Investigating the Impact of a Brief Cognitive Defusion Intervention on State Anxiety and Psychological Inflexibility/Avoidance

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Abstract

Young people aged 12-25 account for the highest prevalence and incidence of mental health disorders across the lifespan (McGorry, Bates & Birchwood, 2013). Onset of mental health disorders, of which anxiety disorders comprise a large portion (Eisenberg, Gollust, Golberstein & Hefner, 2007), are said to present shortly before or during typical college-going years (Kessler, Berglund, Demler, Merikangas & Walters, 2005). A broad body of behavioural researchers emphasize the functional role of fear and avoidance responding as central processes that may underlie and maintain anxiety in humans (Dymond, Bennett, Boyle, Roche & Schlund, in press; Luciano et al; 2014). As an alternative to experiential avoidance of undesirable psychological content, a considerable body research supports the efficacy of cognitive defusion (a behavioural technique derived from Acceptance and Commitment Therapy), as a treatment for anxiety related behaviour (Hayes et al., 2006). Despite the positive outcomes reported for defusion-based interventions, a functional account of the basic behavioural processes involved in cognitive defusion is not well established (Foody, Barnes-Holmes, Barnes-Holmes & Luciano, 2013).

In attempt to expand on the extant compendium of defusion-related analogue component process studies, and shed further light on the behavioural processes that may be responsible for successful defusion outcomes, the current research examined the differential impact of a brief cognitive defusion exercise, (delivered in two distinct formats) on explicit, self-report measures of state anxiety, experiential avoidance and emotional discomfort, believability and willingness to engage with distressful thoughts.

In pursuit of this goal, two experiments were conducted with a non-clinical sample of university students (*N*=80). Both of the experiments employed a similar procedural sequence and examined the same defusion exercise (the *Hands as Thoughts* exercise by Harris, (2009)), but differed in terms of the format by which the exercise was delivered, as well as the outcome measures used to assess its effects. At the beginning of both of the experiments, a stress induction paradigm was utilized to experimentally induce distress using a time-based mathematical task, paired with a deceptive statement regarding a previous cohort's performance of the task. Immediately following the distress induction phase, participants were instructed to discriminate a single self-referential statement (i.e. a verbal stimulus) related to the dominant thought/emotion that they experienced following the math task. This self-referential statement represented the target stimulus with which the defusion exercise would be conducted.

Following this, participants in the intervention condition were exposed to the defusion exercise. Alternatively, participants in the control condition were exposed to a distraction-based task.

In Experiment 1 (*N*=55), which employed a 2 × 2 factorial design, instructions pertaining to the defusion exercise were delivered by the experimenter who modelled the exercise along with participants. Defusion impact/outcomes were assessed using pre- and post-measures of state anxiety and psychological inflexibility/experiential avoidance. Participants exposed to the defusion exercise/intervention (*n*=36) reported a significant reduction in state anxiety and psychological inflexibility/avoidance from pre- to post-intervention. Control group participants who were exposed to a distraction-based control task (*n*=19) also reported a significant reduction in state anxiety and psychological inflexibility/avoidance from pre- to post-control task. No significant difference was detected between the control and intervention groups in terms of the

within-group reductions in psychological inflexibility/avoidance. However, there was a significant between-groups difference regarding the within-group reductions in state anxiety; participants in the intervention condition reported a superior reduction in state anxiety to those in the control condition.

In Experiment 2 (N=35), which employed a 2 × 2 factorial design, instructions pertaining to the cognitive defusion exercise were delivered audibly via an audio-speaker. In addition to pre- and post-measures of state anxiety and psychological inflexibility/avoidance, impact was further assessed using measures of emotional discomfort, believability and willingness to engage with the self-referential thought/emotion (verbal stimulus), in an effort to further examine the potential processes of change. Participants exposed to the defusion intervention (n=19) reported a significant reduction in state anxiety from pre- to post-intervention. While a slight reduction in psychological inflexibility/avoidance was observed, this reduction was not statistically significant. Similarly, participants reported slight reductions in emotional discomfort and believability, and minimal increases in willingness to engage with the self-referential thoughts, however these changes were not statistically significant. An alternative control task to the one employed in the Experiment 1 was utilized in Experiment 2, whereby participants were requested to employ the typical strategies that would normally use to manage unwanted psychological content. Similar to the effects observed in the intervention condition, control group participants (n=16) reported a significant reduction in state anxiety post the control task. A slight pre-to-post reduction in psychological inflexibility/avoidance was observed, however the reduction was not statically significant. Slightly reduced levels of emotional discomfort and believability, and slightly increased levels of willingness to engage with self-statements were reported, however these changes were not statistically significant.

Findings pertaining to both experiments are discussed in relation to those reported in previous analog component process studies. A discussion of the basic behavioural processes that may have moderated these outcomes is also provided. To the author's knowledge, no previous empirical research has examined the *Hands as Thought*s defusion exercise (Harris, 2009) in isolation from other defusion exercises, thus, a discussion of the basic processes in that may mediate the outcomes of this research may not necessarily apply to other ACT-based defusion exercises, due to the variation of procedural elements involved across different defusion techniques.

Behaviour-analytic research surrounding the concept of defusion is not mature, and there remains a deficit of knowledge, and indeed discussion, as to the basic behavioural processes that underlie the concept. The term defusion is somewhat problematic as it is appears to refer to a set of outcomes, which are moderated by an unknown set of behavioural processes, as well as to a number of different therapeutic methodologies. Thus, despite their clinical utility, defusion-based therapeutic methods/techniques are currently being applied with limited precision (Assaz, Roche, Kanter & Oshiro, in press). In addition to extending the current program of empirical research in the area, the present research hopes to contribute to discussions surrounding the behavioural processes that may moderate defusion outcomes from a behaviour-analytic perspective, whilst also considering the procedural limitations of this research, and offering suggestions for future examinations in this area.

Investigating the Impact of a Brief Cognitive Defusion Intervention on State Anxiety and Psychological Inflexibility/Avoidance

A recent article published in the British Journal of Psychiatry reported that people aged 12-25 account for the highest prevalence and incidence of mental health disorders across the lifespan (McGorry, Bates & Birchwood, 2013). Despite this statistic, young people incur the weakest access to mental health services compared to all other age groups in society (McGorry et al., 2013). High prevalence of mental health disorders within young populations is not a new problem however. In 2002, the World Health Organization reported that mental health disorders accounted for up to 50% of total burden of disease in young adults in the U.S. (World Health Organization, 2002).

The results of a national study published in the US in 2007 (N=2,843) reported that 15.6% of under-graduate students and 13% of post-graduate students tested positive for a depressive or anxiety disorder. 2.9% of under-graduates and 3.1% of post-graduates tested positive for generalized anxiety disorder, with females estimated to be twice as likely to screen positively for a panic disorder compared to their male counterparts (Eisenberg et al., 2007),

Missed academic deadlines due to mental health difficulties were reported in 18.4% of the sample of under-graduate students and 14.1% of post-graduate students, while 44.3% of undergraduate students, and 41.2% of post-graduate students reported that mental ill health and/or emotional difficulties had impacted their ability to complete assignments in the past month (Eisenberg et al., 2007).

As such, a myriad of environmental stressors present during college-going years have been identified as sources of anxiety for students, including irregular patterns of sleep, changes

in personal relationships and academic demands (Kadison, 2004, as cited in Eisenberg et al., 2007). A study conducted in the UK (Roberts, 1999) revealed that longer working hours, higher bills and high student debt were all correlated with lower levels of mental health in student populations.

While these findings may raise questions as to the link between college attendance and mental ill health, a national survey by Blanco and others (2008) found that prevalence of mental health disorders is almost equal among college-attending populations and non-college-attending populations. The survey based study, which was carried out with a representative sample of young adults across the U.S., compared college-students with age-matched peers who did not attend college, to examine the prevalence of mental health disorders in the 12 months preceding the study. The study employed a validated, structured interview as its primary data collection method and found that approximately 50% of the sample met the criteria for diagnosis of at least one mental health disorder within the previous year; 12% met the criteria for an anxiety disorder, 11% for a mood disorder, and 18% for a personality disorder (Blanco et al., 2008). While higher rates of alcohol use disorder were reported in the college-student population, lower rates of drug use and nicotine use were reported in the college-student group compared to their non-student counterparts (Blanco et al., 2009; Hunt & Eisenberg, 2010). According to Blanco and colleagues (2009), these findings are in line with three previous research studies that have been conducted within the same decade (see Dawson Grant, Stinson, & Chou, 2004; Slutske et al., 2004; Wu, Pilowsky, Schlenger & Hasin, 2007).

Indeed the incidence of anxiety disorders in young people is a common and longstanding issue that has received signtificant attention in terms of research (Baxter, Scott, Vos & Whilteford, 2013). A number of studies have highlighted an apparent upward trend in prevalence

of anxiety disorders over the past three decades, with some authors alluding to the presence of a mental health epidemic (Baxter et al., 2013). In response, Baxter and others (2013) investigated this hypothesis and found evidence to suggest the contrary. Although prevalence statistics for anxiety disorders indeed indicated an increase (with global estimates rising from 3% in 1990 to 4% in 2010), the results of a Bayesian meta-regression found no evidence of a statistically significant increase in cases across the period. The increase in diagnosed cases, the authors suggest, may be attributed to factors including population growth, increased urbanization, "higher rates of psychological distress as measured using symptom checklists, greater public awareness, and the use of terms such as anxiety and depression in a context where they do not represent clinical disorders" (Baxter et al, 2013, p. 1).

Nevertheless, while associated global prevalence statistics may well be stable, the burden of such afflictions on young people living with problematic levels of anxiety is considerable, and points towards a clear need for effective treatment interventions aimed at easing the subjective and indeed societal burden of anxiety in both clinical and non-clinically anxious student populations. Indeed, early intervention may be key to curbing the onset of clinical anxiety and related disorders in young people. In order to ensure that such treatment interventions are conducted with precision, scientist must first attempt to establish the mechanisms through which anxiety functions.

A Behaviour Analytic Account of Anxiety

In an acclaimed paper published in the Journal of Applied Behavior Analysis (JABA); *'Why Behavior Analysts Should Study Emotion: The Example of Anxiety'* Friman, Hayes and Wilson (1998) describe how advancements in the field of experimental behaviour analysis have made the examination of anxiety and emotion more "tenable" than ever before (p.137). The

authors present a compelling argument as to how the term *anxiety* lacks precision in terms of the number of ways in which it can be deduced and analyzed technically, which in turn presents obvious challenges for behaviour analysts in their devotion to fidelity, and in their pursuit of control and prediction of behavioural phenomena. The authors note Skinner's (1945) position on the analysis of emotion and cognition, such that radical behaviorism

> ''does not insist upon truth by agreement and can therefore consider events taking place in the private world within the skin'' (Skinner, 1974, p.16).

In his aversion to the use of vague, mentalistic emotional terms, Skinner urged that behaviour analysts strive to examine the direct contingencies that govern the presence of such events, in an attempt to identify the functional relationship between the stimuli that are antecedent and consequent to such. However, because 'feeling anxious' is conceptualized as a behavioural event, the analysis of such events are not always amenable to direct manipulation in a manner that renders a functional relationship between the presence of anxious feelings and subsequent responding (Friman et al., 1998). Importantly, Skinner's radical approach to anxiety *does* lend itself to the examination of responding (e.g. running away) that is reinforced by escape/avoidance of events with physical, phylogenic significance (e.g. dangerous stimuli such as fire, dangerous animals etc.), as well as to "seemingly nonsignificant events when those events can be linked *formally or functionally* [*italics inserted*] to aversive consequences" (Friman et al,1998, p.143).

However, as discussed by Friman and colleagues (1998), cases of clinically significant anxiety often involve

> "… avoidance responses whose initiating consequences are direct but very remote and whose perpetuating conditions are mostly derived" (p.143).

As such, when avoidance responses cannot be linked directly to observable contingencies, or related formally or functionally to aversive outcomes, a myriad of apparent challenges can present for behaviour analysts. These analytic challenges may explain in some part the reluctance for some behaviour analysts to study emotional behaviour. In their discussion on this issue, Friman et al. (1998) appeal to behaviour analysts to consider the role of derived relational responding (or Arbitrarily Applicable Relational Responding (AARR) as it is currently known) in providing a contemporary behaviour analytic account of anxiety.

Arbitrarily Applicable Relational Responding

Over the past three decades, a thriving program of experimental behaviour analytic research has attempted to provide a basic, behavioural account of anxiety that is susceptible to technical examination. In doing so, researchers within the fields of experimental behavior analysis and experimental psychopathology have attempted to establish the behavioural processes that may underlie and maintain anxiety disorders in humans. Indeed, neurobiological scientists have made similar efforts to establish the neurobiological mechanisms involved, but have yet to establish a definitive cause (Dymond et al, in press).

In an effort to establish the behavioural processes that may constitute anxiety, a considerable volume of research has been conducted into the role of AARR as a potential explanation of such. Specifically this line or research has focused its attention on the analysis two features of emotional suffering in humans; *fear* and *avoidance.* At present, these two aspects of human behaviour are understood to be common across all anxiety disorders and may thus comprise a behavioural explanation as to the etiology and maintenance of anxiety disorders in humans (Dymond et al., in press). The theory within which the AARR research is embedded is

known as Relational Frame Theory/RFT (Dymond and Roche, 2013; Hayes, Barnes-Holmes & Roche, 2001).

RFT is a contemporary behavioural theory of language and cognition which is based on the empirical overlap between the emergence of linguistic skills, and the capability of typically developing humans to derive relations between various stimuli in the absence of direct training.

Specifically, RFT researchers have evidenced the ability for verbally trained humans to derive relations among stimuli in a rapid and seemingly unprompted fashion; an ability that humans with linguistic-deficits (e.g. those with developmental disorders and brain trauma) and animals do not demonstrate to the same extent (Hughes & Barnes-Holmes, 2014). RFT researchers also emphasize the developmental correlation between the emergence of spoken language in young children and the ability for humans of the same age to demonstrate an increasing number of complex derived relations (Luciano et al., 2007). Interestingly, neuro-imaging studies also support the linguistic basis of derived relational responding such that tasks involving derived relational responding appear to involve similar neural activity as tasks that involve linguistic skills (Barnes-Holmes et al., 2005).

Furthermore, a plethora of RFT research has demonstrated that training in derived relational responding leads to improvements in linguistic skills in individuals who initially present with language deficits and associated impairments in their ability derived relations between stimuli (Barnes-Holmes et al., 2005; Murphy & Barnes-Holmes, 2010a; 2010b; Persicke, Tarbox, Ranick & St. Clair, 2012; Rosales & Rehfeldt, 2007; Walsh, Horgan, May, Dymond & Whelan, 2014; Rehfeldt & Barnes-Holmes, 2009, as cited in Zettle, Hayes, Barnes-Holmes & Biglan, 2016).

Thus, central to RFT's account of human language and learning, is the role of Arbitrarily Applicable Relational Responding (AARR), which refers to a kind of generalized operant behaviour whereby responses to stimuli that have not be *directly* trained, can emerge as a result of previously trained responses (Dymond et al., in press).

Evidence of this ability in language-able humans has yielded rich insights for behaviour analysts in their examination of emotion, by providing an opportunity for practitioners to conceptualize emotional responding in a way that was not possible in previous decades. For example, the consideration of seemingly complex anxiety disorders such as obsessive compulsive disorder, represent an excellent example of how humans can acquire fear and elicit rigid avoidance responding towards non-threatening environmental stimuli such as open-spaces, invisible germs and harmless animals (Dymond et al., in press). In such cases, individuals may have never encountered an aversive consequence involving the feared stimulus in question, yet its presentation (publicly or privately) can come to elicit an upsurge in threat related responses such as hyper-arousal, leading to high-rate avoidance behaviour (Guinther & Dougher, 2015).

The debilitating nature of rigid avoidance responding has obvious implications for individuals living with such afflictions. However, research into the processes involved in AARR has contributed immensely to a theoretical basis of these affrications, by demonstrating the myriad of ways in which humans are capable of relating and responding to public and private events. In particular, the findings that have emerged as result of the AARR research has informed the field of clinical behavioural analysis, from which thousands of individuals have benefited from treatment (e.g. Dymond et al., in press; Hayes et al., 2006).

Specifically, AARR research has demonstrated that language-able human possess the ability to automatically relate arbitrary stimuli that are not directly (i.e. explicitly) trained

(Dymond et al., in press; Sidman, 1994). For example, if individuals are taught to discriminate Stimulus X following the presentation of stimulus A (i.e. A-X), and are also taught to choose stimulus Y following the presentation of stimulus A (i.e. A-Y), they are likely to derive untrained relations between X and A (i.e. X-A), and Y and A (i.e. Y-A), in the *absence* of any feedback whatsoever. This process is referred to as *symmetry*.

Furthermore, based on these learned discriminations between A and X, and A and Y, language-able humans also demonstrate the ability to derive bidirectional relations between stimulus X and Y, and Y and X due to their joint relationship with stimulus A; a process known as an *equivalence relation* (Dymond et al., in press; Dymond & Roche, 2013; Hayes & Hayes, 1992). In addition to the relations described here, RFT researchers have also displayed the operant basis of AARR by demonstrating that humans are capable of deriving relations based on comparison, opposition, temporal order (before and after) and spatial based forms of responding (Hayes, Barnes-Holmes & Roche, 2003).

Anxiety disorders can present a challenge for behaviour analysts because they appear to involve an arousal of threat related responses (Guinther & Dougher, 2015) which precipitate fear, leading to avoidance responding towards seemingly harmless events (Dymond et al., in press). In their review of the AARR research as it pertains to anxiety disoders, Dymond et al. (in press) suggest that AARR processes may explain how humans learn to elicit fear and avoidance towards stimuli that do not appear to be related to stimuli that they have been directly conditioned to fear in the past. Specifically, the authors stress that the behavioural processes involved in AARR provide a potential explanation as to how humans can learn to elicit fear and avoidance responding towards stimuli that are not *perceptually* related to a directly conditioned stimuli. Furthermore, the authors assert that AARR may also explain the processes by which fear

and avoidance responding can be generalized to stimuli that related *conceptually* (Dymond & Roche, 2009). Indeed, in some cases, anxious individuals may display fear elicited responding towards the thought(s) of a feared stimuli alone, which may be *conceptually* related to a historically conditioned fear-eliciting stimulus but bear no physical resemblance to directly conditioned tumulus whatsoever. Indeed, in some cases, individuals can even report fear and avoidance towards to the mere presentation of words and pictures that are symbolically related to the directly conditioned object of their fear e.g. the word 'trapped' or "panic attack" (Dymond et al., in press; Foa & Kozac, 1986)

Based on the operant nature of relational responding, research into AARR has demonstrated that humans can derive and generalize fear-elicited responding toward other stimuli that are both perceptually *and* non-perceptually similar to an original conditioned stimulus. For example, in a landmark study by Dougher and colleagues (1994), the researchers demonstrated (*N*=8) that fear eliciting functions could be transferred to other members of an equivalence relation, by conditioning only one member of the equivalence class to elicit fearful responding. The researchers began by training two four-member equivalence relations e.g. A1, A2, A3, A4 and B1, B2, B3, B4, using line drawings. They then employed a classical conditioning procedure to condition a single member of first relation (B1) to invoke fearful responding (which was measured using electrodermal measures of skin conductance) by pairing its presentation with a mild electric shock. Alternatively, a single member of the second relation (B2) was conditioned without the presence of an electric shock. After testing for the transfer of fear-eliciting functions across the remaining members of the first equivalence relation, 6 of the 8 participants demonstrated transfer of conditioning to all other equivalence class members.

In a second experiment (*N*=4), Dougher and colleagues (1994) replicated and extended the experimental procedure used in their previous experiment, but this time examined the transfer of extinction across equivalence class members. The experimenters began by conditioning all members of an equivalence relation to elicit fearful responding. One member was then presented in extinction (without an electric shock). The remaining members of relation were then tested for fear-eliciting responding. As predicted, transfer of extinction had spread to the remaining members of the equivalence class. The authors further extended their analyses by re-conditioning the stimulus that was previously presented in extinction, to once again elicit fearful responding. The results indicated that the remaining class members regained fear-eliciting functions, thus, supporting the authors' predictions that conditioned fearful responding and extinction are capable of transferring through stimulus classes whose members are trained to be equivalent. These effects have been replicated in numerous studies conducted throughout the following decades (e.g. Auguston, Dougher & Markham, 2000; Markham, Dougher & Auguston, 2002; Markham & Markham, 2002; Barnes-Holmes & Forsyth, 2002).

While a variety of studies have found evidence for the transfer of conditioned fear across equivalence classes, this effect was not observed in a recent study by Medina, Valverde and Lopez (2016). In addition to skin conductance measures, the researchers employed the use of an additional autonomic measure; fear-potentiated eye-blink startle and shock-risk self-report ratings). As in previous experiments, two four-member equivalence classes (A1, A2, A3, A4; B1, B2, B3, B4) were trained (*N*=27) using a match-to-sample procedure, and one member of the first equivalence class (B1) was successfully conditioned using a differential fear conditioning procedure involving an aversive electric shock. Alternatively, one member of the second class (B2) was conditioned without the presentation of the aversive stimulus. Analyses of skin

conductance ratings and eye-blink startle indicated that no transfer of functions had occurred, while a weak difference was observed on the shock-risk self-report ratings. In their discussion, Medina et al. (2016) suggest a number of possible explanations for this effect. They note that a weak aversive conditioning effect may have occurred from the outset, such that the number of conditioning trials that were run during the training/pre-acquisition phase may have been too small to achieve a strong enough aversion towards the conditioned stimulus, which may have impacted upon the transfer of conditioned responses to other class members.

