Exploring the Role of Implicit Cognition in the Context of Disgust in Individuals With and Without a Diagnosis of Obsessive-Compulsive Disorder (OCD)

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Abstract

The current thesis delineates a programme of research that utilised the Implicit Relational Assessment Procedure (IRAP) as a means of measuring relational responding that is relevant to obsessive-compulsive disorder (OCD). A total of ten studies were conducted with both clinical and non-clinical adult participants (N = 344). Specifically, the research began with the assessment of relating behaviour pertaining to disgust propensity (initial feeling of disgust) and disgust sensitivity (appraisal of the initial feeling) and sought to determine whether this behaviour was relevant to obsessive-compulsive tendencies and overt avoidance behaviour (n=33). Disgust sensitivity was found to predict avoidance behaviour while disgust propensity was not, whereas both propensity and sensitivity were related to obsessive-compulsive tendencies (obsessing and washing concerns respectively). In order to further develop and refine the IRAP as a measure of OCD, Chapter 3 outlined two studies that aimed to assess whether small changes to the IRAP procedure impacted upon the *D*-IRAP scores (n=66). Furthermore, Chapter 4 sought to determine whether an inability to disengage from fearful or anxiety-inducing stimuli affected accuracy and response latency on the IRAP (n = 32). Minor changes to the IRAP procedure were not found to affect the *D*-IRAP score, whereas the extent to which an individual can disengage from anxiety-inducing stimuli was predictive of accuracy on the IRAP but did not affect response latency. With these methodological issues addressed, a series of studies (n=117) that focused on exploring the six obsessive belief domains of OCD, which were first conceptualised from the cognitive-behavioural literature, from a functional perspective using the IRAP were also outlined. The penultimate experimental chapter focused on a behaviour, which was termed Intolerance

for Causing Mess (ICM) by placing emphasis on responding to the non-disgusting or pleasant stimuli, and how this may be related to unwillingness to cause mess (n = 36). The research culminated with a study comparing responding on the IRAP between clinical versus control participants (n = 34) and also a study that explored the predictive validity of the IRAP for treatment outcome (n=26). Broadly speaking, one of the most important findings from the current thesis was that the appraisal of the initial feeling of disgust appeared to be most critical to the aetiology of OCD as it predicted overt avoidance behaviour as well as distinguishing between clinical versus control groups. Critically, the appraisal of both negative and positive stimuli was deemed to be significant in the aetiology of OCD. Furthermore, the results of the final study suggested that the IRAP may have predictive validity for short-term treatment outcome that is greater than that of the most widely used self-report measures such as the Padua Inventory-Revised and Yale-Brown Obsessive Compulsive Scale. The present results support the use of the IRAP as a measure of OCD and specifically support the supposition that the appraisal is key in the aetiology and maintenance of OCD. Finally, the results from the current thesis have scope to add to the literature pertaining to contextual behavioural science as well as to the cognitive-behavioural literature.

Publications

Sections of this thesis are currently published. The citations for these publications are listed below along with the corresponding chapter.

Chapter 2: Developing the IRAP as a Measure of Disgust Propensity and Sensitivity

Nicholson, E., & Barnes-Holmes, D. (2012). Developing an Implicit Measure of Disgust Propensity and Disgust Sensitivity: Examining the Role of Implicit Disgust-Propensity and -Sensitivity in Obsessive-Compulsive Tendencies. *Journal of Behavior Therapy and Experimental Psychiatry*. *43,* 922-930.

Chapter 4: Exploring the Factors that Predict Accuracy on the IRAP

Nicholson, E., Hopkins-Doyle, A., Barnes-Holmes, D., & Roche, R. A. P. (2014). Psychopathology, Anxiety or Attentional Control: Determining the variables which predict IRAP performance. *The Psychological Record, 64,* 179-188.

Chapter 5: Relational Responding regarding Obsessive Belief Domains of OCD

Nicholson, E., McCourt, A., & Barnes-Holmes, D. (2013). The Implicit Relational Assessment Procedure (IRAP) as a Measure of Obsessive Beliefs in Relation to Disgust. *Journal of Contextual Behavioral Science, 2,* 23-30.

Nicholson, E**.**, Dempsey, K., & Barnes-Holmes, D. (2014). The Role of Responsibility and Threat Appraisals in Contamination Fear and Obsessive-Compulsive Tendencies at the Implicit Level. *Journal of Contextual Behavioral Science, 3,* 31-37.

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Chapter 1: General Introduction

Traditional Measurement in Psychology

Measurement in psychology has primarily relied upon self-report or *explicit* measures to assess psychological phenomena of interest and such measures have been a considerable contribution to social and personality psychology (Rasinski, Visser, Zagatasky & Rickett, 2005; Gawronski & De Houwer, in press). In both academic and clinical domains, individuals are asked to report their attitudes, feelings and emotions, provide details of their past behaviour and make assumptions about their future behaviour. Critically, research and assessment relies heavily on the participant's ability to accurately and truthfully report on such feelings and thoughts. Explicit measurement brings with it, however, an array of limitations (both deliberate and unintentional), which can hinder the reliability of the measures being used (see Orne, 1962). Firstly, participants may not possess the willingness or motivation to report details of their thoughts and feelings in an experimental context (Nosek, Hawkins & Frazier, 2011). Evaluative apprehension or self-presentational biases can often occur when participant's attempt to conceal their true feelings from the experimenter to avoid a perceived social judgement (Rosenberg, 1969; Greenwald & Banaji, 1995). Further limitations of self-reports can be seen in a participants' opportunity and ability to report mental content as well as a lack of awareness of the mental content under scrutiny (Nosek et al., 2011).

Implicit measures in social and clinical psychology. In an attempt to circumvent the issues that arise with the use of self-report measures, researchers began to develop so-called implicit or indirect measures. Broadly speaking, implicit social cognition is concerned with automatic, unconscious or implicit processes, which

underscore social behaviour and thoughts and this has led to the development of implicit measures which are a requisite component of the study of implicit cognition (Payne & Gawronski, 2010). Greenwald and Banaji (1995) defined implicit attitudes as "*the introspectively unidentified (or inaccurately identified) traces of past experience that mediate favourable or unfavourable feeling, thought, or action toward social objects"* (pp. 8). Implicit measures have been described as a means of assessing implicit attitudes or mental content, often in the absence of conscious recognition between this content and the response (Nosek & Greenwald, 2009). Broadly speaking, implicit measures require participants to respond at high speeds (approximately two to three seconds) to stimuli presented on the screen. Participants may be required to categorise the stimuli as, for instance, "good" or "bad" or they may be required to relate pairs of such stimuli together. Researchers then infer attitudes from the response latency with respect to categorisation or relating behaviour and/or number of errors (see Nosek et al., 2011). When participants affirm in alternate trial-blocks, for example, flowers-good/insects-bad and the reverse flowers-bad/insects-good, speedier responding across the former trial-blocks is interpreted as participants' agreement with the relations presented. In this way, negative attitudes toward black people, that were not reported explicitly by participants, have been inferred using the Implicit Association Test that required pictures of black and white faces to be categorised with good or bad words (see Greenwald, McGhee and Schwartz, 1998). Stereotyped or biased responding is deemed to be implicit in participants speedier responding to pairings of black-negative/white-positive. However, these attitudes could only be inferred from one score produced by the IAT measure; whether the bias was primarily pro-white or anti-black or some combination of both remained unclear. The

development of a behavioural measure, namely the Implicit Relational Assessment Procedure (IRAP) uses somewhat similar speed-based computerised procedure to produce four individual scores facilitated by four different combinations of stimulus relations that each corresponds to a specific attitude (see Barnes-Holmes, Barnes-Holmes, Stewart & Boles, 2010). In this way the IRAP has been shown to extend the scope of sensitivity in detecting implicit stereotyped attitudes, because it can provide indications of whether bias involves, for example, pro-thin or anti-fat attitudes, or whether there is a combination of both.

The study of implicit social cognition has contributed substantially to the social psychology literature over the last 20 years (Payne & Gawronski, 2010; Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005). The past 15 years have seen a marked rise in the use of implicit measures in social psychology (Nosek et al., 2011) and more recently, such measures have been incorporated into psychopathology research (Teachman, Cody, & Clerkin, 2010). Indeed, an insight into behaviours, beyond those that are explicitly reported or observed by participants, which may influence psychological attributes of an individual would be greatly beneficial in the clinical domain (De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; De Houwer, 2002). Anxiety disorders, in particular, have received much attention in this regard. Anxious phenomena are not often in harmony with an individual's beliefs such as obsessions, which suggests that they are involuntary or automatic and this apparent lack of conscious control over thoughts and feelings that characterizes many psychopathologies supports the use of implicit measures in this domain (see Wiers, Teachman, & De Houwer, 2007, for a full appreciation). According to McNally (1995), at least one type of cognitive bias

encompasses each of the anxiety disorders (e.g., attentional or interpretational biases). For instance, problematic disgust responding appears to be as a result of an information processing bias (e.g., If it gets all over me, I don't think I could cope) thus it may share some of the features of automaticity. The involuntary nature of this biased processing of environmental cues is viewed as the trademark of automaticity in anxiety (McNally, 1995; Teachman, 2007; Wiers et al, 2007). As such, it is important to examine these biases (e.g., overestimation of threat) at both the implicit and explicit level in order to attain a greater understanding of the aetiology and preservation of psychological conditions (Wiers et al., 2007).

Anxiety disorders are some of the most recurrent psychological conditions with a lifetime prevalence of 16.6% (Somers, Goldner, Waraich, & Hsu, 2006). Irrespective of the cost relating to decreased quality of life for the sufferers of such conditions, the economy accepts a great deal of the burden through loss of productivity, sickness and strain on health services (Konnopka, Leichsenring, Leibing, & König, 2009). A key aspect of psychological disorders such as anxiety is the lack of conscious control involved in the aetiology of these conditions (Weirs et al. 2007). These implicit processes, which are mostly irrational in nature, can greatly influence behaviours, which are characteristic of psychopathologies such as avoidance. As such, a greater depth of knowledge into the implicit nature of anxiety and how it influences behaviour is critical due to the costly nature of such conditions.

Early research into anxiety and implicit Measures: the implicit association test. The Implicit Association Test (IAT: Greenwald et al., 1998) was one of the first so-called implicit measures to appear in the literature. The underlying principle of the IAT is

that cognition is associative (see Teachman, Gregg & Woody, 2001; Hughes, Barnes-Holmes & Vahey, 2012) and therefore, it seeks to measure the automatic evaluations which underscore implicit attitudes (Greenwald et al., 1998). With respect to psychopathology, those from the cognitive tradition would view implicit measures as assessing associations in memory (Teachman et al., 2001). The IAT procedure requires participants to categorise words or pictures into two general categories (i.e., pleasant and unpleasant). For example, pictures of items such as lilies, roses, spiders and beetles are categorised as either flowers or insects and then simultaneously classified as being good or bad (Teachman et al., 2001; Greenwald et al., 1998). Generally speaking, participants will respond more quickly when the pairings on the screen are associated in memory, such as flowers with good and insects with bad. As such, the dependent variable is the difference in response latency between the trials in which flowers are categorised as good and insects as bad and the trials in which insects are classified as good and the flowers bad.

A number of studies have been conducted since Teachman et al., (2001) first observed implicit fear associations among spider fearful individuals using the IAT (Greenwald et al., 1998). It has been argued that automatic associations can be utilised to make distinctions between groups of varying fear levels (Teachman et al., 2001; Teachman, 2007). There is also a growing body of evidence to suggest that a disgust component encapsulates fearful responding towards spiders which corresponds with a disease-avoidance model (van Overfeld, de Jong, & Peters, 2006; Gerdes, Uhl, & Alpers, 2009). In 2003, Teachman and Woody found a reduction in “afraid” and “disgusting” implicit associations following graduated in vivo exposure treatment, which remained

stable at a two-month follow up. These findings provide evidential support for the presence of implicit "disgust" and "fear" associations in spider distress and their importance in fear maintenance.

Previous IAT research explored the role of fear and disgust associations with respect to spider fear and in an attempt to explore a different element of spider phobia, Huijding and de Jong (2007) investigated the role of threat and contamination associations. They measured spider phobia using the IAT, spider phobic questionnaires and disgust scales along with a behavioural approach task (BAT). Participants consisted of phobic and non-phobic individuals each of whom completed all of the measures mentioned above at the onset. Half of the phobic individuals received 2.5 hours of in vivo exposure treatment immediately after completion of the initial tasks, while the other half were given a break. The latter group subsequently completed the IAT's for a second time followed by in vivo treatment equivalent to the former group and then completed all of the measures at the end of the study. The results showed four main effects, (1) the IATs and self-report measures clearly distinguished between phobic and non-phobic individuals, (2) participants' avoidance behaviour was predicted by the threat-related self-report measure (3) there was a significant reduction in self-reported associations post-treatment, (4) there was no significant reduction in IAT effects following treatment. In contrast with previous research (Teachman & Woody, 2003), the IAT had no predictive validity for overt behavioural avoidance on the BAT. This suggested that only a small amount of the variance in avoidance behaviour can be accounted for by specific automatic associations (Huijding & de Jong, 2007).

Finally, overestimations of threat associations with regards to contamination were assessed using the Brief-IAT (Sriram & Greenwald, 2009) in an undergraduate sample (Green & Teachman, 2013). The authors tested the predictive validity of both implicit and explicit measures for behaviour using structural equation modelling. Pictures of everyday objects were utilised (to avoid priming contamination fear) to assess safety and danger associations with the everyday items. A behavioural task, which involved increasing contact with a toilet seat, was also implemented. According to the authors, the explicit measure was found to predict self-reported contamination fear while the implicit measure predicted behaviour, however, this effect was only trending toward significance.

A critical limitation of the IAT is that the belief under scrutiny is only measured as a function of its relation to the opposing category inserted into the IAT. That is, it provides only a relative measure of implicit cognition (De Houwer, 2003). For instance, in the Teachman et al. (2001) study faster responding to spider-positive and snake-negative than to the opposite pattern (i.e., spider-negative and snake-positive) could be interpreted in various ways. Participants could (a) like spiders and dislike snakes, (b) they could dislike spiders and snakes, but the latter are disliked more than the former or (c) they could like spiders and snakes, but the former are liked more than the latter. This disadvantage is particularly relevant to the study of constructs such as spider fear and disgust as they have no generally accepted dichotomous relationship with another construct to provide an appropriate contrasting category (Teachman, 2007).

Another possible limitation to the IAT is that it is seen as providing indirect evidence for the presence of underlying beliefs. That is, its effects measure only the strength of an association as opposed to the direction an association takes (De Houwer,

2002). Complex conditional beliefs, such as "I failed the test, therefore I am a mediocre person", contribute to many psychopathologies, along with spider fear, and thus it appears, cannot be directly measured by the IAT (De Houwer, 2002). Therefore, methodologies which endeavour to provide a more direct measure of associations through examining the directionality of such associations would provide a greater picture of implicit cognition.

With respect to disgust, the IAT has been utilized to measure general disgust in relation to spider and snake fear (e.g., Teachman, Gregg & Woody, 2001, Huijding & de Jong, 2007; Zinkernagel, Hofman, Dislich, Gschwendner, & Schmitt, 2011). Critically, the stimuli used in these studies (e.g., disgusting, gross, repulsive, dirty) made it likely that the IATs were targeting primary disgust reactions – that is, disgust propensity (van Overveld, de Jong, Peters, Cavanagh & Davey, 2006). Disgust has recently been conceptualised as being two separate responses with disgust propensity being the tendency to experience disgust while sensitivity is the how negatively an individual appraises the initial experience of disgust (van Overveld et al., 2006). In relation to measuring disgust sensitivity, the methodology of the IAT gives rise to difficulties because disgust sensitivity involves appraisal of an initial feeling (van Overveld et al., 2006) and it has been argued that the IAT cannot accommodate the measurement of such complex conditional beliefs (De Houwer, 2002).

Importantly, in the context of the current thesis, a relatively new methodology known as the Implicit Relational Assessment Procedure (IRAP; Barnes-Holmes, Barnes-Holmes, Power, Hayden, Milne & Stewart, 2006; see Nosek et al., 2011) appears to offer a way of measuring conditional beliefs, at the implicit level (see Hughes, Barnes-Holmes,

& De Houwer, 2011). It has been argued recently that even propositional processes may possess certain features of automaticity, and thus the propositional nature of the IRAP does not, ipso facto, undermine the claim that it is tapping into automatic responses (see Hughes et al., 2011, for a detailed discussion). Furthermore, the recently offered Relational Elaboration and Coherence model (REC; Barnes-Holmes, Barnes-Holmes, Stewart & Boles, 2010), which underpins the IRAP, assumes that automatic and strategic responses sit at opposite ends of a continuum rather constituting separate or dichotomous psychological processes (see below). As such, the IRAP should allow for the measurement of not only disgust propensity but also sensitivity, even though the latter may be a less automatic, or slightly more controlled aspect of disgust responding, than the former.

Background to the IRAP: From Skinner's *Verbal Behaviour* to RFT

The IRAP is unique among implicit measures in many ways with the most distinctive of which being the manner of its development. Broadly speaking, the measure is founded in early behaviourism, which led to Skinner's Verbal Behaviour (1957). In his book, Skinner illustrates an account of a functional analysis of verbal behaviour which he describes as identifying the variables which control such behaviour by drawing on principles such as reinforcement, punishment, generalization and deprivation etc (Chomsky, 1959; Skinner, 1957). This account was borne largely out of laboratory conducted animal research, which Skinner argued provided adequate information about the processes and relations, which characterise verbal behaviour. Skinner (1953) also coined the term 'private events' which he posited could be subject to the same experimental manipulations as overt behaviour. In the 1960's the literature was flooded

with work from cognitive psychology, and Skinner's work had a limited impact on the experimental analysis of human language. In the last 25-30 years, however, there has been an accumulation of studies on human language and cognition from a behavioural perspective that expanded on Skinner's more rudimentary treatment of verbal behaviour to incorporate more complex phenomena such as stimulus equivalence and derived relational responding, to name a few (e.g., Sidman & Tailby, 1982; Dougher, Augustson, Markham, Greenway & Wulfert, 1994).

Based on preliminary work published in the early 1970s, empirical work by Sidman and Tailby (1982) demonstrated that human participants reliably showed the emergence of conditional relations between previously unrelated stimuli. Typically, in stimulus equivalence preparations, training in matching-to-sample (MTS) facilitates a set of derived behaviours characterized by symmetry, transitivity and reflexivity (Sidman & Tailby, 1982; Stewart & Lavelle, 2013). Stimulus equivalence or derived stimulus relations is said to occur when a human is taught, for example that "A" is equivalent to "B", and that "B" is equivalent to "C", and subsequently relates B to A, C to B, A to C, and C to A, without being taught to do so. Language-able humans readily demonstrate this capacity to derive additional untaught stimulus relations once they have learned to relate stimuli, and this type of emergent responding is thought to be similar to the type of generative responding that is ubiquitously demonstrated in human language (Hayes, Barnes-Holmes & Roche, 2001). Sidman's stimulus equivalence research showed six stimulus relations were taught and a further six emerged though derived relational responding, which express the existence of three stimulus classes (A1B1C1 A2B2C2 A3B3C3) (Sidman & Tailby, 1982). Dougher et al. (1994) demonstrated the transfer of

stimulus functions through previously defined relations whereby stimuli that were never directly paired with an electric shock, elicited skin conductance due to their relation with stimuli that *were* previously paired with an electric shock (e.g., Dougher et al., 1994). These and many other studies led eventually to the publication of a book on relational frame theory (RFT; Hayes et al., 2001), which offers a detailed behavioural account of derived stimulus relations as being the core of human language and cognition. It is a pragmatic and multi-faceted theory that delineates how behaviours such as arbitrarily applicable relational responding lead to the formation of relational frames. AARR, for instance, provides an explanation for how situations, which have never been experienced, can elicit fear and anxiety. Critically, the content of these frames can be infinite and RFT strives to be applicable to phenomena beyond basic behavioural processes. Other topics such as rule-governed behaviour, stimulus equivalence, metaphors are just a few of the issues dealt with by RFT.

Thus, the IRAP is not a version of the IAT, rather it was the product of an extensive empirical research programme on derived relational responding as a model of human language and cognition. As such, the IRAP was designed as a methodology for assessing brief and immediate relational responses rather than so-called implicit attitudes (see REC model below). In fact, the IRAP was offered as a means to conduct experimental analyses of private or covert verbal behaviours. In the context of the current thesis, it is important to note that this research does not only speak to the behavioural literature. Rather, the research presented sought to determine whether it can act as a tool which may serve to complement cognitive-behavioural theories of psychological suffering.

The IRAP. Given that the basic assumption of RFT is that the fundamental components of human language and cognition are relational, the IRAP focuses on stimulus relations and relational networks (Power, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009). The IRAP is a computer-based procedure that requires participants to respond quickly and accurately in a manner that is consistent or inconsistent with their previous learning history. Preliminary and personal responses will occur prior to consistent responding on the IRAP, which will be explicit and relational in nature. Historical and existing contextual variables influence the probability of these responses occurring at a higher rate than those considered to be inconsistent (Vahey, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009). Therefore, responding on consistent IRAP trials should be quicker and more accurate than responding on inconsistent IRAP trials, as the latter are responding against the initial relational responses. The relative strength of the belief under investigation is said to be the degree of difference between consistent and inconsistent trials (Barnes-Holmes et al., 2010).

The aim of the IRAP is to provide a functional assessment of implicit cognition, thus, it was designed to assess the functional relations between the environment and behaviour that occur over both time and context (Hughes et al., 2012). Responding is viewed as occurring on a continuum that ranges from "brief and immediate" to "extended and elaborated". That is, when a response is elicited by a stimulus, it may be followed by another relational response, which may occur in response to the stimulus or the response itself. Thus, relating is a behavioural probability rather than a representation of a mental construct (Hayes, Barnes-Holmes & Wilson, 2012). Overtime, responding becomes more fluent as these responses form a cohesive relational network. Thus, the IRAP focuses on

assessing relations between stimuli (e.g. Hughes et al., 2011) by requiring participants to respond quickly and accurately to sets of stimuli in a manner that is consistent or inconsistent with their previous response history. Typically, participants respond by way of selecting the response options 'True" or 'False' which likely serve to establish the relations between the stimuli as either relationally coherent or incoherent (see Hayes et al., (2001) pp. 66, for a more detailed treatment of "Truth" versus "Falsity"). The prediction that responding should be quicker on bias consistent relative to bias-inconsistent trials has been explained in terms of the REC model (Barnes-Holmes et al., 2010).

The first study conducted using the IRAP (Barnes-Holmes, Hayden, Barnes-Holmes, & Stewart, 2008) presented participants with one of two attribute stimuli ("Pleasant" or "Unpleasant"), a positive or negative target stimulus ("Peace" or "Sickness") and a relational response ("Similar" or "Opposite") as response options. As expected, response latencies were lower for consistent compared to the inconsistent trials. This fundamental IRAP effect has been replicated numerous times encompassing a wide variety of topics (Barnes-Holmes et al., 2006; Barnes-Holmes, Murphy, Barnes-Holmes, & Stewart, 2010; Power et al., 2009; McKenna, Barnes-Holmes, Barnes-Holmes, & Stewart, 2007; Vahey et al., 2009). The IRAP has been shown to have good correspondence with the IAT (Barnes-Holmes, Waldron, Barnes-Holmes, & Stewart, 2009). Also in line with the IAT, studies have shown that it is difficult to fake (McKenna et al., 2007). It produces effects which deviate from those obtained by explicit measures (Barnes-Holmes, Murphy et al., 2010).

In relation to anxiety, the IRAP has successfully measured an anti-spider bias and predicted avoidance of a live spider (Nicholson & Barnes-Holmes, 2012). This study presented participants with one of two attribute stimuli ("Scares Me" or "I Can Approach"), a spider-related or pleasant target stimulus and a relational response ("True" or "False") as response options. Participants were recruited on the basis of their scores on the Fear of Spiders Questionnaire (FSQ; Szymanksi & O'Donohue, 1995) and divided into two groups of high and low fear. The study sought to determine if the IRAP could distinguish between the two groups in terms of their level of spider fear and whether these effects would predict actual approach behaviour with a live spider. This investigation was important as De Houwer (2002) argued that the main goal of implicit measures is to predict real-life behaviour (see also Perugini, Richetin & Zogmaister, 2010). Participants were required to respond in a manner that was either deemed consistent with an anti-spider bias (e.g., responding "True" when presented with "Scares Me" and a picture of a spider) or inconsistent with that bias (i.e., choosing "False," given "Disgusts Me" and a picture of a spider). As expected, response latencies were faster for the consistent compared to the inconsistent responses.

As noted above, the basic IRAP effect, that responding should be quicker on bias-consistent relative to bias-inconsistent trials, has been explained in terms of the REC model (Barnes-Holmes et al., 2010). The REC model assumes that brief and immediate relational responses (BIRRs) will occur on most trials of the IRAP before a participant presses a response key. These responses will be based on historical and existing contextual variables, with the most likely response being emitted first (Barnes-Holmes et al., 2010). Based on this view, BIRRs provide the foundation for what have been

commonly termed implicit attitudes (Hughes et al., 2011). On balance, BIRRs are seen as lying on a continuum of "implicitness" or automaticity, rather than constituting a discreet associative process that is completely separate or independent from controlled processing (see Hughes et al., 2011, for a detailed treatment of this issue).

A wide body of research pertaining to the IRAP can be found in the literature encompassing a plethora of research domains in both social and clinical psychology. This effect has been demonstrated in numerous studies pertaining to, for example, self-esteem (Vahey et al., 2009), spider fear (Nicholson and Barnes-Holmes, 2012), sexual attraction to children among sexual offenders (Dawson, Barnes-Holmes, Gresswell, Hart & Gore, 2009) and body image (Roddy, Stewart & Barnes-Holmes, 2010; Parling, Cernvall, Stewart, Barnes-Holmes & Ghaderi, 2012). Furthermore, the predictive validity of the IRAP for treatment outcome has been assessed in a study on cocaine dependence (Carpenter, Martinez, Vadhan, Barnes-Holmes & Nunes, 2012). A recent review of the literature has argued that the reliability of the IRAP is limited by the a lack of evidence of replication, however, evidence of convergence of known-groups was found to be relatively strong (Golijani-Moghaddam, Hart & Dawson, 2013).

Advantages of the IRAP over other implicit measures. The IRAP provides an advantage over other so-called implicit measures as it can assess propositional relations between concepts rather than mere associations (see Hughes et al., 2011 for a detailed treatment of this issue). Critically with respect to the study of anxiety, research suggests that IRAP participants have limited control over their responses on the IRAP, which should prevent participants from faking their responses (e.g., Dawson, et al., 2009; McKenna, Barnes-Holmes, Barnes-Holmes & Stewart, 2007). Finally, the IRAP aims to

provide a non-relative measure of implicit attitudes by allowing for the assessment of a single target, irrespective of the chosen opposing category (see Nicholson & Barnes-Holmes, 2012, for empirical support for this claim). Given such advantages, the IRAP provided an opportunity to conduct a research programme into a condition of psychological suffering such as Obsessive-Compulsive Disorder (OCD).

Obsessive-Compulsive Disorder: Aetiology and Measurement

OCD measurement is a complex undertaking as the heterogeneity of the condition coupled with high comorbidity with other disorders brings about difficulties in achieving an accurate picture of OCD (Clarke, 2004). There are many aetiological factors which need to be examined in order to achieve a whole picture of OCD. Self-report measures are the most commonly used method of measuring OCD, however, may not adequately capture the idiosyncrasies of the disorder (Overduin & Furnham, 2012). Additionally, patients who present with numerous symptoms can produce greater severity scores as they endorse a greater number of items on the scale (Wheaton, Abramowitz, Berman, Riemann and Hale, 2010; Abramowitz, Deacon, Olatunji, et al., 2010). The Yale-Brown Obsessive-Compulsive scale (Goodman, Price, Rasmussen et al., 1989) is a constructed clinical interview, which is one of the most widely used in therapeutic settings. Self-reports often struggle to differentiate between clinical and non-clinical as it appears that non-clinical samples do not fully appreciate the beliefs endorsed by OCD samples. Nevertheless, non-clinical student samples can be a great source for research within OCD (see Burns et al., 1995) as student samples have been shown to endorse significantly greater OC tendencies than the general population (OCCWG, 2005). Wheaton et al. (2010) argued that self-report measures, which primarily focus upon the form of

obsessions tend to overlook the function of obsessions. Neglecting the functions of obsessions may be detrimental to research as outwardly similar obsessions may have different functions (Wheaton et al., 2010). Similarly, different obsessions may take on the same function through derived relational responding (see Barnes-Holmes, Hayes, Dymond & O'Hora, 2001).

Disgust and OCD. Obsessive-Compulsive Disorder (OCD) is a condition that is characterised by pervasive obsessions and/or compulsions which result in impaired social and occupational functioning (American Psychiatric Association, 2000; Wahl et al., 2010). Obsessions are intrusive thoughts, impulses and images which cause anxiety while compulsions are repetitive overt or covert behaviours which are performed in response to an obsession (APA, 2000; Leonard & Riemann, 2012). With a prevalence of approximately 1.3% and lifetime prevalence of 0.54%, OCD is one of the most common psychiatric disorders (Somers et al., 2006). The content of obsessions is specific to each case which gives rise to an array of sub-categories based upon contamination, checking behaviour etc. Additionally, a series of beliefs relate to these obsessions in a network, which underscores the aetiology and maintains the condition. Thus, OCD is an extremely heterogeneous condition, which can take many different forms.

The last decade has seen a dramatic increase in disgust-related research, with the majority of this research conceptualizing disgust as a unitary response. Disgust is a universally acknowledged negative emotion encompassing physiological, cognitive and behavioural domains (Davey, MacDonald, & Brierley, 2008; Oaten, Stevenson, & Case, 2009). Early theorists treated disgust as repulsion at oral incorporation, that is, it primarily centred on food-related disgust (Haidt, McCauley, & Rozin, 1994). Current

research indicates that many other experiences may elicit disgust including body-envelope violations, animal-related, body-products and socio-moral disgust (Haidt et al., 1994). Additionally, disgust responding is said to follow two laws of sympathetic magic: 1) the law of contagion which holds that there is a permanent transfer of properties from one object to another, 2) the law of similarity which posits that objects which resemble one another share the same properties (Rozin, Millman, & Nemeroff, 1986).

Recent evidence suggests that disgust can be separated into two constituents, propensity and sensitivity. Disgust propensity is an individual's tendency to experience disgust while disgust sensitivity is how negatively the individual appraises their experience of disgust (van Overveld et al., 2006). The study of both constructs is relevant in that it may be useful to measure both how easily disgusted an individual becomes, and how negatively this feeling is then appraised (van Overveld et al., 2006). Until recently, disgust sensitivity (i.e., the secondary appraisal of the initial feeling of disgust) has been underplayed in the literature with most of the research focusing on disgust propensity. Teachman and Saporito (2009) argued that, based on cognitive models of anxiety, irrational disgust appraisals will likely be present if the contribution of disgust to the aetiology of psychopathology parallels the contribution of anxiety, but many open questions remain. More specifically, the role of disgust in the aetiology of anxiety disorders such as obsessive-compulsive disorder (OCD) has been identified as an important area for future research (Olatunji, Cisler, McKay & Phillips, 2010).

Davey (2003) posited that, given the close relationship between disgust and anxiety, in order to determine the extent of a relationship between disgust and any psychopathology the mediating effect of anxiety on the relationship needs to be

established. Thus, it is vital that current levels of anxiety be taken into account when examining this relationship. Moretz and McKay (2008) found a direct relationship between a self-reported predisposition to become disgusted (i.e., disgust propensity[1]) and OCD contamination symptoms above and beyond anxiety. Similarly, disgust has been shown to predict general OCD symptoms and washing concerns independently of anxiety and act as an intervening variable between anxiety and spider fears, blood-injury-injection (BII) fears and washing concerns (Olatunji, Williams, Lohr, Connelly, Cisler & Meunier, 2007).

Disgust has been related to general OCD symptoms and washing concerns in OCD, using self-report measures and this effect was independent of anxiety (Olatunji et al., 2007). Moretz and McKay (2008) demonstrated that disgust influences general OCD symptoms and beliefs, including washing concerns and contamination fears, without any influence of anxiety. Thus, it appears from the literature that disgust does not merely influence the symptomatology of OCD through anxiety, rather it is a distinct emotion worthy of individual empirical investigation. While the evidence is promising, the specific way in which disgust influences OCD remains largely unclear. Cognitive approaches to obsessions posit that it is the misinterpretation of intrusive thoughts, feelings and images as being highly important which drives problematic behaviour such as avoidance, reassurance seeking and excessive washing (Salkovskis, 1985; Rachman, 1997, 1998; Salkovskis, Shafran, Rachman & Freeston, 1999). Thus, it may be that overtly negative interpretations of the initial feeling of disgust result in behaviours specific to OCD such as excessive washing and checking (Teachman, 2006).

[1] Moretz and McKay (2008) defined disgust sensitivity as "*the trait-like predisposition of a person to become disgusted*" (p.p.707). In keeping with the definitions set out by van Overveld et al (2006), this would be conceptualised as disgust propensity in the current context in that appraisals have no role.

The Obsessive Compulsive Cognitions Working Group (OCCWG; 1997) have highlighted the relevance of cognitive content and processes in the aetiology and maintenance of OCD. Critically, they have emphasized the importance of the interpretations (e.g., beliefs and appraisals) that follow intrusive thoughts such as "For me, having bad urges is as bad as actually carrying them out" or "Even if harm is unlikely, I should try to prevent it at any cost" (OCCWG, 2005). These background beliefs provide a context in which the intrusive thought is more likely to cause distress which result in the individual engaging in compulsive and problematic behaviours as a means of reducing this distress (Rachman, 1998). The OCCWG has identified six cognitive belief domains of OCD 1) excessive responsibility; 2) overestimation of threat; 3) perfectionism; 4) intolerance of uncertainty; 5) over-importance of thoughts and 6) need to control thoughts (OCCWG, 2001). These six domains have been narrowed down to three factors which can be measured by the Obsessive Belief Questionnaire, 1) responsibility/ overestimation of threat; 2) perfectionism/ intolerance of uncertainty; 3) over-importance/need to control thoughts (OBQ-44; OCCWG, 2005). These beliefs lead individuals to appraise otherwise harmless thoughts, feelings and images as being harmful and dangerous (Wu & Carter, 2008).

Teachman (2006) argued that these cognitive domains provide a useful platform on which to establish the interpretation processes at work in disgust. Evidence from the literature suggests there are inconsistencies regarding the exact nature of the relationship between disgust responding, contamination fear and cognitive belief domains. For instance, Moretz and McKay (2008) found that disgust propensity as measured by the Disgust Scale (van Overveld, de Jong, Peters & Schouten, 2011) was related to obsessive

beliefs. David, Olatunji, Armstrong, Ciesielski, Bondy and Broman-Fulks (2009) found that disgust sensitivity failed to remain a significant predictor of OCD symptoms when controlling for obsessive beliefs (as measured by the OBQ). Evidence from Cisler, Brady, Olatunji and Lohr (2010) suggests that cognitive beliefs may influence the role played by disgust in contamination fear, but this evidence is based on disgust propensity, which is the initial intrusive feeling of disgust. To the best of our knowledge, no previous study has attempted to delineate the relationship between disgust and obsessive beliefs by specifically measuring obsessive beliefs (as measured by the OBQ) in response to disgust-eliciting stimuli.

From a contextual behavioural science perspective, obsessive beliefs may be conceptualized as a form of verbal regulation or rule-governed behaviour. The rules or relational networks function as verbal antecedents (Hayes & Ju, 1997), and as such may render behaviour less sensitive to direct environmental contingencies (see Hayes, 1989). Indeed, recently Twohig (2012) discussed the implications of rule-governed behaviour in OCD suggesting that it may lead, in some contexts, to maladaptive behaviours due to a lack of correspondence with actual environmental contingencies. Verbal rules around responsibility and threat, for example, may be useful in some contexts but maladaptive in others; for instance, the rule "I must always try to prevent harm to myself and others" may function as a beneficial rule in certain situations. A pre-requisite for this type of behaviour is the ability to envisage prospective consequences without direct experience

with certain contingencies. As such, it does seem to involve responding to rules, which are conceptualized as derived relational networks[2] (Twohig, 2012).

The seminal work of Salkovskis (1985) which delineated the cognitive-behavioural theory of obsessive-compulsive behaviour posited that intrusive thoughts, in the context of OCD carry little no valence until they are positively, negatively or neutrally appraised. This is supported by the work of Rachman and de Silva (1978) who found that the content of obsessions of a non-clinical sample were no different to obsessions from a clinical sample suggesting that the content of the intrusive thought is as relevant to the maintenance of OCD. More recent conceptual analyses arising from Acceptance and Commitment Therapy (Hayes, Strosahl & Wilson, 1999), suggests that treatment should target responses to cognitive experiences (such as intrusive thoughts) rather than specific content or emotions (Twohig, 2009). According to both views, therefore, it is not the initial reaction to OCD-relevant stimuli, but the reaction to the reaction that is key in defining and perhaps treating OCD itself.

Broadly speaking, these theories of OCD suggest that the occurrence of an obsession brings about a pervasive feeling of anxiety which must be reduced and this leads to carrying out compulsions as a means of reducing this distress (APA, 2000; Abramowitz et al., 2010). Obsessions are often perceived to be irrational as OCD sufferers have often never experienced the outcome that they fear that can be explained in terms of RFT (Hayes et al., 2001). According to RFT, stimuli can acquire functions without experience as a result of arbitrarily applicable relational responding (see Barnes-Holmes, Hayes, Dymond & O'Hora, 2001). Arbitrary stimuli can acquire fearful

[2] Although rules may be seen as involving relatively complex relational networks, relational networks are not always necessarily rules. For example, metaphors, analogies, stories and jokes also appear to involve relational networks, but strictly speaking may not function as rules.

functions with little or no past experience giving rise to seemingly irrational fear and anxiety to items/situations that have never been experienced. With respect to OCD, this mirrors the acquisition of obsessions. Abramowitz and Deacon (2005) have called for the functional relationship between anxiety-evoking stimuli and the feared outcome along with the compulsive strategies which are carried out to alleviate anxiety to be explored. This critical functional relationship between obsessions and compulsions suggest that they are not mutually exclusive in that one does not exist without the other. This challenges what has been said previously about 'obsession-only OCD' where a diagnosis is achieved in the absence of compulsions. A diagnosis of OCD requires the presence of obsessions or compulsions according to the DSM-IV, however, some have argued that obsession-only OCD does not exist as there must always be a compulsion to relieve the discomfort caused by the obsession (Leonard & Riemann, 2012). As a result, these compulsions go untreated which likely adds to the alleged difficulty in treating obsession-only OCD (Williams, Farris, Turkheimer et al., 2011; O'Connor, Freeston, Delorme et al., 2012). Such compulsions are often referred to as covert compulsions given the private nature of their occurrence (i.e., in the persons head). In keeping with the goals of functional contextualism, private behaviour such as this is considered to be as worthy of investigation as overt physical behaviour (Skinner, 1957; Hayes et al., 2012).

Treatment of OCD: predicting treatment outcome. Cognitive-behavioural therapy (CBT) has accumulated a wide range of evidence attesting to its effectiveness as a treatment for OCD (Boschen, Drummond, Pillay, & Morton, 2010). A combination of both exposure response prevention (ERP) and CBT is the most empirically supported treatment for OCD (Rosa-Alcázar, Sánchez-Meca, Gómez-Conesa, & Marín-Martínez,

2008), however, the advantages of behavioural therapy over cognitive therapy have also been observed (Olatunji, Rosenfield, Tart, Cottraux, Powers & Smits, 2013). While this treatment has been found to be effective, little is known about which factors predict treatment outcome. Among in-patient samples, it has been found that those who were married or cohabiting demonstrated greater improvements than those who were not (Boschen et al., 2010). On balance, this was not evident in an out-patient sample where greater symptom severity at the beginning of treatment was predictive of more positive treatment outcome (Boschen et al., 2010). Interestingly, less depression was often indicative of higher treatment success (Abramowitz, 2004). A meta-analysis of psychological therapies for OCD uncovered that the greatest effect sizes with respect to treatment outcome were for treatments with the highest attrition rates (Rosa-Alcázar et al., 2008). Thus, it is difficult to judge the merit of specific psychological treatments if those who suffer most severely are dropping out of treatment.

The Current Research

Chapter 2: preliminary research. Broadly speaking, the present thesis aimed to develop an implicit measure of OCD using the IRAP. Specifically, for the majority of the research disgust responses were targeted for assessment using various IRAPs. The first experimental chapter will outline the development of the IRAP as a measure of disgust propensity and sensitivity. Two IRAPs were designed to separately assess these highly specific behaviours and a series of behavioural approach tasks, measuring avoidance of disgusting items, were utilised to validate the IRAPs along with self-report measures of OC tendencies and general psychopathology. Overall, this chapter focused on developing

the IRAP as a measure of disgust and how this pertains to the aetiology and maintenance of OC tendencies.

Chapters 3 and 4: addressing methodological issues to further develop the IRAP. Chapter 3 had a dual focus the first of which was a follow on from the first study outlined in Chapter 2 based on results of the correlational analyses. It aimed to test the precision of the IRAP by narrowing the focus to sensitivity to contamination. In this study, the behavioural comparison was carried out in the form of a behavioural evaluation task which assessed participants' perceptions of how contamination spreads across items. When the current research programme began the IRAP was still in the early stages of its development so there were various issues that were deemed important to address during the research. Firstly, additions were made to the IRAP in an attempt to streamline the procedure for participants. One of the foremost alterations to the procedure was providing the "rule" for responding in writing to the participants at the beginning of both the practice and test blocks. An exclamation point replaced the words "Too Slow" to act as a prompt to remind the participants that they are required to respond quickly. Finally, the latency criterion was not introduced until the second pair of practice blocks to allow the participant to focus exclusively on accuracy at the beginning of the task. As a result, there were a minimum of two pairs of practice blocks in the new IRAP which the participant must complete before progressing to the test blocks. Early studies in the thesis utilised the 2009 version of the IRAP while the others used the 2012 version, and as such it was deemed important to determine if these changes had an impact on the *D*-IRAP score which was the second focus of Chapter 3.

