The National University of Ireland

Experimental Analyses of Pain: Understanding Processes and Developing Interventions

Thesis submitted to the Department of Psychology, Faculty of Science, in fulfilment of the requirements for the degree of Ph.D., National University of Ireland, Maynooth

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September 2008

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Acknowledgements

Acknowledgements

First, I would like to thank my supervisor Dr. Yvonne Barnes-Holmes for her patience and guidance, without which I may never have reached the end! Second, I would like to thank Prof. Dermot Barnes-Holmes for all his help both with the PhD and across my time in Maynooth. I would like to thank all of the kind people who took part in the experiments -- without them this research would not be possible. I would also like to thank all the post grads and staff at NUIM for their support. Finally, I'd like to thank both my family and Seán for keeping me sane through it all.

Abstract

ABSTRACT

The current thesis compared the relative utility of acceptance and distraction-based interventions on the tolerance and distress of experimentally induced radiant heat pain. The research program comprised five automated experimental studies, including componential analyses to investigate the processes underpinning the use of acceptance and distraction as strategies for coping with pain. Chapter 1 provides a review of the available literature on clinical pain, including empirical evidence on its understanding and treatment. Chapter 2 incorporates two studies -- Experiments 1 and 1A. In Experiment 1 (n=128), acceptance- and distraction-based interventions were compared with a placebo intervention. Only the Acceptance group showed a significant increase in heat tolerance, Distraction participants did not and Placebo showed a significant decrease. In spite of the significant changes in heat tolerance, reported adherence to strategy was lower than expected.

Experiment 1A (n=27) incorporated a modified version of the Distraction Intervention (referred to as Distraction 2). This modification was based on the hypothesis that the original distraction protocol had perhaps provided participants with an opportunity to defuse from the pain-related thoughts that may have exerted an unexpected but positive influence on the outcomes associated with the distraction protocol. As a result, the outcomes for Distraction 2 were then systematically compared with the original Acceptance and Distraction data (Distraction 1) from Experiment 1.

Both Acceptance and Distraction 1 participants showed a near significant increase in tolerance, but Distraction 2 did not. Once again, reported adherence to strategy was low. Overall, the data from Experiment 1A suggested that the modest outcomes associated with Distraction in Experiment 1 may indeed have spuriously resulted from participants defusing, rather than distracting, from the pain-related thoughts.

Experiment 2 (*n*=39) reported in Chapter 3 attempted to match the Acceptance and Distraction protocols more closely, by encouraging *all* participants to engage in positive imagery, to determine key features of the interventions that had facilitated the differential outcomes. At its simplest, the different outcomes may have resulted from the fact that participants in the two key intervention groups were engaging in different experimental activities. This study also modified the adherence measures, which had not yielded strong outcomes thus far. One procedural modification employed to enhance adherence involved the introduction of a Values Clip that advised participants that their involvement in the research would be of indirect assistance to real sufferers of chronic pain. The results from Experiment 2 indicated strong adherence to intervention by all participants, which suggested the potential role played by the Values Clip. Furthermore, the data were supportive of the two previous studies when the Acceptance group showed a significant increase in heat tolerance, while Distraction showed a significant decrease.

Experiment 3 (*n*=36) reported in Chapter 4 removed the Swamp Metaphor from the existing protocols in an attempt to determine the impact this may have had on the outcomes. The results indicated that once again, Acceptance was associated with a significant increase in pain tolerance, while Distraction was not. Unfortunately however, the strong adherence effects recorded previously were not maintained. Although these results initially suggested that the Swamp Metaphor had relatively little impact on outcomes, the low adherence data raised the possibility that the metaphor had been useful in facilitating greater understanding of, and adherence to, the experimental protocols.

In Experiment 4 (*n*=42) reported in Chapter 5, the Swamp Metaphor was re-incorporated into both interventions because of its likely relationship with adherence. However, the Values Clip was now removed in order to determine what role this may have played in the outcomes from Experiments 2 and 3. The data here were consistent with the

four previous studies, with significant pain tolerance increases for Acceptance, but not Distraction. However, adherence to intervention remained problematic.

The current research extends existing evidence of the relative utility of acceptance and distraction as coping strategies for dealing with experimentally induced pain. In all five studies, Acceptance was associated with considerable increases in pain tolerance, Distraction was not. The work also represents the first attempt to employ clinical interventions with radiant heat pain as an analogue of clinical pain. The strong concordance of evidence across all five studies, as well as consistency with existing published findings, highlight the utility of the apparatus in this regard.

Chapter 1

General Introduction

Understanding and Treating Pain

"To heal does not necessarily imply to cure. It can simply mean helping to achieve a way of life compatible with their individual aspirations -- to restore freedom to make choices -- even in the presence of continuing disease."

Rene Dubos (1978)

Chapter 1

Understanding and Treating Pain

Virtually all of us have experienced physical pain of one form or another, varying from the relatively mild to the extreme. When pain occurs, it frequently functions as a barrier to on-going activity, in that we stop what we are doing and attempt to alleviate the discomfort. This response may be relatively brief and trivial such as sucking a pinched finger, or more extended and serious involving, for example, an invasive medical operation. Implicit within this response to pain is the assumption that the discomfort must be removed, or at least reduced, before resuming normal activities. In most cases, this assumption is not problematic, and indeed sensible, because the pain may signal some form of structural fault or damage, which if ignored, could be exacerbated and perhaps lead eventually to death. Nevertheless, there are times when treating pain as a barrier may become more problematic than the pain itself. The current chapter will provide a brief review of the psychology of chronic pain, with a particular focus on recent attempts to treat this disorder with acceptance-based therapies.

Pain and Perception of Pain: Varieties of Clinical Disorder

The burgeoning field of the psychology of pain is focused on understanding and treating our reactions to pain and how these can best be managed for the purposes of psychological well-being. Interest in this area has been motivated by significant increases in the prevalence of practically all forms of 'chronic pain' that now ranges from 10.1% to 55.2% of the general population (Harstall, & Ospina, 2003). For example, Pleis and Coles (1998) reported that in a three-month period prior to

assessment, 28% of a sample of almost 200,000 participants had experienced lower back pain; 16% had experienced migraine or severe headaches; and 15% had experienced neck pain.

A diagnosis of chronic pain is not straight-forward. For example, it does not imply sensation in a specific region, nor stipulate a level of severity. However, a primary index of suffering is level of intrusion or disability and the diagnosis frequently assigns a central role to psychological variables. Pain researchers (e.g. Gatchel, 2005) have distinguished between *nociception* (i.e. the neurological event) and *pain perception* (a personal interpretation of pain sensation), but insist that the relationship between these events is bi-directional. This interaction is often referred to as the *pain-stress cycle*, in that pain generates lifestyle changes which cause stress, that exacerbates pain, and so on. The importance of the perception of pain, rather than the pain itself, is reflected in the findings that: (1) the speed with which sufferers 'return to normal life' may be unrelated to specific symptoms and/or their severity (Englund, 2000); and (2) reactions to symptoms (rather than the symptoms per se) influence both the search for medical assistance and the overall level of resulting disability (Saunders, Von Korff, & Grothaus, 2000).

The Diagnostic and Statistical Manual (currently DSM-IV-TR) differentiates among three basic types of Pain Disorder that are: (1) associated with a General Medical Condition; (2) associated with psychological factors; and (3) associated with both. According to DSM, there must be evidence of clear neurological damage for Points 1 and 3, but not for Point 2. The issue of diagnosis is complicated, however, because there is considerable overlap among the symptoms that are used to identify the specific disorder. That is, all Pain Disorders have the following characteristics: (a) the pain reported by the sufferer is often severe, chronic (i.e. lasts longer than six

months in duration) and may involve a range of sources (e.g. lower back or pelvic pain); (b) the pain is exacerbated by psychological factors; (c) the pain is frequently unresponsive to analgesia; (d) the disorder is reasonably stable across time; (e) the sufferer presents with evidence of distress and impairment in work, social, or personal functioning; and (f) there is no evidence of malingering (Morrison, 1995). It is not surprising, therefore, that it is almost impossible to decipher one Pain Disorder from another.

In response to diagnostic difficulties, a wide range of clinical tools are used to aid the accurate measurement of Pain Disorders and their impact on sufferers. As expected, some of these tools assess the *physical* aspects of pain (e.g. the Multidimensional Pain Inventory, MPI: Kerns, Turk, & Rudy, 1988; and the Symptom Check List-90-Revised, SCL-90-R: Derogatis, 1994). Others focus on the sufferer's *distress* (e.g. the Pain Anxiety Symptoms Scale, PASS: McCracken, Zayfert, & Gross, 1992 and the Beck Depression Inventory-II, BDI-II: Beck, Steer & Brown, 1996) or levels of *social impairment* (e.g. the Sickness Impact Profile, SIP: Bergner, Bobbitt, Carter, & Gilson, 1981). A number of additional measures are concerned with the sufferer's reactions to pain and the coping styles employed (e.g. the Chronic Pain Acceptance Questionnaire, CPAQ: Geiser, 1992). The aim of this sophisticated array of diagnostic tools is to amass a full picture of the profile of chronic pain and the unique range of influences it has on the life of an individual sufferer.

The Treatment of Chronic Pain

The literature on the treatment of chronic pain is vast and has witnessed a critical conceptual shift, within which the range of treatment modalities should be

understood. The previously dominant view of the *homogeneity* of the profile of pain sufferers has given way more recently to specialised attempts to match treatment to specific pain types (Gatchel, 2005; Turk, & Monarch, 2002; Turk, & Okifuji, 2001). The latter perspective has emerged from evidence that patients with the same pain diagnosis may present differences in psychosocial and behavioural characteristics that contribute to different response patterns even in the context of the same treatment regime (Gatchel, 2005).

In a review of the literature on the treatment of chronic pain, Van Tulder, Gossens and Nachemson (2000) concluded that an integrated multi-disciplinary approach is the most effective. For example, Flor, Fydrich and Turk (1992) reported that a combined approach was twice as effective compared to programs containing a single treatment regime (see also Cutler, Fishbain, Rosomoff, Abdel-Moty, Khalil et al., 1994). However, there remains little or no empirical evidence to indicate which aspects of an integrative approach are critical to the relatively positive outcomes.

Common medical/physical interventions for chronic pain include: non-steroid anti-inflammatory drugs; muscle relaxants; antidepressants; epidural steroids; back exercise; pain manipulation; acupuncture; braces; traction; and EMG biofeedback. Although these interventions may be categorised primarily as *physical*, they frequently contain social or psychotherapeutic elements, including: relaxation (Turner, & Jensen, 1993); bibliotherapy (O'Leary, Shoor, Lorig, & Holman, 1988); spouse-assisted coping skills (Keefe, Caldwell, Baucom, Salley, Robinson et al., 1996); and hypnosis (Gatchel, 2005). Indeed, it could be argued that it is not feasible for a pain intervention to be purely physical or even psychological, given the multi-dimensional nature of chronic pain itself.

Cognitive Behavioural Therapy (CBT). This form of therapy is perhaps the most widely available program of psychological intervention for chronic pain. Clinicians and researchers within this tradition have highlighted the importance of sufferers' beliefs about pain, as well as their perceived levels of self-efficacy and control (Geiser, 1992; Weisenberg, 1987). Indeed, the CBT treatment model for chronic pain proposes that the experience of pain per se does not necessitate dysfunction (Flor, 1997). Rather, the critical relationship exists among the pain; the sufferer's approach and reactions to pain; and the type of obstruction pain creates in their lives. A key aim in CBT, therefore, involves increasing exposure to the obstruction in order to undermine its potential to create dysfunction. In so doing, CBT aims also to increase individuals' confidence in their ability to approach events that may be impaired by pain, but which do not need to be avoided in an absolute sense (Dahl, Wilson, Luciano, & Hayes, 2005). Indeed, CBT frequently focuses on patients' levels of catastrophising about their pain and the necessity for it to impact negatively on valued living (e.g. Thorn, 2004).

A number of CBT outcome studies have been reported for chronic pain. For example, Philips (1987) examined the effect of a nine-week outpatient program (one and a half hours per week) on forty chronic pain sufferers. The treatment program involved relaxation; graded increase in physical fitness and exercise; increased control over chronic pain episodes; graded reduction of analgesics; and training in preventative strategies including mood control, anxiety management, and activity pacing. Philips reported that the largest impact of the program was recorded as significant decreases in sufferers' affective reactions to pain and levels of avoidant behaviour associated with it. The latter finding was particularly noteworthy because in the pre-treatment phase, behavioural avoidance and level of complaints about pain

were significantly correlated with participants' evaluation of the size of the 'problem' (i.e. the more one avoided and complained, the more pain was perceived to be a problem). At a two-month follow-up, treatment gains were maintained and in some cases they were enhanced.

In a meta-analysis of twenty-five CBT outcome studies for chronic pain, Morley, Eccleston and Williams (1999) reported that CBT demonstrated significantly greater changes in pain experience, cognitive coping and appraisal, as well as reduced behavioural expressions of pain compared to waiting list controls and patients undergoing other treatment regimes (e.g. Education Family Support -- Radojevic, Nicassio, & Weisman, 1992 and Structure Group Social Support Therapy -- Bradley, Young, Anderson, Turner, Agudelo et al., 1987). Similar outcomes have been reported by Linton (2000) in a meta-analysis of twenty-eight studies and more specific, but equally positive, outcomes were recorded by Lipchik, Holroyd and Nash (2002) for the treatment of migraine and tension-type headaches.

Although the direct empirical support (as well as meta-analyses) for CBT is largely positive, Morley et al. (1999) summarised this evidence as "strong but not overwhelming" (p. 1). Specifically, one difficulty highlighted by Linton (and commonly raised about CBT in other contexts) concerns the treatment components employed across studies. That is, although the treatments share common generic themes, it is impossible to determine which components mediate the positive outcomes. Indeed, evidence regarding the unique contribution of processes within CBT, as well as the extent to which these potentially interact, is scarce (Vowles, McCracken, & Eccleston, 2007). Nonetheless, certain components within CBT, such as cognitive distraction and suppression have attracted some systematic analysis. Regrettably, various researchers have painted a less than positive picture of their

utility. Indeed, some authors have suggested that suppression and distraction *increase* (rather than decrease) a sufferer's attention to pain and are therein counter-productive (Masedo, & Esteve, 2007; Nouwen, Cloutier, Kappas, Warbrick, & Sheffield, 2006).

Mindfulness-Based CBT and Acceptance and Commitment Therapy (ACT). In response to growing concerns about the effects of distraction and suppression, and other aspects of CBT in which patients are encouraged *away from* the pain and the psychological content associated with it, clinicians and researchers have begun to investigate two distinct but related approaches. The first of these is known as mindfulness, which in broad terms encourages patients to *be present to, or even embrace,* their pain. In Mindfulness-Based Stress Reduction (MBSR: Kabat-Zinn, 1994), for example, Eastern practices such as meditation and yoga are used in the treatment of chronic pain. According to Kabat-Zinn, mindfulness involves "paying attention in a particular way [to thoughts, emotions and physical sensations]: on purpose, in the present moment, and non-judgmentally" (Kabat-Zinn, 1994, p. 4 – parentheses added). Mindfulness is believed to increase self-awareness and acceptance; reduce reactivity to thoughts and emotions; and improve the ability to make adaptive choices about responding to aversive experiences (Linehan, 1993a, b). In a recent meta-analysis including controlled trials of MBSR, the outcomes for the therapy were generally positive for a range of problems, including chronic pain, cancer, heart disease and depression (Grossman, Niemann, Schmidt, & Walach, 2004).

The second relatively novel approach, known as Acceptance and Commitment Therapy (ACT), overlaps to some extent with mindfulness, but emerges from a very different tradition, that of behaviour analysis, which is inherently experimental and empirically focused. Acceptance has been a central focus in ACT and, similar to

mindfulness, it is employed to enable clients to embrace (rather than avoid) negative psychological content (Hayes, Strosahl, & Wilson, 1999). Clinicians in ACT, for example, make a strong distinction between emotional acceptance and avoidance, and argue that the latter is correlated with psychological ill-health, rather than well-being. Nevertheless, ACT involves much more than acceptance and includes a focus on cognitive defusion and working within the context of the client's chosen values (Fletcher, & Hayes, 2005). Indeed, ACT researchers have argued that avoidance may in fact exacerbate the psychological content associated with pain and therein increase obstructions to valued living (Dahl et al., 2005, McCracken, & Eccleston, 2003).

In developing ACT for the treatment of pain, some researchers have focused on the psychological processes involved in both acceptance and avoidance of pain-related content. This bottom-up, process-oriented strategy is particularly reflective of the behaviour-analytic tradition from which ACT emerged. In the next two sections, the processes of avoidance and acceptance, respectively, as they apply to chronic pain are briefly considered.

Understanding Pain Processes: Avoidance

According to Wegner's *Theory of Ironic Processes* (1992, 1994), attempts to suppress thoughts are counter-productive and actually increase psychological contact with the thought in question. Consider the example of a patient who regularly has the thought "I should be free of this pain". According to Wegner, an intentional operating process searches for thoughts (e.g. "I'm okay now") that are consistent with the desired state of suppression (e.g. freedom from pain). An ironic monitoring process then seeks out the to-be-suppressed thought ("I should be free of this pain") in order to assess if this desired state has been achieved. Critically, however, the latter process

involves a '*rebound effect'* because the individual must register the thought to determine if it has been successfully suppressed. Although Wegner explicitly described suppression, many researchers and clinicians use the terms suppression and distraction synonymously, and subsume both under the generic term *cognitive control.* It is not exactly clear in the literature if these concepts are functionally distinct in any way, and thus in the current thesis they will be referred to interchangeably, unless cited authors specifically employ one term over another.

In a review of the suppression of neutral and clinically relevant thoughts, Purdon (1999) concluded that the evidence overall is inconsistent. With respect to pain, for example, cognitive control strategies were found to be effective in increasing tolerance of low or moderate pain, but did not decrease pain intensity (Farthing, Venturino, & Brown, 1984; Mullen, & Suls, 1982). In contrast, Cioffi and Holloway (1993) reported that cognitive control was associated with increases in the intrusions of pain-related thoughts for participants exposed to the Cold Pressor Task (see also Jaremko, 1978; Litt, 1988; Nouwen et al., 2006).

The finding that cognitive control strategies are not necessarily therapeutic, and may even be counter-productive, is consistent with the argument that these strategies sometimes involve what ACT researchers describe as psychological avoidance, a process which is associated with negative clinical outcomes. According to Hayes et al. (1999), the concept of avoidance applies when an individual is unwilling to be in contact with his or her private bodily sensations, thoughts, emotions or memories and this is more likely to occur when these events are negatively evaluated. Of course, certain forms of avoidance are adaptive (e.g. you might distract yourself briefly when you are in the dentist's chair) and the outcome in this case is likely to be positive. However, long-term avoidance can itself become maladaptive

and conflict with valued outcomes (Blackledge, & Hayes, 2001). Based on the fact that pain sufferers frequently focus on pain removal, combined with the fact that their pain is often recurrent and thus very difficult to avoid, it has been argued that all attempts at reducing chronic pain and the seeking of treatment in which this is a primary objective, should be viewed as avoidance (McCracken, Gross, Aikens, & Carnrike, 1996; see also McCracken, 2005).

Empirical support for the argument that avoidance participates in, or exacerbates, chronic pain has been obtained from research that shows that the level of avoidance presented by chronic pain sufferers is positively correlated with levels of disability and depression (Asmundson, Norton, & Norton, 1999; McCracken et al., 1992). Consistent with these findings, Turk and Monarch (2002) suggested that it is the anticipation of pain, rather than the sensory experience, that mediates the avoidance of both the pain itself and normal functional activities. Indeed from a treatment perspective, Philips (1987) suggested that CBT improvements in the treatment of chronic pain resulted primarily from significant reductions in pain avoidance behaviour; in affective reactions to pain; and in depression; as well as alterations in patients' attitudes regarding levels of perceived pain control. Although further research is needed on avoidance and its role in the diagnosis and treatment of chronic pain, the empirical evidence gathered thus far supports the view that avoidance is problematic. In any case, acceptance as a psychological process provides the flip side of avoidance and, as we shall see below, there is growing evidence that it is beneficial in terms of coping with chronic pain.

Understanding Pain Processes: Acceptance in Clinical Contexts

McCracken (1998, 1999) defined the acceptance of chronic pain as living with pain without reaction, disapproval, or attempts to reduce or avoid it. Positive support for the utility of acceptance in the context of pain has been obtained from a range of sources. For example, research has shown that chronic pain sufferers who accommodate to their pain through explicit attempts to incorporate it into their lives and still achieve high levels of life satisfaction show less overt pain behaviour and depression (Jacob, Kerns, Rosenberg, & Haythornthwaite, 1993). In interpreting these results, it has been suggested that acceptance in this context involves accommodating to the belief that a cure for pain is unlikely and switching focus to the non-pain-related aspects of one's life (Risdon, Eccleston, Crombez, & McCracken, 2003). Although little has been written about the actual process of acceptance in the context of chronic pain, Geiser (1992) argued that sufferers proceed through a number of defined emotional stages, not unlike mourning an irreversible loss. These stages include: (1) recognising the presence of chronic pain; (2) recognising that one struggles with the pain; (3) recognising the cost of continuing to struggle with pain; (4) giving up on the struggle; and (5) identifying other goals and realistic activity interests. Although Geiser's stage model of acceptance has not been subjected to systematic empirical analysis, a number of studies have attempted to assess the relative effectiveness of acceptance in coping with chronic pain.

One of the first studies that attempted to compare an acceptance-based versus CBT approach to the treatment of chronic pain was reported by Geiser (1992) with sixty-five chronic pain in-patients. The Acceptance Condition focused on encouraging patients to give up the struggle with pain and to channel their efforts into other life goals. In contrast, the CBT Condition focused on the enhancement of skills for

managing or reducing pain as an important step towards living a full life. Both treatments produced significant improvements in pain acceptance, which then predicted increases in total activity and decreases in interference with daily schedules. However, two key differences distinguished the two outcomes. First, only participants in the Acceptance Condition demonstrated significant decreases in drug use. Second, participants in the CBT Condition showed greater loss of initial treatment gains at follow-up in terms of levels of activity, mood and anxiety.

In an attempt to analyse the precise role of acceptance on clinical pain outcomes, McCracken (1998) reported that after controlling for pain intensity and any significant demographic variables, acceptance of pain significantly predicted the seven criterion variables: pain-related anxiety; avoidance; depression; physical and psycho-social disability; daily uptime; and work status. Furthermore, a relatively low correlation between pain intensity and acceptance indicated that acceptance was not merely a function of having a low level of pain tolerance. Further research has bolstered this general finding (Viane, Crombez, Eccleston, Poppe, Devulder et al., 2003). Specifically, Viane et al., examined the construct validity of acceptance by comparing the; the Illness Cognitions Questionnaire (ICQ: Evers, Kraaimaat, Van Lankfeld, Jongen & Billsma, 2001); the pain severity sub-scale of the Multidimensional Pain Inventory (MPI-DLV: Lousberg, Van Breukelen, Groenman, Schmidt, Arntz, et al., 1999); the MOS 36-item Short Form Health Survey (Ware, & Sherbourne, 1992); and the Pain Cognition List (PCL: Vlaeyen, Geurts, Kole-Snijders, Schuerman, Groenman et al., 1990). The analyses revealed that acceptance of pain was associated with less pain catastrophising, but not with pain severity. Furthermore, its role in mediating mental health beyond pain catastrophising and severity was moderate and robust. With acceptance incorporated into a broader ACT

package, Dahl, Wilson and Nilsson (2004) reported superior ACT outcomes relative to treatment as usual in a randomised control trial involving participants with stress and pain symptoms who were at risk of becoming long-term disabled. Specifically, ACT reduced by 91% the number of sick days absent from work over a six-month period.

Additional recent evidence to support the beneficial role of acceptance in coping with chronic pain comes from a study that incorporated ACT components into CBT (Vowles et al., 2007). Specifically, this research showed significant reductions in: pain; depression; pain-related anxiety; disability; and catastrophising; as well as increases in acceptance; walking speed; and sit-to-stand frequency. Unfortunately, as is the case with all treatment packages, it is very difficult to determine the active ingredients that brought about beneficial change. Indeed, this is a particular problem when researchers mix and match different therapeutic components in the absence of a clear understanding of the processes at work. In response to this difficulty, some researchers have focused on experimental analyses of the putative processes that are assumed to mediate therapeutic outcomes. In the next section such analyses in the context of the acceptance of stress/pain induction will be considered.

Acceptance and Pain/Stress Induction in Experimental Contexts

A range of stress induction methodologies have been used to model clinical pain and relevant coping strategies, including: the Cold Pressor Task (Hayes, Bisset, Korn, Zettle, Rosenfarb et al., 1999); the Carbon Dioxide (CO^2) Challenge (Levitt, Brown, Orsillo, & Barlow, 2004); and Brief Electric Shock (Gutierrez, Luciano, Rodriguez, & Fink, 2004). With the Cold Pressor Task, Hayes et al. (1999) compared an Acceptance rationale specifically aimed at disconnecting thoughts and feelings from behaviour to Cognitive Control, comprised of stress inoculation (Turk, 1978),

and an Attention Placebo rationale. In both conditions, the "rationale" lasted ninety minutes, was scripted, and was read aloud to the participant by the Experimenter. In this study, undergraduate participants used self-report measures to rate the level of pain intensity, total sensation and unpleasantness/adversity induced by the task.

