonstrated no neutralising behaviours in response to the TAF-induction. The neutralising group demonstrated significantly greater scores on the MIS, t (47) = 2.68, p = .010 (two-tailed test). The higher scores of the neutralising group for TAFS-Likelihood was approaching significance, t (48) = 1.950, p = .057 (two-tailed test). No significant differences were found between the two groups for TAF-moral, depression, trait anxiety or OCD symptoms.

3.3.3. Is there a difference between the beliefs of spontaneous neutralisers and non-neutralisers with the TAF-induction?

Mann Whitney *U*-tests examined for differences in the ratings on the VAS prior to neutralisation. Significantly greater scores were reported for the neutralising group for ratings for likelihood (U = 106.5, p = .003, two-tailed, N = 50), distress (U = 115.0, p = .005, two-tailed, N = 50), responsibility (U = 97.0, p = .001, two-tailed, N = 50) and urge to cancel (U = 100.0, p = .002, two-tailed, N = 50). At an alpha level of .05 no significant differences were found between the ratings for anxiety or the wrongness of writing the sentence. The median, mode and ranges for these scores are shown in Table 6.

Two-tailed Wilcoxon tests demonstrated that following the neutralising opportunity both the neutralising and non-neutralising group demonstrated a significant reduction in anxiety (Neutralising: Z = -4.805, p = .000, n = 37; Non-neutralising: Z = -2.510, p = .012, n = 13; two-tailed tests). Both groups also demonstrated a significant reduction in the urge to do something to cancel out the

effect of the sentence (Neutralising: $Z = -4.994$, $p = .000$, $n = 37$; Non-neutralising: $Z = -2.756$, $p = .006$, $n = 13$).

Table 6: Comparison of the neutralising and non-neutralising group for scores on the Visual Analogue Scales pre and post neutralisation

	Neutralisers ($n = 37$)			Non-neutralisers ($n = 13$)		
	median	mode	range	median	mode	range
Pre-neutralisation						
Anxiety	64.1	34.5[a]	29.0 - 100	61.4	61.4	13.1 – 98.6
Wrongness	92.4	100.0	.07 - 100	86.9	2.0[a]	2.0 – 100
Likelihood**	22.8	0[a]	0 – 89.7	3.4	0[a]	0 – 22.8
Distress**	89.7	100.0	54.5 – 100	69.7	10.0[a]	10.0 – 100
Responsibility**	80.7	100.0	8.3 – 100	20.7	0[a]	0 – 98.6
Urge to cancel**	83.0	100.0	17.2 - 100	40.7	0[a]	0 – 99.3
Post-neutralisation						
Anxiety	43.4	24.8[a]	15.2 – 84.1	32.4	7.6[a]	7.6 – 62.8
Wrongness	86.9	100.0	2.8 - 100	65.5	97.9	0 - 100
Likelihood**	19.3	0[a]	0 – 72.4	4.8	0	0 – 22.8
Distress	79.3	100	14 - 100	62.1	62.1	2.0 - 100
Reduced likelihood	29.7	4.19	0 - 78.6	17.1	2.1	0 - 66.9
Responsibility**	57.9	100	6.9 - 100	19.3	0[a]	0 – 97.9
Urge to cancel**	86.9	100	2.8 - 100	13.1	0	0 – 81.4

Note:

[a]multiple modes exist, the smallest value is shown.

** Significant difference between groups, $p < .01$.

Following an opportunity to neutralise, the neutralising group continued to demonstrate a significantly greater urge to cancel ($U = 123.0$, $p = .009$, two-tailed, $N = 50$) and a greater feeling of responsibility should an accident occur ($U = 112.5$, $p = .005$, two-tailed, $N = 50$). The neutralising group continued to rate the likelihood of

an accident occurring as greater ($U = 108.5$, $p = .003$, two-tailed, $N = 50$). There was no significant difference on any of the remaining VAS measures, including ratings for the VAS item 'I feel that the activity I used to undo the sentence/scenario has reduced the likelihood that the accident will happen' (reducing likelihood item).

3.4. The relationship between magical thinking and TAF and OCD symptoms

3.4.1. Magical thinking will be significantly associated with OCD symptoms after controlling for the effect of trait anxiety and depression.

Pearson's product moment correlations were calculated to explore the relationships between the transformed values for the measures of magical thinking, OCD, TAF subscales, anxiety and depression (Table 2). Significant correlations were demonstrated for the majority of the measures except for a number of notable exceptions. In particular OCD symptoms significantly correlated with all measures with the exception of TAFS-Likelihood. The greatest correlations with OCD symptoms were for the MIS, STAI and TAFS-Moral (at an alpha level of .01). The BDI-II was significantly correlated with the PI-R at an alpha level of .05. Trait anxiety and depression were associated with all measures except TAFS-Moral. The MIS correlated with all measures except TAFS-Moral.

Replicating Einstein and Menzies (2000) analysis, full and partial correlations were generated to explore whether mood (depression and anxiety) affected the significant correlations for magical thinking and TAF-moral with the PI-R (Table 7).

After partialling out the effect of STAI-trait none of the correlations between PI-R and MIS and BDI-II remained significant. Holding STAI-trait constant, the

correlation between TAFS-Moral and PI-R was still significant although at a reduced alpha level of .05.

Holding depression constant, the associations between the MIS and PI-R, and the STAI-trait and PI-R were no longer significant. Holding BDI-II constant did not affect the association between TAFS-Moral and PI-R.

Table 7: Zero order and partial correlations for measures of magical thinking and TAF with OCD, controlling for trait anxiety and depression

Measure	PI-R total ($N = 50$)	Variable held constant	PI –R total ($N = 50$)
MIS[a]	.36**	TAFS-Likelihood	(.30)*
		TAFS-Moral	(.29)*
		STAI-trait	(.22)
		BDI-II	(.27)
TAFS-Likelihood	.25	MIS	(.14)
		TAFS-Moral	(.18)
		STAI-trait	(.07)
		BDI-II	(.14)
TAFS-Moral	.39**	TAFS-Likelihood	(.35)**
		MIS	(.33)*
		STAI-trait	(.33)*
		BDI-II	(.39)**

Note:

MIS: Magical Ideation Scale; TAFS-Likelihood: Thought-Action Fusion Scale (TAFS) likelihood subscale; TAFS-Moral: TAFS-moral subscale; STAI-trait: State-Trait Anxiety Inventory-trait version; BDI-II: Beck Depression Inventory-2nd edition; PI-R: Padua Inventory Revised.

[a]Due to missing data N = 49.

*$p < .05$. ** $p < .01$.

3.4.2. The association of OCD symptoms with TAF-likelihood and TAF-moral.

Pearson's product moment correlations indicated significant associations at an alpha level of .01 between TAFS-Moral and PI-R (Table 2). Partial correlations (Table 7) holding TAF-likelihood and depression constant did not affect the significance of the correlations between TAFS-Moral and OCD symptoms. Holding trait anxiety and magical thinking constant reduced the significance of the correlation between TAFS-Moral and PI-R, but the correlations were still significant. Therefore TAFS-Moral was associated with symptoms of OCD, and this association remained when controlling for other variables. No significant associations were demonstrated between TAF-likelihood and symptoms of OCD (Table 2).

3.4.3. The relationships between TAF-likelihood and other measures.

In view of the unexpected absence of significant correlations between TAF-likelihood and symptoms of OCD, partial correlations were also used to explore the relationships of the other measures with TAFS-Likelihood, controlling for magical thinking and mood (Table 8).