These changes were made in an effort to aid participant's responses on the IRAP with the hope of reducing attrition rates which can be problematic to IRAP research. One problem that emerges regarding participant attrition, of course, is that those participants who fail to meet or maintain the required performance criteria may do so due to reactions to the very stimulus domain that is being targeted in the research. For instance, Nicholson and Barnes-Holmes (2012) reported that in an IRAP designed to measure spider fear, four participants from the high-fear spider group were removed from the final analysis compared to one from the low-fear group due to a failure to uphold the accuracy criteria. While the aforementioned study yielded positive results, it is possible that results may be skewed toward the non-fearful if one group of participants yields higher levels of attrition relative to another. Occurrences such as this in IRAP research could reduce the likelihood of obtaining a thorough picture of responding in the domain under scrutiny, ultimately masking important results. It is possible that the anxiety elicited by the pictures of spiders used in the study (in particular in the high fear participants) resulted in impaired performance on the IRAP. Gerdes, Alpers and Pauli (2008) reported a similar effect, which suggests that spider phobic individuals fail to disengage their attention from spider stimuli in a reaction time task. Individuals with contamination-based OCD also demonstrated an inability to disengage from fearful and disgusting stimuli on a reaction time task (Cisler & Olatunji, 2010). In relation to the IRAP, it is unclear whether salient stimuli cause the participants' attention to be diverted from the purpose of the task resulting in a greater number of errors or longer response latencies on specific trials only or if this lapse of attention filters throughout the rest of the task also. A theory known as Attentional Control Theory posits that anxiety results in impaired attentional control,

which causes poorer performance in tasks that involve working memory, specifically the central executive[3] (Coombes, Higgins, Gamble, Cauraugh & Janelle, 2009). Due to the seemingly attentionally demanding nature of the IRAP, this theory may offer a possible reason for the high attrition rates in clinical IRAP research, which will be explored in Chapter 4.

Chapter 5: the IRAP and obsessive beliefs. Given the highly heterogeneous nature of OCD, Chapter 5 delineates a series of three experiments which tested the precision of the IRAP with respect to specific patterns of obsessive behaviour as outlined in the cognitive-behavioural literature on OCD. In the first study, the IRAP was designed to measure the six obsessive belief domains of OCD (see OCCWG, 2005) with respect to general disgust. The second study again tested the precision of the IRAP by focusing exclusively on excessive responsibility/overestimation of threat appraisals in relation to contaminated objects. The final study in this chapter complements the previous one by using the IRAP to measure perfectionism/intolerance of uncertainty also with respect to contaminated stimuli. Behavioural approach tasks and self-reports are again used as a comparison to the IRAP.

Chapter 6: intolerance for causing mess (ICM). Returning to the study of disgust propensity and sensitivity, Chapter 6 adopted the same IRAP's as described in Chapter 2, however, with a few critical alterations. The generically pleasant stimuli were replaced with more salient and meaningful positive pictures that were chosen to be direct opposites of the disgust-eliciting stimuli. Similarly, the behavioural approach tasks in this

[3] We acknowledge that by using cognitive terms such as central executive and working memory we are drawing from two separate literatures, however, these terms are ill-defined in behavioural psychology and are the accepted terms in the field of cognitive psychology. Thus we simply use them here because they are used to investigate the variable of interest.

study were designed to measure willingness to be the cause of a mess or disturbance along with avoidance of an item which has been perceived to be disgusting.

Chapter 7: clinical work. Finally, in order to allow for generalisation of the results to OCD, a further two studies were conducted to further validate the IRAPs by implementing them with a clinical sample of individuals who had received a diagnosis of OCD. First, the disgust propensity and sensitivity IRAPs were utilised in a study conducted with a clinical sample of patients with a diagnosis of OCD and a control sample from the university population. Perugini et al. (2010) argued that the predictive validity of implicit measures for behaviour is critical and the earlier chapters explore this at a non-clinical level with behavioural approach tasks. This final chapter explored this theme in greater depth by seeking to determine the variables that predict treatment outcome and examining changes across a five week treatment programme for OCD.

Chapter 2: Developing the IRAP as a Measure of Disgust Propensity and Sensitivity

The aim of Study 1 in the current thesis was to develop implicit measures of both disgust propensity and sensitivity using the IRAP. Two separate IRAPs were developed, one to measure disgust propensity and another to measure disgust sensitivity. The IRAPs presented identical pictorial stimuli depicting either disgusting or pleasant images. The differences between the two IRAPs were the worded reactions to the pictorial stimuli, which represented either disgust propensity (i.e., primary reactions such as "I am Disgusted") or disgust sensitivity (i.e., secondary appraisals such as "I Worry I'll get Sick"). A series of behavioural approach tasks encompassing the disgust domains of food-related disgust, socio-moral disgust, body-envelope violations and animal-related disgust were used to validate the implicit measures. Additionally, a series of questionnaires were implemented to measure general disgust, OC tendencies and general psychopathology. Given that this was the first study to attempt to use implicit measures to provide independent assessments of disgust propensity and sensitivity, we refrained from making specific predictions. However, due to the automatic nature of disgust propensity, it was predicted that this construct would have a closer relationship with the initial elements of disgust responding such as automatic negative thoughts (i.e., initial covert reactions). On balance, based on work by Teachman (2006), in which she argued that secondary disgust reactions would focus on beliefs about the perceived ability to cope with being disgusted (e.g., "If this gets all over me, I'll never feel clean again"), it was hypothesized that the disgust sensitivity IRAP would be a greater predictor of the behavioural aspect of disgust responding (i.e. the compulsion to hand wash).

Method

Participants

Participants (N = 33) were selected from the student population of Maynooth University. There were no selection criteria in order to take part in this study in relation to levels of disgust or OC tendencies. There is increasing support for the idea that OCD symptoms originate in normal human processing. Therefore, the use of non-patient samples that score high on self-report measures of OCD may be relevant to understanding the development of OCD (see Burns, Formea, Koertege, & Sternberger, 1995). There were 12 men and 21 women with ages ranging from 18-25 with a mean age of 19.73. Each participant provided written informed consent prior to taking part in the study and completed the experiment individually in the Department of Psychology at Maynooth University.

Materials

Disgust Scale-Revised (DS-R; Haidt et al., 1994). The Disgust Scale is a 27 item scale and is frequently used to measure disgust propensity across seven domains of disgust including food, animals, body products, death, body envelope violation, hygiene and sex (van Overveld, de Jong, Peters, & Schouten, 2011). The scale has been found to have convergent and discriminant validity and has moderate correlations with a sensation-seeking scale (r = -.46) and a fear of death scale (r =.39).

Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002). The OCI-R is an 18 item self-report measure of symptoms of obsessive-compulsive disorder and was used to measure OC tendencies. It has successfully differentiated between

individuals with and without OCD. For a non-anxious sample, it has demonstrated good-excellent internal consistency (≥.72), and test-retest reliability (.57 - .87).

Depression, Anxiety and Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1993). The DASS is a 21 item self-report questionnaire, which covers a range of core symptoms of anxiety, depression and stress. For a non-clinical sample, it has demonstrated excellent internal consistencies among its three subscales (.82 - .90), good convergent and discrimant validity (.70 - .72) and adequate reliability (.90 - .95) (Henry & Crawford, 2005).

Implicit Relational Assessment Procedure (IRAP). Two IRAPs were completed by each participant, the Disgust Propensity IRAP (hereafter referred to as the DP-IRAP) presented one of two target stimuli on each trial, a Disgust response (e.g. "I Am Disgusted") or a Positive response (e.g. "I Like it"). The Disgust Sensitivity IRAP (hereafter referred to as the DS-IRAP) presented a Distress appraisal response (e.g. "I Need to Look Away") or a Non-Distress appraisal response (e.g. "I Know I Won't Get Sick") on each trial. The label stimuli presented in both IRAPs were identical and consisted of one of sixteen digital images; eight were colour photographs of things which would evoke disgust and the other eight were colour pictures of pleasant things. All but one of the stimuli was taken from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1996). The pictorial stimuli were chosen because they reflected a range of disgust domains (e.g., animal, body-envelope violations, socio-moral; see Appendix C) and the worded stimuli were based on phrases used in self-report scales which have been shown to provide separate measures of disgust propensity and

Sensitivity, with the propensity items focusing on the initial feeling of disgust and the sensitivity items focusing on the consequence of those feelings (van Overveld et al., 2006) (see Table 2.1). Finally, two response options, "True" and "False" were also presented in both IRAPs (see Figures 2.1 and 2.2).

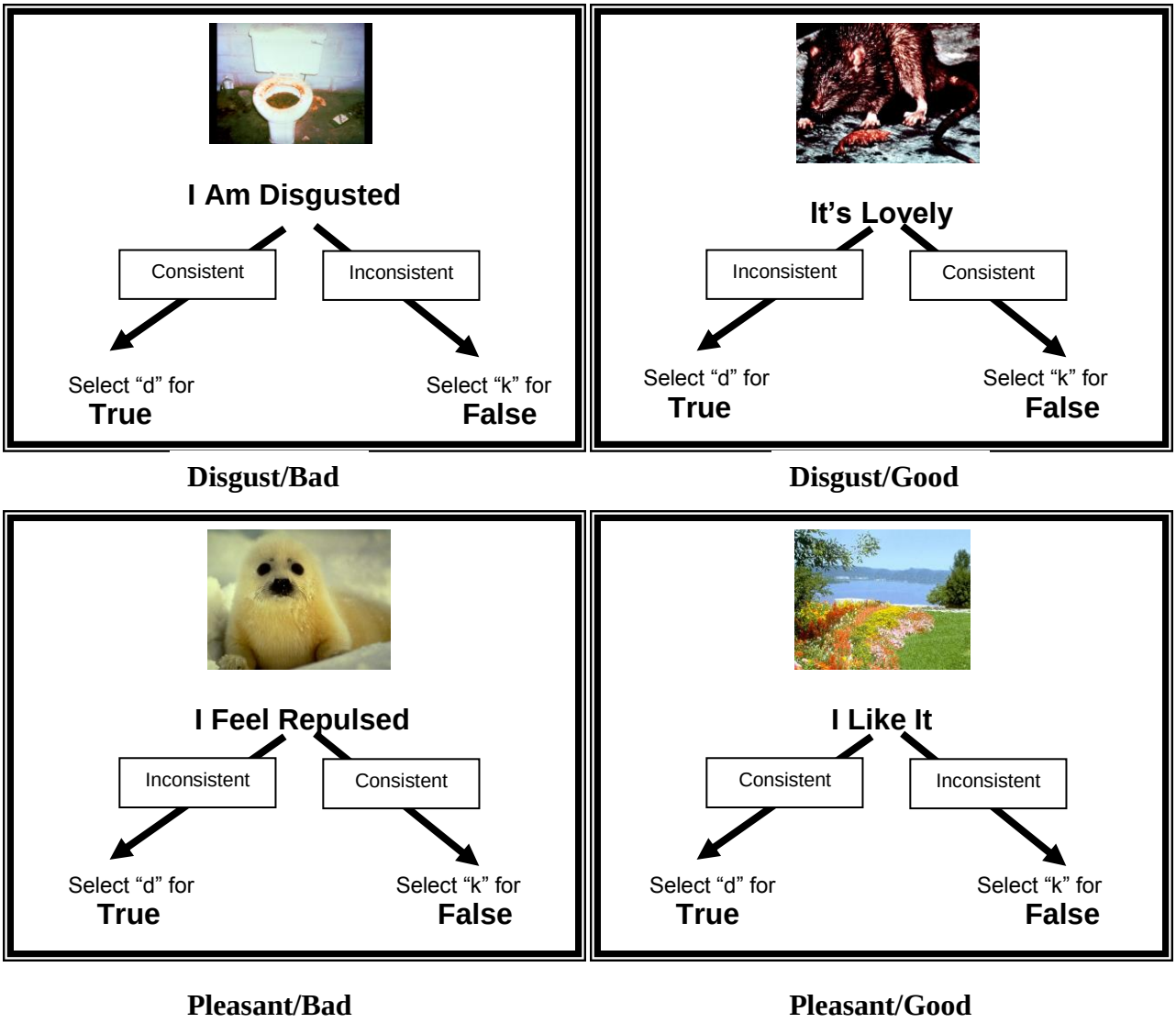
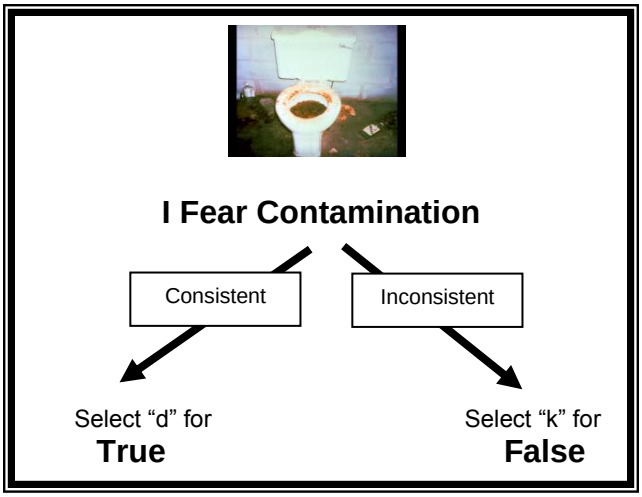
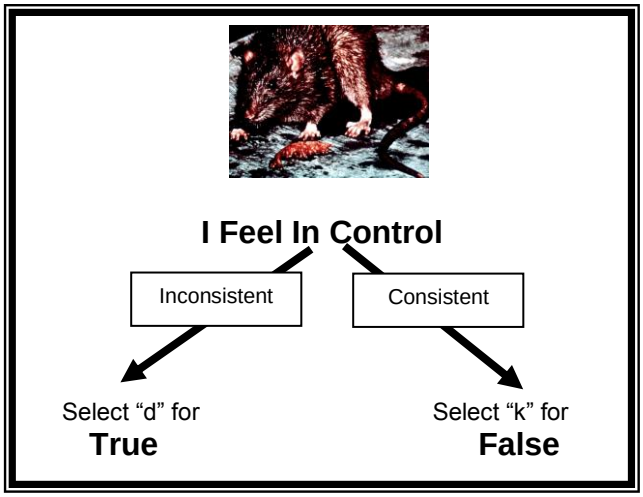


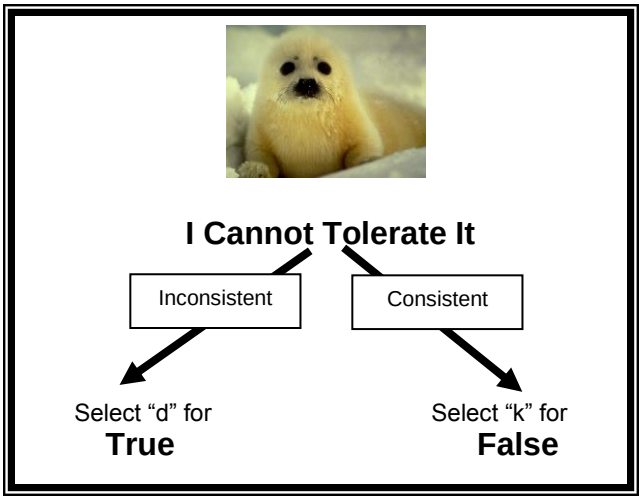
Figure 2.1. Examples of the four trial-types from the DP-IRAP (Note: the boxed words did not appear on the screen for participants)



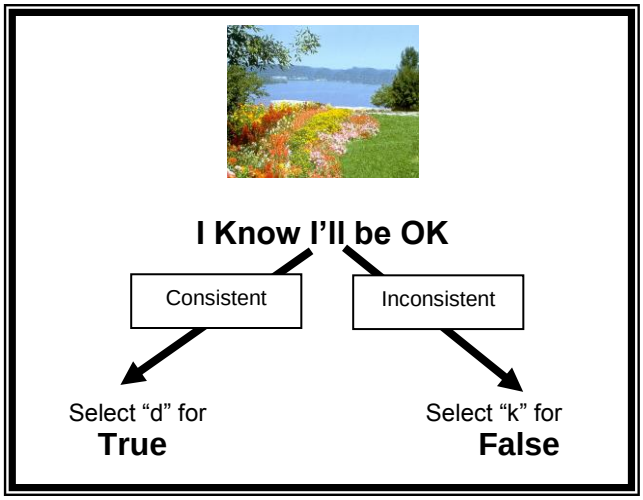
Disgust/Distressing



Disgust/Positive



Pleasant/Distressing



Pleasant/Positive

Figure 2.2. Examples of the four trial-types from the DS-IRAP

Procedure

Behavioural Approach Tasks. Three of the behavioural approach tasks (tarantula, poop cookie, surgery) were selected because they have been used in previous studies assessing disgust (e.g., Teachman & Saporito, 2009) and capture a range of disgust responding in a variety of domains (e.g., animal-related, food, blood-injury-

injection). The socio-moral task was designed specifically for the current study as a means to measure socio-moral disgust in an approach-type manner (see Appendix A).[4]

Disgust Propensity IRAP	
Negative Stimuli	**Positive Stimuli**
I am disgusted	I feel good
I feel repulsed	I feel positive
I feel sick	I feel happy
I feel nauseous	I like it
Turns my stomach	Relaxes me
It's revolting	It's lovely
I might vomit	I feel well
Will contaminate me	Good for me
Disgust Sensitivity IRAP	
Negative Appraisal Stimuli	**Positive Appraisal Stimuli**
I need to look away	I can look
I need to escape	I can stay
I worry I'll get sick	I know I won't get sick
I cannot cope	I can tolerate it
I worry I might faint	I know I won't faint
I fear contamination	I have no fear
I fear losing control	I feel in control
I cannot tolerate it	I can cope with this

Table 2.1. Each of the worded target stimuli used of for the DP- and DS-IRAPs

***Tarantula Skin*.** The molt of a tarantula of approximately 4 inches in length was placed in a small container at the end of a room. Participants were told what was in the room (the molt of a tarantula, not a live spider) and were asked if they would allow the experimenter to open the door to the room (step 1). They were asked if they were willing to enter the room (step 2), approach the spider skin as closely as they felt comfortable (step 3), ultimately picking the spider skin up (step 4) and holding it for up to or for one minute (steps 5 and 6). They were allotted a score from 0 to 5 based on their performance on the task.

[4] A fifth control task adapted from Gordon and Teachman (2008) was used to measure anxiety, however, preliminary analysis found no relationship with self-reported anxiety. As such, it was eliminated from the final analyses.

Surgery Video (adapted from Rozin, Haidt, McCauley, Dunlop, & Ashmore, 1999). A video of a hip replacement surgery which became progressively more graphic was played on a computer screen to the participants. The video was three minutes in length. Participants were told to keep their eyes on the screen and if they wished to cease watching the video they were instructed to push a designated button on the keyboard which would stop the video. Steps completed were scored based on the amount of time spent watching the video and ranged from 0 to 5 (corresponding to six 30 second increments).

Poop Cookie (adapted from Teachman & Saporito, 2009). A piece of chocolate that was designed to look like animal faeces was placed in a litter box-shaped container filled with oats which resembled cat litter. Participants were told that it was not real faeces and were asked how willing they were to step closer to the cookie (step 1). They were then asked would they be willing to stand over the container (step 2), pick up the cookie (step 3), examine it carefully (step 4), put the cookie to their lips (step 5) and step 6 involved taking a bite of the cookie. They were allotted a score between 0 and 5 based on their performance.

Socio-Moral Task. This task was designed to measure the extent to which participants avoid thoughts about performing socially immoral acts. Participants were first asked to think of up to three moral violations that they would consider as being weak (i.e., an act or scenario that the participant believes to be less immoral than other acts such as murder but still immoral in some sense). They were then instructed to rate how they felt about doing this task in the domains of level of difficulty, how morally uncomfortable they felt while doing the task and their willingness to do the task again.

The same procedure was repeated a further three times encompassing different levels of morality; moderate, strong and extreme. The task was scored from 0-5 and participants were allotted one point for every two moral violations they wrote. The task acted as a behavioural approach task in that it was designed to require participants to carry out a task in stages while also inducing discomfort. It was based on the cognitive-behavioural theory of intrusive thoughts set forth by Salkovskis (1985) in which the belief that having a thought about an action is as bad as performing the action (see Shafran & Rachman, 2004, for a review of Thought-Action Fusion).

IRAP. The IRAP is a computer based procedure that requires participants to respond quickly and accurately to blocks of trials that are consistent or inconsistent with their own beliefs. The primary datum from the IRAP is response latency, which is defined as the time in milliseconds that elapses from the onset of a trial to the emission of a correct response.

The instructions for the IRAP (see Appendix B) were presented visually and were read through with the experimenter to ensure that each participant understood the nature of the experiment and what was being asked of them. The experimenter stressed the importance of speed and accuracy in the IRAP. As a result, each participant was aware that, at times, they would be required to respond in a manner that was consistent with their own beliefs and sometimes in a manner that was inconsistent with their own opinions.

There were a number of practice blocks that each participant completed in order to ensure an accuracy rate of 75% and a response latency of less than or equal to 2000ms (for the DP IRAP) and 2500ms (for the DS-IRAP). The participants were required to

meet these criteria across a pair of practice blocks, within six or less blocks, before proceeding to the fixed set of six test blocks. Each trial within the practice and test blocks consisted of one of sixteen category labels which consisted of eight disgust-eliciting pictures and eight pleasant pictures, one of sixteen target stimuli (e.g. "I am Disgusted" or "It's Lovely"), and the two response options, True and False (See Figure 2.1). All of the stimuli remained on the screen until the participant pressed either the 'D' or 'K' keys which correspond to true or false. The words 'Too Slow' appeared on the screen if a participant did not respond within 2000ms. A red 'X' appeared on the screen if a participant selected the incorrect response; the X remained on screen until the correct response was made.

A correct response was determined by whether or not the participant was completing a consistent or inconsistent block. Consistent IRAP blocks were defined as those that required responses which were in line with an anti-disgust and pro-pleasant bias (e.g., for the DP-IRAP: selecting 'True' when presented with a disgust-eliciting picture and a Disgust response such as 'I am Disgusted'; for the DS-IRAP: selecting 'True' when presented with a disgust-eliciting picture and Distress Appraisal response such as 'I Fear Contamination' or for the DP-IRAP: selecting 'False' when presented with a disgusting-eliciting picture and a Positive response such as 'It's Lovely'; for the DS-IRAP: selecting 'False' when presented with a disgust-eliciting picture and a Non-Distress Appraisal response). Inconsistent IRAP blocks required the opposite response pattern, in line with a pro-disgust and anti-pleasant bias (e.g. for the DP-IRAP: selecting 'False' when presented with a pleasant picture and a Positive response such as 'I Like It' and for the DS-IRAP: selecting 'False' when presented with a pleasant picture and a Non-

Distress appraisal response such as ‘I Can Cope with This’ or for the DP-IRAP: selecting ‘True’ when presented with a disgust-eliciting picture and a Positive response such as ‘Good for Me’ and for the DS-IRAP: selecting ‘True’ when presented with a disgust-eliciting picture and a Non-Distress Appraisal response such ‘I Feel in Control’).

Participants were notified that the IRAP would begin with a consistent block of trials and that the IRAP would then alternate between the two types of blocks throughout the rest of the task. Prior to each new block of trials, participants were informed that the previous right answers were now wrong and vice-versa. Each participant received the consistent block of trials first and the blocks were not counterbalanced across participants because it has been shown in previous studies that this variable does not interact with the overall IRAP effect (e.g., Vahey, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009).

The IRAP was presented in blocks of 32 trials. There were a number of practice blocks that each participant completed in order to ensure an accuracy rate of 75% and a response latency of less than or equal to 2000ms for the DP-IRAP and 2500ms for the DS-IRAP. The participants were required to meet these criteria across a pair of practice blocks, within six or less blocks, before proceeding to the fixed set of six test blocks. Each trial within the practice and test blocks presented one of eight category labels, which consisted of eight disgusting pictures and eight pleasant pictures, one of eight target stimuli (e.g., “I Like It” or “I Fear Contamination”) and the two response options, “True” and “False” (see Figures 2.1 and 2.2). All of the stimuli remained on the screen until the participant pressed either the “D” or “K” keys, which corresponded to either “True” or “False. If the response was deemed correct, an inter-trial interval of 400 ms was presented, during which the screen remained blank. The words “Too Slow” appeared

on the screen if a participant did not respond within 2000 or 2500 ms. A red X appeared on the screen if a participant chose the response option deemed incorrect for that trial; the X remained on screen until the correct response was made.

The IRAP program insured that all eight picture stimuli and all eight word stimuli were presented twice within each block of trials. In addition, the trials were presented quasi-randomly, with the constraint that each of the four trial types appeared eight times within each 32-trial block. The program also ensured that the same trial type was not presented across successive trials. Finally, the left–right positioning of the two response options ("True" and "False") alternated randomly across trials with the constraint that they could not appear in the same positions across four successive trials. A correct response on any trial was determined by whether or not the participant was completing a block of trials designed to be consistent or inconsistent with high levels of disgust propensity or -sensitivity (see Figure 2.1). On both IRAPs, consistent trials were those which required participants to respond in an anti-disgust and pro-pleasant manner (e.g., responding "True" when presented with a disgusting picture and "I Feel Repulsed" or "I Fear Contamination") while inconsistent required the opposite response pattern (i.e. pro-disgust and anti-pleasant; e.g., "True" when presented with a disgusting picture and "I Like It" or "I Feel in Control").

Participants were notified that each IRAP would begin with an anti-disgust block of trials and that it would then alternate between the two types of blocks throughout the rest of the task. Prior to each new block of trials, participants were informed that the previously correct answers were now wrong and vice versa. Each participant received the anti-disgust block of trials first, and the blocks were not counterbalanced across

participants because it has been shown in previous studies that this variable does not interact with the overall IRAP effect (see Barnes-Holmes, Barnes-Holmes et al., 2010, for a review).

The experimenter stayed with the participant during the practice blocks and then left the room once the participant had achieved criteria to move to the test blocks. When the participant had completed the six test blocks, they were informed via a message on the screen that this part of the experiment was over and were asked to call the experimenter.

General Procedure

Following informed consent, participants completed either the behavioural approach tasks or the IRAPs first. The procedure was counterbalanced so that half of the participants received the behavioural approach tasks first and the other half received the two IRAPs first. The order in which the behavioural approach tasks were administered was randomized to avoid obtaining a result that was specific to receiving the BATs in a particular sequence. The order in which the IRAPs were administered was counterbalanced. The questionnaires (DS-R, OCI-R, DASS) were administered between completion of the two IRAPs. Participants were given the opportunity to wash their hands with an antibacterial hand gel between the behavioural approach tasks to reduce residual disgust from one task affecting performance on the next task.

Ethical Considerations

The present research was approved by the Research Ethics Committee at Maynooth University. Each participant provided informed consent on their own behalf

and were aware that the research was anonymous and that they could cease participation in the study at any time.

Results

Scoring the IRAP

To insure that the analysed data reflected the relational stimulus control targeted by the IRAP, participants' accuracy scores for each block were first screened. Specifically, if response accuracy fell below 75% on only one test block then participant's analyses were conducted on the remaining two pairs of test blocks; the data for 1 participant were analysed in this way.[5] If a participant failed to maintain =>75% across two or more test blocks, their entire data set for both IRAPs was discarded; the datasets for 4 participants were removed on this basis. The data from three additional participants were removed; for two outliers (for one the *D*-IRAP score was 2 SDs from the mean scores on the DP-IRAP, and for the other the OCI-R and DASS scores were 3 SDs from the mean) and for one participant who chose not to complete any of the BATs. Using an adapted form of the Greenwald, Nosek and Banaji (2003) *D*-algorithm, the response latencies were transformed into *D*-IRAP scores (for a full description see Table 2.2).

[5] An accuracy criterion of 75%, rather than the more typical 80%, was implemented to avoid excessively high attrition rates (Vahey et al., 2009).

1.	Only the response latencies from the six test blocks were utilised
2.	Any latency which exceeded 10,000ms was removed from the data set,
3.	If the data of a participant contained response latencies of less than 300ms in more than 10% of test block trials then the participant was removed from the data set
4.	Twelve standard deviations for the four trial types were calculated: four from the response latencies from the first and second test blocks, four from the response latencies from the third and fourth test blocks and four from the response latencies from the fifth and six test blocks
5.	24 mean latencies were then calculated for the four trial types in each of the six test blocks
6.	For each of the six test blocks, a difference score was calculated for each of the four trial types, by subtracting the latency of the pro-spiders test block from the mean latency of the corresponding pro-pleasant test block
7.	Each difference score was divided by its corresponding standard deviation (calculated in step 4) which yielded twelve *D*-IRAP scores; one for each trial type for each pair of test blocks
8.	Four overall trial type *D*-IRAP scores were then calculated by averaging the three scores for each of the four trial types across each of the three pairs of test blocks
9.	Two *D*-IRAP scores, one for spiders and one for pleasant, were then calculated by then averaging the two spider and the two pleasant scores

Table 2.2. Method for Converting the Response Latencies from Each Participant into D-IRAP Score

Internal Consistency of Socio-Moral Scale

The socio-moral scale designed for the current study was found to have good internal consistency with a Cronbach's alpha of .87. The inter-item correlations (the items measured being the number of scenarios written down, reported level of discomfort, willingness and difficulty: See Appendix A) were good-excellent, ranging from .49 to .84, suggesting that the scales were related without being redundant. The positive correlations between the number of scenarios and the level of discomfort suggest that thinking and writing immoral scenarios evoked discomfort in the participants.

Scoring the BATs

Each behavioural task was scored on a six-point scale. To provide one overall score for the BATs the scores from the four disgust-related tasks were added and then divided by four to obtain an average BAT score.

Implicit Measure Analyses

As noted in the Introduction, a significant limitation of the IAT is that it provides a *relative* response bias to two concepts, rather than a non-relative bias towards a single concept (De Houwer, 2002). In contrast, each trial-type may be analysed separately with the IRAP (e.g., how distressing does an individual find disgusting things). In relation to the current research, the extent to which an individual finds disgusting stimuli as being positive, or pleasant stimuli as being negative, is somewhat irrelevant given that the problematic behaviour of an individual with contamination-related OCD arises from an irrational interpretation of specific stimuli as being dangerous or distressing. Thus, the current set of analyses focused only on the IRAP trial-types that aimed to assess response biases that reflected negative reactions to disgust-eliciting stimuli (i.e., the *Disgust-Bad* and *Disgust-Distressing* trial-types)[6]. Both of these scores were consistent with the predicted response biases; that is, responding *True* more quickly than *False* to disgusting images paired with negative descriptors (*Disgust-Bad*, $M = .23$, $SD = .26$; *Disgust-Distressing*, $M = .17$, $SD = .35$). Both scores proved to be significantly different from zero: *Disgust-Bad*, $t(25) = 4.43$, $p = .0002$; *Disgust-Distressing*, $t(25) = 2.53$, $p = .01$.

Correlation Analyses. A correlation matrix was calculated to examine the relationships between *D*-IRAP scores on the both the DP- and DS- IRAPs, overall

[6] The *D*-IRAP scores for the other trial-types were in the expected direction and in keeping with the hypothesis that participants' will have shorter response latencies on trials that require them to respond that disgusting things are bad/not good and that pleasant things are good/not bad.

performance on the BATs, general disgust (as measured by the DS-R), general psychopathology (as measured by the DASS), depression, anxiety and stress (also measured by the DASS), and OC tendencies (including obsessing and washing, as measured by the OCI-R). The results indicated that stronger disgust responses on the *Disgust-Bad* trial-type predicted higher levels of OC tendencies and specifically obsessing along with depressive symptoms. Stronger IRAP effects on the *Disgust-Distressing* trial-type predicted fewer steps completed across the BATs, higher OC and depressive symptoms along with general psychopathology, and washing concerns specifically. These correlations were not significant, and thus caution is required in interpreting these results as strong evidence that the two IRAPs were tapping into separate constructs.

Predictive Validity of the IRAP. Given the significant correlations, it was deemed important to conduct a series of hierarchical multiple regression analyses to determine the predictive validity of one *D*-IRAP trial-type independently of the other trial-type. In addition, based on suggestions in the literature regarding the study of the relationship between disgust and psychopathology (Davey, 2003), hierarchical multiple regression were subsequently used to control for the effects of anxiety

In Table 2.4 it can be seen that the *Disgust-Distressing* trial-type predicted behaviour independently of the *Disgust-Bad* trial-type and anxiety. Additionally, neither trial-type remained a significant predictor of OC tendencies when the other trial-type or anxiety was controlled for. Though, the *Disgust-Bad* trial-type did remain a significant predictor of OC tendencies when self-reported disgust was controlled for while the *Disgust-Distressing* trial-type was marginally so. Only the *Disgust-Bad* trial-type remained a

significant predictor of OC tendencies when the DS-R was controlled for, however, the *Disgust-Distressing* trial-type was marginally significant. Finally, neither the *Disgust-Distressing* trial-type nor anxiety undermined the predictive validity of the *Disgust-Bad* trial-type for obsessing, while the predictive validity of the *Disgust-Distressing* trial-type only remained significant for washing concerns when controlling for anxiety and marginally so when controlling for the *Disgust-Bad* trial-type.

	DP	DS	BAT	DS-R	OCI-R	Depr	Anx	Stress	DASS	Obsessing	Washing
DP-IRAP	-	.265	.091	.049	**.400***	**.413***	.230	.104	.312	**.494****	.234
DS-IRAP		-	**-.473****	.237	**.406***	**.449***	.267	.252	**.400***	.318	**.391***
BAT			-	-.341	-.369	.005	-.273	-.004	-.104	-.160	-.277
DS-R				-	.248	.009	.213	.081	.117	.282	.143
OCI-R					-	.443*	.343	.371	**.473****	**.764*****	**.701*****
Depression						-	.345	**.570****	**.799*****	.281	.447*
Anxiety							-	**.630*****	**.782*****	**.537*****	.161
Stress								-	**.885*****	**.522****	.297
DASS									-	**.534****	**.376***
Obsessing										-	**.463****

***p* < .05**
****p* < .01**
*****p* < .001**

Table 2.3. Implicit-explicit/behavioural correlation matrix.

Note: DP-IRAP: Disgust Propensity IRAP; DS-IRAP: Disgust Sensitivity IRAP; BAT: Behavioural Approach Tasks; DS-R: Disgust Scale Revised; OCI-R: Obsessive-Compulsive Inventory Revised; Depr: Depression; Anx: Anxiety; DASS: Depression, Anxiety & Stress Scale.

		B	SE B	Beta	*p*
	Dependent Variable: Behaviour				
1.	*Step 1* (R^2 = .008)				
	Disgust-Bad trial-type	.291	.653	.091	.660
	Step 2 (R^2 change =.265)				
	Disgust-Distressing trial-type	-1.33	.459	-.543	.008
2.	*Step 1* (R^2 = .074)				
	Anxiety	-.029	.021	-.273	.178
	Step 2 (R^2 change =.172)				
	Disgust-Distressing trial-type	-1.07	.467	-.431	.031
	Dependent Variable: OC Tendencies				
3.	*Step 1* (R^2 = .061)				
	DS-R	.265	.212	.248	.223
	Step 2 (R^2 change =.151)				
	Disgust-Bad trial-type	14.47	6.90	.388	.047
4.	*Step 1* (R^2 = .164)				
	Disgust-Distressing trial-type	11.70	5.30	.406	.040
	Step 2 (R^2 change =.092)				
	Disgust-Bad trial-type	11.70	6.89	.314	.105
5.	*Step 1* (R^2 = .118)				
	Anxiety	.430	.240	.343	.080
	Step 2 (R^2 change =.109)				
	Disgust-Bad trial-type	12.61	7.02	.339	.085
6.	*Step 1* (R^2 = .061)				
	DS-R	.265	.212	.248	.223
	Step 2 (R^2 change =.127)				
	Disgust-Distressing trial-type	10.60	5.58	.367	.070
7.	*Step 1* (R^2 = .160)				
	Disgust-Bad trial-type	14.88	6.97	.400	.043
	Step 2 (R^2 change =.097)				
	Disgust-Distressing trial-type	9.30	5.38	.322	.097
8.	*Step 1* (R^2 = .118)				
	Anxiety	.430	.240	.343	.086
	Step 2 (R^2 change =.106)				
	Disgust-Distressing trial-type	9.76	5.50	.338	.089
	Dependent Variable: Obsessing				
9.	*Step 1* (R^2 = .101)				
	Disgust-Distressing trial-type	2.39	1.45	.318	.113
	Step 2 (R^2 change =.181)				
	Disgust-Bad trial-type	4.26	1.77	.441	.025
10.	*Step 1* (R^2 = .288)				
	Anxiety	.174	.056	.537	.005
	Step 2 (R^2 change =.145)				
	Disgust-Bad trial-type	3.78	1.56	.391	.023
	Dependent Variable: Washing Concerns				
11.	*Step 1* (R^2 = .055)				
	Disgust-Bad trial-type	2.09	1.77	.234	.251
	Step 2 (R^2 change =.116)				
	Disgust-Distressing trial-type	2.45	1.63	.354	.086
12.	*Step 1* (R^2 = .026)				

Anxiety	.045	.060	.161	.432
Step 2 (R^2 change =.130)				
Disgust-Distressing trial-type	2.59	1.38	.374	.072

Table 2.4. Results from twelve hierarchical multiple regression analyses using the *Disgust-Bad* and the *Disgust-Distressing* trial-types predicting behaviour, general OC tendencies and its sub-components while controlling for the effects of the other trial-type and anxiety.

Discussion

Study 1 sought to determine whether disgust propensity and sensitivity could be assessed with the IRAP and also the extent to which the DS-IRAP predicted behaviour over and above the DP-IRAP. The results provided preliminary evidence that the two IRAPs were assessing distinct relational responses. For instance, the IRAP measuring disgust propensity did not predict behaviour during the BATs while the IRAP measuring disgust sensitivity did. Implicit disgust propensity and sensitivity predicted OC tendencies, but only disgust propensity acted as a predictor of the obsession subscale of the OCI-R, while disgust sensitivity had a relationship with the washing subscale of the OCI-R. There was a non-significant positive correlation (.26) between the DP-IRAP and the DS-R which suggests a relationship between these variables -- the relatively small N may account for the lack of statistical significance. Interestingly, both IRAPs were related to depressive symptoms, however, as this is not the sole concern of this paper it will not be discussed further.

In addition, the impact of each trial-type on the predictive validity of the other was assessed. That is, when you control for the initial feeling of disgust (propensity), is the secondary appraisal of disgust (sensitivity) capable of predicting behaviour/OC tendencies and vice-versa. In terms of behaviour, this was found to be true in that disgust sensitivity was a significant predictor of avoidance when the effects of both disgust propensity and anxiety were controlled for. On the other hand, in relation to OC tendencies, neither trial-type were significant predictors when the other was controlled for (although both approached

significance). A possible explanation for this effect could be that each variable accounts for different aspects of OCD, as evident in the subsequent analyses that showed specific predictive effects for obsessing (with disgust propensity) and washing concerns (with disgust sensitivity).

The present results support the proposition that disgust responding occurs at both a primary (disgust propensity) and secondary (disgust sensitivity) level (van Overveld et al. 2006). Teachman and Saporito (2009) observed evidence of both primary and secondary disgust cognitions in relation to spider fear and Blood-Injury-Injection (BII) phobia with a series of behavioural approach tasks. van Overveld et al (2006) argued that failing to acknowledge both disgust propensity and disgust sensitivity could lead to inflated correlations between disgust and behaviour in experimental settings. If disgust is to be implicated in the aetiology of OCD, measures which are not confounded by such restrictions are vital. Thus, the current study provides two measures of disgust which assess distinctive aspects of responding and demonstrate their individual relationships with psychopathology. Moreover, this is the first study to demonstrate such sensitivity with a measure of implicit cognition, the IRAP.

Chapter 3: Examining the Effects of Changes made to the 2009 version of the IRAP on the *D*-IRAP scores

The primary reason for introducing the foregoing changes to the 2009 IRAP was to alleviate the difficulty that some participants reported (anecdotally) when first exposed to an IRAP. First, the introduction of explicit rules at the beginning of each block appeared to facilitate participants' rapid adaptation to the feedback contingencies particularly during the initial practice blocks. Second, participants reported that replacing "Too Slow" with an exclamation mark reduced the aversiveness of the temporal feedback. Indeed, previously published work has eliminated the 'Too Slow' prompt entirely as participants are often deterred by the prompt (Parling, Cernvall, Stewart, Barnes-Holmes, & Ghaderi, 2012; Vahey et al., 2009; Vahey, Boles, & Barnes-Holmes, 2010). Third, commencing the initial practice blocks without the temporal feedback encouraged participants to achieve and maintain appropriate accuracy levels before then focusing on increasing response speed to the required levels. It is important to note that we did not introduce and test these variables in a systematic manner. Rather, they emerged "organically" within our research group through extensive experience using the IRAP. Thus, it seemed important to determine if these changes appeared to impact upon the final test performances of the procedure itself. This was one of the two main aims of the current research.

A further aim of the current study was to test the general reliability of the IRAP as a generic procedure. That is, the current research involved two studies, one using an older version of the IRAP and the second using a more recent version, but using exactly the same label and target stimuli. Different groups of participants were used across the two studies, but were drawn from the same general population – undergraduate students attending the National University of Ireland, Maynooth. If the IRAP is to be considered a reasonably reliable measure one would expect that the "cosmetic" changes across the older and new

versions would have little impact on the outcomes of the measure. In effect, one would expect to observe the same general pattern of effects across the two versions.

The IRAP used in the present work is a derivative of the Disgust Sensitivity IRAP utilised in Study 1. Disgust sensitivity has been conceptualised as a secondary response or appraisal of an initial feeling of disgust (i.e., propensity) (van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006). This IRAP is one of the more complex IRAPs in the literature as it was not just measuring simple relations but was assessing relations between pictures (which provided the context) and complex propositions. Furthermore, within applied domains, certain stimuli may often be particularly salient and aversive to specific individuals, which in turn can affect accuracy. Barnes-Holmes et al., (2010) recommended amending the performance criteria, based on pilot work, to suit the population being sampled. Vahey et al. (2009) also employed a "preparation" IRAP to familiarise the participants with the procedure in an attempt to reduce attrition.

The IRAP used in the present study applied identical distress appraisals as those used in Study 1, however, the pictorial stimuli were specifically related to contamination fear rather than general disgust. Thus, it could be said that the IRAP was targeting sensitivity to contamination. Two separate studies were conducted which used the 2009 (Study 2) and 2012 (Study 3) versions of the IRAP with identical target and sample stimuli. The primary aim of the current study was to determine whether these changes to the procedure would result in any changes to the *D*-IRAP scores.