The results demonstrated that Placebo participants spent the least time with their hands immersed in the iced water, while Acceptance participants spent the longest time. However, the subjective measures indicated that the latter group *did not experience less pain.* Furthermore, a primary mediator of the acceptance effect was reduced believability in thoughts and feelings about pain.

Similar findings were reported when Acceptance, Suppression and Placebo were compared for sixty Panic Disordered patients exposed to the CO^2 challenge (Levitt et al., 2004). The subjective anxiety reported by participants in the Acceptance Group decreased significantly, but increased for those in the Suppression Group. Furthermore, the former participants reported the greatest willingness (i.e. less avoidance) to participate in a hypothetical subsequent challenge.

Equally positive effects have been reported for acceptance when employed as a strategy for coping with Brief Electric Shock. Specifically, Gutierrez et al. (2004) compared Acceptance and Distraction, including a motivational context with a valuable goal linked to participants' performances on the pain procedure. Both interventions involved a short protocol with examples, a metaphor and an exercise aimed at coping with the experimentally induced pain. The results of the study indicated a statistically significant increase in pain tolerance for Acceptance, but not Distraction. Further analyses also revealed a significant difference between the interventions in terms of tolerance increases amongst those participants who tolerated the *highest* levels of pain at Baseline. Specifically, 71% of Acceptance participants

high in Baseline pain increased their tolerance levels compared to only 11% of the same sub-set within Distraction. Once again, therefore, this increased tolerance was not mediated by reductions in pain severity. Indeed, the Acceptance Condition accounted for the highest percentage of participants reporting the highest levels of pain while still increasing in tolerance (for a replication, see Johnson, Stewart, Barnes-Holmes, Barnes-Holmes, Luciano et al., 2004).

Acceptance and Radiant Heat Induction

The empirical evidence reviewed thus far provides strong positive support for acceptance-based strategies using the existing methodologies for the experimental induction of physical stress or pain. However, it remains the case that each of these procedures has established limitations (Mitchell, Mac Donald, & Brodie, 2004). In an assessment of studies involving the Cold Pressor Task, for example, Mitchell et al. (2004) found a lack of standardised equipment, as well as variations in: the number of immersions; immersion time; maximum tolerance time; and the manner in which hands return to normal temperature. The same researchers reported significant variations in water temperature across studies, ranging from 0 to 7ºC, with only half of the experiments employing water circulation devices. According to Mitchell et al., significantly different pain sensations and experiences will likely occur with variations in temperature on the Cold Pressor Task. Although both the CO^2 Challenge and Brief Electric Shock appear to permit greater methodological reliability than the Cold Pressor Task, one may raise concerns about their external validity. For example, one might question the extent to which a brief electric shock on one's forearm resembles the symptoms of real-life chronic pain.

A number of researchers have begun to examine an alternative methodology that may offer a reasonably sound analogue of clinical pain. Radiant heat induction originated in the animal laboratory in attempts to examine the effects of motivational or emotional factors on animals' ability to tolerate pain. In one study, for example, radiant heat induction was used to determine the point at which rats would tail-flick in response to pain (Meagher, Grau, & King, 1989). These researchers reported that rats exposed to shock or other stressors prior to the heat apparatus demonstrated longer heat tolerance that may be explained by the concept of '*stress induced analgesia'*.

Other researchers have employed a modified version of the heat-induced tail-flick test for use with human participants (Lee, & Stitzer, 1995). In this study, radiant heat induction (i.e. placing the finger directly on the heat pad) was systematically compared to Brief Electric Shock, with two exposures to each procedure in a randomised counterbalanced design. The results of the study indicated greater stability of measures recorded across repeated exposures to the heat apparatus relative to the shock apparatus. The same heat methodology was subsequently employed by Rhudy and Meagher (2000), who distinguished between fear and anxiety, and attempted to assess the relative impact of each on heat tolerance. Fear was manipulated by actually exposing participants to moderate electric shock in between exposures to the heat pad, whereas anxiety was manipulated by informing participants that they would receive an electric shock, but no actual shocks were provided. The results of the study demonstrated that the two emotional states had divergent effects -- fear decreased pain tolerance, while anxiety increased tolerance.

Radiant heat induction appears to offer a high level of experimental precision that might also be harnessed as a sound analogue of chronic pain. Consider the following advantages: (1) all aspects of the procedure may be controlled by computer

software, thus enabling the participant to conduct the entire procedure in the absence of an experimenter (therefore minimising social demand characteristics); (2) heat increments are precise and systematic in terms of both temperature and timing, thus ensuring that the rate of temperature increase remains the same across all participants; (3) participants can indicate in milliseconds the points at which the stimulation is registered as painful and intolerable, thus providing clear indices of the level of pain; (4) all participants have a sense of personal control over the apparatus because they can remove their hand at any point; (5) these aspects of control also ensure high levels of ethical adherence; (6) the automated delivery of heat is slow and intense, perhaps not unlike chronic pain, which is more likely slow to onset than sudden (as would be the case with Brief Electric Shock); (7) the apparatus is simple to use; and (8) recovery time is in the region of two minutes and no skin damage has ever been recorded at the temperatures presented.

The Current Thesis

The current program of research extended existing work on coping strategies for experimentally induced pain, with a particular focus on the relative utility of acceptance versus distraction. A primary aim of the research was also to examine the experimental utility and analogue potential of radiant heat apparatus as a pain induction procedure that would be potentially sensitive to clinical intervention. All experimental aspects of the study were automated, such that participants interacted directly with a computer program, even during the interventions.

The research program here comprised five experimental studies, including componential analyses to investigate the processes underpinning the use of acceptance and distraction as strategies for coping with pain. Chapter 2 included a large-scale

study (Experiment 1) that demonstrated the positive impact of acceptance on radiant heat tolerance, relative to distraction and placebo. Although a limited positive outcome was recorded for distraction, this effect appeared to be attributable to features of defusion implicit in the Distraction protocol. Experiment 1A confirmed this hypothesis when modifications to the distraction intervention produced outcomes for Distraction that were indistinguishable from Placebo.

Experiment 2 reported in Chapter 3 attempted to match the Acceptance and Distraction protocols more closely, by encouraging *all* participants to engage in positive imagery, to determine key features of the interventions that facilitated the differential outcomes. At its simplest, the different outcomes may have resulted from the fact that participants in the two key intervention groups were engaging in different experimental activities. This study also modified the experimental adherence measures, which had not yielded strong outcomes in the previous studies. That is, it had not been clear that participants in the Acceptance Intervention were using acceptance to cope with the pain, and that participants in the Distraction Intervention were using distraction. One procedural modification employed to enhance adherence involved the introduction of a Values Clip that advised participants that their involvement in the research would be of indirect assistance to real sufferers of chronic pain. The results from Experiment 2 indicated strong adherence to intervention by all participants, which suggested the potential role played by the added Values Clip. Furthermore, the data were supportive of the two previous studies with increases in pain tolerance for Acceptance, but not for Distraction.

Experiment 3 reported in Chapter 4 further enhanced the similarities between the Acceptance and Distraction Interventions, such that the two were now only separated by instructing one to use the positive imagery to distract from the pain

(Distraction), while instructing the other to notice that you can have positive imagery and the pain at the same time (Acceptance). In this study, the Swamp Metaphor incorporated into all protocols employed thus far was also removed, to determine the impact this may have had on the previous outcomes. The results indicated that once again Acceptance was associated with increases in pain tolerance, Distraction was not. Unfortunately however, the strong adherence effects recorded previously were not maintained. Although these results initially suggested that the Swamp Metaphor had relatively little impact on outcomes, the low adherence data suggested the possibility that the metaphor may have been useful in facilitating greater understanding of, and adherence to, the experimental protocols.

In Experiment 4, reported in Chapter 5, the Swamp Metaphor was re-incorporated into both interventions because of its likely relationship with adherence. However, the Values Clip was now removed in order to determine what role this may have played in the outcomes from Experiments 2 and 3. The data here were almost consistent with the four previous studies, with pain tolerance increases for Acceptance, but not Distraction. However, adherence to intervention remained problematic.

Chapter 6 presented a systematic comparison of the methodological differences and findings across the five studies. These comparisons yielded three strong features of the research program. First, differential outcomes could not be attributed to pre-experimental participant differences on psychological measures. Second, data from independent raters rendered it unlikely that participants had different perceptions of the therapist who presented the two key interventions. Third, the collective distress ratings suggested that the improvements for Acceptance were not attributable to reductions in discomfort, pain or anxiety levels, relative to

Distraction. Taken together, therefore, it seemed reasonable to assume that the observed changes in heat tolerance resulted from the use of the differential coping strategies with which participants were provided. The data also highlighted the complex interplay of various intervention components, including the Swamp Metaphor and the Values Clip. Interestingly, these features also appeared to have an indirect relationship with levels of experimental adherence.

The current research extends existing evidence of the relative utility of acceptance and distraction as coping strategies for dealing with experimentally induced pain. In all five studies, acceptance was associated with considerable increases in pain tolerance, distraction was not. The work also represents the first attempt to employ clinical interventions with radiant heat pain as an analogue of clinical pain. The strong concordance of evidence across all five studies, as well as consistency with existing evidence, clearly pointed to the utility of the apparatus in this regard. The fully automated procedure, including the computerised delivery of the interventions in the absence of the experimenter is one of the first of its kind in the area of clinical analogue research.

Chapter 2

Experiments 1 and 1A

Examining Interventions for Coping with Experimentally-Induced Radiant Heat Pain

Chapter 2

Examining Interventions for Coping With Experimentally-Induced Radiant Heat Pain

Experiments 1 and 1A

A range of methodologies have been used to examine the relative utility of acceptance-based strategies in coping with experimentally-induced pain, including the Cold Pressor Task (Hayes et al., 1999; Masedo, & Esteve, 2007) and brief electric shock apparatus (Gutierrez et al., 2004; Johnson et al., 2004). Although the outcomes for acceptance have generally been positive, various researchers have highlighted problems inherent in the methodologies themselves and in the types of analyses that have been conducted (Mitchell et al., 2004). One over-riding aim of the current research involved the refinement of published protocols for the delivery of the various strategies, with a key focus on the use of automated interventions. Assuming that the automated interventions here worked well, and functioned as we expected, as brief clinical analogues, the primary aim of Experiment 1 was to explore the possible utility of acceptance-based strategies, relative to distraction and placebo, as a means of coping with experimentally induced radiant heat pain. In short, we predicted that a brief acceptance-based intervention would result in increases in tolerance of the radiant heat pain. In line with previous empirical evidence, we assumed that our distraction-based intervention would also generate increases in tolerance, but we anticipated that these would be smaller than those associated with Acceptance. We predicted that our Placebo intervention would result in no significant tolerance improvements.

EXPERIMENT 1

METHOD

Participants

A non-clinical sample of 182 undergraduate students at the National University of Ireland, Maynooth (NUIM) was selected from a list of potential experimental volunteers and were then contacted directly by the Experimenter for participation in Experiment 1. None of these individuals had any previous experience of the radiant heat apparatus or related procedures.

Participant Exclusion Criteria

There are a number of reasons why participants may have been removed from the original sample, including: refusal to continue at the informed consent phase (2 participants removed) and evidence of recurrent pain, related disorders, medication use, or recent therapeutic intervention, from a medical screening measure (11 participants removed). All of the participants who were removed on the basis of these initial screening criteria were never exposed to the heat apparatus.

Several other inclusion criteria resulted in the further removal of participants. Specifically, participants were removed if they demonstrated a maximum heat tolerance time at Baseline that was at least two standard deviations above the mean (i.e. heat tolerance of more than 13.8secs. -- 23 participants removed). These participants were exposed to the heat apparatus only at Baseline and participation thereafter was terminated. Furthermore, a sub-sample of 18 participants scored outside the normal range on one or more of five pre-experimental screening questionnaires and thus were excluded from data analyses, although these individuals did complete the experiment.

Taken together, all of the exclusion criteria resulted in the removal of 54 participants from all aspects of completion and analysis of Experiment 1, thus leaving 128 participants with full participation and data analysis. Of this remaining sample, 52% were male and 48% were female. They ranged in age from 18 to 41 years, with a mean age of 21.63 years (SD=5.02). These participants were then divided according to gender and experimental intervention: Acceptance (*n*=42); Distraction (*n*=43); and Placebo (*n*=43). As much as possible, males and females were evenly divided across interventions (Acceptance: male *n*=21 and female *n*=21; Distraction: male *n*=22 and female *n*=21; and Placebo: male *n*=23 and female *n*=20).

Experimental Setting

All aspects of Experiment 1 were conducted in an Experimental Room within the Department of Psychology at NUIM. The Experimental Room and an adjoining Observation Room were connected via a two-way mirror that permitted the Experimenter in the Observation Room to observe participants in the Experimental Room, but not vice versa. The Experimental Room contained a desk, a personal computer, a standard computer mouse, the radiant heat apparatus and two chairs. One part of the heat apparatus (i.e. *the heat pad*) was located on the desk beside the computer, while another part (i.e. *the heat generator*) was located on the floor. The desk also contained a button box linked by cable to a buzzer in the Experimental Room. The Experimenter accompanied participants in the Experimental Room during all screening and instructional aspects of the study. However, participants remained alone in the room during the heat tests and intervention phases (at these times the Experimenter was in the Observation Room).

Apparatus

The Experimental and Observation Rooms were also connected via a series of cables that linked the computers in each location. Both computers contained Pentium 4 (2.2Gh) processors; 256MB memories; 40GB hard drives; and 15-inch LCD screens. The computer in the Observation Room controlled the computer in the Experimental Room by way of a KMV 2-way switch box. The radiant heat apparatus consisted of two parts: the heat pad was a square thermode (13.7cms^2) attached to a small black box, and the heat generator (attached to the pad by cables) was a larger blue box that generated the heat and contained a small fan to control the temperature. A number of Velcro pads connected the heat pad to digital scales, employed to control the amount of pressure exerted by each participant on the pad (see Figure 1). A one-button buzzer box enabled participants to communicate directly with the Experimenter. A computer program, written in Visual Basic (Version 6), controlled all aspects of the study, including the delivery of the video clip interventions (see Figure 2). For the purposes of adherence and validity, a Sony Mini D.V. camera was also in operation in the Experimental Room for the recording of all aspects of the study.

Figure 1. The heat pad apparatus and scales.

Figure 2. An example of an intervention video clip presented to participants in Experiment 1.

Materials

Pre-Experimental Measures. Experiment 1 involved the presentation of a large number of psychological measures, mostly employed here as screening tools (see Table 1). At the beginning of the study, all participants completed standard informed

consent (see Appendix I); a medical screening questionnaire (adapted from similar research by Hayes et al. 1999 -- see Appendix II); and the Edinburgh Handedness Inventory (EHI: Oldfield, 1971-- see Appendix III). Five standard psychological assessment measures were also presented at this point: The Acceptance and Action Questionnaire (AAQ-49: Hayes, Strosahl, Wilson, Bissett, Dosheen et al., 2004); The Chronic Pain Acceptance Questionnaire (CPAQ: McCracken, Vowles, & Eccleston, 2004b); The Fear of Pain Questionnaire-III (FPQ-III: McNeil, & Rainwater, 1998); The Depression Anxiety Stress Scale Short Version (DASS-21: Lovibond, & Lovibond, 1995); and The Balanced Inventory Of Desirable Responding Version 6-Form 40 (BIDR: Paulhus, 1988).

Table 1
All Measures Employed in Experiment 1

Pre-Experimental Measures	**Mid-Experimental Measures *(Distress Ratings)***	**Post-Experimental Measures**
Consent Form	Discomfort Rating	McGill Pain Questionnaire (MPQ)
Screening Measures	Pain Rating	***Adherence Measure***
Medical Screening Questionnaire	Anxiety Rating	Pain Intensity Question
Edinburgh Handedness Inventory (EHI)		3 Acceptance Questions
Acceptance and Action Questionnaire (AAQ)		3 Distraction Questions
The Chronic Pain Acceptance Questionnaire (CPAQ)		Strategy Utility
		Strategy Difficulty
Fear of Pain Questionnaire (FPQ)		Frequency of Strategy Use
Depression Anxiety Stress Scale (DASS)		Length of Strategy Use
The Balanced Inventory of Desirable Responding (BIDR)		Strategy Use in Daily Life
		Willingness to Retest

The *AAQ-49* is a written self-report measure of an individual's level of emotional acceptance or avoidance. The AAQ-49 comprises 49 statements that reflect

an orientation towards emotional acceptance (e.g. “It’s OK for me to have thoughts and feelings that I don’t like”) or avoidance (e.g. “If an unpleasant memory comes into my head, I try to get rid of it”). Participants were required to rate the degree to which they felt each statement applied to themselves using a 7-point Likert scale (1: NEVER TRUE to 7: ALWAYS TRUE). A high AAQ score indicates high acceptance/low avoidance (maximum score=343) and a low score indicates low acceptance/high avoidance (minimum score=49). According to Hayes et al. (2004), the AAQ targets specific measures of avoidant coping and self-deceptive positivity. The measure is reported to have an internal consistency of $\alpha = 0.70$ (a Cronbach alpha that is deemed acceptable for a scale in development), as well as good evidence of convergency, criterion-relation and construct validity (Bond, & Bunce, 2003; Hayes et al., 2004). Because norms are not provided by the AAQ, the mean of the full participant sample in Experiment 1 was calculated (M=203.68). Participants who scored at, or above, two standard deviations *over* the mean (i.e. >236) or two standard deviations *below* the mean (<171) were excluded from further analyses. Five participants were removed according to these criteria. A copy of the AAQ 49 is provided in Appendix IV.

The *CPAQ* employed here was adapted from a measure used by McCracken et al. (2004b) that was itself an adaptation of a measure developed by Geiser (1992). The CPAQ was developed explicitly for chronic pain sufferers’ to measure their general acceptance of pain. It is a 20-item inventory that comprises two sub-scales measuring daily activity engagement (score range 0-66) and willingness to have pain without the need to control or avoid it (score range 0-54). All items are rated from 0 (NEVER TRUE) to 6 (ALWAYS TRUE) and nine are reverse scored. A high score on either sub-scale indicates a high level of acceptance of pain within that sub-scale, while a

low score indicates a low level of pain acceptance. The total CPAQ score is simply calculated by adding the two sub-scores. According to McCracken et al., the CPAQ demonstrates appropriate levels of internal consistency and validity, with a reliability coefficient of α=0.78.

The current adaptation of the CPAQ simply involved modifying several statements in a manner that made them more applicable to normal, rather than chronic, pain. For example, the statement: "I lead a full life even though I have chronic pain" was adapted to: "I lead a full life even when I have pain". Before completing the adapted CPAQ, participants were asked to think of a previous experience of pain and instructed "it may be useful to try to remember any pain you have experienced and bear it in mind as you answer the following questions". The norms provided by the original CPAQ could not be employed here because they were designed explicitly for the assessment of chronic pain. Hence, a mean for the current sample was calculated (M=69.3, SD=8.9) and participants who scored three standard deviations or more *above* (>96) or *below* (<43) the mean were excluded from further analyses. In other words, participants who demonstrated an *unusually high* or *low* level of acceptance or avoidance of pain (only one in this case) were excluded from further analyses. A copy of the CPAQ employed here is provided in Appendix V.

The *FPQ-III* is a 30 item self-report measure designed to assess fear of pain across three sub-scales that include: Severe Pain (e.g. "Breaking your arm"); Minor Pain (e.g. "Biting your tongue while eating"); and Medical Pain (e.g. "Receiving an injection in your arm"). Items are scored on a 5-point scale from 1 (NOT AT ALL) to 5 (EXTREME), with a *low* FPQ score indicating *little* fear of pain and a *high* score indicating *strong* fear of pain. According to Osman, Breitenstein, Barrios, Gutierrez and Kopper (2002), the overall internal consistency of the measure is satisfactory, as

is the internal consistency of each sub-scale: Severe pain (α = 0.88); Minor pain (α = 0.87); Medical pain (α =0.87). The test-retest reliability also appears to be adequate (range 0.69 to 0.76). Because the overall FPQ norm is 78.2, participants in the current study who scored over two standard deviations *above* this (>114 -- three in this case) were removed from the analyses. A copy of the FPQ employed here is provided in Appendix VI.

The *DASS-SF* is a 21-item (short form version) self-report measure designed to assess the negative emotional states of anxiety (e.g. "I felt scared without any good reason"), depression (e.g. "I couldn't seem to experience any positive feeling at all") and stress (e.g. "I found it hard to wind down") on three relevant sub-scales (each with 7 statements). Participants rate the extent to which each statement has applied to them over the past week. Scores range from 0 (DID NOT APPLY TO ME AT ALL) to 3 (APPLIED TO ME VERY MUCH OR MOST OF THE TIME). A *high* score on any sub-scale indicates a *high* level of anxiety, depression, or stress. According to Lovibond and Lovibond (1995), the alpha values for each sub-scale are: Depression 0.81, Anxiety 0.73 and Stress 0.81. The sub-scale norms are: Depression 6.34, Anxiety 4.70 and Stress 10.11, with severity ratings above this ranging from Mild, Moderate and Severe to Extremely Severe. In the current study, five participants were removed from the analyses because they scored over the Moderate range on one or more sub-scale (Depression >20, Anxiety >14 and Stress >25). A copy of the DASS-SF is provided in Appendix VII.

The *BIDR* is a 40-item measure, with two sub-scales (20 questions each) measuring self-deceptive positivity (SDE -- the tendency to give self reports that may be honest, but are positively biased) and impression management (IM -- deliberate presentation of the self to an audience). Participants rate their agreement with each

statement on a 7-point likert scale from 1 (NOT TRUE) to 7 (VERY TRUE). All scores of 6 or 7 are identified as *Extreme* and are recorded as an actual score of 1. All other scores below this are not counted and thus recorded as 0. The overall BIDR score is an amalgamation of the SDE and IM sub-scores. Within each sub-scale, every second question is reverse scored. Consider the non-reversed SDE item: "I am a completely rational person" in which a score of 6 or 7 (VERY TRUE) is deemed Extreme because it is clearly not true that a person can be completely rational all of the time. Now consider the reversed SDE item: "I rarely appreciate criticism". Scores of 1 or 2 (NOT TRUE) are recorded as Extreme (because it is clearly true that a person rarely appreciates criticism) and reversed to generate scores of 6 or 7, respectively. The minimum score on either sub-scale is 0, with the maximum 20, thus generating a maximum overall measure of socially desirable responding (SDR) of 40. Hence, only participants who produce *exaggeratedly* desirable responses attain high scores. Robinson, Shaver and Wrightsman (1991) reported a coefficient alpha range of 0.68 to 0.80 for the SDE and 0.75 to 0.86 for IM. Test-retest correlations of 0.69 and 0.65 for SDE and IM, respectively, have also been reported (Paulhus, 1988). Paulhus reported an overall mean for SDR of 11.75, with means for the two sub-scales at: SDE 7.15 and IM 4.6. Because scores lower than the mean indicate low levels of socially desirable responding, participants who score in this range are generally not excluded. Hence, in the current study only participants who scored two or more standard deviations *above* the mean (>18) were removed from further analyses (two in this case). A copy of the BIDR is provided in Appendix VIII.

Mid-experimental Measures. During the experiment, participants were presented with a set of three *Distress Ratings* designed to assess their perceptions of discomfort, pain and anxiety after each heat test. Participants provided answers to

three questions (one discomfort, one pain and one anxiety) by placing an X on a printed 10cm. Visual Analogue Scale (VAS) ranging from 0 (NO Discomfort/Pain/Anxiety) to 10 (VERY MUCH Discomfort/Pain/Anxiety). A copy of the Distress Measures is provided in Appendix IX.

Post-Experimental Measures. A series of additional measures were completed by participants at the end of the experiment that included an adapted version of the McGill Pain Questionnaire-Short Form (MPQ-SF: Melzack, 1975) and a set of questions primarily concerned with participant's use of the intervention strategy to which they were assigned.

The *MPQ-SF* was used to examine how painful participants found the preceding pain tests. The original MPQ was developed in order to measure pain on a multi-dimensional scale including sensory, affective and cognitive aspects. It has been found to be both reliable and valid (Fernandez, & Boyle, 2002). The MPQ-SF was designed to obtain information from patients in a limited space of time. This abbreviated version, therefore, contains eleven sensory words (e.g. "burning") and four affective words (e.g. "punishing"). Participants rate each word as MILD, MODERATE, or SEVERE as an indication of the level of the pain they experienced during the heat tests (e.g. a participant may have rated the pain as SEVERELY "burning"). Each level of intensity was then scored with MILD as 1, MODERATE as 2 and SEVERE as 3 (participants who rated the pain as less than MILD were asked to leave it blank and this was scored as 0). An overall MPQ score, therefore, comprises the combined total from the severity ratings on each of the 15 words. This questionnaire was included at the end of the experimental sequence in order to determine how participants found the pain associated with the heat tests. A copy of the MPQ-SF is provided in Appendix X.

The *Adherence Measure* contained 13 questions, which participants answered by placing an X on a printed 10cm. VAS ranging from 0 (NOT AT ALL) to 10 (VERY MUCH -- see Appendix XI). The adherence questionnaire contained one generic question that assessed participants' overall level of pain experienced during the experiment (see Table 1). There were then four questions that related directly to the strategy that comprised their intervention (acceptance or distraction). These were concerned with: strategy utility; strategy difficulty; frequency of strategy use in experiment; and frequency of strategy use in daily life (Gutierrez et al., 2004; Johnson et al., 2004).