Zero order correlations between MIS, STAI-trait and BDI-II with TAFS-Likelihood were all significant. When controlling for trait anxiety none of the associations between the other measures and TAF-likelihood remained significant. However, keeping the level of magical thinking and depression constant did not affect the significance of the correlations between trait anxiety and TAF-likelihood.

Table 8: Zero order and partial correlations for measures of magical thinking, trait anxiety, depression and TAF-likelihood

	TAFS-Likelihood ($N = 50$)	Variable held constant	TAFS-Likelihood ($N = 50$)
MIS[a]	.35**	STAI-trait	(.17)
		BDI-II	(.25)
STAI-trait	.50**	MIS	(.41)**
		BDI-II	(.36)**
BDI-II	.37**	MIS	(.25)
		STAI-trait	(-.00)

Note:

MIS: Magical Ideation Scale; STAI-trait: State-Trait Anxiety Inventory-trait version; BDI-II: Beck Depression Inventory-2nd edition; TAFS-Likelihood: Thought-Action Fusion Scale-likelihood subscale.

[a]Due to missing data N = 49.

* $p < .05$. ** $p < .01$.

3.4.4. Is magical thinking associated with some subgroups of OCD but not others?

Spearman's rank order correlations between magical thinking and the subscales of the PI-R were analysed. The scores for the subscales of the PI-R were not normally distributed so non-parametric correlations were used. Owing to multiple comparisons a bonferroni corrected significance level of .008 was adopted. The results are shown in Table 9.

Magical thinking was significantly associated with the Obsessional Thoughts subscale, and the association with total score for the PI-R was approaching significance at the corrected significance level.

Table 9: Spearman's Rank Order Correlations between magical thinking and subscales of the Padua Inventory-Revised

Scale	Subscale	MIS
PI-R	Contamination	.23
	Dressing	.36
	Checking	.31
	Obsessional Thoughts about harming self or other	.46*
	Obsessional Impulses about harming self or other	.19
	Total score	.37 (p=.009)[b]

Note:

MIS: Magical Ideation Scale; PI-R: Padua Inventory Revised.

[b]Approaching significance at the $p < .008$ level.

* $p < .008$ (corrected for multiple comparisons).

4. Discussion

4.1. Neutralisation in response to the TAF-induction paradigm

On the TAF-induction task, the experimental effect demonstrated by a high TAF sample (Rachman et al., 1996) was replicated in a sample that was not selected for high levels of TAF-likelihood. Participants demonstrated an increase in anxiety in response to writing out and visualising the sentence, and the anxiety and urge to cancel out the effect of the sentence reduced after a 2-minute opportunity to engage in neutralising behaviour or other coping response. TAF-type responses appear to occur in the normal population.

In response to the TAF-induction paradigm, 96% of participants used at least one neutralising or coping response strategy. A natural tendency to use neutralisation strategies without instruction was demonstrated by 74 % of the sample. The majority of participants used neutralising strategies in conjunction with other coping responses with only three participants using solely neutralising strategies. The

remaining participants used either other coping responses or no response to the induction. A large proportion of the normal sample therefore demonstrated neutralising behaviour in response to TAF-like phenomena.

The spontaneous neutralising group demonstrated greater ratings for distress, responsibility, urge to cancel the effects of the sentence, and a greater likelihood of an accident occurring following the TAF-induction. Following an opportunity to neutralise, both the neutralising and non-neutralising groups demonstrated significant reductions in the ratings for anxiety and urge to cancel the effects of the sentence. However, the neutralising group continued to report an increased likelihood of an accident occurring, increased responsibility and an increased urge to cancel out the effects of the sentence compared with the non-neutralising group. The two groups did not differ in the endorsement of the belief that what they did reduced the likelihood of an accident occurring. Therefore, there was a significant difference in the beliefs of people that use spontaneous neutralising strategies in response to the TAF-induction, compared with those that do not.

It was unclear how the neutralising behaviour was related to a reduction in anxiety and urge to neutralise. Both the neutralising and non-neutralising groups demonstrated the same pattern for anxiety and urge to cancel in response to the TAF-induction, and following an opportunity to neutralise or use other coping strategies. Comparing the two groups, there was no difference in the level of state anxiety prior to the TAF-induction. Post-induction there was no difference in anxiety, although neutralisers reported a greater urge to cancel out the effects of the sentence. Following an opportunity to neutralise, the urge to cancel out the effects of the

sentence reduced for both groups, although the neutralising group continued to report a greater urge to cancel. Thus neutralising behaviour did not appear to remove the urge to cancel out the effect of the sentence. The neutralising group continued to rate the likelihood of an accident as greater following the neutralising period, suggesting that neutralising behaviour does not reduce the perceived likelihood of harm arising as a consequence of the TAF-induction.

Spontaneous neutralisers demonstrated a significantly greater endorsement of magical thinking, and a difference approaching significance in their endorsement of TAF-likelihood. Previous studies have also reported an association between those that spontaneously neutralised and TAF-likelihood (van den Hout et al., 2002). However, there was no difference on the scores of the PI-R suggesting that the neutralisers and non-neutralisers did not differ in OCD symptomatology. The two groups also did not differ in their level of TAF-moral, trait anxiety or depression. It would appear then that magical thinking is associated with the use of a neutralising behaviour in response to intrusive thoughts. This supports Amir et al.'s (2001) conclusion that the fusion of thoughts and actions may be more general and not only associated with cognitive biases in OCD. However, in view of the absence of a difference between the groups for OCD symptoms, is the difference in magical thinking and TAF-likelihood a result of differences in OCD between the two groups, or is the MIS measuring something else?

4.2. The association of magical thinking with OCD

The scores on the MIS and PI-R were significantly correlated ($r = .36$) suggesting that magical thinking and OCD are associated. The magnitude of this

correlation was less than reported in previous analogue studies (r = .53) (Einstein & Menzies, 2000). Controlling for the effect of anxiety and depression the association between the MIS and PI-R was no longer significant. Unexpectedly, no association was found between TAF-likelihood and the PI-R, although significant associations were demonstrated between the MIS and TAF-likelihood. In this sample TAF-likelihood and magical thinking appear to be associated; however TAF-likelihood and OCD symptoms do not. Depression and in particular trait anxiety were also positively associated with OCD symptoms. Thus in this study, it would appear that although there is a positive relationship between magical thinking and OCD symptoms, this relationship is influenced by trait anxiety and depression, suggesting that magical thinking is not a core component of OCD. As a correlational design was used it is unclear how magical thinking and anxiety relate to each other, and to OCD symptoms. It is important to consider that the use of an analogue sample, where psychopathology is mild, may have affected results.

