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Experimental Analyses of Rule-Following: Methodological and Clinical Implications

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Abstract

ABSTRACT

The current thesis investigated the methodological and clinical implications of rule-following behaviour. The research program comprised eight experimental studies, including the match-to-sample methodology and the use of radiant heat apparatus. Chapter 1 provides a review of the available literature on rule-following, including empirical evidence of its clinical implications. *C*hapter 2 incorporated four studies that examined rule-following vs. contingency adaptation in a simple automated match-to-sample task based on previous research (McAuliffe, 2004). In Experiment 1 (n=16), three Pliance conditions (with differing levels of Experimenter involvement) were compared to a Tracking condition. In simple terms, the two types of condition were distinguished in terms of the Experimenter's knowledge of the experimental rules with which participants had been provided. Although the results demonstrated a clear distinction between pliance and tracking, the experimental control of either was not as expected. Specifically, participants in Pliance showed evidence of tracking, with strong adaptation to changing experimental contingencies. In contrast, participants in Tracking showed evidence of pliance, with perseverative rule-following even when the rules became inconsistent with the task contingencies. In the former conditions, the activities of the Experimenter appeared to have little influence over responding.

Experiment 2 (n=24) incorporated minor modifications to experimental instructions based on participant feedback, as well as a greater sample size, to establish more reliable experimental control over pliance and tracking. The results showed evidence of pliance in both Tracking and Pliance conditions, thus raising further issues about experimental

control. To address these issues, Experiment 3 (*n*=16) replicated McAuliffe's original procedure without modification, paying particular attention to the original instructions and with the removal of the instructions after participants had read them. The results recorded here provided the clearest distinction between pliance and tracking (participants in Tracking demonstrated tracking and Pliance demonstrated pliance), but were more like outcomes McAuliffe had reported with depressed, rather than non-depressed, participants. Experiment 4 (*n*=16) replicated Experiment 3, but participants retained the instructions after they had read them. This variable appeared to have had some influence over the previous outcomes when the data indicated a reduction in the distinction between pliance and tracking, with participants in Tracking showing increasing pliance and participants in Pliance showing increasing tracking.

Chapter 3 incorporated two studies that compared pliance and tracking in the context of different rules (tolerance vs. subjectivity) for coping with experimentally-induced pain. Experiment 5 (*n*=40) attempted to replicate previous research by Hayes and Wolf (1984), but replaced the cold pressor task with the radiant heat apparatus. Inconsistent with previous evidence, four of the five conditions recorded decreases in heat tolerance, with the exception of the Pliance/Subjectivity condition. Experiment 6 (*n*=40) replicated Experiment 5, but with the Experimenter absent during the heat tests. The results indicated a notable distinction between pliance and tracking, in which pliance was associated with tolerance increases and tracking was associated with tolerance decreases.

Chapter 4 incorporated two studies that compared brief therapeutic acceptance-based interventions vs. rules to determine which would exert greater influence on heat tolerance. Experiment 7 (*n*=32) systematically compared acceptance-based vs. placebo-

based interventions and rules. Although the results were partly consistent with predictions when both Placebo conditions were associated with tolerance decreases, the outcomes for Acceptance were not as expected. Specifically, the Acceptance Intervention resulted in marginal tolerance decreases, while the Acceptance Rule produced only marginal tolerance increases. The final study, Experiment 8 (n=32), compared acceptance interventions and rules in pliance vs. tracking contexts to determine what impact this variable may have exerted on the previous findings. The results from Experiment 8 indicated that pliance was associated with greater tolerance increases than tracking and the intervention overall produced better tolerance than the rule. The current research raised a number of methodological and conceptual issues that contribute to the existing literature on rule-following behaviour and these are discussed in the final General Discussion Chapter 5.

Chapter 1

General Introduction

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General Introduction

Psychologists have long tried to distinguish the sane from the insane and diagnostic systems often support this distinction (APA, 2000). However, part of the difficulty in determining the extent to which this distinction is a valid one arises from weak consensus on working definitions of practically all of the core psychological disorders (Boyle, 2007). Indeed, this remains the case even in cultures that pay a great deal of attention to psychological phenomena.

Psychologists from across the discipline have offered the counter-argument that the sane and insane are not so different after all because the same basic psychological and behavioural processes operate with both. For example, a natural assumption for behavioural psychologists is that all humans learn through contingencies that shape up overt action and through the derivation of verbal relations that control language and cognition (Hayes, Barnes-Holmes, & Roche, 2001). As a result, perhaps normal and abnormal behaviour differ only by *degree*, rather than by process. This perspective proposes, therefore, that human beings are fundamentally the same and that the same basic processes that make us human can easily drive us insane. Rule-following is a good example that appears to support this view because this type of behaviour is an inherent feature of healthy physical and psychological development, but is also correlated with psychological problems, including depression and anxiety (Torneke, Luciano, & Valdivia, 2008). The current thesis attempts to examine why the same process of rule-following that facilitates healthy development may also drive us into despair.

Rule-following and Development

Rule-following is a highly adaptive feature of human nature and is established in its simplest forms very early in the developmental history. According to Piaget and Inhelder (1972), children learn rules provided to them by adults and there are probably hundreds of minor rules that children have to learn in order to avoid punishment. It makes sense, therefore, that children learn to follow rules before they really 'understand' them. For instance, a child may be instructed "not to talk to strangers" and will follow the rule, regardless of the features of a particular situation and without making full contact with the possible danger of not following the rule. As rule understanding develops, so do more subtle discriminations that *not all rules work all of the time*. Specifically, in certain situations rules may have to be adapted, changed, or even discarded. For example, the rule "Don't talk to strangers" would be problematic in situations where a child needs to make new friends, such as the first day at a new school.

According to Piaget, early rigidity with regard to rule-following is consistent with natural deficits in perspective-taking. That is, the subtleties of discriminating when rules should or should not be followed likely requires a sound appreciation of one's own perspective, as well as the taking of another's perspective. Imagine, for example, a young girl on her first day at a new school. She sees another child crying as her mother leaves. Understanding the distress experienced by the second child, the little girl breaks the "Don't talk to strangers" rule in order to comfort the other girl because the aversiveness of the other child's pain is more salient than the rule in that situation. A younger child with less perspective-taking, however, may be less likely to do this and would perhaps more readily begin to cry herself, rather than approaching a stranger. For Piaget and Inhelder (1972), on-

going developments in perspective-taking generate more egalitarian capabilities and enhanced social co-operation and these probably subsume increased flexibility in rule-following. Furthermore, these social developments are consistent with a gradual shift away from adult authority and towards personal autonomy, the latter of which would not be feasible without a highly sophisticated understanding of rules and how they should be responded to.

Developmental psychologists, not surprisingly, have highlighted the relationship between rule-following and moral development. According to Kohlberg (1984), moral development comprises a series of universal stages that incorporate an increasingly sophisticated understanding of rules. At the *Preconventional Level,* children follow rules primarily to avoid punishment and attain rewards. Thus, behaviour at this stage is primarily egocentric and lacking in perspective-taking. At the subsequent *Conventional Level*, rules are followed in order to feel good about oneself and to court approval from others for 'doing the right thing'. Clearly, some level of perspective-taking is required here, although the behaviour may not be described as moral because the interests of another are not placed above the interests of the self. At the *Postconventional Level,* rule-following may be a function of conscience in which universally applied ethical principles are adhered to, even when they supersede the wishes of the self. A high level of perspective-taking is required here if an individual is to over-write personal rules with the rules of an undefined other or society. Kohlberg insisted that the sequence of moral development was invariant and that an individual's moral behaviour could reflect only one level of morality at any one time. Specifically, he argued that the natural progression towards moral sophistication was

facilitated by parents and other authority figures who stimulate, rather than impart information via fixed rules.

Rigidity in Rule-Following

Human beings have a strong developmental history in which rule-following is reinforced in various ways by persons of perceived authority (e.g. parents, teachers, doctors, police, or religious figures). The perception of authority perhaps originates simply from the fact that parents, for example, are taller and louder and are the individuals who nurture and care for us. As development progresses in line with rule-following, perceptions of authority also become more sophisticated and individuals may be perceived as authorities because of very precise features (e.g. knowledge of a specialised area). However, the paradox is that although, for adults for example, the delivery of a rule by a perceived authority figure is likely to *encourage* rule-following, it is equally possible that the recipients' sophisticated understanding of rules would *discourage* rule-following because they are able to determine that following a rule on a particular occasion would not be appropriate. Indeed, this type of paradox constitutes many scenarios of moral dilemma that appear in the media (e.g. Big Brother).