Study 2

Method

Participants

Participants (N = 33) were selected from the student population in the Department of Psychology at National University of Ireland Maynooth. No selection criteria were used to

target individuals (i.e. 13 males and 20 females). Participants aged in range from 19-36 years (M = 21.45). Each participant gave informed consent on their own behalf and completed the experiment individually in a controlled setting.

Materials

Disgust Scale-Revised (DS-R: Haidt, McCauley, & Rozin, 1994). The Disgust Scale is a 27 item scale and is frequently used to measure disgust propensity across seven domains of disgust including food, animals, body products, death, body envelope violation, hygiene and sex (van Overveld, de Jong, Peters, & Schouten, 2011). It has been found to measure three stable factors, animal-reminder disgust, core-disgust, and contamination disgust (Olatunji, Cisler, Deacon, Connolly, & Lohr, 2007). The scale has been found to have convergent and discriminant validity and has moderate correlations with a sensation-seeking scale (r = -.46) and a fear of death scale (r =.39).

Contamination Obsessions and Washing Compulsion Subscale of the PI (PI: Burns, Keortge, Formea and Sternberger, 1996). The Contamination Obsessions and Washing Compulsions Subscale (COWC) of the Padua Inventory (PI) is a 10 item self-report scale which measures distress and symptom severity across the domains of contamination obsessions and washing compulsions. This subscale has demonstrated good discriminant validity and test-retest reliability (r = .72) [7].

Implicit Relational Assessment Procedure (IRAP). Participants completed an IRAP in which they were presented with either a distress appraisal response that was representative of disgust sensitivity (e.g. "I Fear Contamination") or a non-distress appraisal response (e.g. "I Feel in Control") on each trial. Two response options, "True" and "False" were also presented and were activated by pressing one of two keys on a computer keyboard. Finally,

[7] Participants also completed the Obsessive-Compulsive Inventory-Revised (OCI-R: (Foa et al., 2002), the STAI (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) and an adapted form of the "chain of contagion" task developed by Tolin, Worhunsky, & Maltby (2004).

one of sixteen digital colour images was also presented on each trial; five of the contamination-related images were taken from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1996) while the remaining three contamination-related images were selected based on items commonly referred to in self-report measures of contamination fear (Burns et al., 1996). The clean images were chosen to be directly opposite to the contamination-related images (see Appendix D).

The IRAP was presented in blocks consisting of 32 trials. Participants were required to complete up to 6 practice blocks to achieve a minimum accuracy of 80% within an average latency window of 2500ms or less. Participants were required to maintain these two criteria across a given pair of practice blocks (i.e. consistent and inconsistent), before the program continued to a fixed set of six test blocks. All participants commenced the IRAP by completing a block of consistent (anti-contamination) trials followed by a block of inconsistent (pro-contamination) trials. All remaining blocks, for both practice and test phases of the program, alternated from consistent to inconsistent blocks in this manner. On-screen instructions and additional verbal prompts provided by the researcher served to remind participants of this alternating sequence. Each trial within both the practice and test blocks involved presenting one of sixteen pictures (eight deemed "contamination-related" and eight deemed "clean"), one of sixteen target statements (e.g. "I Cannot Tolerate It" or "I Worry I'll Get Sick"), and the two response options "True" and "False" (see Figure 3.1) which were selected by pressing the keys, "D" and "K".

General Procedure

Participants completed the experiment individually in the department of psychology at Maynooth University. The order in which the IRAP, behavioural task and questionnaires were administered was counterbalanced across participants.

Ethical Considerations

The present research was approved by the Research Ethics Committee at Maynooth University. Each participant provided informed consent on their own behalf and were aware that the research was anonymous and that they could cease participation in the study at any time.

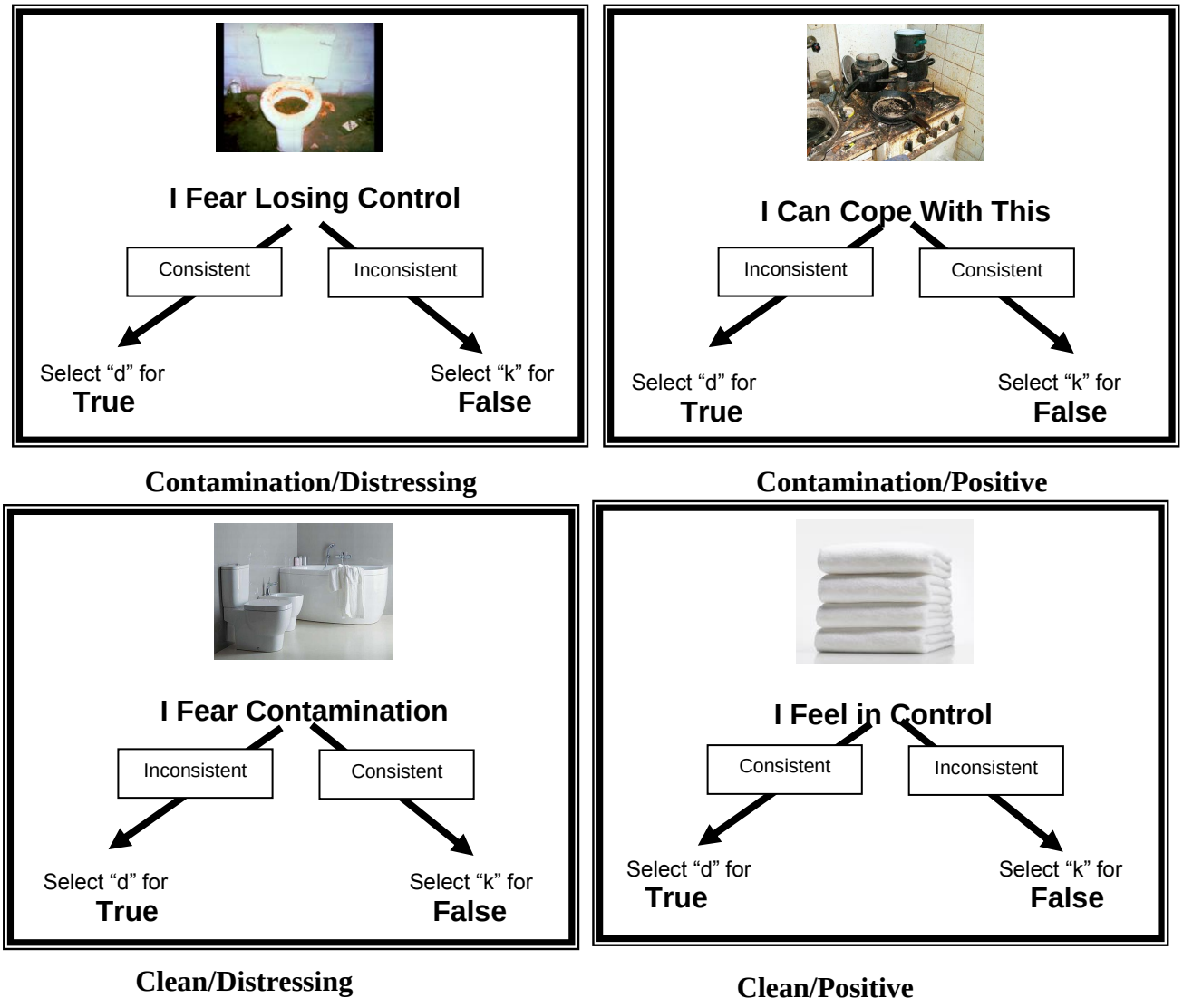


Figure 3.1. Examples of the four IRAP trial types. Note: Boxed-words and arrows which indicate which responses were deemed consistent or inconsistent did not appear on the screen.

Study 3

Method

Participants. Participants (N = 33) were undergraduate students attending the National University of Ireland Maynooth. No selection criteria were used to target individuals

(i.e. 12 males and 21 females). Participants aged in range from 18-40 years (M = 21.4). Each participant gave informed consent on their own behalf and completed the experiment individually.

Materials. Participants completed the DS-R (Haidt et al., 1994) and the contamination subscale of the PI-WSUR (Burns, Keortge, Formea, & Sternberger, 1996)[8].

Implicit Relational Assessment Procedure (IRAP). The 2012 version of the IRAP was used in Study 3. The sample and target stimuli were identical to that used in Study 2. The main changes in the 2012 version include presenting the rules for the consistent and inconsistent blocks in writing to the participants prior to each block. An analysis of the average response latencies from Study 2 indicated that participants were responding within 2000ms, as such, the latency criterion was reduced to 2000ms for Study 3. Further, if the participant did not respond within the 2000ms an exclamation mark acted as a prompt rather than the words "Too Slow".

Results

Scoring the IRAP. The response latency, defined as the time in milliseconds (ms) from the onset of a trial to the first response, provides the primary datum from the IRAP. The IRAP effect is the difference between the consistent and inconsistent mean response latencies recorded for a specific trial-type.

The latency data were transformed into *D*-IRAP scores using the adapted version of the Greenwald, Nosek and Banaji (2003) *D*-algorithm (see Nicholson & Barnes-Holmes, 2012b, for a full description of this procedure). The *D*-algorithm is used to minimize the impact of extraneous factors such as age, motor skills, and/or cognitive ability (Nosek, Greenwald, & Banaji, 2007).

[8] Participants also completed the Depression, Anxiety and Stress Scale (DASS: Lovibond & Lovibond, 1993), the Acceptance and Action Questionnaire-II (AAQ-II: Bond et al., 2011), a Comb behavioural approach task (adapted from (Rozin, Haidt, McCauley, Dunlop, & Ashmore, 1999) and a Coins BAT (see Chapter 5), however, these results will not be included as they were not included in Study 2.

Given the foregoing transformation, a larger *D*-IRAP score indicates a greater difference in response latencies between consistent and inconsistent trials. Positive scores indicate responding in accordance with expected response biases (e.g., responding "True" more quickly than "False" when a contamination-related picture appeared with a negative appraisal) and negative scores indicate responding in a manner that was inconsistent with expected responses biases (e.g., responding "False" more quickly than "True" when a contamination-related picture appeared with a positive appraisal). Scores that approach zero indicate no difference between consistent and inconsistent test blocks.

IRAP analyses. Two repeated measures analyses of variance (ANOVAs) were conducted to examine the average *D*-IRAP scores across the two studies. For study 2, there was a significant effect for the IRAP across the four trial-types, $F(3, 30) = 2.5$, $p = .06$, $\eta_p^2 = .07$; and also for Study 3, $F(3, 30) = 2.67$, $p = .05$, $\eta_p^2 = .07$. Subsequently, a mixed between-within 2x4 repeated measures ANOVA was carried out to directly compare responding on the two IRAPs. There was a non-significant between groups effect, $F(1, 65) = .17$, $p = .7$, and a non-significant interaction, $F(3, 62) = .07$, $p = .97$. There was, however, a significant effect for trial-type, $F(3, 62) = 5.10$, $p = .002$.

A comparison of the *D*-IRAP scores for each trial-type revealed little difference (.005- .04) between the average scores for each trial-type in the IRAP (see Figure 3.2 below). The largest difference was between the Clean-Positive trial-types (.04), however, this difference was not statistically significant when compared with an independent samples t-test ($t(64) = -.51$, $p = .6$).

***Implicit/Explicit Correlations*.** Two correlation matrices were calculated to examine the relationships between the explicit measures and IRAP performance and the compare correlations between the 2009 and 2012 IRAPs (see Table 3.1). A comparison of the correlations between the PI and the IRAP trial-types revealed very little difference, however,

there were marked variations between correlations for the IRAP trial-types and the DS-R. Moreover, the inter-correlations between the trial-types on the two IRAPs were also noticeably different. Finally, there was an interesting significant positive correlation between the Clean/Positive trial-type in study 2 and the number of times they used hand sanitizer throughout the study (r = .40, p = .01).

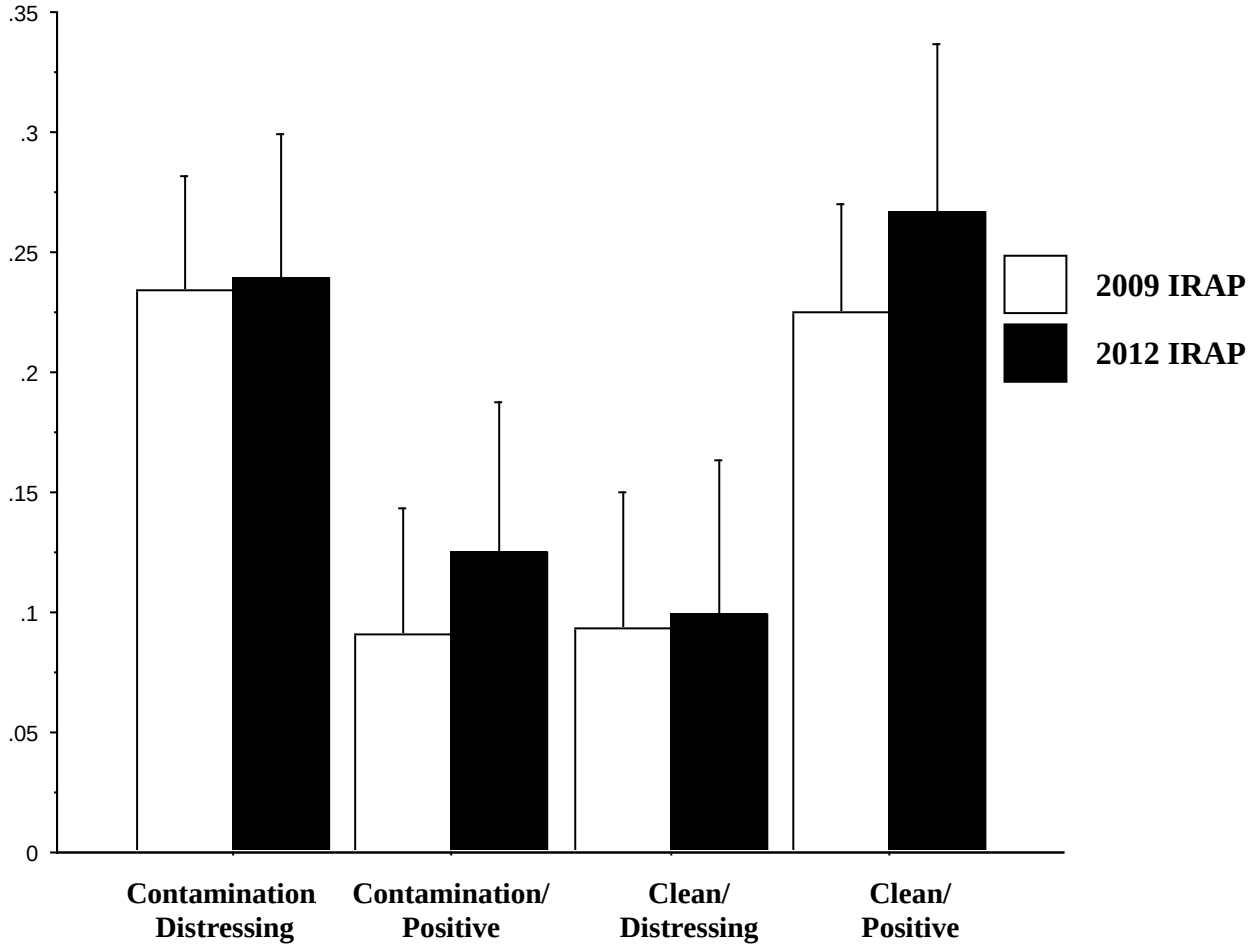


Figure 3.2. Bar chart depicting 2x4 mixed between-within repeated measures ANOVA

	Con /Dis	Con /Pos	Clean /Dis	Clean /Pos	Study 2 DS-R	PI	Con/Dis	Con/Pos	Clean/ Dis	Study 3 Clean/Pos	DS-R	PI
Contamination/ Distressing	-	.03	-.15	.10	-.14	.10	-	**.38***	.28	**.33***	.11	.05
Contamination /Positive	-	-	-.15	-.19	**-.32**[#]	.22	-	-	**.39***	**.39***	**.33**[#]	.23
Clean/ Distressing	-	-	-	**.40****	.14	.29	-	-	-	**.48****	.24	.25
Clean/Positive	-	-	-	-	.15	**.40****	-	-	-	-	.22	**.31**[#]
DS-R	-	-	-	-	-	.17	-	-	-	-	-	**.60****

$p \leq .07$
*$p \leq .05$
** $p \leq .01$

Table 3.1. Implicit/Explicit correlations for Studies 2 and 3

Discussion

A comparison of responding across the two IRAPs suggests that the added features to the 2012 version do not impact upon the *D*-IRAP scores in a meaningful way, in that there were no significant differences observed between each trial-type across the two separate studies. There was a notable difference between the correlations for the Contamination trial-types and the Clean trial-types on the two IRAPs. That is, there was a large significant positive correlation in Study 3 but a small negative correlation observed in Study 2. Minor discrepancies were observed in the correlations between the contamination subscale of the PI and the trial-types across both IRAPs.

The most conspicuous difference between the two IRAPs was the correlations between the contamination trial-types and the DS-R which were in opposite directions. Although the DS-R is widely considered to be a measure of disgust propensity and the present IRAP was designed to be a measure of sensitivity to contamination, it would still be expected that there would be a positive correlation. Evidence from the literature has demonstrated a relationship between propensity (as measured by the Disgust Scale) and sensitivity (Olatunji et al., 2010; van Overveld et al., 2006). On balance, the DS-R was designed before disgust was conceptualized as consisting of propensity and sensitivity, and thus it can be difficult to interpret the presence or absence of a relationship between these constructs using the DS-R. Indeed, the correlations between the two explicit measures, the contamination subscale of the Padua Inventory and the DS-R, across the two studies were also greatly different, highlighting potential problems with the latter measure. Psychometric evaluations for the scale are scarce and the reliability has been shown to unacceptably low (van Overveld, de Jong, & Peters, 2011). Recent psychometric evaluation of the latest

revision have improved the validity and reliability of the DS-R as a measure of the latent disgust constructs of core, animal reminder and contamination but not specifically disgust propensity (van Overveld et al., 2011).

A notable discrepancy that emerged was the difference in the inter-correlations for the IRAPs, which raises questions about the effects of the additions made to the IRAP. Given that the clean category was selected to be directly opposite to the contamination category, it could be argued that the trial-types would not be functionally independent from one another. Thus, it would be expected that inter-correlations between the trial-types would emerge. It is possible that presenting the rule to participants at the beginning of each block allowed for less confusion during the first few trials of each block. This may have resulted in less noise appearing in the data, however, this is speculative. It is possible that this may reflect greater internal reliability; however, this cannot be certain because it would not be internal reliability as it is traditionally defined.

Five of the ten studies conducted as part of the present thesis used the 2009 version of the IRAP while the remaining used the 2012 version. Thus, the present data is reassuring insofar as the alterations to the 2009 version did not impact upon the *D*-IRAP scores. In other words, the results from the studies can be compared without caution. However, as these alterations did not appear to reduce attrition rates further investigation is needed to determine if any cognitive factors impact upon a participant's ability to maintain the required accuracy. Chapter 4 will explore whether variations in attentional control, which is a facet of working memory, will help to predict accuracy on the IRAP.

Chapter 4: Exploring the Factors that Predict Accuracy on the IRAP

Attentional Control Theory (ACT) was put forth by Eysenck, Derakshan, Santos and Calvo (2007) to explicate the effects of anxiety on cognitive performance. The two main functions within ACT have been identified as the Inhibition function which is the ability to purposefully inhibit prepotent processes when needed and focus on relevant ones; and the Shifting function which is the ability to shift between multiple tasks and mental sets (Miyake, Friedman, Emerson, Witzki, Howerter & Wager, 2000; Eysenck et al, 2007). ACT posits that anxiety causes an increase in the salience of the stimulus-driven attentional system and a decrease in the goal-oriented system (Eysenck et al, 2007). Anxiety causes worry about threat to a current goal and anxious individuals come up with strategies to counteract this worry in order to achieve their goal (Eysenck et al, 2007; Derakshan & Eysenck, 2009). This could be applicable to the IRAP as participants need to inhibit or disengage from the emotionally-relevant stimuli or from their covert responses to the stimuli (stimulus-driven) and focus on the task at hand (goal-oriented). An inability to do this may result in a greater number of errors and/or slower speed of responding.

Attentionally demanding tasks, such as the IRAP, likely implement the central executive of working memory and as a result performance may be negatively affected by current levels of anxiety. If highly distracting stimuli are presented (e.g., pictures of spiders for spider-fearful individuals) they may thus impact on the inhibition and shifting functions of attentional control (Lavie, Hirst, de Fockert & Viding, 2004; Eysenck & Derakshan, 2011). Evidence supporting this claim has found that high-anxious individuals have a greater propensity for distraction than low-anxious individuals (Pacheco-Ungietti, Acosta, Callejas & Lupianez, 2010). Insofar as the IRAP is demanding on the central executive, and anxiety can

impair cognitive performance, it stands to reason that high-anxious individuals doing an IRAP designed to measure anxiety, and its related constructs, may struggle to maintain the necessary accuracy or latency criteria. On balance, high- and low-anxious individuals may demonstrate comparable performances if high-anxious individuals attempt to compensate for performance deficiencies by expending more effort (in the form of greater attentional control) than low-anxious individuals (Eysenck et al., 2007). As an aside, it should be noted that IRAPs that do not use anxiety-provoking stimuli sometimes still report high attrition rates, and thus it is unclear if the task itself elicits anxiety which in turn affects performance or if there is another variable which is detrimental to performance.

Study 4 sought to determine the circumstances under which participants will fail to uphold criteria on the IRAP and if there are any predictive variables that can prevent this from happening. The spider fear IRAP used in Nicholson and Barnes-Holmes (2012) was employed along with a series of questionnaires such as the Fear of Spiders Questionnaire (FSQ), State-Trait-Anxiety Inventory (STAI) and the Attentional Control Scale (ACS) and a Behavioural Approach Task (BAT) with a live tarantula. Additionally, a symbol version of the *n*-back task, which is assumed to place great demands on working memory and attention because it involves updating, monitoring and manipulating previously remembered information (Chen, Mitra & Schlaghecken 2008; Owen, McMillan, Laird & Bullmore, 2005), was implemented to determine if performance on an attentionally demanding task is predictive of IRAP performance. The present study was different to previous IRAP studies as it did not make use of the *D*-IRAP scores as the purpose was not to measure spider fear but to determine the variables which predict response latency and accuracy on the IRAP. As such, raw response latencies to specific stimuli and accuracy were the results of interest for this

study. It was hypothesized that performance deficits on the *n*-back would be comparable to those on the IRAP. Based on the attentional control literature, it was also hypothesized that scores on the ACS and its sub-components as well as the FSQ and the STAI would be related to accuracy on both tasks. Finally, evidence from the literature suggests that high-anxious individuals have difficulty disengaging from threatening stimuli (Koster, Crombez, Verscheure & De Houwer, 2004), thus it was assumed that high fear participants would produce longer response latencies on the IRAP than low fear participants.

Method

Participants

An opportunity sample of 32 undergraduate students from the National University of Ireland, Maynooth volunteered to take part in the current study. Informed consent was obtained from each participant prior to them taking part in the experiment. The sample consisted of 18 women and 14 men, who had a mean age of 21.3 years. There were no exclusion criteria implemented for the study. Each participant completed the study individually in the Department of Psychology at Maynooth University.

Materials

Live Tarantula. A live tarantula (Brazilian Black) was used throughout the study. It measured approximately 11cm and was a pet of a member of staff in the Department of Psychology at Maynooth University. The tarantula was confined to a plastic terrarium for the duration of the experimental process.

Fear of Spider Questionnaire (FSQ; Szymanski & O'Donohue, 1995). The FSQ is a self-report scale consisting of 18 items that measures spider fear (e.g., "If I saw a spider now, I would think it would harm me"). Szymanski and O'Donohue (1995) found that phobic

and non-phobic individuals yield significantly different scores on the FSQ based on data obtained from 338 undergraduate students. The FSQ has high test–retest reliability (.97) and a split-half reliability coefficient of .89, along with high internal consistency, Cronbach's alpha = .92 in a non-clinical sample (Szymanski and O'Donohue, 1995). Internal consistency for the present sample was excellent, Cronbach's Alpha = .96.

State-Trait Anxiety Inventory-Form Y-1 (STAI; Spielberger, Gorsuch, & Lushene, Vagg & Jacobs, 1983). The State-Trait Anxiety Inventory-Form Y-1 is a 20 item self-report subscale of the STAI designed to measure state anxiety, i.e. how an individual is feeling right now (e.g., "I feel calm"). Each item is rated on a 5-point (0-4) Likert scale of the level of present anxiety. This subscale of the STAI has been found to have excellent internal consistency among college students, Cronbach's alpha = .90-.91 (Spielberger et al., 1983). Internal consistency for the present sample was excellent, Cronbach's Alpha = .89.

Attentional Control Scale (ACS; Derryberry & Reed, 2002). The ACS is a self report measure of attentional control, which tests two attentional functions; the inhibition function (the ability to maintain attention to a current task regardless of distracters; e.g., "When I am working hard on something, I still get distracted by events around me") and the shifting function (the ability to switch focus between multiple tasks; e.g., "After being interrupted or distracted, I can easily shift my attention back to what I was doing before"). The questionnaire is composed of 20 items. Individuals are asked to rate their personal response to each item on a 4 point Likert scale (1 = almost never, 4 = always). A total ACS score indicates the individual's ability to control his or her attention. Ólafsson et al. (2011) reported internal consistency for the total score and inhibition function as good (Cronbach's Alpha = .84 and .82 respectively). In addition, the shifting function was found to have a

lower but still adequate level of internal consistency (Cronbach's Alpha = .68). Internal consistency for the present sample for the overall score was acceptable, Cronbach's Alpha = .72, and was also acceptable for the inhibition subscale (Cronbach's Alpha = .72), however, internal consistency was poor for the shifting function subscale (Cronbach's Alpha = .62).

Implicit Relational Assessment Procedure (IRAP; Barnes-Holmes, Barnes-Holmes, Power, Hayden, Milne & Stewart, 2006). The 2009 version of the IRAP used during Study 5 was the same IRAP used in Nicholson and Barnes-Holmes (2012). Each trial contained either a fear type label ("Frightens Me", "Disgusts Me", "Scares Me", "Creeps Me Out") or an approach type label ("I Could Approach", "I May Approach", "I Can Approach", "I Will Approach"). Simultaneously one of eight target stimuli was presented, which consisted of four colour pictures of spiders and four colour pictures of landscapes. The pleasant stimuli (i.e., landscapes) were taken from the International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 1996) and the spider images were those used by Huijding and de Jong (2007). In addition, two response options "True" and "False" were displayed on the screen. All stimuli remained present on the screen until a response key was pressed (See Figure 4.1). If a response key was not pressed within the time allowed (e.g. 2000ms) the words "Too Slow" appeared on the screen to prompt the participant for an answer. If an incorrect response was given a red "X" appeared on the screen, which remained there until the correct response was made. The IRAP program insured that all eight picture stimuli and all eight word stimuli were presented twice within each block of trials. In addition, the trials were presented quasirandomly, with the constraint that each of the four trial types appeared eight times within each 32-trial block. The program also ensured that the same trial type was not presented across successive trials. Finally, the left–right positioning of the two response

options (“True” and “False”) alternated randomly across trials with the constraint that they could not appear in the same positions across four successive trials.

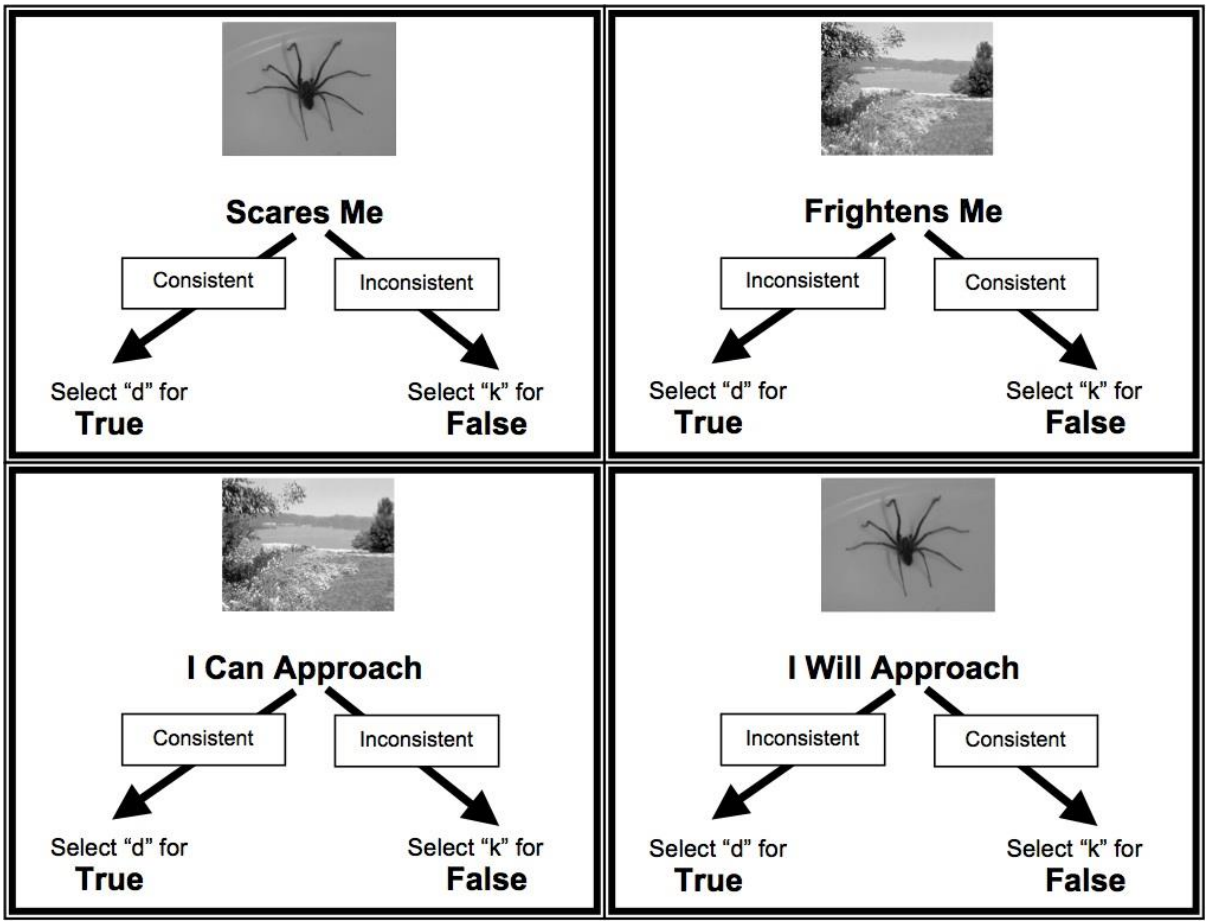


Figure 4.1. Examples of the four trial-types in the IRAP. *Note*. The boxed words (“Consistent” and “Inconsistent”) and the arrows did not appear on screen for participants.

Participants completed up to six practice and six test blocks, with each block consisting of 32 trials. Correct responses were dependant on whether the block was termed consistent or inconsistent. Consistent blocks were defined as those that required responses that were in accordance with the beliefs of spider phobic individuals (e.g. selecting “True” when presented with “Frightens Me” and a spider image; selecting “False” when presented with “I Can Approach” and an image of a spider). Inconsistent blocks were defined as those

counter to the beliefs of spider phobics (e.g. selecting “False” when presented with “Frightens Me” and a picture of a spider; selecting “True” when presented with “I Can Approach” and an image of a spider). Participants were told that the IRAP would begin with a consistent block and would alternate between the two block types across the remaining blocks. Participants were informed that between the completion of one block and prior to the commencement of another that all the previous correct answers were now incorrect and vice-versa. Finally, participants were made aware that, at times, they would be required to respond in a manner that was consistent with their own beliefs and, at other times, in a manner that was inconsistent with their beliefs.

***n*-back task.** The *n*-back (Gevins & Cutillo, 1993) was used as a cognitive task to act as a comparison to the IRAP. The task requires participants to monitor a series of stimuli and to determine on each trial which stimulus was presented *n* trials previously, where *n* is a pre-specified number (Owen et al., 2005). The *n*-back used in the present study had a 2-back memory load and 4 stimulus types could be presented. A rectangle was presented on the screen to each participant, in which one of four symbols (e.g. an asterisk, a square, a triangle or a spider symbol) appeared. They were informed that each symbol corresponded to a key on the keyboard (1 =  , 2 =  , 3 =  , 4 = ), which were not marked on the keyboard. Each stimulus was presented for 2 seconds with only one symbol being presented at any one time. The stimuli changed regardless of the participant’s response or non-response. A fixation cross lasting 500ms appeared in between each trial. A response was given by pressing the correct key, with keys 1-4 (on a standard keyboard) corresponding to one of the four stimuli. Each participant was informed that their task was to watch the sequence of symbols and to correctly identify the symbol that appeared two symbols before the present one on screen.

That is, if the first two trials presented a square followed by a spider and the third trial presented an asterisk, the correct response key to press when the asterisk appeared was the key for the square. Blank trials were presented in pairs throughout the test as a reset. The *n*-back was run using E-prime (Schneider, Eschman, & Zuccolotto, 2002), which administered instructions, stimuli and recorded responses. Each participant completed a practice block of 12 trials and then a test block of 77 trials.

Mental Effort Scale (Paas, 1992). The perceived amount of mental effort expended by each participant during the IRAP and during the *n*-back was recorded with the use of a 1 item self report scale. The amount of effort used corresponded to a numerical value between 1-9, 1 = "*very little mental effort*" and 9 = "*very high mental effort*". The current scale was based on one used by Paas (1992), which has been found to yield a satisfactory reliability coefficient (Cronbach's Alpha .90).

Behavioural Approach Task (BAT; adapted from Nicholson & Barnes-Holmes, 2012). Participants were informed that an adjoining room held a live spider in it. They were subsequently asked to approach the spider, which was contained in a terrarium, and were allocated a rating between 0-6, depending on how close they came to the spider (0 = not allowing the experimenter to open the door, 1 = allowing the experimenter to open the door, 2 = walking into the room but staying by the door, 3 = walking up to the terrarium and standing beside it, 4 = touching the terrarium, 5 = experimenter lifts up the terrarium and the participant places their hand underneath where the spider is situated and 6 = the participant holds their hand underneath the terrarium for a full minute). Each participant was awarded a score that reflected how many steps they completed successfully (i.e., 1 for completing step 1, 2 for completing step 2, and so on up to a maximum score of 6).

General Procedure

Participants completed the questionnaires first in the order of STAI, FSQ and ACS. The STAI was completed first to measure state anxiety at the beginning of the experiment. Participants then completed the IRAP, the *n*-back task and the BAT with the order in which the participants completed each task being counterbalanced. The instructions for both the IRAP task and the *n*-back task were presented on paper and were read through with the experimenter to ensure the participant knew what was being asked of them. Participants completed the Mental Effort Scales after both the IRAP and the *n*-back. Finally, at the end of the experiment participants completed an STAI.

Data Analytic Strategy

The purpose of the study was to determine the factors which effect accuracy and response latency on the IRAP, and thus all analyses were performed using response latencies from each of the stimuli used in the IRAP and *n*-back tasks along with the number or percentage of correct responses. Additionally, the analyses from the questionnaires and performance on the BAT were also included. Due to the primary focus of the study, the *D*-IRAP scores were not analysed. Pearson product-moment correlations were computed to examine the relationships between the variables. There were no formal procedures implemented to correct for multiple testing due to the small sample size in an effort to avoid making a type 1 error (the actual *p* values for the correlations are included with the *r* values to indicate actual levels of significance). Hierarchical multiple regressions were used to determine the factors which predict IRAP performance while controlling for other variables (e.g., pre-experimental anxiety and spider fear).

Ethical Considerations

The present research was approved by the Research Ethics Committee at Maynooth University. Each participant provided informed consent on their own behalf and were aware that the research was anonymous and that they could cease participation in the study at any time.

Results

Scoring the IRAP

The IRAP data contains response latencies and accuracy for each participant, which is central to the scoring process. Typically, these two variables are used to screen out participants by removing those individuals who fail to maintain specific latency and accuracy criteria across the test blocks. Given that the purpose of the current study was to determine if fear-inducing stimuli and anxiety levels impact on the very variables that are typically used to screen out participants, it would be inappropriate to remove those participants in the present research. Three participants thus remained within the final sample that would otherwise have been removed (one participant failed to complete the practice blocks and thereby failing to provide any data for analysis). Finally, also due to the focus of the study, both average response latencies and average response accuracy across all of the test blocks for each participant, for the spider and pleasant trial-types, provided the primary data (i.e., the data were not divided into fear "consistent" versus fear "inconsistent" test blocks or transformed into *D*-IRAP scores). Table 4.1 contains mean values and standard deviations for all measures.

		Mean	SD
Accuracy	***n*-back**	54.18	15.549
	IRAP	90.680	6.295
***n*-back Response Latency (ms)**	**Spider**	502	295
	Star	490	331
	Triangle	492	356
	Square	491	293
IRAP Response Latency (ms)	**Spider**	1339	345
	Pleasant	1351	341
STAI Pre-Experiment		31.7	8.2
FSQ		28.8	26.5
ACS		48.1	7.1
STAI Post-Experiment		33.1	11.4

Note: **STAI**: State-Trait Anxiety Inventory; **FSQ**: Fear of Spiders Questionnaire; **ACS**: Attentional Control Scale.

Table 4.1. Means and standard deviations from all measures

Explicit/Behavioural correlations

A correlation matrix was calculated to examine the relationships between the self-report measures (questionnaires and the Mental Effort sales) and avoidance behaviour as measured by the BAT (See Table 4.2). It revealed that pre-experimental anxiety was positively related to spider fear; also there was a significant negative correlation between approach behaviour and self-reported attentional control. Finally, self-reported spider fear and post-experimental anxiety were negatively related to performance on the BAT. In summary, less avoidance behaviour was associated with low spider fear and low levels of state anxiety at the end of the experiment. Interestingly, greater avoidance behaviour was related to higher levels of self-reported attentional control suggesting that the spider fearful individuals believed they had good attentional control.

	STAI Pre	FSQ	ACS	STAI Post	BAT	Mental Effort IRAP	Mental Effort *n*-back
STAI Pre	-	**.37***	-.21	.16	-.20	-.1	-.07
FSQ		-	.16	.29	**-.77****	-.17	.28
ACS			-	.15	**-.37***	.03	**.34***
STAI Post				-	**-.35***	.25	.33
BAT					-	.20	-.28
Mental Effort IRAP						-	-.03

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

Table 4.2. Pearson Product-Moment Correlations between the self-report measures and the BAT
Note: **STAI**: State-Trait Anxiety Inventory; **FSQ**: Fear of Spiders Questionnaire; **ACS**: Attentional Control Scale; **BAT**: Behavioural Approach Task

Predicting Accuracy and Response Latency on the IRAP

Correlational Analysis. The second set of analyses sought to determine if performance on the IRAP and *n*-back tasks (including accuracy and response latencies on each stimulus) was predicted by spider fear (as measured by the FSQ) avoidance behaviour, attentional control and its two constituents (as measured by the ACS), anxiety level at both pre and post experimental sequence (as measured by the STAI) or mental effort (as measured by the Mental Effort Scale, with respect to the IRAP and the *n*-back). Additionally, the analyses assessed whether performance on a cognitively demanding task (as measured by the *n*-back), would be predictive of performance on the IRAP. The results of the correlational analyses are presented in Table 4.3. IRAP accuracy correlated significantly with the ACS (Inhibition) and accuracy on the *n*-back. These results thus indicated that greater accuracy on the IRAP predicted higher levels of inhibitory control and perhaps rather predictably higher accuracy on another performance based measure that required attentional control. Interestingly, accuracy on the *n*-back correlated negatively with the FSQ, as such it is

possible that greater WM and attention predicted lower levels of self-reported spider fear. Critically, the correlational analyses indicate that neither accuracy nor response latency on the IRAP was significantly related to the measures associated with spider fear or anxiety. Thus, it seems unlikely that the data for many participants are removed from IRAP studies based on individual differences in these two domains, however many open questions remain. Accuracy on the *n*-back was negatively related to response latency on each of the four stimuli used suggesting that faster responding was indicative of greater accuracy. Finally, there were significant positive correlations between scores on the FSQ and response latencies on the spider, star and triangle stimuli along with significant negative correlations between avoidance behaviour and response latencies on the star and triangle stimuli.

		IRAP			*n*-back				
		Accuracy	**Spider RL**	**Pleasant RL**	**Accuracy**	**Spider RL**	**Square RL**	**Star RL**	**Triangle RL**
FSQ		.07	-.14	-.01	-.42**	.45**	.30	.56**	.63***
BAT		-.10	.14	.11	.29	-.34	-.23	-.44**	-.41**
ACS	**Inhibition**	.36*	-.27	-.28	.04	.07	-.06	.19	.05
	Shifting	.24	-.24	-.24	.07	-.08	-.10	.05	-.04
***n*-back**	**Accuracy**	.42**	-.07	-.12	-	-.55**	-.42*	-.61***	-.67***
STAI	**Pre**	-.30	.21	.21	-.14	.20	.14	.29	.27
	Post	-.26	.16	.15	-.17	-.05	-.14	.02	.03
Mental Effort Scale IRAP		-.29	.31	.32	-.07	-.22	-.15	-.26	-.21
Mental Effort Scale N-Back		.10	-.07	-.07	.04	-.08	-.04	-.04	-.00

***p* < .05**
****p* < .01**
*****p* < .001**

Note: STAI: State-Trait Anxiety Inventory; FSQ: Fear of Spiders Questionnaire; ACS: Attentional Control Scale; RL: Response Latency

Table 4.3. Pearson Product-Moment Correlations between average IRAP accuracy, IRAP response latencies (RL), n-back accuracy and n-back response latencies (RL) with nine variables, the FSQ, the BAT , the ACS (Inhibition and Shifting functions), n-back Accuracy, the STAI (pre and post) and the Mental Effort Scales (IRAP and n-back).