In addition to other methodological issues, the authors underlined that the experimental sessions were lengthy in terms of their overall duration, thus, the researchers omitted a re-test of equivalence training as used in most other studies of this nature. Furthermore, the authors suggest that future research examining the transfer of functions and their impact using sensitive physiopsychological measures such as autonomic eye-blink startle, should examine both perceptually and conceptually similar stimuli in their examinations.

Indeed, according to AARR researchers, fear generalisation is viewed as a process involving the transfer of fear-eliciting functions to other non-threatening stimuli due to their similarity with other stimuli that perceived as threatening (Dymond et al., in press). Thus, stimuli can be related to one another both perceptually and conceptually. Perceptually similar stimuli refer to those that can be associated along a physical continuum (Vervlict, Vansteenwegen & Eelen, 2004), whereas physically dissimilar objects can be associated based on a common *conceptual* property (Dunsmoor & Murphy, 2015). Therefore, behaviour events involving the transfer of fear-eliciting functions (i.e. generalisation of function) via arbitrary stimuli can be related through pre-defined conceptual categories that are based on arbitrary factors *not* related to physical aspects (Dymond et al., in press)

In their discussion on the topic, Dymond et al. (in press) emphasize that generalisation of fear can involve *simultaneous* associations that reside along perceptual *and* non-perceptual dimensions, rather than just one or the other. A recent study by Bennett and others (2015) investigated this issue and demonstrated that participants in their study (*N*=30) generalized fear both conceptually (via non-sense words to 3-D animal like objects), and perceptually (using animal- like objects that varied in their perceptual form). In response to the deficit of AARR research employing the use of an instructed fear conditioning paradigm (Rachman, 1977) (as an alternative to a classical conditioning paradigm), Bennett et al. (2015) tested this method as a possible pathway that would facilitate generalisation of fear via perceptual and non-perception relations. The results indicated that fear generalisation was indeed facilitated via simultaneous pathways involving both perceptually and conceptually similar stimuli, and supported the utility of instructed fear conditioning (see Bennett et al., 2015 for a review).

In another recent experiment conducted by Bennett, Meulders, Bayerns and Viseyen (2015) the researchers demonstrated (*N*=80) how conceptually generalized fear can lead to pain-elicited fear towards neutral arm movements that are proprioceptively similar to other arm movements that do result in pain. In this study, the researchers trained two equivalence classes using nonsense words and joystick arm movements. Following this, nonsense words from one of the stimulus classes paired with either electric shock, or threatening information. Alternatively, members of the second equivalence class were paired with either no electric shock or with safety information. During testing, the participants demonstrated transfer of pain-related fear towards joystick arm movements that were trained as equivalent to the pain-relevant nonsense words resulted in increased pain-related fear and unpleasantness ratings. The researchers went one step further by examining two separate fear acquisition models. Direct CS-US (conditioned stimulus–

unconditioned stimulus) conditioning was taught via direct experience, which was compared with verbal instructions about the CS-US relation. The results indicated that both of these conditioning pathways resulted in the transfer/generalisation of pain-related fear to joystick arm movements. Notably, the direct CS-US conditioning led to stronger acquisition and generalisation of pain-related fear towards equivalence class members, compared to levels observed following verbal instructions about the CS-US.

While the majority of fear-related AARR research has focused on the acquisition and generalisation of fear across *equivalence* class members, other research has illustrated how such learning can transfer via *comparative* relations involving 'more/less than' relations (Dougher, Hamilton, Fisk & Harrington, 2007). Indeed, the AARR research concerning the derived transfer/generalisation of fear across multiple stimulus relation other than equivalent relations is needed, going forward. The growing program of research that does exists however, is extremely valuable in terms of providing an empirical account of how fear and related behaviour can spread to seemingly unrelated or non-harmful stimuli in humans.

While research into derived transfer of fearful responding accounts for a portion of the behavioural components that comprise anxiety, AARR research into avoidance responding may further account for the behavioural processes that comprises anxiety and maintain its presentation (Dymond et al., in press).

In addition to fear-elicited responding, another key behavioural component thought to underlie anxiety disorders is that of avoidance responding. Avoidance responding is a central diagnostic factor in many anxiety disorders including generalized anxiety disorder and clinical phobia (American Psycholoigcal Association, 2013; Craske et al., 2009; Dymond et al., in press),

and is considered to be a common coping strategy employed by humans as a means of escaping contact with feared consequence. Avoidance responding can thus lead to rigid patterns of behavioural responding that can result in an increased risk of psychopathology and comorbid psychological disorders (Dymond et al., in press).

In the behavioural literature, avoidance responding can be categorized as either active avoidance, involving an overt response towards a feared stimulus/stimuli, or passive avoidance, which refers to the avoidance of events by withholding responses (Dymond et al., in press). Laboratory AARR research on avoidance has mostly focused on active avoidance (otherwise referred to as free operant avoidance). This research body has demonstrated that in addition to arbitrarily applicable derived transfer of fear elicited responding, language-able humans are also capable of deriving avoidance towards stimuli that have no direct relational history with an aversive consequence.

In the first study to examine derived avoidance, Augustson and Dougher (1997) trained two four-member stimulus equivalence relations (A1, A2, A3, A4; B1, B2, B3, B4) which was followed by a differential conditioning procedure whereby one member of the first equivalence class B1 was paired with the presentation of an aversive electric shock, while one member of the second stimulus relation (B2) resulted in no shock. Participants (N=8) were then exposed to a signaled avoidance procedure such that following prevention of the conditioned B1 stimulus, the associated electric shock could be avoided if a fixed-ratio of 20 response requirement was met. Alternatively, presentation of the B2 stimulus never resulted in an electric shock. Following this, researchers tested to establish whether participants would derive avoidance to other equivalent class members by transferring and eliciting the avoidance schedule to other class members. In support of their hypothesis, all eight participants demonstrated the transfer of avoidance

responding to all other equivalent class members. Further research by Dymond and colleagues, conducted in 2011 and 2012 replicated these findings with larger sample sizes than in Dougher and Augustson's (1997) study, and used various other forms of unconditioned stimuli including aversive sounds and aversive images.

In another seminal study of its kind, Boyle, Roche, Dymond and Hermans (2016) demonstrated how semantic stimuli were also amenable to conditioning that can lead to the derivation and transfer of fear via *synonyms* of the directly conditioned semantic stimulus, within an equivalence relation. In their demonstration, Boyle et al. (2016) employed a differential fear conditioning procedure (N=28) by paring the word "broth" with the presentation of an electric shock. Alternatively, the word "assist" was paired with the absence of an electric shock. Participants where then exposed to an avoidance procedure whereby they were instructed that they could avoid the conditioned fear stimuli by pressing the space bar on a keyboard. The researchers then conducted a generalisation testing phase, using synonyms of the conditioned stimulus, "broth"; "soup". A synonym of the stimulus "assist"; "help" was presented in extinction, without the presence of shock. Fear and avoidance were assessed using skin conductance responses, behavioural avoidance, and US expectancy rantings. The results indicated that participants demonstrated fear generalisation to the semantically related synonyms of e.g. "broth", implying that that the transfer of both fear and avoidance was successfully facilitated via natural language categories.

Notably, this research demonstrates how fear can be a) derived from semantic stimuli (i.e. words) and b) transferred along a semantic continuum to produced fear-elicited responding towards other semantic stimuli that are conceptually related to the directly conditioned word (Boyle, Roche, Dymond & Hermans, 2016).

In sum, the AARR research has demonstrated (at least in a laboratory setting), how language-able humans demonstrate the ability to derive and generalize fear across a range of *non-directly conditioned* stimuli that may be are related perceptually *and* conceptually. Furthermore, the generalisation of avoidance of feared stimuli is also capable of transfer to non-directly conditioned stimuli that can be related via perceptual and/or conceptual characteristics. Furthermore, the research presented and cited also indicates that fear and avoidance elicited responses are amenable to extinction, which can be generalized across classes of inter-related stimuli. Together, these findings hold promise for the treatment of anxiety-related behaviour in real-life settings.

Cognitive Fusion

According to Relational Frame Theory/RFT (Dymond and Roche, 2013; Hayes, Barnes-Holmes & Roche, 2001), from a young age, language-able humans learn to respond to the social world through interactions that are shaped by basic behavioural processes such as differential reinforcement and extinction. Accordingly, learning occurs by relationally responding to stimuli based on their relationship with other sets of stimuli. As a result, respondent behaviour may be controlled not only the by functions that arise from conditioned stimuli, but *also* by the functions of related stimuli, given a certain relational context (Assaz, Roche, Kanter & Oshiro, in press; Augustson & Dougher, 1997; Dougher, Augustson, Markham, Greenway & Wulfert, 1994; Dougher, Hamilton, Fink & Harrington, 2007; Dymond, Roche, Forsyth, Whelan & Rhoden; 2007; 2008; Dymond, Schlund, Roche, Whelan, Richards & Davis, 2011; Roche, Barnes-Holmes, Smeets, Barnes-Holmes & McGeady, 2000; Whelan & Barnes-Holmes, 2004; Whelan, Barnes-Holmes & Dymond, 2006, cited in Assaz et al., in press).

As discussed previously, due to the arbitrarily applicable nature of stimulus relations, a given set of relations that comprise a controlling/functional relation do not require physical similarity (Assaz et al., in press). Therefore, by abstracting common elements across such relations (e.g. “the cow is *more* dangerous than the pig”), single *verbal cues* that have received reinforcement throughout an individual’s history can come to elicit discriminated responses. The abstraction of verbal/contextual cues can thus serve to *contextually control* patterns of respondent behaviour, by signaling the particular kind of relation (”same/equivalent” or “more/less than”) that is applicable to the stimuli in question. Furthermore, arbitrary relations can include those of opposition, comparison, distinction, coordination, hierarchy, temporality, spatiality and causality (Assaz et al., in press). In the RFT literature, these relations are referred to as relational frames.

Thus, as result of AARR processes, the transformation of function can occur via verbal contextual cues which can lead to the transformation of function to *other* stimuli. Contextual cues (including sounds and gestures) can therefore alter the *relational context* in question leading to functionally controlled respondent behaviour (Assaz et al., in press). Due to the arbitrarily applicable means of relating stimuli, contextual cues allow for new relations to occur between stimuli resulting in functional control over behaviour that does not require direct conditioning. Furthermore, the process of derived relational responding that occurs via mutual and combinational entailment (see Ruiz, 2010 for a review) leads to rapid learning via intricate arbitrarily applicable relations (Assaz et al., in press).

From an RFT perspective, the *reinforcement* of behaviour that is based on arbitrarily applicable relations, results in the acquisition of stimulus functions that are mediated by verbal relations. Accordingly, the reinforcement of responding that is controlled by verbal relations can

sometimes ‘override’ non-verbal relations. Problems arise however when responding is controlled almost entirely by the verbal conditioned functions of a stimulus; such over-generalisation can in turn lead to rigid behavioural responding which can have adverse effects on daily functioning. According to RFT, individuals who display maladaptive rigid behavioural responding that is under the stimulus control of conditioned functions are said to be cognitively “fused” with the verbal functions of a given stimulus. Cognitive fusion is not necessarily viewed as problematic, but presents challenges to individuals when such “fusion” leads to maladaptive rigid responding that results in detrimental consequences (Hayes, 2004; Dymond et al., in press).

Given the processes that are thought to facilitate cognitive fusion, a number of behavioural researchers have attempted to examine whether these processes are amenable to disruption using different techniques that aim to facilitate a process known as *defusion*. Importantly however, use of the term *defusion* in the behavioural literature can refer to a process (Hayes et al., 1999), as well as a set of therapeutic methods (Hooper et al.,2013) or techniques (Healy et al., 2008), thus, caution should be employed when assessing the context in which the terms is used.

Cognitive Defusion

A technical definition of defusion provided by Assaz and colleagues (in press) describes defusion as:

> “…the reduction of stimulus function transformation that occurs through verbal relations [which] aims to minimize the influence of verbal relations, such as thoughts, on behavior, when doing so leads to adaptive behavior and valued living . ” (p.2).

Another definition provided by Twohig et al. (2005) and Hooper and McHugh (2013) describes defusion as "the process of undermining the behavior regulatory functions and literal believability of thoughts" (p.2). In an effort to describe defusion in terms of its goal, Healy et al. (2008) refer to the concept as being able to view "thoughts as just thoughts, rather than considering them to have meaning" (p.624). In any case, successful defusion is said to involve a "breaking down" of verbal relations that constitute problematic behaviour (e.g. acute fear towards stimuli, overly rigid behaviour patterns etc.; Healy et al., 2008, p.624).

Defusion is thus a "middle-level term" that denotes a number of underlying processes of change that are hypothesized to lead to higher levels of adaptive behaviour and lower levels of maladaptive responding to distress (such as avoidance). Despite the empirically supported outcomes associated with defusion techniques (Hayes et al., 2006), there is a current deficit of research dedicated to providing a functional account of defusion techniques in terms of the basic learning processes that lead to such (Assaz et al., in press). In an attempt to examine the possible pathways by which defusion operates, researchers in the field of Clinical Behaviour Analysis have examined the effects of defusion techniques from a number of different angles, using various methodologies and outcome measure. While this research in valuable in terms of providing controlled analyses of defusion outcomes, research in the area is not mature and remains ongoing.

One stream of research and practice that has devoted considerable attention to the examination of defusion techniques and related outcomes in applied settings, is that of Acceptance and Commitment Therapy. ACT (said as one word) is a third wave, or third generation behaviour therapy that was born out of the two generations that preceded it; traditional behaviour therapy and cognitive behaviour therapy (Hayes et al., 2006). As such,

ACT is a psychotherapeutic treatment approach to psychopathology which was developed based on the RFT research that underlies cognitive fusion. Accordingly, *fusion*, is seen as a behavioural phenomenon results in literality of thoughts that can lead to behaviour being controlled by stimulus functions, that can result in overly rigid patterns of responding (usually in the form of experiential avoidance) (Luciano, Rodriguez-Valverde & Gutierez., 2004). ACT also emphasized the use of personal values in its therapeutic approach which encourages clients to discriminate their goals and values which can serve to prompt clients in their pursuit of behavioural change.

Both ACT and RFT are based on a philosophy of science known as *functional contextualism*, and are embedded in the traditions of Contextual Behavior Science (CBS). CBS is a wing of functional analytic psychotherapy/behavioural psychology that has addressed itself to the development of a sub-field of behavioural psychology known as Clinical Behaviour Analysis. While Behaviour Analysis and CBS are somewhat at odds in terms of their guiding philosophies, both disciplines share a common commitment to the application of basic behaviour principles, to the understanding and modification of behaviour of organisms (Vilardaga, Hayes, Levin & Muto, 2009).

Just as Skinner (1938; 1966) asserted that the fundamental aim of Behaviour Analysis is to establish a scientific approach to behaviour analysis that would account for the complexities of human behaviour, so too is the goal of CBS (Friman et al., 1998). In doing so, CBS strives to provide basic account of complex behaviour by employing various methodologies that capture behaviour that is clinically relevant to meet the need for interventions aimed at analyzing and modifying behavior as it relates to human suffering.

A key concept of ACT is an emphasis upon ‘acceptance’ of emotionally distressing

psychological events, which is said to involve a willingness to remain in contact with distressing private events as an alternative to employing attempts to avoid or alter them (Wolgast, 2015). In addition to the term 'defusion', 'acceptance' represents another middle-level term used by ACT therapists which is said to refer to a core process of ACT's treatment model. From a behaviour analytic perspective however, these terms seems to lack functional links to behavioural processes (Foody, 2013).

Regardless of this fact, a promising body of empirical research supports the utility of ACT as a treatment for various psychopathological disorders (Hayes et al, 2006). Of the entire volume of ACT related research that has been conducted throughout the past number of decades, a considerable body of correlational research has found a positive association between psychopathology and *experiential avoidance* of distressful events (Bond & Bunce, 2000; 2003; Donaldson & Bond, 2004, as cited in Hayes et al., 2011). The majority of this research has employed the use of the Acceptance and Action Questionnaire (AAQ; Hayes et al., 2004; Hayes et al. 2006), which has been correlated with a wide range of measures used in Clinical Psychology. For example, a meta-analysis of 21 studies (N=4,721) which examined the relationship between the AAQ and various quality of life and psychopathology measures, found that the questionnaire was moderately correlated with outcomes including pain, negative affect, stress, job performance, depression, post-traumatic stress, trichotillomania and anxiety (Hayes et al., 2006). The AAQ has also been found to positively correlate with three well-established measures of anxiety (the Beck Anxiety Inventory, Beck & Steer, 1993; the State-Trait Anxiety Inventory, Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983; and the Anxiety Sensitivity Index, Reiss, Peterson, Gursky, & McNally, 1986).

Based on these findings as well as those of the AARR research, ACT researchers have

committed themselves to the development of a treatment model that can be comprehended and operationalized by clinicians and laymen alike - hence its prominent use of middle-level terms. The ACT Model of Psychopathology and Treatment is comprised of six 'core processes' (Hayes et al., 2006, p. 8); *acceptance, cognitive defusion, being present, self-as-context, values and committed action* (Hayes et al., 2006). Importantly, the model is referred to as an "approach" as opposed to a "specific technology" (Hayes et al., 2006, p. 9), and each of the 'processes' that comprise the model are targeted in a bid for clients to foster increased acceptance of undesirable psychological content, which is thought to result in higher level of psychological flexibility and lower level of experiential avoidance. The term psychological flexibility represents another middle level term that is refers to "the ability to contact the present moment more fully as a conscious human being, and to change or persist in behaviour when doing so serves valued ends" (Hayes et al., 2006, p.9).

For obvious reasons, middle-levels terms can evoke puzzling responses from behavior analysts who are concerned with the functional relations that underpin such emotional talk. Nonetheless, since the model's development, research into the it's six core concepts have yielded empirical support for the utility of ACT in treating various anxiety disorders including social anxiety disorder, panic disorder, generalized anxiety disorder, post-traumatic stress disorder and obsessive compulsive disorder (Arch et al., 2012; Hayes, Levin, Plumb-Vilardaga, Villatte & Pistorello, 2013; Ost, 2014). Aside from the correlational research surrounding the AAQ, researchers investigating the utility of ACT have focused their efforts on interventions employing a combination of the model's six components as part of multi element treatment packages, as well as single, analogue component process studies that have examined processes of psychological change that underlie the each of the model's six components in isolated

conditions.

While the applied research (conduced in the real-world) has contributed greatly to current knowledge of ACT's treatment efficacy, such studies have been limited in terms of their experimental control compared to those that have been conducted in the laboratory. The experimental research that has examined the model's components in isolation has thus enabled enhanced control and manipulation of conditions, which have facilitated greater levels of internal validity of the outcomes reported. As the goal of the present research was to examine the impact of a defusion analogue, a review of the research examining other model components will not be reviewed here. Instead, the following section will review the findings of experimental research that has examined *defusion* analogues in isolated conditions.

Defusion Analogue Studies

In their examination of defusion related outcomes, a number of researchers have employed the use of comparison groups involving the application of alternative strategies (such as thought distraction and thought suppression). One such experimental study by Hoffman, Heering, Sawyer and Asnaani (2009) examined the impact of an abbreviated *acceptance/defusion*-based instruction, a *thought suppression* instruction, and a *tCBT*-based *reappraisal* instruction on measures of physiological arousal and self-repot measures of state anxiety, following a distress inducing task. The study randomly assigned 202 undergraduate students to one of the three conditions and informed each group that they would be asked to give an impromptu video-recorded speech based on one of three controversial topics that were administered to them. Participants were encouraged to extend the duration of their speech for up to 10 minutes, and were instructed to raise their hand if they wanted to cease the video recording at any stage. In an effort to further induce anxious arousal they were informed that their video

recording may be assessed by members of the research team for quality purposes. This statement was deceptive however, and no video footage was actually recorded.

Prior to administration of the speech topics, participants were provided with verbal and written instructions regarding the coping strategy to be employed. Participants in the tCBT *reappraisal* condition were requested to maintain the view that their current situation is non-threatening and does not merit feeling anxious about. Those in the *acceptance/defusion* condition were instructed to attempt to allow their feelings to occur, without attempting to alter or control them. The instruction provided stated

> "…t*ry* to experience your feelings fully and do not try to control or change them in any way. Nevertheless, please let your feelings run their natural course and allow yourself to stay with your emotions, as fully as possible, without trying to control your feelings in any way." (Hoffman et al., 2009, p.391).

Alternatively, those in the *suppression* condition were requested to conceal any visible indicators of feeling anxious or fearful. Fluctuations in heart rate and state anxiety; measured using the STAI state version by Spielberger, Grosuch & Lushene (1970), were recorded on four occasions; at baseline, during an 'anticipation' period (immediately following the administration of instructions regarding the speech based task), during the 'speech' period and during a 'recovery' period (following the speech) (Hoffman et al., 2009, p. 390) It was predicted that participants in the *suppression* condition would report the highest fluctuations in heartrate as previous research has indicated such strategies to be associated with increased physiological and anxious arousal (Gross, 1998; Campbell-Sills & Barlow, 2007 cited in Hoffman et al., 2009).

In support of their prediction, participants in the experiential avoidance/*thought suppression* condition experienced the largest increase in physiological arousal (indicated by a significant increase in heart rate) compared to those in the *acceptance/defusion* and *reappraisal*

conditions from the anticipation phase to the speech phase. In addition, those in the *suppression* condition also reported significantly greater levels of anxiety from the anticipation phase to the speech phase, compared to those in the *acceptance/defusion* and *reappraisal* conditions. This finding is in line with five previous studies that have found the employment of suppression strategies to lead to increases in undesirable emotional and physiological arousal (Cioffi & Holloway, 1993; Gross, 1998; Gross & Levenson, 1997; Wegner & Gold, 1995; Wegner & Zanakos, 1994, as cited in Hoffman et al, 2009).