Psychologists have devoted considerable research efforts to understanding the tension between respect for authority and rule flexibility. The wealth of empirical evidence suggests that the presence of an authority figure commonly *undermines the flexibility* of rule-following and thus increases the likelihood that rules will be followed without question. In the classic Milgram studies (1963, 1974), for example, adult male participants were recruited for an experiment at Yale, the purpose of which (or so they were informed)

was to study the effects of punishment on human learning. Each participant was allocated the role of a teacher, while another participant (an actor) was designated the learner. The teacher's role was to administer a progressively large shock to the participant every time she or he made an error (i.e. 15V for the first error, 30V for the next, 45V for the next and so on). In a typical scenario, the 'learner' first responded to the task correctly but then made several errors, in response to which the teacher was required to administer shocks of upwards of 75V. Once the level of errors warranted shocks greater than this, the learner's reaction to the shock showed signs of considerable distress (e.g. pounding on the walls). However, in response to complaints or pleas by the learner, the teacher was advised to continue with the shock and to instruct or urge the learner to continue with the task. At 300V, the learner had been advised to cease responding (i.e. 'play dead').

Because it seemed unlikely that normal psychologically-healthy adult participants would continue to deliver shocks that appeared to be so distressing, a panel of experts had been asked to predict how many would reach the final phases of the experiment. As expected, they predicted that only 10% of participants would exceed 180V and none would deliver shocks in the region of 300V. However, 65% of participants administered shocks in the region of 450V. Furthermore, numerous researchers have replicated Milgram's findings with a strong concordance of evidence overall (Mantell, 1971; Meeus, & Raaijmakers, 1986; Smith, & Bond, 1999). Indeed, similar findings also emerged from the equally infamous Zimbardo Stanford prison experiments (1974).

In attempting to account for the consistent outcomes, Zimbardo (1974) argued that human obedience was an "end product of a long process of prior programming. . . We are controlled not by physical strength but by the symbols, rules, and words manipulated by

our own kind" (p.566). Specifically, Zimbardo highlighted the paradox within the education system of obeying trivial, irrelevant rules while respecting authority. This perspective highlights the tense relationship between a long history of rule-following and respecting authority with the verbal sophistication that enables us to understand why some rules should be followed and others should not. In the examples of Milgram and Zimbardo, one might argue that the participants' histories of obedient rule-following as children and learners had more influence on their performances because the participants were operating in a context of high anxiety or stress. In this case, therefore, one might predict that the greater the anxiety, the greater the rule-following, even though concerns about the utility or feasibility of the rule would also increase. Indeed, this was the case with Milgram's and Zimbardo's participants. As a result, one might argue that the level of distress to which participants in these experiments were exposed played a critical role in encouraging blind and almost child-like rule-following that appeared to over-write concerns about rule legitimacy.

Rules Vs. Contingencies

Behavioural researchers have been attempting to understand the processes of rule-following since the early 60's. In light of the above, it is perhaps not surprising that one of the most notable findings from this work has been the tension between rules and contingencies, particularly where these are incompatible. Put simply, what do you do when you have been given the wrong rule? There is considerable empirical evidence that experimental participants continue to follow rules even when they are inconsistent with the contingencies, and thus are out of synch with the environment (Ader, & Tatum, 1961;

Harzem, Lowe, & Bagshaw, 1978). Indeed, these studies have suggested that once control over the behaviour is established by a rule, subsequent behaviour is likely to be in accordance with the rule and considerably resistant to change even when the environment changes dramatically (i.e. when you should do the opposite of the rule). This outcome is commonly referred to as the '*insensitivity effect'* and Shimoff, Catania and Matthews (1981) argued that it is a defining property of instructional or rule control (Matthews, Shimoff, Catania, & Sagvolden, 1977).

There appear to be several factors that influence the insensitivity effect, including the type of instructions provided. For example, Hayes, Brownstein, Hass and Greenway (1986) compared the relative insensitivities of participants exposed to different levels of specific instructions -- no instructions, partially inaccurate instructions, or accurate instructions. As expected, all of the participants who received accurate instructions remained 'sensitive' to the contingencies as long as the rule matched the task. However, when the task changed and the rule no longer dictated correct responding, almost half of the participants began to produce more errors, suggesting that they were attending more to the rule than the actual task (i.e. contingency insensitivity). In contrast, participants in the other two groups remained consistent with the task and inconsistent with the rule (i.e. contingency sensitivity). In these latter cases, it was likely that the participants had from the outset learned not to depend upon the rule as an accurate guide to their behaviour. In contrast, for those in the former case the rule had initially proven to be a useful source of behavioural control and thus reinforcement had been provided for rule-following.

The Role of Self-verbalised Rules

A number of researchers have highlighted the importance of individuals' interpretations of rules and the generation of additional self-rules that may contribute to the insensitivity effect and consistent rule-following. Indeed, Lowe (1979) argued that if humans could be prevented from "talking to themselves" about the contingencies, (i.e. using internal rules) their behaviour would more closely resemble that of non-humans.

In a series of studies, Lowe, Harzem and Hughes (1978) attempted to investigate the role of self-rules when comparing the performances of humans and non-humans and hypothesised that the primary difference between the two species lies in the fact that humans naturally generate and follow self-rules, whereas non-humans do not. As expected, the results indicated that humans responded more slowly and methodically on a task than non-humans, which the researchers interpreted as additional time needed between responses to generate self-rules to guide behaviour. For example, the participants may have generated a self-rule (e.g. "count to five and then respond") and were then counting out the length of the interval between responses. As a result, there was an almost systematic 5sec. interval between responding that contrasted sharply with consistently repetitive responding by non-humans. In order to determine the accuracy of this hypothesis, Lowe, Harzem and Bagshaw (1978) created task conditions in which participants were not able to generate or follow self-rules. As expected, the performances in this case became more chaotic and alike typically non-human outcomes.

Lowe, Beasty and Bentall (1983) tested the self-rule hypothesis again by exposing pre-verbal infants to similar tasks on the assumption that their inability to generate self-rules would render their output similar to that of non-humans. Indeed, the data suggested

that this was the case. In contrast, Bentall, Lowe and Beasty (1985) demonstrated that verbally-able five to nine year-old children were capable of producing response patterns that were more akin to adults than either babies or non-humans, thus providing further support for the self-rule hypothesis.

The Influence of Social Contingencies

Another salient feature of rule-following is the influence of the social context. This was readily highlighted by the Milgram and Zimbardo research. Indeed, researchers have argued that for verbally sophisticated human beings there is almost continuous reinforcement for rule-following within the social environment (Hayes, Brownstein, Zettle, Rosenfarb, & Korn, 1986). According to this perspective, the rigid and shocking performances observed by Milgram and Zimbardo under laboratory conditions were not unlike those that might occur in the natural social environment because of the researchers' clever manipulation of the social context. In the study by Hayes et al., one group of participants received instructions across all three experimental sessions, whereas a second group were instructed for the first session only. The results of the study indicated that all but one of the fully instructed participants continued to follow the rules throughout the experiment, even when the rule became inconsistent with the task (i.e. contingency insensitivity). In contrast, those in the second group showed greater task sensitivity, when the task altered and the initial rule became inconsistent. Once again, this was evidence that the extent of rules provided directly influences task output and rule-following, even when the task changes and the rules no longer apply. Put simply, the more rules you are provided

with, the more willing you are to follow them, even when you have determined that they are wrong.

A related study further highlighted the role of social contingencies in the effectiveness of rules in reducing response stereotypy (Barrett, Deitz, Gaydos, & Quinn, 1987). This study comprised of three phases in which participants were required to respond on a maze task in a fixed pattern in Phase 1, with variable patterns in Phase 2 and then return to a fixed pattern in Phase 3. For one group of participants the Experimenter was present throughout the study, but was absent for the other group. Once response stereotypy was established in Phase 1 by the earning of points for continuously responding the same way, participants were instructed that points could only be earned if every eleventh response differed from the previous ten. This second phase continued until strong response variability had been established. In the final phase, participants were again required to return to response stereotypy (as in Phase 1), but they were not explicitly informed that this was the case. Hence, the researchers attempted to determine the rate at which the two groups of participants would switch responding between Phases 2 and 3 in the absence of adequate instruction. The results indicated that of those participants for whom the Experimenter remained present, almost half of their responses remained variable and thus they did not easily switch responding. In contrast, only a quarter of the responses emitted by the other group were novel (not variable) and thus these individuals more readily adapted their responding when the task changed. Hence, the presence of the Experimenter significantly increased the continued following of an inaccurate rule even on tasks in which participants had only recently demonstrated high levels of appropriate responding.