The adherence measure also included three acceptance- (e.g. "How much pain did you actually allow yourself to feel?") and three distraction-based questions (e.g. "Did you try to distract yourself from feeling pain in any way?") that were consistent with the two key interventions. The purpose of these questions was to determine whether participants in the Acceptance Intervention were using acceptance rather than distraction and whether participants in Distraction were using distraction, rather than acceptance. Hence, both groups were presented with all six questions. The measure also contained a final generic question that assessed participants' willingness to do another (hypothetical) heat test.

The experimental materials also included three pieces of card on which participants were instructed to write down three heat pain-related thoughts, an envelope that contained a further piece of card, and a page for writing summaries of the video clips.

Experimental Sequence

An overview of the experimental sequence is provided in Figure 3.

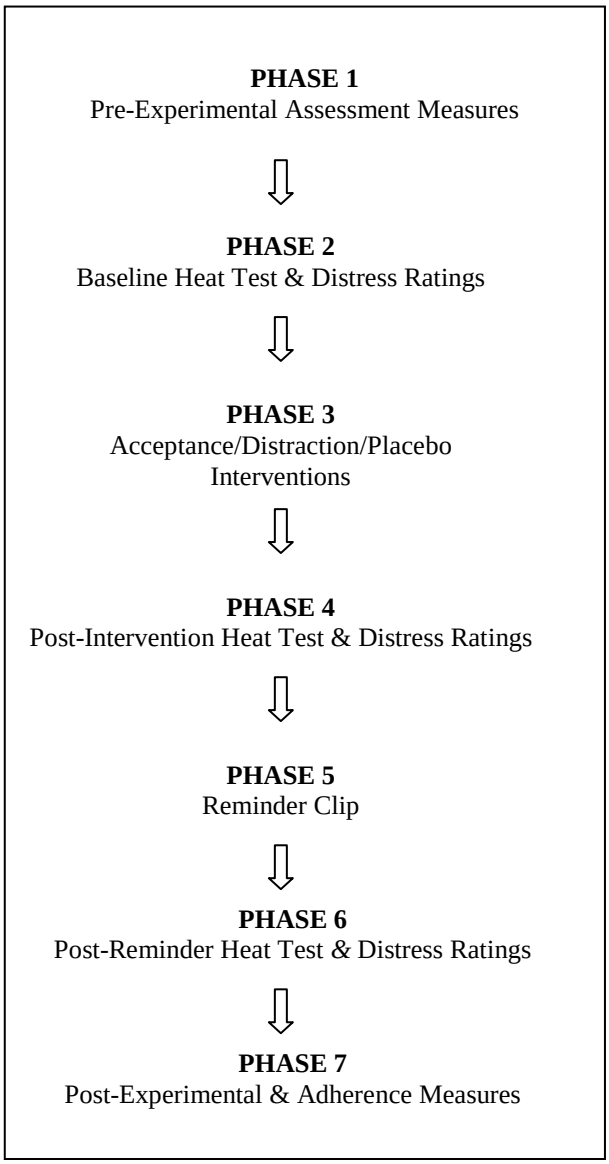

Figure 3. An overview of the experimental sequence conducted in Experiment 1.

Procedure

All aspects of the experiment were filmed and participants were informed of this before entering the room. Participation for each person lasted approximately one hour.

Phase 1: Pre-Experimental Assessment Measures. At the outset of the experiment, all participants were greeted and informed briefly of the nature of the study. All of the questionnaire materials were already available in the room and the Experimenter left the room once the participant was settled comfortably. Participants completed the consent form, the medical screening measure and the EHI as a short printed booklet (in that order) prior to the Experimenter's return. These three measures were then taken to the Observation Room and were checked by the Experimenter, while participants had a short break. If responding on either the medical screening questionnaire or on the consent form was inappropriate for continuation, the participants in question were immediately thanked for their time and their participation in the study was terminated. For participants who responded appropriately, the Experimenter returned to the room and presented them with a second printed booklet containing the five psychological measures. The five psychological measures contained within the second booklet were the AAQ, the CPAQ, the FPQ, the DASS and the BIDR (printed in that order). Once again, the Experimenter remained in the Observation Room during the completion of these measures.

Phase 2: Baseline Heat Test & Distress Ratings. A short while after completing the psychological measures, participants were presented with a third printed booklet that contained instructions for the appropriate use of the heat pad as follows:

> You will notice a radiant heat box beside you. The apparatus works by placing your index and middle fingers of the hand you do NOT use to write with (i.e. your non-dominant hand) FLAT on the square at the centre of the heat pad.
>
> When the machine is on, you will notice that the pad generates radiant heat, which will then begin to pass through your fingers. During some parts of the experiment, you will be asked to notice how the heat passing through your fingers increases.

> Now in order to place the correct level of pressure on the pad with your fingers, you must press down until the pressure on the pad reads between 1000 and 2000 grams on the scales below it. This is the correct amount of pressure that must be placed on the pad *at all times* when using it. If you choose to remove your hand from the pad please do so quickly.
>
> I would like to remind you that every necessary safety precaution has been taken to ensure that exposure to the heat will not harm you in any way. The heat pad itself reaches a designated maximum temperature.
>
> You MUST wait until you have read through at least once and understood each page of instructions before you begin to actually follow the instructions regarding the heat task.

Participants were then familiarised with the heat pad through a number of short practice trials. The first practice trial was designed to ensure that participants could place the correct amount of pressure on the pad. Hence, participants were instructed as follows:

> Please place your two fingers on the pad.
>
> Remember that the pressure on the pad must remain between 1000 and 2000 grams on the scales below it. You must try to remember this level of pressure so that you don't have to look at the scales all of the time because in future tests you will be asked to do something else at the same time.

The second practice trial was designed to familiarise participants with the gradual heating of the pad and in this trial only the maximum heat was adjusted to 37°C (unlikely to be perceived as painful). Hence, participants were instructed as follows:

> This practice trial is simply to help you to adjust to the apparatus. At this stage the machine will only reach a mild heat, at which it is likely that you will *not need to remove your hand.* However, if you find the heat unpleasant please feel free to remove your hand at any time.
>
> When you are ready to start the practice trial, press the Buzzer. You will slowly begin to feel the heat increase through your fingers.
>
> Please remove your hand when you hear the Buzzer.
>
> Once you have removed your hand, please immediately complete the three questions on the next page of the Instruction Booklet.

At this point, participants were required to complete the Distress Ratings in which they rated their experience on the practice trial along three printed 10cm. VAS ratings

of discomfort, pain and anxiety. A 2min. rest period was thereafter provided to ensure that the fingers returned to normal temperature.

The third practice trial was designed to familiarise participants with the use of the buzzer to indicate to the Experimenter the point at which they perceived the heat to be painful (referred to as *threshold*) and the point at which they perceived the heat to be intolerable (referred to as *tolerance*). This third practice trial was identical to an actual heat test in that the maximum temperature was 50°C. However, outcomes on the practice trials were not analysed because it was important to have a practice test in which participants adjusted fully to the apparatus and accurately assessed their individual threshold and tolerance levels. On the third practice trial, participants were instructed as follows:

> The level of heat that you can tolerate must now be calculated. This time the temperature will gradually increase until it reaches the maximum temperature. Place your two fingers on the pad at the pressure previously demonstrated (between 1000 and 2000 grams).
>
> Please press the buzzer when your fingers are stable at this level of pressure and you are ready to begin. The heat pad will then start to heat up.
>
> After you have pressed the buzzer for the first time, you must press it a second time when *the heat sensation on your fingers begins to feel sore or painful.* Please note that you are asked to *keep your fingers on the heat pad for as long as possible* after you have pressed the buzzer the second time.
>
> When you can no longer bear the heat you must press the buzzer button a third time. The heat machine will then be turned off and the test will be over. You may remove your hand once you have pressed the buzzer for the third time.

Once again, participants thereafter rated their levels of discomfort, pain and anxiety and a 2min. rest period ensured that finger temperatures returned to normal. It is important to emphasise that during the written instructions the heat tests were referred to as “heat trials” or “heat tasks” in order to indicate to participants that this was not a “test” in which they could pass or fail.

Participants were then presented with their fourth exposure to the heat pad that now constituted the Baseline heat performance. All aspects of this trial were identical to the third exposure, except that the data were employed for the purposes of analysis. Once again, participants thereafter rated their discomfort, pain and anxiety and rested for 2mins. to ensure that finger temperatures returned to normal.

Heat tolerance was measured as the time taken (in seconds) between the participant indicating that the heat was painful (threshold) and the removal of the hand from the pad (tolerance). As expected, participants differed considerably in their Baseline heat tolerances and in order to control for this, they were categorised at Baseline as LOW, MEDIUM, or HIGH. These categorisations were derived from a mean heat tolerance of 6.85 seconds that was recorded with the initial participating sample. Specifically, participants were categorised as LOW if their tolerance time was two or more standard deviations *below* the group mean (i.e. 0 to 4.7 secs.); MEDIUM if tolerance time was one standard deviation below or above the mean (i.e. 4.8-8.5 seconds); and HIGH if tolerance time was two or more standard deviations *above* the mean (i.e. 8.6-13.8 seconds). All participants who exceeded a tolerance time of 13.8 secs. at Baseline participated in the experiment, but their data were not included in analyses.

Phase 3: Therapeutic Interventions. Participants were assigned to the therapeutic interventions based on their baseline heat tolerance category, such that there were equal numbers of participants from each category assigned to each intervention. The interventions were also balanced for gender. The three interventions that comprised Phase 3 were: Acceptance, Distraction and Placebo (see Figure 3). Most aspects of this phase were similar across the two key interventions (Acceptance and Distraction) because each comprised three core elements -- a Cards Exercise, a

Walking Exercise and the Swamp Metaphor. In the Cards Exercise, participants were instructed to write down pain-related thoughts from the Baseline heat test on a set of cards. In the Walking Exercise, participants were required to walk around the room using specific strategies to enable them to deal with pain-related thoughts and feelings. Finally, the Swamp Metaphor was explicitly designed to create an analogy between the strategy identified in the metaphor for crossing a swamp and the strategy they had been given to deal with the pain-related thoughts. Both the Acceptance and Distraction protocols were matched as closely as possible for word content, number of strategies and opportunities to practise the strategy. Each protocol was also matched for the number of explicit references to the Baseline heat test and the number of instructions regarding continuation in subsequent heat tests. At its simplest, therefore, there were only functional or strategy-based differences between the Acceptance and Distraction protocols and these are described below. All video clips employed in the study contained the same therapist and were recorded on the same day.

The *Acceptance Intervention* was specifically designed to disconnect overt actions from thoughts and feelings, with the primary aim of enabling participants to notice pain-related thoughts and feelings, without permitting this type of content to control overt action. All instructions were automated and presented on-screen as a series of seven video clips incorporated into the VB program.

The first acceptance clip presented the Cards Exercise in which participants were given 60secs. to recall three thoughts about the pain they had experienced during the Baseline heat test. Participants were instructed verbally by the therapist in the first video clip as follows:

> I would like you to recall three thoughts that you experienced at the point at which you decided to stop the heat in the previous pain trial. For example, you may have had the thought "I can't stand this pain or heat".
>
> When you have remembered three of these thoughts, could you please write each thought on one of the three pieces of card placed on the right hand side of the desk beside you. You have plenty of time, about sixty seconds, in which to do this.

After a pause in the clip of 60secs., participants were asked:

> Please summarise in your own words what you have just been told and what you did, and when you are ready to continue, please click on the next button to see the next clip.

At this point, they were required to write down on a summary sheet on the desk their perceptions of what they had been instructed to do and what they actually did.

The second clip comprised the first part of the Walking Exercise and participants in Acceptance were instructed as follows:

> Now that you have written down three thoughts, please keep the three pieces of card on the desk beside you. Okay, if you now look at the left hand-side of the desk you will see a sealed envelope containing a piece of card. Please open the envelope and take out the piece of card inside. Then read aloud the sentence written on the card and place the card in the box on the table. You have plenty of time, about twenty seconds, in which to do this.

The envelope employed in the Acceptance Intervention contained the written statement "I cannot walk" that was used to highlight the fact that one can think one thing and do the opposite (i.e. one can walk around the room and at the same time have the thought "I cannot walk"). Hence, one does not have to do what one's thoughts and feelings say. After 20secs., participants were instructed as follows:

> Imagine that the sentence is like one of the three pain-related thoughts that you wrote down previously. Now I would ask you to please get up and walk once around the room while repeating aloud the sentence that was written on the card. Notice that as you walk around the room you are saying, "I cannot walk, I cannot walk, I cannot walk".

Prior to walking, participants were instructed on-screen to "click on the next box when you have walked around the room". Participants then walked once around the room repeating aloud the phrase "I cannot walk".

The third clip instructed participants to summarise the instructions and actions associated with Clip 2 as follows:

> Please summarise in your own words what you have just been told and what you did, and when you are ready to continue, please click on the next button to see the next clip.

The second part of the Walking Exercise was presented in the fourth clip, which explicitly drew an analogy between the Walking Exercise and the heat test as follows:

> I would like you to consider the possibility that during the next pain trial you could notice thoughts and feelings about pain, but at the same time you could continue to tolerate the pain or heat, regardless of the content of those thoughts and feelings. For example, just like saying, "I cannot walk" while walking around the room, you can have the thought "I can't stand this pain or heat" and still continue with the trial.
>
> Please summarise in your own words what you have just been told, and when you are ready to continue, please click on the next button to see the next clip.

The fifth clip presented the first part of the Swamp Metaphor and contained another analogy between the difficulties of crossing a swamp and the pain experienced during the heat test, with specific emphasis placed upon the utility of the therapeutic strategy that had been provided. In the Acceptance Intervention, therefore, some of the content of the metaphor focused explicitly on enabling participants to notice thoughts and feelings while remaining focused on the task at hand:

> Now I would like you to imagine that the next pain trial you will experience is a bit like trying to cross a muddy swamp. Imagine that the swamp is full of dirt, rubbish and leftovers that smell really bad and really stink. What kind of thoughts do you think are going to occur in such a situation? It's likely that thoughts such as "I can't stand this. This is unbearable. I can't do anything this unpleasant or disgusting. It's not worth the effort. It's nonsense" will all show up. The best way you could possibly cross the swamp would be to notice all those thoughts and the distress they carry with them and let them be, to notice them and make room for them while you keep crossing the swamp. It's about being open to all the thoughts that may show up and the distress associated with them, about carrying them with you while you keep doing what you were trying to do in the first place-- that is crossing the swamp and reaching the shore (in other words tolerating the heat pain). Notice all the thoughts that show up while you perform the pain trial and carry them with you because you can have whatever thoughts and act differently to what you think or feel.

> Please summarise in your own words what you have just been told, and when you are ready to continue, please click on the next button to see the next clip.

The sixth clip then connected the Swamp Metaphor with the heat test and instructed participants as follows:

> For the next part of the study, it is important that you imagine that doing the pain trial is a bit like trying to cross the swamp, in that there is some kind of emotional or physical discomfort that seems to be standing in the way of something you want. You should think of the heat in this part of the study as being like the discomfort that stands in your way.
>
> Please summarise in your own words what you have just been told, and when you are ready to continue, please click on the next button to see the next clip.

The seventh clip was the final in the intervention series and simply instructed participants that the experiment had now ended:

> Thank you. Please press the buzzer button and the Experimenter will be with you shortly.

The *Distraction Intervention* was designed specifically to enable participants to use positive imagery as distraction to disconnect actions from thoughts and feelings. Because there were only functional (i.e. strategy-based) differences between this and the Acceptance protocol, only the differences are highlighted below. However, the full Distraction Intervention is presented in Appendix XII.

In Clip 2 of Distraction, the envelope contained a blank piece of card (rather than the statement "I cannot walk"), on which participants were asked to try to imagine a positive scene that could be used for distraction:

> Now that you have written down three thoughts, please keep the three pieces of card on the desk beside you. Sometimes it helps to engage in distraction when trying to deal with thoughts and feelings. To show you how this works please try to think of a nice pleasant scene in as much detail as you can. You have plenty of time, about thirty seconds, in which to do this.
>
> Okay, if you now look at the *left* hand-side of the desk you will see a sealed envelope containing a piece of card. Please open the envelope and take out the piece of card inside. Try to imagine that the blank piece of card inside the envelope contains the nice pleasant scene that you imagined. Then put

> the card in the box on the table. You have plenty of time, about twenty seconds, in which to do this.

For the Walking Exercise, participants in the Distraction Intervention walked around the room saying aloud one of the pain-related thoughts and immediately trying to distract themselves from this by imagining their pleasant scene. Participants were instructed to do so as follows:

> Now please pick up one of the three pieces of paper on which you wrote a pain-related thought. Read that thought aloud and then please walk once around the room while repeating aloud the sentence that was written on the paper. At the same time, try to distract yourself from the thought by thinking about the pleasant scene you imagined before. Notice that as you walk around the room you are trying to distract yourself from the pain-related thought by imagining the pleasant scene.

Clip 4 of the Distraction Intervention also attempted to draw an analogy between the Walking Exercise and the heat test as follows:

> I would like you to consider the possibility that during the next pain trial you could notice thoughts and feelings about pain and then try to distract yourself from these thoughts and feelings by imagining your nice pleasant scene. For example, if you had the thought "I can't stand this pain or heat", you could immediately try to imagine your pleasant scene in order to take this thought away and still continue with the test.

The Swamp Metaphor provided to these participants in Clip 5 contained explicit references to distraction (rather than acceptance) as follows:

> Now I would like you to imagine that the next pain trial you will experience is a bit like trying to cross a muddy swamp. Imagine that the swamp is full of dirt, rubbish and leftovers that smell really bad and really stink. What kind of thoughts do you think are going to occur in such a situation? It's likely that thoughts such as "I can't stand this. This is unbearable. I can't do anything this unpleasant or disgusting. It's not worth the effort. It's nonsense" will all show up. The best way you could possibly cross the swamp would be to try to think of more pleasant things, to imagine for instance that you are in a lovely landscape and meanwhile to keep crossing the swamp. It's about removing distress and unpleasant thoughts and thinking of more positive things, so that you can get on with what you were trying to do in the first place -- that is crossing the swamp and reaching the shore (in other words tolerating the heat pain). While you are performing the pain trial try to remove pain-related thoughts that show up and think of more pleasant and positive things because those thoughts will help you to keep performing the trial.

Many of the presentation aspects of *Placebo* resembled the other two interventions, although the content was not related to heat in any way and no therapeutic strategy was instructed. Specifically, the content of the Placebo protocol was a geographical documentary about the British Isles. Hence, there was no Cards Exercise or Swamp Metaphor, although participants did walk around the room. The full Placebo Intervention is provided in Appendix XIII.

Phase 4: Post-Intervention Heat Test & Distress Ratings. Immediately after the intervention, participants were exposed to the Post-Intervention heat test followed by VAS ratings of discomfort, pain and anxiety that were identical to the Baseline test in Phase 2.

Phase 5: Reminder Clip. During Phase 5, participants were presented with a therapeutic reminder clip that summarised the strategy provided to them previously. The reminder clip for the Acceptance Intervention was as follows:

> Remember the heat is like the discomfort that appears to stand in the way of something you really want. You can keep performing the trial regardless of whatever thoughts you have while doing it. Remember that you can make room or space for your thoughts and act completely different to what they tell you.

The reminder clip for the Distraction Intervention was as follows:

> Remember the heat is like the discomfort that appears to stand in the way of something you really want. You can keep performing the trial by distracting yourself and thinking of pleasant things. Remember that if you think of pleasant and positive things, you will be able to act in the direction you want.

The reminder clip for Placebo contained additional geographical information (see Appendix XIII).

Phase 6: Post-Reminder Heat Test & Distress Ratings. Immediately after the reminder clip, participants were exposed to the final Post-Reminder heat test and VAS ratings, identical to the two previous heat exposures.

Phase 7: Post-Experimental and Adherence Measures. Phase 7 comprised the MPQ and the adherence questionnaire. After completion of these, participants were debriefed (see Appendix XIV) and thanked for their participation (queries were also answered as appropriate).

Video Clip Inter-Rater Reliability

In order to ensure that the Acceptance and Distraction Interventions were appropriately matched, four blind and independent raters were asked to rate the believability, genuineness, likeability and empathy of the 'therapist' in the clips. In order to respond, the raters selected a number on a Likert scale (see Appendix XV) from 1 (e.g. NOT AT ALL) to 10 (e.g. HIGHLY) for each of the four qualities on each of the 16 clips (8 Acceptance and 8 Distraction). Four separate independent samples t-tests (one for each aspect of the video clips) found no significant differences among the groups (all p's > 0.41).

RESULTS

In the current and all subsequent experiments, gender and level of initial heat tolerance were matched across interventions. However, neither gender nor tolerance category were central to the current research programme and thus these were not

subjected to statistical analyses. Indeed, incorporating these two variables into factorial analyses would have reduced the *n* in each cell to unacceptably low values (in some cases as low as 4 per cell). The general analytic strategy adopted in the current study and subsequent experiments involved conducting an initial mixed repeated measures ANOVA followed by three planned within participant ANOVAs. The latter ANOVAs are conducted in each case to test specific predictions concerning which intervention would produce a significant increase in tolerance from Baseline to Post-Intervention and Post-Reminder. Given that the research will seek to replicate key effects across multiple experiments, this should serve to protect against Type-II errors when using multiple ANOVAs. The data from the various aspects of Experiment 1 are presented separately below.

Data from Pre-Experimental Measures

The data from the five psychological measures were collated by intervention and the means on each are presented in Table 2. Across four of the measures, there were little or no differences among the intervention groups. However, on the DASS the Placebo group produced considerably higher scores than the other two groups.

Table 2
The Means and Standard Deviations for Intervention on the Psychological Measures in Experiment 1

Intervention	**Psychological Measures**				
	AAQ	*CPAQ-A*	*FPQ*	*DASS*	*BIDR*
Acceptance	200.10	69.12	76.81	10.62	9.10
SD	15.85	9.14	16.95	6.77	5.20
Distraction	203.02	67.74	76.87	11.86	8.98
SD	19.73	8.81	19.53	7.00	4.81
Placebo	207.54	71.12	76.95	16.00	9.20
SD	17.49	8.73	16.97	8.29	4.26
Overall Means	203.55	69.33	76.88	12.83	9.09
Overall SD	18.09	8.94	17.66	7.47	4.80

Five separate one-way between-groups Analyses of Variance (ANOVAs) were conducted (one per measure). These revealed non-significant main effects for intervention on four of the measures (all p's > .186), excluding the DASS [$F(2,126) = 4.752$, $p = 0.010$, $\eta_p^2 = 0.072$] which had a significant effect. Post hoc tests (Scheffe's) on this measure revealed a highly significant difference between Acceptance and Placebo ($p = 0.009$), all other p's > 0.286.

Because the FPQ and the DASS have specific sub-scales that are usually analysed separately (Lovibond, & Lovibond, 1995; Osman et al., 2002) and because of the significant effect for intervention on the overall DASS scores, additional statistical analyses were conducted to determine if the interventions differed at this level. Six separate one-way between groups ANOVAs were conducted (one for each sub-scale). These revealed significant or marginally significant effects for intervention on the three DASS sub-scales (all other p's > 0.145). On the anxiety sub-scale, the effect was highly significant [$F(2,126) = 4.537$, $p = 0.013$, $\eta_p^2 = 0.0676$]. Intervention also approached significance on the stress [$F(2,126) = 2.998$, $p = 0.053$, $\eta_p^2 = 0.046$] and depression sub-scales [$F(2,126) = 2.47$, $p = 0.089$, $\eta_p^2 = 0.04$]. Post-hoc analyses

(Scheffe's) indicated that Placebo participants were significantly higher than Acceptance on anxiety ($p = 0.013$) and stress ($p = 0.055$) all other p's > 0.370.

Although the effects for the DASS may complicate the interpretation of subsequent analyses, the effects were ignored here for three reasons. First, the DASS effects for the Placebo group were likely attributable to exam stress these participants were experiencing at the time of completing the experiment. Second, an effect on the DASS was not obtained in any of the subsequent experiments. Third, the central focus of the current work was on the Acceptance versus Distraction Interventions.

Tolerance Data

The tolerance data were collated according to intervention and heat test and the means are provided in Figure 4. Acceptance showed an increase of at least three seconds from Baseline to Post-Intervention and this was maintained at Post-Reminder. In contrast, Distraction showed a relatively small increase at Post-Intervention that was also maintained at Post-Reminder. Interestingly, Placebo showed no increase at Post-Intervention and a relatively large drop in tolerance at Post-Reminder.

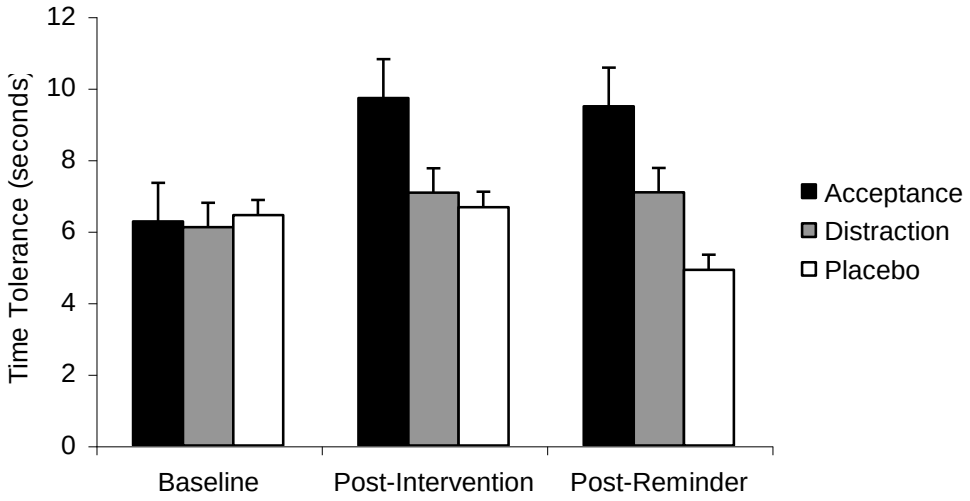

Figure 4. Heat tolerance means for each intervention across heat tests in Experiment 1.