Interestingly, participants in the *acceptance/defusion* and *suppression* conditions reported statistically similar levels of anxiety reduction from the speech phase to the recovery phase (i.e. no significant difference was detected between these reductions), suggesting that both strategies were equally effective in reducing or regulating anxiety. Furthermore, while no significant reductions in state anxiety were reported *between* the three conditions, participants in the tCBT-based *reappraisal* condition reported a stronger reduction in anxiety compared to those reported in the *acceptance* and *suppression* conditions. As a significant increase in heart rate was observed in the suppression condition from baseline/anticipation phase to the speech phase, this finding suggests that the suppression strategy had a differential impact on physiological distress compared to the acceptance and reappraisal strategies examined, but the defusion strategy did not appear to be any more or less superior to the other strategies examined in terms of impacting state anxiety. Furthermore, none of the strategies examined lead to significant reductions in this regard.

The *acceptance/defusion*-based instruction employed by Hoffman et al. (2009) appears to reflect a defusion technique known as *Leaves on a Stream* (Hayes et al., 1999) which encourages participants to notice their thoughts as they occur, whilst refraining from efforts to change or

avoid them. This technique has been examined previously by Foody et al. (2015) and Marcks et al. (2005) and was found to reduce levels of emotional discomfort associated with negative self-referential thoughts. Importantly, while Marcks et al. (2005) reported that participants in their defusion condition reported reduced levels of discomfort associated with negative self-relevant thoughts, participants did not report a reduction in their frequency. This effect is in line with Blackledge's (2007) account of defusion as a process involving a disruption of the context of literarily that arises from derived relations and transformation of functions of stimuli across contextual commonalities such as verbal stimuli. Thus, while the frequency of thoughts may well remain the same, the *contextual conditions* that facilitate the verbal functions are disrupted and the function of the distressing thoughts (as distressing/discomforting) are posited to reduce (Blackledge, 2007). As such, Hoffman et al.'s defusion and reappraisal instructions (which both resulted in similar reductions in state anxiety), may have both provided verbal contextual cues for participants to view thoughts at a *distance* from themselves, which in turn altered the context in which the distressful thoughts were experienced. Furthermore, the cognitive reappraisal strategy employed by Hoffman et al. (which lead the greatest reduction in state anxiety), may have also facilitated a change/altering of the functional context because the instructions provided stated:

> "It is quite normal that an impromptu speech creates some level of discomfort or even fear. Please try to take a realistic perspective on this task, by recognizing that there is no reason to feel anxious. Nevertheless, please realize that the situation does not present a threat to you. Regardless of what occurs during this task or how anxious you appear, it is just an experiment, and there are no negative consequences to be concerned with." (Hoffman et al., p.390).

As such, this instruction may have led to a recontexualization of the perceived extent of psychological threat which diminished the control of distressful verbal thoughts on state anxiety. Indeed, this notion has been proposed by Assaz and colleagues (in press) who suggest that certain defusion exercises (such as *Leaves on a Stream*, *Content on Cards* and *Hands as Thoughts)* may involve verbally contextualizing distressful thoughts (as relational responses) by introducing distance between an individual and a given problematic thought. Accordingly, research by Rachlin (2006), as cited in Assaz et al. (in press), posits that the value of a stimulus is "a function of its probability of occurrence and temporal delay" (Assaz et al., in press, p.19). In support of this notion, research that has emerged from the Personality and Social Psychology arena also supports the positive effects of employing a *self-distanced* (versus a *self-immersed* perspective) when recalling distressful emotional content (Kross & Ayduk, 2008).

Specifically, in an experiment by Kross et al. (2008) participants were assigned to a *self-distancing* condition and were requested to recall an occasion in which they experienced significant sadness and upset. They were then requested to recall the occasion from an *objective*, 'fly on the wall' perspective. In contrast, participants in a *self-immersed* condition were requested to do the same, but were instructed to employ a *subjective* perspective of the event.

Participants in the *self-distancing* condition reported a greater reduction in depressed affect (measured using the Self-Assessment Manikin (SAM; Bradley & Lang, 1995; as cited in Kross et al., 2008), compared to a self-immersed perspective. Indeed, other studies into self-distancing have also found support for its effects in reducing negative affect and self-reported levels of anger (Kross, Gard, Deldin, Clifton & Ayduk, 2012; Mischkowski, Kross & Bushman, 2012).

In Hoffman et al.'s (2009) research, the authors remark on the empirical shortcomings

associated with not employing a control condition. They recommend that employment of a 'no-instruction' control condition whereby participants are provided with no instructions as to a coping strategy to apply to induced negative states, would enhance the integrity of future research findings. They also suggest an alternative control condition whereby participants are requested to employ the coping strategy that they typically employ to regulate anxiety, would also be an interesting direction for future research.

An experimental study by Pilecki and Kay (2012), in fact, employed a version of the control condition recommended in Hoffman et al. (2009). The study compared the effects of *defusion* (using an adapted version of the *Having Thoughts* exercise), *thought suppression* and *control strategies* on experimentally induced negative emotional states. The study was conducted with a sample of 67 university students and involved the experimental inducement of negative psychological states via exposure to adverse stimuli (video clips) intended to elicit fear/anxiety, sadness and disgust. Participants in all conditions were provided with written and verbal instructions about the strategy to be employed, and were given 30 seconds to practice the strategy before being exposed to the video clips. Participants in the *defusion* condition were instructed to notice and label their thoughts as they occur, and to maintain the view that they are 'just' thoughts. Alternatively, participants in the *thought suppression* condition were instructed to ignore and will away any unwanted thoughts that occur during the session (see Wegner, 2004, as cited in Pilecki et al., 2012). Finally, participants in the *control* condition were asked to identify the coping strategy that they typically employ to manage distress in everyday life. They were also provided with a list of strategies excluding defusion and thought suppression strategies and were asked to choose one from the list if they wish.

Following exposure to each of the three video clips (aimed at inducing anxiety, sadness

and disgust), participants in each condition completed six Visual Analogue Scales (VASs) to rate the extent to which they felt fear/anxiety, sadness, disgust, anger, amusement and contentment. The measurement of anger, amusement and contentment were administered in an effort to control for demand characteristics and were not analyzed. Following this, participants completed a computer based Stroop test aimed a measuring indirect emotional arousal. At the end of the sessions, all participants were requested to complete four questionnaires measuring a) *anxiety sensitivity*; using the Anxiety Sensitivity Index-3 (ASI-3) by Taylor et al. (2007), b) *mood*; using the Positive and Negative Affect Schedule (PANAS) by Watson, Clark, & Tellegen (1988), c) *experiential avoidance*; using the Acceptance and Action Questionnaire (AAQ) by Hayes at al. (2004), and d) *disgust sensitivity*; using the Disgust Scale-Revised (DS- R) by Haidt, McCauley, & Rozin, 1994 (as cited in Pilecki et al., 2012).

The authors predicted that there would be a significant difference between the groups in terms of emotional arousal indicated on the anxiety, sadness and disgust VASs. Specifically they predicted that participants in defusion condition would report significantly less sadness and anxiety than those in control condition. In addition, it was posited that participants in the thought-suppression condition would report greater levels of sadness and anxiety compared to participants in the defusion and control conditions. Contrary to their predictions however, no significant differences were detected between any the groups in terms of the VAS measures of sadness, anxiety or disgust, indicating that none of conditions impacted emotional arousal to a significant extent.

Interestingly, significant differences were detected between the groups on the Stroop task completion times, which was employed as a measure of cognitive disruption. Participants in the *defusion* condition displayed faster Stroop test reaction times compared to those in the *control*

condition, following exposure to the video clips aimed at inducing disgust and sadness, but not for the clip intended to induce anxiety. Participants in the *thought-suppression* condition also reacted faster to the Stoop test compared to controls following exposure to the disgust and sadness clips, but not for the anxiety clip. Interestingly, following exposure to the video clip intended to elicit anxiety, participants in the *control* group reported the least amount of anxiety compared to those in the *defusion* and *thought-suppression* conditions. A combined contrast of the sadness and disgust ratings for each group however, revealed that following exposure to the video clips intended to elicit disgust and sadness, participants in the *defusion* and *thought-suppression* conditions reported less distress than those in the control condition. The authors concluded that of the three conditions, the *defusion condition* appeared to be most effective in terms of reducing distress but questioned the underlying mechanisms said to be responsible for its effects.

A more recent experimental analysis by Hooper and McHugh (2013) examined the impact of the same defusion exercise (*Having Thoughts* exercise) against a *thought-suppression* technique on problem solving. The research assessed the impact of the two strategies on paper-based maze completion times following exposure to a learned helplessness induction exercise. As in Pilecki et al. (2012), Hooper and McHugh also employed the use of a no-instruction control, as recommended by Hoffman and colleagues (2009).

Participants in the *defusion* condition were provided with written instructions to notice their thoughts as they occur and to refrain from seeing them as reality (see Hooper et al., 2013 for a full review of the instructions provided). Those in the *thought distracting* condition were requested to suppress any negative thoughts that may occur and to replace them with positive thoughts, maintaining a focus on the positive thought while completing the exercise that was to

follow. Alternatively, participants in the no-instruction condition were not provided with any instructions; rather they proceeded to the next procedural phase (the learned helplessness task). The groups were then exposed to an unsolvable, computer-based learned helplessness task. On completion of the task, participants in all conditions were administered a paper-based maze task and requested to complete it. They were also informed that their completion time would be recorded by the experimenter.

In line with findings reported by Pilecki et al. (2012), participants in the *defusion* condition performed significantly faster on the problem solving task compared to participants in the *thought suppression* and *control* conditions. Taken together, the findings reported in Hoper et al. and Pilecki et al.'s (2012) study appear to support the hypothesis that the *Having Thoughts* defusion exercise is capable of significantly impacting problem solving capabilities following induced distress. While no further inferences were drawn from the research, other than those stated previously, the authors discuss that the research represents a preliminary examination of the concepts studied. They recommend that future research employ pre- and post-experimental measures to enhance the internal validity of such a study. Furthermore, they discuss a potential shortcoming with regard to the length of the cognitive defusion instruction versus the thought suppression instruction, and suggest that participants in the cognitive defusion condition may have perceived the instruction to be more credible based on the length of the instruction provided. As such, the thought suppression instructions were of a far shorter length, thus participants may have perceived the instruction to have a low level of credibility. This is an important point of consideration and represents a weakness in terms of in the internal validity of the study.

The findings of Hooper et al. (2013) and Pilecki et al.'s study do support the application

of defusion as a superior coping strategy to thought suppression in situations that demand optimum cognitive performance/problem solving. However, as no differences were detected between the experimental groups on any of Pilecki et al.'s (2012) visual analogue scales employed to measure changes in anxiety, sadness and disgust, the process by which defusion functioned to differentially impact cognitive disruption in both of these studies in unclear.

The discrepancy between these findings further highlights that while defusion exercises appear to be able to impact behaviour in a significant way, due to the lack of precision with which the procedures are applied, in addition to the range of measures employed to assess their impact, it is difficult to determine the processes by which defusion works through. Indeed, little to no studies could be sourced that offer an account of the change processes that explain defusion outcomes (Dymond, Roche & Bennett, 2013).

Pilecki et al. (2012) do note however that future research would benefit from the inclusion of measures of believability and distress in order to further examine processes of change within cognitive defusion conditions, which is somewhat encouraging.

Indeed, the pathways by which defusion occurs appear to be complex. In their review of this topic, Assaz et al. (in press) suggest that defusion methods may not be as straightforward as one might hope, insofar as conceptualizing defusion as a mere disruption of processes.For example, the authors emphasize how *various* learning processes can lead to the transformation of stimulus functions (e.g. an avoidance function can be elicited following direct conditioning *and* derived relational responding, as well as through observation and verbal instructions). As such, this is not necessarily a direct pathway. Hence, the authors underline the need for researchers to consider the role of various behavioural processes that may facilitate defusion, particularly considering the research demonstrating that extinction of stimulus functions which were derived

relationally, are capable of transferring to perceptual and conceptually related stimuli (Dougher et al., 1994; Roche, Kanter, Brown, Dymond & Fogarty, 2008; Vervoort et al., 2014). In other words, ”a resulting functional transformation does not precisely specify the process by which the stimulus produced it, and the process of function does not have to be a functional opposite of the process of function acquisition” (p.16)

Therefore, different defusion exercises may work via different learning principles and may also render different effects depending on the procedures involved. For example, research by Foody et al. (2015) and Marcks et al. (2005) who also examined the *Leaves on a Stream* exercise, both reported reductions in the level of discomfort associated with negative self-referents, while other studies of defusion exercises such as *Carrying Cards* (e.g. Gutieriez, Luciano, Rodriguez & Fink, 2004) and *Content on Cards* exercises have yielded no effect on discomfort, but have led to significant reductions in avoidance responding and subsequent increases in approach-related behaviour.

An investigation by Masuda et al. (2004) which examined the impact of a different defusion (using the *Word Repetition* exercise (Titchener, 1916), as cited in Masuda et al. 2004) on levels of discomfort and believability of negative self-referential statements, found support for defusion as being capable of impact emotional discomfort. Each condition included a rationale for the technique being practiced, and a brief opportunity to practice the strategy was provided to ensure that participants knew what they were being requested to do.

Reductions in believability and discomfort of negative self-statements were reported across all conditions (defusion, thought control and distraction), however, greater reductions were observed within the defusion condition compared to the control conditions. In an attempt to minimize the potential for demand characteristics and strengthen the credibility of the

findings, the authors conducted an additional experiment with 24 participants assigned to either a defusion condition, or a thought control condition. A similar procedure was conducted in both conditions. First, identification of negative self-statements by each individual was conducted. Following this, the participants in both conditions were provided with a rationale for their respective conditional technique (defusion or thought control) but neither was provided with an opportunity to practice the techniques with the experimenter in advance of engaging with the techniques in the experiment. The results indicated that exposure to the defusion rationale had no significant effect on participants' thoughts; however, exposure to the thought control rationale significantly reduced perceived believability of negative self-relevant thoughts. Notably, exposure to the defusion technique with and without an opportunity to practice the exercises resulted in prominently different outcomes, suggesting that the effectiveness of the defusion condition merits more than the presentation of a rationale alone.

In light of this finding, consideration of the role of the experimenter/facilitator in addition to the opportunity to practice the exercise(s) is an important consideration. This was a key consideration in the present research. In response, the present research explored whether the delivery of an identical cognitive defusion exercise delivered from a human being (the experimenter) versus a pre-recorded instruction played via an audio speaker would result in differential outcomes. In Experiment 1 of this research, the cognitive defusion intervention was delivered by the experimenter. In Experiment 2, the same cognitive defusion intervention was delivered via a pre-recorded instruction which was played via an audio speaker.

Summary

A considerable body of previous research supports the efficacy of ACT as treatment for anxiety (see Arch et al., 2012 for a review) however the experimental research underlying the

impact of single ACT components on various psychological outcomes is currently limited. While previous analogue component/'micro-studies' into the 6-factor Hexaflex model of psychological flexibility (Hayes et al., 2006) support its application in practice, experimental analyses of the model is said to have "lagged behind the research examining its practical applications" (Rolfs et al., 2016, p. 1).

While this deficit may be explained by the fact that "many current empirically-supported [ACT] treatment protocols are large packages composed of diverse elements." (Hayes et al., 2006, p. 11), there is a clear need for advanced research in the area. In defense of this deficit, it should be also be noted that the ACT treatment model is classified as an "approach" as opposed to a "specific technology" (Hayes et al., 2006, p. 9). While the 6 key components that comprise the model are said to interlinked, the manipulation of certain processes through which ACT works represents an important goal for the ACT research, going forward.

Notably, off the research that has examined cognitive defusion in isolation, several process measures have been employed in an effort to pin down the mechanisms through which defusion functions. However the conclusions derived from these studies are limited due to a common lack of internal and external validity. For example, much of the experimental studies examining processes of change appear to employ several different cognitive defusion instructions, and use several different processes measures. The aim of the thesis at hand was to address this research gap.

Experiment 1: Introduction

Further to the review of literature presented previously, the fundamental research question that guided our analyses in Experiment 1 was as follows: Does exposure to a brief cognitive defusion exercise effect levels of experimentally induced state anxiety and levels of psychological inflexibility/avoidance? The aim of Experiment 1 was to address the previously discussed research deficit by conducting experimental analyses on one of ACT's 6 core processes; cognitive defusion. In doing so, we objected to examine the utility of a brief cognitive defusion intervention on levels of psychological inflexibility/avoidance (as measured by the Acceptance and Action Questionnaire-II; AAQ-II, Bond et al., 2011), and affective levels of state anxiety (as measured by the State Trait Anxiety Inventory Form Y-1; STAI Form Y-1, Spielberger, 1983). While ACT based interventions are not intended to alter affective symptoms, our goal was extend the work of Hoffman et al. (2009) by further examining the effect of cognitive defusion on levels of state anxiety following anxious arousal.

To this end, a control and intervention group were employed to examine the comparative impact of exposure to a distracting-based control task versus exposure to the cognitive defusion intervention on the aforementioned measures, pre and post exposure to each condition. We hypothesized that participants in the intervention condition would report significant reductions in state anxiety levels from pre- to post-intervention. Furthermore, we predicted that participants in the intervention condition would report significant pre- to post-intervention reductions in psychological inflexibility/avoidance scores. In an effort to inform the extant ACT-based correlational research, we conducted exploratory analyses into the relationship between levels of trait anxiety and baseline/pre-experimental levels of psychological inflexibility/avoidance scores

(measured using he AAQ-II; Bond et al., 2011) across both participant groups. Based on previous research findings that have indicated the AAQ (Hayes et al., 2004) to be positively correlated with the STAI (Hayes et al., 2006), we predicted that there would be a positive relationship between scores across the two measures. In addition, we also explored whether trait anxiety levels mediated the relationship between changes to state anxiety levels measured pre- and post- intervention.

Finally, a key procedural element in this research was the experimental inducement of distress. Distress was induced within *both* groups (N=55) using a math based task, paired with a deceptive statement informing participants that a previous cohort had completed the math task in 7 minutes, without the use of calculators, and had scored an average group score of 83%. The rationale for inducing anxiety was to manipulate a self-referential verbal statement from participants, which represented the verbal contact to be *de-fused* in the intervention condition.

The utilisation of a math-based task as a means to induce anxiety was based on previous research indicating the high prevalence of math anxiety in college students (Abo Hamanza & Helal, 2013; Niss, 2012; Wilder, 2012; Zettle, 2003). As such it was thought that the employment of a math task would represent a likely medium by which to induce distress. In order to control for the effect of math anxiety a potential mediator of state anxiety change (which would thus confounded the results) we examined this relationship statistically.

Experiment 1: Methodology

Design

A 2 × 2 factorial design was employed to investigate the impact of a brief cognitive defusion exercise on self-report measures of state anxiety and psychological inflexibility/avoidance. A control group was employed as a baseline condition upon which to examine variations in state anxiety and psychological inflexibility/avoidance scores across the two participant groups, over time. The independent variables examined were time (pre-intervention/control task and post-intervention/control task) and condition (control and intervention). The dependent variables comprised of state anxiety and psychological inflexibility/avoidance . Trait anxiety and math-related anxiety were also measured for exploratory purposes

Participants and Settings

A non-clinical, mixed-gender sample of 55 college students (*N*=55), aged between 18 and 65 years, attending an Irish university was recruited for the study. Convenience sampling was used to recruit participants via voluntary participation. Students were invited to participate in the study in one of two ways; an allocated number of students were sourced from a Post-graduate Participant Pool who had previously vested their interest in being invited to partake in a psychology study were invited to participate via email, or phone. Students were also approached on their college campus and subsequently invited to be contacted about taking part in the study. Interested students were contacted via email or phone with information about the research study and details regarding the testing location. Of the entire sample (*N*=55), the control group (*n*=19) comprised of 5 males and 14 females. The intervention group (*n*=36) comprised of 13 males and 23 females.

All aspects of the control and experimental group sessions took place in a Psychology Laboratory within the Department of Psychology at Maynooth University. The laboratory was organized with 15 chairs with adjoining desks, spaced approximately 3 feet apart. Due to restraints related to participants' college schedules, it was not possible to conduct the control and experimental group sessions at the same time of day, thus sessions were conducted at various times of the day, and on various days of the week.

Inclusion criteria.

Participants aged between 18 and 65 years

Participants who, by their own judgement have a good ability to speak, comprehend, and write in the English language

Participants who are registered students of Maynooth University

Exclusion criteria.

Participants under the age of 18

Participants who do not have a good ability to speak, comprehend and write in the English language

Participants who are not registered students studying at Maynooth University

Participants with a clinically diagnosed mental health issue

Ethical Considerations.

The research at hand involved the assessment and manipulation of anxiety, and employed the use of deception as a means to experimentally induce distress. The experimental procedures employed were thus subject to rigorous ethical evaluation prior to experimentation. Participants were not screened for clinical levels of anxiety prior to the research commencing but were requested (via the Information Sheet; see Appendix A) to self-exclude themselves from

consenting to participate in the research if they had a clinical history of anxiety or depression (see Consent Form; Appendix B). Furthermore, in order to ensure that the experimenter (the research student) was competent in her conduct of the procedure, the first three experimental sessions were supervised by the research student's co-supervisor, Dr. Veronica Cullinan, an experienced ACT specialist.