The Effect of Response Variability

Various researchers have argued that some types of behaviour are more or less sensitive to rule rigidity. For example, Hayes, Brownstein, Zettle and Rosenfarb (1986) exposed participants to either to a single instruction (e.g. "go fast" or "go slow") or mixed instructions (e.g. "go fast" and "go slow") and reported that the latter produced more accurate responding than the former. The researchers argued that more variable response patterns were less sensitive to rigidity than more stable patterns, probably because the rules for completing the former are always changing. This hypothesis had previously gained considerable support (e.g. Ellis, 1962) from suggestions that performances on novel tasks are facilitated more effectively with explicit training in a variety of response alternatives (see also Le Francoise, Chase, & Joyce, 1988).

A Distinction between Tracking and Pliance

The sections above highlighted the conditions that increase the relative sensitivity of behaviour to contingencies or rules, including variable patterns of responding over fixed patterns, the impact of a rule-provider, the level of authority associated with the rule-provider and the level of stress associated with the task. Taken together, these variables provide a more complete picture of when and why individuals follow rules that suggests a primary distinction between behaviour that is governed directly by the environment (i.e. more sensitive to contingencies and less sensitive to rules) vs. behaviour that is governed by rules provided by the self or another (and thus is less sensitive to contingencies and more sensitive to rules). According to Zettle and Hayes (1982), this distinction generates

two functionally different types of rule-following that have been referred to as pliance and tracking (see also Hayes, & Wilson, 1993).

Pliance is "rule-governed behavior under the control of apparent socially mediated consequences for a correspondence between the rule and relevant behavior" (Hayes, Zettle, & Rosenfarb, 1989, p.203). Consider the following example of a teacher who tells a student to "get the homework done". The student then completes the homework because of a history of consequences for rule-following, mediated by the verbal community that has included prior punishment for failing to follow the teacher's instructions. In this case, the student's completion of the work constitutes an example of pliance. Although this type of rule-following is not directly tied to environmental contingencies, pliance nevertheless demands that the instructed behaviour be conducted, as well as a recognition by the social community of a correspondence between the rule and the subsequent behaviour.

According to Hayes et al. (1989), *tracking* is "rule-governed behavior under the control of the apparent correspondence between the rule and the way the world (environment) is arranged" (p.206). Using the previous example, consider that the student now completes the homework in order to be more knowledgeable about the subject area, so the rule-following in this case is tracking. In effect, the listener makes contact with the relation specified in the rule and this in turn changes some aspect of the listener's behaviour. Although tracking implies a more direct relationship between the behaviour and the environment that might suggest that the behaviour in question is not rule-following at all, it remains the case that it is aspects of the rule that control behaviour directly, rather than the environment per se. In other words, the student in the example can engage in the track that dictates the homework without knowing for sure that more will be learned. Thus,

even if the consequences of the behaviour on one occasion were altered such that the student became frustrated and no additional learning occurred, then the student would continue to engage in the behaviour in spite of the aversive consequences. In this case, the student continues to follow the track and the behaviour remains the same, rather than following the contingencies directly and changing behaviour.

Empirical evidence for a distinction between pliance and tracking has come from a number of sources. For example, Zettle and Hayes (1983) compared the effectiveness of self-statements about coping styles in a public versus private context by randomly assigning speech-anxious students to one of three groups: a public coping self-statement group, a private coping self-statement group, or a control group. The public and private groups each received the same self-statement ("I can remain calm and relaxed by taking deep breaths and talking more slowly"), which they were required to repeat quietly before and during speeches. The private group, however, was led to believe that no-one (including the Experimenter) knew which self-statement each participant had received. In contrast, the public group repeated the self-statement aloud to the Experimenter.

The results of the study indicated that participants in the public group produced stronger speech performances, with reduced anxiety levels. In contrast, the performances of the control group and private group were similar and reflected weaker speech performances and high levels of anxiety. The researchers argued that the improved performances of the public group were evidence of pliance, based on the Experimenter's knowledge of the rule. In contrast, the private group and the control group showed no such improvements, because of the absence of the all-important pliance effect (they believed that the Experimenter was not aware of the rule).

Although the research by Zettle and Hayes (1983) provided preliminary evidence of different types of rule-following, it is difficult to know in a given instance whether or not an example of rule-following is a ply or a track, or perhaps even both. For instance, the student in the example above may have complied with the teacher's demand because of past consequences for failing to do the homework, *as well as* knowledge enhancement. Furthermore, it is difficult to determine the overlap between the technical concepts of pliance and tracking and the more common ideas incorporated within public versus private contexts. Indeed, these issues are difficult to resolve in the present context of limited empirical research.

Augmental Control

In addition to the distinction between pliance and tracking, Hayes et al. (1989) defined a third type of rule-following as *augmenting* in terms of "behavior due to antecedent verbal stimuli that alters the degree to which events function as consequences" (Hayes, & Hayes, 1994, p.49). According to these researchers, *motivative augmentals* describe "behavior due to antecedent verbal stimuli that temporarily alter the degree to which previously established consequences function as reinforcers or punishers" (p. 49). Consider the following television advert for McDonalds that describes a Big Mac in terms of 'two beef burgers, special sauce, lettuce, cheese and onions, on a sesame seed bun.' If a consumer has previously enjoyed a Big Mac at a local McDonald's, the advertisement may function as a motivative augmental by supplying some of the sensory experiences of eating a Big Mac and thus the co-ordination between the behaviour specified within the rule (go

and eat a Big Mac) is enhanced and the probability of engaging in the behaviour is increased.

Formative augmentals, on the other hand, involve "behavior due to antecedent verbal stimuli that establish given consequences as reinforcers or punishers" (p.50). For example, imagine that you bought lots of goods in glass bottles because you were led to believe that glass recycling is better for the environment that recycling plastic, but you were then told that making glass is more damaging to the environment than making plastic. In this case, the reinforcing verbal consequence of buying glass would become aversive relative to the new reinforcing consequences of buying plastic. Hence, the rule here has switched the functions of buying glass and plastic and co-ordinated changes in your behaviour are likely.

Augmentals appear to control rule-following because the rule is not being followed via pliance (e.g. you don't get punished for failing to do what it says in a television advert), nor because you have directly contacted the stated contingencies (global warming may be as yet unseen). Nonetheless, the functions of the implied consequences have changed by virtue of the new rule and behaviour is changed accordingly. The empirical evidence examining augmentals is even more limited than research on pliance and tracking and indeed it is more difficult to determine the relationships and distinctions among the three main types of rule-following behaviour.

Rules and Measures of Psychological States

A number of researchers have suggested that rule-following behaviour is also subject to the influence of individual differences. Harzem (1984), for example, reported a positive

correlation between general academic competence and adaptation to changing task contingencies. Although participants were presented with a relatively simple key pressing task, the experimental contingencies changed continuously. Thus, the core experimental aim was to determine the levels of contingency adaptation that would be demonstrated by high vs. low academically competent individuals. Perhaps unsurprisingly, the most academically competent individuals showed greater contingency adaptations than the less competent, thus suggesting a correlation between contingency sensitivity and academic competence.

In a related study, Wulfert, Greenway, Farkas, Hayes and Dougher (1994) examined the correlation between self-reported 'rigidity' and rule-governed insensitivity to contingencies. Specifically, participants were selected on the basis of their respective scores on the Personality Rigidity Scale (Rehfisch, 1958) and were then grouped according to the types of task-based instructions they received. The basic experimental question sought to determine whether participants high in rigidity would demonstrate greater rule-control (and less sensitivity to contingencies) than those low in rigidity.

In Experiment 1, both high- and low-rigidity participants were exposed to adequate or minimal instructions regarding the task. During the first two sessions, reinforcement was provided in accordance with the schedules specified by the instructions and all participants performed well. However in Session 3, all responses were subject to extinction and the high-rigidity participants who had received adequate instructions persevered most with the rule (i.e. responding changed slowly), whereas the participants in the other groups altered their responding more quickly. In Experiment 2, all participants were provided with adequate instructions, but only half were informed about the change in the task. In this

case, the high-rigidity participants not informed of the change again continued to follow the instructions even when they became inaccurate. In contrast, low and high-rigidity participants who had received instructions about the task change adapted responding readily. Taken together, these findings suggest a relationship between personality rigidity and rule-following that may be identified by aspects of the rules provided.

Other researchers have gone further in arguing that sensitivity to rule-following may also increase one's propensity to psychological ill-health. Specifically, Hayes, Kohlenberg and Melancon (1989) suggested that depression, for example, may involve *excessive* rule-following and insensitivities to contingencies. As a result, their perception of situations in which rule-following is ineffective or counter-productive is also impaired. In contrast, other researchers have suggested that sufferers of depression display *deficits* in rule-following that include both inaccurate and ineffective rule-based behaviour (Rosenfarb, Burker, Morris, & Cush, 1993). Based on this assumption, Rehm and Rokke (1988) developed a self-management program that targeted self-monitoring, self-evaluation and self-reinforcement skills regarding rule-following (see also Beck, Rush, Shaw, & Emery, 1979).