In view of previous research that has demonstrated robust correlations between TAF-likelihood and OCD (Amir et al., 2001; Shafran et al., 1996) the absence of a correlation between TAF-likelihood and the PI-R was surprising. In this sample TAF-likelihood was not a hallmark of OCD symptoms. A previous study using a larger sample of undergraduate students from the University of Southampton (Gordon, 2003) found a small but significant correlation between TAF-likelihood and an alternative revision of the PI (van Oppen, Hoekstra & Emmelkamp, 1995) and it is possible that the absence of a correlation in this study was a result of a reduced power of the sample. However, power calculations based on previous analogue studies (Einstein & Menzies, 2000) suggest that the sample size in this study was

sufficient to show the effect. The mean scores for the measures were similar to those reported in other studies (e.g., Lee et al., in press). Unexpectedly, a significant correlation was found between TAF-moral and the PI-R. The majority of TAF research has suggested that TAF-moral is not associated with OCD (Einstein & Menzies, 2000; Shafran et al., 1996; Rassin, Diepstraten et al., 2001) however contradictory results have also been reported (Einstein & Menzies, 2004; Yorulmaz et al., in press). In agreement with previous studies TAF-moral was not associated with magical thinking (Lee et al., in press), however in this sample the OCD symptoms appear to be related to how bad one feels at a moral level about entertaining thoughts (Rachman, 1993, 1998).

A possible explanation for the unexpected findings was the use of the PI-R (Burns et al., 1996) as a single measure of OCD symptoms. OCD is argued to be a multidimensional and heterogeneous disorder (Calamari et al., 2004), and measures of OCD that are based upon specific symptom clusters, may omit other key symptoms. Composite severity ratings based on all obsessions and compulsions also loses the diversity of symptoms (Leckman, 1997). This study is limited by using the PI-R, thus focusing on a single set of symptoms that are based upon the *DSM-IV* criteria for OCD (APA, 1994). Identifying OCD according to *DSM* criteria alone is criticised for representing a heterogeneous mix of clinical phenotypes, and this is argued to account for the many positive but inconsistent findings in studies of OCD (Sobin et al., 2000).

Previous studies (Einstein & Menzies, 2000, 2004) use the original PI (Sanavio, 1988) and this measure is demonstrated to overlap considerably with worry

(Burns et al., 1996). Total scores on the original PI are heavily weighted towards scores on the 'Importance of Controlling Mental Activities' subscale, and this subscale is the most problematic in the overlap between symptoms of OCD and worry (Burns et al., 1996). Moreover, the original PI demonstrated a stronger association with magical thinking compared with other OCD measures, and the strongest association with magical thinking was reported for the Importance of Controlling Mental Activities subscale (Einstein and Menzies, 2000, 2004). The PI-R was selected in this study to reduce the overlap between worry and OCD symptoms. As TAF-likelihood and magical thinking are associated, and TAF-likelihood is related to both general anxiety (Abramowitz et al., 2003) and pathological worry (Haslett-Stevens et al., 2002), the reduced association between magical thinking and OCD symptoms, and the absence of an association between TAF-likelihood and OCD symptoms in this study, might have resulted from the use of the PI-R.

Furthermore, examining the association of magical thinking with the subscales of the PI-R in this sample, the only significant correlation was reported with the 'Obsessional Thoughts about Harming Self or Others' subscale of the PI-R. Despite the revision of the PI some shared variance with worry remains (Burns et al., 1996; Wells & Papageorgiou, 1998), and the Obsessional Thoughts subscale is one of the two content areas most strongly associated with worry (the other area being checking) (Freeston et al., 1994). The Obsessional Thoughts subscale shares 14% of variance with worry, which is the greatest overlap of any of the subscales (Burns et al., 1996). The suggested association of magical thinking with worry might therefore account for the association of the Obsessional Thoughts subscale of the PI-R with magical thinking, further suggesting that magical thinking is associated to some

extent with worry, and the overlap with OCD symptoms may explain the association of OCD and magical thinking.

A possible explanation for the unexpected association between TAF-moral and OCD symptoms was the participant's prior knowledge that the study was concerned with magical thinking. The instructions at the beginning of the experiment also warned participants that they might find some aspect of the study distressing. As the TAFS has been criticised for having poor temporal stability (Rassin, Merckelbach et al., 2001) these factors may have increased participant's scores on the measure.

The use of the MIS to measure magical thinking is also problematic, as the MIS was designed to measure magical beliefs in schizotypy and contains a range of items that vary considerably in their content. Items included concern superstitious belief, paranormal items, thought fusion, ideas of reference, unusual perceptual experiences, thought transmission and indirect influence (Vyse, 1997). It is possible that the scale is tapping into different constructs and large-scale factor analytic studies of the measure are required to determine the construct validity of the MIS. Further study is also required to determine whether the MIS is an appropriate measure for studies of magical thinking in OCD as some of the items of the MIS may overlap with OCD symptoms (e.g., item 26: at times I perform certain rituals to ward off negative influences), potentially confounding any associations with OCD.

4.3. Critique of the paradigm and experimental procedure

From the results it was unclear whether the TAF-induction paradigm was modelling behaviour seen in OCD. As the paradigm is hypothesised to model TAF-likelihood, Rachman et al. (1996) advocated that the effect would be greater in individuals who demonstrate high level of TAF. However, there appears to be no difference in the pattern of anxiety and urge to neutralise in this study, compared with a study using high TAF individuals (Rachman et al., 1996). There were no significant correlations for the MIS, TAF-likelihood subscale, and PI-R, with the success of the paradigm in evoking anxiety and urge to cancel, or in decreasing anxiety and urge to cancel following a neutralising opportunity. TAF-induction does not, therefore, only occur in magical thinkers, or with high levels of TAF-likelihood, or with OCD symptoms.

Alternative explanations may account for the comparable drop in anxiety in neutralising and non-neutralising groups. All strategies used by participants may represent general coping strategies in response to anxiety. The type of strategy used may be a result of a participant's preferred strategy to deal with unpleasant emotions provoked by imagining an unpleasant scenario. Some participants may use magical strategies to restore a sense of control over the situation, whereas other participants may use rationalising, distraction or other coping techniques to reduce their anxiety. In classifying the responses to the TAF-induction an assumption was made that magical strategies and other coping strategies were performed for different reasons. It was assumed that magical strategies were akin to neutralising behaviour seen in OCD (Zucker et al., 2002) and had a restorative or ameliorative function in response to the content of TAF-induction, whilst coping strategies were used in response to

anxiety (Freeston & Ladouceur, 1997). One limitation of the experimental design was the failure to record details of participant's motivations for using specific strategies in response to the induction. It was possible to infer that some of the spontaneous behaviours demonstrated no causal association to external events and so could be identified as magical, but without a record of the motivation for behaviour the responses from 12 participants were ambiguous. For example, a number of participants noted that one strategy they used was imagining the person as "okay" and in a "different positive situation". It was possible that this was done as a distraction, or to provide a sense of reassurance, or because of some magical belief that imagining the person as unharmed would protect them from harm. Although the classification system developed had a high interrater reliability it was simply a topographical description of the behaviours demonstrated. An improvement on the experimental design would have been to record the participant's motivation for the behaviours performed, however, in view of the difficulties of self report of magical thinking (Subbotsky, 2001, 2004) this may be problematic. Further research is necessary to determine whether different motivations underpin neutralising and other coping strategies.

Another explanation for the comparable drop in anxiety is that the experimental effect is short lived and participants may simply habituate to the level of anxiety. A possible way to examine this would be to prevent participants that use spontaneous neutralising strategies from engaging in neutralising behaviour by using mental tasks following the TAF-induction (van den Hout et al., 2002), and comparing the effect on anxiety reduction and urge to neutralise with participants who engage in spontaneous neutralisation.