Regression Analyses. Three hierarchical multiple regression analyses were conducted to confirm that the Inhibition function predicted IRAP accuracy after controlling for the effects of pre-experimental anxiety and spider fear (when polynomial regression analyses were conducted, these yielded the same statistical conclusions as those reported subsequently). The first hierarchical multiple regression entered pre-experimental anxiety (pre-STAI) into step 1 of the model, which accounted for 9.2% of the variance, β = -.30, p = .09. The Inhibition function was then entered as step 2 of the model and was shown to account for 12.8% of the variance, β = .36, p = .04. The next regression analysis, entered FSQ as step 1 in the model and it accounted for .6% of the variance, β = .07, p = .67. Similarly the Inhibition function was entered as step 2 and accounted for 12.6% of the variance, β = .36, p = .05. In both cases, therefore, Inhibition predicted IRAP accuracy independently of anxiety and spider fear. A final hierarchical regression was completed based on the correlation found between the FSQ and *n*-back accuracy (see Table 4.1), which sought to confirm that *n*-back accuracy was a stable predictor of IRAP accuracy regardless of the effects of spider fear. As before, FSQ was entered as step 1 into the model, accounting for .6% of the variance, β = .07, p = .68. *n*-back accuracy was subsequently entered as step 2 in the model and was found to account for 26.1% of variance, β = .58, p = .00, thus confirming that *n*-back accuracy does indeed predict accuracy on the IRAP independently of self-reported spider fear.

One final hierarchical multiple regression was carried out to determine if scores on the FSQ could predict accuracy on the *n*-back independently of pre-experimental state anxiety. Anxiety (pre-STAI) was entered at step 1 of the model and was a marginally significant predictor of accuracy on the *n*-back accounting for 9% of the variance, β = -.31, p = .08. Scores on the FSQ were entered into step 2 of the model accounting for an additional

23.4% of the variance, β = -.4, p = .02. Thus, the self-reported spider fear was a significant predictor of accuracy on the *n*-back, independently of levels of state anxiety.

Discussion

The main finding of the current study was that the inhibition function of ACT was a predictor of performance on the IRAP, specifically in regards to accuracy. There was no relationship between the components of attentional control (inhibition and shifting) and performance on the *n*-back task. Factors such as the relevance of the stimuli to the participant's psychopathology or anxiety did not appear to reduce accuracy on the IRAP; however, spider fear was a predictor of accuracy on the *n*-back. Contrary to the hypothesis, there was no variation in response latencies between participants who scored higher in on the FSQ on the spider trial-types. Finally, accuracy on the *n*-back task was a significant predictor of accuracy on the IRAP.

Correlational analyses revealed that those who demonstrated greater avoidance behaviour reported higher levels of spider fear at the beginning of the experiment and greater state anxiety at the conclusion of the experiment. This analysis also produced an interesting finding which showed that those who were highly avoidant on the BAT reported a greater propensity for attentional control. This result conflicts with evidence from the *n*-back task in which higher spider fear appeared to result in a greater number of errors suggesting poorer attentional control. It is possible that there were self-presentational biases at work on the ACS or perhaps the high fear participants were merely unaware of their actual ability to control their attentional resources. Nevertheless, it appears from the present results that high spider fear can impair performance on an attentionally demanding task (i.e., the *n*-back) in which spider stimuli are presented. The current results are not the first to show the effects of psychopathology on the *n*-back task. For example, previous research found that depressed patients demonstrated significant impairments in performance on an *n*-back task compared to

controls (Harvey, Le Bastard, Pochon et al., 2004). Regarding response latency on the *n*-back, high levels of spider fear were related to longer response latencies on the spider, star and triangle stimuli. A possible explanation of this effect could be due to having to respond to the other stimuli while the spider is on the screen or having to respond to the spider while the other stimuli were on the screen. Thus, there is a greater interaction between the stimuli rather than on the IRAP. Overall, this finding is consistent with Attentional Control Theory as it posits that anxiety (likely evoked from the spider stimuli) results in impaired attentional control on a task such as the n-back that implements working memory (Eysenck et al., 2007; Derakshan & Eysenck, 2009).

The results are promising regarding the use of the IRAP in clinically relevant domains as it appears that the salience of the stimuli to the psychopathology of the participant did not affect performance on the IRAP. Critically, following an examination of response latencies of both the spider and pleasant trial-types in the correlation analyses, it did not appear that the higher fear participants produced longer response latencies on the spider trial-types suggesting that they did not struggle to disengage from the spider stimuli as hypothesized. Thus, the results support the use of the IRAP in applied domains as they suggest that clinical or high-anxious participants will not struggle to maintain criteria across the IRAP, more so than a non-clinical sample. It should be noted that the present study was limited as it used a non-clinical student sample that scored across a continuum from low to high fear on the self-report measure. Thus, the high fear participants are only high scoring in comparison to a non-clinical sample. Further research could utilize a clinical sample of spider phobic individuals (or those suffering with a different psychopathology) to determine if there is an effect of the stimuli used in the IRAP in clinical samples. Nevertheless, the evidence is promising with respect to using the IRAP as a means to assess anxious phenomenon and thus, we can proceed with the development of the IRAP as a measure of OCD.

Chapter 5: Relational Responding regarding Obsessive Belief Domains of OCD

As discussed in the Introduction, the OCCWG (1997; 2005) identified six cognitive belief domains of OCD 1) excessive responsibility; 2) overestimation of threat; 3) perfectionism; 4) intolerance of uncertainty; 5) over-importance of thoughts and 6) need to control thoughts. These six domains have been narrowed down to three factors which can be measured by the Obsessive Belief Questionnaire, 1) responsibility/ overestimation of threat; 2) perfectionism/ intolerance of uncertainty; 3) over-importance/need to control thoughts (OBQ-44; OCCWG, 2005). Critically, they have emphasized the importance of the interpretations (e.g., beliefs and appraisals) that follow intrusive thoughts such as "For me, having bad urges is as bad as actually carrying them out" or "Even if harm is unlikely, I should try to prevent it at any cost" (OCCWG, 2005). Evidence from Chapter 2 supports this supposition as it suggests that it is the appraisal that follows the initial disgust-related thought that is indicative of avoidance behaviour rather than the initial thought itself.

The present chapter presents the results of three studies which sought to explore the relationship between disgust and the six obsessive belief domains from a functional perspective. Study 5 was primarily exploratory in nature and as such we refrained from making specific predictions. The IRAP was used as a means to measure appraisals pertaining to obsessive beliefs in response to both disgust-eliciting and generically pleasant pictorial stimuli as well as positive descriptive words in response to the same stimuli. Questionnaires assessing obsessive beliefs, general OC tendencies and anxiety were also implemented as a comparison to the IRAP. However, it was assumed that those who score highly on the explicit measures, specifically the OBQ-44, would produce greater implicit negative appraisals of the disgusting stimuli. Study 6 differs from Study 5 as the cognitions that the IRAP was trying to target are specifically pertaining to responsibility and threat in relation to contamination rather than disgust propensity and sensitivity. Finally, Study 7 was conducted

which explored relations between contamination and beliefs regarding perfectionism and intolerance of uncertainty.

Study 5

Method

Participants. There were no selection criteria in order to take part in this study with regards levels of disgust or OC tendencies. Participants (N = 44; 13 men and 31 women) were selected from the student population of Maynooth University. The mean age of the participants was 26.7 with a range of 18-46 years. Each participant provided written informed consent prior to taking part in the study and completed the experiment individually in the Department of Psychology at Maynooth University.

Materials

Obsessive Belief Questionnaire-44 (OBQ-44; OCCWG, 2005). The Obsessive Belief Questionnaire is a 44 item self-report scale designed to measure individual differences in obsessive beliefs across three cognitive domains of OCD. It consists of three factors including (1) responsibility/threat (e.g. "If I do not take extra precautions, I am more likely than others to have or cause a serious disaster."), (2) perfectionism/uncertainty (e.g. "In order to be a worthwhile person, I must be perfect at everything I do"), (3) importance/control of thoughts (e.g. "If I have aggressive thoughts or impulses about loved ones, this means I may secretly want to hurt them."). Each item is rated on a 7-point (1-7) Likert scale of agreement with belief statements. Internal consistency achieved in this sample was approaching excellent (α =.785)

Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002). The OCI-R is an 18 item self-report measure of symptoms of obsessive-compulsive disorder and was used to measure OC tendencies. It has successfully differentiated between individuals with and

without OCD. For a non-anxious sample, it has demonstrated good-excellent internal consistency (≥.72), and test-retest reliability (.57 - .87).

Padua Inventory-Washington State University Revision (PI-WSUR; Burns, Formea, Keortge, & Sternberger, 1995). The Padua Inventory-Washington State University Revision is a 39 item self-report scale designed to measure obsessive and compulsive symptoms. It is also designed to reduce overlap with worry. Each item is rated on a 5-point (0-4) Likert scale assessing the degree of disturbance caused by thought or behaviour. It consists of five subscales including (1) contamination obsessions and washing compulsions, (2) dressing/grooming compulsions, (3) checking compulsions, (4) obsessional thoughts of harm to self/others and (5) obsessional impulses of harm to self/others. This scale has adequate internal consistency and test-retest reliability (Burns, Keortge, Formea, & Sternberger, 1996). Internal consistency achieved in this sample was approaching excellent (α =.711).

State-Trait Anxiety Inventory-Form Y-1 (STAI; Spielberger, Gorsuch, & Lushene, Vagg & Jacobs, 1983). The State-Trait Anxiety Inventory-Form Y-1 is a 20 item self-report subscale of the STAI designed to measure state anxiety, i.e. how an individual is feeling right now. Each item is rated on a 5-point (0-4) Likert scale of the level of present anxiety. The STAI has been found to have good reliability and validity (Spielberger et al., 1983).

Implicit Relational Assessment Procedure (IRAP). The IRAP is a computer based measure which presents sets of stimuli in the form of trials within a series of blocks. On each trial of the IRAP, a *label stimulus* was presented at the top of the screen. There were a total of twelve *label stimuli* which were digital images; six were colour photographs of things which would evoke disgust and the other six were colour photographs of generically pleasant images. All but one of the label stimuli were taken from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1996) (see Appendix E). There were a total of

twelve target stimuli, six of which referred to a negative appraisal based on the six cognitive belief domains of OCD (e.g. "My Responsibility") and six of which referred to a positive response (e.g. "Harmless") (see Table 5.1). On each trial of the IRAP, one of the target stimuli was presented in the middle of the computer screen. Two response options ("True" and "False") were presented on each trial which appeared at the bottom left- and right-hand corners of the computer screen, alternating at random between trials (see Figure 5.1).

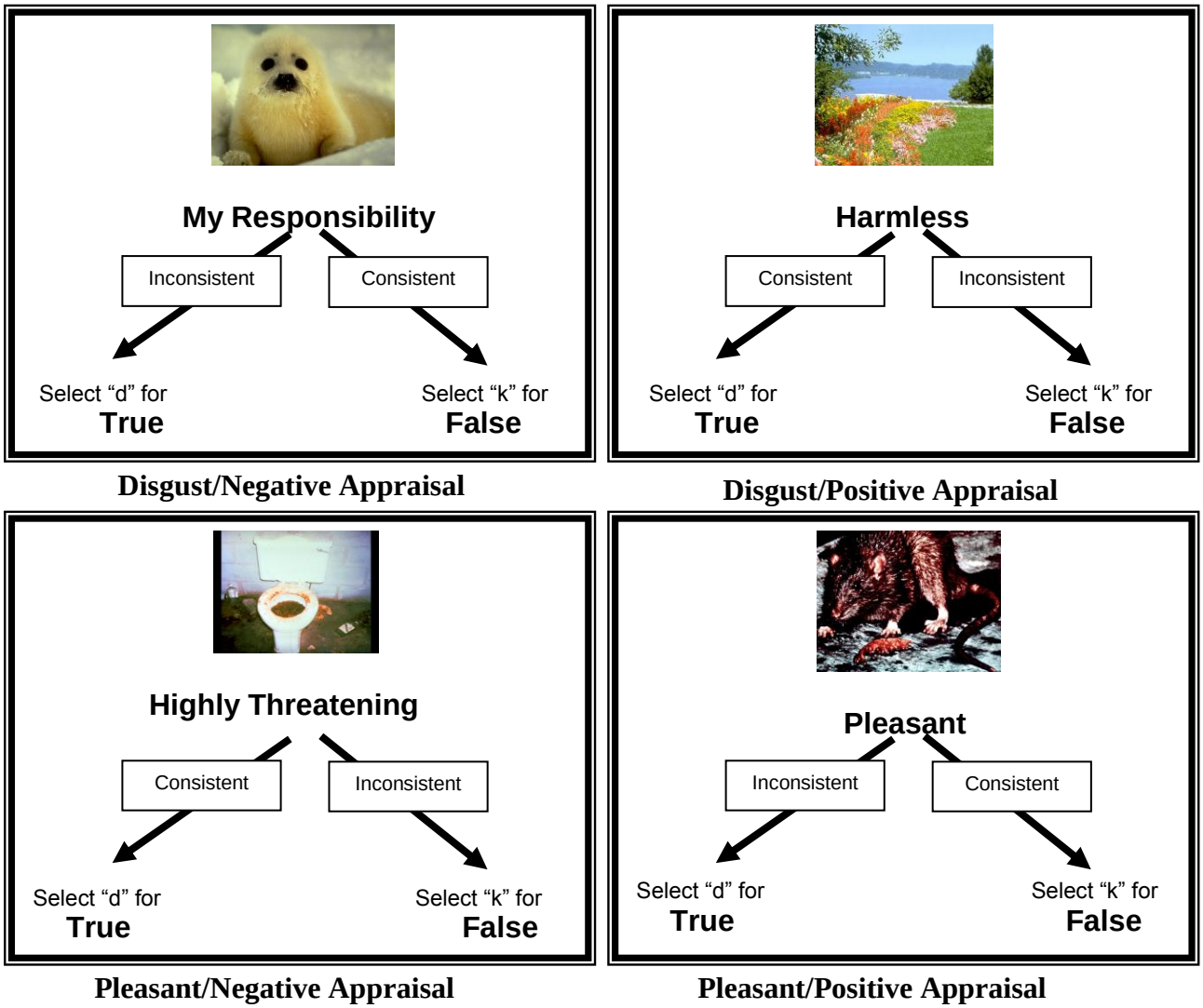


Figure 5.1. Examples of the four trial-types from Study 5

Target Stimuli	
Negative-Appraisal Stimuli	**Positive-Appraisal Stimuli**
My Responsibility	Acceptable
Highly Threatening	Soothing
I Must Control	Pleasant
Unacceptable	Harmless
Not Perfect	Perfect
Distressing	Not Distressing

Table 5.1. Target stimuli for Study 5

The 2009 version of the IRAP was used in Study 5 and was presented in blocks of 24 trials which encompassed four different trial-types; *Disgust-Negative Appraisal, Disgust-Positive Appraisal, Pleasant-Negative Appraisal, Pleasant-Positive Appraisal.* Up to 6 practice blocks were implemented to ensure an accuracy rate of 80% and a response latency of less than or equal to 2000 ms. The participants were required to meet these criteria across a pair of practice blocks, within six or less blocks, before proceeding to the fixed set of six test blocks. For each block of 24 trials, all of the label and target stimuli were presented in various combinations, with the program ensuring that each of the four trial-types was presented six times in a quasi-random order. The program also ensured that the same trial-type was not repeated across successive trials.

The instructions for the IRAP were presented on paper and were read through with the experimenter to ensure that participants understood the nature of the experiment and what was being asked of them. The experimenter stressed the importance of speed and accuracy in the IRAP. Each participant was aware that, at times, they would be required to respond in a manner that may be consistent with their own beliefs and sometimes in a manner that may be inconsistent with their beliefs. The experimenter explicitly classified the pictorial stimuli as "disgusting" or "non-disgusting" thus providing a context to reduce the likelihood that participants would respond to the stimuli as being merely negative or positive. Furthermore, the response options "True" and "False" would likely serve to establish the relations between

the pictures and statements as either relationally coherent or incoherent. For example, responding "True" to a disgusting picture and the statement "My Responsibility" asks a participant to respond to the relationship between the two items as relationally coherent; responding "False" in this case asks a participant to indicate that the relationship is incoherent (see Barnes-Holmes, Hayes, Dymond & O'Hora, 2001, for a more detailed treatment of "Truth" versus "Falsity"). Or in other words, the response options asked participants to evaluate or "appraise" the relational network in which the pictures and statements participated as either true or false. Participants were told that there were two rules that they would be required to respond in accordance with throughout the IRAP task (i.e., one rule for the consistent blocks and another for the inconsistent blocks). Thus, the participants were aware of the pattern of responding that would be required of them throughout the task before they began.

General Procedure

Following informed consent, half the participants were selected randomly to complete the self-report questionnaires first, followed by the IRAP, with the remaining participants completing the measurements in the opposite order. The order in which the questionnaires were administered was randomized.

Ethical Considerations

All studies in Chapter 5 were approved by the Research Ethics Committee at Maynooth University. Each participant provided informed consent on their own behalf and were aware that the research was anonymous and that they could cease participation in the study at any time.

Results

Scoring the IRAP. The response latency, defined as the time in milliseconds (ms) from the onset of a trial to the first response, provides the primary datum from the IRAP. The

IRAP effect is the difference between the consistent and inconsistent mean response latencies recorded for a specific trial-type. To insure that IRAP effects were derived from performances that involved the targeted patterns of stimulus control, response accuracy was assessed first. If accuracy fell below 70% on a given test block, or pair of test blocks, then the IRAP effects for that participant were calculated using the remaining two pairs of test blocks. The data for four participants were analyzed in this manner. If accuracy fell below 70% across multiple pairs of tests blocks then the data for that participant were discarded – the data for twelve participants were removed on this basis.

The latency data were transformed into *D*-IRAP scores using the adapted version of the Greenwald, Nosek and Banaji (2003) *D*-algorithm (see Nicholson & Barnes-Holmes, 2012, for a full description of this procedure). The *D*-algorithm is used to minimize the impact of extraneous factors such as age, motor skills, and/or cognitive ability (Nosek, Greenwald, & Banaji, 2007).

Given the foregoing transformation, a larger *D*-IRAP score indicates a greater difference in response latencies between consistent and inconsistent trials. Positive scores indicate responding in accordance with expected response biases (e.g., responding "True" more quickly than "False" when a disgusting picture appeared with a negative appraisal) and negative scores indicate responding in a manner that was inconsistent with expected responses biases (e.g., responding "False" more quickly than "True" when a disgusting picture appeared with a negative appraisal). Scores that approach zero indicate no difference between consistent and inconsistent test blocks.

Implicit Measure Analysis. Scores from each trial-type in the IRAP were in the expected direction and were significant from zero, *Disgust-Negative Appraisal* (M = .284, SD = .332; t (26) = 4.43, $p < .0001$); *Disgust-Positive Appraisal* (M = .343, SD = .333; t (26) =

5.35, $p < .0001$); *Pleasant-Negative Appraisal* ($M = .364$, $SD = .342$; $t\ (26) = 5.53$, $p < .0001$); *Pleasant-Positive Appraisal* ($M = .358$, $SD = .271$; $t\ (26) = 6.88$, $p < .0001$).

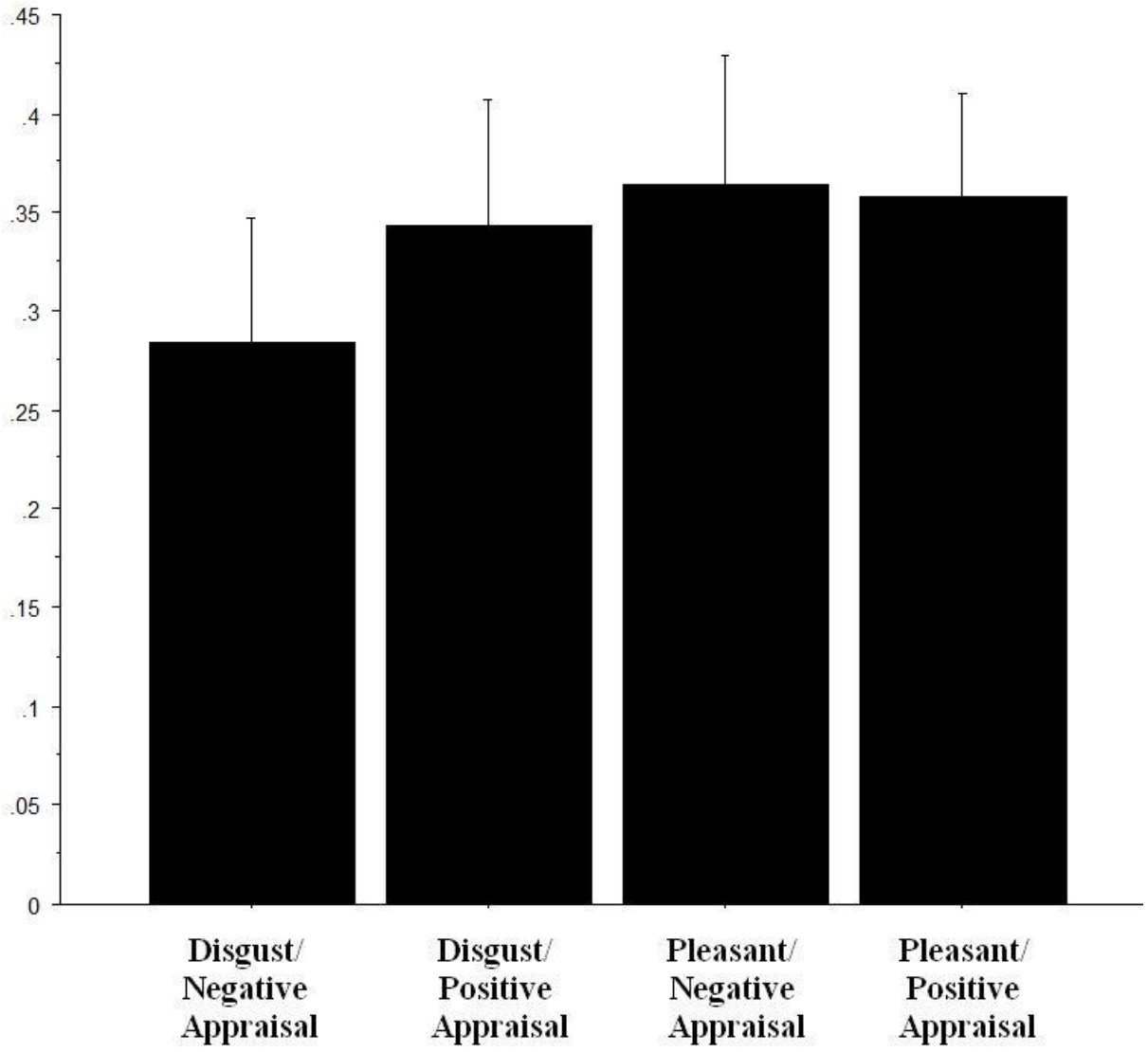


Figure 5.2. Average *D*-Scores from each of the trial-types from the IRAP

Correlation Analysis. A correlation matrix involving the *D*-IRAP scores from the *Disgust-Negative Appraisal* trial-type and all of the explicit measures is presented in Table 5.2. Due to the generic nature of the opposing category stimuli, the majority of the remaining analyses will focus on the *Disgust-Negative Appraisal* trial-type to assess response biases that reflected negative interpretations to pictures that were chosen to evoke disgust responses. The remaining trial-types will be examined simply to test for divergent validity. Table 5.2

presents all of the correlations among the explicit measures simply to confirm that the expected large number of inter-correlations was observed. The only notable exception was the absence of any correlation between the Obsessional Impulses of Harm to Self and Others (OI) and any of the other measures. Consistent with the general purpose of the current study, the subsequent set of analyses focused on the correlations among the *D*-IRAP score and the explicit measures.

The results indicated that there was a medium positive correlation between the *D*-IRAP scores and the OBQ-44, and two of its subscales, Responsibility/Threat and Perfectionism/Uncertainty. The *D*-IRAP scores failed to correlate with the OCI-R. The relationship between the Padua Inventory and the *D*-IRAP scores approached significance, and thus its subscales were included in the correlation matrix to determine if any specific factors were driving the correlation toward significance. Two of these five scales, Compulsive Checking and Obsessional Thoughts of Harm to Self/Others, yielded moderate positive correlations with the *D*-IRAP scores. Finally, the state anxiety measure (STAI) failed to correlate with the *D*-IRAP scores. This pattern of correlations indicates that the more rapidly participants interpret disgusting pictures as being negative, the more highly they scored on two of three general measures of Obsessive-Compulsive tendencies, and on specific sub-scales of these two measures.

Variable	Disgust -Neg	OBQ	R/T	P/C	I/CT	OCI-R	PI	Con	D/G	C/C	O/T	O/I
Disgust-Neg	1.0											
OBQ	.48*	1.0										
R/T	.56**	.93**	1.0									
P/C	.43*	.94**	.80**	1.0								
I/CT	.18	.67**	.52**	.49**	1.0							
OCI-R	.17	.61**	.63**	.71**	-.004	1.0						
PI	.34	.80**	.82**	.80**	.23	.87**	1.0					
CON	.03	.52**	.50**	.61**	.03	.80**	.80**	1.0				
D/G	-.01	.51*	.46*	.60**	.12	.72**	.70**	.80**	1.0			
CC	.50**	.82**	.86**	.77**	.39*	.68**	.83**	.39*	.30	1.0		
OT	.40*	.73**	.80**	.66**	.31	.62**	.82**	.45*	.36	.84**	1.0	
OI	.25	-.04	.09	-.09	-.19	.03	.22	.00	.009	.13	.06	1.0
STAI	.16	.54**	.48**	.52#	.36	.34	.47**	.30	.30	.41*	.51**	.11

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

Note. OBQ-44 (*M* = 155, *SD* = 42) SUBSCALES: R/T = Responsibility/Threat (*M* = 59, *SD* = 17), P/C = Perfectionism/Certainty (*M* = 65, *SD* = 20), I/CT = Importance/Control of Thoughts (*M* = 30, *SD* = 11)
PI (*M* = 30, *SD* = 19) SUBSCALES: CON = Contamination (*M* = 10, *SD* = 7), D/G = Dressing/Grooming (*M* = 2, *SD* = 3), C/C = Checking Compulsion (*M* = 11, *SD* = 7), O/T = Obsessional Thoughts of Harm to Self/Others (*M* = 5, *SD* = 5), O/I = Obsessional Impulses of Harm to Self/Others (*M* = 1, *SD* = 3). STAI (*M* = 35, *SD* = 9)

Table 5.2 Pearson Correlation Matrix of *Disgust-Negative Appraisal* trial-type, OBQ-44, OCI-R, PI, and STAI

A second correlation matrix, which was calculated to assess patterns of responding between the remaining three trial-types and the questionnaires, yielded few interesting results. There were two significant negative correlations between the *Pleasant-Negative Appraisal* trial-type and the washing concerns subscale of the OCI-R (r = -.40, p = .03) and the contamination subscale of the Padua Inventory (r = -.38, p = .05). Thus, the greater the implicit response bias towards the pleasant stimuli as *not* being related to obsessive belief appraisals (i.e., not threatening/their responsibility/perfect etc) the less contamination fear they reported.

Predictive Validity of the IRAP. As noted in the Introduction, increased levels of anxiety are often associated with obsessive-compulsive tendencies, and indeed this was confirmed in the pattern of correlations recorded in Table 5.2 with five significant (and one marginally so) correlations between the anxiety measure and the explicit measures of OCD tendencies. Although the *D*-IRAP score failed to correlate with anxiety it was deemed important to determine if the implicit measure still predicted obsessive-compulsive tendencies independently of anxiety. Similarly, it was important to determine the predictive validity of the OBQ-44 subscales for scores on the IRAP while controlling for the other subscales to determine which factors are possibly implemented in disgust responding. A series of hierarchical multiple regression analyses were thus conducted to determine the predictive validity of the *D*-IRAP measure while controlling for anxiety and other OC relevant factors (see Table 5.3). Results indicated that anxiety was a significant predictor of OC tendencies as measured by the OBQ-44, as were the *D*-IRAP scores from the *Disgust-Negative Appraisal* trial-type when anxiety was controlled for. As can be seen from the subsequent sets of regression analyses (2, 4, 6, and 7), the *Disgust-Negative Appraisal* trial-type predicted OC tendencies independent of anxiety in all but one case, Obsessional Thoughts of Harm to Self/Others subscale of the PI. Also, the effect of the *Disgust-Negative*

Appraisal trial-type for perfectionism/uncertainty was undermined by responsibility/threat, while perfectionism/uncertainty did not undermine the effect of the IRAP trial-type for responsibility/threat. Similarly, the effect of the perfectionism/uncertainty factor for negative disgust responding on the IRAP was undermined by the responsibility/threat factor, while perfectionism/uncertainty did not influence the effect of responsibility/threat for disgust responding.

		B	SE B	Beta
	Dependent Variable: OBQ-44			
1.	Step 1 (R^2 = .189**)			
	Anxiety	1.90	.664	.435**
	Step 2 (R^2 *change* = .144**)			
	Disgust-Negative Appraisal Trial-Type	52.06	19.22	.380**
	Dependent Variable: Responsibility/Threat OBQ-44			
2.	Step 1 (R^2 = .178**)			
	Anxiety	.777	.283	.421**
	Step 2 (R^2 *change* = .225**)			
	Disgust-Negative Appraisal Trial-Type	27.52	7.69	.475**
3.	Step 1(R^2 = .508***)			
	Perfectionism/Certainty	.636	.106	.713***
	Step 2 (R^2 *change* = .059*)			
	Disgust-Negative Appraisal Trial-Type	15.13	7.02	.261*
	Dependent Variable: Perfectionism/Certainty OBQ-44			
4.	Step 1 (R^2 = .084)			
	Anxiety	.599	.334	.290
	Step 2 (R^2 *change* = .127*)			
	Disgust-Negative Appraisal Trial-Type	23.16	9.90	.357*
5.	Step 1 (R^2 = .508***)			
	Responsibility/Threat	.799	.133	.713***
	Step 2 (R^2 *change* = .000)			
	Disgust-Negative Appraisal Trial-Type	1.52	8.94	.023
	Dependent Variable: Checking PI			
6.	Step 1 (R^2 = .186**)			
	Anxiety	.333	.118	.431**
	Step 2 (R^2 *change* = .168**)			
	Disgust-Negative Appraisal Trial-Type	9.99	3.36	.410**
	Dependent Variable: Obsessional Thoughts of Harm to Self/Others Subscale of PI			
7.	Step 1 (R^2 = .311***)			
	Anxiety	.318	.080	.55***
	Step 2 (R^2 *change* = .039)			
	Disgust-Negative Appraisal Trial-Type	3.55	2.48	.198
	Dependent Variable: *Disgust-Negative*			

	***Appraisal* Trial-Type**			
8.	Step 1 (R^2 = .236**)			
	Responsibility/Threat	.008	.003	.486**
	Step 2 (R^2 *change* =.001)			
	Perfectionism/Certainty	.001	.003	.036
9.	Step 1 (R^2 = .133*)			
	Perfectionism/Certainty	.006	.002	.364*
	Step 2 (R^2 *change* =.104*)			
	Responsibility/Threat	.008	.004	.460*

*$p \leq .05$
**$p < .01$
***p < .000

Table 5.3. Results from nine hierarchical multiple regression analyses using the *Disgust-Negative Appraisal* trial-type and OBQ-44 subscales to predict obsessive beliefs and sub-components of OC tendencies while controlling for the effects of anxiety and other obsessive beliefs

Discussion

The results of the present study suggest that the IRAP can be used as a measurement of the obsessive beliefs of OCD in response to disgust-eliciting stimuli. A greater bias toward interpreting the disgusting stimuli as being negative predicted overall scores on the OBQ-44 and specifically scores on the responsibility/threat and perfectionism/uncertainty subscales of the OBQ-44. Additionally, scores on the checking subscale of the Padua Inventory were predicted by the IRAP. Critically, these effects (from both the OBQ-44 and the Padua Inventory Revised) were independent of current levels of anxiety. One effect which was influenced by anxiety was the relationship between scores on the IRAP and the obsessive thoughts of harm to the self/others subscale of the PI. The impact of OC relevant beliefs such as responsibility/threat and perfectionism/uncertainty on the predictive validity of the IRAP were also examined. The regression analyses indicated that the *Disgust-Negative Appraisal* trial-type from the IRAP failed to predict perfectionism/uncertainty when controlling for responsibility/threat. However, when controlling for perfectionism/uncertainty, the IRAP still predicted responsibility/threat, which further highlights the role of the latter factor in disgust responding. The lack of any meaningful relationships between the other trial-types and self-

report measures was indicative of the discriminant validity of the IRAP in that only the OC relevant trial-type (*Disgust-Negative Appraisal*) was related to obsessive beliefs and other obsessive-compulsive constructs.

Study 6

Method

Participants. Participants consisted of 38 undergraduate students (21 women and 17 men) from the National University of Ireland Maynooth with a mean age of 27.6. All participants volunteered to take part in the study and there were no exclusion criteria for taking part. Participants completed the experiment individually in the Department of Psychology at Maynooth University.

Materials

Obsessive Beliefs Questionnaire (OBQ-44; OCCWG, 2005). As above.

Depression, Anxiety and Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1993). The DASS is a 21 item self-report questionnaire which covers a range of core symptoms of anxiety, depression and stress. For a non-clinical sample, it has demonstrated excellent internal consistencies among its three subscales (Cronbach's Alpha's = .82 - .90), good convergent and discrimant validity (*r's* = .70 - .72) and adequate reliability (Cronbach's alpha = .90 - .95) (Henry & Crawford, 2005).

Padua Inventory-Washington State University Revision (PI-WSUR; Burns, Keortge, Formea, & Sternberger, 1995). As above.

Acceptance and Action Questionnaire-II (AAQ-II; Bond, Hayes, Baer et al., 2011). The AAQ-II is a seven item scale assesses the construct experiential avoidance and psychology inflexibility (Bond et al., 2011). Each item (e.g., "I worry about not being able to control my worries and feelings") is rated on a 7 point Likert scale. The scale has been shown

to have excellent internal consistency (Cronbach's alpha ≥ .84) and test-retest reliability at 3 (Cronbach's alpha = .81) and 12 months (Cronbach's alpha =.79).

Disgust Scale-Revised (DS-R; Haidt et al., 1994). The Disgust Scale is a 27 item scale and is frequently used to measure disgust propensity across seven domains of disgust including food, animals, body products, death, body envelope violation, hygiene and sex (van Overveld, de Jong, Peters, & Schouten, 2011). The scale has been found to have convergent and discriminant validity and has moderate correlations with a sensation-seeking scale (r = -.46) and a fear of death scale (r =.39) (Haidt et al., 1994).

Behavioural Approach Tasks. Three of the behavioural approach tasks (Toilet Seat, Coins and Urine Cup Tasks) were created specifically for the purpose of the current study while the comb task was adapted from Rozin, Haidt, McCauley, Dunlop & Ashmore (1999). Each task was rated from a scale of 0-3.

Toilet Seat task. A piece of chocolate shaped like faeces was placed on a new toilet seat placed on a table. Participants were told that it was not real faeces and were asked if they were willing to touch the toilet seat (No = 0, Yes = 1). They were then asked would they be willing to pick up the chocolate and touch it off their lip (2) ultimately taking a bite of the chocolate (3).

Coins task. Participants were asked if they were willing to touch coins in a large jar (No = 0, Yes = 1). They were then asked if they were willing to place their hand into the jar of coins (2) and then take a handful of the coins out of the jar and hold it on their hands (3).

Comb task (adapted from Rozin et al., 1999). Participants were first told that the comb in front of them had been used by the previous participant (which was untrue). They were then asked if they were willing to pick up the comb (No = 0, Yes = 1). They were then asked if they were willing to brush their hair with the comb and were given the opportunity to wash the comb first (2) or not wash it (3).

Urine cup task (adapted from Rozin et al., 1999). A container used for storing urine (with the label Urine on the container) filled with apple juice was placed in front of the participants. The participants were told that the cup contained apple juice, not urine. They were then asked if they were willing to pick up the cup (No = 0, Yes = 1). If yes, they were then asked if they were willing to touch the cup off their lip (2) ultimately taking a sip of the juice (3).

Hand Sanitizer. A container of anti-bacterial gel was in the room while participants were completing the BATs and the participants were told that they could use the hand sanitizer at any point during the BATs. The number of times the participants used the gel was recorded.

Implicit Relation Assessment Procedure (Barnes-Holmes et al., 2006). A correct response on any trial on the responsibility/threat IRAP (hereafter referred to as the RT-IRAP) was determined by whether or not the participant was completing a block of trials designed to be consistent or inconsistent with a strong or weak history of deriving responsibility/threat appraisals in response to contaminated stimuli. Consistent trials were those which required participants to respond "Yes" when presented with a responsibility/threat appraisal (e.g., "My Responsibility to Clean" or "Highly Threatening") paired with a contamination related picture or when a clean picture was presented with a positive/neutral appraisal (e.g., "Doesn't Bother Me" or "Inviting") (see Table 5.4 for full list of target stimuli and Appendix E for sample stimuli). Inconsistent responding required the opposite response pattern which was responding "Yes" when a contaminated picture was presented with a positive/neutral appraisal (e.g., "It's Lovely" or "Harmless") and responding "No" when a contamination related picture was presented with a responsibility/threat appraisal (e.g., "Harmful" or "I Cannot Ignore This") (See Figure 5.3). In other words, the response options allow participants to appraise the relational network in which the pictures and statements

participated as either relationally coherent or incoherent. The extent of the observed difference between the consistent and inconsistent trials is assumed to provide an index of the strength of the response bias under scrutiny, which serves as the dependent measure in the current study.

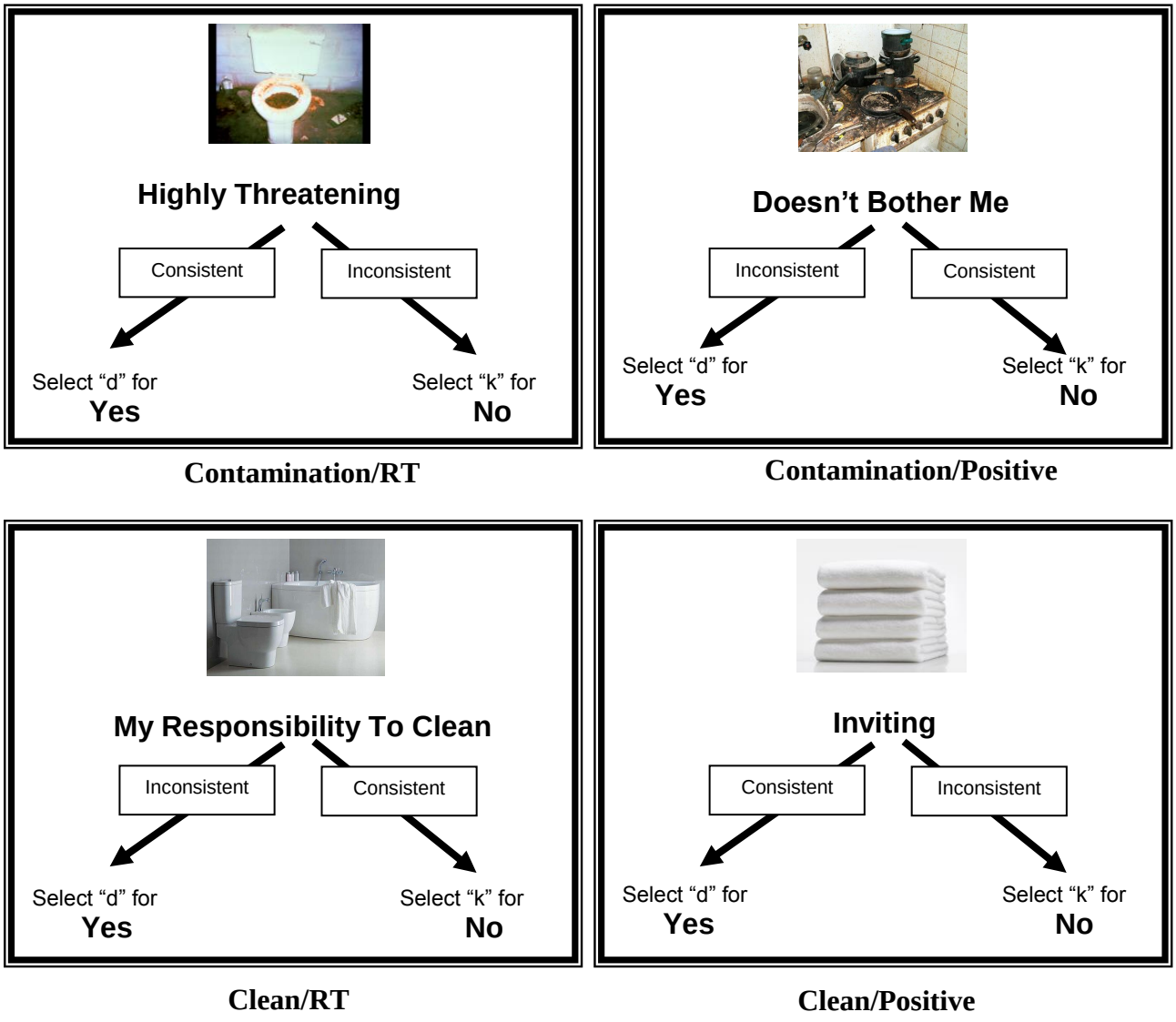


Figure 5.3. Examples of the four trial-types from Study 6

RT Trial-Types	Positive Trial-Types
My Responsibility to Clean	This is Clean
Highly Threatening	Doesn't Bother Me
I Should Fix This	Not Threatening
Extremely Dangerous	This is OK
I Cannot Ignore	Not Dangerous
I Should Prevent	I Like This
May Cause Harm	Harmless
Unsafe	Safe

Table 5.4. Target stimuli for the RT-IRAP

The 2012 version of the IRAP was utilized in Study 6 and was presented in blocks of 32 trials. There were a number of practice blocks that each participant completed in order to ensure an accuracy rate of 80% and a response latency of less than or equal to 2000 ms. The participants were required to meet these criteria across a pair of practice blocks, within six or less blocks, before proceeding to the fixed set of six test blocks. The instructions for the IRAP were presented on paper and were read through with the experimenter to ensure that each participant understood the nature of the experiment and what was being asked of them. The experimenter explicitly classified the pictorial stimuli as "contaminated" or "clean" thus providing a context to reduce the likelihood that participants would respond to the stimuli as being merely negative or positive; and also stressed the importance of speed and accuracy in the IRAP. Before each block, the rule for responding was provided to the participants so they were aware for the block that they were required to respond as if the contaminated things were threatening/their responsibility and the clean things were positive/non-threatening and vice-versa.

General Procedure.

The order in which the experiment was administered was counterbalanced between the IRAP, questionnaires and the BAT. Within the questionnaires, the order in which they were administered was randomized.

Results

Scoring the IRAP.

To insure that IRAP effects were derived from performances that involved the targeted patterns of stimulus control, response accuracy was assessed first. If accuracy fell below 75% on a given test block, or pair of test blocks, then the data from this participant was removed from the dataset (see Barnes-Holmes et al., 2010). The data from five participants were removed on this basis while the data from an additional four were removed for failing to make it through to the test blocks on the IRAP, leaving 29 participants for the final analysis.