In an attempt to determine whether depression may be better characterised as a propensity towards excessive or deficient rule-following, a series of studies by McAuliffe (2004) examined the correlation between depressive symtomatology in adolescents and rule-governed insensitivity to contingencies. One hundred and sixty-eight male adolescents who participated across five studies were administered The Inventory for Depressive Symptomatology (IDS: Rush, Giles, Schlesser, Fulton, Weissenburger, & Burns, 1986). Thereafter, they were divided into "depressed" and "non-depressed" on the basis of their

scores. On a simple automated task, some participants read the experimental instruction/rule "publicly" to the Experimenter (i.e. the Pliance Condition), while others read it "privately" to themselves (the Tracking Condition). The experimental design was a 2x2 in which depression vs. non-depression and pliance vs. tracking was manipulated.

The experimental task comprised four almost identical phases of match-to-sample (MTS) that required participants to match three-character stimuli in a three-comparison one-to-many array. Only the experimental contingencies distinguished the first two phases from the latter two. That is, in Phases 1 and 2 the instructional rule was consistent with the experimental contingencies, hence reinforcement was provided for rule-following. Without warning, however, the contingencies suddenly changed at the beginning of Phase 3 such that the initial rule no longer matched the experimental contingencies operating in Phases 3 and 4 (i.e. rule-following was now punished). In simple terms, the contingency change required participants to start the task by matching the sample and comparison that were most alike, while the latter phases then required the matching of the sample and comparisons that were least alike.

Perhaps the key finding from McAuliffe's research was a series of differences between the non-depressed vs. depressed participants in which the latter showed greater pliance or rule-following even when the rules no longer matched the contingencies. Interestingly, however, when assigned to tracking conditions, there were almost no differences between the two samples and both showed high levels of contingency sensitivity. Taken together, this research successfully manipulated pliance vs. tracking in an experimental context and demonstrated that at least with regard to pliance conditions, depressed participants showed greater pliance sensitivities than the non-depressed. Indeed,

the researchers argued that such excessive rule-governed behaviour by depressed individuals likely results from excessive concerns for the opinions of others (see also Moorey, 2002). Put simply, depressed individuals may follow rules rigidly to avoid potential criticisms for rule-breaking and uncertainties regarding the appropriateness of their actions (Joiner, & Schmidt, 1998).

In a subsequent but related study, Baruch, Kanter, Busch, Richardson and Barnes-Holmes (2007) replicated McAuliffe's (2004) procedure using female depressed vs. non-depressed undergraduates in order to determine the extent to which the previous outcomes may have been specific to male adolescents and thus could not be generalised to depressed populations. Consistent with McAuliffe's research, Baruch et al. also reported differences between the non-depressed vs. depressed participants, but these did not indicate that the latter showed greater pliance sensitivities. Specifically, the depressed participants demonstrated greater tracking (contingency adaptations) in both tracking and pliance conditions, while in contrast the non-depressed demonstrated pliance in both conditions. Put simply, these findings were almost the opposite of McAuliffe's and demonstrated greater pliance sensitivities by the non-depressed participants, relative to the depressed.

In an attempt to account for the considerable differences between the two studies, Baruch et al. (2007) suggested that the level of depression in the clinical samples may have been influential. Specifically, they suggested that closer inspection of participant depression scores in both studies indicated greater levels of depression in McAuliffe's participants than in the later study. Hence, they argued that perhaps higher levels of depression only correlate with greater pliance. In support of this suggestion, Baruch et al. also suggested that McAuliffe's knowledge of his participants may also have facilitated

greater pliance to the Experimenter's rule than the unfamiliar undergraduates. With no further research in this area, it is difficult to ascertain the possible accuracy of these hypotheses or which data set more accurately reflects the performances of non-depressed and depressed individuals. The experimental studies in the first empirical chapter of the current thesis attempted to address these issues.

The Current Thesis

The current thesis investigated the methodological and clinical implications of rule-following behaviour. The research program comprised eight experimental studies, including the match-to-sample methodology and the use of radiant heat apparatus. *C*hapter 2 incorporated four studies that examined rule-following vs. contingency adaptation in a simple automated match-to-sample task based on previous research (McAuliffe, 2004). In Experiment 1 (n=16), three Pliance conditions (with differing levels of Experimenter involvement) were compared to a Tracking condition. In simple terms, the two types of condition were distinguished in terms of the Experimenter's knowledge of the experimental rules with which participants had been provided. Although the results demonstrated a clear distinction between pliance and tracking, the experimental control of either was not as expected. Specifically, participants in Pliance showed evidence of tracking, with strong adaptation to changing experimental contingencies. In contrast, participants in Tracking showed evidence of pliance, with perseverative rule-following even when the rules became inconsistent with the task contingencies. In the former conditions, the activities of the Experimenter appeared to have little influence over responding.

Experiment 2 (*n*=24) incorporated minor modifications to experimental instructions based on participant feedback, as well as a greater sample size, to establish more reliable experimental control over pliance and tracking. The results showed evidence of pliance in both Tracking and Pliance conditions, thus raising further issues about experimental control. To address these issues, Experiment 3 (*n*=16) replicated McAuliffe's original procedure without modification, paying particular attention to the original instructions and with the removal of the instructions after participants had read them. The results recorded here provided the clearest distinction between pliance and tracking (participants in Tracking demonstrated tracking and Pliance demonstrated pliance), but were more like outcomes McAuliffe had reported with depressed, rather than non-depressed, participants. Experiment 4 (*n*=16) replicated Experiment 3, but participants retained the instructions after they had read them. This variable appeared to have had some influence over the previous outcomes when the data indicated a reduction in the distinction between pliance and tracking, with participants in Tracking showing increasing pliance and participants in Pliance showing increasing tracking.

Chapter 3 incorporated two studies that compared pliance and tracking in the context of different rules (tolerance vs. subjectivity) for coping with experimentally-induced pain. Experiment 5 (*n*=40) attempted to replicate previous research by Hayes and Wolf (1984), but replaced the cold pressor task with the radiant heat apparatus. Inconsistent with previous evidence, four of the five conditions recorded decreases in heat tolerance, with the exception of the Pliance/Subjectivity condition. Experiment 6 (*n*=40) replicated Experiment 5, but with the Experimenter absent during the heat tests. The results indicated

a notable distinction between pliance and tracking, in which pliance was associated with tolerance increases and tracking was associated with tolerance decreases.

Chapter 4 incorporated two studies that compared brief therapeutic acceptance-based interventions vs. rules to determine which would exert greater influence on heat tolerance. Experiment 7 (n=32) systematically compared acceptance-based vs. placebo-based interventions and rules. Although the results were partly consistent with predictions when both Placebo conditions were associated with tolerance decreases, the outcomes for Acceptance were not as expected. Specifically, the Acceptance Intervention resulted in marginal tolerance decreases, while the Acceptance Rule produced only marginal tolerance increases. The final study, Experiment 8 (n=32), compared acceptance interventions and rules in pliance vs. tracking contexts to determine what impact this variable may have exerted on the previous findings. The results from Experiment 8 indicated that pliance was associated with greater tolerance increases than tracking and the intervention overall produced better tolerance than the rule. The current research raised a number of methodological and conceptual issues that contribute to the existing literature on rule-following behaviour and these are discussed in the final General Discussion Chapter 5.

Chapter 2

Examining Rule-Following Behaviour Using Variations to Match-to-Sample

Experiments 1-4

Chapter 2

Examining Rule-Following Behaviour

Using Variations to Match-to-Sample

Experiments 1-4

In spite of some empirical evidence for a functional distinction between pliance-based and tracking-based rule-governed behaviour, both McAuliffe (2004) and Baruch et al. (2007) failed to find a significant difference between pliance and tracking behaviour in non-depressed participants. Hence, there remains a lack of empirical clarity on different types of rule-following in *non-clinical* participants that should be addressed prior to raising similar questions about the relationship between depression, for example, and rules. The current chapter of research attempted to investigate this issue directly with a series of four studies that comprised a replication of, and modifications to, the procedure by McAuliffe using non-depressed undergraduate participants.