As the neutralising group used a greater number of strategies in response to the TAF-induction, neutralising may be a consequence of using more numerous coping strategies. Although the two groups did not differ in anxiety, the neutralising group reported more distress with the TAF-induction, and this may have resulted in an increased number of strategies being used by this group. Individuals may have included neutralising strategies due to perceived experimental demands, although explicit instructions that they did not have to do anything were included. Although an experimental procedure was used in an attempt to reduce the reliance on subjective personal experience of magical thinking (as are included in the MIS) and a high rate of neutralising behaviour was reported, some of the university educated British participants used in this study may still have been reluctant to report behavioural strategies that are of a 'magical' nature (Subbotsky, 2001). Participants may also not have been aware of fleeting strategies performed in response to the experiment (de Silva et al., 2003).

Finally, the TAF-induction paradigm as an experimental method is problematic as it relies on the participant's internal imaginal experience and there is no control over this. Following the experiment, most participants reported that they did not imagine the most serious scene possible due to the aversive nature of the stimulus. The experience of imagining an aversive scene may not have evoked distress that is comparable to the distress experienced by individuals with OCD in response to their intrusions. Although writing out and imagining an obsession-like thought produces distinct anxiety and an urge to cancel the effect, the public nature of this is very different to the private experience of an intrusive thought (van den

Hout et al., 2002). However, it could be argued that concentrating on the unpleasant content of an intrusive thought, rather than not attending to a fleeting thought, is similar to the experience of OCD.

5. Conclusion

Magical thinking is associated with the use of neutralising strategies in response to the TAF-induction experiment. However in view of the comparable decline in anxiety for neutralising and non-neutralising individuals, neutralising strategies may be a means of managing anxiety associated with the effect of writing out the sentence. It is not clear that this paradigm is modelling the effects seen in OCD, and further research is required to determine what the paradigm is evoking before results from the model are used to support the cognitive model of OCD, or to inform clinical treatment of OCD (e.g. Zucker et al., 2002). It would be useful to investigate the paradigm using a clinical sample, but this raises ethical difficulties considering its aversive nature.

The results suggest that magical thinking is not a core feature of OCD, and that the association of magical thinking with OCD is affected by anxiety. However the study is limited by its correlational nature and so no conclusions can be drawn as to the causal direction of the effect. Generalisation of the results is also limited by the small sample size and non-clinical sample. Magical thinking may be associated with some subtypes of OCD, possibly where the subtype demonstrates a greater overlap with symptoms of worry.

Investigating the role of TAF and magical thinking is of clinical relevance to OCD, as cognitive biases have implications in Cognitive-Behavioural Therapy methods of treatment (Abramowitz et al., 2003). Further studies may shed light on how magical thinking, anxiety and OCD are associated, and future studies should consider the overlap of magical thinking with worry, possibly by including the Penn State Worry Questionnaire (Meyer, Miller, Metzger & Borkovec, 1990). Further analysis of the construct validity of the MIS is also necessary to determine whether it is a suitable measure for studies of magical thinking in OCD.

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Appendices

Appendix A:

Clinical Psychology Review – Instructions to Authors

CLINICAL PSYCHOLOGY REVIEW

INSTRUCTIONS TO AUTHORS

AIMS AND SCOPE: *Clinical Psychology Review* publishes substantive reviews of topics germane to clinical psychology. Its purpose is to help clinical psychologists keep up-to-date on relevant issues outside of their immediate areas of expertise by publishing scholarly but readable reviews. Papers cover diverse issues, including: psychopathology, psychotherapy, behavior therapy, behavioral medicine, community mental health, assessment, and child development.

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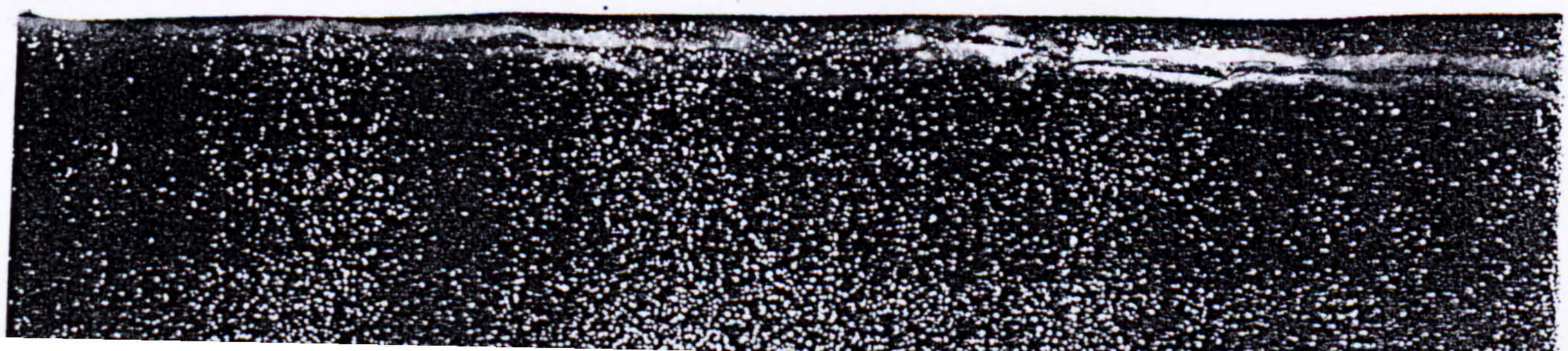

Appendix B:

Behaviour Research and Therapy – Instructions to Authors

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print page close win

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Author names and affiliations. Where the family name may be ambiguous (e.g., a double name), please indicate this clearly. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate address. Provide the full postal address of each affiliation, including the country name, and, if available, the e-mail address of each author.

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Abbreviations. Define abbreviations that are not standard in this field at their first occurrence in the article: in the abstract but also in the main text after it. Ensure consistency of abbreviations throughout the article.

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Appendix C:

(i) Magical Ideation Scale

M I Scale

(Eckblad & Chapman 1983)

Please read through the questions below. Give your answers to each item by placing a tick under either the "true" or "false" column. Do not miss out any items.

		True	False
1.	Some people can make me aware of them just by thinking about me.		
2.	I have had the momentary feeling that I might not be human.		
3.	I have sometimes been fearful of stepping on cracks in the pavement.		
4.	I think I could learn to read others' minds if I wanted to.		
5.	Horoscopes are right too often for it to be a coincidence.		
6.	Things sometimes seem to be in different places when I get home, even though no one has been there.		
7.	Numbers like 13 and 7 have no special powers.		
8.	I have occasionally had the silly feeling that a TV or radio broadcaster knew I was listening to them.		
9.	I have worried that people on other planets may be influencing what happens on earth.		
10.	The government refuses to tell us the truth about flying saucers.		
11.	I have felt that there were messages for me in the way things were arranged, like in a store window.		
12.	I have never doubted that my dreams are the products of my own mind.		
13.	Good luck charms don't work.		
14.	I have noticed sounds on my records that are not there at other times.		
15.	The hand motions that strangers make seem to influence me at times.		
16.	I almost never dream about things before they happen.		
17.	I have had the momentary feeling that someone's place has been taken by a look-alike.		
18.	It is not possible to harm others merely by thing bad thoughts about them.		
19.	I have sometimes sensed an evil presence around me, although I could not see it.		
20.	I sometimes have a feeling of gaining or losing energy when certain people look at me or touch me.		
21.	I have sometimes had the passing thought that strangers are in love with me.		