Positive scores indicate responding in accordance with expected response biases (e.g., responding "Yes" more quickly than "No" when a contamination-related picture appeared with a responsibility/threat appraisal) and negative scores indicate responding in a manner that was inconsistent with expected responses biases (e.g., responding "No" more quickly than "Yes" when a contamination-related picture appeared with a positive/neutral statement). Scores that approach zero indicate no difference between consistent and inconsistent test blocks.

Implicit Measure Analysis.

A repeated measures ANOVA was conducted to assess responding on the IRAP across the four trial-types, F (3, 26) = .54, $p < .65$ (see Figure 5.4) indicating very little difference in responding across the four trial-types.

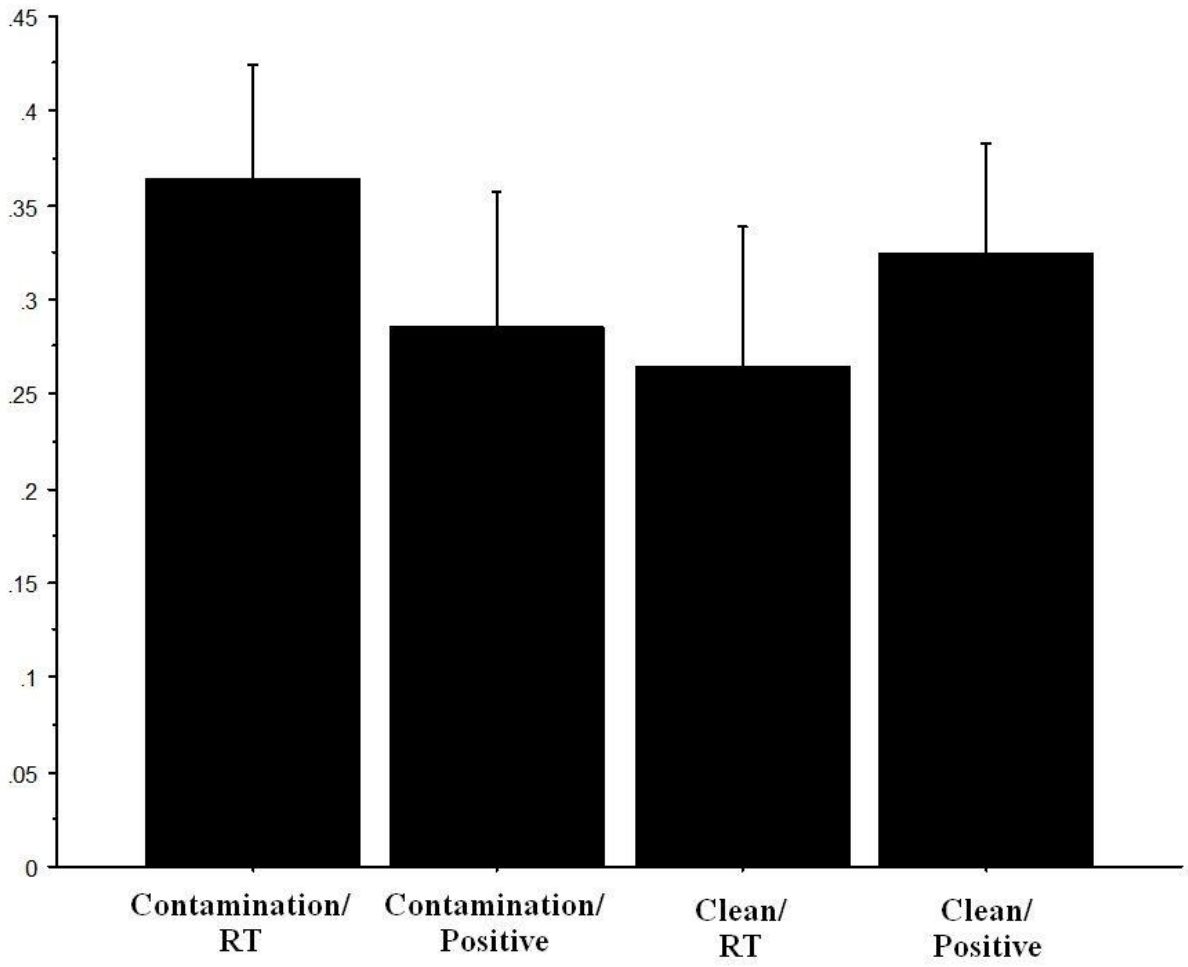


Figure 5.4. Average *D*-IRAP scores for the four trial-types on the RT-IRAP

Correlation Analyses. Two correlation matrices were conducted to assess the relationships between the four *D*-IRAP scores and scores on the self-report measures of general disgust, OC tendencies, psychological flexibility and anxiety as well as the BATs. The *Contamination-Positive* trial-type produced a significant negative correlation with the Comb BAT (see Table 5.5). Further, it was the only one that produced significant relationships with the self-report measures, namely the disgust and OCD scales (see Table 5.6). The remaining inter-correlations between the self-reports can be found in Appendix F.

	Comb BAT	Coins BAT	Toilet BAT	Urine Cup BAT	Hand Sanitizer
Contamination/RT	-.28	.13	-.10	-.03	.14
Contamination/Positive	**-.39***	-.25	-.05	-.12	-.16
Clean/RT	.007	.05	.21	-.21	.12
Clean/Positive	-.15	-.18	-.11	-.28	.28

*$p \leq .05$

Table 5.5. Pearson Product Moment Correlation between the RT-IRAP trial-types and the Behavioural Approach Tasks

Predictive Validity of the IRAP. Based on the results of the correlation analyses, two hierarchical multiple regressions were carried out to determine if *D*-IRAP scores could be predictive of general OC tendencies, self-reported contamination fear and avoidance behaviour when controlling for anxiety and scores on the self-report measures. For the first regression analyses for predicting avoidance behaviour (as measured by the Comb BAT), anxiety (as measured by the DASS) was entered into step 1 of the model and accounted for 5% of the variance, β = -.22, p = .24. The Contamination-Positive trial-type was entered into step 2 of the model and accounted for an additional 12.5% of the variance, β = -.36, p = .05. For the second regression predicting OC tendencies (as measured by the Padua Inventory), anxiety was entered into step 1 of the model (R^2 = *.221,* β = .47, p = .009) and the Disgust-Positive trial-type was entered into step 2 and accounted for a further 14.3%, β = .39, p = .02.

	PI	Contamination	Dressing/ Grooming	Checking	OTHSO	OIHSO	OBQ	OBQ-RT	DASS	DS-R	AAQ-II
Contamination/RT	.17	.16	.29	.01	.13	.16	.21	.24	.21	.14	.20
Contamination/ Positive	**.48****	**.52****	.17	.20	.28	**.42***	.15	.14	.24	**.51****	.16
Clean/RT	.24	.24	.21	.17	.09	.02	.05	.16	.02	.29	-.00
Clean/Positive	.02	.14	-.14	.09	-.13	-.14	-.08	-.11	.25	-.03	.10

*$p \leq .05$
** $p \leq .01$

Table 5.6. Implicit/Explicit Pearson Product Moment Correlations between the RT-IRAP trial-types and the self-reports

Discussion

The results were somewhat consistent with the hypotheses as those who reported high levels of OC tendencies on the PI and on the contamination subscale of the PI produced greater responsibility/threat biases on one of the contamination-related trial-types on the IRAP. However, there was no observed relationship between scores on the OBQ-44, or any of its subscales, and responses on either trial-type on the IRAP. The *Contamination/Positive* trial-type was predictive of both self-reported contamination fear, disgust propensity and OC tendencies along with avoidance behaviour on the Comb BAT, with the latter two effects being independent of anxiety.

Study 7

Method

Participants.

Participants (N = 35) for the present study consisted of undergraduate students attending Maynooth University. The study took place individually in the Department of Psychology at Maynooth University. Participants provided consent on their own behalf and there were no exclusion criteria for the current study.

Materials.

Padua Inventory-Revised (PI-R: Burns, et al., 1996). Cronbach's Alpha for the present sample was .95.

Obsessive Beliefs Questionnaire-Perfectionism/Intolerance of Uncertainty Subscale (OBQ-PC: OCCWG, 2005). The Perfectionism/Intolerance of Uncertainty subscale of the OBQ-44 is a 16 item scale. Items include "*For me, things are not right if they are not perfect*" and "*It is essential for everything to be clear cut, even in minor matters*". Cronbach's Alpha for the present sample was .95.

The Frost Multi-Dimensional Perfectionism Scale (FMPS: Frost, Marten, Lahart & Rosenblate, 1990). The FMPS is a multi-dimensional measure of perfectionism which was originally conceived of as having six individual subscales (Concern over Mistakes (CM), Personal Standards (PS), Parental Expectations (PE), Parental Criticism (PC), Doubts about actions (D), and Organization (O)) (Frost et al, 1990). Factor analysis has revealed that there are in fact four subscales (Stober, 1998; Enns, Cox, & Clara, 2005) It is a 5 point scale which ranges from strongly disagree to strongly agree. Cronbach's alpha for the present sample was .93. Cronbach's alphas for the present sample was .93.

Depression, Anxiety and Stress Scale (DASS: Lovibond & Lovibond, 1993). Cronbach's Alpha for the present sample was .95.

Behavioural Approach Tasks. The BAT's for Study 7 were identical to those used in Study 6.

IRAP (Barnes-Holmes et al., 2006). A correct response on any trial on the perfectionism/certainty IRAP (hereafter referred to as the PC-IRAP) was determined by whether or not the participant was completing a block of trials designed to be consistent or inconsistent with a strong or weak history of deriving perfectionism/intolerance of uncertainty appraisals in response to contaminated stimuli. Consistent trials were those which required participants to respond "Yes" when presented with a perfectionism/intolerance of uncertainty appraisal (e.g., "Not Right") paired with a contamination related picture or when a clean picture was presented with a positive/neutral appraisal (e.g., "Just Right") (see Table 5.7 for full list of target stimuli and Appendix E). Inconsistent responding required the opposite response pattern which was responding "Yes" when a contaminated picture was presented with a positive/neutral appraisal (e.g., "Perfect") and responding "No" when a contamination related picture was presented with a perfectionism/intolerance of uncertainty appraisal (e.g., "Might Be Dangerous") (See Figure 5.5 and Table 5.7). In other words, the

response options allow participants to appraise the relational network in which the pictures and statements participated as either relationally coherent or incoherent. The extent of the observed difference between the consistent and inconsistent trials is assumed to provide an index of the strength of the response bias under scrutiny, which serves as the dependent measure in the current study.

Perfectionism/Intolerance of Uncertainty Stimuli	Positive Stimuli
Not Right	Perfect
Fails to Meet a High Standard	Just Right
Unclean	Very Clean
I Cannot Cope	I Can Cope With This
I'm Not Sure it's Clean	I'll be OK
Might be Dangerous	I'm Certain it's Clean
Not Good Enough	Good Enough
May Cause Harm	Harmless

Table 5.7. Target stimuli for the PC-IRAP

The IRAP was presented in blocks of 32 trials. There were a number of practice blocks that each participant completed in order to ensure an accuracy rate of 80% and a response latency of less than or equal to 2000 ms. The participants were required to meet these criteria across a pair of practice blocks, within six or less blocks, before proceeding to the fixed set of six test blocks. The instructions for the IRAP were presented on paper and were read through with the experimenter to ensure that each participant understood the nature of the experiment and what was being asked of them. The experimenter explicitly classified the pictorial stimuli as “contaminated” or “clean” thus providing a context to reduce the likelihood that participants would respond to the stimuli as being merely negative or positive; and also stressed the importance of speed and accuracy in the IRAP. Before each block, the rule for responding was provided to the participants so they were aware for the block that they were required to respond as if the contaminated things were threatening/their responsibility and the clean things were positive/non-threatening and vice-versa.

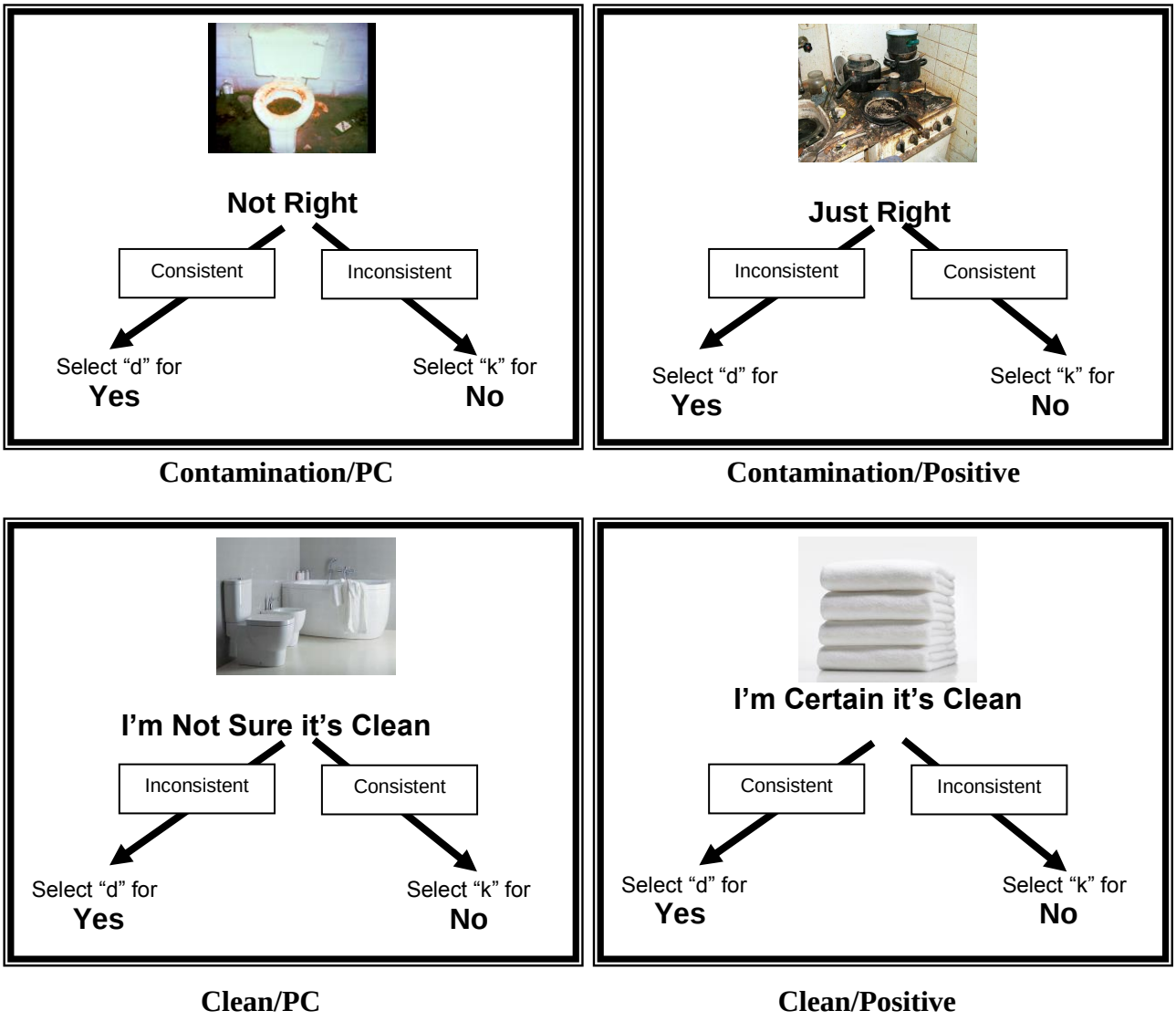


Figure 5.5. Examples of the four trial-types from the PC-IRAP

General Procedure.

The order in which the questionnaires were administered was randomised. The order in which the participants received the study was counterbalanced between the IRAP, questionnaires and BATs. Within the BATs, the order in which the participants completed this part of the study was also counterbalanced.

Results

Scoring the IRAP.

If accuracy fell below 80% or response latency fell below 2000ms on a given test block, or pair of test blocks, then the data from this participant was removed from the dataset (see Barnes-Holmes et al., 2010). The data from three participants were removed on this basis while the data from an additional five were removed for failing to make it through to the test blocks on the IRAP, leaving 27 participants for the final analysis.

Positive scores indicate responding in accordance with expected response biases (e.g., responding "Yes" more quickly than "No" when a contamination-related picture appeared with a perfectionism/intolerance of uncertainty appraisal) and negative scores indicate responding in a manner that was inconsistent with expected responses biases (e.g., responding "No" more quickly than "Yes" when a contamination-related picture appeared with a positive/neutral statement).

Implicit Measure Analysis.

A repeated measures ANOVA was conducted to assess responding on the IRAP across the four trial-types, F (1, 29) = 8.3, $p < .0001$(see Figure 5.6).

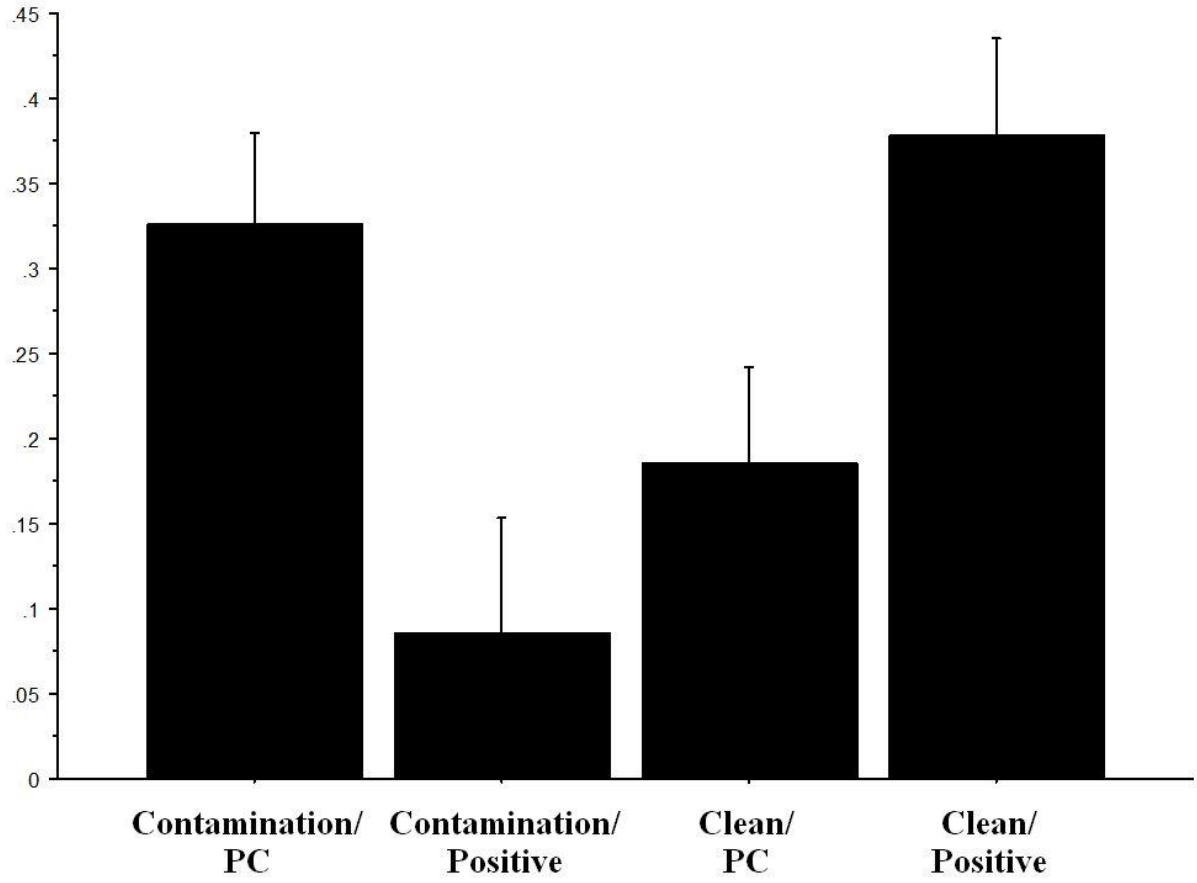


Figure 5.6. Average *D*-IRAP score for the PC-IRAP

Implicit/Behavioural Correlations. A correlation matrix was conducted to determine the relationships between the BATs and the IRAP trial-types. Large negative correlational effects emerged between the Comb BAT and both of the Contamination trial-types (see Table 5.8).

	Comb BAT	**Coins BAT**	**Hand Sanitizer**
Contamination/PC	**-.39***	.35	.28
Contamination/Positive	**-.42***	.07	.01
Clean/PC	-.27	.16	-.02
Clean/Positive	-.17	-.09	.11

*$p \leq .05$

Table 5.8. Pearson's product moment for the PC-IRAP trial-types and the BATs

Implicit/Explicit Correlations. A second correlation matrix was calculated to explore the relationships between the four IRAP trial-types and the self-report measures. A number of trends emerged, most notably the positive correlations between the IRAP trial-types and the Checking and Dressing/Grooming subscales of the Padua Inventory-Revised as well as with

the overall measure. There were also significant correlations between the FMPS and the IRAP (See Table 5.9). The inter-correlations among the self-report measures can be found in Appendix G.

Predictive Validity of the IRAP. Given the fewer number of participants in Study 7 (N = 27) and the fact that anxiety does not appear to have influenced scores on the IRAP up to this point, a simple regression was conducted rather than a hierarchical multiple regression as it has been recommended that there should be at least 15 participants per step. To determine predictive validity for the behavioural tasks, the *Contamination/PC* trial-type was entered into a regression analysis and predicted 15.2% of the variance (β = -.39, p = .04). Similarly when the *Contamination/Positive* trial-type was entered into a second regression analysis to predict outcome on the comb BAT it accounted for 17.6% of the variance (β = -.42, p = .03).

Given the strong correlations observed between the two PC trial-types and the FMPS, two more regression analyses were conducted. The first sought to determine the predictive validity of the IRAP for the prediction of scores on the FMPS with the *Contamination/PC* trial-type accounting for 30.2% of the variance (β = .55, p = .003). Secondly, the *Clean/PC* trial-type was entered into a regression model and accounted for 19.8% of the variance (β = .45, p = .02).

Discussion

Broadly speaking, the results provide preliminary supporting evidence for the utility of the IRAP as an implicit measure of perfectionism and intolerance of uncertainty in relation to contamination. Both of the contamination trial-types correlated significantly with the Comb BAT, which suggested that these trial-types were tapping into behaviour that is relevant to overt avoidance. There was no significant relationship between the Clean trial-types and the behavioural tasks suggesting that these may be less critical to avoidance of

contamination. Study 7 produced some of the strongest effect sizes in terms of correlations with the self-report measures. Indeed, both of the PC trial-types produced strong correlations with the FMPS (self-report measure of perfectionism), while the clean trial-types were not related. There were many correlations between the self-report measures and the IRAP trial-types specifically with the Dressing/Grooming and Checking subscales of the PI-R. This finding is promising as the Dressing/Grooming subscale assesses perfectionist behaviour, while intolerance for uncertainty is typically manifested as checking behaviour.

	PI	Contamination	Dressing/ Grooming	Checking	OTHSO	OIHSO	FMPS	OBQ-PC	DASS
Contamination/PC	**.36**[#]	-.01	**.48****	**.41***	.33	.23	**.55****	.05	.25
Contamination/ Positive	**.48****	.29	**.51****	**.39***	**.41***	.34	.24	.08	.27
Clean/PC	.32	.07	**.40***	.30	**.41***	.15	**.45***	.15	.36[#]
Clean/Positive	.25	.05	.17	**.41***	.16	.01	.25	-.07	.15

$p \leq .07$
*$p \leq .05$
** $p \leq .01$

Table 5.9. Pearson's product moment correlations between the PC-IRAP trial-types and the self-reports

General Discussion

The first study assessed the six obsessive beliefs as a whole and how they are related to general disgust. Despite the very broad range of behaviours that it was measuring, a significant relationship was found with overall scores on the OBQ-44. The second study was more specific in that it targeted only excessive responsibility/overestimation of threat relations with respect to contamination. However, there was a significant relationship observed between the *Contamination/Positive* trial-type and the Comb BAT which mirrored the effect observed in the final study when a significant relationship was observed between the same task and the *Contamination/Positive* trial-type in Study 7. The three studies outlined in the present chapter serve a number of different functions within the overall research programme. Firstly, they demonstrate the use of the IRAP as a measure of obsessive beliefs in the context of disgust and contamination. Secondly, they reveal the precision that can be achieved with the IRAP with regards to targeting highly specific relational responding as it pertains to OCD.

In Study 5, scores on the checking subscale of the Padua Inventory were predicted by the IRAP and critically, these effects (from both the OBQ-44 and the Padua Inventory-Revised) were independent of current levels of anxiety. One effect which was influenced by anxiety was the relationship between scores on the IRAP and the obsessive thoughts of harm to the self/others subscale of the PI-R. The impact of OC relevant beliefs such as responsibility/threat and perfectionism/uncertainty on the predictive validity of the IRAP were also examined. The regression analyses indicated that the *Disgust-Negative Appraisal* trial-type from the IRAP failed to predict perfectionism/uncertainty when controlling for responsibility/threat. However, when controlling for perfectionism/uncertainty, the IRAP still predicted responsibility/threat, which further highlights the role of the latter factor in disgust responding. The lack of any meaningful relationships between the other trial-types and self-

report measures was indicative of the discriminant validity of the IRAP in that only the OC relevant trial-type (*Disgust-Negative Appraisal*) was related to obsessive beliefs and other obsessive-compulsive constructs.

The IRAP used in Study 5 was not specifically designed to measure checking compulsions; however, the *Disgust-Negative Appraisal* trial-type predicted scores on the checking subscale of the PI, independently of anxiety. This finding suggests that the IRAP was tapping into OC-relevant cognitions beyond those measured in the OBQ-44, on which it was based. The PC-IRAP study also found strong correlations between three of the IRAP trial-types and the checking subscale of the PI-R. These findings can be explained with respect to the fact that checking is often viewed as a by-product of perfectionism and as a precursor for uncertainty which is intolerable to OCD sufferers. Repetitive checking behaviours, which are characteristic to OCD sufferers, actually serve to facilitate greater uncertainty in patients as they become less trusting of memory (van den Hout & Kindt, 2004). Similarly, perfectionism, which is often motivated by a desire to avoid highly unlikely catastrophic events, could be manifested in the form of compulsive checking behaviours to prevent a negative event from occurring (Bouchard, Rheaume & Ladouceur, 1999). Indeed, perfectionism has been shown to play a specific role in the maintenance of checking compulsions and this effect was mediated by anxiety (Moretz & McKay, 2009).

Previous research has found that responsibility appraisals mediated the role of perfectionism on checking and cleaning symptoms in a normal sample (Yorulmaz, Karancı and Tekok-Kılıç, 2006). These results somewhat reflect the finding in Study 5 that the responsibility/threat factor negatively influenced the effect of the perfectionism/uncertainty factor for disgust responding as measured by the IRAP. The results obtained by Yorulmaz et al. (2006) drew distinctions between self and socially orientated perfectionism (see Hewitt & Flett, 1991); that is, responsibility mediated the effect of self-orientated perfectionism for

checking and socially-orientated perfectionism for cleaning. Based on the statements in the OBQ-44, the perfectionism subscale appears to be measuring both self and socially orientated perfectionism. A possible explanation for the similarity in findings between the present study and Yorulmaz et al. (2006) is that cleaning behaviours, along with checking, could be motivated by a heightened sense of disgust sensitivity which could be why responsibility/threat influenced the effect of perfectionism/uncertainty for disgust.

An inflated sense of personal responsibility has long been considered a vital component of OCD (Salkovskis, 1985; 1989) and the results from the RT-IRAP appear to add to existing evidence which suggests that it may be critical in problematic disgust responding also. Indeed, previous research has found that the responsibility/threat subscale was predictive of contamination symptoms in an OCD population (Wheaton et al., 2010). Teachman (2006) posited that maladaptive disgust responding could be interpreted in terms of excessive responsibility for contamination prevention. That is, an individual who has a greater sensitivity to disgust could interpret disgusting or contaminated objects in the environment as being their responsibility to clean up or eliminate (e.g., "When I see any opportunity to do so, I must act to prevent bad things from happening"). However, insofar as the responsibility/threat factor in the OBQ-44 measures both constructs in one subscale, further research examining this relationship more thoroughly is needed to determine the extent to which responsibility and threat individually influence disgust responding.

The finding that the *Contamination/Positive* trial-type of the RT-IRAP (i.e., responsibility/threat appraisals in relation to contamination) were associated with high scores on the Obsessional Impulses to Harm the Self/Others subscale of the PI-R were similar to that of OCCWG (2005) who found significant relationship between the responsibility/threat subscale of the OBQ and Obsessional Impulses to Harm the Self/Others. Individuals who have a tendency to experience a heightened sense of responsibility may be disposed to feel

considerable guilt for their own actions and the actions of others (Salkovskis et al., 1999; Mancini & Gangemi, 2004). On balance, experiencing impulses to harm the self or others may produce feelings of guilt as those suffering from OCD tend to place greater importance on their thoughts as they believe they can influence world events (see Thought-Action Fusion; Shafran & Rachman, 2004). Thus, guilt may be a common factor underlying both responsibility/threat and Obsessional Impulses to Harm the Self/Others. Furthermore, both of these constructs (including responsibility/threat as measured by both the IRAP and the OBQ-44) correlated with the contamination subscale of the PI suggesting that these factors may play a role in contamination fear.

Previous research using the most popular measure of implicit attitudes, the IAT (Greenwald, et al., 1998), failed to find a significant relationship between the implicit appraisal of unwanted thoughts as being personally meaningful and the cognitive belief domains as measured by the OBQ (see Teachman, Woody & Magee, 2006). However, it is worth noting that the IAT in this study used worded stimuli such as "Unwanted Thoughts" and "Wanted Thoughts" and a list of words to categorize each type of thought such as "Important" or "Meaningful" (Teachman et al., 2006). That is, there was no reference to the specific content of the unwanted thoughts. Rachman and de Silva (1978) have demonstrated that the majority of people (both OCD and non-OCD) experience similar intrusive thoughts in terms of content or context. The present results using the IRAP, which presented specific disgust-eliciting stimuli, suggest that the content of intrusive and unwanted thoughts may be critical when measuring cognitive belief domains at the implicit level. Indeed, domain-specificity is important in the study of perfectionism as the behaviour is often localised to one or two contexts within an individual's life (i.e., domestic environment) (Hasse, Prapavessis & Owens, 2013). As such, measures like the IRAP that take the context in which the behaviour takes place into account, may be valuable asset to the literature on perfectionism.

Additionally, a detailed examination of the items in the OBQ-44 brings to light the propositional nature of the measure (e.g., "If I don't act when I foresee danger, then I am to blame for any consequences"). The IAT was designed as a measure of the strength of associations between concepts in memory and it is widely accepted that IAT effects do not reflect propositional processes (see De Houwer, 2002, for a detailed explanation). In contrast, the IRAP is based on a theoretical framework of cognition that assumes that implicit cognition is highly relational or propositional in nature (Hughes, et al., 2011), and indeed the IRAP was specifically designed to measure the relational properties of implicit cognition. Thus, the finding that scores on the IRAP were related to scores on the OBQ-44 while the IAT were not supports the use of the IRAP as a measure of conditional beliefs such as those observed in OCD.

In both Studies 2 and 3, the trial-types were in the expected direction in that those who reported higher levels of OCD produced larger *D*-IRAP scores on the RT- and PC-IRAPs. In other words, those who reported high levels of OC tendencies on the PI-R and on the contamination subscale of the PI-R produced greater responsibility/threat relating behaviour/perfectionism/uncertainty relating behaviour on the contamination-related trial-types on the IRAP. However, there was no observed relationship between scores on the OBQ-44, or any of its subscales, and responses on any trial-type of either IRAP. The *Contamination/Positive* trial-type was related to both self-reported OC tendencies and contamination fear along with avoidance behaviour on the Comb BAT, with the latter two effects being independent of anxiety. For Study 7, both the PC trial-types produced strong correlational relationships with the FMPS (self-report measure of perfectionism) and both contamination trial-types were predictive of avoidance behaviour.

Critically, the present studies represent an example of a theory that emerged primarily from the cognitive-behavioural tradition being assessed with a measure which was derived

from the behavioural tradition, specifically functional contextualism. It was deemed important to conduct such analyses as a means to broaden the scope of the research. It has been argued that measures which provide functional assessments of obsessive-compulsive behaviour are critical to the OCD literature as too much focus has been placed on measuring symptoms (Abramowitz & Deacon, 2005; Wheaton et al., 2010).

Chapter 6: Intolerance for Causing Mess (ICM)

In Chapter 2, the IRAP was first used as a measure of disgust propensity and sensitivity and it was found that the *Disgust-Distressing* trial-type from the DS-IRAP was related to avoidance behaviour. The *Disgust-Bad* and *Disgust-Distressing* trial-types were both found to be related to OC tendencies and general depressive symptoms. This study only used a single trial-type from each IRAP as it was assumed that problematic disgust responding occurs from the negative appraisal of disgusting stimuli. Further, the opposing category in these IRAPs were designed to be generically pleasant and were, therefore, not likely to be particularly salient in relation to any specific psychopathology. Study 2 found a relationship between the *Clean/Positive* trial-type and use of hand sanitizer which suggested that such trial-types may be important with respect to washing concerns. Thus, it was deemed important to build upon the results from Study 1 by further exploring the relationship between disgust, OC tendencies and avoidance behaviour but with a second focus on the non-disgusting opposition category.

As previously discussed, Salkovskis (1985) posited that the intrusive thoughts carry no salience to an individual until they have been positively, negatively or neutrally appraised. Disgust research has almost exclusively focused on how people negatively respond to disgust-eliciting items or related intrusive thoughts across a range of domains. At the time of writing, there was no evidence in the literature which provided information on whether the extent of positively appraising clean/ordered/non-disgusting stimuli was related to OC symptoms or behaviour. The negative appraisal of disgust is often manifested by avoidance behaviour which has been measured by both implicit and explicit means (Rozin et al.,1999). Relations between positive appraisals and positive stimuli can be assessed using the IRAP, however, how this behaviour may be overtly manifested may be more difficult to assess. If relating negative appraisals with disgusting images is overtly observed in the laboratory as

avoidance behaviour from a disgusting or contaminated item then relating positive appraisals with non-disgusting stimuli could be manifested as an unwillingness or intolerance of causing mess.

The present study used IRAPs very similar to the DP-IRAP and DS-IRAP from Study 1, however, the opposing category of non-disgusting images were chosen to be direct opposites to each of the disgusting pictorial stimuli. In order to assess the degree to which participants feel positive about the non-disgusting/ordered stimuli, we devised two behavioural tasks that aimed to assess how participants deal with causing mess. While a behavioural avoidance task assesses how willing an individual would be to approach an undesirable item, these tasks were devised to gauge the willingness of participants to cause mess and disorder by asking them to knock over a Jenga tower and to rub chocolate spread on a clean table. The concept for these tasks came from a common behaviour in OCD/anxiety disorders where sufferers are unable to cause disturbance to environments they perceive to be in order or 'just right'. It was hypothesised that those who produce a greater bias toward the pleasant stimuli would be less willing to cause a mess on those tasks.

Method

Participants

Participants (15 men and 21 women) consisted of undergraduate students at Maynooth University who completed the study individually in the Department of Psychology. There were no exclusion criteria to take part in this study. Each participant provided informed consent on his or her own behalf.

Materials

IRAP (Barnes-Holmes et al., 2006). Two IRAPs were employed in the present study which were similar to the disgust propensity (DP-IRAP) and disgust sensitivity (DS-IRAP) IRAPs from Study 1. This study utilised the 2012 version of the IRAP and some of the

stimuli used in these IRAPs were changed from Study 1 in an attempt to achieve greater specificity from the IRAP effect. The eight pleasant pictorial label stimuli (see Appendix H) were replaced with pictures of item which were deemed to be opposite to one of the eight disgusting pictorial stimuli (i.e., if there was a picture of a dirty bathroom there was a picture of a clean bathroom). Based on feedback from participants, some of the target stimuli for the DS-IRAP were altered to aid smoother responding (see Table 6.1). The target stimuli for the DP-IRAP were identical to those used in Study 1. An example of the trial-types can be seen in Figures 6.1 and 6.2.

Negative Appraisal Responses	Positive Appraisal Responses
I Need to Look Away	I Can Look
I Need to Escape	I Can Stay
I Worry I'll Get Sick	I'll Be OK
I Cannot Cope	I Can Tolerate It
I Worry I Might Faint	I Feel Clear-Headed
I Fear Losing Control	I Have No Fear
I Fear Contamination	I Feel in Control
I Cannot Tolerate It	I Can Cope With This

Table 6.1. Target Stimuli for the DS-IRAP

Padua Inventory-Revised (PI-R: Burns et al., 1996). Cronbach's Alpha for the overall scores for this sample was .90 and ranged from .60-.90 for the five subscales.

Depression, Anxiety and Stress Scale (DASS-21: Lovibond & Lovibond, 1995). Cronbach's Alpha for the overall scores for this sample was .92 and ranged from .87-.90 for the three subscales.

Obsessive Beliefs Questionnaire-Perfectionism/Intolerance of Uncertainty Subscale (OBQ-44-PC: OCCWG, 2005). Cronbach's Alpha for this sample was .94.

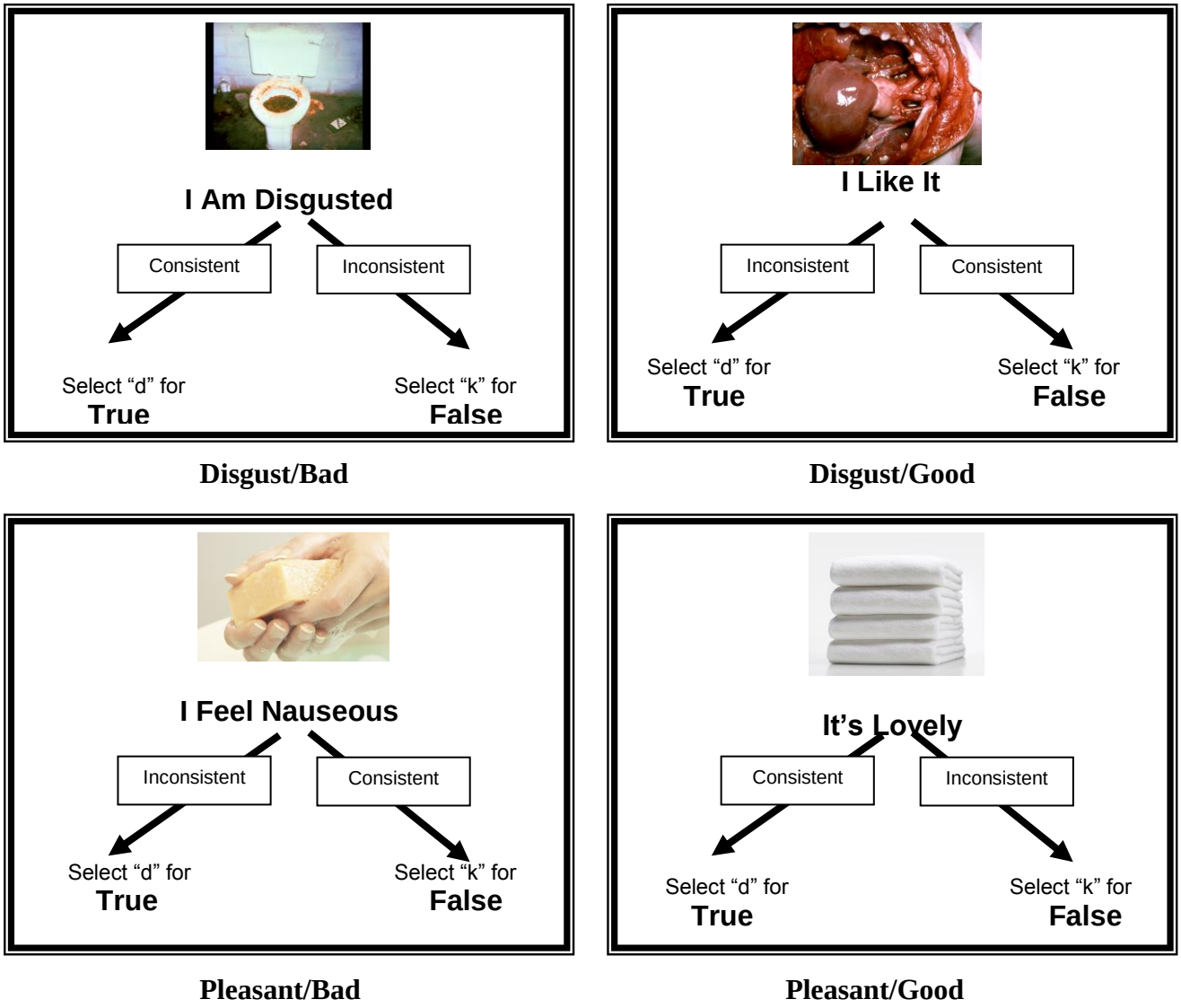


Figure 6.1. Example of the four trial-types for the DP-IRAP

Behavioural Tasks.

Comb BAT. The procedure for the Comb BAT was identical to that used in Chapter 5.

Jenga. A fully constructed Jenga tower (containing 54 pieces) was placed in front of the participants. They were simply asked would they be willing to knock over the tower at any point. The number of Jenga pieces on the floor were counted at the end of the study.