Experiment 1 primarily attempted to distinguish pliance and tracking. Consistent with Barrett et al. (1987), we attempted to explore pliance conditions further by manipulating the presence of the Experimenter and the extent to which this individual explicitly reinforced rule-following. For the most part, the procedure employed in Experiment 1 replicated McAuliffe's (2004), with modifications to enhance the clarity of the generic experimental instructions (including participants retaining the instructions) and the additional manipulations of Experimenter-influence. As a result, we hoped to have more success than both McAuliffe and Baruch et al. (2007) in recording distinctions between pliance and tracking that were in accordance with experimental manipulations (i.e.

we expected to observe tracking in the Tracking condition and pliance in the Pliance conditions) with non-depressed participants. Furthermore, we anticipated that there would be perhaps greater pliance observed in conditions in which the Experimenter was more active. Although the results from Experiment 1 showed clear distinctions between pliance and tracking, responding within conditions was not as expected. In short, participants in Pliance showed evidence of tracking and participants in Tracking demonstrated pliance. Furthermore, the activities of the Experimenter appeared to have little influence across Pliance conditions.

Working on the assumption that the small sample sizes may have been a contributing factor, as well as feedback from participants indicating that the experimental instructions, particularly in Pliance conditions, may have been confusing, Experiment 2 attempted to replicate Experiment 1 with these issues addressed. Once again, however, the results were not as expected. Although the Pliance conditions now showed evidence of pliance, this was influenced to some extent by the presence of the Experimenter, who surprisingly facilitated less, rather than more, pliance. Furthermore, consistent with Experiment 1, the Tracking condition also generated pliance.

Because of the variability of data from the two previous studies, as well as the discrepancies between the original findings from both McAuliffe (2004) and Baruch et al. (2007), Experiment 3 replicated McAuliffe's procedure exactly, and in particular without any alteration to the original instructions and the removal of the instructions after reading. Although in this study, we found perhaps the clearest distinction between pliance and tracking (participants in Tracking demonstrated tracking and participants in Pliance

demonstrated pliance), the outcomes were surprisingly identical to McAuliffe's depressed, rather than non-depressed, participants.

One of the key (although perhaps minor) differences between Experiments 1 and 2 compared with Experiment 3 concerned participants' retention of the instructions in the former, but not in the latter. In order to determine the extent to which this variable may have contributed to the divergent outcomes, Experiment 4 replicated Experiment 3, but without the removal of the instructions after participants had read them. However, the data indicated a reduction in the distinction between pliance and tracking, with participants in Tracking showing increasing pliance and participants in Pliance showing increasing tracking.

EXPERIMENT 1

METHOD

Participants

Sixteen participants (eight males and eight females), aged between 22 and 28 years old (mean=23.5 years) were involved in Experiment 1. All were graduate students at the National University of Ireland, Maynooth (NUIM). Each was assigned to one of four experimental conditions, with two males and two females per condition (see Table 1). None of the participants received any remuneration for their involvement.

Table 1
An Overview of the Four Conditions in Experiment 1.

Experimental Conditions			
Tracking	*Pliance*		
	Experimenter Absent	Experimenter Present	Experimenter Reinforcing

Setting

All stages were conducted in a small experimental room in the Department of Psychology at NUIM. During the instructional stage, the Experimenter accompanied all participants. However, during the Tracking and Pliance/Experimenter Absent conditions, participants completed all trials alone and the Experimenter was seated outside. In contrast, during the Pliance/Experimenter Present and Pliance/Experimenter Reinforcing conditions, the Experimenter remained in the room throughout the study, seated beside each participant at the experimental table.

Apparatus

A personal computer, keyboard and standard mouse were situated on the experimental table. All experimental trials were delivered via a Visual Basic (Version 6) program that controlled all aspects of stimulus presentation and the recording of participants' responding. Experiment 1 comprised a total of 80 stimulus sets presented as part of the automated program (40 in Stage 3 and 40 in Stage 4, see Appendix I and II, respectively). Each set contained four members -- one sample and three comparisons. All of the stimuli were combinations of three types of character -- letters, alphabetical

characters, and shapes (e.g. –0, iii, }-}, $8!, Mb7). Sets may have contained identical characters.

Materials

Pre-Experimental Measures. Experiment 1 involved the presentation of a number of self-report measures, employed as screening tools. These included a standard informed consent (see Appendix III) and five psychological self-assessments. The latter comprised: the Depression Anxiety Stress Scale-Short Version (DASS: Lovibond, & Lovibond, 1995); the Beck Depression Inventory (BDI-II: Beck, Steer, & Brown, 1996); the State-Trait Anxiety Inventory for Adults Form Y1 (STAI: Spielberger, 1977); The Scale for Personality Rigidity (SPR: Rehfisch, 1958) and the Balanced Inventory of Desirable Responding (BIDR: Paulhus, 1988).

The *DASS* is a 21-item self-report measure designed to assess 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 applies 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, participants were excluded from analyses (but

completed the experiment) if they scored above the Mild range on one or more sub-scale (Depression >12, Anxiety >9 and Stress >17). A copy of the DASS is provided in Appendix IV.

The BDI-II is a 21-item self-report measure of depression. Each item incorporates four statements, from which participants select the one that best describes how they have been feeling in the past two weeks. Statements are scored from 0 (e.g. "I do not feel sad") to 3 (e.g. "I am so sad or unhappy that I cannot stand it"). Steer, Kumar, Ranieri and Beck (1998) reported good internal consistency with an alpha of .92 and Beck et al. (1996) found a test-retest correlation of .93. Reported norms for the BDI are: Non-depressed: 7.65; Mildly depressed: 19.14; Moderately depressed: 27.44; and Severely depressed: 32.96. A range of 0-13 is commonly adapted for minimal or no depression, hence participants in the current study were removed from analyses (but completed the experiment) if they scored >13. A copy of the BDI is provided in Appendix V.

The STAI-Form Y1 is a 20-item questionnaire that measures state anxiety. Items are categorised as anxiety-present/absent (10 of each) and scored between 1 and 4. On an anxiety-present item, 4 indicates high anxiety, while on an anxiety-absent item 4 indicates low anxiety. Anxiety-absent items are reverse scored and thus the minimum score is 20 and the maximum is 80. Spielberger (1977) reported an alpha reliability score of .93 and a mean of 36.47 for male college students (SD 10.02) and 38.76 for females (SD 11.95). For the current study, an overall mean of 37.62 (SD 10.99) was calculated and participants who scored two standard deviations above the mean were excluded from the analyses (but completed the experiment). A copy of the STAI is provided in Appendix VI.

The SPR is a 35-item questionnaire that measures rigidity in personality. Each item contains a statement (e.g. “I don’t like things to be uncertain and unpredictable”), which participants rate as “true” or “false”. A score of 1 indicates the presence of rigidity on an item, thus generating a maximum overall score of 35 (high rigidity) and a minimum of 0 (low rigidity). Rehfisch (1958) reported an alpha reliability score of .72. There are no generic norms reported for this measure, hence a mean was calculated for current purposes (9.94, SD 4.75) and participants who scored more than two standard deviations above the mean were excluded from analyses (but completed the experiment). A copy of the SPR is provided in Appendix VII.

The *BIDR* is a 40-item measure, with two sub-scales (20 questions each) measuring self-deceptive enhancement (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 scores below this are 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 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 the analyses (but completed the study). A copy of the BIDR is provided in Appendix VIII.

Printed Instructions. Participants also received two sets of printed instructions. Generic instructions were placed on the table at the outset of participation. In addition, a second set of instructions specific to each condition was contained within a small cloth bag located at the corner of the table. The bag employed in each condition contained 10 identical printed instructions, but the actual instructions varied across conditions.

Experimental Overview

Experiment 1 comprised four stages (see Figure 1). In Stage 1, participants completed the consent and self-report forms as indicators of pre-experimental levels on each measure. In Stage 2, all participants received written instructions about the experimental task, which differed in part in accordance with each condition. Stages 3 and 4 each comprised two phases (Stage 3 contained Phases 1 and 2, while Stage 4 contained Phases 3 and 4) and presented the core experimental task. These two stages were

differentiated primarily in terms of the reinforcement contingencies for specific patterns of responding. That is, in Stage 3 the reinforcement contingencies were *consistent* with experimental instructions or rules, whereas in Stage 4 the contingencies switched automatically and reinforcement was now inconsistent with instructions. The primary experimental aim was to determine how readily participants would adapt to the new contingencies or whether they would continue to follow the original instructions even after they had become inaccurate.