A 3x3 mixed repeated measures ANOVA was conducted with intervention as the between participant variable and heat test as the within participant variable. Both intervention [$F(2,125)=3.694$, $p = 0.028$, $\eta_p^2=0.056$] and heat test [$F(2,250)=4.474$, $p = 0.012$, $\eta_p^2=0.035$] were significant, as was the interaction effect [$F(4,250)=3.86$, $p = 0.005$, $\eta_p^2=0.058$].

Planned Within Interventions Tolerance Data

Three one-way repeated measures ANOVAs were conducted separately for each intervention. In Acceptance, there was a significant main effect for heat test [$F(2,39)=4.961$, $p < 0.009$, $\eta_p^2=0.067$], with post-hoc tests (Scheffe's) indicating significant differences between Baseline and Post-Intervention ($p = 0.023$) and between Baseline and Post-Reminder ($p = 0.036$). In Distraction, heat test was not significant ($p = 0.429$). In Placebo, heat test was also significant [$F(2,40)=8.063$, $p < 0.001$, $\eta_p^2=0.088$], with post-hoc tests revealing significant differences between Baseline and Post-Reminder ($p = 0.008$), and between Post-Intervention and Post-

Reminder ($p = 0.002$). However, as Figure 4 indicates this was a *reduction* in tolerance for Placebo, not an increase. In short, Acceptance significantly increased tolerance from Baseline to Post-Intervention and to Post-Reminder. Placebo significantly decreased tolerance from Baseline to Post-Reminder. There was no significant change in tolerance for participants in Distraction.

Data from Mid-Experimental Distress Ratings

After each heat test, participants were presented with three separate VAS ratings of the discomfort, pain and anxiety they had experienced during the previous heat test.

Discomfort Ratings. The discomfort ratings indicated some changes across time for each intervention (see Figure 5: *Note that graphs are only presented if significant effects are obtained*). Specifically, while the discomfort of Placebo participants decreased steadily across heat tests, both Acceptance and Distraction decreased at Post-Intervention, but increased at Post-Reminder. A 3x3 mixed repeated measures ANOVA was conducted. Heat test was significant [$F(2,250)=6.791$, $p = 0.013$, $\eta_p^2=0.052$] and intervention approached significance [$F(2,125)=2.789$, $p = 0.065$, $\eta_p^2=0.043$]. The interaction effect was not significant ($p = 0.328$).

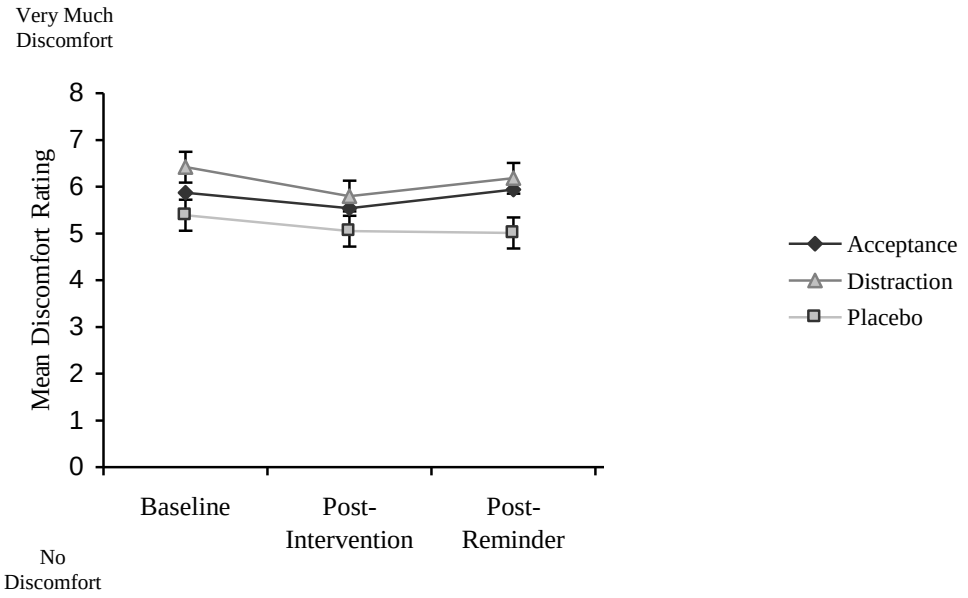

Figure 5. Discomfort ratings for each intervention across heat tests in Experiment 1.

Planned Within Interventions Discomfort Data

Three one-way repeated measures ANOVAs were conducted separately for each intervention. For Acceptance, there was no significant effect for heat test ($p = 0.129$). Heat test was significant for Distraction [$F(2,82)=4.466$, $p = 0.014$, $\eta_p^2=0.096$], with post-hoc tests (Scheffe's) indicating a significant difference between Baseline and Post-Intervention ($p = 0.015$, all other p's > 0.194). In Placebo, heat test approached significance [$F(2,82)=2.429$, $p = 0.094$, $\eta_p^2=0.055$], but all post-hoc tests were non-significant (all p's > 0.139). In short, Distraction participants showed significantly decreased discomfort from Baseline to Post-Intervention, whereas Acceptance and Placebo showed no significant change.

Pain Ratings. There were little or no changes in the pain ratings across intervention or time. A 3x3 mixed repeated measures ANOVA indicated that all main and interaction effects were non-significant (all p's > 0.155).

Anxiety Ratings. The anxiety ratings indicated some differences across intervention and time (see Figure 6). Specifically, anxiety for Placebo decreased, it

decreased very marginally for Acceptance, and decreased then increased again for Distraction. A 3x3 mixed repeated measures ANOVA indicated that heat test was significant [$F(2,250)=5.407$, $p = 0.005$, $\eta_p^2=0.042$], but intervention and the interaction effect were not (both p's > 0.170).

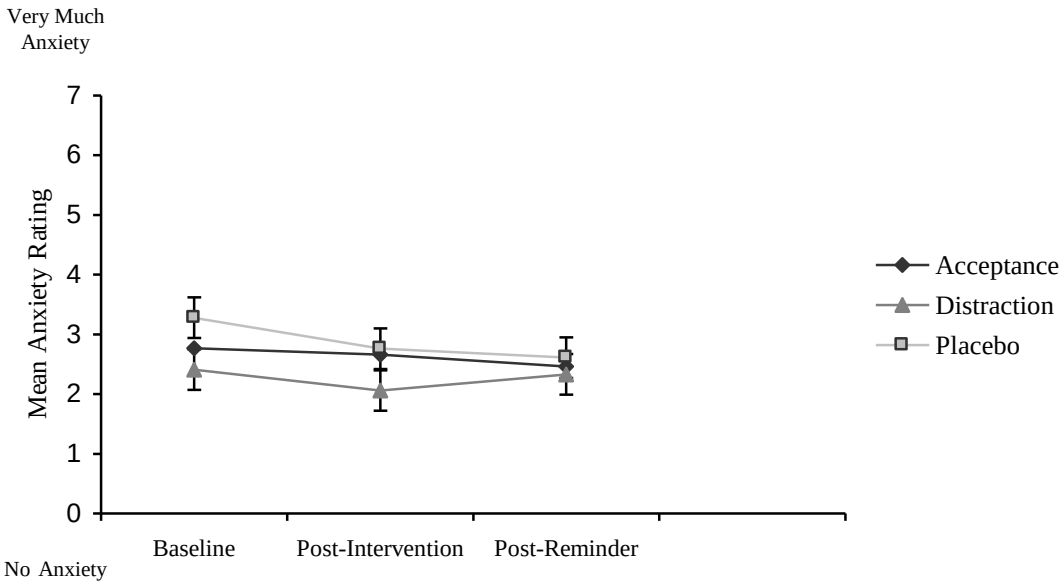

Figure 6. Anxiety ratings for each intervention across heat tests in Experiment 1.

Planned Within Interventions Anxiety Data

Three one-way repeated measures ANOVAs were conducted separately for each intervention. Heat test was significant for Placebo [$F(2,82)=4.0$, $p = 0.022$, $\eta_p^2=0.087$], although all post-hoc tests (Scheffe's) were not significant (all p's > 0.139). Heat test was not significant for either Acceptance or Distraction (both p's > 0.121). In short, none of the groups showed significant changes in anxiety across time.

Data from Post-Experimental Measures

A total MPQ score was calculated for each participant and the means were collated for each intervention group. The MPQ scores overall were low (Acceptance:

M=16.17; Distraction: M=14.70; Placebo: M=11.12), suggesting that participants did not experience the pain during the heat tests as particularly intense. Unexpectedly, a one-way between groups ANOVA indicated a highly significant effect for intervention [$F(2,126)=5.04$, $p = 0.003$, $\eta_p^2 = 0.077$]. Post-hoc tests (Scheffe's) indicated that Placebo differed significantly from Acceptance ($p = 0.003$) and the difference between Placebo and Distraction approached significance ($p = 0.052$), although Acceptance and Distraction did not differ from one another ($p = 0.589$). In short, Placebo participants reported significantly or marginally significantly less experimental pain on the MPQ than both Acceptance and Distraction. However, on their ratings of level of overall experimental pain, the groups were not differentiated (M=6.11, SD=1.79) and a one-way between groups ANOVA confirmed no significant effect for intervention ($p = 0.784$).

When asked about the strategy they had been given during the intervention (i.e. usefulness, difficulty, frequency, length of use, daily use), five independent samples t-tests confirmed that the differences were not significant for four aspects of strategy (all p's > 0.204).

The data on the six acceptance-based and distraction-based questions were surprising and revealed lower than anticipated levels of strategy adherence. Specifically, all three groups reported equal levels of acceptance (Acceptance Intervention M=5.75; Distraction Intervention M=5.51; Placebo Intervention M=6.01) and almost equal levels of distraction (Acceptance Intervention M=5.61; Distraction Intervention M=6.27; Placebo Intervention: M=4.45). Indeed, two one-way between groups ANOVAs revealed non-significant effects for intervention on both types of question (all p's > 0.124). Hence the intervention groups did not appear to

discriminate clearly on the adherence measure between acceptance and distraction strategies.

Although the majority of participants indicated that they would be willing to repeat the heat test (Acceptance: 86%; Distraction: 96%; Placebo 96%), a one-way ANOVA indicated that the effect for intervention was significant [$F(2,126)=3.382$, $p = 0.037$, $\eta_p^2=0.053$]. Post-hoc tests (Scheffe's) indicated differences between Acceptance and Distraction ($p = 0.077$) and between Acceptance and Placebo ($p = 0.091$) that approached significance. In short, Acceptance participants were almost significantly least willing to repeat the heat test.

Summary of Results

The two key intervention groups (Acceptance and Distraction) did not differ significantly on a range of pre-experimental measures and thus these variables could not account for differential changes in heat tolerance for these two groups. Only the Acceptance group showed a significant increase in heat tolerance from Baseline to Post-Intervention and Baseline to Post-Reminder (Placebo showed a significant decrease). Analyses of the distress ratings indicated no significant change for any group on pain or anxiety, although Distraction participants showed a significant decrease in discomfort, while Acceptance and Placebo did not. In spite of the significant changes in heat tolerance, adherence to strategy was lower than expected and indicated that the two key intervention groups could not distinguish clearly between acceptance and distraction strategies at the end of the experiment. Acceptance participants were the least willing to repeat the heat test.

DISCUSSION

The results from Experiment 1 offered the first empirical support for the use of the radiant heat apparatus as a means of inducing experimental pain in humans and the sensitivity of tolerance on this apparatus to brief clinical intervention. The findings also highlighted the utility of the brief automated interventions as clinical analogues. Most importantly, the data indicated that significant increases in radiant heat tolerance were associated with an acceptance-based coping strategy, but not with one that was based on distraction. The Placebo group here actually showed significantly decreased tolerance. The differential changes in heat tolerance could not readily be accounted for by other variables, apart from the interventions.

The significant improvements in tolerance were consistent with experimental predictions and the existing literature on acceptance. Although it was predicted that acceptance would result in a significant tolerance increase, it was assumed that some level of increase would also be associated with Distraction. This finding has been reported in several other pain analogue studies published to date. Closer inspection of the Distraction data and of the protocols employed here, however, began to generate a number of possible reasons why Distraction had the effect it had. Specifically, closer inspection of the protocol, relative to Acceptance, suggested that certain features contained therein had inadvertently encouraged participants to *accept* their discomfort, rather than attempting to distract themselves from it. Consider the Walking Exercise in which Distraction participants were asked to walk around the room distracting themselves from a pain-related thought. It might reasonably be argued that this type of engagement functioned as defusion that permitted participants to be separated from their thoughts prior to their attempts to distract. As a result, perhaps defusion rather than distraction was an active ingredient in the observed

improvement in tolerance. Indeed, this might also account for the pain tolerance improvements that had been recorded elsewhere in the literature. This issue was addressed in Experiment 1A, which involved specific refinements to the existing Distraction Intervention in order to remove the possibility of defusion.

In spite of the predicted changes in heat tolerance that likely reflected the differential influence of the interventions, the adherence to strategy outcomes from Experiment 1 were lower than expected. One possibility was that participants were not accurately reporting their use of strategy, but were using the designated strategy appropriately. Although, it seemed wise to examine this issue further, this issue was not directly addressed in Experiment 1A because it was important to ensure that any outcome differences in the modified vs. original distraction protocols could not be attributed to any other features, apart from the protocol changes. Hence, we did not alter the adherence measure in Experiment 1A, but did so in subsequent experiments.

EXPERIMENT 1A

The results from Experiment 1 indicated that the Acceptance Intervention significantly increased participants' heat tolerance. Although the Distraction and Placebo Interventions did not generate significant improvements, some level of improvement was associated with the former and this was consistent with evidence from previous research. However, closer inspection of the protocols from Experiment 1 suggested that the improvement for Distraction might not have resulted directly from participants' attempts to distract themselves from the pain-related thoughts (as instructed), but from other spurious features of the protocol. Specifically, it was possible that certain features of the Distraction protocol had permitted participants to defuse from their pain-related thoughts prior to distracting themselves, and this

feature was critical to the tolerance increases. In order to address this possibility, the Distraction Intervention in Experiment 1A was modified to remove this potential confound. To permit more accurate comparisons, the modified Distraction Intervention in Experiment 1A (referred to as Distraction 2) was then systematically compared to the original Acceptance and Distraction Interventions from Experiment 1. In short, we predicted that significant tolerance increases would again be recorded for Acceptance. Furthermore, we expected that the modest tolerance improvements originally recorded for Distraction would not be replicated with Distraction 2.

METHOD

Participants

Twenty-seven undergraduate students from NUIM participated in Experiment 1A (14 females and 13 males). These individuals ranged in age from 18 to 45 years (M=21.59, SD=5.74). Participants were selected in an ad-hoc manner from a list of potential experimental volunteers. In line with Experiment 1, participants were initially grouped according to Baseline levels of heat tolerance. However, only those individuals categorised as LOW and MEDIUM were recruited here (participants categorised as HIGH had been extremely difficult to find for Experiment 1 and thus this category was excluded from Experiment 1A and the rest of the thesis). The exclusion criteria were identical to the previous study and resulted in the removal of three participants. Hence, 24 participants remained in the final sample (50% female and 50% male).

Experimental Setting, Apparatus and Materials

The experimental setting, materials and apparatus were identical to Experiment 1.

Procedure

Experiment 1A comprised entirely of the presentation of a Distraction Intervention. The format and delivery of this was identical to Experiment 1, except that minor modifications were effected to the intervention. In order to distinguish this from the original Distraction Intervention employed in the previous study, the modified intervention in Experiment 1A is referred to as *Distraction 2* and the original Distraction Intervention is referred to here as Distraction 1. As noted previously, this change was focused specifically on removing participants' experiential contact with pain-related thoughts during the Walking Exercise (i.e. reducing the possibility of defusion).

During Distraction 2, participants were provided with an envelope that contained a card with the sentence "I can walk", which they repeated aloud while walking around the room (note that the Acceptance Intervention had employed a card stating "I cannot walk"). Participants were asked to distract themselves from this statement by imagining the pleasant scene they had previously generated (as an alternative to distracting themselves from a pain-related thought). Thus, the amendments in Distraction 2 relative to Distraction 1 were as follows (amendments highlighted in bold below):

> Now that you have written down three thoughts, please keep the three pieces of paper on the desk beside you. Okay, if you now look at the *left*-hand side of the desk you will see a sealed envelope containing a piece of paper. Please open the envelope and take out the piece of paper inside. **Then read aloud the sentence written on the paper and place the paper**

in the box on the table. (You have plenty of time, about twenty seconds, in which to do this).

Pause for 20 seconds

Imagine that the sentence is like one of the three pain-related thoughts that you wrote down previously. Now I would ask you to please get up and walk once around the room while repeating aloud the sentence that was written on the paper. At the same try to distract yourself from the thought by thinking about the pleasant scene you imagined before. Notice that as you walk around the room you are trying to distract yourself from the thought by imagining the pleasant scene.

The complete instructional details for Distraction 2 are provided in Appendix XVI. Minor alterations were also thereafter effected to the Swamp Metaphor in order that there would be consistency across the video clips (see Appendix XVII).

Video Clip Inter-Rater Reliability

Once again, four blind and independent raters assessed the believability, genuineness, likeability and empathy of the therapist in the clips that comprised Distraction 2. For improved analyses, Distraction 2 was compared with the LOW and MEDIUM tolerance sub-sets from the original Acceptance and Distraction Groups in Experiment 1. Four separate independent samples t-tests (one for each aspect of the video clips) found no significant differences among these groups (all p's > 0.531).

RESULTS

It is important to emphasise that the analyses conducted on Distraction 2 comprised only of participants rated as LOW or MEDIUM in Baseline heat tolerance. This differed from Distraction 1 and Acceptance in Experiment 1, which also contained participants rated as HIGH in tolerance. In the interests of comparison, therefore, the HIGH tolerance participants were removed from the dataset of Distraction 1 and Acceptance, such that comparisons between these and Distraction 2

were only drawn between participants categorised as LOW or MEDIUM in heat tolerance.

Data from Pre-Experimental Measures

The data from the five measures were collated by intervention and the means on each measure are presented in Table 3. Across the five measures, there were little or no differences among the intervention groups.

Table 3
The Means and Standard Deviations for Intervention on the Psychological Measures for data from Experiment 1 and 1A

Intervention	***Psychological Measures***				
	AAQ	*CPAQ-A*	*FPQ*	*DASS*	*BIDR*
Acceptance	201.48	67.79	80.24	8.89	8.83
SD	16.71	9.60	16.09	6.42	3.98
Distraction 1	203.21	67.31	74.20	11.03	9.07
SD	17.74	8.00	19.89	7.27	3.55
Distraction 2	202.83	69.74	77.74	9.48	10.56
SD	19.82	7.03	18.67	5.33	3.34
Overall Means	202.50	68.28	77.39	9.80	9.49
Overall SD	17.86	8.30	17.98	6.43	3.62

Five separate one-way between-groups ANOVAs were conducted (one per measure). These revealed no significant effects for intervention on any measure (all p's > 0.4). Six separate one-way between groups ANOVA's (one for each sub-scale of the FPQ and DASS) also revealed no significant effects (all p's > 0.133).

Tolerance Data

The tolerance data were collated according to intervention and heat test and the means are provided in Figure 7. Acceptance showed an increase of at least two

seconds from Baseline to Post-Intervention and increased slightly again at Post-Reminder. Distraction 1 increased somewhat at Post-Intervention and increased again at Post-Reminder. In contrast, Distraction 2 remained stable between Baseline and Post-Intervention and decreased slightly at Post-Reminder.

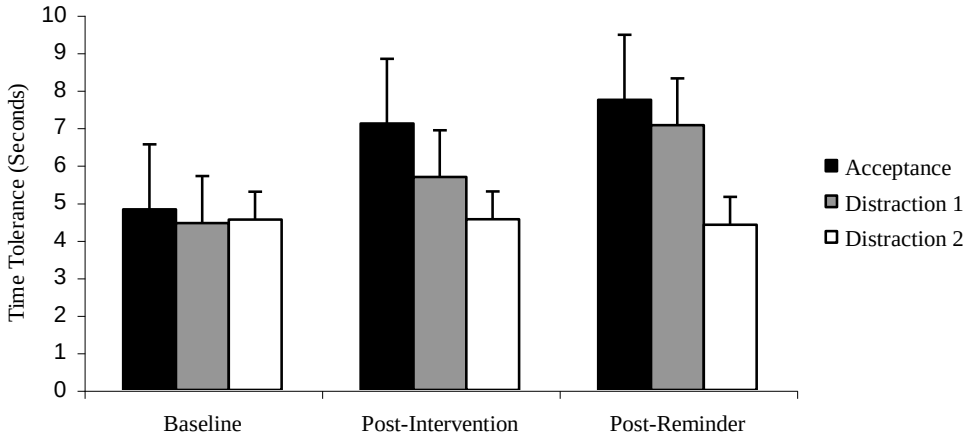

Figure 7. The mean heat tolerance time for each intervention across heat tests with data from Experiments 1 and 1A.

A 3x3 mixed repeated measures ANOVA indicated that heat test [$F(2,162)=4.904$, $p = 0.009$, $\eta_p^2=0.057$] was highly significant and intervention approached significance [$F(2,81)=2.391$, $p = 0.098$, $\eta_p^2=0.053$]. The interaction effect was not significant ($p = 0.205$).

Planned Within Interventions Tolerance Data

Three one-way repeated measures ANOVAs were conducted separately for each intervention. In Acceptance, there was a significant main effect for heat test [$F(1, 28)=3.175$, $p = 0.049$, $\eta_p^2=0.113$], with post-hoc tests (Scheffe's) indicating a near significant difference between Baseline and Post-Reminder ($p = 0.065$; all other p's > 0.183). In Distraction 1, the effect approached significance [$F(1, 28)=3.019$, $p =$

0.057, η_p^2=0.113] and post-hoc tests (Scheffe's) revealed a near significant difference between Baseline and Post-Reminder (p = 0.057; all other p's > 0.434). In Distraction 2, the effect was not significant (p = 0.954). That is, although Acceptance and Distraction 1 generated significant or near significant tolerance increases from Baseline to Post-Reminder, Distraction 2 produced no significant changes in tolerance.

Data from Mid-Experimental Distress Ratings

Discomfort Ratings. The discomfort ratings indicated some changes across time for each intervention (see Figure 8). The discomfort ratings for participants in Acceptance remained stable at Post-Intervention and increased slightly at Post-Reminder. For Distraction 1, discomfort decreased slightly at Post-Intervention and increased very slightly at Post-Reminder. For Distraction 2, discomfort decreased sharply at Post-Intervention and increased again at Post-Reminder. A 3x3 mixed repeated measures ANOVA indicated a significant main effect for heat test [F(2,162)=9.537, p < 0.001 , η_p^2=0.105], but intervention and the interaction effect were not significant (all p's > 0.142).

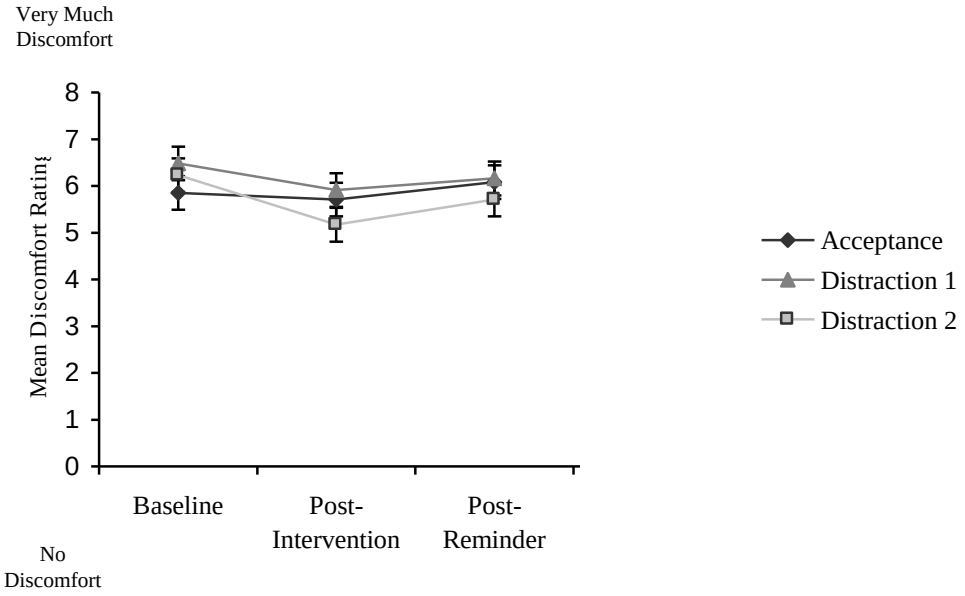

Figure 8. Discomfort ratings for each intervention across heat tests with data from Experiments 1 and 1A.

Planned Within Interventions Discomfort Data

Three one-way repeated measures ANOVAs were conducted separately for each intervention. In Distraction 1, heat test was significant [$F(2,56)=4.426$, $p = 0.016$, $\eta_p^2=0.136$] with post-hoc tests (Scheffe's) revealing significant differences between Baseline and Post-Intervention ($p = 0.016$), all other p's > 0.331. Heat test was also significant for Distraction 2 [$F(2,56)=6.815$, $p = 0.002$, $\eta_p^2=0.214$], with post-hoc tests indicating a significant difference between Baseline and Post-Intervention ($p = 0.003$), all other p's > 0.142. The effect was not significant for Acceptance ($p = 0.329$). In short, Distraction 1 and Distraction 2 reported significantly decreased discomfort from Baseline to Post-Intervention, Acceptance showed no significant change.