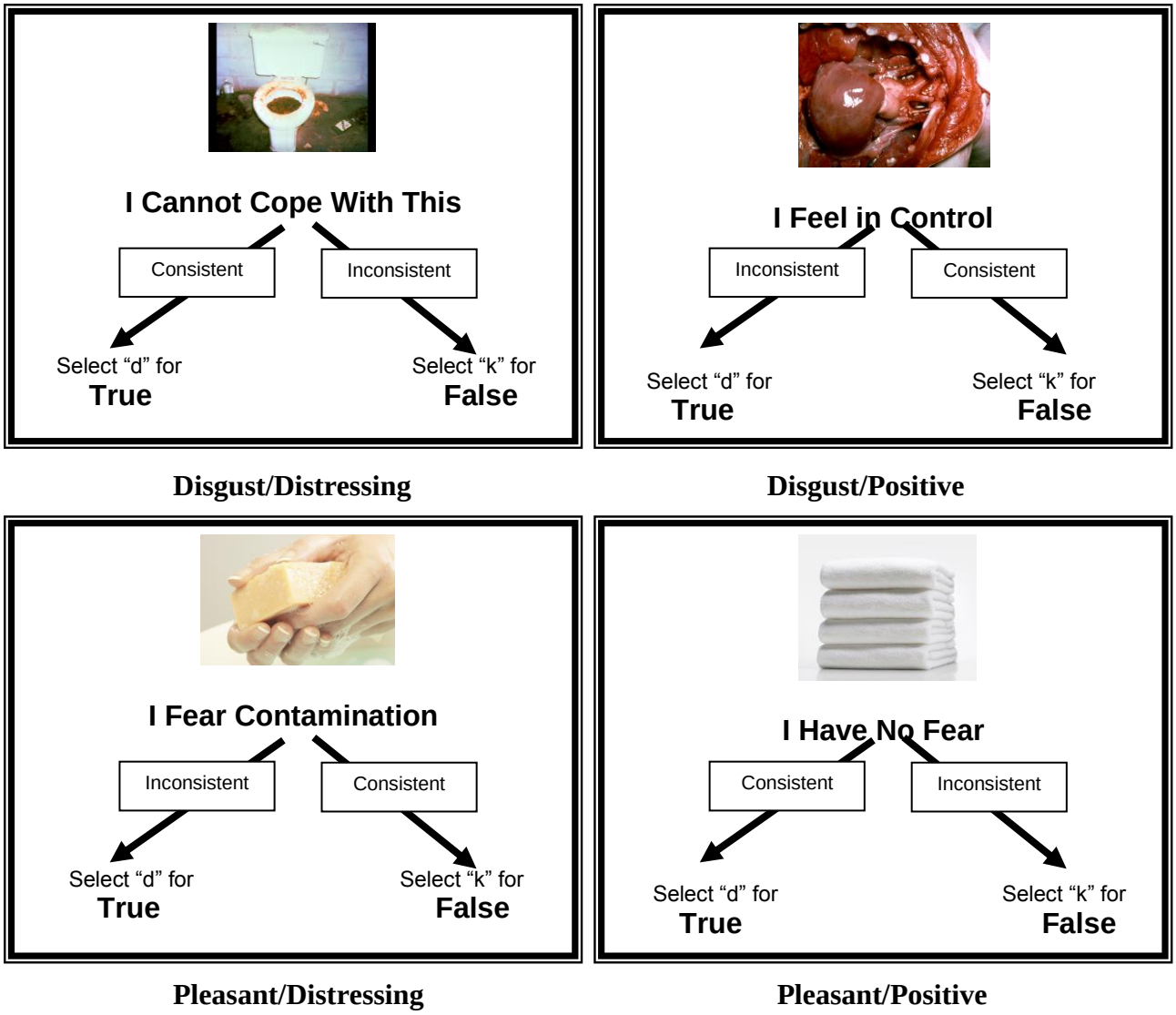


Figure 6.2 Example of the four trial-types from the DS-IRAP

Chocolate Spread Task. A tub of white and milk chocolate spread was placed in front of the participants along with a plastic glove. They were asked if they would be willing to smear the chocolate spread onto the table using a gloved hand. If so, they were asked to do so in as large an area as they felt comfortable.

Hand Sanitizer. A tub of anti-bacterial hand sanitizer was placed on the table and the amount of times the participant used the gel was recorded.

General Procedure

The order in which the experiment was administered was counterbalanced between the IRAPs, BATs and questionnaires. Within the BATs and questionnaires the order in which

they were administered was randomised and the order of the IRAPs was counterbalanced between the Propensity and Sensitivity IRAPs.

Ethical Considerations

The present research was approved by the Research Ethics Committee at Maynooth University. Each participant provided informed consent on their own behalf and were aware that the research was anonymous and that they could cease participation in the study at any time.

Results

Scoring the IRAP

In order to insure that IRAP effects were derived from performances that involved the targeted patterns of stimulus control, response accuracy was assessed first. If accuracy fell below 80% on a given test block, or pair of test blocks, then the data from this participant was removed from the dataset (see Barnes-Holmes et al., 2010). The data from five participants were removed on this basis while the data from an additional four were removed for failing to make it through to the test blocks on the IRAP, leaving 31 participants for the final analysis. No participants were removed on the basis on response time.

IRAP Analyses

Trial-Type Analysis. Two repeated measures ANOVAs were conducted to assess responding across the four trial-types for both the DP- and DS- IRAPs. For both IRAPs, there was a significant effect for trial-type F (3, 28) = 11.75, $p < .0001$, $np^2 = .28$ and F (3, 28) = 6.759, $p = .0004$, $np^2 = .18$ (See Figures 6.3 and 6.4).

Implicit/Explicit Correlations. A correlation matrix was conducted to explore the relationships between the IRAP trial-types from both the DP- and DS- IRAPs and the explicit measures. For the DP-IRAP, only the *Disgust-Bad* and *Disgust-Good* trial-types were significantly related to the PI-R and some of its subscales (see Table 6.2). For the DS-IRAP,

a medium correlation was produced between the *Disgust-Distressing* and the *Disgust-Positive* trial-types and the contamination subscale of the PI-R (see Table 6.3). The remaining inter-correlations among the self-reports can be found in Appendix I.

Implicit/Behavioural Correlations. A second correlation matrix was carried out to assess the relationships between the behavioural tasks and the IRAPs. For the DP-IRAP, there were medium to strong negative correlations between the *Disgust-Bad* and *Disgust-Good* trial-types and the Comb BAT along with a negative correlation between the *Disgust-Good* trial-type and the Jenga task (see Table 6.4). For the DS-IRAP, there were medium negative correlations between the *Disgust-Distressing, Disgust-Positive* and the *Pleasant-Distressing* trial-types and the Comb BAT along with a strong negative correlation between the *Pleasant-Distressing* trial-type and the Jenga task (See Table 6.5).

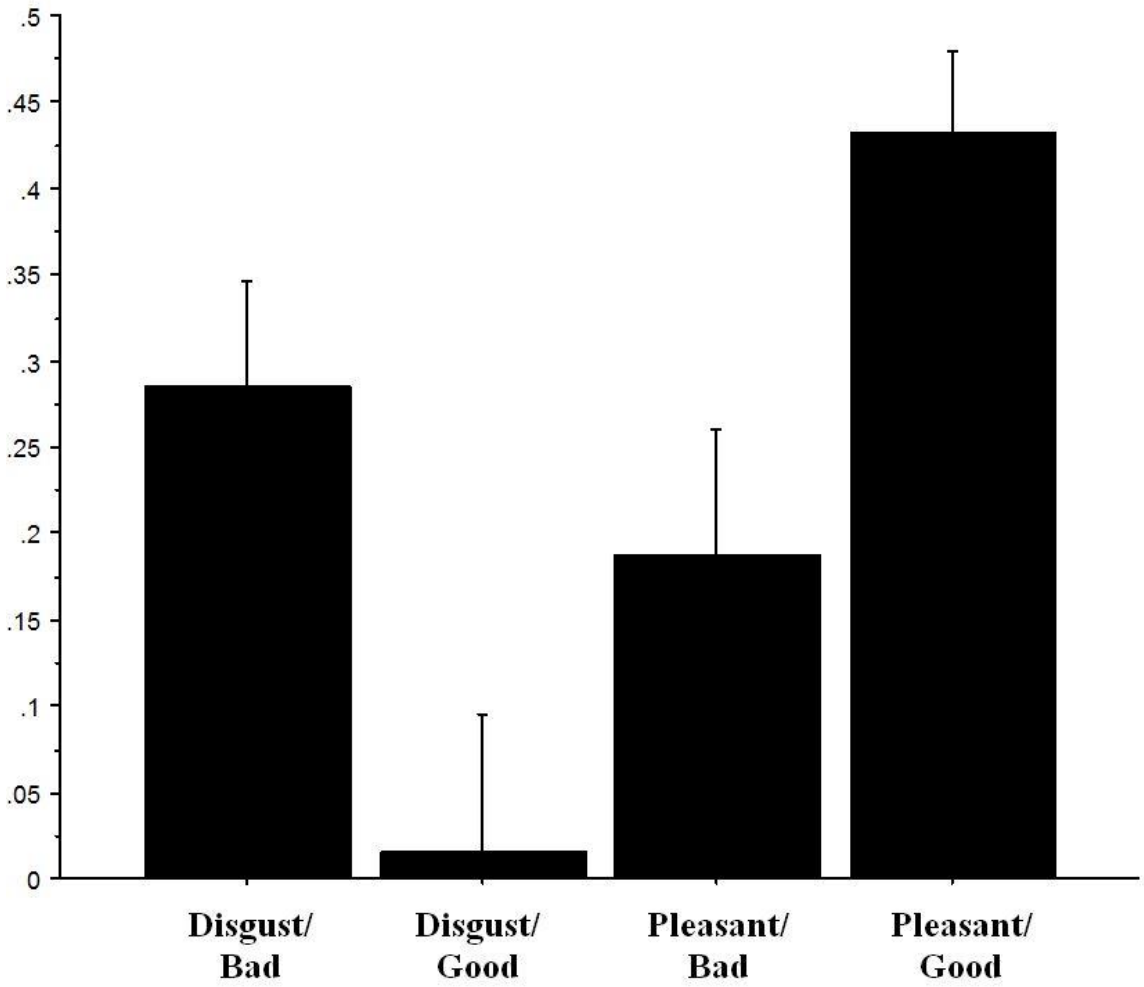


Figure 6.3. Four trial-types for the DP-IRAP

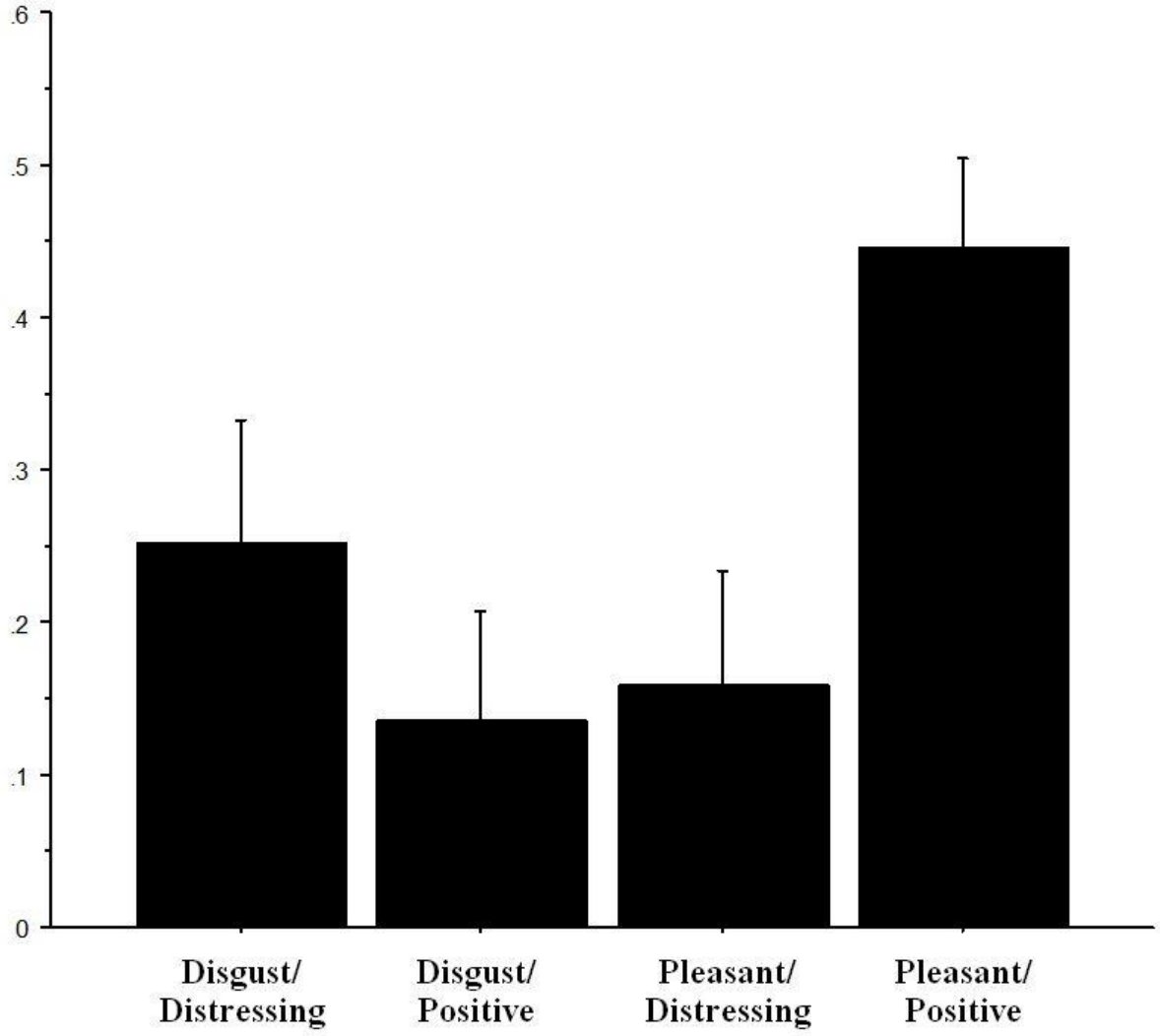


Figure 6.4. Four trial-types for the DS-IRAP

	Comb BAT	**Jenga**	**Chocolate Spread**	**Hand Sanitizer**
Disgust/Bad	**-.44****	.12	.03	.14
Disgust/Good	-.30	**-.35***	-.13	.09
Pleasant/Bad	-.23	-.28	-.09	.08
Pleasant/Good	-.20	-.21	-.23	-.13

*$p \leq .05$
**$p \leq .01$

Table 6.4. Pearson's Product Moment correlations for the DP-IRAP trial-types and the behavioural tasks

	Padua Inventory	Contamination	Dressing/ Grooming	Checking	OTOH	OIOH	DASS	OBQ-PC
Disgust/Bad	**.41***	**.53****	**.34***	.11	.26	**.36***	-.02	.17
Disgust/Good	.25	**.49****	-.06	.02	**.38***	.02	-.13	.05
Pleasant/Bad	.13	.15	-.21	.15	.28	-.11	.08	-.05
Pleasant/Good	.03	.11	-.16	.05	.08	-.09	-.27	-.29

*$p \leq .05$
**$p \leq .01$

Table 6.2. Pearson's Product Moment correlations for the DP-IRAP trial-types and the self-reports

	Padua Inventory	Contamination	Dressing/ Grooming	Checking	OTOH	OIOH	DASS	OBQ-PC
Disgust/Distressing	.15	**.31**[#]	.03	.01	-.01	.14	-.18	.15
Disgust/Positive	.29	**.41***	-.02	.20	.20	.08	.01	.06
Pleasant/Distressing	.14	.08	-.12	.16	.32	-.01	.09	.08
Pleasant/Positive	.32	.36	.15	.14	.21	.34	-.10	-.04

#$p \leq .08$
*$p \leq .05$
**$p \leq .01$

Table 6.3. Pearson's Product Moment correlations for the DS-IRAP trial-types and the self-reports

	Comb BAT	Jenga	Chocolate Spread	Hand Sanitizer
Disgust/Distressing	-.30	-.05	-.02	-.13
Disgust/Positive	**-.33**[#]	-.21	-.10	-.18
Pleasant/Distressing	**-.31**[#]	**-.50****	-.17	-.28
Pleasant/Positive	-.17	-.15	-.14	.16

#$p \leq .08$
**$p \leq .01$

Table 6.5. Pearson's Product Moment correlations for the DS-IRAP trial-types and the behavioural tasks

Predictive Validity of the IRAP. A series of regression analyses were conducted to determine the predictive validity of both IRAPs for avoidance behaviour. The first regression was calculated to assess in the influence of anxiety on the predictive validity of the DP-IRAP for avoidance behaviour as measured by the Comb BAT with anxiety entered into step 1 of the model which accounted for 11.7% of the variance, β = -.34, p = .04. The *Disgust-Bad* trial-type was entered into step 2 and accounted for a further 9% of the variance, β = -.30, p = .06. A second regression was conducted to assess the influence of anxiety on the DS-IRAPs ability to predict avoidance behaviour. As before, anxiety was entered into step 1 (see previous regression for figures) and the *Disgust-Distressing* trial-type was entered into step 2 and accounted for an additional 12.3% of the variance, β = -.38, p = .02. Thus, the DP-IRAP appears to have been more influenced by anxiety.

The third regression analysis conducted explored the proportion of variance for the Jenga task with anxiety entered into step 1 accounting for .07% of the variance, β = -.09, p = .62. The *Pleasant-Distressing* trial-type was entered into step 2 and accounted for an additional 25.6% of the variance, β = -.51, p = .002.

Discussion

Study 8 was conducted to determine whether the opposing stimuli to the disgusting stimuli would produce meaningful effects which are relevant to obsessive-compulsive behaviours. It was found that the *Pleasant-Distressing* trial-type was related to the number of

Jenga cubes the participants were willing to knock over with greater *D*-IRAP scores on the aforementioned trial-type related to less Jenga cubes being knocked over. Further, the *Disgust-Bad* trial-type produced a medium to strong correlation with the Comb BAT while three of the trial-types from the DS-IRAP produced medium negative correlations with the Comb BAT. Critically, the DS-IRAP was not influenced by anxiety whereas the DP-IRAP was.

At the time of writing, the present study was the first to relate responding toward pleasant stimuli as being relevant to OC psychopathology. Much of the literature with regards to disgust has focused on negative appraisals of disgust eliciting stimuli. The cognitive-behavioural theory of obsessions suggested that negative, positive and neutral appraisals are critical to the aetiology of OCD (see Salkovskis, 1985) and thus the present results are important in that regard. It has provided the first evidence that responding with respect to positive stimuli may be relevant in obsessive-compulsive tendencies. It should be noted though that up until this point in the thesis, the results have focused exclusively on responding with non-clinical student samples. While such evidence is critical to the research programme in order to provide preliminary results, work with a clinical sample is required in order for the research to be generalized to OCD.

Chapter 7: Establishing the IRAP as Tool in the Applied Domain

Traditional cognitive-behavioural approaches to obsessions argue that it is the catastrophic misinterpretation of intrusive thoughts, feelings and images as being overly significant which drives problematic behaviour such as avoidance and excessive washing (Salkovskis, 1985; Rachman, 1997, 1998). Moreover, third-wave behavioural therapies such as Acceptance and Commitment Therapy (ACT; Hayes, Stroshal & Wilson, 1999) also focus on responses to intrusive thoughts and feelings rather than the feeling themselves (Twohig, 2009). Overtly negative interpretations of the initial experience of disgust may result in behaviours and cognitions specific to OCD such as excessive washing, checking and need to control thoughts (Teachman, 2006). Thus, it is critical when studying an emotion such as disgust in a clinical setting that the appraisal component of the response (i.e., disgust sensitivity) be examined separately from the initial feeling.

Preliminary research from the present thesis suggests that not only can these constructs be measured separately at the implicit level but they have distinctive relationships with obsessive-compulsive tendencies and the behavioural and symptomatic level. It was found that the appraisal of disgusting stimuli (i.e., disgust sensitivity) was predictive of avoidance behaviour on a series of disgusting eliciting tasks while the tendency to experience disgust (i.e., disgust propensity) was not. Disgust propensity was, however, related to obsessive behaviour while disgust sensitivity was related to washing concerns. This research was carried out with a non-clinical student sample, as such the results, while suggestive, cannot be generalized to a clinical presentation of OCD.

The present research aimed to address this issue by carrying out a similar study which compared implicit disgust propensity and sensitivity in a clinical sample receiving treatment for OCD and non-clinical student sample. The first study focused on comparing a clinical sample of individuals with a diagnosis of OCD to a non-clinical student sample. Participants

completed the disgust propensity and sensitivity IRAPs from Study 1 along with various self-report measures. A second study explored the utility of the IRAP as a predictor for treatment outcome by assessing relational responding on week one of a five week treatment programme and then again on week five. At the end of the five weeks, the outcome for each participant was recorded (e.g., discharged or did not complete the programme).

Study 9

Method

Ethical Considerations

Studies 9 and 10 were approved by both the Research Ethics Committee in St. Patrick's University Hospital Dublin and by the Ethics Committee in Maynooth University. Copies of the stimuli were provided to the team responsible for the treatment of the participants in the clinical group to allow for appropriate action to be taken if they became distressed by the stimuli. The primary investigator was approved as an honorary researcher by St Patrick's University Hospital and appropriate reporting procedures were followed in the instance of participant becoming distressed during the research.

Participants.

All participants (N = 34) volunteered to take part in the study and provided informed consent on their own behalf. The participants from the control sample (N = 17) were recruited from the student population at Maynooth University. Participants from the clinical sample (N = 17) were recruited from the OCD stream of the Anxiety Program at St. Patrick's University Hospital Dublin. All participants from the clinical sample had received a diagnosis of OCD. The treatment program in the Hospital is a combination of CBT with mindfulness approaches and medication.

Materials.

Disgust Scale-Revised (DS-R; Haidt et al., 1994). The Disgust Scale is a 27 item scale and is frequently used to measure disgust propensity across seven domains of disgust including food, animals, body-products, death, body-envelope violation, hygiene and sex (van Overveld, de Jong, Peters, & Schouten, 2011). The scale has been found to have convergent and discriminant validity and has moderate correlations with a sensation-seeking scale (r = -.46) and a fear of death scale (r = .39).

The Disgust Propensity and Sensitivity Scale Revised (DPSS-R; van Overveld, de Jong, Peters, Cavanagh & Davey, 2006). The Disgust Propensity and Sensitivity Scale is 16 item scale which measures disgust propensity and sensitivity. The scale has demonstrated adequate to good reliability (Cronbach's alphas >. 71) and good test-retest reliability for both subscales, disgust propensity (.69) and disgust sensitivity (.77). Each subscale has also been shown to have moderate convergent validity with other disgust measures such as the Disgust Scale and the Disgust and Contamination Sensitivity Questionnaire (*r's* -.21 - .37).

Padua Inventory-Washington State University Revision (PI-WSUR; Burns, Keortge, Formea, & Sternberger, 1996). The Padua Inventory-Washington State University Revision is a 39 item self-report scale designed to measure obsessive and compulsive symptoms. It is also designed to reduce overlap with worry. Each item is rated on a 5-point (0-4) Likert scale assessing the degree of disturbance caused by thought or behaviour. It consists of five subscales including (1) contamination obsessions and washing compulsions, (2) dressing/grooming compulsions, (3) checking compulsions, (4) obsessional thoughts of harm to self/others and (5) obsessional impulses of harm to self/others. This scale has adequate internal consistency and test-retest reliability (Burns, Keortge, Formea, & Sternberger, 1996). Internal consistency achieved in this sample was approaching excellent (α =.711).

Obsessive-Compulsive Inventory-Revised (OCI-R; Foa et al., 2002). The OCI-R is an 18 item self-report measure of symptoms of obsessive-compulsive disorder and was used to measure OC tendencies. It has successfully differentiated between individuals with and without OCD. For a non-anxious sample, it has demonstrated Good-excellent internal consistency (-.72), and test-retest reliability (.57-.87).

State-Trait Anxiety Inventory-Form Y (STAI; Spielberger, Gorsuch, & Lushene, Vagg & Jacobs, 1983). The State-Trait Anxiety Inventory-Form Y is a 40 item self-report subscale of the STAI designed to measure state anxiety (i.e. how an individual is feeling right now) and trait anxiety (i.e., how an individual feels generally). Each item is rated on a 5-point (0-4) Likert scale of the level of present anxiety. The STAI has been found to have good reliability and validity (Spielberger et al., 1983).

Implicit Relational Assessment Procedure (IRAP). Two IRAPs were completed by each participant and were very similar to those used in Study 1. The main difference between the IRAPs was the non-disgusting or pleasant category label stimuli which were selected to be opposite to the disgusting pictorial stimuli (see Appendix H). The label stimuli presented in both IRAPs were identical and consisted of one of sixteen digital images; eight were colour photographs of things which would evoke disgust and the other eight were colour pictures of non-disgusting images (see Appendix H for the new opposing category stimuli). The pictorial stimuli were chosen because they reflected a range of disgust domains (e.g., animal, body-envelope violations, socio-moral etc). The worded target stimuli for both the DP- and DS-IRAPs were identical to those used in Study 1. The DP-IRAP presented either a disgusting or pleasant pictorial stimulus and one of two target stimuli on each trial, a disgust response (e.g., “I Am Disgusted”) or a positive response (e.g., “I Like it”). The DS-IRAP presented a disgusting or pleasant pictorial stimulus and a distress appraisal response (e.g., “I Need to Look Away”) or a non-distress appraisal response (e.g., “I Know I Won’t Get Sick”)

on each trial. Two response options, "True" and "False" were also presented in both IRAPs (see Figures 7.1 and 7.2).

The IRAPs were presented in blocks of 36 trials with four different trial-types in each. Up to 6 practice blocks were implemented to ensure an accuracy rate of 80% and a response latency of less than or equal to 2000 ms (DP-IRAP) and 2500ms (DS-IRAP). The participants were required to meet these criteria across a pair of practice blocks, within six or less blocks, before proceeding to the fixed set of six test blocks. For each block of 36 trials, all of the label and target stimuli were presented in various combinations, with the program ensuring that each of the four trial-types was presented six times in a quasi-random order. The program also ensured that the same trial-type was not repeated across successive trials.

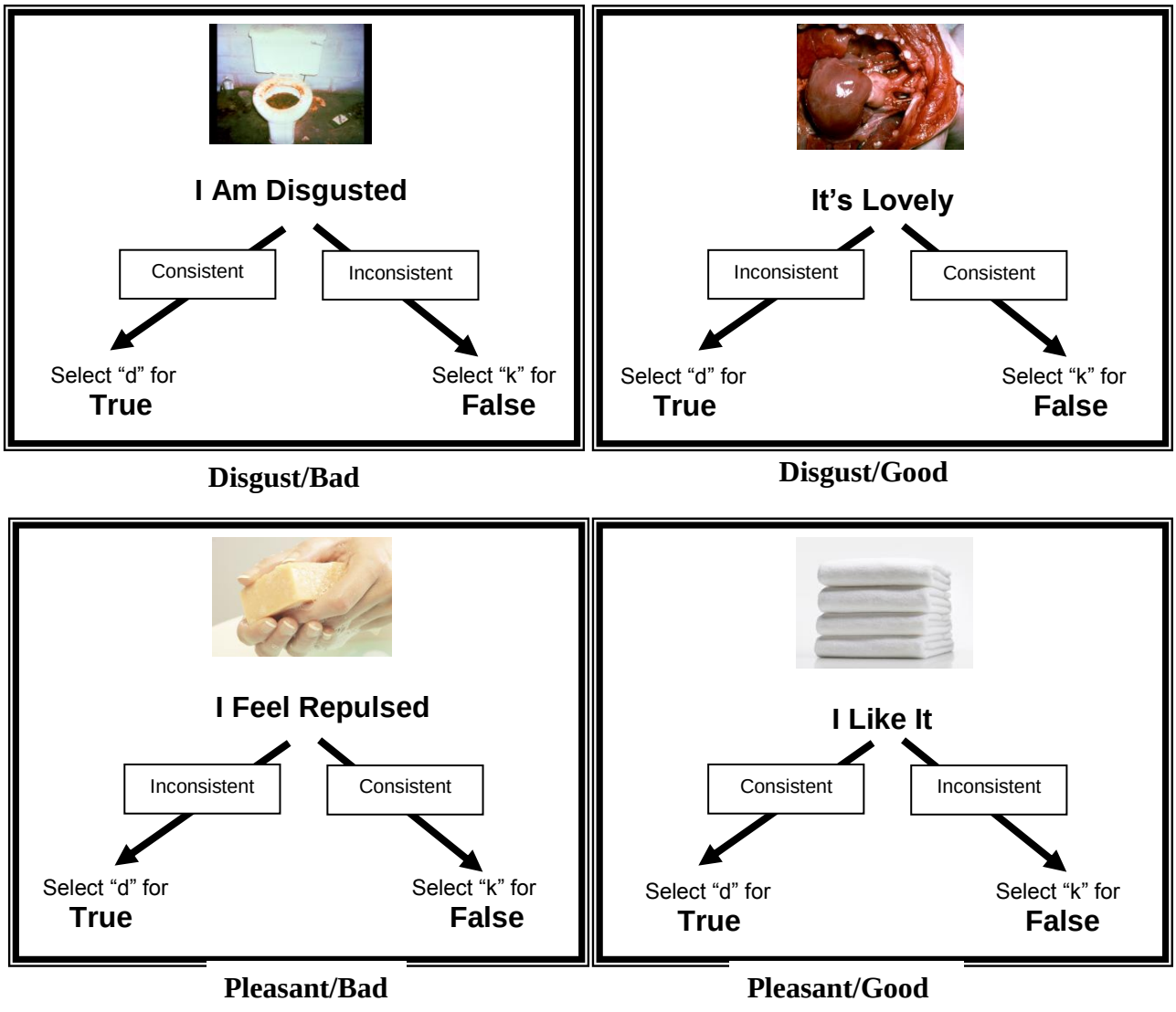


Figure 7.1. Examples of trial-types from the DP-IRAP for Study 9

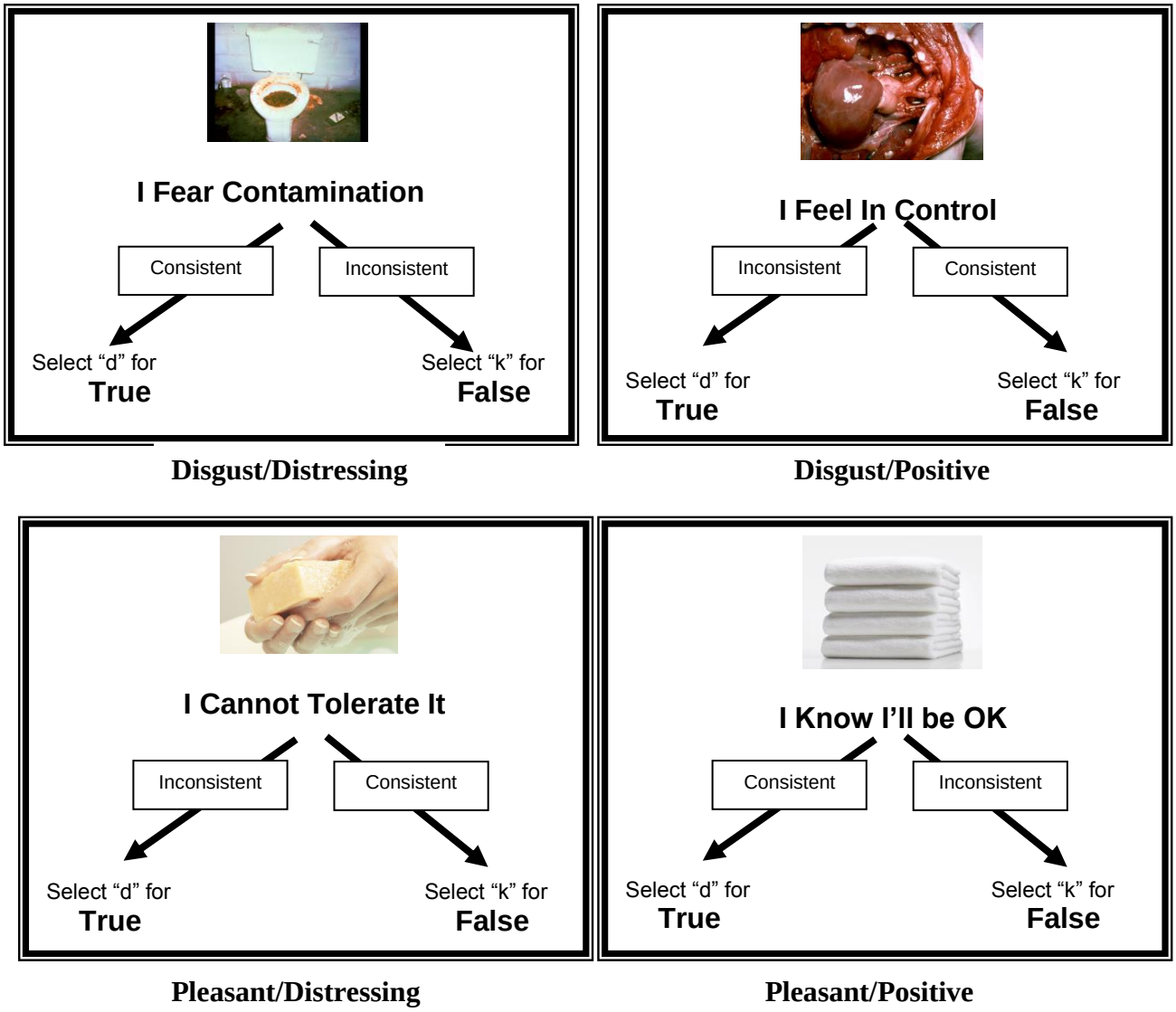


Figure 7.2. Examples of trial-types for the DS-IRAP in Study 9

The instructions for the IRAP were presented on paper and were read through with the experimenter to ensure that participants understood the nature of the experiment and what was being asked of them.

The experimenter stressed the importance of speed and accuracy in the IRAP. Each participant was aware that, at times, they would be required to respond in a manner that may be consistent with their own beliefs and sometimes in a manner that may be inconsistent with their beliefs. The experimenter explicitly classified the pictorial stimuli as “disgusting” or “non-disgusting” thus providing a context to reduce the likelihood that participants would respond to the stimuli as being merely negative or positive. Participants were told that there

were two rules that they would be required to respond in accordance with throughout the IRAP task (i.e., one rule for the consistent blocks and another for the inconsistent blocks). Thus, the participants were aware of the pattern of responding that would be required of them throughout the task before they began.

General Procedure.

Half of the participants received the DP-IRAP first while the other half completed the DS-IRAP first. The order in which the IRAPs and questionnaires were presented was counterbalanced while the order of the questionnaires was randomized. The control group completed the experiment individually in the Department of Psychology in Maynooth University while the clinical group completed the experiment individually in St. Patrick's University Hospital Dublin.

Results

Scoring the IRAP.

The primary datum for the IRAP is response latency which is defined as the time in milliseconds (ms) from the onset of a trial to the first response emitted by the participant by way of a key press. The IRAP effect is the difference in mean response latencies between the anti-disgust/prop-pleasant trial-types and the pro-disgust/anti-pleasant trial-types. To insure that IRAP effects were derived from performances that involved the targeted patterns of stimulus control, response accuracy was assessed first. If accuracy fell below 70% or if response latency was greater than 2000 or 2500 ms on a given test block, or pair of test blocks, then the data from this participant was removed from the dataset.

The latency data were transformed into *D*-IRAP scores using the adapted version of the Greenwald, Nosek and Banaji (2003) *D*-algorithm (see Nicholson & Barnes-Holmes, 2012b, for a full description of this procedure). The *D*-algorithm is used to minimize the

impact of extraneous factors such as age, motor skills, and/or cognitive ability (Nosek, Greenwald, & Banaji, 2007).

Given the foregoing transformation, a larger *D*-IRAP score indicates a greater difference in response latencies between consistent and inconsistent trials. Positive *D*-IRAP scores indicate responding in accordance with anti-disgust and pro-pleasant biases for both Propensity and Sensitivity (e.g., responding "True" more quickly than "False" when a disgust-eliciting picture appeared with a negative statement or a negative appraisal; or responding "True" more quickly than "False" when a pleasant picture was presented with a positive statement or positive appraisal). Negative scores indicate responding in a manner that was inconsistent with pro-disgust and anti-pleasant biases (e.g., responding "False" more quickly than "True" when a disgust-eliciting picture appeared with a negative statement or appraisal; or responding "False" more quickly than "True" when a pleasant picture was presented with a positive statement or appraisal). Scores that approach zero indicate no difference between consistent and inconsistent test blocks.

IRAP analyses. Preliminary analyses using the Kolmogorov-Smirnov statistic indicated that scores on the IRAP trial-types were normally distributed as a result a series of Analyses of Variance (ANOVA) were calculated to compare performance between the groups across the IRAP trial-types.

***Four Trial-Type Analyses*.** A 2x4 mixed repeated measures ANOVA was carried out to determine if there were any between group variables across the two IRAPs. For the DP-IRAP, there was no main effect of group $F(1, 33) = .08$, $p = .78$, $np^2 = .009$, and no interaction, $F(3, 31) = 1.2$, $p = .3$, $np^2 = .04$, but there was a significant effect of trial-type, $F(1, 33) = 5.2$, $p = .002$, $np^2 = .14$. For the DS-IRAP, there was a significant main effect of group, $F\ (1, 32) = 5.4$, $p = .02$, $\eta_p^2 = .14$, but no significant effect for IRAP, $F\ (1, 32) = 1.1$, $p = .4$, nor was there a significant interaction, $F\ (1, 32) = 1.4$, $p = .2$.

A series of between-group ANOVAs explored the differences between the groups on the eight IRAP trial-types. The *Disgust/Distressing* trial-type was marginally significant, $F(1, 32) = 3.4$, $p = .07$, $n^2 = .09$, while the *Pleasant/Distressing* trial-type produced a significant difference, $F(1, 32) = 7.3$, $p = .01$, $n^2 = .18$. There were no significant effects observed among the remaining six trial-types (see Figures 7.3 and 7.4).

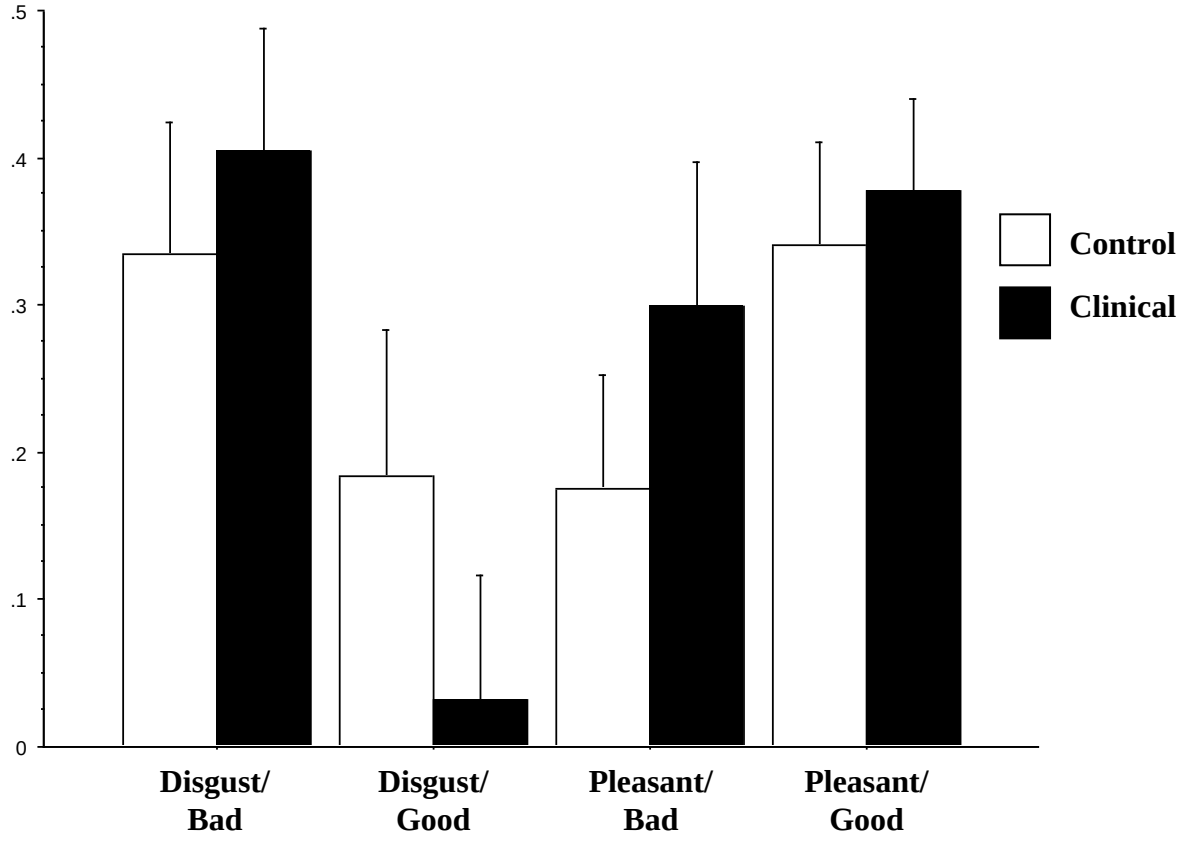


Figure 7.3. Mixed between-within between groups ANOVA for the DP-IRAP

Self-Report Measure Analyses.

***Correlation Analyses*.** There were no significant correlations between the IRAP scores and the self-reports observed in the current study. There were a number of significant correlations between the self-reports which can be found in Appendix J.

***Between-Group Analyses*.** A series of between group ANOVA's were calculated to assess differences between the groups on the self-report measures. There was a significant difference in scores on the Obsessional Thoughts of Harm subscale of the PI between the

Control and Clinical groups, F (41) = 6.68, p = .01. There were significant differences observed between the groups on the STAI and its two subscales, STAI: F (41) = 19.11, p = .0001; STAI-S: F (41) = 7.85, p = .007; STAI-T: F (41) = 28.88, p = .0001. Also the group differed significantly on the Checking (F (41) = 4.04, p = .05) and Obsessing (F (41) = 30.7, p = .0001) subscales of the OCI-R.