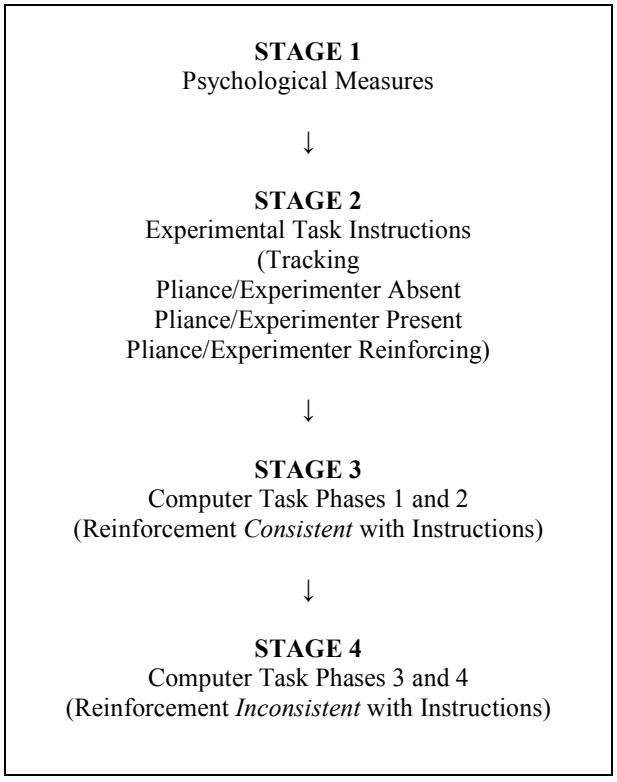

Figure 1. An overview of the experimental sequence employed in Experiment 1.

Corrective Feedback

In Stage 3, corrective feedback was consistent with both experimental contingencies (i.e. points gain or loss) and instructions. Specifically, reinforcement (gaining a single point per correct response) was provided for selecting the comparison stimulus that was *most like* the sample and was accompanied by explicit feedback that appeared automatically in the centre of the screen (i.e. "Correct: You Win 1 Point" – see Figure 2). The tally of points earned thus far always remained in the top right-hand side of the screen. Incorrect responses were consequated with the deduction of a point and were accompanied by the phrase "Wrong: You Lose 1 Point" (see Figure 2). Although the format of the feedback in Stage 4 was identical to this, the reinforcement contingencies were reversed, such that points were now gained for selecting the comparison that was *least like* the sample and points were lost for selecting the comparison that was *most like* the sample. In both stages, trials involving incorrect responses were not repeated and the next trial appeared automatically.

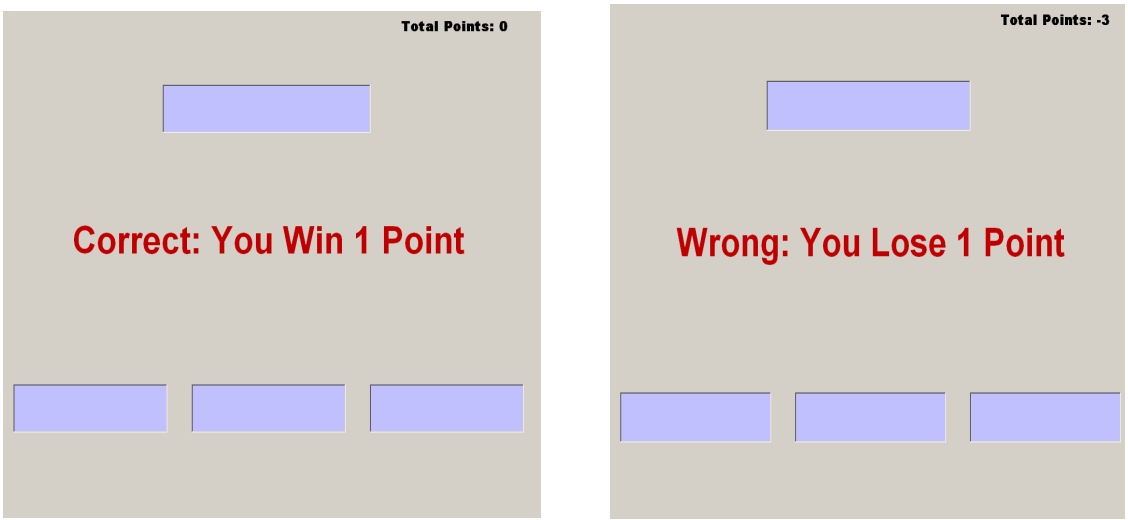

Figure 2. The corrective feedback provided to participants in the computer task in Stages 3 and 4 of Experiment 1.

Only participants in the Pliance/Experimenter Reinforcing condition received additional verbal feedback. This was delivered via a variable ratio (VR4) schedule that provided praise for responding in accordance with experimental instructions. For example, the Experimenter may have said: "Well done, you got that one correct". Feedback did not consequate any responses that were inconsistent with experimental instructions (even when correct). Verbal feedback was not given to participants in any other condition.

Procedure

Stage 1: Psychological Measures. Prior to exposure to the experimental phases, all participants were presented with the self-report questionnaires, in the following order: DASS, BDI, STAI, SPR and finally the BIDR.

Stage 2: Experimental Task Instructions. Prior to exposure to the experimental trials, all participants were presented with a set of printed generic instructions about the experimental task as follows:

> The current experiment contains a series of simple tasks. During each task, the computer screen will display four groups of symbols or characters (e.g. "XYX", "X!!!" or "(/;)"). On each task, one of the groups of symbols will appear in the top centre portion of the screen and three groups of symbols will appear to the left, middle and right along the bottom of the screen.
>
> Your task is simply to decide which one of the three groups of symbols from the bottom goes with the group of symbols on the top. After you have made your selection, the symbols will disappear and a +1 or -1 score will appear on the screen. +1 means that you have made the right selection on that task and that you have gained a point. –1 means that you have made the wrong selection on that task and that you have lost a point. As you continue to gain or lose points for each task, an individual score for each task, as well as a total overall score for your performance in that part of the experiment, will be displayed on the screen.
>
> It is very important that you understand what you are being asked to do and if you have any questions at this point please ask the Experimenter.
>
> Further instructions for completing the task correctly are written on pieces of paper contained within the bag beside you. Please now place your hand inside the bag and draw out *one* piece of paper from inside.

Participants then selected one set of short printed instructions from the bag that was specific to each condition (participants were unaware that all pieces of paper within the bag were identical in each condition). In short, the selection of this additional instruction was designed to explicitly differentiate the tracking and pliance conditions. Specifically, participants in the Tracking condition were instructed as follows:

> Please read **SILENTLY** the instruction below for completing the task and please ensure that the Experimenter is NOT aware of the instruction.
>
> Your task is simply to select from the bottom three groups of symbols, the *one* which you consider to be *most like* the group of symbols at the top of the screen. In order to make your selection, you simply use the mouse to click on the group of symbols at the bottom that you have chosen on-screen.
>
> You will not be able to ask the Experimenter any questions once the experiment begins so if you wish to ask any questions please do so now.
>
> Now please fold this page up and place it under the computer keyboard until the experiment is over.

In the three Pliance conditions (Experimenter Absent, Experimenter Present and Experimenter Reinforcing), the instructions were largely similar to Tracking, except that they included a verbally implied social contingency in the experimental task. These instructions were as follows (bolded text represents the features that had not been included in the Tracking instructions):

> Please read **ALOUD** the instruction below for completing the task and please ensure that the experimenter is aware of the instruction.
>
> **I want you** to select from the bottom three groups of symbols, the *one* which you consider to be *most like* the group of symbols at the top of the screen. In order to make your selection, you simply use the mouse to click on the group of symbols at the bottom that you have chosen on screen.
>
> **I (the Experimenter) will be checking your performance at the end of each of the four phases.**
>
> You will not be able to ask the Experimenter any questions once the experiment begins so if you wish to ask any questions please do so now.

> Now please fold this page up and place it under the computer keyboard until the experiment is over.

Participants in the Pliance/Experimenter Present and Pliance/Experimenter Reinforcing conditions were also presented with the following instructions regarding the presence of the Experimenter:

> **Please note that the Experimenter will be present in the room for the duration of the experiment. If you feel uncomfortable with this and therefore do not wish to participate please indicate immediately.**
>
> **If you still wish to participate, please fold this page up and place it under the computer keyboard until the experiment is over.**

Stage 3: Computer Task (Phases 1 and 2). Stage 3 comprised Phases 1 and 2. In Phase 1, participants were presented with 40 simple MTS tasks that were identical in format (see Figure 3). Phase 2 was identical, except that the sequence of trials was randomised. *In both phases and for all participants,* the reinforcement contingencies were consistent with experimental instructions and involved selecting the comparison stimulus that was *most like* the sample (see Figure 3, left-hand side). Immediately after the 40th trial in Phase 1, participants received a 3min. break before commencing Phase 2. Participants were not explicitly informed that they were beginning a new experimental phase and Phase 2 commenced automatically.