This research was granted ethical approval by the Departmental Ethics Sub-Committee within the Department of Psychology at Maynooth University in November 2015. All research data pertaining to this study are presented in aggregate format. All participants were informed that their aggregated data sets may be used to represent the results of the study both in conference presentations, in thesis format, and they may also be submitted for publication to peer-reviewed journals. The Information Sheet provided to participants prior to participation outlined these terms clearly.

Data collection, handling and presentation was conducted in line with the Code of Good Practice for Psychological Testing as outlined by the British Psychological Association in addition to the current standards and codes of ethics dictated by the Psychological Society of Ireland, the Behavior Analysis Certification Board and those outlined by Maynooth University's Ethics policies.

Materials

Regardless of session type being conducted (i.e. a control or intervention session) on entering the laboratory, each participant was provided with a paper-based booklet containing all of the materials required for the session. The control and intervention session booklets were almost identical in terms of content and the order in which the materials were presented. Each booklet contained an Information Sheet (see Appendix A), a consent form (see Appendix B), the

State Trait Anxiety Inventory Form Y-1 and Y-2 (STAI Form Y-1 and Y-2, Spielberger et al., 1983; see Appendix C and D), the Acceptance and Action Questionnaire-II (AAQ-II, Bond et al., 2011; see Appendix E), the Math Task (see Appendix F), a single Self-Statement Question (see Appendix G), a *second* copy of the STAI Form Y-1 (state anxiety measure, Spielberger et al., 1983; see Appendix C), a document entitled 'Reading Task' which contained a list of short stories (see Appendix H; this document was only included in booklets administered to the control group), a *third* copy of the STAI Form Y-1 (state anxiety measure, Spielberger et al., 1983; see Appendix C), a *second* copy of the AAQ-II (Bond et al., 2011; see Appendix E), the Math-Anxiety Rating Scale-Brief (MARS-Brief, Suinn & Winston, 2003; see Appendix I), and Debrief Sheet (see Appendix J).

State Trait Anxiety Inventory Form Y.

The STAI Form Y (Spielberger et al., 1983), which is comprised of the STAI Form Y-1 and Y-2 was employed to measure state and trait anxiety. The state measure (STAI Form Y-1) consists of 20 self-statements to which respondents rate how much each statement applies to them in the *present moment*, from 1 (not at all) to 4 (very much so). The trait measure (STAI Form Y-2) also consists of 20 self-statements to which respondents rate how much the statements apply to them in *general*. The STAI Form Y has been validated for use with college students in a number of previous studies (Zettle, 2003; Zettle & Rains, 2000), including studies investigating ACT based concepts in college populations (Healy et al., 2008; Hoffman et al., 2008).

The scale is a widely used, validated measure of anxiety, with good test-retest reliability and good internal consistency (Healey et al., 2008; Spielberger 1983). It is said to measure a variety of anxiety related concepts such as worry, apprehension, tension and nervousness

(Spielberger, 1983).

Acceptance and Action Questionnaire-II.

The Acceptance and Action Questionnaire-II (AAQ-II; Bond et al., 2011) is a 7-item questionnaire that is designed to measure the extent to which an individual is psychologically flexible or psychological inflexible/avoidant in terms of their willingness to experience unpleasant thoughts and feelings (Tapper, Shaw, Ilsley, Hill, Bond & Moore, 2009). Participants are request to rate the extent to which each of the 7 statements apply to them, from 1 (never true) to 7 (always true). Psychometric evaluation of the scale report it to retain good test-retest reliability, and good construct, concurrent, predictive and discriminant validity.

Cognitive Defusion Exercise.

A cognitive defusion exercise by Harris (2009) called *Hands as Thoughts* was employed for the defusion intervention. The *Hands as Thoughts* exercise was selected for examination as it was felt that the simple metaphor that underpins the exercise would be easily comprehended by individuals who are new to the concept of cognitive distancing. To the authors knowledge, no previous analogue component studies have examined this exercise in an experimental context.

Math Task.

The Math Task comprised of an A4 sheet containing a list of six math questions (topics included algebra, trigonometry and probability), each of which were derived from previous Scholastic Assessment Test (SAT) examinations.

Math Anxiety Rating Scale-Brief.

The Math Anxiety Rating Scale-Brief (MARS-Brief; Suinn & Winston, 2003) is a self-report questionnaire that consists of 30-items presented in Likert format, ranging from 1 “not at all” to 5 “very much”. Scores corresponding to each item are summed to produce an overall

score, with higher scores indicating higher math anxiety levels. The instrument is designed to measure concepts such as tension related to the use of math skills in educational and in everyday contexts (Suinn & Winstron, 2003). The MARS-Brief is a modified version of the original 98-item Math Anxiety Rating Scale (Richardson & Suinn, 1972), which has been widely used in clinical and applied research studies since its development in 1972 (Suinn & Winstron, 2003). Extensive analyses of the psychometric properties of the MARS-Brief have been conducted in numerous research studies and have evidenced the scale to be a reliable and valid assessment tool that has been validated for use with college students (Wilder, 2012; Suinn & Winston, 2003).

Stopwatch.

A 'Precision Training 1500 Series' stopwatch was used to time the math task.

Procedure

Both the control and the experimental groups were exposed to an identical set of procedures (see Figure 1), with the exception of one element; the control group was exposed to a control task in place of the defusion intervention. Notably, the control and intervention group sessions were conducted separately.

Regardless of the session type (i.e. control or intervention) on entering the laboratory, individuals were provided with a paper-based booklet containing all of the materials required for the upcoming session. They were then invited to take a seat at any one of the desks in the room. The group was then requested to read the Information Sheet (see Appendix A), and subsequently offered the opportunity to ask questions. The group was then verbally briefed about the aims of the research and reminded of their rights as research participants. Following this, they were

requested to sign the Consent Form (see Appendix B) if they were willing to proceed with participation. On signing the Consent Form, they were kindly requested to refrain from turning the pages on their booklets until requested to do so by the experimenter.

Participants were requested to complete the three questionnaires presented on the following pages of their booklets; the STAI Form Y-1 and Y-2 (Spielberger et al., 1983; see Appendix C and D) and the AAQ-II (Bond et al., 2004; see Appendix E). On completion of the questionnaires, the group was requested to turn the next page of their booklet to complete the Math Task (see Appendix F). Pilot study data indicated that completion of the math task required an average of 8.5 minutes (no pilot test participants demonstrated completion of all of the questions), thus, in an attempt to induce distress within the group, participants were requested to attempt the Math Task within a 7 minute duration. In addition, the researcher elicited a deceptive statement, which stated that a previous cohort of college students had completed the same math task within 7 minutes without the use of a calculator, and scored an average of 83% overall. This statement was employed with the intention to experimentally induce distress. The researcher used a stopwatch to time the task.

Following the Math Task, the group were asked to answer the single question presented on the next page of the booklet which read, 'Having completed the math task I feel _____' (see Appendix G). The purpose of this question was to attempt to elicit a verbal statement that reflected how participants felt following the Math Task. For participants in the intervention condition, the self-statement served as the content to be used within the defusion intervention that was to follow. Alternatively, for participants in the control condition, the self-statements were recorded for descriptive statistics purposes only (for a review of participant responses to the self-statement questions across both conditions, see Appendix O).

Following completion of the self-statement question, participants were asked to turn to the next page to fill out the questionnaire presented; the STAI Form Y-1 (Spielberger, 1983; see Appendix C). As this was the second occasion that participants were presented with this measure, the question items were presented in a different order to the order in which they were presented initially. The rationale for this was to attempt to minimize the potential for practice effects such that participants may recall the order of their responses to the previous version that they had completed.

Despite the type of session that was being conducted, (i.e. a control condition *or* intervention condition) participants in either condition were exposed to the same set of procedures up to this point. Participants in the intervention group were then exposed to the cognitive defusion intervention, and the control group were exposed to a control task

Control Task: (reading the Short Stories; see Appendix H) Participants in the control group were requested to read a compilation of short stories presented in their booklets, for 3.5 minutes.

Defusion Intervention: Delivery of the cognitive defusion exercise (*Hands as Thoughts* exercise by Harris (2009) was conducted by the experimenter who read from a script of instructions (see Appendix K for a review of the script). The exercise lasted 3.5 in minutes in duration. Participants were requested to engage with the exercise as the experimenter read from the script and modelled the actions involved in the exercise.

On completion of the defusion exercise/control task participants were asked to complete the following three questionnaires presented in their booklets; the third and final presentation of STAI Form Y-1 (Spielberger et al., 1983), the second and final presentation of the AAQ-II (Bond eta al., 2011), and the Math Anxiety Rating Scale-Brief (MARS-B, Suinn & Winston,

2003; see Appendix I). The question items pertaining to the STAI Form Y-1 were presented in a different order to that of the previous two versions that had been administered, to minimize the potential for practice effects. Following completion of the three aforementioned questionnaires, participants were thanked for their time and debriefed using the Debrief Form (see Appendix J).

Control Group Procedure	Intervention Group Procedure
• Brief/Introduction • Informed Consent • Baseline State Anxiety • Baseline Psychological Inflexibility/Avoidance • Trait Anxiety	• Brief/Introduction • Informed Consent • Baseline State anxiety • Baseline Psychological Inflexibility/Avoidance • Trait anxiety
Math Task	Math Task
• Self-statement • Pre-control task State Anxiety	• Self-statement • Pre-intervention State Anxiety
Control task	Defusion intervention
• Post-control task State Anxiety • Post-control task Psychological Inflexibility/Avoidance • Math Related Anxiety • Debrief	• Post-intervention State Anxiety • Post-intervention Psychological Inflexibility/Avoidance • Math Related Anxiety • Debrief

Figure 1. Experiment 1: Visual Representation of Experimental Procedure for both Group

Experiment 1: Results

Table 1 presents the descriptive statistics for each of the psychological measures pertaining to both participant groups.

Preliminary Analyses

Preliminary analyses were carried out prior to conducting each statistical test in order to screen for violation of assumptions. No violations were identified in any case. As illustrated in Table 1, participants in the intervention group displayed moderate levels of baseline state anxiety (M=34.89, SD=10.59) which were consistent with college student norms reported by Spielberger (1983); norms range from 36.47 to 38.76. The control group displayed slightly higher levels of baseline state anxiety (M=41.32, SD=9.76), however the results of independent samples t-test rendered no significant difference between the two groups in this regard, $t(53)=1.85$, $p=.07$, two-tailed.

Moderate levels of psychological inflexibility/avoidance were observed across both participant groups at baseline (control group: M=25.00, SD=8.37; intervention group: M=22.11, SD=8.24), with no pre-experimental difference detected between the groups, $t(53)=1.23$, $p=.22$, two-tailed. The two participant groups were also matched in terms of math-related anxiety (control group: M=80.00, SD=22.89; intervention group: M=80.37, SD=22.80), $t(52)=.06$, $p=.96$, two-tailed, and trait anxiety (control group: M=46.79, SD=11.98; intervention group: M=41.81, SD=10.79), $t(53)=1.57$, $p=.12$, two-tailed.

Table 1

Experiment 1: Means and Standard Deviations for Psychological Measures across Participant Groups

	Group	
	Control	Intervention
Measurement Variables	*n*	*n*
Males	5	13
Females	14	23
N	19	36
	M (SD)	*M (SD)*
Baseline State Anxiety	40.32 (9.76)	34.89 (10.60)
Pre-intervention/control task State Anxiety	46.47 (12.62)	44.39 (12.50)
Post-intervention/control task State Anxiety	41.74 (12.23)	33.53 (9.93)
Baseline Psych. Inflexibility	25.00 (8.37)	22.11 (8.24)
Post-intervention/control task Psych. Inflexibility	14.68 (4.62)	14.36 (4.70)
Trait Anxiety	46.79 (11.98)	41.81 (10.79)
Math Anxiety	80.00 (22.89)	80.37 (22.80)

Note. *n*=Number of participants. *M*=Mean scores. *SD*=Standard deviations. Psych. Inflexibility=psychological inflexibility/avoidance scores.

A series of paired samples t-tests were performed to assess whether exposure to the math task (intended to experimentally induce distress) had a significant impact on mean state anxiety scores within each participant group. Indeed, a statistically significant increase in mean state anxiety scores was observed across both participant groups from baseline to pre-intervention/control task (intervention group, $t(35)=-6.55$, $p < .001$, eta squared=-.55; control group, $t(18)=-2.81$, $p=.01$, eta squared=-.31), suggesting that exposure to the math task was responsible for the observed increase in state anxiety scores.

Since the variables of interest pertaining the hypotheses were time (pre- and post-intervention/control task), and condition (control or intervention condition), a series of 2 × 2 mixed between-within subjects analysis of variances (ANOVAs) were conducted to assess for significant differences between the groups, across the experimental/control sessions.

Hypothesis 1: To test hypothesis 1; that participants in the intervention group would report a significant reduction in mean state anxiety scores from pre- to post-intervention, a 2 × 2 ANOVA was performed. A time × condition interaction effect was yielded, $F(1, 53)=.90$, $p=.017$, implying that there was a statistically significant change in state anxiety levels within *and* between the two conditions. In support of hypothesis 1, post-hoc analyses yielded a significant decrease in state anxiety cores from pre-intervention ($M=44.39$, $SD=12.50$) to post-intervention ($M=33.53$, $SD=9.93$), $t(35)=6.93$, $p < .001$, eta squared=.58, indicating a very large effect size.

Post-hoc analyses performed on the control group's scores also rendered a significant reduction in state anxiety scores pre-control task ($M=46.47$, $SD=12.62$) to post-control task ($M=41.74$, $SD=12.23$), $t(18)=2.83$, $p=.011$, eta squared=.78, suggesting that the exposure to the control task (reading short stories) may have been responsible for the reduction in scores.

Notably, while both groups reported a significant decrease in state anxiety scores from pre- to post-intervention/control task, the time × condition interaction effect indicated a significant difference *between* the groups in terms of these changes. On comparison of the score reductions observed for each group, a larger reduction in state anxiety was detected from pre- to post-intervention than from pre- to post-control task. In other words, participants in the intervention condition reported a significantly greater reduction in state anxiety scores.

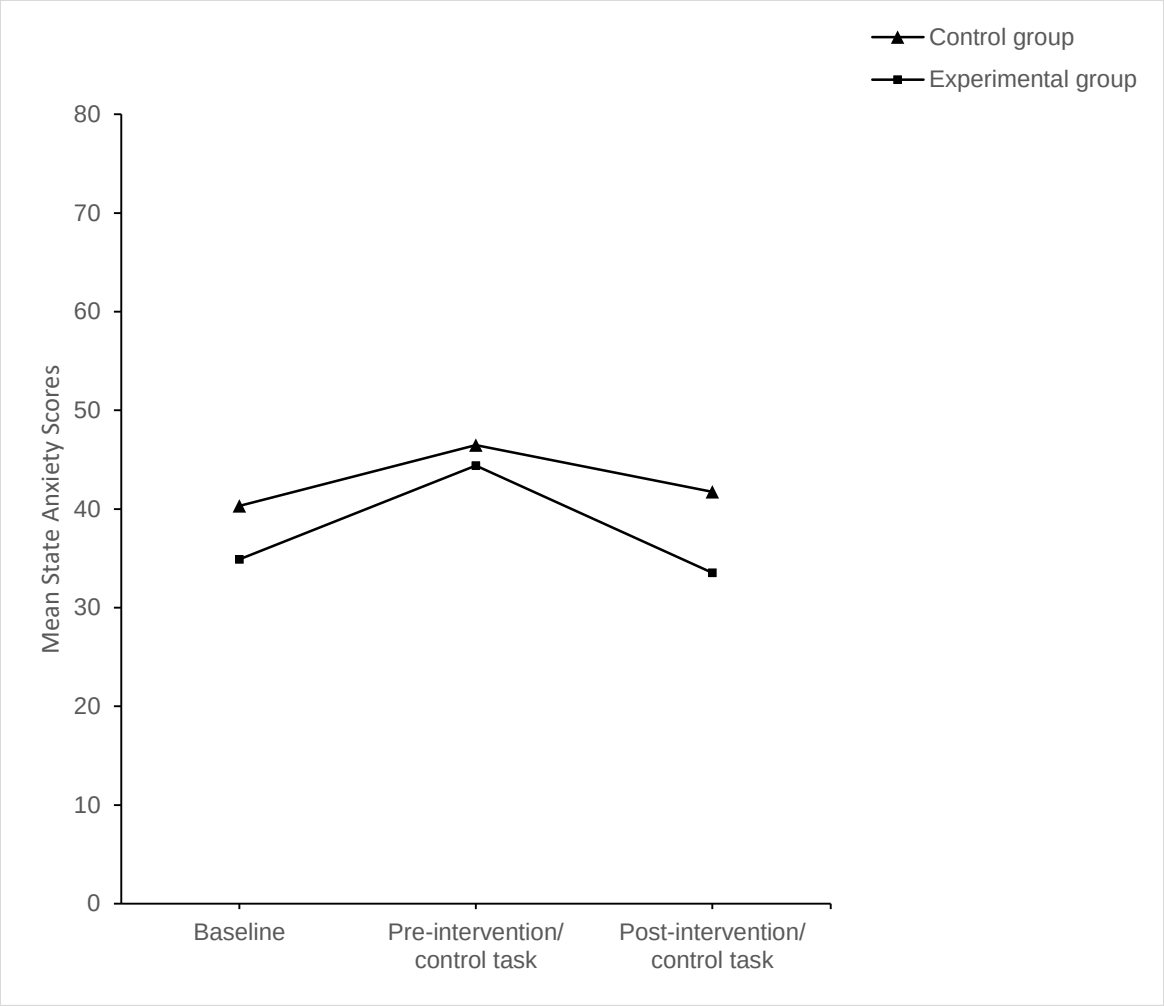

Figure 2. Experiment 1: Mean State Anxiety Scores for both Groups across Time

Hypothesis 2: A second prediction lay with the differential impact of the two conditions on mean psychological inflexibility/avoidance scores. We predicted that participants exposed to the defusion intervention would report a significant reduction in terms of mean psychological inflexibility/avoidance scores from baseline to post-intervention. The results of a 2 × 2 ANOVA detected a significant main effect for time, Wilks' Lambda=.35, $F(1, 53)=98.73$, $p < .001$, partial eta squared=.65, indicating that in at least one condition, a significant reduction in psychological inflexibility/avoidance scores was detected. A main effect for condition, was not significant, $F(1, 64.16)=.92$, $p=.34$.

In support of Hypothesis 2, a significant reduction in psychological inflexibility/avoidance scores was reported in the intervention group from baseline (*M*=22.11, *SD*=8.24), to post-intervention (*M*=14.36, *SD*=4.70), *t*(35)=7.32, *p*<.001, two-tailed, eta squared=.37, implying a large effect size (see Figure 3). A significant reduction in scores was also observed in the control group from baseline (*M*=25.00, *SD*=8.37) to post-control task (*M*=14.68, *SD*=4.62), *t*(18)=6.99, *p*=< .001, two-tailed, eta squared 1.58.

As such, exposure to the defusion condition resulted in significantly lower levels of psychological inflexibility/avoidance i.e. higher levels of psychological flexibility/acceptance. Interestingly, this effect was also observed in the control condition. As no significant difference was detected between the two conditions in terms of the observed reductions, it appears that exposure to both conditions were equally as effective in terms of reducing psychological inflexibility/avoidance.

Hypothesis 3: As stated previously, trait anxiety was recorded on one measurement occasion only; at the beginning of the control/experimental sessions. The purpose of this was to test hypothesis 3 which held that there would be a positive relationship between trait anxiety levels and baseline levels of psychological inflexibility/avoidance. The prediction was tested using a Pearson r which yielded a strong, positive correlation between the two variables. Indeed, a significant relationship was observed between higher levels of psychological inflexibility/avoidance and higher levels of trait anxiety, *r*=.80, *n*=55, *p* < .001.

While no formal hypothesis was tested regarding a potential relationship between math-related anxiety and state anxiety change across time, we harnessed the opportunity to explore such an effect.

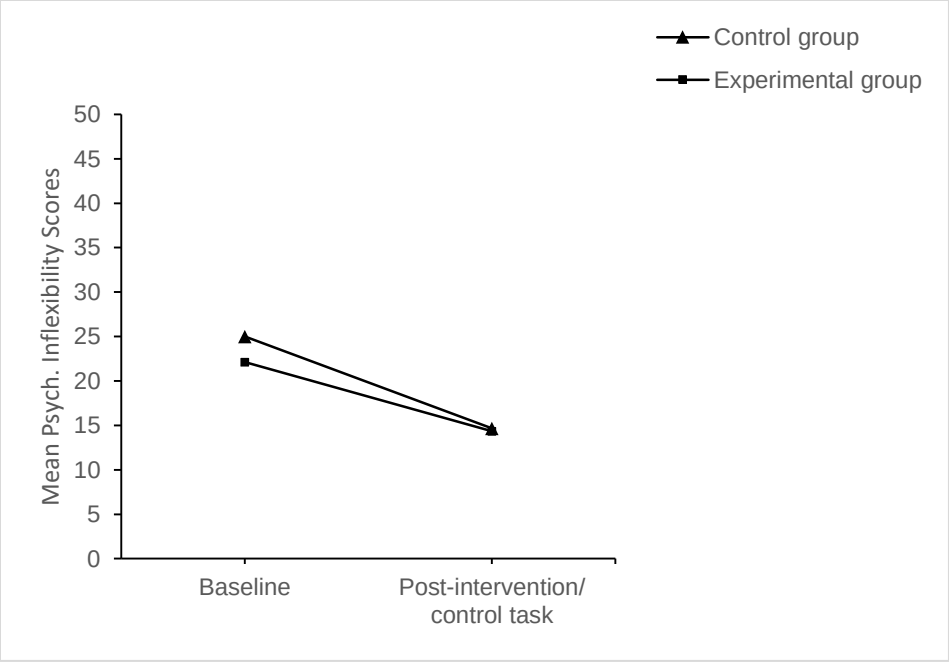

Figure 3. Experiment 1: Mean Psychological Inflexibility Scores for both Groups across Time

Thus, we examined the role of math-related anxiety as a potential moderator of state anxiety change to assess whether the changes to state anxiety across time (i.e. the reductions reported across both groups) were perhaps moderated by math-related anxiety. A partial correlation was performed to examine the relationship between state anxiety scores measured at baseline and post-intervention/control task, whilst controlling for math-related anxiety as a co-variate. Prior to statistically controlling for the effect of math-related anxiety, a strong positive correlation was yielded between the state anxiety scores at pre- to post-intervention, r=.66, n=33, p<.001. After controlling for math-related anxiety however, analyses of the zero order correlation (r=.58) indicated a minimal effect of math-related anxiety in terms of moderating the strength of this relationship. The same analysis was conducted with the control group's scores

which outputted similar results; a strong positive correlation was observed between state anxiety measured pre- and post-control task, r=.83, n=17, p<.001. The zero order correlation in this case rendered little to no effect of math-related anxiety on this relationship, r=.83, n=16, p<.001. In sum, we concluded that math anxiety did not moderate the relationship between state anxiety scores measured pre and post exposure to the intervention/control task.