		True	False
22.	I have never had the feeling that certain thoughts of mine really belonged to someone else.		
23.	When I am introduced to strangers, I rarely wonder whether I have know them before.		
24.	If reincarnation were true, it would explain some unusual experiences I have had.		
25.	People often behave so strangely that one wonders if they are part of an experiment.		
26.	At times I perform certain little rituals to ward off negative influences.		
27.	I have thought that I might cause something to happen just by thinking too much about it.		
28.	I have wondered whether the spirits of the dead can influence the living.		
29.	At times I have felt that a professor's lecture was meant especially for me.		
30.	I have sometimes felt that strangers are reading my mind.		

Appendix C:

(ii) Thought Action Fusion Scale

Name:_____ Date:___/___/___

TAF-R

Please read the following statements. In each section, use the rating scale below to indicate how much you agree or disagree with each statement. Please write your rating next to each statement in the space provided. Please do not think too much about any one statement. Use the entire range for your answers.

0	1	2	3	4
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

1.__ When I think about making an obscene remark or gesture in a place of worship, it is almost as immoral as actually doing it.

2.__ Thinking about swearing at someone else is almost as unacceptable to me as actually swearing.

3.__ Having obscene thoughts in a place of worship is unacceptable to me.

4.__ Having violent thoughts is almost as unacceptable to me as violent acts.

5.__ Thinking of making an extremely critical remark to a friend is almost as unacceptable to me as actually saying it.

6.__ Having a blasphemous thought is almost as sinful to me as a blasphemous action.

7.__ When I have a nasty thought about someone else, it is almost as bad as carrying out a nasty action.

8.__ When I think unkindly about a friend, it is almost as disloyal as doing an unkind act.

9.__ If I think about making an obscene gesture to someone else, it is almost as bad as doing it.

10.__ If I wish harm on someone, it is almost as bad as doing harm.

11.__ If I have a jealous thought, it is almost the same as making a jealous remark.

12.__ Thinking of cheating in a personal relationship is almost as immoral to me as actually cheating.

13.__ If I think of myself being injured in a fall, this increases the risk that I will have a fall and be injured.

14.__ If I think of myself becoming ill, this increases the risk that I will become ill.

15.__ If I think of myself being in a car accident, this increases the risk that I will have a car accident.

For questions 16-27 use the same rating scale as above to indicate how much you agree or disagree with each of the following statements. Please provide ratings for each of the three statements and use the entire range for your answers.

0	1	2	3	4
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

16: If I think of a relative/friend being in a car accident,
__this increases the risk that he/she will have a car accident.
__I would consider myself a bad person.
__this would be a bad thought.

Name:_____ Date:___/___/___

0	1	2	3	4
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

17. If I think of a friend/relative having a relaxing vacation,
__this increases the chance that he/she will have a relaxing vacation.
__I would consider myself good person.
__this would be a good thought.

18. If I think of a relative/friend being hired for a job,
__this increases the chance that he/she will be hired for a job.
__I would consider myself good person.
__this would be a good thought.

19. If I think of a relative/friend becoming ill,
__this increases the risk that he/she will become ill.
__I would consider myself bad person
__this would be a bad thought.

20. If I think of a friend/relative being injured in a fall,
__this increases the risk that he/she will have a fall and be injured.
__I would consider myself a bad person.
__this would be a bad thought.

21. If I think of a friend/relative winning the lottery,
__this increases the chance that he/she will win the lottery.
__ I would consider myself a good person.
__ this would be a good thought.

22. If I had a thought about a friend/relative staying healthy,
__this increases the chance that he/she will stay healthy.
__ I would consider myself a good person.
__ this would be a good thought.

23. If I think of a friend/relative receiving a favorable compliment from their boss,
__this increases the chance that he/she will receive a favorable compliment.
__I would consider myself a good person.
__this would be a good thought

24. If I think of a relative/friend being able to avoid a car accident,
__this increases the chance that he/she will be able to avoid a car accident.
__I would consider myself a good person.
__that would be a good thought.

25. If I think of a relative/friend losing their job,
__this increases the risk that they will lose their job.
__I would consider myself a bad person.
__that would be a bad thought.

26. If I think of a friend/relative having an enjoyable dinner in a restaurant,
__this increases the chance that he/she will have an enjoyable meal in a restaurant.
__I would consider myself a good person.
__that would be a good thought.

27. If I think of a friend/relative avoiding being injured in a fall,
__this increases the chance that he/she will avoid a fall and be injured.
__I would consider myself a good person.
__that would be a good thought.

Appendix C:

(iii) Padua Inventory – Washington State University Revision

The following statements refer to thoughts and behaviors which may occur to everyone in everyday life. For each statement, Choose the reply which best seems to fit you and the degree of disturbance which such thoughts or behaviors may create.

1	I feel my hands are dirty when I touch money.	Not at All	A little	Quite a Lot	A Lot	Very Much
2	I think even slight contact with bodily secretions (perspiration, saliva, urine, etc.) may contaminate my clothes or somehow harm me.	Not at All	A little	Quite a Lot	A Lot	Very Much
3	I find it difficult to touch an object when I know it has been touched by strangers or by certain people.	Not at All	A little	Quite a Lot	A Lot	Very Much
4	I find it difficult to touch garbage or dirty things.	Not at All	A little	Quite a Lot	A Lot	Very Much
5	I avoid using public toilets because I am afraid of disease and contamination.	Not at All	A little	Quite a Lot	A Lot	Very Much
6	I avoid using public telephones because I am afraid of contagion and disease.	Not at All	A little	Quite a Lot	A Lot	Very Much
7	I wash my hands more often and longer than necessary.	Not at All	A little	Quite a Lot	A Lot	Very Much
8	I sometimes have to wash or clean myself simply because I think I may be dirty or "contaminated".	Not at All	A little	Quite a Lot	A Lot	Very Much
9	If I touch something i think is "contaminated", I immediately have to wash or clean myself.	Not at All	A little	Quite a Lot	A Lot	Very Much
10	If an animal touches me, I feel dirty and immediately have to wash myself or change my clothing.	Not at All	A little	Quite a Lot	A Lot	Very Much
11	I feel obliged to follow a particular order in dressing, undressing, and washing myself.	Not at All	A little	Quite a Lot	A Lot	Very Much

12	Before going to sleep, I have to do certain things in a certain order.	Not at All	A little	Quite a Lot	A Lot	Very Much
13	Before going to bed, I have to hang up or fold my clothes in a special way.	Not at All	A little	Quite a Lot	A Lot	Very Much
14	I have to do things several times before I think they are properly done.	Not at All	A little	Quite a Lot	A Lot	Very Much
15	I tend to keep on checking things more often than necessary.	Not at All	A little	Quite a Lot	A Lot	Very Much
16	I check and recheck gas and water taps and light switches after turning them off.	Not at All	A little	Quite a Lot	A Lot	Very Much
17	I return home to check doors, windows, drawers, etc., to make sure they are properly shut.	Not at All	A little	Quite a Lot	A Lot	Very Much
18	I keep on checking forms, documents, checks, etc., in detail to make sure I have filled them in correctly.	Not at All	A little	Quite a Lot	A Lot	Very Much
19	I keep on going back to see that matches, cigarettes, etc., are properly extinguished.	Not at All	A little	Quite a Lot	A Lot	Very Much
20	When I handle money, I count and recount it several times.	Not at All	A little	Quite a Lot	A Lot	Very Much
21	I check letters carefully many times before posting them.	Not at All	A little	Quite a Lot	A Lot	Very Much
22	Sometimes I am not sure I have done things which in fact I knew I have done.	Not at All	A little	Quite a Lot	A Lot	Very Much
23	When I read, I have the impression I have missed something important and must go back and reread the passage at least two or three times.	Not at All	A little	Quite a Lot	A Lot	Very Much