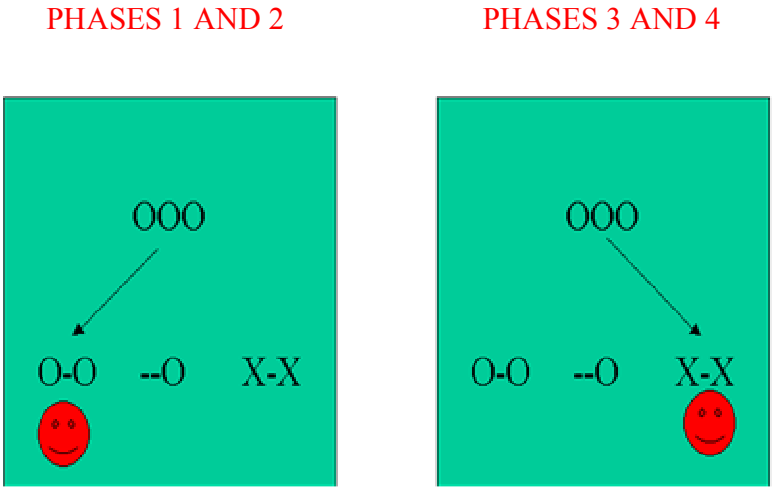

Figure 3. The MTS format and patterns of correct responding (indicated by smiley faces) for Phases 1 and 2 (Stage 3), and Phases 3 and 4 (Stage 4) of Experiment 1. The arrows or smiley faces did not appear on-screen at any point.

Stage 4: Computer Task: Phases 3 and 4. Stage 4 comprised Phases 3 and 4. These were identical in format to Stage 3, except that 40 novel stimulus sets were employed and the contingencies for correct responding were reversed. It is important to note that participants had not been made aware of the reversal of the contingencies and had received no form of instruction to indicate same. The result of this omission was that participants were required to determine across trials that the contingencies had changed and that the original instructions had become inaccurate. Put simply, the experimental rules accurately matched Phases 1 and 2 (matching most like sample and comparison), but not Phases 3 and 4 (matching least like sample and comparison). Once again, Phases 3 and 4 were only distinguished in terms of the randomisation of the trials.

RESULTS

In the current and all subsequent experiments, participants were balanced for gender. However, because gender was not central to the research programme, this variable was not subjected to statistical analyses. Indeed, incorporating this variable into factorial analyses with the current small sample sizes would have reduced the *n* in each cell to unacceptably low values. Each results section that follows is divided according to the two core types of data recorded and analysed, namely outputs on the psychological measures and data on rule-following, respectively.

Psychological Measures

The outcomes on each of the psychological measures were analysed according to condition and the mean scores for each are presented in Table 2. All participants scored within the normal range and the means did not differentiate the conditions on any measure.

Table 2
The Means and Standard Deviations for Each Condition on the Psychological Measures in Experiment 1.

Condition	**Psychological Measures**				
	DASS (38.00)	*BDI* (7.65)	*STAI* (37.62)	*SPR* (9.94)	*BIDR* (11.75)
Tracking	10.50	2.50	28.75	10.75	11.00
SD	3.0	1.73	3.40	5.91	5.41
Pliance/Experimenter Absent	17.00	2.50	24.00	10.00	12.50
SD	7.40	0.58	2.94	5.22	5.25
Pliance/Experimenter Present	7.50	2.50	24.25	7.75	10.50
SD	5.74	2.38	2.99	3.40	5.0
Pliance/Experimenter Reinforcing	14.50	4.50	26.50	11.25	8.50
SD	3.42	1.29	2.38	5.32	4.36
Overall Means:	**12.38**	**3.00**	**25.88**	**9.94**	**10.63**
Overall SD	**4.88**	**1.5**	**2.93**	**4.96**	**5.01**

* The figure in brackets indicates the norm for each measure.

Parametric statistics were employed in the analyses of the data from the psychological measures because the scores were normally distributed. Five separate one-way between-groups Analyses of Variance (ANOVAs), one per measure, indicated a non-significant result for condition on each measure (all p's > 0.101). Closer inspection of the sub-set data (not shown) also suggested no variations from norms and no differences among conditions. In short, participants within or across conditions could not be differentiated pre-experimentally in terms of current levels of depression, anxiety, stress, rigidity, or desirability in social responding, using the present measures.

Rule-following Analyses

The categorisation of responses as correct or incorrect depends upon whether one bases responding on the instructions or on the contingencies. Indeed in Stage 1, these two aspects were consistent because the information contained within the instructions matched the feedback and the contingencies (because participants were always encouraged to select the comparison that was most like the sample). However, the automatic contingency reversal at the beginning of Phase 3 (Stage 4), with no update on instructions, resulted in an obvious schism between these with immediate effect in the first trial in Phase 3. Hence, participants could now continue to follow the instructions (matching sample and comparison), but would receive negative feedback and points loss, thus indicating that following instructions was no longer correct. Alternatively, participants could 'abandon' the instructions and begin to follow the contingencies (mismatching sample and comparison) to gain points and respond 'correctly'. Hence to avoid confusion regarding the use of the terms 'correct' and 'incorrect' for responding, the terms *contingency-correct* and

contingency-incorrect are adopted forthwith. The number of contingency-correct responses was calculated per participant for each of the four phases.

Figure 4 shows the median number of contingency-correct responses for participants in each condition across each phase (individual participant data is provided in Appendix IX). In Phases 1 and 2, practically all participants demonstrated perfect accuracy, thus yielding no differences among conditions. As expected, response patterns began to change in Phase 3, although these changes were not consistent with predictions. Specifically, participants in the Tracking condition continued to follow the instructions almost throughout Phases 3 and 4, thus showing the slowest adaptation to the new contingencies. In contrast, participants in the three Pliance conditions appeared to adjust relatively quickly to the new contingencies and did not differ notably from one another in this regard.

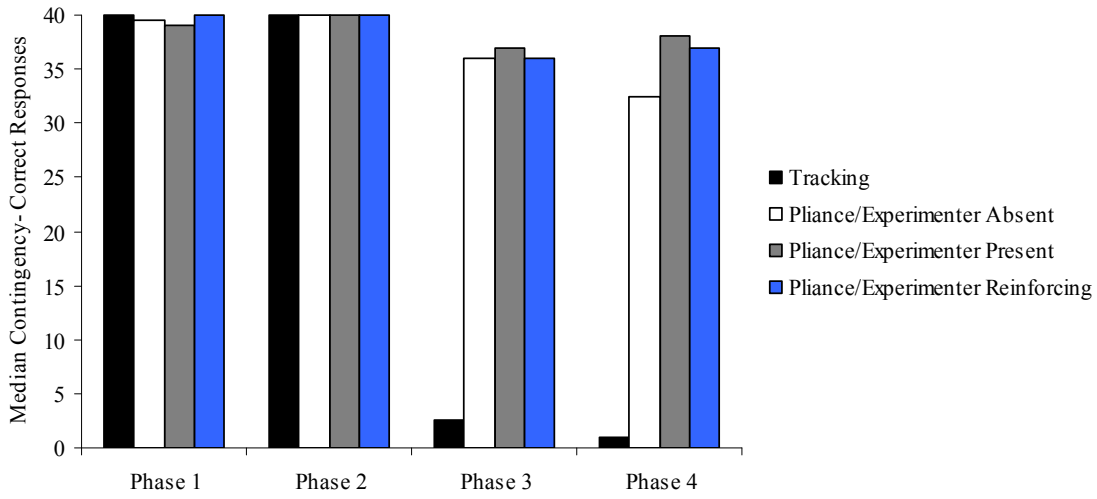

Figure 4. The median number of contingency-correct responses for participants in each condition in each phase in Experiment 1.

Within Participant Analyses. Due to the bi-modal nature of the rule-following data, non-parametric statistics were employed. Four Friedman tests (one per condition) were used to observe potential differences across phases and indicated that the differences were significant for all four conditions (all p's < 0.035). Wilcoxon Signed Rank Tests (six per condition) systematically compared all phases with each other for each condition. The Tracking condition yielded a difference between Phases 1 and 3 (p = 0.068), Phases 2 and 3 (p = 0.068), Phases 1 and 4 (p = 0.059) and Phases 2 and 4 (p = 0.066) that approached significance (all other p's > 0.317). Interestingly, in the Pliance/Experimenter Present condition, the differences between Phases 2 and 3 (p = 0.066), Phases 1 and 4 (p = 0.068) and Phases 2 and 4 (p = 0.066) also approached significance (all other p's > 0.180). In Pliance/Experimenter Absent, the difference between Phases 2 and 3 also approached significance (p = 0.066) (all other p's > 0.109). In Pliance/Experimenter Reinforcing, the differences between Phases 1 and 3 (p = 0.066) and Phases 2 and 3 (p = 0.066) also approached significance (all other p's > 0.109). In short, the performance of participants in the Tracking condition deteriorated rapidly and significantly. Thus, contrary to experimental predictions, they continued to follow the instructions in the reversed contingencies. Although participants in other pliance conditions also showed changes across time that approached significance and suggested some continuation of rule-following, these were very considerably reduced compared to Tracking.