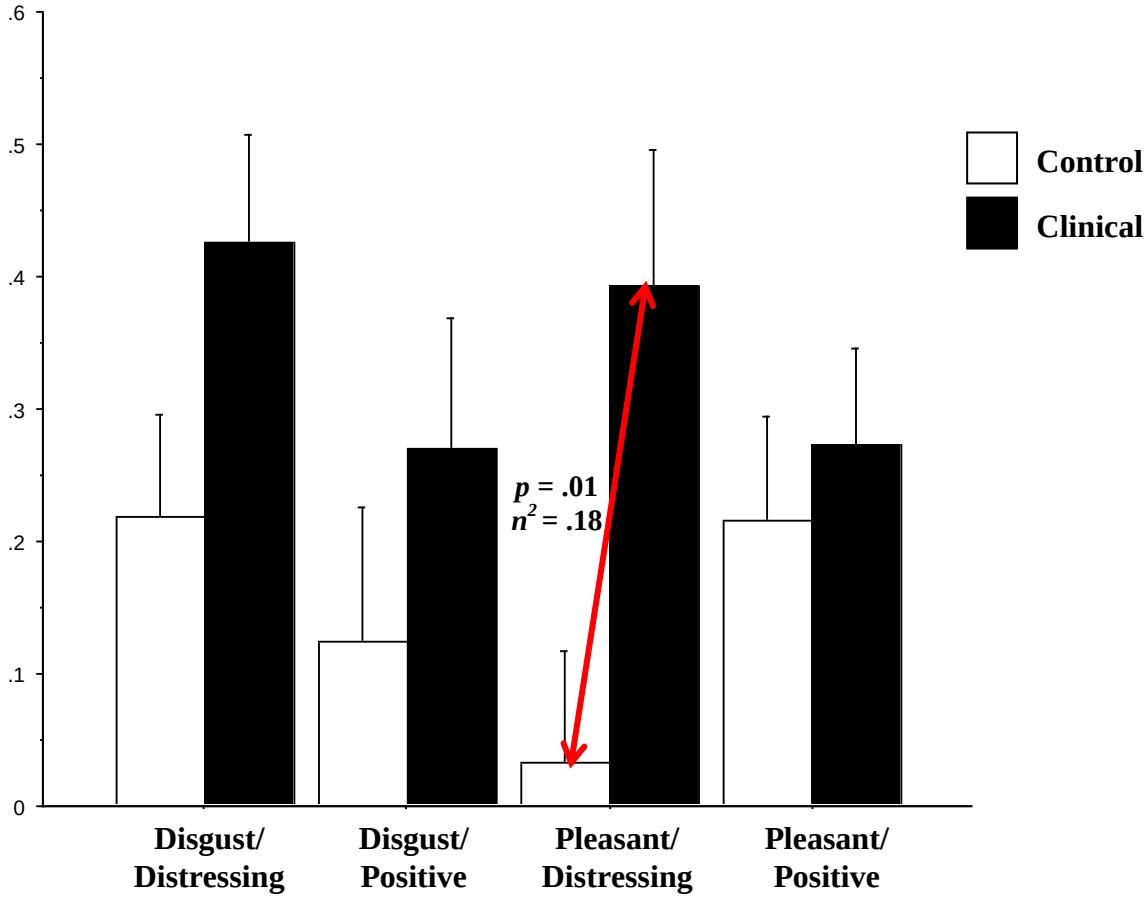


Figure 7.4. Mixed between-within between groups ANOVA for the DS-IRAP

ROC Analyses-Area under the Curve.

IRAP. It was deemed important to determine the ability of the IRAP to assign participants to a group based on their *D*-IRAP scores. The Receiver Operator Characteristic (ROC) was constructed by plotting the probability of the IRAP predicting a "hit" (i.e., correctly identifying an individual as OCD based on their *D*-IRAP scores) against the probability of a "false alarm" (incorrectly predicting an individual was OCD based on their

D-IRAP scores). This then allows for the Area under the Curve (AUC) to be calculated. The *Pleasant/Distressing* trial-type produced a fair ability to classify group membership, AUC = .768, p = .009 (see Figure 7.5). The combined *Disgust/Distressing* produced a poor ability to predict group membership, AUC = .665, p = .1 (see Figure 7.6).

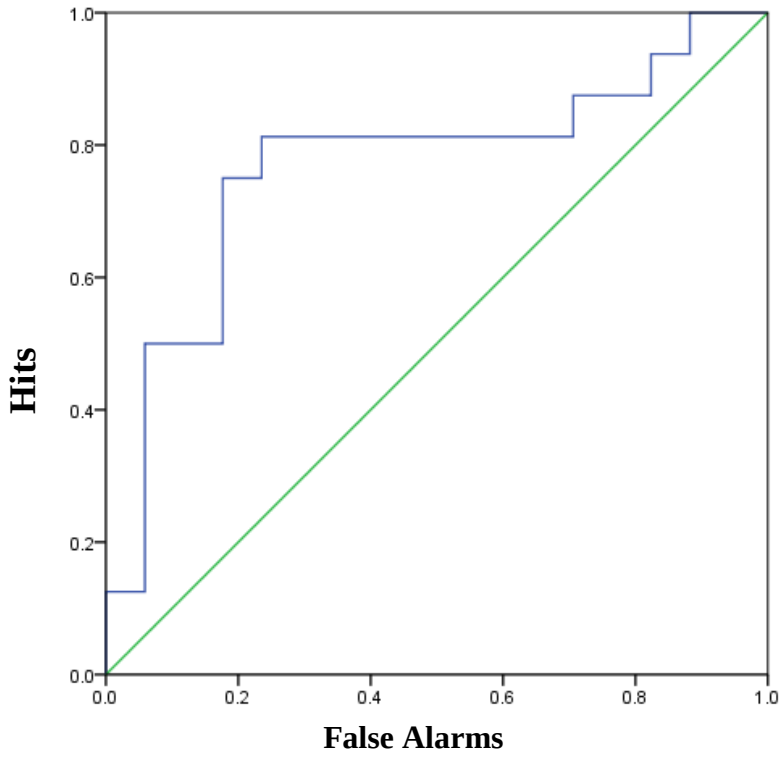


Figure 7.5. ROC curve for *Pleasant/Distressing* Trial-Type

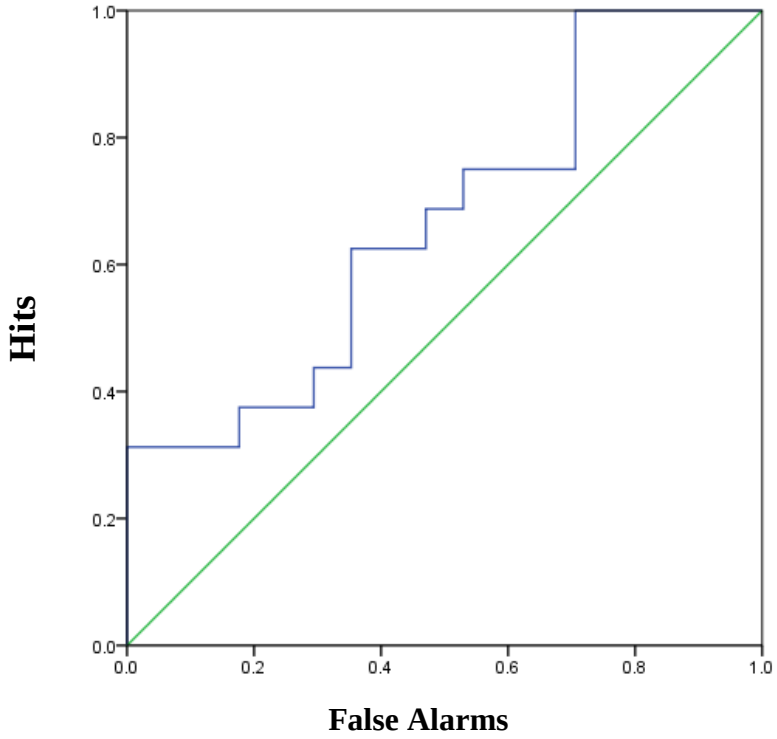


Figure 7.6. ROC curve for *Disgust/Distressing* Trial-Type

***Self-report measures*.** To determine the probability of the Padua Inventory and the Obsessional Thoughts of Harm subscale predicting a "hit" (i.e., correctly identifying an individual as OCD based on their scores) against the probability of a "false alarm" (incorrectly predicting an individual was OCD based on their scores). The PI produced a poor ability to predict group membership, AUC = .639, p = .1 (see Figure 7.7). The Obsessional Thoughts of Harm subscale produced a poor but significant ability to predict group membership, AUC = .682, p = .03 (see Figure 7.8).

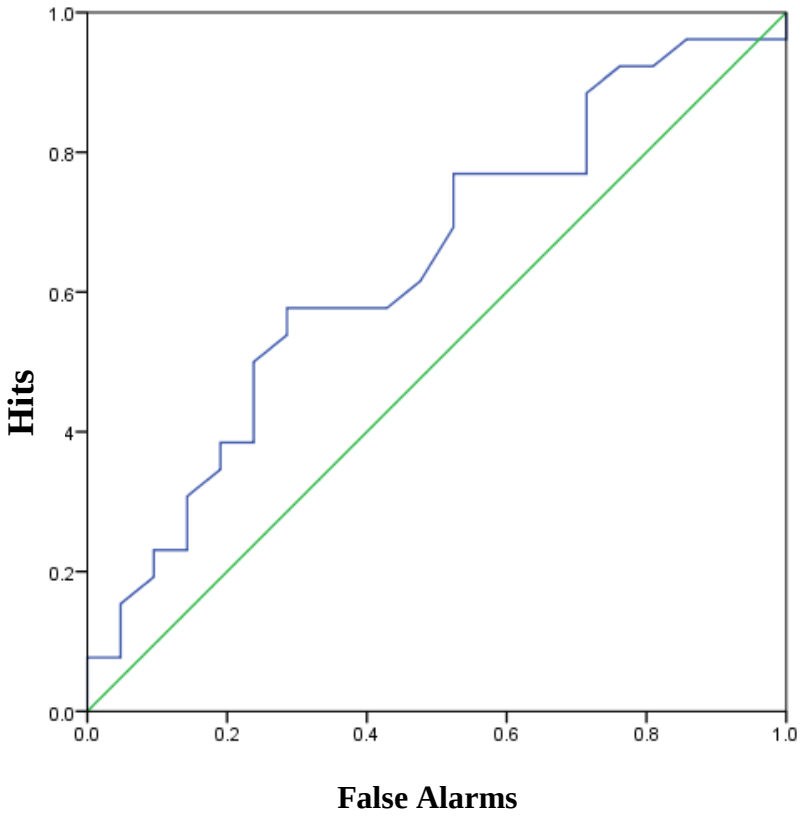


Figure 7.7. ROC curve for the Padua Inventory-Revised

Discussion

The empirical evidence from Study 9 is rather strongly in favour of the IRAP as a valuable measure in the clinical domain, specifically in the context of disgust and OCD. The clinical and control groups differed significantly on the DS-IRAP compared to the DP-IRAP which mirrors the findings observed in Study 1. At the trial-type level, it was the *Pleasant/Distressing* trial-type that produced the greatest difference between the groups. These results were furthered by the ROC analysis which demonstrated the ability of the IRAP to predict group membership with 77% accuracy based on the *Pleasant/Distressing* trial-type. Critically, the IRAP outperformed the self-report measure, the most successful of which predicted group membership 68% of the time.

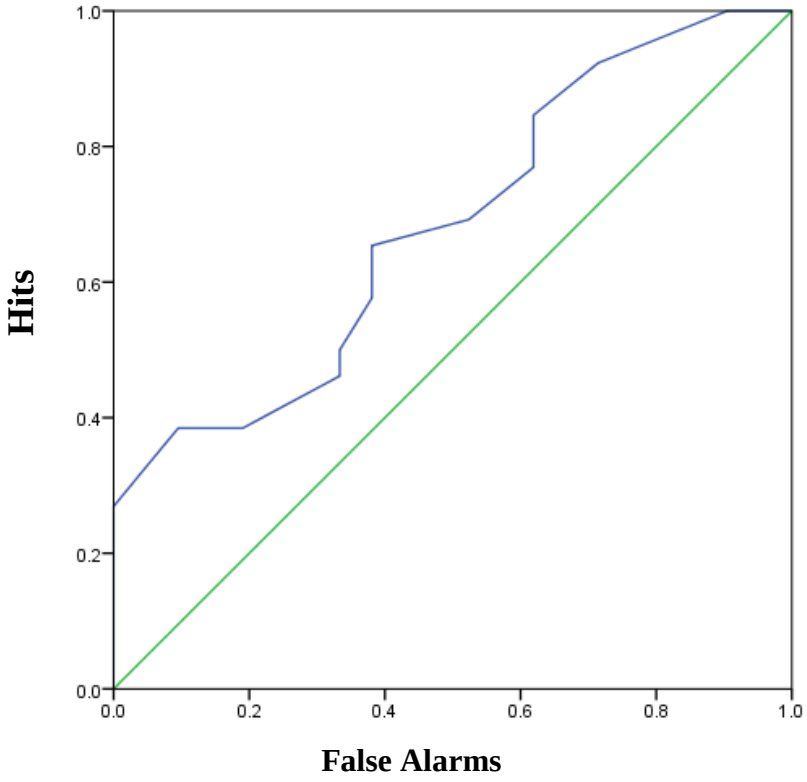


Figure 7.8. ROC curve for Obsessional Thoughts of Harm Subscale

Study 10

Method

Participants.

Participants (N = 26) were recruited from the OCD stream of the Anxiety Programme at St. Patrick's University Hospital Dublin. There were 12 men and 14 women with an age range from 20-63 and a mean age of 32. All participants had received a diagnosis of OCD from St. Patrick's University Hospital Dublin.

Materials.

Disgust Scale-Revised (DS-R; Haidt et al., 1994).

Padua Inventory-Washington State University Revision (PI-WSUR; Burns, Keortge, Formea, & Sternberger, 1996).

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

Acceptance and Action Questionnaire-II (AAQ-II: Bond et al., 2011)

Implicit Relational Assessment Procedure (IRAP). Two IRAPs were completed by each participant and were identical to the IRAPs used in Chapter 6.

General Procedure.

The first assessment for the present study was conducted during week 1 of Level 1 of the treatment programme. During this session, participants completed the two IRAPs and the self-report measures (which were presented in a randomised order). Level 1 is a five week programme so during the 5th week, participants completed the second assessment. During this session, they completed the IRAPs (in a counterbalanced order) and the self-report measures again.

Results

Scoring the IRAP.

A total of 26 participants were recruited to the study during week 1 of the programme. 6 were removed due to a failure to achieve or maintain the necessary IRAP criteria (70% accuracy and 2000 or 2500ms) in the practice or test blocks of the IRAPs leaving 20 participants for analysis. If participants dropped accuracy on one pair of test blocks then this block was removed and the *D*-IRAP score was calculated on the remaining two pairs of blocks; the data for three participants was dealt with in this way for the DS-IRAP only.

Data from one participant from the DS-IRAP was removed due to a failure to maintain the criteria on more than one of the test blocks, leaving 19 participants for analysis for the DS-IRAP.

IRAP analyses: Time 1.

A series of Kolmogorov-Smirnov tests and plots indicated that the IRAP data for each trial-type was normally distributed. A repeated measures ANOVA was conducted to assess responding on the IRAP across the four trial-types for the DP-IRAP. Given previous scores on the DP-IRAP, there was a significant main effect for trial-type F (3, 17) = 7.1, p = .0004. At the individual trial-type level, four one group t-tests were conducted to determine whether the trial-types were significant form zero with all but the *Disgust-Good* trial-type being significant (*Disgust-Bad:* t(19) = 4.48, p = .0003; *Disgust-Good:* t(19) = 1.3, p = .19; *Pleasant-Bad:* t(19) = 2.7, p = .01; *Pleasant-Good:* t(19) = 4.7, p = .0002).

A second repeated measures ANOVA was conducted to assess responding on the IRAP across the four trial-types for the DS-IRAP. There was no significant main effect for trial-type F (3, 16) = 1.02, p = .39. At the individual trial-type level, four one group t-tests were conducted to determine whether the trial-types were significant from zero all of which were significant (*Disgust-Distressing:* t(18) = 4.7, p < .0002; *Disgust-Positive:* t(18) = 4.00, p = .0008; *Pleasant-Distressing:* t(18) = 4.3, p = .0004; *Pleasant-Positive:* t(18) = 2.5, p = .02).

Correlational Analyses-Time 1. A correlation matrix was conducted using Pearson's Product Moment and a few patterns emerged such as four medium to strong positive correlations between the IRAP trial-types and the DS-R. Similarly, there were notable strong positive correlations between the IRAP trial-types and the Obsessive-Thoughts-of-Harm subscale of the PI also (an effect which has also emerged in previous studies). Trial-types from the DP-IRAP also correlated positively with the AAQ-II (see Table 7.1). The inter-correlations among the self-reports can be found in Appendix K.

	DS-R	AAQ-II	STAI-S	STAI-T	PI	Contamination	Dressing/ Grooming	Checking	OTOH	OIOH
Disgust/Bad	.40	**.63****	.36	**.42**[#]	**.42**[#]	.19	**.44**[#]	.36	.40	.09
Disgust/Good	.34	**.44***	.30	.19	.28	.07	.39	.24	.29	.23
Pleasant/Bad	.26	**.49***	.32	.32	.41	.09	**.57****	.26	**.41**[#]	.26
Pleasant/Good	**.53****	**.43**[#]	.25	.25	**.46***	.33	.29	.36	**.42**[#]	.14
Disgust/Distressing	.25	.08	.24	.05	.35	**.69*****	**.40**[#]	.05	.24	-.16
Disgust/Positive	**.45**[*]	.39	.07	.08	**.44**[#]	.22	.04	.35	**.45***	.32
Pleasant/Distressing	**.50***	.33	.05	.13	**.57****	.35	.18	.36	**.62****	.36
Pleasant/Positive	**.42**[#]	.06	.12	-.001	**.47***	**.53****	.10	.32	**.53****	-.02

[#]p ≤ .07
*p≤ .05
**p ≤ .01
***p ≤ .001

Table 7.1. Pearson's Product Moment correlations between the eight IRAP trial-types and the self-reports

Outcome analysis-Time 1. The participants were divided into two groups based on the outcome at the end of Level 1 of the programme based on the next step they took when it was complete. Those who were discharged from the hospitals services were put into the Discharged group (N = 9) while those who dropped out or continued in treatment were put into the In Treatment/DNC (Did Not Complete) group (N = 17).

IRAP analysis. A 2x4 repeated measures mixed between-within ANOVA was then conducted to determine if there were any differences between these groups at the beginning of Level 1. In other words, to determine if the IRAP has any predictive validity for treatment outcome. For the DP-IRAP, there was a no main effect of group, $F(1, 19) = .82$, $p = .37$, $np^2 = .04$, but there was a significant effect for trial-type, $F(3, 17) = 5.57$, $p = .002$, $np^2 = .23$ (see Figure 7.9). For the DS-IRAP, there was a non-significant of group, $F(1, 18) = 2.5$, $p = .1$, $np^2 = .13$ and a non-significant effect for trial-type, $F(3, 16) = .718$, $p = .54$, $np^2 = .04$ (see Figure 7.10). Thus, the DS-IRAP appeared to be a marginally better predictor of treatment outcome at the end of Level 1.

Given the uneven numbers in the groups and the small sample size of the discharged group (see Field, 2009 p. 542), a series of Mann-Whitney tests were conducted to determine whether the groups differed on individual trial-types. The results are displayed in Table 7.2. Interestingly, the *Pleasant/Bad* and the *Pleasant/Distressing* trial-types produced the only marginally significant Mann-Whitney U tests with medium to large effect sizes.

	U	***z***	***p***	***r***	***Md***	***N***
Disgust/Bad	24	-1.15	.13	-.33	.41	20
Disgust/Good	41	-.082	.93	-.02	.09	20
Pleasant/Bad	22	-1.65	.09	-.37	.09	20
Pleasant/Good	30	-.990	.32	-.22	.51	20
Disgust/Distressing	27	-1.10	.29	-.25	.43	19
Disgust/Positive	32	-.614	.53	-.14	.49	19
Pleasant/Distressing	20	-1.66	.09	-.38	.28	19
Pleasant/Positive	30	-.789	.43	-.17	.32	19

Table 7.2. Results of the eight Mann-Whitney U tests

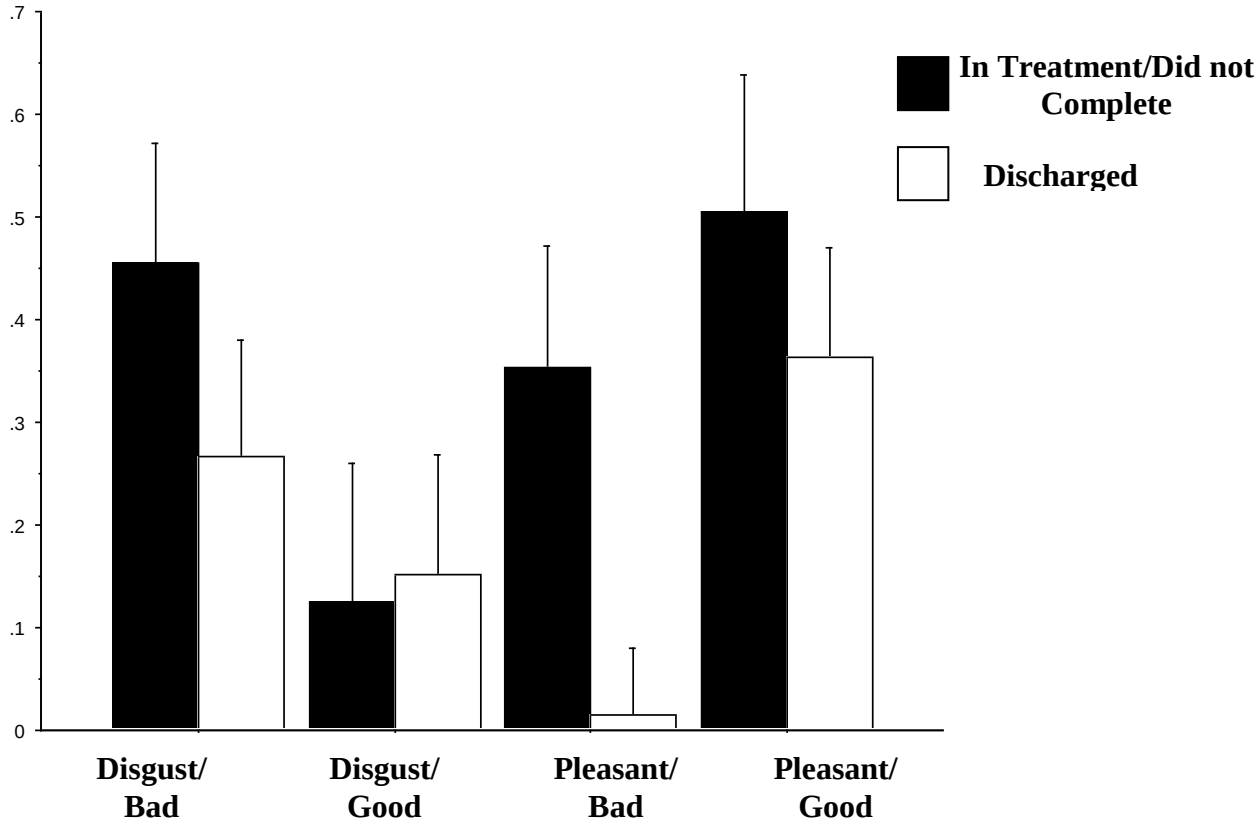


Figure 7.9. Bar chart depicting group differences across the DP-IRAP at Time 1

Yale-Brown Obsessive Compulsive Scale (Y-BOCS). As the most widely used diagnostic tool in the literature, the YBOCS was used as a comparison to the IRAP for predicting treatment outcome. It generates three scores (obsessions, compulsions and beliefs) which were used as dependent variables for three Mann-Whitney U tests to explore the differences between the outcome groups (see Table 7.3). There were no significant difference between groups on the obsessions and compulsions scales; obsessions: $U = 28$, $z = -1.18$, $p = .23$, $r = -.27$, $Md = 11$, $N = 19$ and compulsions, $U = 36.5$, $z = -.46$, $p = .64$, $r = -.11$, $Md = 11$, $N = 19$. There was a significant difference observed between the groups on the beliefs ratings scale but not in the direction that might be expected (i.e., the Discharged group scored significantly higher than the In Treatment/DNC group); $U = 15$, $z = -2.1$, $p = .03$, $r = -.49$, $Md = 50$, $N = 18$.

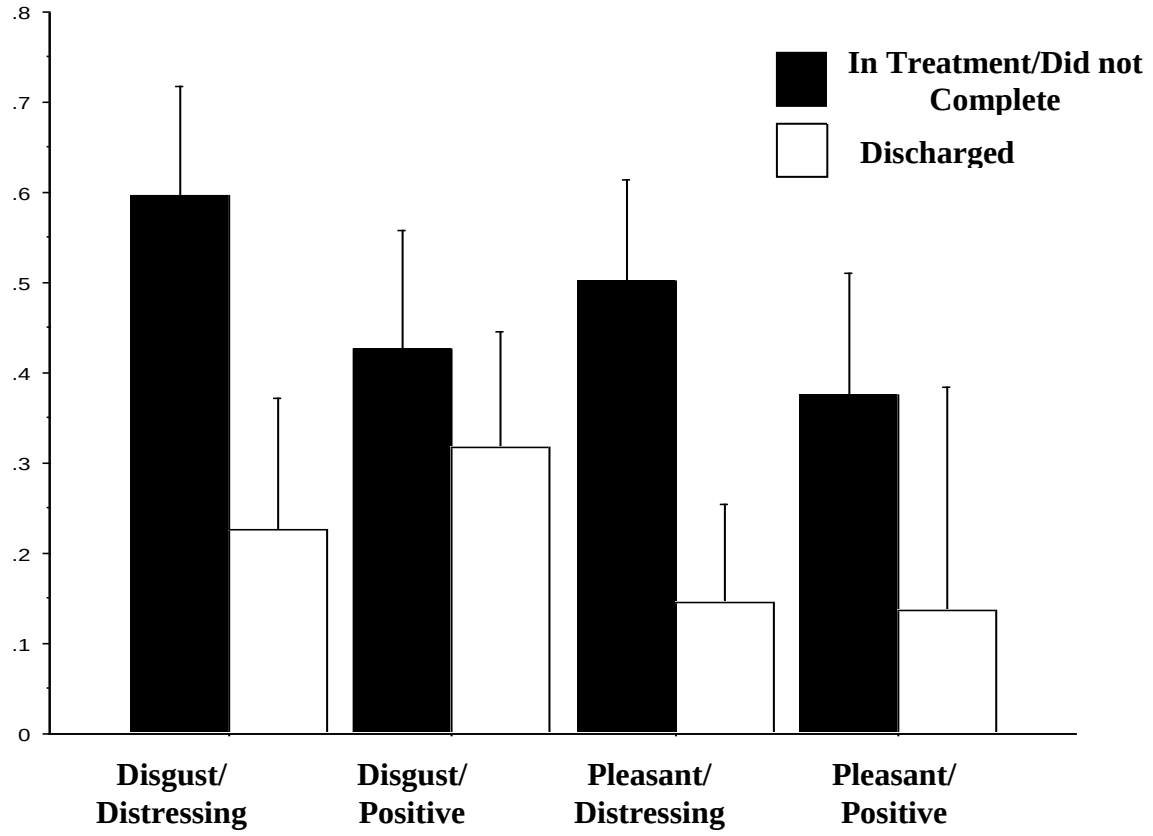


Figure 7.10. Bar chart depicting group differences across the DS-IRAP at Time 1

	Means		Standard Deviations	
	In Treatment/DNC	**Discharged**	**In Treatment/DNC**	**Discharged**
Obsessions	11.54	12	4.99	2.25
Compulsions	11.27	11.71	4.45	2.43
Belief Ratings	26.77	59.29	30.36	27.3

Table 7.3. Means and Standard Deviations for the YBOCS for both groups

IRAP analysis-Time 2. 15 of the original 26 participants who took part in the study completed the IRAPs again at the end of Level 1. 3 of these participants failed to maintain criteria on the test blocks (these were the 3 who failed to maintain criteria for the Time 1 also). Such low numbers warrant caution when conducting analysis, however, the results of two repeated measures ANOVAs are presented below (see also Figures 7.12 and 7.13 for an illustration of changes across time).

For the DP-IRAP, there was a non-significant effect of trial-type $F(3,9) = .964$, $p = .42$, $np^2 = .08$ and only the *Disgust/Bad* ($t(11) = 3.01$, $p = .01$) and *Pleasant/Good* ($t(11) = 2.7$, $p = .01$) trial-types were significantly different from zero. For the DS-IRAP, there was a non-significant effect of trial-type $F(3,9) = .594$, $p = .62$, $np^2 = .05$. All trial-types were significantly different from zero*; Disgust/Bad*: $t(11) = 3.8$, $p = .002$); *Disgust/Good*: $t(11) = 3.2$, $p = .008$); *Pleasant/Bad*: $t(11) = 2.5$, $p = .02$); *Pleasant/Good:* ($t(11) = 2.5$, $p = .02$).

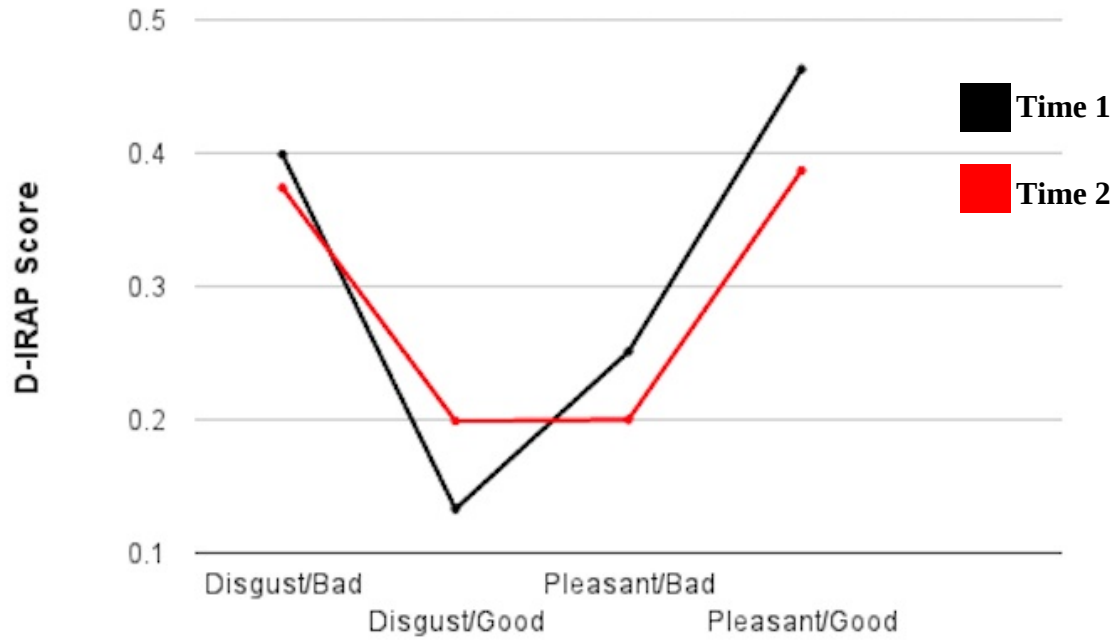


Figure 7.11. Line graph depicting differences in the group from Time 1 to Time 2 on the DP-IRAP

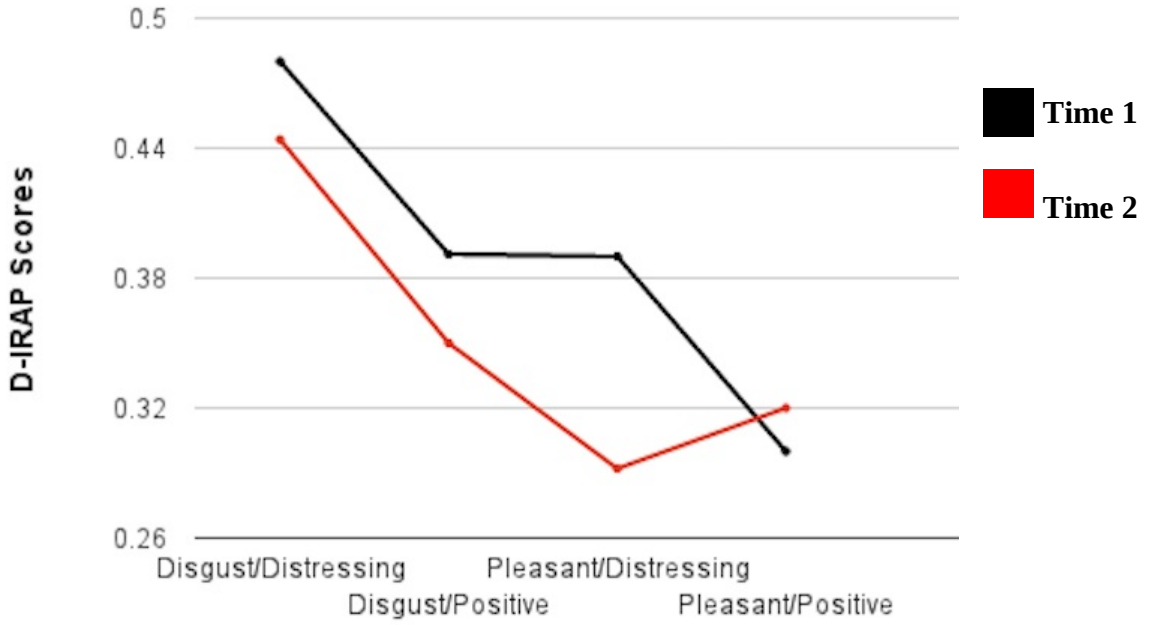


Figure 7.12. Line graph depicting differences in the group from Time 1 to Time 2 on the DS-IRAP

Discussion

Once again the *Pleasant/Distressing* produced the strongest effect sizes particularly in comparison to the self-report measures. The small sample size and high drop-out rate may have hindered the ability of both measures to predict treatment outcome but the IRAP outperformed the YBOCS in this regard.

General Discussion

The studies outlined in the present chapter were vital in the overall thesis as they provided evidence of disgust-related relational responding in clinical samples. The first study demonstrated differences between a clinical group with a diagnosis of OCD and a control student sample. Generally, the clinical group appeared to produce a greater anti-disgust and pro-pleasant bias on the DP-IRAP compared to the control group, however, the difference was not significant. With respect to the DS-IRAP however, there was a significant difference between the groups on the DS-IRAP across the four trial-types with the greatest differences emerging on the *Disgust/Distressing* and *Pleasant/Distressing* trial-types. This mirrors the

findings observed in Chapter 1 where the DS-IRAP predicted avoidance behaviour while the DP-IRAP did not. Critically, it was the *Pleasant/Distressing* trial-type that produced the largest between group effect supporting the previous finding from Chapter 6 where this trial-type was related to an intolerance of causing mess.

For Study 10, the *Pleasant/Distressing* trial-type was the most predictive of treatment outcome based on the between groups effects. While there were no significant differences observed, the effects sizes were of medium size (see Cohen, 1988) and the IRAP outperformed both the YBOC-S and the Padua Inventory-Revised. It is clear that more research is needed to determine the predictive validity of the IRAP in applied areas. Ideally, research that explores more specific obsessive-compulsive relating behaviour such as that measured in Chapter 5 and greater precision may increase the likelihood that changes across treatment will be observed. Nevertheless, given that predicting treatment outcome for OCD is very difficult (see Boschen et al., 2010), the present data is promising with respect to the use of the IRAP as a predictor of clinical outcomes.

Chapter 8: General Discussion

Brief Summary of the Empirical Chapters

The present thesis offered a programme of empirical research that assessed various forms of obsessive-compulsive behaviour as a means to develop an implicit measure of OCD. Study 1 set about developing two separate measures of disgust propensity and disgust sensitivity using the IRAP. Results were very promising with respect to the IRAPs' ability to assess propensity and sensitivity which was further validated by its predictive validity for avoidance behaviour and self-reported OC tendencies. Critically, this work supports the cognitive-behavioural theory of OCD put forward by Salkovskis (1985) approximately thirty years ago.

The studies outlined in Chapter 3 had a dual purpose within the research programme the first of which was to test the impact of changes to the 2009 version of the IRAP on the *D*-IRAP score. Generally speaking, these alterations appeared to have little or no impact. This is important in the context of the current thesis because subsequent studies used the 2012 IRAP and as such it was deemed important to determine whether these alterations impacted upon the *D*-IRAP scores. Thus, studies using both the 2009 and 2012 versions may be interpreted alongside each other. Secondly, with respect to the research reported in Chapter 3, the *Clean-Positive* trial-type correlated positively with the amount of times that the hand sanitizer was used throughout the experiment. As explained below, this finding was critical in the design of future studies.

Continuing with the development of the IRAP as a measure, Study 4 sought to determine the variables that would predict accuracy on the IRAP. Using an IRAP that targeted spider fear from a previously published previously, the variables of interest were level of spider fear, general anxiety and attentional control. As a comparison, an *n*-back task (i.e., task of working memory) was adapted to display various symbols (such as spider

shapes) against which accuracy on the IRAP could be compared. Critically, level of spider fear was not predictive of accuracy or response latency but attentional control was found to predict accuracy on the IRAP. On balance, spider fear was predictive of accuracy on the *n*-back task. In summary, the psychopathology in question did not affect accuracy and response latency on the IRAP and as such we can proceed with developing the IRAP as measure of OCD.

Chapter 5 presented a series of three empirical studies that focused on the obsessive belief domains of OCD in relation to both general disgust and contamination. Study 5 assessed relational responding of all six domains in regards to general disgust with positive correlations observed between *D*-IRAP scores and the self-report measure (the OBQ). In an attempt to assess the precision of the IRAP, Study 6 measured relating behaviour regarding excessive responsibility and overestimation of threat with a focus on contaminated stimuli only. This precision was further tested in Study 7 that explored the relations between contaminated pictorial stimuli and perfectionism and intolerance of uncertainty. Trial-types from both studies two and three were predictive of avoidance behaviour and various measures of OC tendencies. This chapter was critical in demonstrating the precision of the IRAP, which will be discussed in greater detail below.

Chapter 6 returned to the measure of disgust propensity and sensitivity, but based on the results of Study 3 the pleasant stimuli were altered to be directly opposite to the disgusting stimuli. Similarly, two new behavioural tasks were designed to test the willingness of participants to cause a mess as opposed to their willingness to avoid items which were perceived to be disgusting. Results were consistent with the hypothesis that the Pleasant trial-types would be related to an intolerance or unwillingness to cause a mess, whereas the Disgust trial-types were related to avoidance of a contaminated item (i.e., the comb-task).

The final chapter once again utilised the DP- and DS-IRAPs to explore this type of relational responding but in a clinical sample. The first study (Study 9) explored differences between a clinical group with a diagnosis of OCD and a student control group attending Maynooth University. The clinical group scored significantly higher on the DS-IRAP than the control group with fewer differences emerging on the DP-IRAP. The second study (Study 10) assessed the predictive validity of the IRAP for treatment outcome with the IRAP outperforming the self-reports as a means to predict treatment outcome. Across the two studies, it was the *Pleasant/Distressing* trial-type that distinguished between the groups and was the most predictive of treatment outcome.

The IRAP as a Measure of Obsessive-Compulsive and Related Behaviour

As discussed in the introduction, the primary source of measurement for OCD is through the use of self-reports and diagnostic interviews such as the Padua Inventory-Revised and the Yale-Brown Obsessive-Compulsive Scale. These measures have been the main tools in much empirical work exploring the aetiology and maintenance of OCD, specifically at the symptomatic level (see Wheaton et al., 2010). Nevertheless, the need for functional and behavioural methodologies has been stressed because many self-report measures place too much emphasis on symptoms, which may obscure the functions of obsessions, thoughts and feelings (Abramowitz & Deacon, 2005; Wheaton et al., 2010). Further, content-specific measures have also been cited as critical in the study of behaviour such as perfectionism, which from a behavioural standpoint, is in keeping with the position that the context is critical to behaviour (Hasse, Prapavessis & Owens, 2013). The present thesis has offered the IRAP as a means of providing both a functional and context-specific assessment of obsessive-compulsive tendencies and their related behaviours. Generally speaking, given the collection of correlational and between-groups effects, the IRAP has performed well as a measure of obsessive-compulsive and related behaviour.

Measuring Disgust Propensity and Sensitivity.

Comparison with the Disgust Scale-Revised as a measure of OC tendencies. The use of implicit measures, it has been argued, may provide insights into the aspects of psychopathology that can appear irrational and uncontrollable (Wiers, Teachman, & De Houwer, 2007). For example, it is unclear if individuals' suffering from conditions such as OCD have conscious access to the controlling irrational behaviours and if these behaviours can be measured through self-report means. In other words, measures such as the IRAP may provide a means to assess behaviour that the individual may not have access to or there is a lack of self-discrimination (see below for further detail on this point). Indeed, in Study 1 there was a non-significant positive relationship between scores on the DS-R and OC tendencies (as measured by the OCI-R), whereas both implicit disgust propensity and sensitivity, as measured by the IRAP, correlated significantly with OC tendencies. As an aside, previous research did find a *significant* relationship between self-reported disgust propensity and OC tendencies (Berle et al., 2012; Berger & Anaki, 2014), but critically the effect size from Study 1 in the current thesis (r = .24) was very similar in magnitude to that observed in those two previous studies. Note, however, that the N in Study 1 was approximately four times less than the samples in those studies, which may account for the lack of significance at the .05 level. On balance, it is important to recognize that larger effect sizes did emerge between self-report measures of disgust such as the DS-R and the PI-R ($r \geq$ .46) in subsequent Studies (8, 9 and 10), along with strong correlations between the IRAP and the PI-R and its subscales. Overall, therefore, in comparison to a widely used self-report measure of disgust, the IRAP compares favourably as a measure of OC-relevant behaviour.

As a measure of avoidance behaviour. The most supportive evidence for the validity of the IRAP arose from the correlations observed between the IRAP and the behavioural approach tasks. While the DS-R correlated non-significantly with the overall BAT score in

Study 1, it was the DS-IRAP that correlated most strongly with avoidance behaviour. Nevertheless, this finding makes sense if you accept that the DS-R is primarily a measure of propensity rather than sensitivity (see van Overveld et al., 2011). Interestingly, the DP-IRAP correlated with avoidance behaviour in Study 8 (i.e., the Comb task), but this was the only task in which there was clear deception (i.e., the participant was led to believe that the comb was actually contaminated). One could argue, therefore, that unwillingness to use this item was based largely on a participant's immediate gut reaction of disgust (propensity) rather than appraisal of that reaction (sensitivity). As such, it appears that the IRAP may be sensitive to the idiosyncrasies of avoidance behaviour inherent in both disgust propensity and sensitivity.

Propensity and sensitivity and OC tendencies. It should be noted that while disgust propensity as measured by the DP-IRAP did not predict avoidance behaviour in most cases, it did predict OC tendencies (i.e., obsessions) along with disgust sensitivity. However, this relationship between disgust propensity and OC tendencies in Study 1 was influenced by anxiety, which suggests that trait anxiety may exacerbate the initial experience of disgust (Davey, 2003). Additionally, the obsessions subscale of the OCI-R measures general obsessing, rather than specific obsessions (e.g., contamination, checking, etc), and thus the specific relationship between disgust propensity and specific obsessions remained unclear. However, when subsequent research was conducted with a clinical sample, in Study 10, the DP-IRAP was found to correlate with general OCD (when measured by the PI-R) as well as obsessions related to harm, which appears to be consistent with the findings from Study 1. Furthermore, propensity was also related to psychological flexibility whereas sensitivity was not. Thus, while propensity may not be critical in "irrational" avoidance behaviour, it may still be a useful variable in the study of OCD.