24	I imagine catastrophic consequences as a result of absent-mindedness or minor errors which I make.	Not at All	A little	Quite a Lot	A Lot	Very Much
25	I think or worry at length about having hurt someone without knowing it.	Not at All	A little	Quite a Lot	A Lot	Very Much
26	When I hear about a disaster, I think it is somehow my fault.	Not at All	A little	Quite a Lot	A Lot	Very Much
27	I sometimes worry at length for no reason that I have hurt myself or have some disease.	Not at All	A little	Quite a Lot	A Lot	Very Much
28	I get upset and worried at the sight of knives, daggers, and other pointed objects.	Not at All	A little	Quite a Lot	A Lot	Very Much
29	When I hear about a suicide or a crime, I am upset for long time and find it difficult to stop thinking about it.	Not at All	A little	Quite a Lot	A Lot	Very Much
30	I invent useless worries about germs and disease.	Not at All	A little	Quite a Lot	A Lot	Very Much
31	When I look down from a bridge or a very high window, I feel an impulse to throw myself into space.	Not at All	A little	Quite a Lot	A Lot	Very Much
32	When I see a train approaching, I sometimes think I could throw myself under its wheels.	Not at All	A little	Quite a Lot	A Lot	Very Much
33	At certain moment, I am tempted to tear off my clothes in public.	Not at All	A little	Quite a Lot	A Lot	Very Much
34	While driving, I sometimes feel an impulse to drive the car into someone or something.	Not at All	A little	Quite a Lot	A Lot	Very Much
35	Seeing weapons excites me and makes me think violent thoughts.	Not at All	A little	Quite a Lot	A Lot	Very Much

36	I sometimes feel the need to break or damage things for no reason.	Not at All	A little	Quite a Lot	A Lot	Very Much
37	I sometimes have an impulse to steal other people's belongings, even if they are of no use to me.	Not at All	A little	Quite a Lot	A Lot	Very Much
38	I am sometimes almost irresistibly tempted to steal something from the supermarket.	Not at All	A little	Quite a Lot	A Lot	Very Much
39	I sometimes have an impulse to hurt defenseless children or animals.	Not at All	A little	Quite a Lot	A Lot	Very Much

Appendix D:

Response sheet booklet

Ref:

RESPONSE SHEETS

Date of birth:

Gender:

Date:

PLEASE LISTEN TO THE INSTRUCTIONS AND DO NOT TURN OVER THE PAGES UNTIL YOU ARE INSTRUCTED TO DO SO

Response sheet one

Please indicate how much you agree with the statement below, by marking the line between 0 and 100.

1. I would rate my current level of anxiety as:

0	100
(not at all anxious)	(extremely anxious)

DO NOT TURN OVER TO PAGE 2 UNTIL INSTRUCTED TO DO SO.

Response sheet two

Please indicate how much you agree with each statement, by marking the line between 0 and 100.

2. I would rate my current level of anxiety as:

0 100
(not at all anxious) (extremely anxious)

3. I feel a sense of 'wrongness' that I imagined someone close to me having an accident.

0 100
(not at all) (agree completely)

4. It is now more likely that the person I imagined having the accident will have one in the next few days.

0 100
(not at all) (agree completely)

5. I feel distressed about imagining someone having an accident.

0 100
(not at all) (agree completely)

6. If an accident occurred in the next few days to the person I had been thinking about, I would feel responsible.

0 100
(not at all) (agree completely)

7. I want to do something to cancel out the effects of the sentence that I visualised.

0 100
(not at all) (agree completely)

TURN OVER THE PAGE

8. How serious was the accident that you imagined?

---

0 100
(not at all serious) (extremely serious)

9. How vividly did you imagine the accident?

---

0 100
(not at all) (extremely vivid)

10. When being asked to visualise the accident, what proportion of the time did you spend visualising the accident?

0% 100%

DO NOT TURN OVER THE PAGE UNTIL INSTRUCTED TO DO SO

Response sheet three

11. I would rate my current level of anxiety as:

0 100
(not at all) (extremely anxious)

12. It is now more likely that the person I imagined having the accident will have one in the next few days.

0 100
(not at all) (agree completely)

13. I feel distressed about imagining someone having an accident.

0 100
(not at all) (agree completely)

14. I feel that the activity that I used to undo the sentence/scenario has reduced the likelihood that the event will happen.

0 100
(not at all) (agree completely)

15. I still want to do something to cancel out the effects of the sentence that I visualised.

0 100
(not at all) (agree completely)

16. If an accident occurred in the next few days to the person I had been thinking about, I would feel responsible.

0 100
(not at all) (agree completely)

16. I feel a sense of 'wrongness' that I imagined someone close to me having an accident.

0 100
(not at all) (agree completely)

DO NOT TURN THE PAGE OVER UNTIL INSTRUCTED TO DO SO

Response sheet four

In the time following imagining the scenario, what did you do either in connection with the sentence or in response to your feelings about it? Please list anything you did (either mentally or physically) in the spaces below. You may have done more than one thing. If so, please try to list each separate thing that you did on a different line against a different number. Don't worry about listing what you did in any order, just try to separate out the different things that you did.

1	
2	
3	
4	
5	
6	

THIS IS THE END OF THE EXPERIMENT

THANK YOU VERY MUCH FOR TAKING PART

Appendix E:

Participant information sheet and consent form

Magical Thinking in anxiety
Consent Form for Research Participants

Information sheet

I am Laura Bocci a Postgraduate student on the clinical psychology doctoral programme. I am requesting your participation in a study regarding the role of *'magical thinking' in anxiety.* It will involve asking you to complete a number of questionnaires and then perform a short task. The whole thing should take about 45 minutes. Personal information will not be released to or viewed by anyone other than researchers involved in this project. Results of this study will not include your name or any other identifying characteristics.

Your participation is voluntary and you may withdraw your participation at any time. If you choose not to participate there will be no consequences to your grade, the credits received or to your treatment as a student in the psychology department. If you have any questions please ask them now, or contact me Laura Bocci at 0779 6840828 and/or lb701@soton.ac.uk.

Signature _____ Date_____
Name_____ *[researchers name]*

_____

Statement of Consent

I _____*[participants name]* have read the above informed consent form.

I understand that I may withdraw my consent and discontinue participation at any time without penalty or loss of benefit to myself. I understand that data collected as part of this research project will be treated confidentially, and that published results of this research project will maintain my confidentially. In signing this consent letter, I am not waiving my legal claims, rights, or remedies. A copy of this consent letter will be offered to me.

I give consent to participate in the above study. Yes / No
(Circle Yes or No)

Signature _____ Date_____

Name_____ *[participants name]*

I understand that if I have questions about my rights as a participant in this research, or if I feel that I have been placed at risk, I can contact the Chair of the Ethics Committee, Department of Psychology, University of Southampton, Southampton, SO17 1BJ.
Telephone: (023) 8059 3995.