Finally, a partial correlation was conducted to examine whether trait anxiety moderated the relationship between state anxiety levels measured pre and post exposure to the intervention and control task. In the intervention group, a strong positively correlation was yielded between the state anxiety scores measured across the two occasions, r=26, n=32, p=.14. After controlling for the effect of trait anxiety on this relationship, a non-significant relationship was observed between the state anxiety scores across the experimental session, implying that trait anxiety did in fact moderate changes in state anxiety r=.66, n=33, p<.001.

Similar findings were observed for the control group; prior to controlling for the effect of trait anxiety, a strong positive relationship was yielded between the two state anxiety scores, r=.44, n=16, p=.07. However, after controlling for trait anxiety, a non-significant relation was rendered, r=.83, n=17, p<.001, indicating that trait anxiety had a significant moderating effect on the strength of relationship between state anxiety scores measured pre and post the control task.

To summarize, in line with our first prediction, participants in the intervention group displayed significant reductions in state anxiety levels from pre- to post-intervention. Participants in the control condition also reported significant reductions in state anxiety from pre- to post-control, however, participants in the defusion condition reported statistically greater reductions in state anxiety levels than those in the control condition. Secondly, we hypothesized that

participants in the defusion condition would report a significant reduction in psychological inflexibility/avoidance scores from pre- to post-intervention. This prediction was also supported. Interestingly, the control group also displayed a significant reduction in mean state anxiety scores and psychological inflexibility/avoidance scores from pre- to post-control task. Furthermore the groups did not differ in terms of the reductions to psychological inflexibility/avoidance scores suggesting that both conditions appeared to impact psychological inflexibility/avoidance to same extent, statistically.

Consistent with our third prediction, for both groups, a strong positive correlation was yielded between mean psychological inflexibility scores and mean trait anxiety scores. While no tentative prediction was drawn relative to math anxiety as a moderator of state anxiety change across the session, we nonetheless explored this issue as a potential confounding variable. Indeed, math anxiety was not found to moderate levels of state anxiety measured pre and post exposure to the control task, or defusion exercise. Lastly, trait anxiety was indeed found to moderate the relationship between state anxiety measured pre and post exposure to the control task and defusion exercise.

Experiment 1: Discussion

An important feature of the present study was the experimental inducement of distress which as achieved using a time-based math task which was paired with a deceptive statement regarding a previous cohort's performance on the task. According to behavioural researchers Hooper and McHugh (2013), experimentally inducing negative states involves "exposing participants to an unsolvable task, or an uncontrollable relationship between an action and its outcome" (Hooper et al., 2013, p. 1; Teasdale & Fogarty, 1979). Although the math task cannot be classified as a learned helpless task per se (such that it was comprised of math problems derived from previous Standard Aptitude Tests (SATs), which are similar to the those on the Irish Leaving Certificate math papers, so may be therefore be achievable to some degree), pilot tests indicated that the task could not be completed in 7 minutes, hence the this time limit was applied.

While no formal hypothesis was employed to test the efficacy of the math task, a statistically significant increase in state anxiety scores was observed within both groups (control and intervention group), immediately following exposure to the math task. The signtificant increase in distress levels (indicated by sudden increases in state anxiety) suggests that the math task was responsible for the statistical increase in scores observed. Interestingly, analyses of these effects at a gender level rendered differential findings for males and females within and across both participant groups. Contrary to the group-level findings, the male participants in both participant groups (control and intervention) did *not* report a significant increase in state anxiety following exposure to the task. The female participants in both conditions however, did report a significant increase in state anxiety following the math task, suggesting that the task was

effective for the female participants only. This finding suggests that the method used to induce distress within the sample was limited in terms of effects across both genders.

Previous ACT researchers have also noted the limitations associated with certain types of experimental stimuli aimed at inducing anxiety (Pilecki et al., 2012) and have called for further research into various types of distress evoking stimuli that may be used in defusion-based experiments. As such, there is strong evidence the math task employed in the present research impacted upon state anxiety levels for both participant groups, however this result was likely skewed by the effects observed for females. Nonetheless, this finding may serve as a contribution to discussions surrounding effective distress invoking stimuli suitable for use within university student populations.

Given that the distress inducing task employed in this study was math-based, it was important assess whether math-related anxiety may have moderated changes in state anxiety across the experimental period. Indeed, math anxiety has been documented as a highly prevalent and pervasive phenomenon in university students (Abo Hamanza et al., 2013; Niss, 2012; Wilder, 2012; Zettle, 2003), hence the exploration of this relationship was important. In order to examine whether math-related anxiety may have moderated the observed changes in state anxiety within the two conditions, a partial correlation was performed which indicated a minimal effect of math anxiety in terms of moderating the strength of the relationship between state anxiety scores, within both participant groups. Thus, we were able to conclude with relative confidence that math-related anxiety did not moderate the relationship between state anxiety measures pre and post exposure to the control task or defusion exercise.

Hypothesis 1: As per hypothesis 1, we tested whether the peaked levels of state anxiety observed following the math task were subject to significant change following exposure to the

defusion intervention that immediately followed, such that levels of state anxiety would reduce significantly from pre to post the intervention. In support of this prediction, the intervention group reported a significant reduction in state anxiety levels at post-intervention, suggesting that the defusion exercise may have been responsible for the observed reduction in scores. Furthermore, a significantly larger reduction in state anxiety was observed post-defusion compared to levels recorded post-control task.

This result is not consistent with the findings reported by Hoffman et al. (2009) who did not observe any significant difference in state anxiety post-defusion (which was measured using the same scale used in the present research; the STAI Form Y-1, Spielberger et al., 1983). The acceptance/defusion exercise employed by Hoffman et al. (2009) examined a different defusion analogue however; the *Leaves on a Stream* exercise. Although a direct comparison of the defusion analogue utilized by Hoffman et al. (2009) compared to the one examined here cannot be made due to the procedural differences between the analogues, Assaz et al. (in press) suggest that both of these exercises may involve similar learning processes. As noted previously, the authors propose that both of these analogues may involve the introduction of a contextual cue which may serve to prompt individuals to view distressful thoughts at a *distance* from themselves.

The introduction of such a cue may be explained by AARR processes that result from previously reinforced exemplars of *more*; involving a higher quantity, and *less*; involving a lesser quantity, which are learned historically via comparison-based relations. In this way, the introduction of a contextual cue provided by the *Hands as Thought* metaphor may be have served to change or disrupt in the relational context that previously supported the distress-eliciting function of verbal processes that occasioned the pre-intervention anxiety levels.

In addition to the effects observed here, previous research has also reported positive outcomes following self-distanced perspectives on the emotional distress (Kross et al., 2008). In order to examine whether the same reductions in state anxiety were consistent for male and female participants alike, a mixed between-within-subjects ANOVA was conducted which revealed a significant time × gender interaction effect. Post-hoc analyses indicating that both the male and female participants experienced a significant reduction in state anxiety levels from pre- to post-defusion, however a significantly greater reduction in anxiety was observed for the female participants. However, due to the greater ratio of female (n=23) to male participants (n=13), implications surrounding the superior impact of the intervention on females' state anxiety levels are limited due to the unequal gender balance within the group.

Notably, participants in the control group also reported a significant reduction in state anxiety scores from pre-control task (M=46.47, SD=12.62), to post-control task (M=41.74, SD=12.23) suggesting that exposure to the distraction-based control task may have been responsible for the reduction in scores. As such, the female participants reported a significant reduction in state anxiety from pre- to post-control task, however the male participants did not report this effect, thus, the reduction in state anxiety scores observed at group level was skewed by scores pertaining to the female participants.

Functionally speaking, it is possible that the control task may have facilitated an opportunity for participants to engage in experiential avoidance from their previously reported negative states. If this were the case, it may be argued that engagement in experiential avoidance (e.g. *distraction*, prompted by the instruction to read the short stories) led to the reduced levels of state anxiety. Experiential avoidance is common method of mental control (Wenzlaff & Wegner, 2000) and can be characterized as a subjective intention to alter, eliminate or avoid the form,

frequency or context of unpleasant private events e.g. thoughts, emotions, bodily sensations (Hayes, Wilson, Gifford, Follette & Strosahl, 1996).

While the short-term effects of avoidant behaviour may be perceived as favorable in terms of escaping experiences of negative private events, research indicates the impact of avoidant responding can lead to an increase the frequency of the avoided thought overtime (Deacon, Fawzy, Lickel, & WolitzkyTaylor, 2011; Gold & Wegner, 1995; Hooper, Saunders, & McHugh, 2010). In any case, distraction from the distressful thoughts facilitated by the control task may be seen as a form of negative reinforcement which may go some way to explain its popularity as a coping strategy among humans (Hayes et al., 2004). This effect might also explain why control based strategies that involve distraction/escape from anxiety invoking stimuli can lead to reduction in self-reported anxiety following distress, as reported in Pilecki et al.'s (2012) research.

It is also possible that the reduction in state anxiety following the control task may have resulted from the same processes of contextual change facilitated by the aforementioned distancing cue. In other words, distraction from negative emotional states may have enabled a change in the functional context of distressful verbal context resulting from the introduction of distance-related cues that may have led to a reduction in the functional control of distressful thoughts. Indeed this chain of processes may also explain why previous research has reported significant reductions in emotional distress (using VAS measures of discomfort and believability) associated with negative self-statements following the application of distraction-based strategies (e.g. Masuda et al., 2004). Although distraction is often classified in the behavioural literature as a form of experiential avoidance comprising maladaptive behaviour, the

findings yielded in this research in addition to those reported by Masuda et al (2004) appear to support distraction in terms of reducing emotional distress.

Arguably, the control task employed in Experiment 1, which may have facilitated distraction, represents a limitation of Experiment 1 in terms of its efficacy as a *true* control. Indeed he control task was not designed specifically as distraction condition, thus conclusions surrounding its utility are limited. While this issue did not impact the results pertaining to the intervention condition, it did serve to inform the design of a revised control condition Experiment 2 of this research.

Notably, participants in the defusion condition experienced a significantly greater reduction in state anxiety scores compared to participants in the control group. This finding suggest some superiority of cognitive defusion over the control task examined. Although the results of this experiment may be confounded by the differential impact of defusion across the two genders, they appear to compound with those reported by Masuda et al. (2012) who too found support for cognitive defusion as superior to a similar distraction-based control condition, which also involved reading arbitrary reading material for a brief period of time. While Masuda et al.'s (2012) research did not examine anxious arousal, participants reported significant reductions in emotional distress, indicated by reductions in self-report ratings of believability and discomfort of negative self-referential thoughts.

Hypothesis 2: We predicted that participants in the intervention condition would report a significant reduction in self-report levels of psychological inflexibility/avoidance scores from baseline to post-intervention. In support of our hypothesis, a 2 × 2 mixed between-within subjects ANOVA detected a large main effect for time, such that a significant reduction in AAQ-II scores was observed from baseline (M=22.11, SD=8.24), to post-defusion (M=14.36,

SD=4.70). Iinterestingly, a similar reduction in scores was also observed in the control condition from baseline (*M*=25.00, *SD*=8.37) to post exposure to the control task (*M*=14.68, *SD*=4.62). Due to the significant decrease in psychological inflexibility/avoidance scores in the intervention condition, hypothesis 2 was thus supported.

At a group level, this finding suggests that exposure to both conditions decreased levels experiential avoidance, and therefore increased levels of acceptance of undesirable psychological content. Gender level analyses revealed that both male and female participants experienced a reduction in AAQ-II scores post-defusion. However, a differential effect of the control task on AAQ-II scores was observed between male and females in the control group. Specifically, the significant reduction in AAQ-II scores applied to female participants only; the male participants in the control group did not report a significant reduction in psychological inflexibility/avoidance scores. In sum, exposure to the defusion intervention appeared to impact both male and female participants to the same extent, in terms of reducing psychological inflexibility/avoidance scores.

Surprisingly, no research could be sourced providing gender level analyses of cognitive defusion impact however the present research may thus inform this research gap in some way. Although our analyses reveal that exposure to the cognitive defusion intervention was effective for both male and female participants in terms of statistically reducing levels of psychological inflexibility/avoidance, it was out of the scope of this study to examine whether the aforementioned effect was maintained at follow-up periods, which represents a limitation of this study.

A possible explanation for the significant reduction in experiential avoidance levels may be explained as a function of effects of prolonged exposure to distress-related stimuli (the self-referential statements). Indeed previous behavioural research has reported a wealth of positive

outcomes for the impact of systematic desensitization as treatment for anxiety related disorders (Foa & Kozak, 1986; Watson, Gained & Marks, 1971). Notably, the defusion exercise examined here requested participant to attend to the verbal self-referents (represented by their hands) for 3.5 minutes, which promoted extended contact with the distressful verbal content. Such an effect may have served as means of extinguishing avoidance responding such that the distress-elicited functions of the self-statements diminished in terms of their functional strength.

In addition it is possible that automatic reinforcement may have been a consequence of adherence/participation in the defusion exercise, which could have served to reinforce approach-related behaviour as an alternative to experiential avoidance (i.e. DRA) which may have weaken the functional control of the distressful thought to be avoided. It should be noted however that not all of the self-statements disclosed by the intervention group participants reflected 'negative' emotional states, thus it is difficult to quantify whether the self-referential statements were distressful in and of themselves. The question item posed to participants however was purposively phrased in a non-directional manner in an effort minimize the potential for demand characteristics which may have confounded the self-report responses provided across the experimental sessions. As such, the measurement of implicit processes was out of the scope of this experiment, thus, we can only assume that participants exposed to the defusion condition engaged with the emotional stimuli that they identified during the session

We were also interested to know whether there was an association between baseline measures of psychological inflexibility/experiential avoidance and levels of trait anxiety, which was measured at the beginning of the control and experimental sessions. The results of a meta-analyses of correlational studies (Karekla, Forsyth & Kelly, 2004; Stewart, Zvolnesky1 & Eifert, 2002; Strosahl, Hayes, Bergan & Romano, 1998) by Hayes and colleagues (2006) indicated that

the AAQ was significantly related to three commonly used anxiety measures; The State Trait Anxiety Inventory (Spielberger, Gorsuch, Luschene, Vagg, & Jacobs, 1983), the Beck Anxiety Inventory, (Beck and Steer, 1993), and the Anxiety Sensitivity Index, (Reiss, Peterson, Gursky and MacNally, 1986). In a bid to contribute to knowledge in the area, we explored whether there would be a positive correlation between levels of trait anxiety and baseline levels of psychological inflexibility/avoidance scores recorded for both participant groups. A Pearson r was conducted which yielded a strong, positive correlation between mean psychological inflexibility scores and mean trait anxiety scores.

Lastly, we explored whether levels of trait anxiety moderated the relationship between changes in state anxiety measured pre- and post-intervention. Prior to controlling for the effect of trait anxiety, a positive correlation was observed between state anxiety scores measured pre- and post-intervention, and pre- and post-control task. After controlling for the effect of trait anxiety however, the relationships observed were not significant, indicating that trait anxiety indeed moderated the change in state anxiety levels within both groups.

In summary, the results of Experiment 1 indicate that exposure to the *Hands as Thoughts* defusion exercise (Harris, 2009) resulted in significantly reduced levels of state anxiety and psychological inflexibility/avoidance for both male and female participants, and may thus show promise as an effective treatment for task-related anxiety in college students. Furthermore, the findings derived from the control condition suggest engagement in a distraction-based strategy (reading short stories for 3.5 minutes) following a distressful event may also lead to significant reductions in anxious arousal and reduced levels of experiential avoidance, but may be limited in terms of its utility for female college students. As the distraction-based task did not lead to reductions in state anxiety or psychological inflexibility/avoidance for male participants, the

distraction-based strategy examined may not be effective for male college students. These results raise questions as to the differential impact of distraction strategies on male and female participants, and represent an interesting line of enquiry for future research in the area.

Experiment 2: Introduction

In an effort to further explore processes of psychological change present within a sample of college students, Experiment 2 had two main aims; 1) to replicate the experimental analyses of the of the same defusion strategy examined in Experiment 1 (Harris, 2009) on levels of state anxiety and psychological inflexibility/avoidance, and 2) to examine whether participants exposed to the defusion condition would report a reduction in pre- to post-intervention ratings of discomfort and believability, and higher pre- to post-intervention ratings of willingness to engage with the self-statement disclosed following the math task. The employment of these additional dependent measures (discomfort, believability and willingness to engage scales) enabled advanced assessment of the effects of the defusion intervention on processes of change present across the experimental session. As discussed previously defusion methods are posited to lead to a reduction in the literality of verbal stimuli that functionally control emotional distress. Thus, it is posited successful defusion will result in an increase in psychological flexibility/acceptance of induced distressful states which may in turn result in a weakening of the functions that underlie such states.

Further to the addition of the new measures, a number of variables measured in Experiment 1 were omitted from examination in Experiment 2. First, the measurement of math-related anxiety (indexed using the Math Anxiety Rating Scale-Brief (Suinn and Richardson, 1972), was omitted in Experiment 2 because the results of Experiment 1 indicated that math-related anxiety did not moderate changes in state anxiety in either condition. Likewise, the measurement of trait anxiety was also omitted in Experiment 2. As hypothesized, trait anxiety was found to correlate with baseline levels of psychological inflexibility/avoidance scores in Experiment 1. Further analysis of this effect was not conducted due to procedural time

constraints because the addition of the new measures in Experiment 2 extended the duration of the experimental session so in a bid to minimize attrition rates during the session, it was decided to omit the measurement of trait anxiety.

Experiment 1 indicated that participants exposed to the distraction-based control task in place of the defusion intervention reported significantly lower levels of state anxiety and psychological inflexibility/avoidance from pre to post exposure to the control task. As discussed in Chapter 2, it may be argued that the control task (reading short stories) facilitated experiential avoidance in the form of distraction from the negative emotional states (elevated state anxiety) reported by participants following the math task. Importantly, the aim of employing a control condition in Experiment 1 was to provide a baseline of responding to the distress inducing task, upon which to compare and evaluate the findings derived from the intervention condition. As such, prompting participants to engage in a distraction-based task as a consequence to distress (as opposed to a more naturalistic contingency such as measuring the typical coping strategies employed by participants in response to distress), represented a procedural shortcoming of Experiment 1. In response, a revised control task was implemented which was adapted from experimental research by Pilecki et al. (2012). Similar to the present research, the study by Pilecki et al. (2012) compared the impact of three conditions; cognitive defusion, thought suppression and a control condition, on experimentally induced negative emotional states. As such, participants in the defusion and thought control conditions were provided with instructions pertaining to each strategy, while participants in the *control* condition were asked to employ a coping strategy that they would typically use to manage distressful private events. In the current study, participants in the control group were provided with a similar instruction which is described further in this chapter; the aim of which was to minimize the potential that control

group participants may employ a defusion based strategy, which would have confounded the internal validity of our findings and threatened the integrity of the research design.

Finally, in Experiment 1 the defusion instruction was delivered by the experimenter who read from a script. In experiment 2 we attempted to further control for confounding variables such as experimenter effects such that the experimenter's delivery of the instruction may impact participants' behaviour (Robson & McCartan, 2011). Thus, in the present experiment, the defusion instruction was delivered using a pre-recorded mp4 file which was played from a mobile phone via an external audio speaker.

Experiment 2: Methodology

Design

Experiment 2 employed a 2 × 2 factorial design to examine the impact of the *same* cognitive defusion exercise on self-report measures of state anxiety and psychological inflexibility/avoidance and ratings of discomfort, believability and willingness to engage with negative private events (resulting from induced distress).

As in Experiment 1, the independent variables under examination were time (pre-intervention/control task and post-intervention/control task) and condition (control and intervention). The dependent variables comprised of state anxiety and psychological inflexibility/avoidance, ratings of Discomfort, Believability and Willingness to engage with negative emotions. Similar to Experiment 1, a control group was once again employed for comparative purposes to investigate variations in scores recorded on the dependent measures.

Participants and Settings

A non-clincial, mixed-gender sample of 35 college students (N=35), aged between 18 and 65 years were recruited, using a convenience sampling method. Participation in the study was entirely voluntary. The control group (n=16) comprised of 7 males and 9 females and the intervention group (n=19) comprised of 12 males and 7 females. None of participants in Experiment 2 had participated in Experiment 1.