Pain Ratings. The pain ratings indicated little or no differences across intervention or heat test. A 3x3 mixed repeated measures ANOVA indicated that none of the main or interaction effects were significant (all p's > 0.116).

Anxiety Ratings. The anxiety ratings showed some changes across intervention and heat test (see Figure 9). Although anxiety was relatively stable in Acceptance, it decreased and then increased for Distraction 1, but decreased steadily for Distraction 2. A 3x3 mixed repeated measures ANOVA indicated a significant main effect for heat test [$F(2,162)=5.791$, $p = 0.004$, $\eta_p^2=0.067$]. Intervention and the interaction effect were not significant (both p's > 0.177).

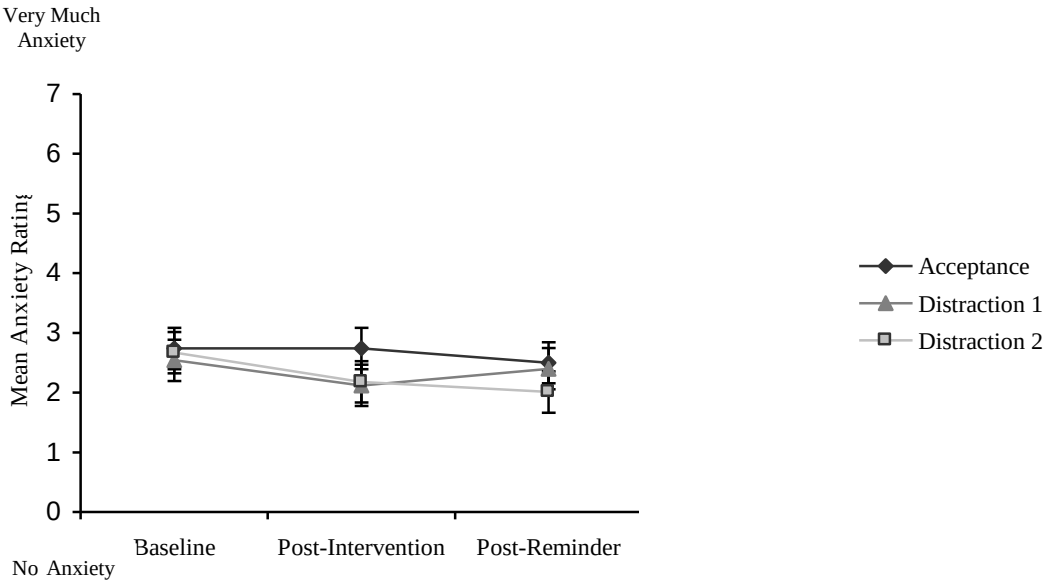

Figure 9. Anxiety ratings for each intervention across heat tests with data from Experiments 1 and 1A.

Planned Within Interventions Anxiety Data

Three one-way repeated measures ANOVAs were conducted separately for each intervention. Heat test was not significant for Acceptance or Distraction 1 (both p's > 0.478), but was significant for Distraction 2 [$F(2,56)=6.34$, $p = 0.004$, $\eta_p^2=0.202$]. Post-hoc tests (Scheffe's) indicated a significant difference between

Baseline and Post-Intervention ($p = 0.042$) and between Baseline and Post-Reminder ($p = 0.006$), all other p's > 0.729. In short, Distraction 2 participants showed significantly decreased anxiety from Baseline to Post-Intervention and from Baseline to Post-Reminder, but there was no significant change in anxiety for Acceptance or Distraction 1.

Data from Post-Experimental Measures

The mean MPQ scores were again low, indicating that participants did not experience the pain in the heat tests as extreme (M=15.14, SD=7.085) and a one-way between groups ANOVA indicated that the effect for intervention was non-significant ($p = 0.584$). The three groups were also not differentiated in their overall experimental pain as measured on the adherence measure (M=5.97, SD=1.82) and a one-way between groups ANOVA revealed no significant effect ($p = 0.544$).

When asked about the strategy they had been given during the intervention (i.e. usefulness, difficulty, frequency, length of use, daily use) there were little or no differences between the two intervention groups. Five one-way between groups ANOVAs indicated no significant effect for intervention for four aspects of strategy (all p's > 0.269). However, the effect for intervention on strategy usefulness (Acceptance M=5.62, Distraction M=6.75, Distraction 2=5.74) approached significance [$F(2,81)=2.7$, $p = 0.073$, $\eta_p^2=0.059$], although post-hoc tests (Scheffe's) found no significant differences (all p's > 0.11).

The data on the six acceptance-based and distraction-based questions were again surprising with low levels of reported strategy adherence. Specifically, all three groups reported equal levels of acceptance (Acceptance: M=5.91; Distraction 1: M=5.67; Distraction 2: M=5.54) and almost equal levels of distraction (Acceptance:

M=6.11; Distraction 1: M=6.79; Distraction 2: M=5.83). Indeed, two one-way between groups ANOVAs revealed non-significant effects for intervention on both types of question (all p's > 0.212).

The majority of participants indicated that they would be willing to repeat the heat test (Acceptance: 93%; Distraction 1: 93%; Distraction 2: 89%) and a one-way between groups ANOVA indicated that the effect for intervention was non-significant ($p = 0.517$).

Summary of Results

The three key intervention groups (Acceptance, Distraction 1 and Distraction 2) did not differ significantly on pre-experimental measures. The Acceptance group showed a near significant increase in tolerance between Baseline and Post-Reminder, as did Distraction 1. There was no significant change in tolerance for Distraction 2. Analyses of the distress ratings indicated no significant change for Acceptance on any measure. However, both Distraction groups reported significant decreases in discomfort and Distraction 2 reported significant decreases in anxiety. Once again, reported adherence to strategy was low with all groups failing to explicitly differentiate acceptance from distraction. On this occasion, the groups did not differ in their willingness to repeat the heat tests.

DISCUSSION

The refinement of the Distraction Intervention in the current experiment was designed explicitly to eliminate the possibility that the modest improvements recorded for Distraction in Experiment 1 resulted inadvertently from defusion. The outcomes from the two Distraction protocols differed considerably in a manner that supported

the experimental predictions. In short, Distraction 2 resulted in almost no changes in tolerance across the heat tests. The contrasting findings for the two Distraction protocols that differed only with regard to the hypothesised defusion element indicated that defusion may indeed have had a spurious but positive impact on the tolerance increases associated with the Distraction Intervention in Experiment 1.

In spite of the consistency of the results here with experimental predictions, it remained possible that the original differences between Acceptance and Distraction resulted from other processes that were as unidentified. For example, participants in both interventions were engaging in different exercises. Specifically, Distraction participants were instructed to generate positive imagery and then engage in a distraction exercise in which this imagery was used to remove unwanted thoughts about the heat pain. However, the Acceptance participants were not asked to generate positive imagery, irrespective of whether this would then be used for the purposes of distraction. In other words, if Acceptance participants were somehow also allowed to generate positive imagery and encouraged to be open to this imagery if it came to mind (rather than distract from it), then only the manner in which participants were instructed to use the imagery (i.e. as distraction or not) would separate the two groups. This issue was the primary focus of Experiment 2.

One other issue that emerged across the two previous experiments was the low level of reported strategy adherence. Indeed, participants in Distraction 2 had produced evidence of equally low levels of strategy adherence to previous participants. In short, participants in Acceptance were explicitly reporting that they were engaging in as much distraction as acceptance and participants in Distraction were engaging in as much acceptance as distraction. Of course, it might be argued that participants in both groups were unable to *report accurately* on the strategies they had

been using throughout the experiment (although they were doing as instructed) and thus that our adherence measure was not adequately tapping into their experiences during the heat tests and interventions. However, only further attention to the adherence issue would allow us to determine whether this was in fact the case. The secondary aim of Experiment 2, therefore, was to address the weaknesses in adherence observed thus far.

Chapter 3

Identifying the Critical Variables of Acceptance and Distraction

Experiment 2

Chapter 3

Identifying the Critical Variables of Acceptance and Distraction

Experiment 2

The primary aim of Experiment 1A had been to examine those features of Distraction that may have contributed to the modest tolerance outcome associated with this intervention in Experiment 1 and elsewhere in the literature. The results from the second study suggested that the initial benefits for Distraction (albeit small) likely resulted from participants' inadvertent use of defusion with regard to the presence of the pain-related thoughts during the Walking Exercise, because removal of same resulted in a poorer outcome for Distraction. Although this preliminary componential analysis of the distraction protocol had been useful in highlighting a potential confound between distraction and defusion in the current context, questions remained about the processes that more commonly underpin distraction- and acceptance-based coping strategies and potentially contributed to the differential outcomes observed here.

In the context of Experiment 1, the two key interventions differentially relied upon acceptance versus distraction and all of the elements within each were concerned with either of these overarching strategies. Hence, although the interventions were closely matched at an experimental level and contained the same basic elements, there were core differences. For example, the Distraction participants generated positive imagery that was used as distraction from pain-related thoughts. In contrast, participants in Acceptance did not generate any imagery and did not engage

in a distraction exercise. The experimental question posed in Experiment 2 sought to determine whether permitting Acceptance participants to generate positive imagery and then allowing them to be open to these images during the Walking Exercise (rather than actually distracting from them at this critical point) might alter the outcomes recorded previously for Acceptance. For example, perhaps the inclusion of these features would reduce tolerance in Acceptance. In any case, enhancing the similarity between the two interventions and leaving only the instruction about whether or not the positive imagery was to be used explicitly for the purposes of distraction would permit a better understanding of what participants were actually doing with the imagery. Put simply, if both groups generated positive imagery, but then each had a specific instruction about what to do with the imagery when the pain-related thoughts came to mind, then only the precise instructions that either encouraged participants to use the imagery for distraction (Distraction) or to notice that you can have the images and still do other things (Acceptance) would separate the two groups. This was the primary focus of Experiment 2.

The secondary aim of Experiment 2 concerned the weak and unpredicted adherence outcomes recorded previously, in which both groups of participants appeared unable to report accurately on the strategies they had used throughout the experiment. This outcome raised three possibilities. First, participants may not in fact have adopted the strategies with which they were provided. However, this seemed unlikely given the strong and significant tolerance differences that emerged. Second, the adherence measures employed may not have adequately tapped into participants' perceptions of what they were doing, even though they were actually doing what they had been instructed. This latter possibility seemed more likely and thus Experiment 2

incorporated a series of revisions to the adherence statements that attempted to rectify this difficulty.

Third, it remained possible that participants were doing what they were instructed to do, but cared little for their part in the experiment generally. In order to improve participant adherence further, a Values clip was presented after the psychological screening questionnaires in Experiment 2. This clip suggested to participants that their involvement in the study would assist research on pain and as such impact upon the lives of chronic pain sufferers. Thus, it was predicted that this would increase participants' motivation to attend carefully to the instructions and to enhance adherence. This manipulation had been employed in previous studies in which participants were described as operating within a 'high-values' context (Johnson et al., 2004). Once again, however, the core prediction remained the same and asserted that participants assigned to the Acceptance Intervention would show significant tolerance increases.

METHOD

Participants

A sample of 41 undergraduate students (24 females and 15 males) from NUIM ranging in age from 18 to 30 years (M=19.08, SD=3.04) participated in Experiment 2. All were selected in an ad-hoc manner from a list of experimental volunteers. Once again, they were grouped according to Baseline levels of heat tolerance as LOW and MEDIUM (using the selection criteria outlined previously). The other exclusion criteria also applied here and resulted in the removal of two participants. Hence, 39 participants remained in the final sample (62% female and 38% male).

Setting, Apparatus and Materials

The setting, apparatus and materials were largely identical to Experiments 1 and 1A, with a few exceptions. The EHI was omitted. The AAQ-49 was replaced with the shorter revised version -- the *AAQ-10* (communication with author). This latter was constructed from the former version by including only the 10 items with the highest factor loadings. Again, a high score indicated high acceptance/low avoidance (now a maximum score of 70) and a low score indicated low acceptance/high avoidance (minimum score of 7). A copy of the AAQ-10 is provided in Appendix XVIII.

During Experiment 2, there were extensive modifications to the *Adherence Measure* (see Table 4). There were now four separate adherence sheets (referred to as Adherence Sheets 1, 2, 3 and 4) that were completed at different experimental stages (see Appendices XIX, XX XXI and XXII, respectively).

Table 4
The Adherence Measures Employed in Experiment 2

Mid-Experimental Adherence Measures	**Post-Experimental Adherence Measures**
Post-Intervention Adherence Sheet 1	***Post-Reminder Adherence Sheet 3***
6 Acceptance Questions	6 Acceptance Questions
6 Distraction Questions	6 Distraction Questions
Utility of Strategy in Next Heat Test	Example of Strategy Used
	Strategy Change
Post-Intervention Adherence Sheet 2	***Post-Reminder Adherence Sheet 4***
6 Acceptance Questions	Pain Intensity Question
6 Distraction Questions	Length of Strategy Use
	Strategy Use in Daily Life

Adherence Sheet 1 was presented immediately after the intervention video and was designed to determine whether participants correctly understood the strategy-based instructions they had received in the video. Specifically, they were asked: “If I

experience unpleasant thoughts and feelings about the heat task, I am supposed to . . .” and then they simply circled which acceptance statement (e.g. “allow myself to experience whatever emotions come up”) or distraction statement (e.g. “I must make my thoughts go away in order to complete the task”) was most appropriate. This measure also contained a question that asked participants to rate (on a Likert scale of 1 to 7): “How useful do you expect the instructions presented in the video to be during the next heat test?” A similar adherence question had been employed by Gutierrez et al. (2004).

Adherence Sheet 2 attempted to determine how much participants had actually used the strategy during the Post-Intervention heat test (“Using the scale below, please indicate how much you used each of these strategies during the heat task”). In order to avoid participants simply repeating the instructions from the videos, they were advised as follows: “Please do not take into account whether you were asked to use each strategy, rather record how much you actually did the following during the task”. Participants simply rated the frequency with which they employed the strategy presented within each statement using a Likert scale from 0 (NOT AT ALL) to 8 (ALL OF THE TIME).

Adherence Sheet 3 attempted to determine how much participants used the chosen strategy throughout the heat tests *generally* (“Using the scale below, please indicate how much in general you used each of these strategies during the heat task”). This measure was presented immediately after the Distress ratings for the Post-Reminder heat test. Once again, participants were advised not to take into account the instructions contained within the intervention, but to record what they actually did during the heat test. Again, they rated the frequency with which they employed the strategy in each statement using a Likert scale from 0 (NOT AT ALL) to 8 (ALL OF

THE TIME). Adherence Sheet 3 also contained three qualitative open-ended questions designed to determine what participants felt they were doing during the heat tests. The first question asked: “Please summarise or give an example of the strategy you used”. The second and third questions were designed to determine whether participants used the same strategy throughout (i.e. “Did your use of the strategy change as you repeated the heat task?” and “If yes, please describe how and when it changed”).

Adherence Sheet 4 contained only three of the generic questions from the adherence measure in Experiments 1 and 1A, regarding: overall level of pain; length of strategy use; and typical strategy use in daily life.

Procedure

Experiment 2 comprised the same two key interventions as before -- Acceptance and Distraction. In most respects, the procedure here was identical to Experiment 1, with a number of exceptions. (1) The Distraction Intervention was Distraction 2 from Experiment 1A. (2) The EHI was omitted and the AAQ-49 was replaced with the AAQ-10. (3) Instead of just one set of adherence questions at Post-Reminder, participants were now presented with adherence questions throughout (see Table 4). (4) A Values Clip was added to the beginning of the computer program for all participants. (5) Appropriate adjustments were made to the relevant video clips in line with experimental aims.

Values Clip. In order to improve experimental adherence overall, participants were presented with an additional 2min. Values Clip at the end of Phase 1. The basic message indicated to participants that their involvement in the study would assist

research on pain that might thereafter impact upon the lives of chronic pain sufferers. The precise content was as follows:

> Your participation in this study will help us to examine and refine psychological interventions for people who suffer from pain disorders. Pain disorders are quite common among the general population, so uncovering coping methods that work for different people is very important. Pain itself is a normal response that works for the purposes of escape and limits the impact of dangerous situations. However for some people, pain can become ongoing or chronic. The pain itself may cause distressing thoughts and feelings, as well as impair work, social, or personal relationships. Pain, therefore, may affect a person's ability to lead a full and valued life. Although the experience of pain may differ greatly across individuals, it is thought that similar processes may be involved. The findings of this research, therefore, may be valuable to a range of different pain sufferers across many different settings. Therefore, the data collected from your participation in this study will contribute towards developing increasingly effective treatments for pain sufferers.

Interventions. Although the primary aim of Experiment 2 was to increase the overlap between the two interventions by requiring both groups to engage in positive imagery, this resulted in only minor changes to the video clips that presented the Walking Exercise.

Although the *Distraction Intervention* already required participants to generate positive imagery, it was modified slightly to place greater emphasis on using the positive imagery to distract from the pain-related thoughts (the full Distraction Intervention is provided in Appendix XXIII). This aspect of the instructions was as follows:

> Notice that you can have a thought about heat or pain and distract yourself from it by imagining a pleasant scene. Notice that in order to get rid of the thought about pain you can use the pleasant scene as distraction. In this way, thinking about the pleasant scene will help you to get rid of, or replace, the thought about pain or heat.

The Walking Exercise was also modified further to emphasise to participants the potential utility of the distraction strategy in coping with the heat pain, as follows (text in bold highlights additions relative to Experiment 1A):

> Now I would like you to consider **how walking around the room is similar to the pain task. For example, during the next pain task you could notice**

> **thoughts and feelings about pain and use your pleasant scene to distract yourself from these.** For example, if you had the thought "I can't stand this pain or heat", you could immediately try to imagine your pleasant scene in order to take this thought away and this will allow you to continue with the task. **This type of distraction would be a useful way to control your thoughts about pain and thus enable you to keep your hand on the heat pad.**
>
> Please summarise in your own words what you have just been told, and when you are ready to continue, please click on the next button to see the next clip.

Naturally, more substantive changes were necessary to the Acceptance Intervention to incorporate the use of positive imagery and to make the additional points of emphasis that had been effected to Distraction. In the context of positive imagery, the key feature of Acceptance emphasised to participants that they could generate imagery, but did not need to use this to distract themselves from pain-related thoughts. In contrast, they were encouraged to notice that they could have both positive imagery and pain-related thoughts simultaneously. The full Acceptance protocol employed here is presented in Appendix XXIV, but the key content was as follows (text in bold highlights additions relative to Experiment 1A):

> Now that you have written down three thoughts, please keep the three pieces of paper on the desk beside you. **It may help to give you an example of how to deal with thoughts and feelings. To show you how this works please try to think of a nice pleasant scene in as much detail as you can**. (You have plenty of time, about thirty seconds, in which to do this).

After a pause in the clip of 30secs., participants were asked:

> Okay, if you now look at the *left*-hand side of the desk you will see a sealed envelope containing a piece of paper. Please open the envelope and take out the piece of paper inside. **Try to imagine that the blank piece of paper inside the envelope contains the nice pleasant scene that you imagined.** Then put the paper in the box on the table. (You have plenty of time, about twenty seconds, in which to do this).

After a further pause of 20secs., participants were asked:

> Now please pick up one of the three pieces of paper on which you wrote a pain-related thought. Read that thought aloud and then please walk once around the room while repeating aloud the sentence that was written on the paper. At the same time, **please think about the pleasant scene you imagined before. Notice that you can have a thought about pain and at the same time still do something else like imagining a pleasant scene. Notice that the thought about pain doesn't have to control what you do. You can imagine your pleasant scene and have the thought about pain both at the same time. If you can have several thoughts at the same time**

no one thought needs to control your behaviour. They are all just thoughts anyway.

Now I would like you to consider how walking around the room is similar to the pain task. For example, during the next pain task, you could notice thoughts and feelings about pain **and you could also think about a pleasant scene. For example if you had the thought "I can't stand this pain or heat" you could also imagine your pleasant scene. All of these things could be going on at the same time and you could also keep your hand on the heat pad. Whatever thoughts and feelings you have about pain or your pleasant scene-- none of them need to control how long you keep your hand on the heat pad. They are all just thoughts anyway**.

Please summarise in your own words what you have just been told, and when you are ready to continue, please click on the next button to see the next clip.

Adherence Measures. As noted above, the adherence measure here comprised a much more extensive version of that employed previously. Indeed, there were now four separate Adherence Sheets, administered to participants at: Post-Intervention; after the Post-Intervention distress ratings; after the Post-Reminder distress ratings; and at the end of the experiment.

Video Clip Inter-Rater Reliability

Once again, four independent raters assessed how believable, genuine, likeable and empathic the therapist was in the video clips. Four separate independent samples t-tests (one for each aspect of the video clips) found no significant differences among these groups (all p's > 0.38).

RESULTS

Data from Pre-Experimental Measures

The data from the five psychological measures were grouped by intervention and the means for each are presented in Table 5. Across the five measures, there were little or no differences between Acceptance and Distraction.

Table 5
The Means and Standard Deviations on the Psychological Measures Across Interventions in Experiment 2

Intervention	**Psychological Measures**				
	AAQ	*CPAQ-A*	*FPQ*	*DASS*	*BIDR*
Acceptance	50.70	67.45	83.30	9.85	9.00
SD	6.59	14.06	19.20	5.61	4.03
Distraction	50.60	72.11	86.00	14.16	7.16
SD	7.69	9.25	22.18	10.25	3.11
Overall Means	50.65	69.78	84.65	12.01	8.08
Overall SD	7.05	12.04	20.47	8.39	3.68

Five separate one-way between-groups ANOVAs were conducted (one per measure). These revealed non-significant main effects for intervention on all measures (all p's > 0.12). Six separate one-way between groups ANOVAs conducted on the sub-scales revealed no significant differences (all p's > 0.188).

Tolerance Data

The heat tolerance data were collated according to intervention and heat test and the means are provided in Figure 10. Acceptance showed an increase of around three seconds from Baseline to Post-Intervention, although this was reduced by around one second at Post-Reminder. In contrast, Distraction showed a small decrease at Post-Intervention and this decrease continued at Post-Reminder.

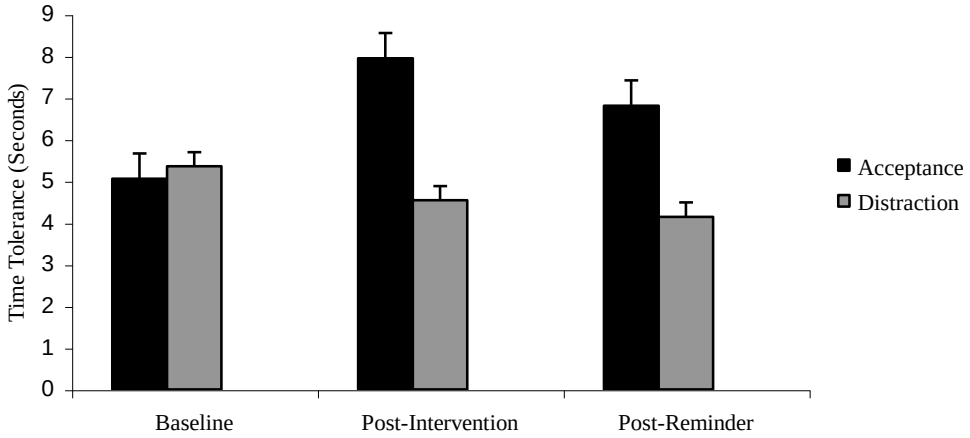

Figure 10. The mean heat tolerance for each intervention across heat tests in Experiment 2.

A 3x2 mixed repeated measures ANOVA indicated a near significant main effect for intervention [$F(1,37)=2.879$, $p = 0.098$, $\eta_p^2=0.07$]. Heat test was not significant ($p = 0.208$), but the interaction effect was [$F(2,74)=5.318$, $p = 0.007$, $\eta_p^2=0.125$].

Planned Within Interventions Tolerance Data

Two one-way repeated measures ANOVAs were conducted separately for each intervention. In Acceptance, there was a significant main effect for heat test [$F(2,19)=3.554$, $p = 0.039$, $\eta_p^2=0.086$], with post-hoc tests (Scheffe's) indicating a significant difference between Baseline and Post-Intervention ($p = 0.04$), all other p's > 0.289. In Distraction, the main effect was also significant [$F(2,18)=3.858$, $p = 0.03$, $\eta_p^2=0.097$], with post-hoc tests revealing a significant difference between Baseline and Post-Reminder ($p = 0.034$), all other p's > 0.199. In short, Acceptance significantly increased tolerance from Baseline to Post-Intervention, while Distraction significantly decreased tolerance from Baseline to Post-Reminder.

Data from Mid-Experimental Distress Ratings

Discomfort Ratings. The discomfort ratings indicated little or no changes across time and intervention and a 3x2 mixed repeated measures ANOVA revealed no significant main or interaction effects (all p's > 0.103).

Pain Ratings. There were little or no changes in the pain ratings of the two groups at any point and a 3x2 mixed repeated measures ANOVA revealed no significant main or interaction effects (all p's > 0.256).