Appendix F:

Instructions for experiment

Instruction script

Thank you for participating in this experiment. I would like to remind you that your participation in this experiment is voluntary and you may stop and withdraw from this experiment at any time. This will not affect you being rewarded credits for taking part. If you decide to stop please will you sit and wait for the others to finish so as not to disturb them.

I am going to read out a set of instructions and I would appreciate it if you would try to follow them as closely as possible. Try to ignore myself and the other people in the room.

In front of you there should be a booklet entitled 'response sheets' and a separate piece of coloured paper blank side up on the table. I would like you to complete these in order, and please do not turn over the coloured paper or any pages until you are instructed to do so. Does everyone have these?

Some of the instructions may seem a little strange and the rationale for this experiment will be outlined when you have finished.

Please fill your details on the front sheet.

Any questions before we start?

****

To start with just let yourself relax. Close your eyes if you wish (pause for 10 seconds).

When you are feeling relaxed I would like you to turn to response sheet one, on page one, of the response sheet booklet and mark on the line how anxious you are feeling right now by marking on the line between 0 (not at all) and 100 (the most you possibly could have) in response to the statement written on the page.

****

I would like you to think of someone who means a great deal to you at the moment.

In a minute I am going to ask you to insert the name of this person into a blank space in a sentence depicting a traumatic event and then visualise the content of this sentence. Some people find that this is too traumatic to do, and if you find that this is too distressing for you, then re-write the sentence inserting this person's name into a similar but less serious scenario. Only do this if you feel that the original sentence would be much too distressing for you to imagine. If you alter the scene make it as serious as you will be able to imagine.

Please listen to the instructions and do not begin until I say.

Again just let yourself relax, closing your eyes if you wish (pause). Now, I would like you to think of that person who means a great deal to you at the moment. Take a moment to get a clear picture in your mind..... (leave 10 seconds).

When you have a clear picture of this person in your mind take the coloured sheet of paper from in front of you. Turn it over, and insert the name of this person into the blank space in the sentence. When you have done so, please copy the whole sentence on the reverse (plain) side of the sheet of paper.

As soon as you have written out the sentence, I would like you to close your eyes and think for a few moments about the situation described in the sentence. Try to concentrate on this. Imagine the person, the scene, other related things going on around. What is the accident? What is happening? Picture the person that you were thinking about. What are they doing? Is there anyone else there? You may find that you are picturing a series of events or a single image. Try to imagine a scene that is as realistic as possible, and hold this in your mind for a moment or so. (total time for this 30 seconds, including verbal prompts).

****

When you have clearly visualised what you have written on the paper turn to page two of the response sheets (response sheet 2). On the next *two* pages there are a number of statements regarding the scenario that you have just imagined.

In response to each statement please rate the degree to which you agree with it by marking on the line, between point 0 (not at all) and 100 (the most you possibly could have).

****

Now that you have completed the ratings, we no longer need the sentence that you wrote on the coloured piece of paper. You have some time to do anything you would find helpful in connection with the sentence, or in response to your feelings about it.

You do not need to do anything if you don't want to, but if you do wish to do something this can be anything you want, either mentally or physically, and it can involve the paper if you wish.

(Leave approximately 2 minutes).

****

Turn to page four which is response sheer three. Again, rate the degree to which you agree with each of the statements below by marking the line between the two points: 0 and 100.

****

I now want to ask you about what you have just done after imagining the scenario.

If you turn to page five there is a table on the page with numbers in the right hand column and blank spaces in the left hand column. I'd like you to think about what things you just did either in connection with the sentence or in response to your feelings about it. You may have done something physically or something mentally. You might have done more than one thing. You might not have done anything.

Try to list each separate thing that you did in a different box in the table, corresponding to a different number. Don't worry about listing what you did in any order, just try to separate out the different things that you did. If you did not do anything leave the table blank.

****

Thank you very much. I will not ask you to do anything else as this is the end if the experiment.

Please wait a few minutes for me to debrief you about the purpose of the experiment. I would appreciate it if you did not discuss the experiment to others who may be doing it, as this will affect the results.

****

Appendix G:

Debriefing statement

DEBRIEFING STATEMENT

This project is concerned with the relationship between magical thinking and Obsessive-Compulsive Disorder (OCD). Magical thinking refers to beliefs that defy culturally acceptable laws of causality. The experiment that you have just undertaken was developed by Rachman and colleagues (1996) and is designed to induce a form of magical thinking (thought-action fusion) that is concerned with increasing the perceived likelihood of an event happening due to thinking it. It is believed that this is one of the cognitive distortions that is present in OCD and gives rise to some of the symptoms. Other researchers have argued that thought-action fusion is not specific to OCD and is associated with anxiety in general.

The study is concerned with the following hypotheses:

1. That magical thinking is a core cognitive feature of OCD symptoms.
2. That magical thinking and thought-action fusion is associated with anxiety in general and not only OCD.
3. That the experimental procedure will be more effective in individuals who show a greater degree of magical thinking/thought-action-fusion.

The study is also concerned with investigating the kinds of strategies that individuals use to 'undo' any perceived increase in the likelihood of an event occurring as a consequence of the experiment.

It is estimated that 80-90% of the population have unwanted intrusive thoughts and some of these thoughts may be similar to the thought of harm involved in this experiment. Often, when people have intrusive thoughts they feel these thoughts are wrong, and that somehow their thought will make the event more likely to happen. These thoughts are perfectly normal and have no influence over outside events, nor are they a reflection of your character.

To induce thought-action fusion a highly emotional stimulus must be used, as in this experiment. This experimental paradigm has been used in a number of studies and also as an aid to teaching about thought-action-fusion. It is in no way harmful. However, if you feel at all distressed following this experiment, or would like to speak to me about any aspect of it, then please contact me by telephone (0779 6840828), or email (lb701@soton.ac.uk).

Thank you for participating in this experiment.

Laura Bocci

Reference:
Rachman, S., Shafran, R., Mitchell, D., Trant, J., & Teachman, B. (1996). How to remain neutral: an experimental analysis of neutralisation. *Behaviour Research and Therapy, 34*, 889-898.

Appendix H:

Content analysis classification

Strategies used for neutralising

Code: 1. Do something to destroy the sentence on the paper: e.g., cross out/screw up/crumple/tear up.
2. Alter the sentence to change the meaning, e.g. add the word 'not', 'never', 'no one'; write the sentence so that it is the opposite of the original.
3. Visualise the accident but with a less serious/positive outcome.
4. Do something to destroy the image imagined.
5. Superstitious act.
6. Rationalise about writing the sentence.
7. Clear mind/stop thinking about/think about something different (distract).
8. Use relaxation techniques.
9. Plan to do something following experiment.
10. Imagine the person involved in the accident as okay: healthy, happy, doing nice things etc.
11. Unclassifiable.
12. Do something to destroy the sentence so no longer look at the sentence without destroying the sentence, e.g., move paper away, fold it up.
13.Religious strategy.
14. Do nothing.