The finding that disgust sensitivity predicted washing concerns above and beyond anxiety expands on research by Olatunji et al. (2007), who found that both anxiety and general disgust were predictors of washing concerns. The authors concluded that disgust acts as a significant intervening variable, in that the path from anxiety to washing concerns decreased when disgust was added to a regression model. However, the study conceptualized disgust as a unitary response, and thus it may have been affected by an interaction between propensity and sensitivity, as predicted by van Overveld et al (2006), which may have weakened the role played by disgust. Critically, the findings from the current thesis suggest that disgust sensitivity may be the factor through which disgust responding becomes pathological above and beyond the impact of anxiety.

Measuring the Obsessive-Belief Domains.

Chapter 5 outlined a series of three experiments, which were conducted as a means to assess the six obsessive belief domains, not only at the implicit level, but also in the context of disgust and contamination. The results from the correlations between these IRAPs and the accepted measure of obsessive beliefs (i.e., the OBQ-44) are rather inconsistent. For instance, in Study 5 a greater bias toward interpreting the disgusting stimuli as being negative did predict overall scores on the OBQ-44 and specifically scores on the responsibility/threat (RT) and perfectionism/uncertainty (PC) subscales of the OBQ-44. However, in Studies 6 and 7 there was no relationship between the RT and PC subscales of the OBQ-44 and trial-types on the RT- and PC-IRAPs. However, other self-report measures of OCD correlated with the RT- and PC-IRAPs (e.g., the self-report measure of perfectionism was related to scores on the relevant IRAP trial-types on the PC-IRAP) and each of these IRAPs predicted avoidance behaviour. Thus, it can be concluded with relative confidence that these IRAPs were indeed tapping into relevant obsessive-compulsive behaviour, despite a perceived lack of relationship with the behaviour it was specifically designed to measure.

The notorious complexity of OCD may provide an explanation for these effects. Research has suggested that sufferers may not be fully aware of the exact nature of their symptoms and may not be cognizant of certain obsessional behaviour or compulsions they experience (Leonard & Riemann, 2012). From a contextual-behavioural point of view, this would be seen as a lack of self-discrimination behaviour insofar some features of OCD-relevant responses do not participate in on-going relational activity with deictic relations (see Hughes et al., 2012). Indeed, 40% of OCD patients report being unable to identify a perceived consequence, which leads them to carry out compulsions (Tolin, Abramowitz, Kozak & Foa, 2001). Given that treatment is most effective when a thorough understanding of both obsessions and compulsions is obtained (Williams et al., 2011), methods which can assess the intricate and less overtly observable nature of an individual's psychopathology appear to be vital. Interestingly, the results from Studies 6 and 7 supported the idea that some obsessive behaviour may involve brief and immediate relational responding, which may fail to participant in deictic relations, particularly in a non-clinical sample. Although this result was not predicted, the lack of correlation between the responsibility/threat subscale of the OBQ-44 and the IRAP could be interpreted (post-hoc) as evidence of a lack of self-discrimination, or specific deictic relational responding, on behalf of at least some of the participants. More informally, this type of responding may not participate in deictic relations when it occurs at relatively high speeds or high levels of fluency. The potential specificity of this lack of self-discrimination is highlighted by the fact that the IRAP *was* predictive of self-reported fear of contamination and overt avoidance behaviour. In any case, the data suggest that the IRAP may be a useful tool in the measurement of the obsessive belief domains.

The literature on the value of the IRAP as a measure of clinical behaviour is growing (see Vahey, Nicholson & Barnes-Holmes, 2015) and the present results provide an interesting insight into the use of the IRAP in clinically-relevant domains. The stimuli that were used in

the IRAP to target responsibility/threat and perfectionism/intolerance of uncertainty were very specific to OC-type responding, particularly of the contamination-related subtype. These IRAPs were targeting very specific cognitions pertaining to OCD (namely, responsibility and threat appraisals in relation to contamination fear) and the results are highly suggestive that the IRAP was indeed tapping into cognitive features of OC-type behaviour. The current findings therefore underscore the need for future research to select stimuli that will likely target the appropriate domain(s) of OCD. In addition to the specificity, it appears that the IRAP was also targeting highly complex cognitions, with a precision that the IRAP readily affords (because it allows for the use of relatively complex statements or relational networks). For example, evidence from the IAT, which arguably is a somewhat more blunt instrument than the IRAP, found that implicit threat estimations of contaminated objects were only marginally significant predictors of behavioural avoidance (Green & Teachman, 2013). In other words, the design of the IAT is such that it cannot specify the exact relationship between the stimuli in the way propositions measured by the IRAP can (Gawronski & De Houwer, in press), which limits its use in the domain of psychopathology.

Perfectionism has been described as setting unrealistically high-standards and being extremely self-critical when these standards are not met (Frost et al., 1990; Flett & Hewitt, 2002; Frost & Steketee, 1997). Originally, it was thought to be a wide-reaching behaviour that impacts upon an individual's life across a number of situational contexts. However, it has also been theorised that perfectionist behaviour is actually context-specific and may vary in degree across different situational contexts (Hamachek, 1978; Hasse, Prapavessis & Owens, 2013). This reflects the argument above regarding the importance of content or context in assessing such behaviours. The IRAP may provide a means to assess perfectionism and intolerance of uncertainty within a certain context; indeed a variety of contexts could be inserted into the IRAP in the place of contamination. Broadly speaking, it appears that a

measure that has been derived from a literature that adopts a functional-contextualistic stance of human behaviour would add greatly to the cognitive-behavioural literature (Abramowitz Deacon, 2005; Wheaton et al., 2010). We shall return to this issue subsequently.

Evidence from Research with Clinical Samples.

Data from the work conducted with a clinical sample provided crucial evidence with respect to developing the IRAP as a clinical tool. The *Pleasant/Distressing* trial-type successfully differentiated between the clinical and non-clinical samples with the *Disgust/Distressing* trial-type acting as a marginal predictor of group membership. The self-report measures such as the Obsessive-Thoughts-of-Harm subscale of the PI-R was also a significant predictor but was 10% less accurate than the IRAP on the ROC analysis. Interestingly, there were no large correlational effects observed between the IRAP trial-types and the self-report measures in Study 9, which is the only case of this occurring in the present thesis. Nevertheless, the results of the ROC analysis demonstrate the merit of the IRAP as a predictor of whether an individual had received a diagnosis of OCD or not.

In the final study outlined in the present thesis, relational responding was used as a means of predicting treatment outcome across the five-week treatment programme with two outcome variables identified. The first being those who were still in treatment or who had dropped out by the end of the five week cycle and the second being those who were discharged at the end of the treatment programme. In keeping with the results from the previous chapters, the DP-IRAP was not related to the treatment outcome groups. However, there was a pattern in which the In Treatment/DNC group did produce a greater anti-disgust bias than the Discharged group. The most successful trial-type with respect to predicting treatment outcome was once again the *Pleasant/Distressing* trial-type. A limitation of this study, however, is the relatively small sample size, which may have hindered the IRAPs predictive validity. Nevertheless, the IRAP outperformed the YBOCS, which is one of the

most commonly used measures in clinical outcome studies (Fisher & Wells, 2005). Given that the YBOCS is designed to assess symptomatology (Goodman et al., 1989; Fisher & Wells, 2005) and the IRAP was designed to provide a functional account of behaviour, the greater performance of the IRAP in predicting whether an individual would be discharged or still in treatment at the end of the programme supports the supposition that functional and behavioural assessments are needed for OCD research. Critically, as noted previously, approximately 40% of patients do not respond to treatment (Fisher & Wells, 2005; Boschen et al. 2010) and thus there is potential here for the IRAP to make a valuable contribution to the literature as a functional measure of OCD.

The Role of the Appraisal in OCD and its Related Behaviour

The collection of studies from the present thesis strongly suggests that the appraisal of initial thoughts and feelings may be crucial to the aetiology and maintenance of OCD and its related behaviour. This idea was first posited by Salkovskis (1985) who discussed the importance of the appraisal with respect to initial intrusive thoughts and feelings, that have been reported to be experienced in equal amounts by both clinical and non-clinical samples (see Rachman & de Silva, 1978). Indeed, the role of the appraisal was given prime focus in the current research with each empirical chapter containing a study that assessed appraisal responses at a brief and immediate level directly relevant to OCD, such as the obsessive belief domains or disgust behaviour.

This seminal work of Salkovskis (1989) on the cognitive-behavioural aspect of obsessions is clearly supported by the present data. Specifically, he asserted that intrusive thoughts carry no specific tone until they are positively, negatively or neutrally appraised by an individual. It was further posited that the overt or covert behavioural reactions to the initial intrusive thought will become salient to the individual. When this appraisal has direct implications of possible harm, it will result in discomfort, which must be neutralized (often in

the form of a compulsion such as hand-washing, checking or mental neutralising, to name a few). Once the neutralizing responses to the intrusive thoughts are established, they are preserved based on their relationship with less discomfort. The fact that disgust propensity predicted obsessions and sensitivity predicted avoidance and washing concerns could be seen as generally consistent with Salkovskis' argument. That is, if intrusive thoughts constitute an important component of disgust propensity, and sensitivity is an important component of the appraisal of such thoughts, this would explain the relationship between propensity and self-reported obsessions on the one hand and sensitivity and actual behavioural avoidance on the other.

The finding that disgust sensitivity predicted avoidance behaviour on the BATs along with clinical group membership whereas disgust propensity did not, suggests that the initial feeling of disgust may not be indicative of behaviour. Rather, it appears that it is the appraisal of disgust which results in behavioural avoidance. This evidence provides empirical support for Teachman's (2006) theory of pathological disgust, which hypothesized that primary responses to disgust-eliciting stimuli would focus on beliefs regarding the likelihood of contamination or becoming disgusted (e.g., "It turns my stomach" or "Will contaminate me"), whereas secondary appraisals or interpretations would reflect the individual's perceived ability to cope with the initial feeling of disgust (e.g., "I worry I'll get sick" or "I cannot tolerate it"). Thus, it is presumed that while the majority of individuals would experience some degree of disgust in response to a disgust-eliciting stimulus, those who interpret this response as being threatening or meaningful are more likely to engage in dysfunctional avoidance behaviour.

Once again, the results from the research with the clinical sample added further credence to the initial findings, in that the DS-IRAP appeared to have more relevance to the clinical presentation of OCD than the DP-IRAP. That is, the clinical group produced a greater

anti-disgust bias compared to the control group on the *Disgust/Distressing* trial-type, with the greater difference between the groups emerging on the *Pleasant/Distressing* trial-type. Interestingly, this finding could be considered consistent with the results from Study 1 in which the *Disgust/Distressing* trial-type was related to avoidance behaviour, and also with the results from Study 8 in which the *Pleasant/Distressing* trial-type predicted the number of Jenga blocks participants were willing to knock over (i.e., intolerance of causing mess). On balance, there were few significant correlations between these trial-types and the self-report measures for participants from the clinical sample. Thus, these findings are suggestive that the IRAP may provide some insights into OCD that self-report measures do not.

Given the results from the behavioural tasks, these findings suggest that there may be a functional difference between disgust avoidance behaviour and the need for order/control in your environment or an intolerance of a feeling of incompleteness (Summerfeldt, 2004). In other words, there may be a difference in the motivations behind unwillingness to approach a supposedly disgusting/unclean situation (e.g., a public bathroom) and unwillingness to disturb a clean environment for fear of causing contamination (e.g., a kitchen). Such behaviours could be diagnosed as contamination-related OCD, but the functions of these behaviours are critically distinct from one another. In keeping with the previous argument that research needs to move away from symptomatology and focus on exploring the motivations or functions of such behaviours (Cougle et al., 2011), the findings reported in Study 8 further support the potential benefits of using the IRAP because it appeared to assess functionally exclusive behaviours with one IRAP.

It should be noted that in Salkovskis' original paper (1985), positive and neutral appraisals were deemed to be as important as negative appraisals. Nevertheless, negative appraisals have taken precedence in the literature, particularly with respect to assessment. Negative outcomes are routinely assessed in relation to a variety of symptoms (e.g., "*I wash*

my hands more often and longer than necessary" from the PI-R; "*If I can't do something perfectly, I shouldn't do it at all*" from the OBQ; "*I find it difficult to control my thoughts*" from the OCI-R). In Study 3, however, the *Clean/Positive* trial-type correlated significantly with the number of times participants used an anti-bacterial hand gel throughout the experiment. This was interesting in that it was the first suggestion throughout the current programme of research that relational responding on the IRAP pertaining to positive or clean stimuli would be relevant to OCD (this also brought up interesting points about the IRAP itself which will be revisited below). Such behaviour makes sense when obsessive behaviour such as perfectionism and the 'just right' feeling, as discussed previously, are taken into account. Perfectionism is the act of being over critical and consistently striving for perfectionism (often in specific areas of an individual's life), while the just right experience is an internal feeling of satisfaction that something is "right" which is not measured by any metric other than an internal feeling of satisfaction (Summerfeldt, 2004). In summary, therefore, the consistency of the findings in the current thesis provide robust evidence for the relevance of not only the negative appraisal but also how positive appraisals can contribute to the maintenance of OCD.

The Place of the Present Data in the CBS/IRAP and CBT literatures

The current data in the IRAP literature. As discussed in the General Introduction, the IRAP was derived from a substantial body of empirical research on derived relational responding, which spanned approximately two decades. The present body of work can add to this literature by attempting to extend the precision of the IRAP to further its use as a measure of clinical behaviours. Precision is one of the goals of contextual behavioural science (see Hayes et al., 2012) and so it was deemed to be important that the IRAPs attempted to be as precise as possible by targeting highly specific functional behaviour that characterises OCD. For instance, assessing excessive responsibility/overestimation of threat

in relation to contaminated stimuli was an attempt to measure extremely specific forms of relational responding with the IRAP. Furthermore, measuring related yet distinct behaviours such as disgust propensity and sensitivity provided more evidence of the precision of the IRAP. Indeed, evidence from the studies reported in Chapter 5 suggests that the more precise the IRAP the greater the magnitude of the effects observed (e.g., greater effect sizes were found in Studies 6 and 7 compared to Study 5).

The REC model has been offered as an explanation of the IRAP effect in which the *D*-IRAP score reflects the impact of the stimuli presented in the IRAP within the wider context in which the measure is presented (see Hughes et al., 2012; Barnes-Holmes et al., 2010). Brief and immediate relational responses (BIRRs) are described as being involved in automatic or implicit responses while extended and elaborated relational responses (EERRs) are more involved in explicit or controlled responding (Barnes-Holmes et al., 2010). The DP- and DS-IRAPs measured general disgust across a range of domains and critically both were assessed at the brief and immediate level, although the DS-IRAP might be seen as targeting more complex relational networks (i.e., involving appraisals) than the DP-IRAP (which targeted initial disgust responses). This finding is important within this literature because it added further credence to the position that brief and immediate relational responding is a single process which lies on a continuum rather reflecting than being two separate processes (see Barnes-Holmes et al., 2010 p. 538).

The Relevance of the Opposing Category. The IRAP, as a non-relative measure, is unique among implicit measures due to its ability to measure non-orthogonal categories (Gawronski & De Houwer, in press). This feature was deemed important when dealing with contexts such as disgust in which it can be difficult to identify an obviously opposite category (see Teachman et al., 2001). Indeed, the IRAP has been used to measure spider fear with generic pleasant scenes entered as the opposing category (Nicholson & Barnes-Holmes,

2012). General disgust could be seen as falling into a similar domain as spider fear, and as a result the first DP- and DS-IRAP study used generically pleasant pictorial stimuli to act as the opposing context (these had very little salience for participants). Critically, these trial-types produced no effect in Study 1 of the present thesis. However, for the remaining studies, which assessed propensity and sensitivity, the opposite stimuli were chosen to be counter-examples of the disgusting stimuli (i.e., where there was a soiled toilet seat in the disgusting category there was a spotlessly clean toilet in the opposite category). Large effects were then observed on the non-disgusting or pleasant trial-types. In other words, once meaningful opposite stimuli were introduced, the IRAP appeared to produce effects not observed when such stimuli were not employed. Critically, this shift from using stimuli that were deemed to be unrelated to disgust to stimuli that were deemed opposite in some way produced effects that appeared to reflect specific features of OCD, such as intolerance of causing mess. In any case, this finding highlights the need for future researchers to consider the importance of the opposing category when using the IRAP.

Implications for IRAP Research: Methodological Issues. The current thesis aimed to address various methodological issues around the use of the IRAP as a measure of clinical behaviours. While the results from Chapter 3 suggest that IRAP effects are relatively stable when taken from the same population (i.e., student popualtion), it should be noted that IRAP effects may be malleable under certain conditions. Explicit and implicit attitudes can both be influenced by extraneous variables and situational factors (Hofmann, Gschwendner, Nosek, & Schmitt, 2005; Wilson, Lindsey, & Schooler, 2000) thus, it stands to reason, that such factors can render implicit attitudes susceptible to change. For instance, food deprivation may impact upon *D*-IRAP scores on a food related IRAP. Moreover, a sad mood induction caused a reduction in positive responses in a mild/moderate depressive group but no change in a normative group (Hussey & Barnes-Holmes, 2012). Additionally, an anti-old bias was

reversed by administering pro-old exemplars which also reduced a pro-young bias (Cullen, Barnes-Holmes, Barnes-Holmes, & Stewart, 2009).

A degree of caution should be taken when making changes to the IRAP procedure, which compromises its standing as a relational assessment of implicit cognition. The results must reflect an interaction between the context in question and the learning history of the participant (Barnes-Holmes et al., 2010; Hughes et al., 2012) lest the measure ceases to be the IRAP as it was originally conceived. In certain contexts it may be prudent for researchers to make minor alterations to the procedure as a means of aiding the participants' responding. For instance, the RT and PC IRAPs from Chapter 5 used 'Yes' and 'No', because pilot testing indicated that participants preferred these response options over 'True' and 'False'. Critically, however, in the context of the IRAP, 'True' and 'False' and 'Yes' and 'No' response options allow the participant to indicate whether the relationship between stimuli on the screen is relationally coherent or incoherent (the response options 'Similar' and 'Opposite' serve the same function).

It is also worth noting that the IRAP data can also be analyzed in different ways depending on the research questions of each particular study. *D*-IRAP scores are used to assess differences in response latencies between the consistent and inconsistent blocks, however, some research questions require a more nuanced interpretation of the data. Kishita, Muto, Ohtsuki, and Barnes-Holmes (2014) examined the relative changes observed between response latencies on the consistent and inconsistent blocks separately after the implementation of a defusion task. Likewise, the IRAP in Chapter 4 of the current thesis evaluated specific response latencies for the spiders and pleasant scenes to test the effects of attentional control on IRAP responses. That is, differences in a specific cognitive ability, the inhibition function, appeared to be responsible for the participants' ability to achieve and maintain performance criteria across the test blocks of the IRAP. Normally, the *D*-IRAP

transformation controls, at least to some extent, for differences in cognitive ability across participants, and thus if the performance criteria are met and maintained, individual differences in cognitive ability becomes largely irrelevant during the final analysis. However, participants are typically eliminated from studies before a *D*-score is calculated because they do not maintain criteria across the test blocks. The current findings suggest that the inhibition subscale of the ACS may provide a way to screen participants to determine who may need extra assistance in getting through the IRAP. Of course, should participants be screened before completing the IRAP, it is important to implement valid methodologies which will assist them in achieving the necessary criteria.

The purpose of the inhibition function is to refrain from attending to task-irrelevant stimuli and responses (Eysenck & Derakshan, 2011), and as mentioned previously, anxiety impairs performance of the inhibition function (see Derakshan & Eysenck, 2009). Thus, it could be argued that anxiety has a detrimental effect on the inhibition function which results in a greater number of mistakes made on the IRAP. However, the source of this anxiety remains unclear. The present results suggest that self-reported spider fear and pre-experimental anxiety were not predictive of lower accuracy on the IRAP, although the task itself may be eliciting anxiety in the participants. Indeed, there was a slight increase in state anxiety by the end of the experiment. Perhaps, future research could further examine the possibility that test anxiety adversely impacts IRAP performance through the inhibition function as previous research has found that test anxiety negatively effects achievement (Hembree, 1988).

Previous research has utilized a practice IRAP to familiarize participants with the task before doing the IRAP proper (Vahey et al., 2010). One issue around this method is that a practice IRAP can be time-consuming and more importantly participants may be cognitively "tired" by the time the second IRAP is presented, which could result in more errors. Insofar

as differences in attentional control appear to predict variations in accuracy, a method which improves this factor could be highly beneficial. Some researchers have posited that mindfulness, which is enhanced attentiveness and awareness of present experience (Brown & Ryan, 2003), possesses many features of attentional control. Indeed, poor attentional control is indicative of low levels of mindfulness (Baer, Smith, Hopkins, Krietemeyer & Toney, 2006; Walsh, Balint, Smolira SJ, Fredericksen & Madsen, 2009), thus it is possible that implementing a mindfulness task before completion of the IRAP may help participants to avoid attending to task-irrelevant thoughts and feelings that may arise while carrying out the IRAP. However, further research is vital to determine the intricacies that would be necessary in order for the mindfulness task to improve attentional control in the relatively short duration of an experiment.

It is worth noting that accuracy on the IRAP was positively related to accuracy on the *n*-back task. That is, participants who made a greater number of errors in responding on the *n*-back also made a higher number of errors on the IRAP. The *n*-back task is a test of working memory and attention switching (Sliwinski, Smyth, Hofer & Stawski, 2006), which provides empirical evidence for the assumption that working memory is required while carrying out the IRAP. However, high levels of self-reported spider fear (as measured by the FSQ) were related to a greater number of errors on the *n*-back task, whereas self-reported spider fear did not influence performance on the IRAP. Thus, it appears that the cause of errors on the IRAP is different from that of the *n*-back. Namely, the *n*-back may be more affected by the relevance of the stimuli to the psychopathology of the participant. This could also be due to procedural differences between the tasks. For example, the IRAP employed in the current study presented up to six thirty-two trial practice blocks while the *n*-back presented a total of twelve practice trials. Thus the participants may have become desensitized to the anxiety evoked by the spider pictures on the IRAP before the test blocks, which resulted in less

distraction whereas the relatively limited practice for the *n*-back may not have allowed the fear to be extinguished before the test block. This result suggests that not only are the practice blocks useful for familiarizing participants with the IRAP task, they also may serve as a way in which to extinguish internal responses which may be detrimental to performance on the IRAP. Critically, however, any such desensitization effects do not appear to undermine the validity of the IRAP as a measure because previous IRAP research has demonstrated between-group differences across a range of domains relevant to psychopathology, including fear (Nicholson & Barnes-Holmes, 2012), addiction (Carpenter et al., 2012), depression (Hussey & Barnes-Holmes, 2012) and disgust.

The DP- and DS-IRAPs used in the current thesis presented identical disgust-eliciting photographs while the target stimuli changed depending on which aspect of disgust the IRAP was designed to measure. The finding that two distinct yet very similar IRAPs produced results that differed in apparently important ways, has important implications for the IRAP itself. Firstly, it emphasizes the importance of the target stimuli in the IRAP. Future researchers should thus take great care to select stimuli that are meaningful and relevant to the theory which underpins the questions under consideration. Secondly, it demonstrates the ability of the IRAP to measure the subtle differences, which encompass one type of responding. This shows the flexibility of the IRAP as a measure of different aspects of psychopathology.

A Functional Measure of OCD in the CBT Literature. As discussed above, the present data can be interpreted in terms of cognitive-behavioural models of anxiety and OCD, and can offer researchers in this area a behavioural measure that supports its most prevalent theories (e.g., Salkovskis, 1985). The OCD literature is permeated with arguments citing the need for functional or behavioural measures of OCD that avoid an over-reliance on symptomatology (see Abramowitz & Deacon, 2005; Wheaton et al., 2010; Cougle et al.,

2011). For example, at the basic level, there is a functional relationship between obsessions and compulsions in that the obsessions cause anxiety which in turn results in carrying out compulsions in order to alleviate this anxiety (Abramowitz & Deacon, 2005). Furthermore, context has been highlighted as an important focus for future research, specifically in the assessment of perfectionism (see Hasse et al., 2013). However, this argument could be extended to other domains of OCD, for instance, the belief that one is responsible for preventing harm to the self and others may be relevant in the context of excessive cleaning and also in checking behaviour. In other words, this belief holds the same function for two different behaviours. On balance, contamination fear may be expressed as excessive hand washing or avoidance of public bathrooms yet may be caused by two distinct types of relational responding (e.g., overly negative appraisals of disgusting situations or overly positive appraisals of clean stimuli). Thus, viewing behaviour as an act-in-context which occurs across time is critical (see Hayes et al., 2012). Similarly, the functions of such behaviour need to be given greater focus in research over that of symptomatology. In summary, a functional-contextualistic model of obsessive-compulsive behaviour may contribute greatly to the literature and the IRAP appears to be a promising means to provide that.

It is important to recognise that the IRAPs in the present thesis were largely designed with theories from the cognitive-behavioural literature in mind, but were assessed with a measure that was derived from a functional contextualistic standpoint; most notably, the role of appraisal, which has long been considered critical in the aetiology of OCD (Salkovskis, 1985; OCCWG, 1997). Many measures have been developed, which have attempted to measure these appraisals such as the OBQ-44 and PI-R but these have been limited by an over-reliance on symptoms (Wheaton et al., 2010). As discussed previously, the benefits of the IRAP in this regard may contribute to the CBT literature, and vice versa the current

programme of research has benefitted from longstanding theories offered in that literature. As such, the findings from the current thesis could make a contribution to both the functional-contextualistic and CBT literatures and it seems important to recognise the value of mutual discussion across both traditions within the field of clinical psychology.

Conclusion

Broadly speaking, the results from the ten studies outlined in the current thesis suggest that the IRAP is adept at assessing obsessive-compulsive tendencies and behaviours. Specifically, the IRAP was used to distinguish between disgust propensity and disgust sensitivity as two separate functional classes of responding. Arguably, the most important finding was the relevance of appraisal, insofar as trial-types from the disgust sensitivity IRAP were generally related to overt avoidance behaviour and were predictive of group membership with respect to clinical versus control groups. While disgust propensity was found to be related to various self-reported OC behaviours, sensitivity was more critical to the clinical presentation of OCD. This finding seems important for the CBT literature, which has posited the importance of appraisal for almost three decades, and also seems important for the functional-contextual literature, which has argued that psychopathology is typically characterised by how one responds to one's own behaviour rather than by direct responses to the environment per se. A measure which provides a functional assessment has been deemed critical for the measurement of OCD with a focus on symptoms being replaced with a focus on the functions of behaviours including the context in which they occur. The programme of research reported in the current thesis has aimed to contribute towards the development of just such a measure.

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Appendices

List of Appendices:

Appendix A: Socio-Moral Scale from Chapter 2

Instructions: Please think of three examples or scenarios of a moral violation which you would consider to be weak/moderate/strong/extreme violations of morality. <u>Please make sure you stop if you feel uncomfortable or find that you cannot think of three scenarios.</u>

***Example of a weak violation of morality*.** A women is cleaning out her closet, and she finds her old Irish flag. She doesn't want the flag anymore, so she cuts it up into pieces and uses the rags to clean her bathroom.

Weak/Moderate/Strong/Extreme Moral Violation 1.

Weak/Moderate/Strong/Extreme Moral Violation 2.

Weak/Moderate/Strong/Extreme Moral Violation 3.

<u>Please answer the following questions based on the scales provided</u>

1. How difficult did you find this task?

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

(1 being extremely easy and 10 being extremely difficult)

2. How morally uncomfortable did you feel when carrying out this challenge?

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

(1 being extremely comfortable and 10 being extremely uncomfortable)

3. How willing would you be to do this task again?

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

(1 being extremely willing and 10 being extremely unwilling)

<u>NB: You should consider stopping with the task if you answered 8 or above on No. 3.</u>

Appendix B: IRAP Instructions

INTRODUCTORY INSTRUCTIONS

Our research investigates cognitive processes that are used in decisions that involve memory. We are seeking to develop and test theories of cognitive processes that occur inside and outside of awareness in the routine use of memory.

Stimuli will be presented on this display screen, and your responses will be entered on the keyboard.

The research assumes that you can read English fluently, and that your vision is normal or corrected to normal. If you do not consider yourself fluent in English, or if your vision is not normal or corrected to normal, and ESPECIALLY IF YOU ARE HAVING SOME DIFFICULTY READING THIS DESCRIPTION, PLEASE ask the experimenter now whether or not you should continue.

Your identity as a subject is confidential. Further, you are free to discontinue participation at any time, without penalty.

In keeping with standard practice, your data may be retained for 5 years or so, during which time only the investigators on this or successor projects will have access to them.

PLEASE NOW READ THE STATEMENT BELOW, WHERE YOU WILL BE ASKED TO RESPOND TO A STANDARD INFORMED CONSENT QUESTION.

CONSENT STATEMENT

I have read the description of the procedure. I understand that the questions I may have about this research will be answered by Professor Barnes-Holmes or one of the other researchers working on this project.

If you consent to participate in the research that has been described on the preceding display pages you should now read the Instructions for the sorting tasks below.

[INSTRUCTION: If you wish to ask any questions first, alert the experimenter now. IF YOU WISH NOT TO PROCEED, you should inform the experimenter].

INSTRUCTIONS

Shown below are illustrations of the four different types of task that will be presented repeatedly in this part of the experiment. To help you understand the tasks each of the four illustrations is explained immediately underneath. Please examine each illustration and then read carefully the explanation attached to it. Please make sure that you understand each task before continuing with the experiment.

IMPORTANT: From trial to trial the positioning of the response options (True and False) will vary randomly between left and right.

Illustration 1

I Am Disgusted

Select ‘d’ for **True**

Select ‘k’ for **False**

Explanation for Illustration 1

If you select “True” by pressing the ‘D’ key, you are stating that “The dirty toilet is disgusting.”

If you select “False” by pressing the ‘K’ key, you are stating that “The dirty toilet is NOT disgusting”

Illustration 2

It's Lovely

Select 'd' for **False**

Select 'k' for **True**

Explanation for Illustration 2

If you select "True" by pressing the 'D' key, you are stating that "The rat makes you feel positive"

If you select "False" by pressing the 'K' key, you are stating that "The rat does NOT make you feel positive."

Illustration 3

I Feel Repulsed

Select ‘d’ for **True**

Select ‘k’ for **False**

Explanation for Illustration 3

If you select “True” by pressing the ‘D’ key, you are stating that “The clean bathroom turns my stomach.”

If you select “False” by pressing the ‘K’ key, you are stating that “The clean bathroom does NOT turn my stomach.”

Illustration 4

I Am Happy

Select ‘d’ for **False**

Select ‘k’ for **True**

Explanation for Illustration 4

If you select “True” by pressing the ‘D’ key, you are stating that “I like this person.”

If you select “False” by pressing the ‘K’ key, you are stating that “I DO NOT like this person.”

NOTE: During the experiment a range of different images of “disgusting things” and “pleasant tings” will be presented. Also, a range of different phrases related to “I am Disgusted” and “I Like It” will be used.

REMEMBER: From trial to trial the positioning of the response options (True and False) will vary randomly between left and right.

FINAL INSTRUCTIONS

During the experiment you will be asked to respond as **quickly and accurately** as you can across all trials.

The relating tasks will be presented in short ***sessions*** that are separated by the appearance of instructions on the computer screen. You can take a short break if you like while the instructions are on on-screen.

During each short session the relating task follows one general rule. An incorrect response on any trial is signalled by the appearance of a red 'X' in the centre of the screen. To remove the red 'X' and move on to the next trial please press the correct response key quickly.

After each session, further instructions will appear and they will tell you that the general rule that applied in the previous session is now completely reversed. Please pay close attention to these instructions and do your best to follow them.

So, just to clarify, there will be only ***two*** general relating rules, and so the first thing you should do at the beginning of each session is to discover the rule by using the feedback you get in the form of the red 'X'.

It is very important to understand that sometimes you will be required to respond to the tasks in a way that ***agrees*** with what you believe and at other times you will be required to respond in a way that ***disagrees*** with what you believe. **This is part of the experiment**.

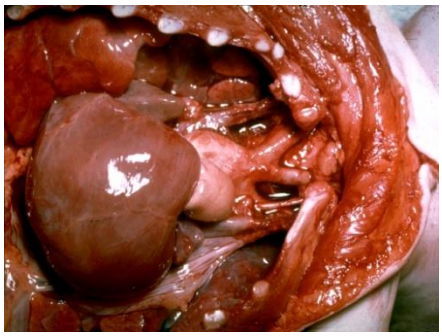
The first two sessions are for ***practice*** only and these are repeated until you respond accurately on at least 80% of the relating trials, and respond faster, on average, than 2000 milliseconds (i.e., 2 seconds). When you complete the practice phase, the ***test-phase*** will then start. Remember, you should try to make your responses as **accurately and quickly** as possible.

Good Luck

If you do not understand something about the foregoing instructions or have any further questions please talk to the researcher before clicking on the blue button.

Appendix C: Pictorial Stimuli from Chapter 2

Disgusting Stimuli:



Non-Disgusting or Pleasant Stimuli:








Appendix D: Pictorial Stimuli from Chapter 3

Contamination-Related Stimuli

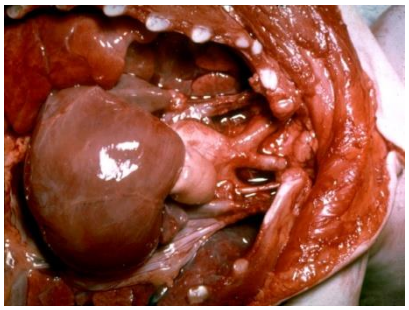
Clean-Related Stimuli

Appendix E: Pictorial Stimuli from Chapter 4

Study 5: Disgusting Stimuli





Non-Disgusting/Pleasant Stimuli






Study 6: Contamination-Related Stimuli

Study 6: Clean Stimuli

Study 7: Picorial Stimuli were identical to those used in Study 2 with one exception. The bunny photograph was replaced with picture below

Appendix F. Inter-correlations between self-report measures for Study 6 Chapter 5

	AAQ-II	Anxiety	OBQ-RT	OBQ-PC	OBQ-ICT	OBQ Total	Padua	Contamination	Checking	D/G	OTOH	OIOH
DS-R	**.58*** **	.09	.14	**.41***	.08	.28	**.45****	.23	.34	.01	**.54****	.13
AAQ-II	-	**.46****	**.50****	**.48****	**.45****	**.56****	**.55****	.31	**.43****	-.03	**.63*****	.16
Anxiety		-	**.45****	**.38***	**.68*****	**.58****	**.47****	.22	.26	.06	**.63****	.34
OBQ-RT			-	**.63*****	**.68*****	**.88*****	**.62****	**.50****	.31	19	**.58****	**.44****
OBQ-PC				-	**.49****	**.87*****	**.51****	16	**.41***	.14	**.68*****	.07
OBQ-ICT					-	**.79*****	**.55****	**.44****	.25	.04	**.60****	**.39***
OBQ Total						-	**.65*****	**.40***	**.39***	.15	**.73*****	.32
Padua							-	**.74*****	**.79*****	.31	**.73*****	.31
Contamination								-	**.42***	.09	.22	**.37***
Checking									-	.09	**.51****	-.20
Dressing/Grooming										-	.21	.16
OTOH											-	.27

***p* ≤ .05**
****p* ≤ .01**
*****p* ≤ .0001**

Note: AAQ-II; Acceptance and Action Questionnaire; OBQ=Obsessive Beliefs Questionnaire; RT= responsibility/threat subscale; PC = Perfectionism/uncertainty scale; ICT=importance and need to control thoughts; D/G Dressing & Grooming scale; OTOH = Obsessional Thoughts of Harm to the self and others; OIOH = Obsessional Impulses to Harm the self and others.

Appendix G. Inter-correlations between self-report measures for Study 7 Chapter 5

	FMPS	OBQ-PC	Anxiety	Depression	Stress	DASS	Padua	Contamination	Checking	D/G	OTOH	OIOH
FMPS	-	**.38***	**.57****	**.49****	**.51****	**.58****	**.50***	.14	**.44****	**.41***	**.59****	**.37***
OBQ-PC		-	**.38***	**.37***	.35	**.41***	.23	.26	.01	.07	**.41***	.21
Anxiety			-	**.66*****	**.77*****	**.91*****	**.85*****	**.39***	**.61****	**.62****	**.91*****	**.84*****
Depression				-	**.67*****	**.87*****	**.47****	.01	**.42***	**.52****	**.49****	**.49*****
Stress					-	**.91*****	**.78*****	**.56****	**.51****	**.67****	**.72*****	**.68*****
DASS						-	**.79*****	**.36**	**.57****	**.67****	**.79*****	**.75*****
Padua							-	**.62****	**.83*****	**.77*****	**.85*****	**.78*****
Contamination								-	.31	**.44***	**.44***	.27
Checking									-	**.58****	**.57****	**.49****
Dressing/Grooming										-	**.56****	**.64****
OTOH											-	**.78*****

***p* ≤ .05**
****p* ≤ .01**
*****p* ≤ .0001**

Note: FMPS= Frost Multidimensional Perfectionism Scale; OBQ-PC=Obsessive Beliefs Questionnaire-Perfectionism/uncertainty scale; DASS = Depression, Anxiety and Stress scale; D/G Dressing & Grooming scale; OTOH = Obsessional Thoughts of Harm to the self and others; OIOH = Obsessional Impulses to Harm the self and others.

Appendix H: Pictorial Stimuli from Chapters 6 and 7

Non-Disgusting/Pleasant Stimuli

Appendix I. Inter-correlations between self-report measures for Chapter 6

	Padua Inventory	**Contamination**	**Dressing/ Grooming**	**Checking**	**OTOH**	**OIOH**	**Anxiety**	**Depr-ession**	**Stress**	**DASS**	**OBQ-PC**
Padua Inventory	-	**.79*** **	**.78*** **	**.78*** **	**.77*** **	**.66*** **	**.41***	.22	.32	**.41***	**.53** **
Contamination		-	**.57** **	.34	**.62*** **	**.46** **	.20	.09	.26	.25	.28
D/G			-	**.49** **	**.52** **	**.69*** **	**.42** **	.08	.22	.32	**.44** **
Checking				-	**.54** **	.31	.30	.23	.19	.29	**.50** **
OTOH					-	**.36***	**.57** **	**.37***	**.56** **	**.65*** **	**.45** **
OIOH						-	.28	.08	.12	.21	.34
Anxiety							-	.10	**.63*** **	**.78*** **	.25
Depression								-	**.39***	**.56** **	**.41***
Stress									-	**.93*** **	.20
DASS											.34

***$p \leq .05$**
****$p \leq .01$**
*****$p \leq .0001$**

Note: OTOH = Obsessional Thoughts of Harm to the self and others; OIOH = Obsessional Impulses to Harm the self and others; DASS = Depression, Anxiety and Stress scale; OBQ-PC = Perfectionism/Intolerance of Uncertainty Subscale of the Obsessive Beliefs Questionnaire.

Appendix J. Inter-correlations between self-report measures for Study 9 Chapter 7

	DS-R	STAI-S	STAI-T	STAI	DPSS-R	OCI-R	Wash	Check	Ordering	Obsessing	Neutralise	Padua	CF	D/G	Checking	OTOH	OIOH
1	-	**.36*.**	24	**.32***	**.50****	**.56****	**.39****	**.42****	**.40****	.27	**.39****	**.54****	**.41****	**.34***	**.46****	**.42****	.03
2		-	**.77*****	**.94*****	.28	**.34***	.23	**.44****	.02	**.57*****	.11	**.59*****	.28	.25	**.50****	**.60*****	**.42****
3			-	.95***	.19	.31*	.23	.27	-.09	.70***	.10	.52**	.29	.02	.43**	.56**	.45**
4				-	.25	.36*	.25	.37*	-.05	.67***	.11	.58***	.31	.14	.49**	.62***	.46
5					-	.50**	.48**	.20	.37*	.27	.42	.44***	.47**	.07	.32	.24	.16
6						-	.54**	.63***	.75***	.63***	.84***	.65***	.51**	.38**	.61***	.43**	.01
7							-	.04	.38**	.28	.47**	.67***	.87***	.19	.42**	.33*	.14
8								-	.35*	.36*	.33*	.49**	.16	.37*	.60***	.45**	-.17
9									-	.12	.66***	.38*	.31	.45**	.33*	.19	-.11
10										-	.43**	.40**	.27	.02	.37*	.34*	.18
11											-	.47**	.42**	.38**	.38**	.27	.00
12												-	.75***	.48**	.84***	.74***	.37*
13													-	.32*	.42**	.41**	.15
14														-	.33*	.30	.04
15															-	.51***	.20
16																-	.31

***p* ≤ .05**
****p* ≤ .01**
*****p* ≤ .0001**

Note: DS-R=Disgust Scale Revised; STAI = State-Trait Anxiety Inventory; DPSS-R=Disgust Propensity and Sensitivity Scale; OCI-R=Obsessive Compulsive Inventory Revised; CF=Contamination Fear scale; D/G Dressing & Grooming scale; OTOH = Obsessional Thoughts of Harm to the self and others; OIOH = Obsessional Impulses to Harm the self and others.

Appendix K. Inter-correlations between self-report measures for Study 10 Chapter 7

	DS-R	AAQ-II	STAI-S	STAI-T	Padua Inventory	Contamination	D/G	Checking	OTOH	OIOH
DS-R	-	.07	.25	.06	.46*	.44*	.23	.16	.58***	.20
AAQ-II		-	.49*	.49*	.38	.07	.15	.27	.52**	.31
STAI-S			-	.62***	.60**	.22	.55**	.54**	.46*	.32
STAI-T				-	.53*	.17	.36	.51*	.46*	.28
Padua Inventory					-	.59**	.38	.84***	.83***	.57**
Contamination						-	.18	.23	.47*	-.13
Dressing/ Grooming							-	.39	.03	-.03
Checking								-	.53**	.47*
OTOH									-	.58**

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

Note: DS-R=Disgust Scale Revised; AAQ-II; Acceptance and Action Questionnaire; STAI = State-Trait Anxiety Inventory; D/G Dressing & Grooming scale; OTOH = Obsessional Thoughts of Harm to the self and others; OIOH = Obsessional Impulses to Harm the self and others.