Anxiety Ratings. The anxiety ratings showed some differences across intervention and time. Specifically, anxiety in Acceptance decreased marginally at Post-Intervention and returned to Baseline levels at Post-Reminder. In contrast, anxiety for Distraction decreased steadily across the heat tests (see Figure 11). A 3x2 mixed repeated measures ANOVA indicated that heat test was significant [$F(2,74)=3.954$, $p = 0.023$, $\eta_p^2=0.097$], but intervention and the interaction effect were not (both p's > 0.376).

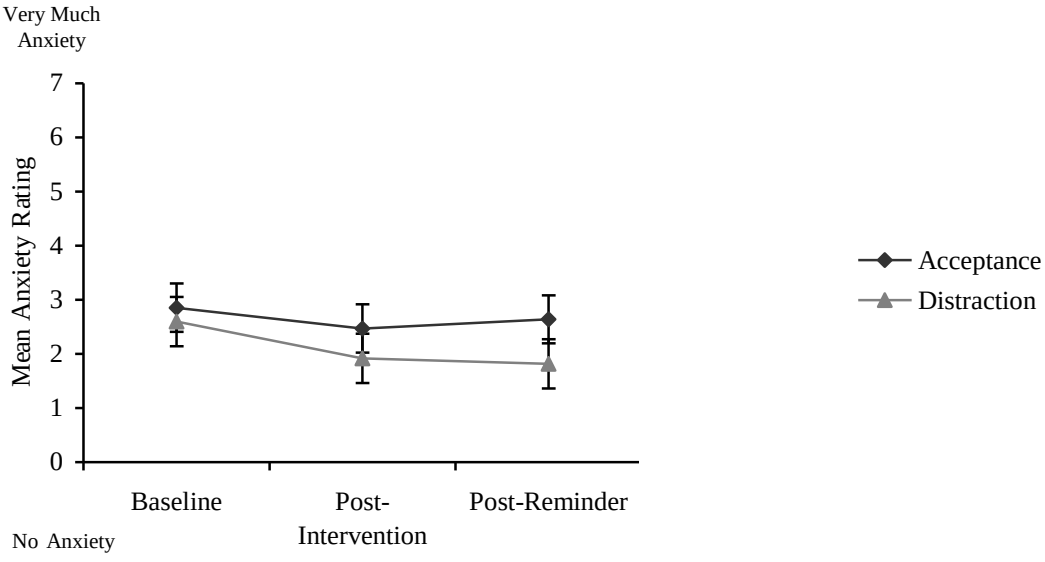

Figure 11. Anxiety ratings for each intervention across heat tests in Experiment 2.

Planned Within Interventions Anxiety Data

Three one-way repeated measures ANOVAs were conducted for each intervention. Heat test was significant for Distraction [$F(2,36)=5.204$, $p = 0.01$, $\eta_p^2=0.224$] and post-hoc tests (Scheffe's) indicated significant differences between Baseline and Post-Intervention ($p = 0.047$), and between Baseline and Post-Reminder ($p = 0.02$), all other p's > 0.93. The effect was not significant for Acceptance ($p = 0.508$). In short, Distraction participants showed significantly decreased anxiety from Baseline to Post-Intervention and from Baseline to Post-Reminder, but there was no significant change in anxiety for Acceptance.

Data from Post-Experimental Measures

The low mean MPQ scores again indicated that participants did not experience the pain in the heat tests as extreme (M=14.97, SD=7.15) and an independent samples t-test indicated that the difference between the groups was not significant ($p = 0.809$). At this point, the two groups were not differentiated in their ratings of overall experimental pain (M=6.22, SD=1.84) and an independent samples t-test indicated that the difference between the groups was not significant ($p = 0.556$).

On Adherence Sheet 1 presented immediately after the video intervention, the data on the six acceptance-based and six distraction-based questions confirmed that the two groups understood the differential strategy information in the video clips. Specifically, the Acceptance group scored higher (M=3.7) on acceptance questions than Distraction (M=0.74) and Distraction scored higher (M=3.26) on the distraction questions than Acceptance (M=1.8). Indeed, two independent samples t-tests revealed significant differences between the groups on both types of question: acceptance questions [$t(37)=6.001$, $p < 0.001$, $\eta_p^2=0.027$] and distraction questions [$t(37)=-2.822$,

$p = 0.008$, $\eta_p^2 = 0.005$]. However, the groups did not differ on their expectations of the utility of the strategy in the forthcoming heat test (Acceptance: M=4.6; Distraction: M=4.47) and an independent samples t-test confirmed this ($p = 0.787$).

On Adherence Sheet 2 presented immediately after the Post-Intervention heat test, there was evidence that the two groups continued to understand the differential strategy information they had received. Again, Acceptance scored higher (M=26.8) on the acceptance questions than Distraction (M=17.68) and Distraction scored higher (M=32.68) on the distraction questions than Acceptance (M=21.55). Again, two independent samples t-tests revealed significant differences between the groups on both types of question: acceptance questions [$t(37)=2.928$, $p = 0.006$, $\eta_p^2=0.027$] and distraction questions [$t(37)=-3.221$, $p = 0.003$, $\eta_p^2=0.027$].

On Adherence Sheet 3 presented immediately after the Post-Reminder heat test, it appeared that the two groups continued to understand the differential strategy information at this point. Again, Acceptance scored higher (M=29.7) on the acceptance questions than Distraction (M=19.0) and Distraction scored higher (M=34.37) on the distraction questions than Acceptance (M=24.2). Again, two independent samples t-tests revealed significant differences between the groups on both types of question: acceptance questions [$t(37)=3.18$, $p = 0.006$, $\eta_p^2=0.027$] and distraction questions [$t(37)=-2.931$, $p = 0.006$, $\eta_p^2=0.027$].

When asked to provide an example of the strategy they had used during the heat tests, the Distraction group described using a distraction-consistent strategy (79% were strategy-consistent) more often than Acceptance described an acceptance-consistent strategy (50% strategy-consistent). A Chi ² analysis indicated a near significant difference between the interventions (χ^2 (1, 39)=3.548, $p = 0.06$). When asked about whether they had continued to use the same strategy or had switched

strategies, both groups indicated that they continued to use the same strategy (65% continued in Acceptance and 73% continued in Distraction). A Chi ² analysis indicated that the difference between the groups was non-significant (χ^2 (1, 39)=0.345, p = 0.557).

When asked about the strategy they had been given during the intervention (i.e. length of use, daily use and usefulness), three independent samples t-tests found no significant differences between the groups on any aspect of strategy (all p's > 0.32).

Summary of Results

The Acceptance and Distraction groups did not differ on the pre-experimental measures. The Acceptance group showed a significant increase in heat tolerance from Baseline to Post-Intervention, while Distraction showed a significant decrease in tolerance from Baseline to Post-Reminder. Analyses of the distress ratings indicated no significant change for Acceptance on any measure, although Distraction showed significant decreases in anxiety. The adherence data, on this occasion, showed strong reported adherence to strategy by both groups at all three adherence points, indicating that each group could accurately differentiate acceptance from distraction at all times.

DISCUSSION

The results from Experiment 2 indicated once again that Acceptance was associated with significant tolerance increases. In contrast, Distraction here actually decreased tolerance. Both groups were doing very similar interventions that were separated only, at a functional level, by whether or not they were instructed to use the positive imagery to accept or avoid their pain-related thoughts. The data suggest,

therefore, that this was likely a crucial difference that mediated the differential outcomes and this was consistent with experimental predictions.

The assertion that the instructions regarding the imagery were critical to the outcomes assumes that the instructions did in fact guide participants' subsequent actions closely. Hence, it was particularly critical to Experiment 2 that the previous difficulties with adherence were resolved. This was indeed the case in the current study where the adherence outcomes strongly suggested that participants did understand and follow the instructions appropriate to their designated intervention. It was also predicted that the inclusion of the Values Clip would assist with adherence and the adherence changes here compared to the two previous studies suggest that this was the case.

The narrowing of the protocol differences that was the primary focus of Experiment 2 and the success of the outcomes naturally led to further questions about structural aspects of the interventions that might be associated with the outcomes. As a result, the next study examined another aspect of the protocols that had likely played a key role in the outcomes recorded thus far. In Experiment 3, the Swamp Metaphor was removed from both protocols to determine the impact this might have on the tolerance outcomes.

Chapter 4

Determining the Impact of the Clinical Metaphor in Acceptance and Distraction

Experiment 3

Chapter 4

Determining the Impact of the Clinical Metaphor in Acceptance and Distraction

Experiment 3

Experiment 3 represented an extension to the on-going dismantling of the original Acceptance and Distraction protocols as a means of determining the critical elements that were associated with the now established outcomes. The primary specific aim of the current study was to examine the role played by the Swamp Metaphor, given that the use of metaphor is a characteristic of numerous types of clinical intervention (McCurry, & Hayes, 1992). As a result, the Swamp Metaphor was similarly removed from both Acceptance and Distraction Interventions.

Although the focus on the impact of removing the metaphor required, for the purposes of comparison, that all other aspects of the protocols remain constant, it was necessary to make several further adjustments to the revised protocols in order to ensure high levels of internal consistency and fluency. This also meant that some revisions to the adherence measures were necessary. It is important to point out, however, that the Values Clip remained in place and participants in Acceptance continued to generate positive imagery (as in Experiment 2).

METHOD

Participants

A sample of 38 undergraduate students from NUIM who ranged in age from 18 to 39 years (M=20.44, SD=5.07) participated in Experiment 3. Again, they were selected in an ad-hoc fashion from a wider pool of experimental volunteers. Once

again, participants were grouped according to Baseline levels of heat tolerance as LOW and MEDIUM (using the selection criteria outlined for Experiment 1). The same exclusion criteria applied again and resulted in the removal of two participants, leaving 36 in the final sample (22 females and 14 males, 61% female, 39% male).

Setting, Apparatus and Materials

The experimental setting, apparatus and materials were largely identical to Experiment 2, with two primary differences. (1) The removal of the Swamp Metaphor from both interventions required modifications to Clips 5, 6 and 7 from each. (2) There were further additions to the adherence measures, with the inclusion of Adherence Sheets 1A, 2A and 3A (see Appendices XXV, XXVI and XXVII, respectively). These revised adherence measures were presented after each of the original adherence sheets (see Table 6). Each sheet contained six statements (3 acceptance and 3 distraction), which participants were required to select as applicable. For example, in Adherence Sheet 1A they were asked: "If I experience unpleasant thoughts and feelings about the heat task, I am supposed to . . ." and they then circled the acceptance statements or distraction statements that were most appropriate. Adherence Sheets 2A and 3A attempted to determine how much participants had actually used each strategy during the Post-Intervention heat test and the heat tests in general ("Using the scale below, please indicate how much you used each of these strategies during the heat task"). Participants rated the frequency with which they employed the strategy presented within each statement using a Likert scale from 0 (NOT AT ALL) to 8 (ALL OF THE TIME).

Table 6
The Adherence Measures Employed in Experiment 3

Mid-Experimental Adherence Measures	**Post-Experimental Adherence Measures**
Post-Intervention Adherence Sheet 1	***Post-Reminder Adherence Sheet 3***
6 Acceptance Questions	6 Acceptance Questions
6 Distraction Questions	6 Distraction Questions
Utility of Strategy in Next Heat Test	Example of Strategy Used
	Strategy Change
Post-Intervention Adherence Sheet 1A	***Post-Reminder Adherence Sheet 3***
6 Acceptance Questions	6 Acceptance Questions
6 Distraction Questions	6 Distraction Questions
Post-Intervention Adherence Sheet 2	***Post-Reminder Adherence Sheet 4***
6 Acceptance Questions	Pain Intensity Question
6 Distraction Questions	Length of Strategy Use
	Strategy Use in Daily Life
Post-Intervention Adherence Sheet 2A	
6 Acceptance Questions	
6 Distraction Questions	

Procedure

Experiment 3 comprised of two key Interventions -- Acceptance and Distraction. The presentation of the pre-experimental questionnaires and the general format of the experiment were identical to Experiment 2.

Interventions. The primary aim of Experiment 3 was to explore the utility of the Cards and Walking Exercises when presented without the Swamp Metaphor. Specifically, the removal of the metaphor involved removing the three relevant video clips (5, 6 and 7) from the program sequence. In the interests of clarity, the revised Acceptance and Distraction Interventions (i.e. with the metaphor removed) are provided in Appendices XXVIII and XXIX, respectively.

Adherence Measures. Adherence Sheet 1A was presented to participants after they had completed Adherence Sheet 1 (i.e. Post-Intervention). Sheet 2A was similarly presented after Adherence Sheet 2 (after the Post-Intervention distress

ratings). Adherence Sheet 3A also followed Sheet 3 after the Post-Reminder heat test.

Video Clip Inter-Rater Reliability

Once again, four independent raters rated how believable, genuine, likeable and empathic the therapist delivering the message in the video clips was. Four separate one way between groups ANOVAs found no significant differences in any aspect of the videos (all p's > 0.438).

RESULTS

Data from Pre-Experimental Measures

The data from the five psychological measures were collated by intervention and the means on each are presented in Table 7. Across the five measures, there were little or no differences among the intervention groups.

Table 7
The Means and Standard Deviations For Each Intervention on the Psychological Measures in Experiment 3

Intervention	**Psychological Measures**				
	AAQ	*CPAQ-A*	*FPQ*	*DASS*	*BIDR*
Acceptance	52.12	72.82	77.35	11.24	9.00
SD	7.48	13.86	17.44	4.71	3.95
Distraction	51.42	74.68	75.05	8.37	9.26
SD	8.80	12.70	16.21	5.56	4.24
Overall Means	51.77	73.75	76.20	9.81	9.13
Overall SD	8.10	13.10	16.60	5.31	4.05

Five separate one-way between-groups ANOVAs (one per measure) revealed no significant effect for intervention on any measure (all p's > 0.107). Six separate one-way between groups ANOVAs conducted on the sub-scale data also revealed no significant main effects (all p's > 0.17).

Tolerance Data

The tolerance data were collated according to intervention and heat test and the means are provided in Figure 12. Acceptance showed an increase of around two seconds from Baseline to Post-Intervention and this reduced by about one second at Post-Reminder. Distraction increased very slightly at Post-Intervention and returned to Baseline level at Post-Reminder.

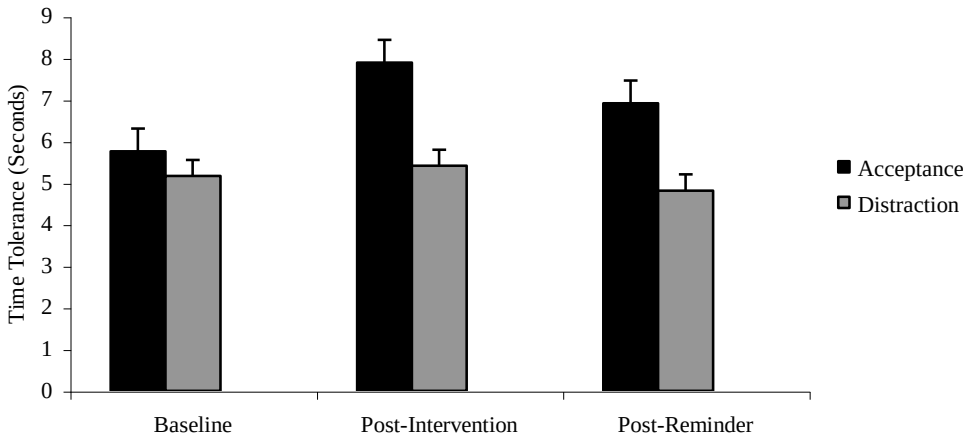

Figure 12. The mean heat tolerance for experimental interventions across heat tests in Experiment 3.

A 3x2 mixed repeated measures ANOVA indicated that heat test [$F(2,68)=13.097$, $p = 0.022$, $\eta_p^2=0.106$] was significant and the interaction effect approached significance [$F(2,68)=8.919$, $p = 0.071$, $\eta_p^2=0.075$]. Intervention was not significant ($p = 0.106$).

Planned Within Interventions Tolerance Data

Two one-way repeated measures ANOVAs were conducted separately for each intervention. In Acceptance, there was a significant main effect for heat test [$F(2,16)=4.37$, $p = 0.021$, $\eta_p^2=0.12$], with post-hoc tests (Scheffe's) indicating a significant difference between Baseline and Post-Intervention ($p = 0.021$; all other p's > 0.289). In Distraction, heat test was not significant ($p = 0.47$). In short, Acceptance significantly increased tolerance from Baseline to Post-Intervention, but there were no significant tolerance changes for Distraction.

Data from Mid-Experimental Distress Ratings

Discomfort Ratings. The discomfort ratings indicated similar differences across heat tests for both interventions, but little differences between the two groups (see Figure 13). Although discomfort in Distraction remained stable from Baseline to Post-Intervention, discomfort in Acceptance increased somewhat at this time. Discomfort decreased for both groups from Post-Intervention to Post-Reminder. A 3x2 mixed repeated measures ANOVA indicated that intervention and the interaction effect were non-significant (all p's > 0.409), but heat test approached significance [$F(2,68)=2.58$, $p = 0.083$, $\eta_p^2=0.071$].

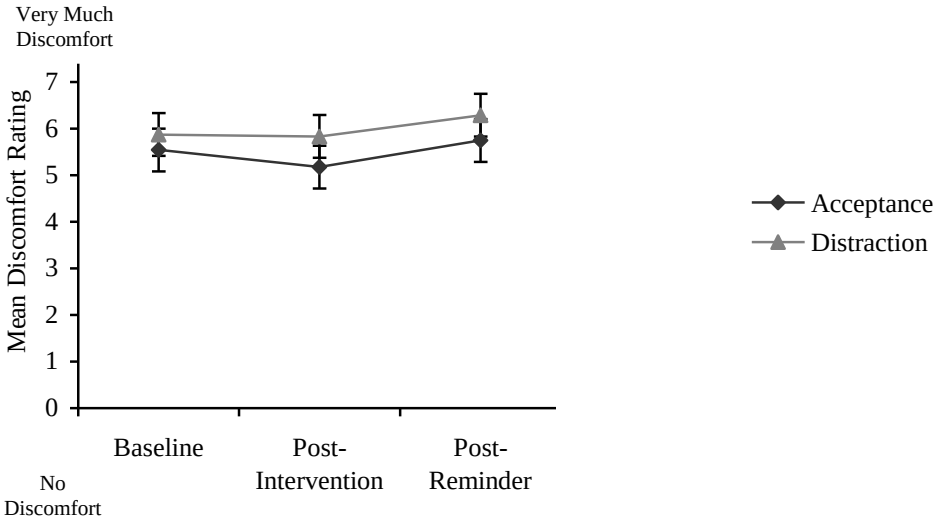

Figure 14. Discomfort ratings for each intervention across heat tests in Experiment 3.

Planned Within Interventions Discomfort Data

Three one-way repeated measures ANOVAs were conducted separately for each intervention but there were no significant effects for heat test for either group (both p's > 0.331). In short, neither Acceptance nor Distraction participants showed significant changes in discomfort.

Pain Ratings. There were little or no changes in the pain ratings recorded by the two groups at any point. A 3x2 mixed repeated measures ANOVA revealed no significant main or interaction effects (all p's > 0.503).

Anxiety Ratings. The groups did not appear to differ on anxiety at any point and a 3x2 mixed repeated measures ANOVA indicated that there were no significant main or interaction effects (all p's > 0.382).

Data from Post-Experimental Measures

The mean MPQ scores were again low overall, indicating that participants generally did not experience the pain in the heat tests as extreme (M=11.14,

SD=7.827). An independent samples t-test indicated that there was no significant difference between the groups (p = 0.269). The two groups were not differentiated in their ratings of overall experimental pain (M=5.59, SD=2.1) and an independent samples t-test revealed no significant difference (p = 0.297).

The acceptance and distraction questions on Adherence Sheets 1 and 1A (immediately after the intervention videos) indicated a good understanding of both strategies. That is, Acceptance scored higher (Sheet 1: M=1.35, Sheet 1A: M=1.0) on the acceptance questions than Distraction (Sheet 1: M=0.58, Sheet 1A: M=0.13) and Distraction scored higher (Sheet 1: M=2.84, Sheet 1A: M=1.25) on the distraction questions than Acceptance (Sheet 1: M=1.29, Sheet 1A: M=0). On Sheet 1, two independent samples t-tests revealed significant differences between the groups on both types of question as predicted -- acceptance questions [t(34)=2.178, p = 0.035, η_p^2=0.03] and distraction questions [t(34)=-3.548, p = 0.001, η_p^2=0.031]. This was also the case for Sheet 1A: acceptance questions [t(32)=6.0, p = 0.001, η_p^2=0.031] and distraction questions [t(32)=-4.286, p = 0.001, η_p^2=0.031].

However, responses to the two types of question on Adherence Sheets 2 and 2A (presented directly after the Post-Intervention heat test) were not as positive. On Sheet 2, Acceptance participants reported using similar levels of acceptance (M=23.35) and distraction (M=20), while Distraction participants indicated that they had used more distraction (M=29.05) than acceptance (M=22.68). Indeed, two independent samples t-tests revealed no significant difference between the groups on the acceptance questions (p = 0.843), but there was a significant difference on the distraction questions [t(34)=-2.75, p = 0.01, η_p^2=0.031]. On Sheet 2A, Acceptance participants reported using similar levels of acceptance (M=11) and distraction (M=10.67), and Distraction used similar levels of distraction (M=10.88) and

acceptance (M=11.25). Two independent samples t-tests confirmed that there was no significant difference between the groups on either type of question: acceptance questions (p = 0.911) and distraction questions (p = 0.941).

On Sheets 3 and 3A, Acceptance participants reported using similar levels of acceptance (Sheet 3: M=22.77, Sheet 3A: M=28.57) and distraction (Sheet 3: M=20.77, Sheet 3A: M=9), while Distraction participants used more distraction (Sheet 3: M=33.53, Sheet 3A: M=15.25) than acceptance (Sheet 3: M=22.79, Sheet 3A: M=11.13). Two independent samples t-tests on Sheet 3 confirmed this: acceptance questions (p = 0.995) and distraction questions [t(34)=-3.918, p = 0.004, η_p^2=0.003], as did the same statistic conducted on Sheet 3A: acceptance questions (p = 0.289) and a difference nearing significance on the distraction questions [t(32)=-2.047, p = 0.063, η_p^2=0.031].

Distraction participants described using distraction more often than Acceptance participants reported using acceptance and a Chi ² analysis indicated that this difference was significant (χ^2 (1, 36)=5.968, p = 0.015), although the strategy examples provided by both groups were consistent with the interventions. Furthermore, both groups reported the continued use of their strategy and a Chi ² indicated that they did not differ significantly in this regard (χ^2 (1, 36)=1.393, p = 0.238). The groups did not differ on reported length of use, daily use, or usefulness of strategy and three independent samples t-tests revealed no significant differences between the groups on any aspect (all p's > 0.309).

Summary of Results

Acceptance and Distraction did not differ on the pre-experimental measures. Acceptance showed a significant increase in heat tolerance from Baseline to Post-

Intervention, there was no change in tolerance for Distraction. The distress ratings did not differentiate the groups on any measure. Reported adherence to strategy was variable and the data generally indicated that the groups distinguished acceptance from distraction more accurately early in the experiment than later. Overall, reported strategy adherence was better for Distraction than Acceptance.

DISCUSSION

The key structural difference between the current and previous studies concerned the removal of the Swamp Metaphor in an effort to determine the potential influence this exerted on the differential outcomes recorded thus far. Overall, the consistency of the current findings with the previous studies suggested that the Swamp Metaphor exerted little direct influence on the outcomes. Nonetheless, the reduced success of the current adherence measures relative to Experiment 2 pointed to the possibility that the metaphor had been exerting some influence on adherence. In other words, it is possible that the metaphor helped participants to articulate what they were doing in terms of the target strategy for dealing with the pain.

One issue that emerged from the data from Experiments 2 and 3 concerned the potential impact of the Values Clip and its relationship with adherence. Experiment 4 attempted to address this issue by removing the Values Clip once again and re-employed the same adherence measures that had worked well in Experiment 2.

Chapter 5

Examining the Impact of Values on Acceptance and Distraction

Experiment 4

Chapter 5

Examining the Impact of Values on Acceptance and Distraction

Experiment 4

The primary aim of Experiment 4 was to determine the potential impact of the Values Clip on the outcomes recorded since Experiment 2. In order to address this issue, Experiment 4 comprised Acceptance and Distraction protocols from which the Values Clip was removed. However, the Swamp Metaphor was re-instated and the adherence measure from Experiment 2 was re-employed.

METHOD

Participants

A sample of 44 undergraduate students from NUIM who ranged in age from 18 to 44 years (M=22.24, SD=6.43) participated in Experiment 4. They were again selected in an ad-hoc fashion from a wider pool of experimental volunteers and were grouped according to Baseline levels of heat tolerance as LOW and MEDIUM. The exclusion criteria applied again and resulted in the removal of two participants. Of the remaining sample of 42 participants, 21 were female and 21 were male (50% female and 50% male).

Setting, Apparatus, Materials and Procedure

The setting, apparatus and materials were largely identical to the previous studies. The adherence measures are outlined in Table 8. There were also a number of

key differences. (1) The video clips containing the Swamp metaphor (identical to Experiment 2) were re-introduced to the computer program. (2) The Values Clip was removed. All other aspects of the procedure were identical to Experiment 3.