Participant	Strategy	Coder 1	Coder 2
1	Put 'not' in the sentence. Imagined the person having a small bump with another car but being fine. Imagined the person at home doing normal things.	2 3 10	2 3 10
2	Just tried to clear my mind by gazing out the window	7	7
3	Added the word 'never' to the sentence on the paper. Imagined the person happy and safe. Imagined the person driving safely and carefully.	2 10 10*	2 10 4
4	Crossed out the sentence I wrote. Crossed out my boyfriends name on the printed side. Wrote 'no-one' above. Imagined him as I last saw him yesterday, and with me.	1 1 2 10	1 1 2 10
5	Changed the wording of the sentence to 'is not'. Stopped thinking about and visualising the accident.	2 7	2 7
6	Crumpled the paper. Pictured in my mind person healthy and all right. Told myself it is not going to happen.	1 10 6	1 10 6
7	Thought of Tom up in his room. Moved piece of paper away.	10 12	10 12
8	Touched wood and hoped it wouldn't happen. Crossed out the sentence that was written. Wished that I hadn't thought it.	5 1 11	5 1 11
9	Crossed out the sentences on both sides of the piece of paper. Ripped up the paper. Tried to think of the accident being as minor as possible with no one hurt. Tried to tell myself that thinking about an accident will not make it more likely to happen.	1 1 3 6	1 1 3 6
10	Tore up the piece of paper. Thought how awful it would be.	1 11	1 11
11	Mentally imagine positive outcome. Screw up paper. Pray for blessing on friend.	3 1 13	3 1 13
12	Crossed out the sentence I had written. Scribbled out the name in the blank space. Wrote 'experiment scenario' on the page to make it clear why I wrote such a sentence. Folded the paper up.	1 1 6* 12	1 1 2 12

13	Removed the name mentally. Ripped up the page into large chunks. Ripped it up further if words were still complete. Pushed the rubbish to the side of the table.	11* 1 1 12	4 1 1 12
14	Did nothing.	14	14
15	Tore the paper in half, waited, tore the paper again down the sentence.	1	1
16	Scribbled out the name. Wrote 'no-one' in its place. Visualised a nice scenario with the person instead.	1 2 10	1 2 10
17	Wanted to phone the person. Tore up the paper. Crossed out the sentence	11 1 1	11 1 1
18	Tried not to think about what I had imagined previously. Crossed out the name and the sentence I had written.	7 1	7 1
19	I ripped up the paper – the sentence now no longer exists.	1	1
20	Tried to think good things about the person to cancel it out. Replaced "I hope…." With "A. T. will be in a car accident"	10 2	10 2
21	Wrote out another sentence correcting the original. Imagined a nice thing happening to the person. Imagined the person was ok from the accident.	2 10 3	2 10 3
22	Changed the word "is" to "isn't" in the sentence. Imagine this person in a safe environment.	2 10	2 10
23	Nothing	14	14
24	Changed the sentence so that it meant the opposite.	2	2
25	I scribbled out the hand written sentence about the car accident.	1	1
26	Reassured myself (mentally) that what I had written/thought about would not make any difference. Thought about something more positive regarding the person to get the image out of head.	6 10	6 10
27	Thought: Jon wouldn't be in a car anyway in the next few weeks. Thought: I only spoke to him a little while ago and he is not even going out for a while. Lessening the seriousness of the accident. Making the other people involved less close to him.	6 6 3 3	6 6 3 3
28	Ripped the paper in half. Tried to stop visualising the accident. Thought of him doing something happy.	1 7 10	1 7 10
29	I said to myself that 'I didn't mean it'. I thought of a time when we were having fun. I imagined her to be happy.	11* 10 10	2 10 10
30	Crossed out name on paper. Tried to think about the person in a positive situation. Tried not to think about the accident.	1 10 7	1 10 7
31	Wrote a sentence that was the opposite of the original to cancel out the original. Wished I hadn't been able to visualise the accident. Prayed that it would not happen.	2 11 13	2 11 13
32	Folded the paper with the sentence on it. I thought of ways to undo what I wrote about. I worry about the person I thought about.	12 11 11	12 11 11
33	Apologised to her for thinking the way I did. Told myself that I would phone/text her after I have left to check that she is OK.	11 9	11 9
34	Told myself that writing the sentence wouldn't make any difference, it wouldn't make my mum have a car accident. Told myself that I don't believe in the power of the mind working in that way.	6 6	6 6
35	I screwed up the paper into a ball.	1	1

35 cont.	I imagined life after the car crash when everything was fine.	10	10
36	Scribbled out the whole sentence that I wrote. Scribbled out the name I inserted in the other sentence. Said: "I didn't mean it" in my mind.	1 1 6	1 1 11*
37	Decided to avoid looking at the sentence.	12	12
38	Thought mentally about good times with that person – made me smile-feel at ease, being with her. Opened my eyes to remember where I was – in an experiment, only imagining it, not real.	10 6*	10 7
39	Crossed out the original sentence. Wrote a new sentence, the opposite of the original. Took a deep breath. Concentrated on how I didn't mean it.	1 2 8 11	1 2 7 11
40	Thought about the scenario where accident could have happened but it didn't. Thought about when I next would see her, going home this weekend.	11 11	3* 10*
41	I used the sentence and turned it around. I hope ____ never has a car accident. Told myself: "It feels right because it is really what I feel". I wanted to tear it up, but it would still be there.	1 11 11*	2 11 1
42	Ripped up the piece of paper into small squares (believe relieved anxiety). Mentally tried to detach from situation be thinking about happier thoughts. I also carried out a superstitious act which I believe helps in potentially threatening situations – biting my tongue.	1 11 5	1 10* 5
43	Inserted the word 'not'. Mentally imagined the person as physically well. Thought of telling the person of today's experiment to lessen the feelings of guilt.	2 10 1	2 10 1
44	Thought about how horrible the image I imagined was. Ripped up the piece of paper, as it was distressing. Thought about the person in the scenario more, and how much they mean to me.	11 1 11	11 1 11
45	Screwed up the piece of paper. Tried to imagine something good happening to that person.	1 10	1 10
46	Wished I hadn't thought about it. Wished I hadn't written it down. Really hoped that it would never happen, as I would feel responsible to some degree. Screwed up the piece of paper. Cancelled the thoughts mentally. Said that I was told to do the task. Tried to imagine the person wasn't injured.	11 11 11 1 11 6 3	11 11 11 1 4* 6 3
47	Tore up the piece of paper. Imagined Mark survived. Imagined it never happened. Imagined him as healthy – smiling at me.	1 3 3 10	1 3 4* 10
48	Rationalised thinking about something doesn't make it happen, if it did happen I would not be responsible, cause and effect not possible.	6	6
49	Scribbled out entire handwritten sentence. Scribbled out persons name in typed script. Replaced her name with "no-one".	1 1 2	1 1 2
50	Used mental imagery to visualise the accident not happening at all. I told myself that I didn't mean it and that I didn't really want it to happen. I apologised to the person. I tried to make myself feel less guilty as it is part of an experiment.	3 11 11 6	4* 11 11 6

Note: * indicates the final code that was selected for classification of the strategy.

Appendix I:

Confirmation of ethical approval

University of Southampton

School of Psychology

University of Southampton
Highfield Southampton
SO17 1BJ United Kingdom

Tel +44 (0)23 8059 3995
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10 June 2004

Laura Bocci
Department of Clinical Psychology
University of Southampton
Highfield
Southampton SO17 1BJ

Dear Laura,

Re: An experimental study of magical thinking in compulsions in obsessive compulsive disorder

I am writing to confirm that the above titled ethics application was approved by the School of Psychology Ethical Committee on 22 August 2003.

Should you require any further information, please do not hesitate in contacting me on 023 8059 3995.

Please quote approval reference number CLIN/03/17.

Yours sincerely,

KLucas

Kathryn Lucas
Secretary to the Ethics Committee