Participants were recruited in two ways: 1) via a ‘Post-graduate Participant Pool’ that consisted of a list students who had previously signed up to be invited to partake in a psychology study in their university, and 2) via face-to-face canvasing which took place on the university campus; students were approached on campus and invited to be contacted about taking part in

the psychology study. All interested students were contacted via email or phone with information about the research study and details regarding the testing location.

All aspects of the experimentation/data collection took place in a Psychology Laboratory within the Department of Psychology at Maynooth University. The laboratory was organized with 15 chairs with adjoining desks that were spaced approximately 3 feet apart. Due to constraints related to participants college schedules, it was not possible to conduct the control and experimental group sessions at the same time of day, thus sessions were conducted at various times of the day, and on various days of the week.

Inclusion criteria.

Participants aged between 18 and 65 years

Participants who, by their own judgement, have a good ability to speak, comprehend, and write in the English language, i.e. participants must self-identify regarding their language competencies.

Participants who are registered students of Maynooth University

Exclusion criteria.

Participants under the age of 18

Participants who do not have good ability to speak, comprehend, and write in the English language

Participants who are not registered undergraduate psychology students studying at NUIM

Participants with a clinically diagnosed mental health issue

Ethical Considerations.

The ethical considerations pertaining to Experiment 2 were identical to those of Experiment 1. For a detailed review, see the Ethical Considerations section on page 32.

Materials

Regardless of session type (control or intervention), on entering the laboratory, each participant was provided with an almost identical paper-based booklet containing all of the materials required for the session. The booklet contained an Information Sheet (see Appendix A), a consent form (see Appendix B), the State Trait Anxiety Inventory Form Y-1 and Y-2 (STAI Form Y-1 and Y-2, Spielberger et al., 1983; see Appendix C and D), the Acceptance and Action Questionnaire-II (AAQ-II, Bond et al., 2011; see Appendix E), the Math Task (see Appendix F), a single Self-Statement Question (see Appendix G), a *second* copy of the STAI Form Y-1 (state anxiety measure, Spielberger et al., 1983; see Appendix C), a document entitled 'Reading Task' which contained a list of short stories (see Appendix H; this document was only included in booklets administered to the control group), a *third* copy of the STAI Form Y-1 (state anxiety measure, Spielberger et al., 1983; see Appendix C), a *second* copy of the AAQ-II (Bond et al., 2011; see Appendix E), and Debrief Sheet (see Appendix J).

Visual Analogue Scales.

Three Visual Analogue Scales (see Appendix M) were used to measure self-report ratings of believability, discomfort, and willingness to engage in the thought/emotion generated in response to the Self-statement question. A Visual analogue scale is a self-report measure that comprises of a single horizontal line, with fixed interval ratio marks positioned on both ends of the line. The scale ranges from 0 to 100, which is represented by a single black line. Participants are instructed to place an X at some point along the scale to indicate the extent to which they a)

believe the thought in question (in the measurement of *believability*), b) the extent to which they feel *uncomfortable* when they engage with the thought (in the measurement of *discomfort*), and c) the extent to which they are willing to engage with the thought (in the measurement of willingness to engage). Visual analogue scales have been employed in a variety of peer-reviewed behavioural research, much of which is experimental research (e.g. Foody, Barnes-Holmes & Barnes-Holmes, 2012; Keogh, Barnes-Holmes, Barnes-Holmes, Luciano, Bond & Foody, 2014; Parling, Cernvall, Stewart, Barnes-Holmes & Ghaderi, 2012)

Stopwatch.

A 'Precision Training 1500 Series' stopwatch was used to time the math task

Audio Speaker.

A 'Big Blue Unplugged Wireless Indoor-Outdoor Bluetooth Speaker' was used to deliver the control task and the defusion intervention instructions, played from mp4 files from an iPhone 6S Plus mobile phone device.

Procedure

Experiment 2 employed a similar procedure to that of Experiment 1, with the exception of three elements; a) both the control task and the defusion intervention were delivered in audio format (from an audio speaker) via a pre-recorded mp4 file; b) three new dependent measures of Discomfort, Believably and Willingness to engage with the self-statements generated following the math task, were implemented; and c) a revised control task was employed. As was the case in Experiment 1, participants in both conditions were exposed to an identical set of procedures (see Figure 4), bar one element; participants in the control group were exposed to a control task in place of the defusion intervention.

On entering the laboratory, each participant was administered a paper-based booklet of materials required for the session (see Materials section of this chapter for a description of the materials that comprised the booklet). Participants were requested to read the Information Sheet (see Appendix A) and were offered the opportunity to ask questions. The experimenter briefed participants verbally about their rights as research participants and subsequently requested them to sign the Consent Form (see Appendix B) if they were willing to participate in the research.

On obtaining informed consent, participants were asked to complete the two questionnaires presented on the following two pages (the STAI Form Y-1, Spielberger 1983; and the AAQ-II, Bond et al., 2011). Following this, participants were requested turn to the next material presented in their booklets; the Math Task (see Appendix F). Before beginning the Math Task, the experimenter informed the group that a previous cohort had completed the Math Task within 7 minutes, without the use of calculators and scored an average of 83% correct on the test. As in Experiment 1, this statement was deceptive and was employed with the intention of experimentally inducing distress. The researcher used a stopwatch to time the task.

Following the time-sensitive Math Task, participants were asked to answer the question presented on the next page of their booklets; this question was the same self-statement question employed in Experiment 1, which read, 'Having completed the math task I feel _____' (see Appendix G). As in Experiment 1, the self-referential statement served as the verbal content to be used in the defusion intervention that was to follow. The self-statement was also recorded in the control condition for descriptive statistics purposes only (see Table 5 for a review of participant responses to the self-statement questions). Next, participants were asked to complete the three questionnaires presented on the following three pages of their booklets; the STAI Form-Y1 (Spielberger 1983) the AAQ-II (Bond et al., 2004) and the Visual Analogue Scale measures

of Discomfort, Believability, and Willingness to engage in the self-referential statements disclosed following the math task. Despite the type of session that was being conducted, (i.e. a control condition *or* intervention condition) participants in either condition were exposed to the same set of procedures up to this point. In an intervention condition session, however, the intervention group was exposed to the cognitive defusion intervention; in a control condition, the control group was exposed to a control task

Control Task: The control task instruction (see Appendix L) was delivered audibly using a pre-recorded instruction which was played to the group. The instruction (see Appendix L) requested participants to focus on their response to the self-statement question, from earlier. They were then asked to think about the strategies they typically employ when managing negative thoughts and feelings in everyday life. Participants were then asked to take 1 minute to apply the strategy in question, to the self-statement response (see Appendix P for a list of the coping strategies employed by the control group). The entire control task was delivered audibly and lasted for 2 minutes, 11 seconds.

Defusion Intervention: As with the Control Task, the defusion intervention was also delivered audibly, and lasted for a similar duration as the control task; 2 minutes 36 seconds (see Appendix K for a review of the script in the defusion recording). Participants were asked to focus their attention on their response to the self-statement that they had written down in their booklets following the math task. They were then asked to apply the defusion instructions to the self-statement response, while the experimenter modeled the actions involved in the exercise.

On completion of the defusion exercise *or* control task, participants were asked to complete the following three questionnaires presented on the following three pages of their booklets; the third and final presentation of STAI Form Y-1 (Spielberger et al., 1983), the second

presentation and final presentation of the AAQ-II (Bond et al., 2011), and the second and final presentation of the VAS scales. As in Experiment 1, the 20 items that comprise the STAI Form Y-1 questionnaire were presented in a different order to that of the previous two occasions, in a bid to minimize the potential for practice effects. At the end of the session, participants were asked to submit a written description of the coping strategy that they used during the session (see Appendix N). Responses to this question were analyzed thematically in order to examine whether any control group participants had employed a defusion-based strategy in the control task (for a list of the coping strategies employed by the control group, see Appendix P). Finally, participants were thanked for their time, debriefed verbally and in writing (see Appendix J).

Control Group Procedure	Intervention Group Procedure
• Briefing/introduction • Informed Consent • Baseline State Anxiety • Baseline Psychological Inflexibility/Avoidance	• Briefing/introduction • Informed Consent • Baseline State anxiety • Baseline Psychological Inflexibility/Avoidance
Math Task	Math Task
• Self-statement • Pre-control task State Anxiety • Pre-control task Discomfort, Believability and Willingness ratings	• Self-statement • Pre-intervention State Anxiety • Pre-intervention Discomfort, Believability and Willingness ratings
Control task	Defusion intervention
• Post-control task State Anxiety • Post-control task Psychological Inflexibility/Avoidance • Post-control task Discomfort, Believability and Willingness ratings • Description of coping strategy employed in control task • Debrief	• Post-intervention State Anxiety • Post-intervention Psychological Inflexibility/Avoidance • Post-intervention task Discomfort, Believability and Willingness ratings • Debrief

Figure 4. Experiment 2: Visual Representation of Experimental Procedure across Groups

Experiment 2: Results

Preliminary analyses

Preliminary analyses were conducted in advance of each statistical test in order to screen for violation of assumptions. No violation of assumptions were identified. Table 2 presents the means and standard deviations for each of the variables measured across the control and intervention sessions. In line with state anxiety norms for college students (which range from 36.47 to 38.76; Spielberger, 1983), moderate levels of state anxiety were observed at baseline across both participant groups (control condition: M=35.53, SD=8.51; intervention condition: M=37.98, SD=9.12).

To assess whether exposure to the math task successfully induced anxious arousal, a series of paired samples t-tests were performed. Participants in the intervention condition displayed a significant increase in state anxiety scores from baseline (M=35.53, SD=8.51) to pre-intervention (M=40.95, SD=12.17), $t(18)$=-2.56, p=.02 (two-tailed), eta squared=.27, suggesting that exposure to the math task successfully induced distress for participants in the intervention condition. This effect was not observed for the control however.

To investigate the comparative impact of condition (control and intervention) on mean state anxiety scores measured pre and post exposure to the defusion intervention/control instruction, a 2 × 2 mixed ANOVA was conducted. A *time* × *group* interaction effect was not identified, Wilks' Lambda=.93, $F(1, 33)$=2.40, p=.13, partial eta squared=.07, hence there was no significant difference between state anxiety change across the two conditions.

Table 2

Experiment 2: Means and Standard Deviations for Psychological Measures Across Participant Groups

	Group	
	Control	Intervention
Measurement Variables		
Males	7	12
Females	9	7
N	16	19
	M (SD)	*M (SD)*
Baseline State Anxiety	35.53 (8.51)	37.98 (9.12)
Pre-intervention/control task State Anxiety	40.95 (12.17)	42.94 (11.14)
Post-intervention/control task State Anxiety	36.79 (13.87)	34.25 (7.76)
Baseline Psych. Inflexibility	19.31 (6.35)	20.79 (7.73)
Post-intervention/control task Psych. Inflexibility	18.44 (6.26)	20.47 (7.93)
Pre-intervention/control task Discomfort	51.80 (27.22)	40.63 (27.16)
Post-intervention/control task Discomfort	44.47 (22.69)	38.79 (29.87)
Pre-intervention/control task Believability	64.13 (24.49)	71.05 (18.86)
Post-intervention/control task Believability	61.33 (23.56)	67.63 (26.39)
Pre-intervention/control task Willingness to engage	50.67 (29.69)	57.26 (33.82)
Post-intervention/control task Willingness to engage	54.33 (25.97)	60.16 (31.31)

Note. *n*=Number of participants. *M*=Mean scores. *SD*=Standard deviations. Psych. Inflexibility=psychological inflexibility/avoidance scores.

Additionally, the main effect for *condition* was not significant $F(1, 33)=.01$, $p=.94$, partial eta squared=.001. A significant main effect for *time* was observed however, Wilks'

Lambda=.63, $F(1, 33)=19.32$, $p < .0001$, partial eta squared=.37, implying that there was a significant change in anxiety scores within at least one of two conditions (see Figure 5).

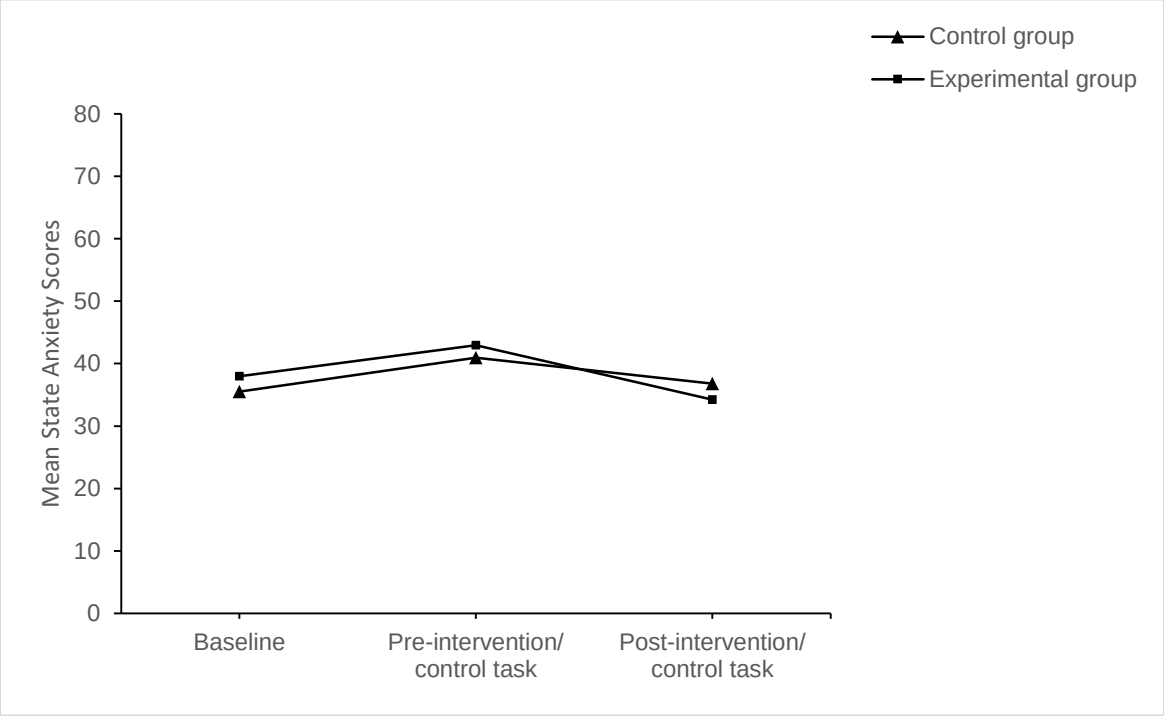

Figure 5. Experiment 2: Mean State Anxiety Scores for both Groups across Time

Hypothesis 1: It was hypothesized that participants in the intervention group would display a significant decrease in state anxiety scores from pre to post exposure to the defusion intervention. In support of this prediction, a significant decrease in scores was yielded from pre- (M=40.95, SD=12.17) to post-intervention (M=36.79, SD=13.87), $t(18)=2.11$, p=.049, two-tailed, eta squared=.20, suggesting that exposure to the defusion intervention may have been responsible for the reduction in scores. Outlier analyses rendered one extreme score at post-intervention (M=65.00) such that one participant's state anxiety scores (M=34.25) recorded at post-intervention fell outside the normal distribution of scores for the group, Removal of the participant's data set rendered similar results to those observed prior to omitting the data set in

question; as such, a greater significance value was observed following removal of the outliner data, $t(17)=2.28$, $p=..036$, eta squared=.10.

In the control condition, an increase in state anxiety scores was observed from time baseline ($M=37.98$, $SD=9.12$) to pre-control task ($M=42.94$, $SD=11.14$), $t(15)=2.09$, $p=.054$, however, this increase did not reach significance implying that exposure to the math task failed to significantly induce distress in the control group. Despite this limitation, a significant decrease in state anxiety was observed from pre-control task ($M=42.94$, $SD=11.14$) to post-control task ($M=34.25$, $SD=7.76$), $t(15)=4.02$, $p=.001$, eta squared=.53, suggesting that employment of the control instruction led to such decreases.

Hypothesis 2: In order to test hypothesis 2; that participants in the intervention condition would display a significant reduction in psychological inflexibility/avoidance scores from pre-intervention to post-intervention, a second 2 × 2 ANOVA was performed. While participants in the intervention condition reported a slight decrease in psychological inflexibility/avoidance scores across the two measurement occasions i.e. from baseline ($M=20.79$; $SD=7.72$) to post-intervention ($M=20.47$, $SD=7.93$), this reduction was not statistically significant.

The same effect was observed in the control condition; while a reduction in psychological inflexibility/avoidance scores was observed from baseline ($M=19.31$, $SD=6.35$), to post-control task ($M=18.44$, $SD=6.26$), the reduction was not statistically significant. Indeed, the main effect for *time*, Wilks Lambda=.96, $F(1,33)=1.32$, $p=.26$ and *condition* was not significant, $F(1,33)=.55$, $p=.47$. In sum, contrary to our prediction, exposure to the defusion intervention did not result in a significant reduction in mean psychological inflexibility/avoidance scores from pre- to post-intervention (see Figure 6).

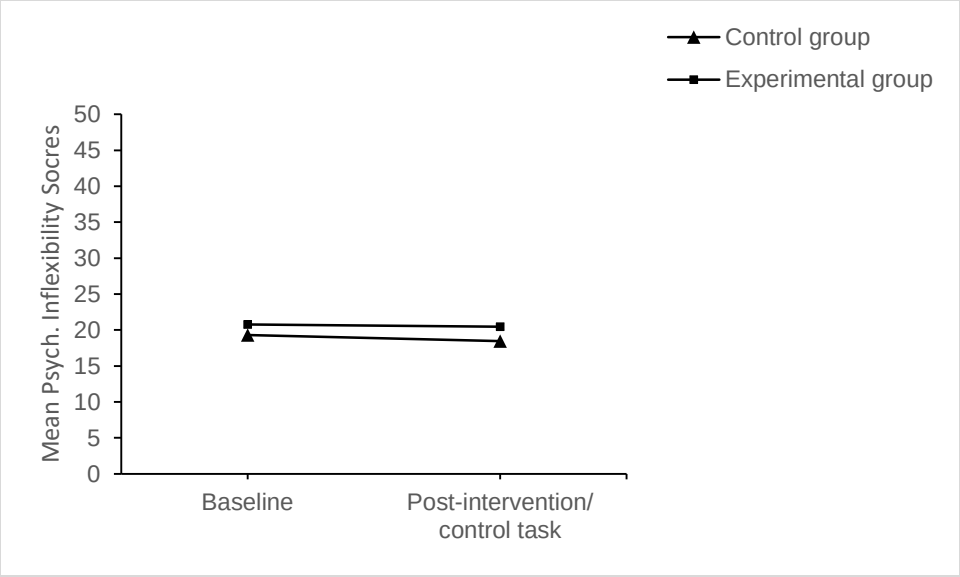

Figure 6. Experiment 2: Mean Psychological Inflexibility/Avoidance Scores for both Groups across Time

Hypothesis 3: Hypothesis 3 predicted that participants in the intervention condition would report a significant reduction in perceived *discomfort* pertaining to the verbal statements from pre- to post-intervention. Although mean group ratings of discomfort moved in the hypothesized direction (pre-intervention; *M*=40.63, *SD*=27.16 to post-intervention; *M*=38.79, *SD*=29.87), the reduction was not significant. The same effect was observed in the control group (pre-control task, *M*=51.80, *SD*=27.28 to post-control task; *M*=44.47, *SD*=22.69). Indeed, no main effect for time, Wilks' Lambda=.93, $F(1,32)=2.46$, $p=.13$ or group $F(1,32)=.90$, $p=.35$ was identified, implying that exposure to both the cognitive defusion and control condition led to slight reductions in discomfort, however, neither of these reductions were statistically significant (see Figure 7).

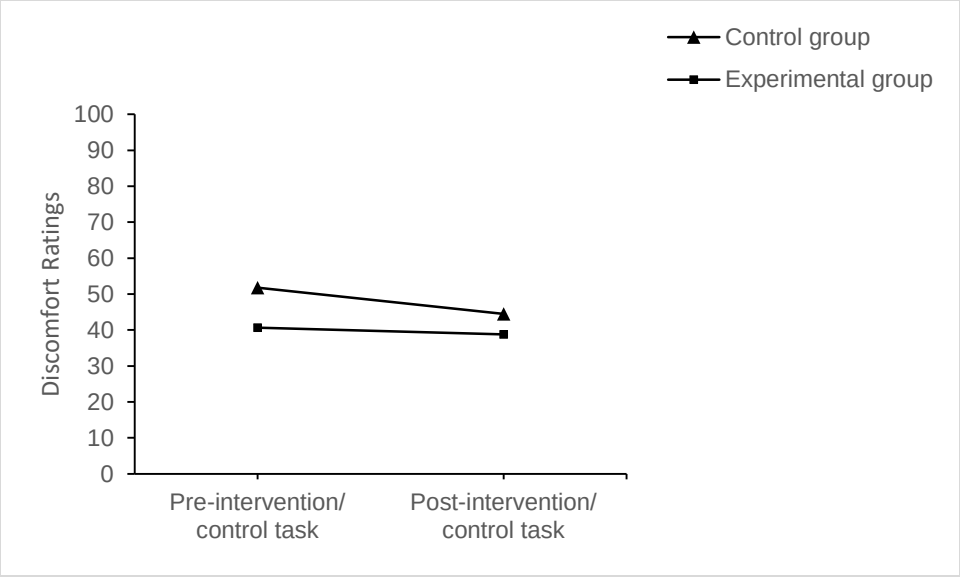

Figure 7. Experiment 2: Mean Discomfort Scores for both Groups across Time

Hypothesis 4: Hypothesis 4 held that participants in the intervention condition would report significantly reduced levels of *believability* of the self-referents disclosed from pre- to post-intervention. While a slight mean reduction in believability of the self-referents was observed (pre-intervention; *M*=71.05, *SD*=18.90 to post-intervention; *M*=67.63, *SD*=26.40), the reduction was not statistically significant, hence, hypothesis 4 was not supported (see Figure 8).