Table 8
The Adherence Measures Employed in Experiment 4

Mid-Experimental Adherence Measures	**Post-Experimental Adherence Measures**
Post-Intervention Adherence Sheet 1	***Post-Reminder Adherence Sheet 3***
6 Acceptance Questions	6 Acceptance Questions
6 Distraction Questions	6 Distraction Questions
Utility of Strategy in Next Heat Test	Example of Strategy Used
	Strategy Change
Post-Intervention Adherence Sheet 1A	***Post-Reminder Adherence Sheet 3***
6 Acceptance Questions	6 Acceptance Questions
6 Distraction Questions	6 Distraction Questions
Post-Intervention Adherence Sheet 2	***Post-Reminder Adherence Sheet 4***
6 Acceptance Questions	Pain Intensity Question
6 Distraction Questions	Length of Strategy Use
	Strategy Use in Daily Life
Post-Intervention Adherence Sheet 2A	
6 Acceptance Questions	
6 Distraction Questions	

Video Clip Inter-Rater Reliability

Once again, four independent raters assessed the believability, genuineness, likeability and empathy of the therapist in the video clips. Four separate one way between groups ANOVAs found no significant effect for intervention on any aspect (all p's > 0.638).

RESULTS

Data from Pre-Experimental Measures

The data from the five psychological measures were collated by intervention and the means indicated little or no group differences (see Table 9). Five separate one-

way between-groups ANOVAs (one per measure) revealed non-significant effects for intervention (all p's > 0.412). Six separate one-way between groups ANOVAs (one per sub-scale) also revealed no significant effects (all p's > 0.16).

Table 9
The Means and Standard Deviations for Intervention on the Five Psychological Measures in Experiment 4

Intervention	***Psychological Measures***				
	AAQ	*CPAQ-A*	*FPQ*	*DASS*	*BIDR*
Acceptance	52.05	67.55	81.75	11.30	8.30
SD	7.46	10.87	17.01	9.63	3.48
Distraction	53.04	69.96	84.59	9.23	8.09
SD	7.50	10.96	16.89	6.35	3.64
Overall Means	53.55	68.76	83.17	10.27	8.20
Overall SD	7.41	10.85	16.80	8.04	3.52

Tolerance Data

The tolerance data were collated according to intervention and heat test and the means are provided in Figure 14. Acceptance showed an increase of almost three seconds from Baseline to Post-Intervention, but this decreased by around one second at Post-Reminder. In contrast, Distraction was identical to Baseline at Post-Intervention and decreased at Post-Reminder.

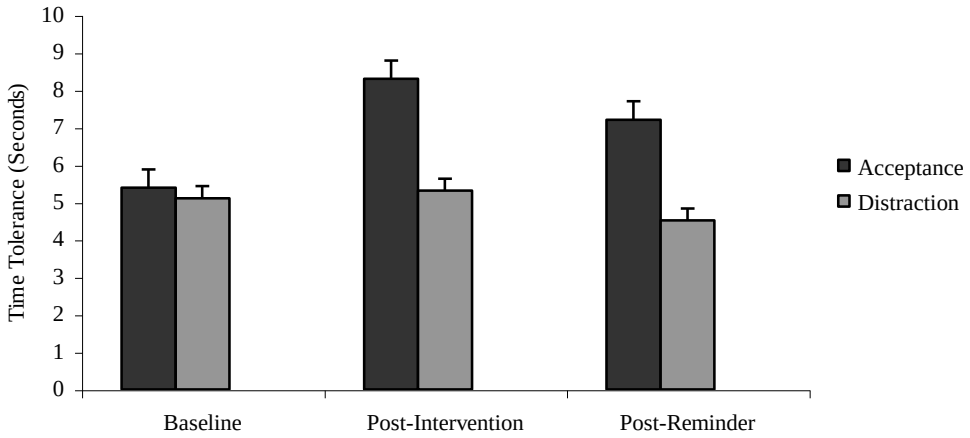

Figure 14. The mean heat tolerance for each intervention across heat tests in Experiment 4.

A 3x2 mixed repeated measures ANOVA indicated that both intervention [$F(1,40)=6.389$, $p = 0.015$, $\eta_p^2=0.137$] and heat test [$F(2,80)=4.566$, $p = 0.013$, $\eta_p^2=0.103$] were significant, as was the interaction effect [$F(2,80)=4.337$, $p = 0.016$, $\eta_p^2=0.098$].

Planned Within Interventions Tolerance Data

Two one-way repeated measures ANOVAs were conducted separately for each intervention. In Acceptance, there was a significant main effect for heat test [$F(2,38)=7.399$, $p = 0.002$, $\eta_p^2=0.162$], with post-hoc tests (Scheffe's) indicating significant or approaching significant differences between Baseline and Post-Intervention ($p = 0.002$) and between Baseline and Post-Reminder ($p = 0.072$). In Distraction, heat test was not significant ($p = 0.626$). In short Acceptance significantly increased tolerance from Baseline to Post-Intervention and from Baseline to Post-Reminder, Distraction showed no significant change.

Data from Mid-Experimental Distress Ratings

Discomfort Ratings. The discomfort ratings indicated some changes across time for each intervention (see Figure 15). Acceptance decreased slightly at Post-Intervention but increased sharply at Post-Reminder to just above Baseline levels. In contrast, Distraction decreased sharply at Post-Intervention and decreased again very slightly at Post-Reminder. A 3x2 mixed repeated measures ANOVA revealed a significant main effect for heat test [$F(2,80)=5.613$, $p = 0.005$, $\eta_p^2=0.123$], but not for intervention ($p = 0.763$). The interaction effect was also significant [$F(2,80)=6.471$, $p = 0.003$, $\eta_p^2 =0.139$].

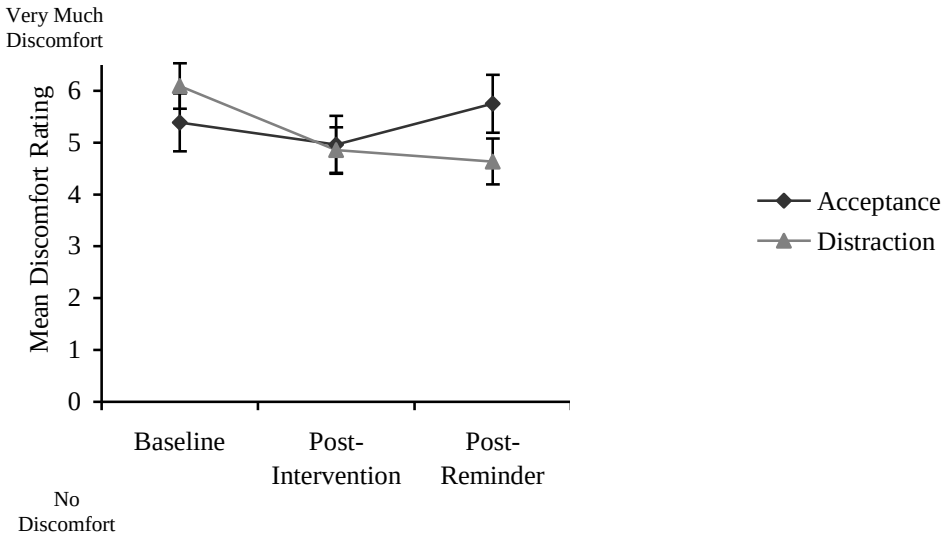

Figure 15. Discomfort ratings for each intervention across heat tests in Experiment 4.

Planned Within Interventions Discomfort Data

Two one-way repeated measures ANOVAs were conducted separately for each intervention. Heat test was significant for Acceptance [$F(2,42)=3.539$, $p = 0.039$, $\eta_p^2=0.157$], with post-hoc tests (Scheffe's) indicating a significant difference between Post-Intervention and Post-Reminder ($p = 0.039$), all other p's > 0.361. In Distraction, heat test was also significant [$F(2,42)=7.74$, $p = 0.001$, $\eta_p^2=0.271$], with post-hoc tests

indicating significant differences between Baseline and Post-Intervention ($p = 0.013$) and between Baseline and Post-Reminder ($p = 0.003$) all other p's > 0.861. In short, Acceptance participants reported significantly increased discomfort between Post-Intervention and Post-Reminder, while Distraction participants reported significantly decreased discomfort from Baseline to Post-Intervention and Baseline to Post-Reminder.

Pain Ratings. The pain ratings showed little differences across intervention or time. A 3x2 mixed repeated measures ANOVA revealed no significant main or interaction effects (all p's > 0.122).

Anxiety Ratings. The anxiety ratings showed some differences across intervention and time. For Distraction, anxiety decreased steadily, but there was no change for Acceptance (see Figure 16). A 3x2 mixed repeated measures ANOVA indicated a significant main effect for heat test [$F(2,80)=4.812$, $p = 0.019$, $\eta_p^2=0.095$], but not intervention ($p = 0.296$). The interaction effect was also significant [$F(2,80)=3.984$, $p = 0.022$, $\eta_p^2=0.091$].

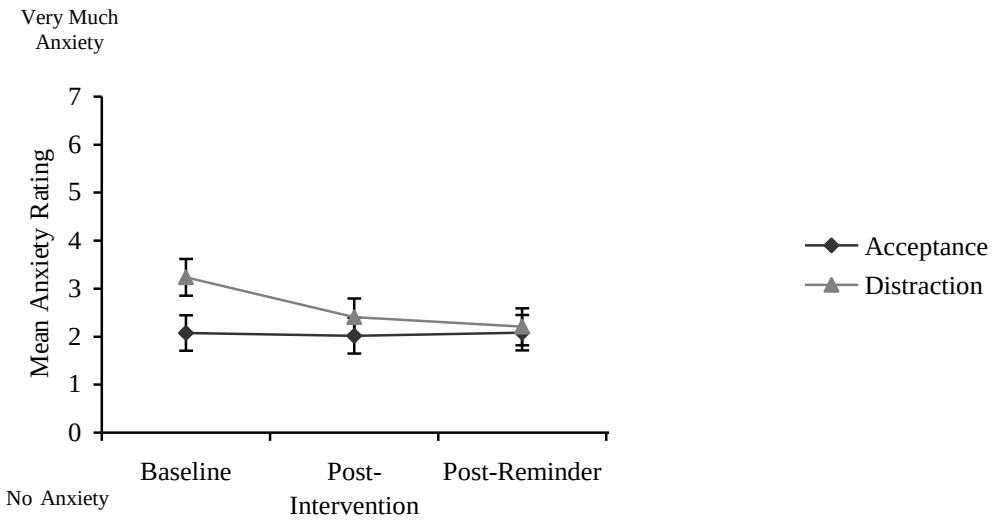

Figure 16. Anxiety ratings for each intervention across heat tests in Experiment 4.

Planned Within Interventions Anxiety Data

Two one-way repeated measures ANOVAs were conducted separately for each intervention. Heat test was significant for Distraction [$F(2,42) = 5.364$, $p = 0.008$, $\eta_p^2 = 0.203$], with post-hoc tests (Scheffe's) indicating a significant difference between Baseline and Post-Reminder ($p = 0.013$) and a difference nearing significance between Baseline and Post-Intervention ($p = 0.057$), all other p's > 0.829. In Acceptance, there was no significant main effect ($p = 0.912$). In short, Distraction participants reported significantly or near significantly decreased anxiety from Baseline to Post-Intervention and from Baseline to Post-Reminder.

Data from Post-Experimental Measures

The mean MPQ scores were again low overall, indicating that participants generally did not experience the pain in the heat tests as extreme ($M=12.31$, $SD=8.55$). An independent samples t-test indicated that there was no significant difference between the groups ($p = 0.164$). The two groups were not differentiated in

their ratings of overall experimental pain (M=5.51, SD=2.02) and an independent samples t-test revealed no significant effect ($p = 0.811$).

On Adherence Sheets 1 and 1A (after video), there was strong evidence that both groups understood the strategies they had been given. On Sheet 1, Acceptance participants reported using more acceptance (M=2.8) than distraction (M=0.25), while Distraction participants reported using more distraction (M=2.73) than acceptance (M=0.64). Two independent samples t-tests revealed significant differences between the groups on both types of question: acceptance questions [$t(40)=4.514$, $p < 0.001$, $\eta_p^2=0.025$] and distraction questions [$t(40)=-5.813$, $p < 0.001$, $\eta_p^2=0.025$]. On Sheet 1A, Acceptance participants reported using more acceptance (M=1.35) than distraction (M=0.2), while Distraction participants reported using more distraction (M=1.12) than acceptance (M=0.41). Two independent samples t-tests again revealed significant differences between the groups on both types of question: acceptance questions [$t(40)=3.942$, $p = 0.003$, $\eta_p^2=0.025$] and distraction questions [$t(40)=-4.974$, $p < 0.001$, $\eta_p^2=0.024$].

On Adherence Sheets 2 and 2A (Post-Intervention heat test), there was some evidence that the groups continued to understand their different strategies. On Sheet 2, Acceptance participants reported using as much distraction (M=16.1) as acceptance (M=24.4), while Distraction participants used more distraction (M=30.68) than acceptance (M=20.32). Two independent samples t-tests found that the groups did not differ significantly on the acceptance questions ($p = 0.139$), although they did differ significantly on the distraction questions [$t(40)=4.569$, $p < 0.001$, $\eta_p^2=0.025$]. On Sheet 2A, the outcomes were more positive. Acceptance participants reported using more acceptance (M=14) than distraction (M=8.05), while Distraction participants used more distraction (M=16.59) than acceptance (M=10.82). Two independent

samples t-tests found that the difference between the groups approached significance on the acceptance questions [$t(40)=1.992$, $p < 0.053$, $\eta_p^2=0.025$] and was highly significant on the distraction questions [$t(40)=4.508$, $p < 0.001$, $\eta_p^2=0.025$].

Adherence Sheet 3 (i.e. how frequently the relevant strategy was used in general during the heat tests) indicated that adherence had weakened, particularly with regard to acceptance. Acceptance participants reported using as much distraction (M=17.45) as acceptance (M=23.7), while Distraction participants used more distraction (M=34.73) than acceptance (M=20.91). Two independent samples t-tests found that the groups did not differ significantly on the acceptance questions ($p = 0.35$), but did on the distraction questions [$t(40)=-5.818$, $p < 0.001$, $\eta_p^2=0.025$]. This was also the case for Adherence Sheet 3A. Acceptance participants again reported using as much distraction (M=7.3) as acceptance (M=13.2), while Distraction participants used more distraction (M=18.41) than acceptance (M=11.55). Two independent samples t-tests found no significant difference between the groups on the acceptance questions ($p = 0.41$), but did on the distraction questions [$t(40)=-7.122$, $p < 0.001$, $\eta_p^2=0.025$]. In short, reported adherence to strategy was high early in the experiment for both groups, but became considerably weaker for Acceptance participants. The groups did not differ on any other aspects of adherence, including reported length of use, daily use, usefulness and overall pain (all p's > 0.1).

When asked for strategy examples on Adherence Sheet 3, participants gave appropriate examples and a Chi ² analysis indicated no significant difference across interventions (χ^2 (1, 40)=1.222, $p = 0.269$). Both groups reported the continued use of their strategy and a Chi ² indicated that they did not differ significantly in this regard (χ^2 (1, 40)=0.005, $p = 0.945$). When asked to describe any alternative strategies used participants generally described a strategy consistent with their intervention. The

groups did not differ on any other aspects of adherence, including reported length of use, daily use and usefulness. Three independent samples t-tests indicated that the groups did not differ significantly on any of these aspects (all p's > 0.19).

Summary of Results

Acceptance and Distraction did not differ on the pre-experimental measures. Acceptance showed a significant increase in heat tolerance from Baseline to Post-Intervention and a near significant increase from Baseline to Post-Reminder. Distraction showed no significant change in tolerance. Analyses of the distress ratings indicated that neither groups showed changes in pain across heat tests. However, Acceptance showed a significant increase in discomfort, while Distraction showed significant decreases. Although Acceptance showed no significant change in anxiety, Distraction participants showed significant decreases. Reported adherence to strategy was high for both groups early on, but weakened considerably for Acceptance across time, although Distraction continued to report high strategy adherence throughout.

DISCUSSION

Once again, the now established pattern of tolerance improvements for Acceptance but not for Distraction was recorded. However, adherence remained problematic, as had been the case for Experiment 3, even though the same adherence measure that had worked well in Experiment 2 had been used. The consistency of the outcomes with the previous studies suggested that the removal of the Values Clip had little or no direct impact on the outcomes recorded in Experiment 4, and thus probably played a similar role in the two previous studies. However, the current study was also concerned with the potential relationship between values and adherence and the

possibility that success on the latter required the presence of the former. On one hand, the consistency in the weak adherence outcomes across Experiments 3 and 4 when the former contained Values but the latter did not suggested that Values had little or no influence on adherence. On the other hand, in order to account for the differences among the last three experiments, it remained possible that both Values and the Swamp Metaphor were necessary to produce sound adherence because Experiment 2 was the only study in which both were present and in which the most reliable adherence outcomes were recorded.

Chapter 6

Experimental Comparisons

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Experimental Comparisons

Each of the five preceding experiments involved a great deal of participant assessment, including medical and psychological screening, tolerance data, distress ratings and adherence measures. Taken together, these generated a wealth of information regarding the participants' psychological status before, and during, the experiment and particularly their reactions to the radiant heat pain. Although a range of analyses of these variables was conducted within the context of each experiment, there have as yet been no systematic comparisons of the data across studies. This was the primary aim of the current chapter. In the interests of clarity, the present chapter focuses specifically on a number of key variables that best identified the intervention groups and permitted comparisons among them, including: psychological measures; inter-rater reliability of interventions; heat tolerance data and impact of interventions; distress ratings; and adherence to strategy. Each of these is discussed separately below.

Psychological Measures

Participants in all experiments (n=272) were presented with the same set of psychological measures that included the AAQ, the CPAQ, the FPQ, the DASS and the BIDR at the beginning of the experiments. In all cases, participants who scored two or more standard deviations outside of the norm for an original sub-set of participants were excluded from the analyses. This left only participants who scored within the 'normal range' on all of these measures at the outset of each experiment. It was not surprising, therefore, that there were almost no significant differences

amongst any groups of participants in this regard. The only exception was Experiment 1, where the DASS data indicated that Placebo participants had significantly higher anxiety and stress than Acceptance participants (although critically Acceptance and Distraction did not differ). When the details of this study were examined carefully, it was observed that individuals in the Placebo group generally participated in the study during an examination period, whereas most of the individuals in the Acceptance and Distraction groups had participated earlier in the academic year. To some extent, this type of outcome was unavoidable given the large sample originally involved in the study and the length of time the research took to conduct. Hence, on-going participation in college exams most likely accounted for the significant difference in pre-experimental levels of anxiety and stress for the Placebo group. However, when the data from the psychological measures is evaluated collectively, it is reasonable to assume that the differential changes in tolerance could not be attributed to pre-experimental differences among the intervention groups on the psychological areas assessed here.

Inter-Rater Reliability of Interventions

All five experiments involved the fully automated delivery of specific therapeutic interventions (primarily Acceptance and Distraction) as a short series of video clips. Although it was important for experimental purposes to use the same therapist in the construction of the videos for the interventions, this raised obvious questions about whether the therapist would present the different therapeutic objectives in an equal manner. Specifically, in the case of the experiments conducted here, the therapist in question was explicitly trained in acceptance-based therapies, rather than in cognitive control treatments, hence there remained the possibility that

this individual could, for example, be perceived as more believable in the Acceptance clips relative to the Distraction clips (although this seemed unlikely). In order to control for this possibility, the video clips to be used in each experiment were subjected to the scrutiny of a sample of independent raters who did not participate in the experiments. In each case, the raters were asked to assess each set of video clips in terms of: believability of the messages; genuineness of the therapist; likeability of the therapist; and empathy of the therapist. Furthermore, the raters were blind to the experiments and were not given any details about each type of intervention. In all five studies, there were no significant differences between the Acceptance and Distraction clips on any of the target aspects of the videos. Hence, subtle differences within the automated interventions could not account for the subsequent differences in outcomes.

Heat Tolerance Data and Impact of Interventions

The primary dependent variable across all five studies was tolerance of radiant heat pain from Baseline to Post-Intervention and Post-Reminder. In Experiment 1, Acceptance, Distraction and Placebo were compared in this regard; whereas in Experiment 1A Acceptance, Distraction 1 and Distraction 2 were compared; and only Acceptance and Distraction were compared thereafter.

Across all five studies, the intervention groups did not differ unexpectedly in heat tolerance at Baseline. This was because participants' tolerance categories were strictly controlled from the outset and categorised as LOW, MEDIUM, or HIGH, using means established with an initial sub-set of participants. The majority of participants overall presented to the experiment as LOW and MEDIUM in Baseline tolerance and in fact HIGH tolerance individuals were hard to find. This is why we removed them from the four latter studies. Although tolerance category was not a core aim of the research, controlling variability in this respect is an important feature of

experimental pain induction procedures and was an important asset to the current work Mitchell et al., 2004). In summary therefore, spurious differences in tolerance category could not account for the differential tolerance outcomes subsequently observed.

In all five experiments, participants in the Acceptance Intervention increased tolerance significantly across heat tests. In four of the studies (1, 2, 3 and 4) tolerance was significantly higher at the Post-Intervention heat test relative to Baseline and in three studies (1, 1A and 4), tolerance was significantly higher at Post-Reminder relative to Baseline. In those studies in which Post-Reminder did *not* differ significantly from Baseline, tolerance in Acceptance had generally decreased relative to Post-Intervention, but at no point did tolerance return to Baseline levels for Acceptance participants. In summary, there were no experiments in which Acceptance generated no change in tolerance or decreased tolerance. Although we had predicted that Acceptance would be associated with increases in tolerance, we were somewhat surprised by the extent of the changes and the consistency of the effects across all five experiments.

The outcomes for the Distraction Interventions differed considerably from Acceptance. In Experiments 1, 3 and 4, Distraction showed no significant change in tolerance across heat tests and this was also the case for Distraction 2 in Experiment 1A. The *best* tolerance outcome for Distraction was recorded in Experiment 1A, where Distraction 1 showed a near significant increase from Baseline to Post-Reminder. In contrast, the *worst* tolerance outcome for Distraction was recorded in Experiment 2, where participants in this group showed significantly *decreased* tolerance from Baseline to Post-Reminder. Taken together, the only Distraction intervention that increased tolerance significantly was Distraction 1, which

incidentally was the only protocol that contained the possible influence of defusion. Indeed, the comparisons among this and all subsequent outcomes for Distraction lend strong support to the hypothesis that the initial tolerance increases association with Distraction may have resulted from the influence of defusion. In fact, when this potential element was removed, Distraction outcomes were, on occasion, similar to those recorded for Placebo in Experiment 1.

Although our primary comparison in the research was between Acceptance and Distraction, Experiment 1 incorporated a Placebo condition so that we could be sure early on that participants in the intervention groups would not change tolerance by virtue of repeated exposure to the heat tests per se. Indeed, the significant tolerance decrease that emerged for Placebo in Experiment 1 indicated that repeated exposure to the heat tests decreased, rather than increased, tolerance in the absence of a strategy-based intervention.

Distress Ratings

All participants were required to provide three self-report distress ratings of discomfort, pain and anxiety as a measure of their explicit impression of the pain experienced during each immediately preceding heat test. The primary aim in including these measures was to determine whether the participants in each intervention differed qualitatively in their reactions to pain, irrespective of how long they were actually tolerating it. For example, Gutierrez et al. (2004) reported that participants in Acceptance who tolerated the highest level of pain (from the electric shock apparatus) were those who reported the pain as the most qualitatively unpleasant. Hence, it was not the case in that study that Acceptance simply worked because its participants were experiencing less pain.

The discomfort ratings obtained across the five experiments showed differences between participants in Acceptance and Distraction. In Experiment 1, Distraction participants showed a significant decrease in discomfort from Baseline to Post-Intervention, yet there were no significant changes for Acceptance. In Experiment 1A, participants in both Distraction 1 and 2 again showed a significant decrease in discomfort from Baseline to Post-Intervention. But again, there was no significant change for Acceptance. The overlap between these two studies is hardly surprising given that one's data was a subset of the other's. However, a similar pattern emerged in Experiment 4, where Distraction participants showed significant decreases in discomfort from Baseline to Post-Intervention and from Baseline to Post-Reminder. Interestingly, in this experiment discomfort actually increased significantly for participants in Acceptance between Post-Intervention and Post-Reminder. Although it is not surprising that discomfort decreased for Distraction participants who were not tolerating significantly more heat, it is interesting that discomfort only increased on one occasion for participants in Acceptance who were consistently tolerating significantly more heat. Taken together, these findings suggest that the significant tolerance increases observed for participants in Acceptance did not occur because they were feeling less discomfort.

The anxiety ratings obtained across the five experiments also showed differences between participants in Acceptance and Distraction. In Experiments 1A, 2 and 4, Distraction participants showed significant or near significant decreases in anxiety from Baseline to Post-Intervention and from Baseline to Post-Reminder, yet there were no significant changes for Acceptance. Again it is not surprising that anxiety decreased for Distraction participants who were not tolerating significantly more heat, but it is interesting that anxiety did not increase for participants in

Acceptance who were consistently tolerating significantly more heat. These findings also suggest that the significant tolerance increases for participants in Acceptance did not occur because they were feeling less anxiety about the heat tests.

The explicit pain ratings, however, were perhaps the most important of the self-report data, given the nature of the experimental task. In all five studies, the explicit pain ratings did not differ across heat tests or interventions. Furthermore, the overall MPQ means were always low, indicating that at the end of the experiments participants generally did not perceive the pain across the heat tests as extreme. Although there were no significant differences among the two key intervention groups in this regard at any point, the Placebo group in Experiment 1 did report significantly or near significantly less pain on the MPQ, relative to Acceptance and Distraction, respectively. However, this was not entirely unexpected given that Placebo participants were given no strategy for coping with the pain at any point and overall demonstrated lower tolerance across the heat tests when compared to participants in Acceptance and Distraction. The groups also did not differ in their responses to the generic pain question presented in the adherence measure in all five studies. Taken together, there is sound reason to believe that the increased tolerance associated with Acceptance did not result from the possibility that participants in this group were experiencing less pain than those in the other groups.

Adherence to Strategy

In spite of numerous analogue studies in the clinical literature, adherence has attracted relatively little empirical attention. One possible reason for this concerns logistical difficulties in generating sound adherence measures, including them in an experimental sequence without disrupting the momentum of interventions and

generating measures that will actually tell you what participants are doing at any point in the procedure. However, because the current research was concerned with both demonstration and process issues regarding acceptance in particular, it seemed worthwhile in this context to try to incorporate some measure of the participants' adherence to the designated interventions. Put simply, we wanted to determine whether participants provided with an Acceptance Intervention and who subsequently demonstrated improved pain tolerance, were actually using acceptance to cope with the pain. We felt from the outset that this was an important issue because several pilot studies that we had conducted elsewhere indicated that many experimental participants do not fully understand acceptance. Indeed, aspects of our own adherence data here actually supported this view.

Experiments 1 and 1A incorporated only one adherence measure at the end of the experiment. This comprised two sets of statements, six acceptance-based and six distraction-based. The basic prediction was that Acceptance participants would indicate that they had engaged in acceptance more than distraction by reporting that the acceptance-based statements applied to them, but the distraction-based statements did not. The reverse was predicted for the Distraction group. Unfortunately however, the data from both studies suggested that neither group of participants could report accurately on the strategies they had used throughout the experiment. This outcome raised three possibilities. First, participants may not in fact have adopted the strategies with which they were provided. However, this seemed unlikely given the strong and significant tolerance differences that emerged. Second, the adherence measures employed in the early studies may not have adequately tapped into participants' perceptions of what they were doing, even though they were actually doing what they had been instructed. This latter possibility seemed more likely and thus Experiment 2

incorporated a series of revisions to the adherence statements that attempted to rectify this difficulty, particularly by employing adherence measures *throughout* the study, rather than simply at the end. Third, it remained possible that participants were doing what they were instructed to do, but cared little for their part in the experiment generally. In order to address this issue, the Values Clip was added Experiment 2, based on a similar manipulation reported by Johnson et al., 2004.

In Experiment 2, participants were presented with acceptance- and distraction-based adherence statements immediately after the intervention but prior to the Post-Intervention heat test and after the Post-Intervention and Post-Reminder heat tests. That is, immediately after the intervention, participants were asked about the strategy presented to them during the video clips. After the Post-Intervention heat test, they were asked to identify the strategies they had used during the previous heat test. Then at Post-Reminder, they were asked about the general strategies they had used across the three preceding heat tests. In all, these adherence measures were considerably more successful than the measure used in the two previous studies and indicated that participants in the two key interventions reported using significantly different strategies from each other, but in both cases these were consistent with the designated intervention. These outcomes suggested that repeated adherence checks throughout the experiment yielded more reliable information than simply asking participants at the end.

In Experiment 3, some revisions were effected to the adherence measures to accommodate the removal of the Swamp Metaphor, but we continued to assess strategy adherence at relevant points throughout the experiment. Although, both groups correctly discriminated acceptance from distraction immediately after the video, this pattern had changed by the Post-Intervention heat test. Both here and at the

Post-Reminder heat test, reported strategy adherence was low for Acceptance, but remained high for Distraction.

The difference in adherence between Experiments 2 and 3 may have been attributable to the minor differences in the measures themselves from one experiment to the next, although this seemed unlikely. Alternatively, we hypothesised that the difference was attributable to the Swamp Metaphor which had been present in Experiment 2 but absent in Experiment 3. Specifically, we argued previously that certain features of the metaphor may have provided participants with additional clarification and means of understanding what they had to do and how to do it. In other words, perhaps the metaphor gave the participants 'more language' for describing what they were supposed to do? Participants in the Acceptance group seemed to be particularly susceptible to this effect.

In order to test this hypothesis, the same adherence measures from Experiment 3 were re-employed in Experiment 4, where the Swamp Metaphor was re-instated (but the Values Clip was removed). However, an almost identical pattern of adherence responses were recorded in Experiment 4, suggesting that perhaps the metaphor per se was not entirely critical to sound adherence, especially for participants in the Acceptance group.

What remained then for us to determine was why adherence had worked well in Experiment 2, but not so well for Acceptance participants in particular in Experiments 3 and 4. Our basic conclusion was that the presence of *both* the metaphor and the Values Clip were important for participants in the Acceptance group to give an accurate account of what they thought they had been doing to cope with the heat pain.

The adherence measures contained a number of additional questions through which we attempted to determine to what extent each group had applied the designated strategy and in most respects the groups did not differ. Specifically, in all studies the groups did not differ in their perceptions of: the level of strategy difficulty; how long they had used the strategy throughout the experiment; how frequently they had used the strategy in the experiment; how much they used it in their daily lives; and whether they had switched strategy through the experiments. Furthermore, both groups offered examples that were strategy-consistent. The only differences between the groups were as follows. In Experiments 1 and 1A, participants in Distraction reported that their strategy was significantly more useful than Acceptance participants reported the utility of acceptance, but this did not recur in any of the other studies. In Experiment 1, Acceptance participants were significantly less willing to repeat the heat test than Distraction and Placebo, but this was not the case in Experiment 1A.

Taken together, our adherence measures perhaps created as many questions as they answered. In some respects, they offered evidence that participants were using the strategies they had been given and the tolerance data certainly supported this. Although the significant differences between the two groups' responses to the acceptance- and distraction-based statements perhaps suggested that participants in Distraction better understood their strategy overall, there was also evidence that Acceptance participants were simply more sensitive to components of the intervention package, especially the Swamp Metaphor and the Values Clip. In all then, it seems safest to conclude that it was wise to examine adherence to the extent that we had done and that we learned a lot about how this can be done well and how it might influence experimental outcomes.

Summary

The wealth of data collected on participants before, during and after the experiments was at times overwhelming. However, our primary experimental question concerned the relative utility of acceptance and distraction as coping strategies for experimentally-induced radiant heat pain. The tolerance data across all five experiments were unanimous in indicating that Acceptance was associated with significant tolerance increases, but Distraction was not (neither was Placebo). We had some reason for confidence in the belief that the tolerance changes observed were most likely the result of the interventions. Specifically, they could not readily be attributed to pre-experimental differences on a range of psychological measures; spurious differences in levels of heat tolerance at Baseline; gender differences; subtle differences regarding the therapist in the video clips; or reduced levels of self-reported pain, discomfort, or anxiety for participants who were tolerating more heat pain. Although adherence to strategy was an on-going concern through which we could never be entirely certain that the participants were doing what they had been instructed, there was reason to believe that they were at least at times and we had also learned how difficult it was to incorporate sound adherence measures into clinical analogue research.

Chapter 7

General Discussion

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General Discussion

The current thesis examined the relative utility of acceptance and distraction-based coping strategies in the context of experimentally induced radiant heat pain and was also concerned with process issues that might underpin these two common treatment regimes. As well as repeatedly demonstrating the superiority of acceptance over distraction for radiant heat pain tolerance, the experimental manipulations examined the utility of specific features of the intervention protocols on the outcomes, including the use of a metaphor and values. In short, the manipulation of the various intervention features appeared to have little direct impact on the tolerance outcomes, but did influence levels of strategy adherence, particularly for participants in the Acceptance group. The data from each study is summarised below and generic theoretical issues emerging from the work are thereafter discussed.

Chapter 2: Summary of Findings

Experiment 1 was a large-scale study (*n*=128) that was the first to examine clinical coping strategies in the context of experimentally induced radiant heat pain. The study systematically compared the relative impacts of brief automated analogue interventions that comprised Acceptance, Distraction and Placebo on three heat test exposures, referred to as Baseline, Post-Intervention and Post-Reminder. The key research prediction, based on previous evidence, suggested that Acceptance would increase pain tolerance.

In Experiment 1, the two key intervention groups (Acceptance and Distraction) did not differ significantly on a range of pre-experimental measures and

thus these variables could not account for subsequent changes in heat tolerance. Only the Acceptance group showed a significant increase in heat tolerance from Baseline to Post-Intervention and Post-Reminder (Placebo showed a significant decrease). Analyses of the distress ratings critically indicated that there had been no change on any measure for participants in Acceptance, even though they were tolerating significantly greater heat. However, Distraction participants reported significantly less discomfort from Baseline to Post-Intervention, even though their level of heat tolerance had not changed significantly.

In spite of the significant changes in heat tolerance, adherence to strategy was lower than expected and indicated that the two key intervention groups could not distinguish clearly between acceptance and distraction at the end of the experiment. Acceptance participants were significantly least willing to repeat the heat test.

Although the positive outcome for Acceptance was consistent with experimental predictions, the small improvement in tolerance for Distraction was also of interest, because similar changes had been recorded by previous researchers (e.g. Gutierrez et al., 2004). In order to analyse this latter effect, the Distraction Intervention was examined closely and specific features therein suggested that distraction alone might not have accounted for the changes in tolerance associated with this intervention. Specifically, it appeared possible that defusion processes may have exerted a spurious influence within the Distraction protocol that contributed to the modest change in tolerance.

This issue was addressed in *Experiment 1A* (n=27) with some revisions to the original Distraction Intervention that sought to eliminate the potential influence of defusion. Again, the three key intervention groups (Acceptance, Distraction 1 and Distraction 2) did not differ significantly on pre-experimental measures. The

Acceptance group showed a near significant increase in tolerance between Baseline and Post-Reminder, as did Distraction 1. There was no significant change in tolerance for Distraction 2. Again the increased tolerance for participants in Acceptance coincided with no significant changes on any of the distress measures. However, participants in Distraction 1 and 2 reported significantly less discomfort from Baseline to Post-Intervention, while the latter also reported significantly reduced anxiety from Baseline to Post-Intervention and from Baseline to Post-Reminder. Once again however, reported adherence to strategy was low with all groups failing to explicitly differentiate acceptance from distraction. On this occasion, the groups did not differ in their willingness to repeat the heat tests. The results, therefore, once again confirmed experimental predictions and supported the defusion hypothesis when the modified intervention (Distraction 2) produced a weaker outcome than the original Distraction Intervention in Experiment 1.

Chapter 3: Summary of Findings

Experiment 2 (n=39) attempted to examine the processes that may have accounted for the considerable differences in the interventions recorded thus far. Although the original interventions had been tightly matched for experimental purposes, it was clearly necessary that they were functionally distinct -- one primarily targeted acceptance, the other targeted distraction. It remained possible, therefore, that any one of these features may have contributed to the outcomes. Experiment 2 attempted to determine whether permitting Acceptance participants to generate positive imagery (as in Distraction) and then allowing them to be open to these images during the Walking Exercise (rather than actually distracting from them at this critical point) might alter the outcomes recorded previously for Acceptance.

The secondary aim of Experiment 2 concerned the weak and unpredicted adherence outcomes recorded previously, in which both groups of participants appeared unable to report accurately on the strategies they had used throughout the experiment. The significant tolerance changes rendered it unlikely that participants simply had not adopted the strategies with which they were provided, and more likely that the adherence measures employed had not adequately tapped into participants' perceptions of what they were doing. Experiment 2 incorporated a series of revisions to the adherence measure that attempted to rectify this difficulty and to ensure that participants valued their involvement in the study. The latter issue was explicitly addressed by the addition of a Values Clip, which suggested to participants that their involvement in the study would assist research on pain and impact upon the lives of chronic pain sufferers. This manipulation had been employed in previous studies in which participants were described as operating within a 'high-values' context (Johnson et al., 2004).

The findings indicated that once again the Acceptance and Distraction groups did not differ on the pre-experimental measures. The Acceptance group showed a significant increase in heat tolerance from Baseline to Post-Intervention, while Distraction showed a significant decrease in tolerance from Baseline to Post-Reminder. Again, the tolerance increase for participants in Acceptance did not coincide with significant changes on any of the distress ratings. Furthermore, participants in Distraction again reported significant decreases in anxiety form Baseline to Post-Intervention and from Baseline to Post-Reminder, even though they were not tolerating significantly more heat. The adherence data, on this occasion, showed strong adherence to strategy by both groups at all three adherence points in the experiment, indicating that each group could accurately differentiate acceptance

from distraction at all times. The revisions to the adherence measures and/or the inclusion of the Values Clip appeared to exert a positive influence on reported adherence to strategy, but did not appear to alter the differential outcomes associated with the two intervention groups.

Chapter 4: Summary of Findings

Experiment 3 (*n*=36) involved the systematic removal of the Swamp Metaphor in order to determine its potential impact on the outcomes recorded thus far. Once again, the results indicated that Acceptance and Distraction did not differ on the pre-experimental measures. Acceptance showed a significant increase in heat tolerance from Baseline to Post-Intervention. There was no change in tolerance for Distraction. The distress ratings did not differentiate the two groups in any significant way. Reported adherence to strategy was variable and the data generally indicated that the groups distinguished acceptance from distraction more accurately early in the experiment than later. Overall, strategy adherence was better for Distraction than Acceptance. Thus, the Swamp Metaphor *per se* appeared to play little, if any, direct role on heat tolerance. However, the strong adherence success of Experiment 2 was not replicated in Experiment 3, which suggested that although the metaphor may not have affected the outcomes of the interventions *directly*, it functioned similar to the Values Clip and perhaps altered the language participants used to describe their actions.

Chapter 5: Summary of Findings

Experiment 4 (*n*=42) was the final experiment in the current series and focused primarily on the potential impact of the Values Clip. Hence, in this study the Values Clip was removed and the Swamp Metaphor was re-instated. The findings

indicated that Acceptance and Distraction did not differ on the pre-experimental measures. Acceptance showed a significant increase in heat tolerance from Baseline to Post-Intervention and a near significant increase from Baseline to Post-Reminder. Distraction showed no significant change in tolerance. Participants in Distraction showed significant decreases in discomfort from Baseline to Post-Intervention and from Baseline to Post-Reminder, as well as a significant decrease in anxiety from Baseline to Post-Reminder and a near significant decrease from Baseline to Post-Intervention. Reported adherence to strategy was high for both groups early on, but weakened considerably for Acceptance across time, although Distraction continued to report high strategy adherence throughout.

The absence of the Values Clip, therefore, appeared to exert little direct influence on the tolerance outcomes, although again, adherence to strategy was problematic. This latter effect suggested that the Values Clip perhaps functioned in a similarly indirect way as the metaphor, by influencing adherence (particularly for participants in Acceptance), but not impacting directly upon tolerance. Indeed, the best adherence outcomes, particularly for the Acceptance group, had been observed in Experiment 2, where both the Swamp Metaphor and the Values Clip were included.

Chapter 6: Summary of Experimental Comparisons

Chapter 6 offered a systematic comparison of the methodological differences and findings across the four studies. A number of key themes emerged from these comparisons. First, the data across all studies was remarkably consistent in showing significant tolerance increases for Acceptance, but not Distraction. Second, the wealth of data collected on variables other than tolerance offered a number of reasons why we could be reasonably sure that the tolerance differences were not the result of unknown and spurious sources of control. These reasons were as follows: (a) the

participant groups did not differ at the outset on the psychological screening measures. (b) Participants' levels of Baseline heat tolerance, as well as gender, were strictly controlled. (c) Data from the independent raters indicated that participants did not have different perceptions of the therapist in the videos in terms of empathy, etc. (d) The collective distress ratings suggested that the improvements for Acceptance were not attributable to decreases in distress in any form. Taken together, it is reasonable to assume that the observed changes in heat tolerance resulted from the different strategy interventions with which participants were provided.

Theoretical Issues Arising from the Thesis

A number of theoretical issues emerged from the running and analyses of the five experiments that comprised the current thesis. These can be summarised under three core headings: contribution of the research to the field; the relationship with existing research; and alternative accounts of the findings. Each of these is discussed separately below.

Contribution of the Research to the Field. A growing body of empirical evidence provides strong positive support for acceptance-based strategies using existing methodologies for the experimental induction of physical stress or pain. But each of these procedures has limitations (Mitchell et al., 2004). For example, research evidence involving the Cold Pressor Task may require caution because of a lack of standardised equipment, and variations in the number of immersions, immersion time, maximum tolerance time and water temperature.

Apparatus for radiant heat induction that originated in the animal laboratory has been modified for use with human participants as a new type of pain induction procedure that may not be as susceptible to similar difficulties. Indeed, this procedure

has shown greater stability across measures compared to electric shock apparatus (Lee, & Stitzer, 1995; Rhudy, & Meagher, 2000). Radiant heat induction appears to offer a high level of experimental precision that might be harnessed as a sound analogue of chronic pain. Possible advantages for the use of this apparatus in this context include: (1) all aspects of the procedure may be controlled by computer software in the absence of an experimenter; (2) the rate of temperature is constant across participants; (3) there are clear indices of pain tolerance; (4) all participants have a sense of control over the apparatus; (5) the automated delivery of heat is slow and intense, not unlike chronic pain; and (6) the apparatus is simple to use. Because there is no existing published research on the utility of clinical interventions on radiant heat tolerance, the current research is the first of its kind. Secondary aims of the current research, therefore, were to determine how useful the radiant heat apparatus was as a method of experimental pain induction and how sensitive it would be to the influence of clinical intervention. Over 250 participants were involved across the five studies and none indicated any displeasure at using the apparatus. In all respects, the apparatus was easy to use and the data easily analysed. The consistency of our findings across all five studies lends further support to the reliability of the methodology. Even if we had not confirmed our experimental predictions, the current program of work attests to the utility of the radiant heat apparatus as a pain induction procedure. It is an added advantage, as the data here indicates, that the procedure also appears to be highly susceptible to the use and effects of clinical interventions.

Part of our aim in sourcing the radiant heat apparatus had been to find a methodology that could be presented to participants in the absence of the experimenter, because of growing concerns in the field about demand characteristics (Roche, Forsyth & Maher, 2007). This desire arose in part from previous success

reported by us and others in the use of fully automated clinical interventions as experimental analogues (Gutierrez et al., 2004, Johnson et al., 2004). The radiant heat apparatus easily accommodated both of these concerns and completely removed the possibility that the tolerance increases reported here for Acceptance were attributable in any way to experimenter influence.

Of course, the automated delivery particularly of these very *brief* interventions raised its own concerns about whether or not tolerance changes would even be recorded in such an abbreviated and 'cold' experimental context. Indeed, it is true that clinical interventions do not often come in this form, although take-home materials are a rapidly growing feature of treatment packages (Kazantzis, Deane & Ronan, 2006). However, this is an almost unavoidable criticism in the context of experimental research and is perhaps worth it to some extent to create an experimentally sound setting. In short, this sort of environment poses a considerable challenge to any clinical interventions, such that effects observed here are probably very robust indeed. Furthermore, the overlap between the tolerance increases here observed for Acceptance and those elsewhere in the literature recorded with other methodologies indicated that our effects had more to do with the interventions than the radiant heat apparatus.

Relationship with Existing Research. There is strong evidence from clinical research that acceptance of pain is linked to better functioning for chronic pain patients, relative to those who adopt alternative coping strategies (e.g. Jacob et al., 1993). These positive outcomes for pain acceptance, however, appear to do more than alter sufferers' perception of pain, but have other widespread quality of life benefits. For example, there is evidence that pain sufferers who engage in acceptance have less long-term disability (Dahl et al., 2004).

The distress ratings we recorded here were largely consistent with the view that acceptance does not necessarily work by making the pain feel any easier. Indeed, from an ACT perspective, one has almost no control over sensory aspects of pain, so one should try to focus on valued living in conjunction with whatever pain is perceived. It was clearly not the case that our Acceptance participants tolerated more pain from Baseline because aspects of their distress or pain were reduced. Perhaps it is interesting that their anxiety increased on only one occasion *because* they were tolerating more pain. This finding is somewhat inconsistent with previous evidence by Gutierrez et al. (2004) who demonstrated that the largest proportion of participants who reported the most pain were those in Acceptance whose tolerance increased the most (see also Masedo, & Esteve, 2007). In other words, these were the individuals for whom acceptance was the greatest. However, that is not to say that acceptance only worked for those who tolerated a great deal of pain. Indeed, the data from the current research indicated no differences in distress ratings and no differences among the tolerance levels of the three categories of heat tolerance. These data, however, are consistent with previous research by Levitt et al. (2004) and Hayes et al. (1999), who also did not find group differences on the distress measures that would account for the significant tolerance increases observed with acceptance.

The body of clinical analogue research relevant to chronic pain is growing considerably and the majority of findings support the more direct evidence from clinical research. Evidence from analogue research shows strong support for acceptance in pain induction procedures. For example, Hayes et al. (1999) compared Acceptance, Cognitive Control and Placebo on the Cold Pressor Task and found that Placebo participants spent the least time with their hands immersed, while Acceptance participants spent the longest time (although again the latter did not experience less

pain). The CO^2 challenge has yielded similar superiority of Acceptance over Suppression and Placebo with Panic Disordered patients (Levitt et al., 2004). On the Electric Shock Apparatus, Gutierrez et al. (2004) similarly reported a statistically significant increase in pain tolerance for Acceptance, but not Distraction. The Acceptance outcomes reported here with the radiant heat apparatus are consistent with this existing evidence. The Acceptance Interventions presented currently increased tolerance significantly across heat tests in all five studies and at no point did tolerance return to Baseline levels for these participants.

The outcomes for the Distraction Interventions were also largely consistent across the studies conducted here. In Experiments 1, 3 and 4, Distraction showed no significant change in tolerance across heat tests and this was also the case for Distraction 2 in Experiment 1A. The *best* tolerance outcome for Distraction was recorded in Experiment 1A, where Distraction 1 showed a near significant increase from Baseline to Post-Reminder. In contrast, the *worst* tolerance outcome for Distraction was recorded in Experiment 2, where participants in this group showed significantly *decreased* tolerance from Baseline to Post-Reminder. These findings are also consistent with existing evidence in which Distraction has either no effect or a small positive effect (Gutierrez et al., 2004). Indeed, this very finding was the impetus for our experimental manipulation of the defusion element that appeared to be operating in Defusion 1. The difference in tolerance outcomes for Distraction 1 and Distraction 2 and the consistency of the data from the rest of the research with Distraction 2 did support the view that a defusion element had been present in the Distraction protocol. To some extent, this was a surprise given the extent to which the protocols had been matched for experimental purposes. However, the findings serves as an important reminder for how easily participants in clinical interventions can be

encouraged to behave in ways that researchers do not intend and how it may be difficult for them to decipher what we are try to teach tem to do. Our adherence data, particularly with regard t acceptance is a case in point.

Alternative Account of the Findings. One simplistic account of acceptance and its impact on tolerance might suggest that acceptance is simply a function of *paying attention to the pain*. In other words, perhaps acceptance here simply encouraged participants to attend to the pain in a mindful fashion, rather than accept it. Indeed, mindfulness meditation (as outlined previously) involves "paying attention in a particular way [to thoughts, emotions and physical sensations]: on purpose, in the present moment, and non-judgementally" (Kabat-Zinn, 1994, p. 4, parentheses added) and mindfulness has been shown to have strong clinical benefits, including a decrease in prescribed drug use and an increase in activity levels and self-esteem for chronic pain sufferers. Although at a functional level, there is some debate about the overlap between acceptance and mindfulness, the latter does aim to increase acceptance, while acceptance in turn appears to require strong attention to what it is that one is trying to accept. For example, Geiser's (1992) stage model of acceptance of chronic pain includes stages like *recognising* the presence of chronic pain, *seeing* struggles with the pain and *knowing* the cost of continuing to struggle. Even in the brief protocols employed here, participants in Acceptance were reminded repeatedly to "notice" ain-related thoughts. Perhaps then acceptance and mindfulness are indecipherable and the benefits observed currently for 'acceptance' are in part a function of participants in this group attending to the pain in a more mindful manner than their counterparts in Distraction. Only further experimental analyses that systematically attempts to compare acceptance with mindfulness, as we had done here with distraction, will be able to separate these critical process issues.

Concluding Comments

The current program had two relatively simple aims. First, we wanted to assess the utility of radiant heat apparatus as a pain induction procedure that might lend itself to clinical intervention, while offering a high level of experimental rigour. Second, we predicted that an acceptance-based intervention would increase heat tolerance in this context. In both regards, we achieved what we set out to do. The consistency of practically all aspects of the data supports this. That is, radiant heat apparatus does lend itself well to clinical intervention, it does generate reliable outcomes, and in this context our Acceptance Intervention generated significant increases in heat tolerance, while Distraction and Placebo did not. Indeed, it is worth bearing in mind that our Acceptance Intervention was a brief automated set of video clips containing the Swamp Metaphor, a cards Exercise and a Walking Exercise, so this was a reasonably good test for any apparatus. The apparatus itself and concordance across a wealth of additional measures gave us further confidence that our outcomes were not the result of other spurious sources of control. Concordance of the data with existing clinical and analogue research also suggested that our effects had more to do with the interventions than the apparatus, even though this was the first study to employ radiant heat induction in this way. Taken together then, the data speak for themselves and suggest that acceptance works well in increasing pain tolerance. It could be assumed that to some extent this effect would generalise to clinical populations who suffer real and chronic pain as from a functional perspective it is most likely that that pain affects humans in similar ways (Dahl et al., 2005). If this is the case then perhaps the link between the experimental analysis of these processes and the clinical application of this knowledge is not as wide as previously thought. Future research could examine this basic-applied generalisation.

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