A similar effect was observed in the control condition such that a small but insignificant reduction in levels of believability was observed (pre-control task; *M*=64.13, *SD*=24.50 to post-control task; *M*=61.33, *SD*=23.60). In sum, the results of a 2 × 2 ANOVA did not detect a significant main effect for *time*, $F(1,33)=.78$, $p=.38$ or *group*, $F(1,32)=.82$, $p=.37$.

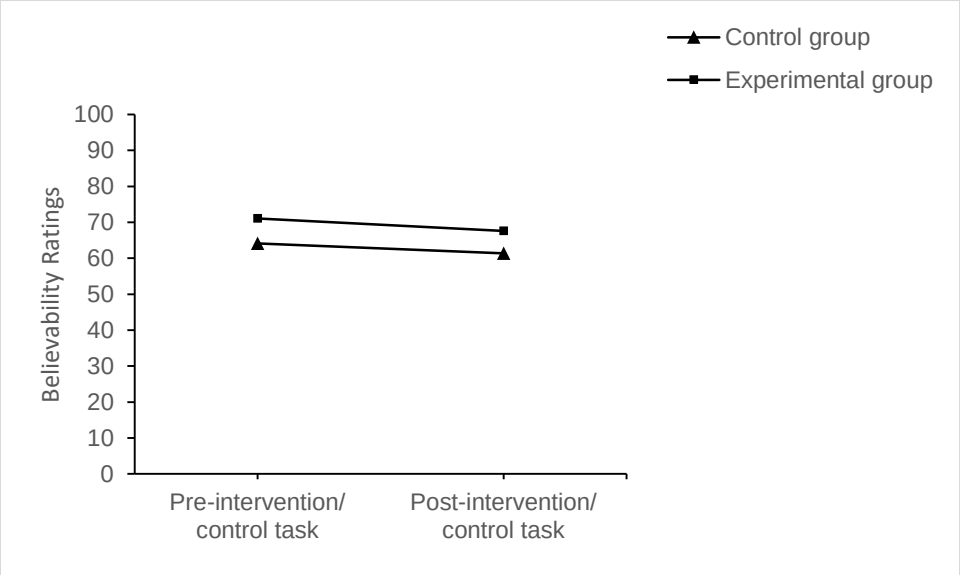

Figure 8. Experiment 2: Mean Believability Scores for both Groups across Time

Hypothesis 5: It was posited that participants in the intervention condition would report a significant increase in terms of their *willingness to engage* with the self-referents from pre- to post-intervention. While increases in ratings of willingness to engage were observed across time for both the intervention group (pre-intervention; *M*=57.26 , *SD*=33.82, to post-intervention; *M*=60.16, *SD*=31.31) and the control group (pre-control task; *M*=50.67, *SD*=29.69 to *M*=54.33, *SD*=25.97), the observed increases did not reach statistical significance. Indeed, a 2 × 2 ANOVA did not detect a main effect for time, Wilks' Lambda=.94, $F(1,32)=1.95$, $p=.17$, or a main effect for group, $F(1,32)=.36$, $p=.55$. In other word, these findings indicates that there was no significant difference between self-report ratings of willingness to engage with the self-referents across either of the conditions (see Figure 9).

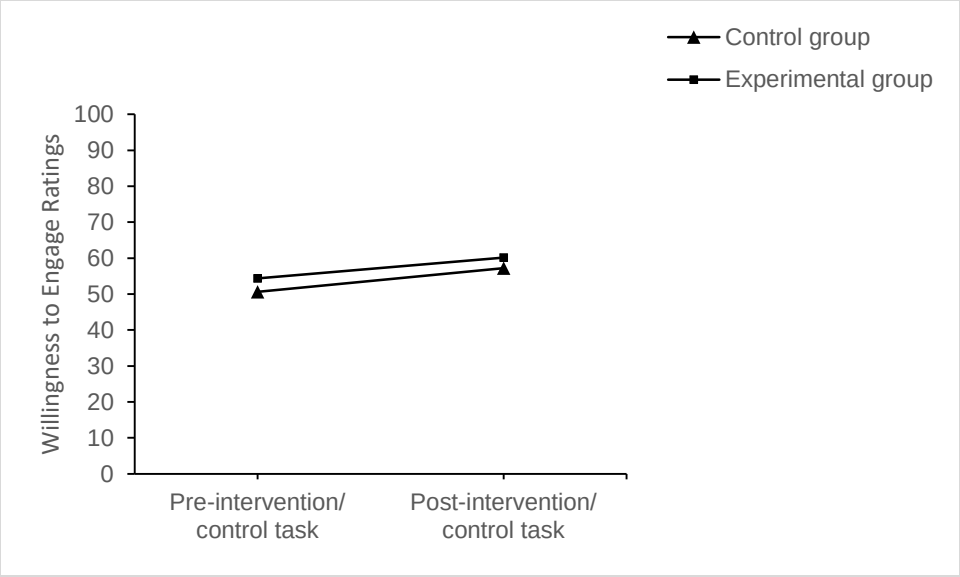

Figure 9. Mean Willingness to Engage Scores for both Groups across Time

In summary, as predicted, participants in the intervention condition reported statistically significant reductions in state anxiety from pre to post-intervention. Contrary to our predictions, significant reductions in psychological inflexibility/avoidance scores, discomfort, and believability were not observed. In addition, no difference was observed between willingness to engage ratings from pre- to post-intervention. Notably, though observed reductions did lean in the hypothesized direction, none reached statistical significance.

For the control group, a significant reduction in state anxiety was observed from pre- to post-control task, however no significant reduction in psychological inflexibility/avoidance scores was detected across the time. Furthermore, control group participants did not report significant differences with regard to ratings of the discomfort, believability or willingness to engage with the verbal statements.

General Discussion

The aim of Experiment 1 was to attempt to advance on current knowledge surrounding the processes through which cognitive defusion may or may not work, by examining the utility of a brief cognitive defusion intervention (Harris, 2009) on pre and post measures of state anxiety and psychological inflexibility/avoidance. In response to the research question employed in Experiment 1: "Does exposure to a brief cognitive defusion exercise effect levels of experimentally induced state anxiety and levels of psychological inflexibility/avoidance?", the results indicated that exposure to defusion intervention led to significant reductions in state anxiety and psychological inflexibility/avoidance. As discussed previously, the reductions observed across both measures suggest that the defusion exercise examined may have led to a weakening of the underlying function of emotional distress associated with the verbal self-referents, facilitated via contextual cues provided in the exercise. Specifically the Hands as Thoughts exercise may have signaled to participants that the distressful verbal-self referents are 'less threatening as a result of spatial distance between the participants and their thoughts. In addition, it could be argued that the defusion exercise facilitated prolonged exposure to distressful self-referential thoughts which may have extinguished avoidance responding and differentially reinforced (automatically) exposure as an alternative behaviour. Thus, as a result of prologue exposure, a weakening of the controlling functions of distressful thoughts may have occurred.

These findings of may contribute to the extant body of literature that supports the utility of cognitive defusion as an effective treatment for the reduction of emotional arousal. Furthermore, the findings derived from Experiment 1 suggest the potential in which exposure to

a brief cognitive defusion interventions may hold for the reduction of psychological avoidance in university students.

The reductions in state anxiety levels and psychological inflexibility/avoidance were not exclusive to the intervention condition however; significant reductions in state anxiety and psychological inflexibility/avoidance were also observed within the control condition. Although the control task employed in Experiment 1 was guided by the control task utilized by Masuda et al. (2004) it does not represent a validated distraction analogue, thus conclusions regarding the processes of change preset within the control condition are limited as a result. However, it is noteworthy that reductions in state anxiety and avoidance levels were observed after participants read short stories for 3.5 minutes and raises questions as to the behavioral processes that may have facilitated this effect. Research my Masuda et al. (2004) also reported a reduction in distress (indicated by reduction in discomfort and believability of self-referential thoughts) following a similar control task whereby participants were requested to read an article about Japan. As mentioned, engagement in such actives may facilitate a reduction in stimulus function via processes of negative reinforcement (escape from distressful emotional context). Alternatively, distraction facilitated by reading materials may also involve contextual cues that signal that verbal context are not threatening in the short-term, which may subsequently alter the functional control of the stimuli.

In an effort to further examine processes of psychological change in response to the defusion instruction employed in Experiment 1, we reexamine the same intervention in Experiment 2. Thus, in Experiment 2 we aimed to extend our analyses of the variables examined in Experiment 1, by conducting an examination of the same defusion intervention, delivered in an alternative format; via a pre-recorded instruction. We found that participants exposed to the

intervention via this format reported significant reductions in state anxiety, but *not* psychological inflexibility/avoidance.

Thus, contrary to the significant post-intervention reductions in psychological inflexibility/avoidance observed in Experiment 1, participants exposed to the defusion intervention via a pre-recorded instruction did not report the same impact. This finding suggests that the absence of a facilitator to deliver the intervention may have moderated its impact on psychological inflexibility/avoidance outcomes.

It is possible that the presence of a facilitator may enhance the salience of the contextual cues which may have directly mediated the differential impact of the defusion analogue observed between Experiment 1 and 2. Another explanation for this effect may be that participants perceived the pre-recorded defusion instruction to have low credibility. Indeed reference to the benefits of measuring the credibility of the defusion and control instructions has been discussed in previous research (Hooper et al., 2013), and represent an opportunity for future research to employ such checks. As recommended by Hooper et al. (2013), future research employing credibility checks could ask a non-participant sample to rate how credible or 'helpful' they perceive a given instruction to be, which may help to gauge the extent to which individuals may perceive a given experimental instruction to be. In their discussion on the topic, Hooper et al. (2013) note that such credibility checks may control for the confounding impact of comparison condition instructions that vary in length. In fact, this was a key consideration in the design of Experiment 2 in the present research; we controlled for the length of time taken to provide both the control and defusion instructions such that both of the instructions were closely matched in terms of duration *and* in terms of introductory content (see Appendix K and L for a review of the scripts used for both instructions). In an attempt to further control for confounding variables in

Experiment 2, the decision to use pre-recorded instructions to deliver the control and defusion instructions was borne out of an attempt to control for the impact of experimenter effects.

Interestingly, reductions in state anxiety were observed from pre- to post-intervention and from pre- to post-control task, in *both* Experiment 1 and Experiment 2. This finding suggests that state anxiety reduction may be a function of the passage of time, such that anxious arousal tends to decrease over time. Indeed, this effect has been reported in previous research (Hoffman et al., 2009). As discussed earlier, Hoffman et al. (2009) examined the impact of an ACT-based acceptance instruction, a thought suppression instruction and a tCBT-based reappraisal instruction on physiological and anxious arousal following experimentally induced distress. Slight reductions in pre to post measures of state anxiety were reported across all conditions, with no signtificant differences yielded between any of the groups. While the authors observed the largest state anxiety reductions following the tCBT-based reappraisal instruction, the reduction was not significant. Furthermore, no significant reductions were recorded within or between any of the three conditions. The research by Hoffman et al. (2009) was the only study that could be sourced that has examined state anxiety changes in response to an ACT-based intervention, hence, further well-controlled research is needed to assess such patterns of responding.

Taken together, the findings from the current research (which indicated the presence of state anxiety reductions across *both* groups/conditions within *both* Experiment 1 and 2) in addition those reported by Hoffman et al (2009), raise questions as to whether the reductions in state anxiety reported across all of these conditions are the functions of each of the emotional regulation strategies examined, or, whether the reductions in anxious arousal were due to possible reductions in the salience of the verbal stimuli underlying participants' reactions.

However, despite considerable efforts to experimentally control implicit behaviour within any experimental condition, it can be difficult to measure the extent to which any research participant operationalizes the strategies assigned to them. In other words, it is difficult to manipulate the extent to which participants are capable of, and indeed choose to disengage with their typical emotional regulation strategies in order to employ *alternative* behavioural strategies presented to them. As such, the briefness of the present intervention may explain the lack of significant differences observed across all of the groups in this, and in Hoffman et al.'s (2009) research.

Another interesting observation is that although state anxiety reductions were observed across each of the two participant groups, in Experiment 1 *and* Experiment 2, psychological inflexibility/avoidance changes were only reported in Experiment 1. As both studies employed the same cognitive defusion strategies that differed only in terms of the medium through which they were delivered, this suggests that the presence of an experimenter/facilitator may have moderated the significant impact to psychological inflexibility/avoidance observed in Experiment 1. While it is unclear as to why participants in the control group reported a significant reduction in psychological inflexibility/avoidance following the distraction-based control task (reading short stories), one possible explanation for this may be that the AAQ-II (Bond et al., 2011) may have reflected changes in momentary distress experienced by the control group. If this were the case, then this does corroborate with the distress levels recorded on the state anxiety measure, which also reduced significantly. This suggestion is in line with research by Wolgast (2014) entitled *What Does the Acceptance and Action Questionnaire (AAQ-II) Really Measure?* Following an exploratory factor analysis of each of the factors that comprise the scale, Wolgast (2014) reported a stronger relationship between that the items that comprise the AAQ-II, and items designed to measure distress, more so than those aimed at directly or indirectly

measuring the concept of acceptance/non-acceptance. In his critique of the scale, the author states “for many of the items it is hard to distinguish if a specific response is grounded in levels of psychological inflexibility/experiential avoidance, or, for example, in levels of experienced aversive emotions, memories, and worries.” (p. 833)

On the contrary however, the results from Experiment 2 do not support this idea because while state anxiety reductions were recorded from pre- to post-intervention *and* control task, no changes were detected in terms of psychological inflexibility/avoidance, which does not fit with the explanation that the AAQ-II measures state related distress.

In an effort to extend our analyses of the processes of change in Experiment 2, we also examined pre- and post-intervention/control task levels of discomfort, believability and willingness to engage with self-referential statements. While the intervention group participants indeed reported reductions in believability and discomfort of the self-referents, these reductions did not reach statistical significance. In addition, while the group reported increases in willingness to engage with the self-referents, these increases were also not statistically significant. This finding is somewhat unsurprising however because analyses of the pre- to post-intervention scores on the AAQ-II (measuring psychological inflexibility/avoidance) suggested that participants did not experience adequate defusion from the self-referents. When compared to the results of Experiment 1, it can be seen that the intervention group reported significant reductions in psychological inflexibility/avoidance suggesting that the intervention was effective in this way. However, due to the fact that intervention group participants in Experiment 2 did not report significant reductions in psychological inflexibility/avoidance, this discrepancy may be attributed to the change in mode of delivery of the intervention.

In support of previous research that has demonstrated the efficacy of ACT-based interventions in terms of reducing levels psychological inflexibility/avoidance (Blackledge, 2004; Zettle, 2003) the results of Experiment 1 indicated that exposure to Harris' (2009) Hands as Thoughts cognitive defusion intervention resulted in significant decreased in psychological inflexibility/avoidance levels. This finding also supports the postulation that cognitive defusion interventions are capable of increasing psychological flexibility following brief exposure to Hariss' (2009) Hands as Thoughts metaphor. Furthermore, this finding highlights the potential potency of cognitive defusion such that exposure to a brief cognitive defusion instruction can result in significant reductions in self-reported experiential avoidance. The findings derived from Experiment 1 and 2 raise questions as to impact of various modes of delivery of cognitive defusion interventions.

Lastly, analyses of the correlation between trait anxiety levels and baseline psychological inflexibility/avoidance rendered a strong positive correlation between the two measures. As such higher levels of trait anxiety were associated with higher levels of experiential avoidance. This finding supports previous correlational research that has found positive associations between higher levels of experiential avoidance and higher levels of anxiety (Hayes et al., 2006).

While the findings presented appear to support the role of Harris' (2009) Hands as Thoughts metaphor as an effective cognitive defusion intervention for use with university students (delivered via a human facilitator), this finding is not generalizable. Nonetheless, future research could opt to replicate the methods employed in this research to further examine the efficacy of this cognitive defusion exercise with a larger population of university students, which would enhance the external validity of the findings of this study.

As discussed previously, the prevalence of mental health disorders among university student populations is concerning. While further research is needed to validate the use of the cognitive defusion metaphor studied here, dissemination of the results derived in this research is an important next step and may serve as preliminary research upon which further research may advance upon. Additionally, future research could also examine whether self-reported changes in psychological inflexibility/avoidance that may result following the exposure to the intervention, are maintained at follow up periods e.g. at 1 month, 6 month and 12 month follow ups.

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Appendices

APPENDIX A

INFORMATION SHEET

You are kindly invited to take part in an upcoming research study that is taking place in Maynooth University (MU) in spring 2016.

What is the Study About?

The study is being carried out with undergraduate students at MU and aims to examine how different types of people perform under different conditions. The project is being led by Louise Cleary, a doctoral student at MU, as a requirement for the Doctorate in Psychological Science in Behaviour Analysis and Therapy. The study will run from February 2016 to May 2017. Your participation however, will only involve your attendance at an hour long **once-off research session** which will take place in a psychology laboratory within the Department of Psychology at MU.

Do I have to participate?

No, your choice to participate is entirely voluntary. No penalty will apply if you chose not to participate. No lecturers or tutors will be informed as to whether or not you participate. In order to participate, you must be between the age of 18 and 65, be a registered student at MU, and have proficient use of the English language. Students with a diagnosed mental health condition are kindly requested not to put themselves forward for participation in the study for ethical reasons because they may be sensitive to the methods involved. If you have a diagnosed mental health condition, please self-exclude yourself and refrain from participating.

What does it involve?

If you agree to participate, you will be asked to sign a Consent Form and participate in a once-off research session. The session will last approximately 1 hour and involves filling out a number of questionnaires and engaging in a number of different exercises. The study is will be led by Louise Cleary who will accompanied by her supervisor, Dr. Veronica Cullinan.

How long will it take?

The session will last approximately 1 hour and will not coincide with academic lectures.

If I do participate, can I back out at any point?

If for any reason you'd like to stop participating in the session, you are free to leave without question. In addition, you also have the right to request that your data be removed from the study if you wish. To do this, you will need to contact the lead researcher, Louise Cleary, at the email provided below with your **participant ID number – this number will be given to you at the research session**. Please note that removal of your data can only be done within **one week** of the research session because after this time, the data will be mixed and analysed with other participants' data at a group level and will not be retrievable after that point.

Are there any advantages to taking part?

You may find that participating in the study will provide you with first-hand experience and knowledge about what it's like to be a participant in psychology research study.

Are there any disadvantages to taking part?

As the study asks you to complete a number of exercises and fill out a number of questionnaires, you may experience different thoughts or feelings in response to these tasks. Again, you are free to leave the testing session at any point and have your data removed from the study on request, within a week of the session.

Who has reviewed the study?

The research has been approved by the Research Ethics Committee within the Department of Psychology at MU and will be conducted in line with the Code of Good Practice for Psychological Testing outlined by the British Psychological Society (BPS) and in accordance with the current standards and Code of Ethics dictated by the Psychological Society of Ireland (PSI), Maynooth University Research Ethics Policy, Maynooth University Research Integrity Policy and the Behavior Analysis Certification Board (BACB). The study has been designed under the guidance and supervision of Dr. Carol Murphy and Dr. Veronica Cullinan.

Is my information confidential?

Any data you provide in the study will be treated with full confidentiality between you and research team and will not be shared with any third party. ID numbers will be used in place of names on all data sheets to further protect your identity. Your name will only appear on your Consent Form which will be stored separate to your data. Consent forms will be stored in a locked cabinet in the researcher's home office. All other data will be stored in a locked cabinet in the Department of Psychology and in a password encrypted file on a password protected computer.

As above, if you would like to withdraw your data from the research, you can request to do so within 1 week of attending the research session by contacting the lead researcher with your ID number which will be given to you at the research session. After this time, your data will be mixed with other data and analyzed at a group level, thus, withdrawal of data will not be possible after 1 week of participating in the research session. The document containing a list of participant names and respective ID numbers will be shredded 1 week after the research session has taken place.

The handling of all research data in this study will comply with the Data Protection Act 1998 and the EU Directive 95/46 on Data protection. As per the Maynooth University Research Integrity Policy, all research data will be kept for a minimum of 10 years following the study's completion date for verification and/or further reassessment. After this time, the research data will be expunged from the computer it is stored on, and hard copy data will be shredded and disposed of responsibly

What will happen to the results of the study?

Once the study is completed, the results will be presented in thesis format as an academic requirement for the Doctorate of Psychological Science in Behaviour Analysis and Therapy at MU, and may be submitted for conference presentation and publication in scientific journals.

Thank you for giving up your time to read this information and for considering participating.

Louise Cleary	***Dr. Carol Murphy***	***Dr. Veronica Cullinan***
psychologystudynuim2016@gmail.com	carol.a.murphy@nuim.ie	veronica.cullinan@nuim.ie
John-Hume Building	John-Hume Building	John-Hume Building
Department of Psychology,	Department of Psychology	Department of Psychology
Maynooth University	Maynooth University	Maynooth University
Co. Kildare	Co. Kildare	Co. Kildare

APPENDIX B

CONSENT FORM

This form, once signed, represents an agreement to participate in the research study which is being led by Louise Cleary (Student Researcher) and is supervised by Dr. Carol Murphy (Principal Supervisor) and Dr. Veronica Cullinan (Co-supervisor).

Tick which statements apply to you:

□ I confirm that I have read and understand the information sheet and have had the opportunity to ask questions

□ I understand that my participation is voluntary and that I am free to leave the research session at any time during its hour-long duration

□ I understand that I can withdraw my data from the study up to one week following my participation in the research session but not after that time

□ I understand that my data will contain an ID number in place of my name, which I have taken note of

□ I am between the age of 18 and 65 years of age

□ I am a registered undergraduate student at MU

□ I am proficient in my ability to speak, understand and write in the English language

□ I understand that my participation in this research does not involve a clinical intervention or treatment of any kind and that my psychological levels may increase, decrease or remain the same as a result of participating

□ I have never been diagnosed with a mental health disorder

□ I agree to participate in this study

Date: _____

Name: _____

Signed: _____

APPENDIX C

THE HERE AND NOW QUESTIONNAIRE

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to describe how you feel ***right now in this moment***. There are no right or wrong answers. Move swiftly through the questions, but try to answer each question as it relates to how you feel in the ***present moment***.

		NOT AT ALL	SOMEWHAT	MODERATELY	VERY MUCH SO
1	I feel calm	1	2	3	4
2	I feel secure	1	2	3	4
3	I feel tense	1	2	3	4
4	I feel strained	1	2	3	4
5	I feel at ease	1	2	3	4
6	I feel upset	1	2	3	4
7	I am presently worrying over possible misfortunes	1	2	3	4
8	I feel satisfied	1	2	3	4
9	I feel frightened	1	2	3	4
10	I feel comfortable	1	2	3	4
11	I feel self-confident	1	2	3	4
12	I feel nervous	1	2	3	4
13	I feel jittery	1	2	3	4
14	I feel indecisive	1	2	3	4
15	I feel relaxed	1	2	3	4
16	I feel content	1	2	3	4
17	I feel worried	1	2	3	4
18	I feel confused	1	2	3	4
19	I feel steady	1	2	3	4
20	I feel pleasant	1	2	3	4

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APPENDIX D

SELF-EVALUATION QUESTIONNAIRE

STAI Form Y-2

Name_____ Date_____

DIRECTIONS

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	1	2	3	4
22. I feel nervous and restless	1	2	3	4
23. I feel satisfied with myself	1	2	3	4
24. I wish I could be as happy as others seem to be	1	2	3	4
25. I feel like a failure	1	2	3	4
26. I feel rested	1	2	3	4
27. I am "calm, cool, and collected"	1	2	3	4
28. I feel that difficulties are piling up so that I cannot overcome them	1	2	3	4
29. I worry too much over something that really doesn't matter	1	2	3	4
30. I am happy	1	2	3	4
31. I have disturbing thoughts	1	2	3	4
32. I lack self-confidence	1	2	3	4
33. I feel secure	1	2	3	4
34. I make decisions easily	1	2	3	4
35. I feel inadequate	1	2	3	4
36. I am content	1	2	3	4
37. Some unimportant thought runs through my mind and bothers me	1	2	3	4
38. I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39. I am a steady person	1	2	3	4
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

APPENDIX E

AAQ-II

Below you will find a list of statements. Please rate how true each statement is for you by circling a number next to it. Use the scale below to make your choice.

1	2	3	4	5	6	7
never true	very seldom true	seldom true	sometimes true	frequently true	almost always true	always true

1.	My painful experiences and memories make it difficult for me to live a life that I would value.	1	2	3	4	5	6	7
2.	I'm afraid of my feelings.	1	2	3	4	5	6	7
3.	I worry about not being able to control my worries and feelings.	1	2	3	4	5	6	7
4.	My painful memories prevent me from having a fulfilling life.	1	2	3	4	5	6	7
5.	Emotions cause problems in my life.	1	2	3	4	5	6	7
6.	It seems like most people are handling their lives better than I am.	1	2	3	4	5	6	7
7.	Worries get in the way of my success.	1	2	3	4	5	6	7

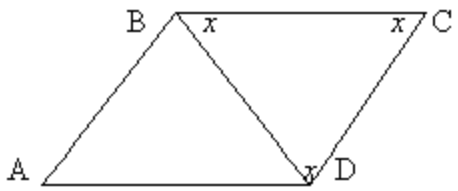
APPENDIX F

MATH TASK

Question 1

A certain animal in the zoo has consumed 39 pounds of food in six days. If it continues to eat at the same rate, in how many more days will its total consumption be 91 pounds?

Question 2

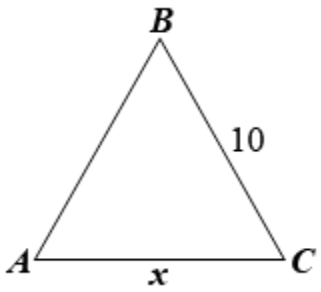


ABCD is a parallelogram. BD=2. The angles of triangle BCD are all equal. What is the perimeter of the parallelogram?

Question 3

If $x-2$ is a factor of $x^3+kx^2+12x-8$, then $k=$

Question 4



In the figure above, $AB=BC$ and the measure of $\angle C$ is 40°. What is the value of x?

Question 5

Half the people on a bus get off at each stop after the first, and no one gets on after the first stop. If only one person gets off at stop number 7, how many people got on at the first stop?

APPENDIX G

Question**:**

Having completed the math task, using one word, I feel

_____.

APPENDIX H

Reading Task

In the beginning, we were too young to take much notice of our neighbours. They were the kind of people who kept to themselves. Once, my mother baked a chocolate cake and invited herself over to the Hank's place for tea. But that was a long time ago. And when she came back, afterwards, she told us that Mr. Hanks, who lived with his wife and daughter, was very sick. She told us that we were to keep the noise down in the street outside their house when we played. She said that if we did stray, better to do so on Old Joe's side.

Joe lived on his own, when he was in town. Sometimes he would stop and speak for a while with my father, and they would both nod, solemnly at each other, their voices low and gruff. We were scared of the old man, even though he ignored us, mostly, even when we played cricket with the other children in the neighbourhood, right outside his gate.

We got used to him not being around. Every couple of months he would pack up his green van and drive off down the road, and we wouldn't see him for a long time. Then his mail would pile up on his front porch, and the windows would grey, so much so that there was no chance of peeking inside, and the grass would grow so long that we would give up searching for the cricket balls that flew amiss.

And then Joe would come back from wherever he had been; his green van caked brown in a map of mud that told of distant travels. He would tend to the house and the garden with slow and meticulous care. And we would watch him from between two loose boards in our fence, and we would wonder where he had been, and why. But the wondering was brief, there was always something else more fun to do.

After some time we lost interest in Joe. We'd come home with the bus each day after school and wolf down lunch before running off down to the river. Our father had fashioned us simple fishing rods and we'd spend hours waiting for something to bite. We never caught any fish with the sticks. We'd come home, empty handed and pester my father as he read the paper after dinner. We would beg him for real fishing rods, our argument that only once we had the proper equipment, would we be able to catch any fish. But he told us that we should work hard, and maybe if our results at school were good enough, and maybe if we finished our chores instead of running off each day, then maybe he would.

I was 12 years old, my brother was only 8, when we went down to the river for the first time with the fishing rods that my father eventually bought us one Christmas. We had been fishing for an hour or two, when I suggested that we go back home for some lemonade and lunch. My brother, his name was Tim, said he would rather wait at the river, and asked if I wouldn't mind going alone, if I wouldn't mind bringing something back for him to eat. I hurried the whole way, not wanting to leave him there for too long.

I was breathless when I got back to where I had left him sitting. But he wasn't there. Just his boots, tossed to one side, with his miss-matched socks in little balls lying next to them. I called out to him, thinking that he might have off wandered behind a bush to pee. When he didn't

answer, I followed the path along the river's edge, walking slowly and yelling out for him to show himself and stop with his games. I was more irritated than anxious, I was wasting precious fishing time. After a minute or two, I turned back, looking a little more carefully this time. And then I noticed his fishing rod, the line caught up in a branch hanging low over the river. I went forward to try and jerk it free, thinking how careless he was to leave his brand new rod like this.

When I eventually saw him, he was looking up at me with a lost stare, confused almost. Lying sprawled out beneath the water. His face was pale, and his hair was moving gently in the tiny waves that lapped about my feet. I stared down at him for a long while, uncertain as to what I should do. I thought that he might jump up, laughing and splashing, I thought he might pull me under with him, I thought he might show me something that I didn't yet know about being underwater and holding your breath for longer than we'd done before.

When he didn't move, I knelt down next to him, got as close as I could, and put my fingers through his hair, smoothing it, over and over again, as it floated around his skull. The water was red and then pink and then red again, and I let it wash all over me.

The sun eventually set on us and it was finally dark. But still I sat there, waiting for something to happen that I could maybe understand.

With the darkness came my father's voice. I heard my name as his boots splashed into the river a little way away from where I was crouched in the water. I dropped my brother's head and stood up slowly, because everything was numb. He asked me where Tim was and I pointed at my feet. The light from his torch shone first onto my dress, and then my legs and then slowly, finally onto my brothers face.

And then it was gone. The torch floated away and took all the light with it.

The end.

Mrs. Jackson-Smith wore a large canary yellow caftan, underneath which, her vast two hundred and seventy five pound bulk heaved and fell as she entered the foyer of the hotel. It wasn't just the merciless summer heat, she thought to herself (as she pushed back a loose strand of perfectly coiffed ash blonde hair). No, it was her size.

Mrs. Jackson-Smith was not only a heavily weighted woman. She was also tall, with long solid legs and strong arms. Her features rested uncomfortably on her surprisingly small face. A generous mouth with full red lips, and wide set blue eyes, which seemed to float on the fleshy outskirts of her countenance so near to her ears, that her tiny nose seemed lost. She moved however with an elegance that one wouldn't expect from such a large woman.

Her husband worked hard to keep his wife and children in grand style. This luxury was a substitute for the love he couldn't share with them, and Mrs. Jackson-Smith was content with

this. She had known her husband was a passionless man even before she had married him, but had accepted his proposal, made even before a first kiss, because who else would love her, being the size she was.

She had arrived early, and was sipping a pink gin and tonic when Janice walked in. The friends met most Thursdays to consume liquid calories and share delicious gossip.

-Tess, sorry I'm late, I couldn't get away from the damn office, you know how they are sometimes … oh! I'm fine thank you, practically dead from this heat though…. but enough complaining, we have a guest! Tess this is Peter Randall….

And so the meal began, and ended all so quickly. And when it was over Tessa drove dreamily, sometimes dangerously, home. She wasn't fully aware. And so the days passed, lonely beige days, sometimes a spark of colour when she thought of him and then she'd whisper his name, and she would blush, feeling guilty and shy at the desire that would suddenly overwhelm her.

A week later Janice telephoned to cancel lunch. She was sorry, etcetera, etcetera, but she was too busy at work. Peter had asked about her, said she was lovely, had he called, more etceteras, and then goodbye.

Soon after, she dozed off on the sofa, warm in the glow of her imaginings, and when she finally awoke it was to the ringing of the doorbell. The soft light of the setting sun made her home seem so peaceful, quiet, almost surreal. As if she had slipped from fantasy into dream, or vice versa. She thought for a minute it might be one of the children's friends come to visit but then remembered that they were away at University, their absence a scar.

She padded through the entrance hall, bare feet on thick carpet. Slowly she opened the door, and there he stood, dark and mysterious all over again, always, that would be how she remembered him. He murmured an Hello, and she smiled.

It's strange how some find overwhelming beauty in things that others see only for what their exterior shows. It's wonderful how some see passion in the eyes of a woman hidden beneath so many layers of fabric and flesh. Sometimes when two people meet, call them kindred souls if you will, there is a secret message which passes from one to the other. They know each other's deepest thoughts and darkest longings and they become one. For this, people may search their whole lives, and never find. It may come once, it may come sooner, later, always or never. But when it does, if it does, the feeling is so remarkable, so isolated, that it becomes everything, and nothing else has meaning. And so Peter Randall knew Tessa's soul, and she knew his.

It was all over very quickly. He took her, covering her face with brutal kisses and then crushing her body with his as they fell to the floor. There in the entrance hall of Mr. Jackson-Smith's home, his wife was ravished by the other half of her soul.

After he had left, Tessa closed the front door and walked up the stairs to her bedroom. She lifted the tent like dress over her head and dropped it to the floor. Naked she stood, in the centre of the room, alone and exposed. Slowly, she drew the curtains and lay down on the bed, staring into

the darkness around her, listening for the sound of her husband's car on the gravel drive outside their home.

When, finally she heard the roar of the motor, the crunching of stone, she allowed herself a smile. And then a tear, one lone tear, which ran from the corner of her eye, down, slowly past her small left ear, and into a tiny crease in the folds near the base of her neck. She whispered his name, just once, for the last time. Peter, she said, before getting up to take a bath and prepare dinner for her husband.

APPENDIX I

The items in the questionnaire refer to things that may cause fear or apprehension. For each item decide which of the ratings best describes how much you are frightened by it nowadays - "Not at all" "A little" "A fair amount" "Much" or "Very much". Mark your answers on the answer sheet only. On the answer sheet, fill in "1" for Not at all; "2" for A little, "3" for A fair amount, "4" for Much or "5" for Very much.
Do not mark this question sheet. Work quickly but be sure to consider each item individually.

	Not at all	A little	A fair amount	Much	Very much
1. Taking an examination (final) in a math course.	_	_	_	_	_
2. Thinking about an upcoming math test one week before.	_	_	_	_	_
3. Thinking about an upcoming math test one day before.	_	_	_	_	_
4. Thinking about an upcoming math test one hour before.	_	_	_	_	_
5. Thinking about an upcoming math test five minutes before.	_	_	_	_	_
6. Waiting to get a math test returned in which you expected to do well.	_	_	_	_	_
7. Receiving your final math grade in the mail.	_	_	_	_	_
8. Realizing that you have to take a certain number of math classes to fulfill the requirements in your major.	_	_	_	_	_
9. Being given a "pop" quiz in a math class.	_	_	_	_	_
10. Studying for a math test.	_	_	_	_	_
11. Taking the math section of a college entrance exam.	_	_	_	_	_
12. Taking an examination (quiz) in a math course.	_	_	_	_	_
13. Picking up the math text book to begin working on a homework assignment.	_	_	_	_	_
14. Being given a homework assignment of many difficult problems which is due the	_	_	_	_	_

(Further text on next page)

next class meeting.					
15. Getting ready to study for a math test.	–	–	–	–	–
16. Dividing a five digit number by a two digit number in private with pencil and paper.	–	–	–	–	–
17. Adding up 976 + 777 on paper.	–	–	–	–	–
18. Reading a cash register receipt after your purchase.	–	–	–	–	–
19. Figuring the sales tax on a purchase that costs more than $1.00.	–	–	–	–	–
20. Figuring out your monthly budget.	–	–	–	–	–
21. Being given a set of numerical problems involving addition to solve on paper.	–	–	–	–	–
22. Having someone watch you as you total up a column of figures.	–	–	–	–	–
23. Totaling up a dinner bill that you think overcharged you.	–	–	–	–	–
24. Being responsible for collecting dues for an organization and keeping track of the amount.	–	–	–	–	–
25. Studying for a driver's license test and memorizing the figure involved, such as the distance it takes to stop a car going at different speeds.	–	–	–	–	–
26. Totaling up the dues received and the expenses of a club you belong to.	–	–	–	–	–
27. Watching someone work with a calculator.	–	–	–	–	–
28. Being given a set of division problems to solve.	–	–	–	–	–
29. Being given a set of subtraction problems to solve.	–	–	–	–	–
30. Being given a set of multiplication problems to solve.	–	–	–	–	–

APPENDIX J

Debrief Form

Our sincere thanks for taking the time to participate in this research study. Your participation is highly valued by the researchers. The 'Hands as Thoughts' behavioural exercise that we engaged in is designed to facilitate a process called de-fusion which is said to help people to de-fuse or detached from undesirable thoughts and feelings, using metaphors that introduce new psychological perspectives to those who practice them. The purpose of this research was to investigate whether the Hands as Thoughts exercise was effective in helping people to detach from the undesirable feeling or thought that they identified following completion of the challenging math task. It s hoped that the results of this research will help us to better understand the effectiveness of the exercises performed today, in order to advance on current knowledge on the topic. Thank you for making this possible! The results of this research will be available for distribution in winter 2017. If you'd like a copy of the research study sent to you once it's completed, please email your request to psychologystudynuim2016@gmail.com

Do remember that if you would like to **withdraw your data** from the study you can do so without reason; simply email the lead researcher Louise Cleary at the email address below. The withdrawal of data can only be performed within one week following attendance at the research session because after this time, your research will be mixed among other participants' data and will not be retrievable from then on. If you have any questions or concerns regarding any aspect of your participation, please do not hesitate to contact the researcher or her supervisors at the details provide below and your questions and/or concerns will be treated sensitively. In addition, contact details of two helpful organizations are provided at the bottom of this leaflet should you feel you wish to talk to somebody further for any reason.

You're reminded again that all of the information you have provided in this research will be handled confidentially. Your data will not be presented in a way that will identify you personally because your data will be represented by a number instead of your name and will be presented in summary format in presentations. All of the data collected in this study will be kept in the strictest confidence and stored securely. Your anonymised data will not be shared with any third parties but may be submitted for conference presentation and publication to scientific journals.

Our sincere thanks once again for your participation,

Louise Cleary, Dr. Carol Murphy and Dr. Veronica Cullinan

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APPENDIX K

Cognitive Defusion Exercise

Hands as Thoughts Metaphor: Cognitive Fusion & Mindful Defusion

Imagine for a moment that your hands are your thoughts. When you reach the end of this paragraph, I'd like you to put this writing down and hold your hands together, palms open, as if they're the pages of an open book. Then I'd like you to slowly and steadily raise your hands up toward your face. Keep going until they're covering your eyes. Then take a few seconds to look at the world around you through the gaps in between your fingers and notice how this affects your view of the world. Please do this exercise now, before reading on.

Now imagine what it would be like to go around all day with your hands covering your eyes in this manner. How much would it limit you? How much would you miss out on? How would it reduce your ability to respond to the world around you? This is approximately how restricted we are in cognitive fusion; we become so caught up in our thoughts that we lose contact with many aspects of our here-and-now experience, and our thoughts have such a huge influence over our behavior that our ability to act effectively (behave functionally) is significantly reduced. When you reach the end of this paragraph, I'd like you to cover your eyes with your hands, yet this time, lower them from your face very, very slowly. As the distance between your hands and your face increases, notice how much easier it is to connect with the world around you. Please do this now before we move forward.

This exercise provides a metaphor for cognitive defusion. Notice how much easier is it to take effective action without your hands covering your eyes; how much more information can you take in; how much more connected are you with the world around you?

APPENDIX L

Control Task Instructions Script used in Experiment 2

We are now going to engage in an exercise using the thought or feeling that you have just written down on your booklets following the math task. Nobody will be asked to read their statement aloud. As we all know, when we get upset or distressed, it can cause us to experience difficult thoughts and feelings that can hinder our ability to perform in the way we would like. Different people use different techniques to manage undesirable thoughts or feelings. PAUSE TO 2 SECS. How do ***you*** manage when you're faced with undesirable thoughts and feelings? What do you do when you feel distressed or upset?

PAUSE FOR 10 SECS

Please take a moment to focus on the thought or feeling that you wrote down in your booklets following the math task. How does it feel to experience that thought or feeling again?

PASUE FOR 5 SECS

For the next minute, please apply the strategy that you *normally* use to manage undesirable thoughts, and apply it to the thought or feeling that you wrote down in you booklet, following the math task.

PAUSE FOR 1 MINUTE

----------END----------

APPENDIX M

Using the scale below, rate the level of **discomfort** you feel regarding the thought/feeling that you noted previously, by placing an X at some point on the scale.

No discomfort		**Neither**		**Very uncomfortable**
0%	25%	50%	75%	100%

Using the scale below, rate **how much you believe the thought/feeling** that you noted previously, by placing an X at some point on the scale.

I don't believe it		**Neither**		**I truly believe it**
0%	25%	50%	75%	100%

Using the scale below, rate **your willingness to engage in the thought/feeling** that you noted previously, by placing an X at some point on the scale.

I don't want to engage		**Neither**		**I'm happy to engage**
0%	25%	50%	75%	100%

APPENDIX N

Please describe the strategy that you applied to the thought/feeling that you experienced following the math task.

APPENDIX O

Experiment 1: Post-Math Task Self-statements

Group	
Control	Intervention
Unfinished	Stupid
Stressed	Uneducated
Tired	Unsure
Uneasy	Stupid
Disappointed	Terrible
Accomplished	Stupid
Forgetful	Relieved
Unsure	Calm
Grand	Embarrassed
Stupid	Stressed
Tired	Frustrated
Down	Relaxed
Confused	Angry
Stupid	Annoyed
Stressed	Good
Frustrated	Confused
	Confused
	Alert
	Pleasant

APPENDIX P

Experiment 2: Post-Math Task Self-statements

Group	
Control	Intervention
Unfinished	Stupid
Stressed	Uneducated
Tired	Unsure
Uneasy	Stupid
Disappointed	Terrible
Accomplished	Stupid
Forgetful	Relieved
Unsure	Calm
Grand	Embarrassed
Stupid	Stressed
Tired	Frustrated
Down	Relaxed
Confused	Angry
Stupid	Annoyed
Stressed	Good
Frustrated	Confused
	Confused
	Alert
	Pleasant

APPENDIX Q

Experiment 2: Post-math task Coping Strategies Used to Manage Distress by Control group

Theme	*n*
Thought of positive images/other things	5
Analyzed it rationally/thought about it in a different way	6
Cleared head/avoided	2
Took deep breaths to calm down	2
Ruminated in the negative emotion	1