Between Participant Analyses. Four Kruskal-Wallis tests were conducted (one per phase) and found no significant differences among the conditions (all p's > 0.195).

DISCUSSION

Although the results from Experiment 1 showed clear distinctions between pliance and tracking, responding within conditions was not as expected. In short, participants in Pliance showed evidence of tracking and participants in Tracking demonstrated pliance. Furthermore, the activities of the Experimenter appeared to have little influence across Pliance conditions. A number of variables may have contributed to these unexpected outcomes. (1) Relative to the original research by McAuliffe (2004), the sample sizes in Experiment 1 were small. (2) Feedback from participants, particularly in the Pliance conditions, pointed to the possibility that they may not have fully understood the instructions, particularly because the perspective implied within the rule was not clear. Specifically, the Pliance rule stated that "I, the Experimenter . . ." although participants may have been unclear to whom "I" was referring. Experiment 2 attempted to replicate Experiment 1 with these issues addressed.

EXPERIMENT 2

Experiment 2 attempted to replicate Experiment 1, with minor modifications, largely aimed at establishing more reliable experimental control over pliance and tracking responding. These modifications may be summarised as follows: (1) We increased the number of participants in each condition. (2) The generic instructions were modified for all conditions to enhance clarity and the specific instructions for the Pliance conditions were also modified to ensure greater understanding of the perspective of the Experimenter. (3) Because of the previously limited impact of the reinforcement for rule-following provided by the Experimenter in the previous study, this condition was excluded.

METHOD

Participants

Twenty-nine individuals (14 males and 15 females) were recruited for Experiment 2. Five were removed according to the exclusion criteria outlined in Experiment 1, leaving a sample of 24 for full participation and analyses. The participating sample were all aged between 18 and 35 years old (mean=20.4 years) and comprised 12 males and 12 females. All participants were undergraduate students at NUIM selected from a list of potential volunteers contacted directly by the Experimenter. Each participant was assigned to one of three conditions, with four males and four females in each (see Table 3).

Table 3
An Overview of the Three Conditions in Experiment 2.

Experimental Conditions		
Tracking	*Pliance*	
	Experimenter Absent	Experimenter Present

Setting

All aspects of the setting were identical to Experiment 1 (as appropriate by condition).

Apparatus and Materials

Experiment 2 employed the same apparatus and materials as the previous study, with minor adjustments to instructions.

Corrective Feedback

The corrective feedback was identical to that outlined in Experiment 1.

Procedure

The experimental sequence was identical to Experiment 1 and the key differences between the two studies concerned the explicit instructions. Specifically, in order to enhance the clarity of the instructions for all participants, the following phrase was added to the previous generic instructions in Stage 2:

> **In a moment you will be asked to put your hand inside the bag beside you and to select one piece of paper from this bag. Written on the piece of paper will be the precise instructions regarding the types of symbols that go together. Please now place your hand inside the bag and draw out *one* piece of paper from inside.**

The specific instructions for Tracking were identical to Experiment 1, with some modifications to instructions for Pliance. The primary purpose of the latter was to emphasise explicitly the Experimenter's knowledge of the selected instructions as follows (modifications highlighted):

> Please read **ALOUD** the instruction you have selected from the bag and please ensure that the experimenter is aware of this instruction.
>
> **The Experimenter wants me to select from the bottom three groups of symbols, the *one* which I consider to be *most like* the group of symbols at the top of the screen. In order to make my selection, I simply use the mouse to click on the group of symbols at the bottom that I have chosen on screen.**
>
> ***The Experimenter will be checking my performance at the end of each of the four phases.***
>
> **I will not be able to ask the Experimenter any questions once the experiment begins so if I wish to ask any questions I should do so now.**
>
> Now please fold this page up and place it under the computer keyboard until the experiment is over.

All other aspects of the procedure were identical to Experiment 1.

RESULTS

Psychological Measures

The outcomes on each of the psychological measures were analysed according to condition and the mean scores for each are presented in Table 4. All participants scored within the normal range and the means did not differentiate the conditions on any measure. Parametric tests were employed for analyses due to the normal distribution of scores. Five

separate one-way between-groups ANOVAs indicated a non-significant effect for condition on each measure (all p's > 0.270).

Table 4
The Means and Standard Deviations for Each Condition on the Psychological Measures in Experiment 2.

Condition	**Psychological Measures**				
	DASS (38.00)	*BDI* (7.65)	*STAI* (37.62)	*SPR* (9.94)	*BIDR* (11.75)
Tracking	15.74	6.87	29.50	12.75	11.00
SD	9.04	4.26	4.81	7.15	5.81
Pliance/ Experimenter Absent	17.70	5.87	31.00	12.13	9.50
SD	8.84	3.00	4.41	6.92	4.87
Pliance/ Experimenter Present	20.74	6.12	29.63	13.00	9.87
SD	10.72	5.06	5.10	2.98	4.02
Overall Means:	**18.06**	**6.29**	**30.04**	**12.63**	**10.12**
Overall SD	**9.74**	**4.03**	**4.62**	**5.74**	**4.78**

* The figure in brackets indicates the norm for each measure.

Rule-following Analyses

Figure 5 shows the median number of contingency-correct responses for participants in each condition across each phase (individual participant data for each condition is provided in Appendix X). Again, in Phases 1 and 2, practically all participants demonstrated perfect accuracy, thus yielding no initial differences among conditions. As expected, response patterns began to change again in Phase 3. As before, these changes were not consistent with predictions, but showed some overlap with the results of Experiment 1. Specifically, participants in Tracking continued to follow the instructions (thus failing to adapt to the contingencies) almost throughout Phases 3 and 4 and indeed this was more marked in the latter than the former. Contrary to Experiment 1, participants in the two Pliance conditions showed different response patterns from each other in the latter phases. That is, Pliance/Experimenter Absent participants, like Tracking, continued to

follow instructions. In contrast, Pliance/Experimenter Present showed considerable adaptation on approximately 50% of trials in each of the latter two phases.

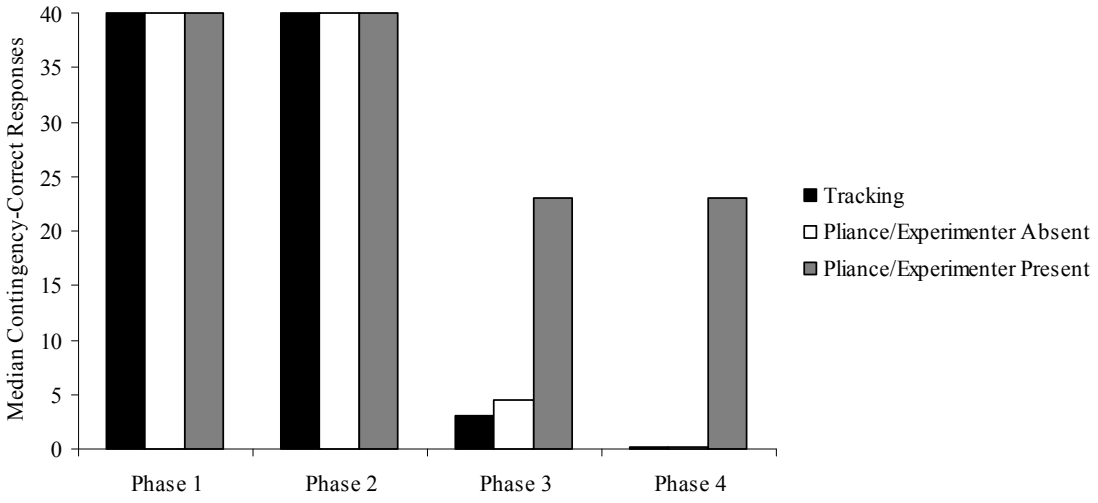

Figure 5. The median number of contingency-correct responses per condition in each phase in Experiment 2.

Within Participant Analyses. Three Friedman tests (one per condition) determined potential differences across phases and indicated that the differences were significant for all conditions (all p's < 0.001). Wilcoxon Signed Rank tests (six per condition) then systematically compared all phases with each other. In all three conditions, there were significant differences between: Phases 1 and 3; 1 and 4; 2 and 3; and 2 and 4 (all p's < 0.028, all other p's > 0.157).

Between Participant Analyses. Four Kruskal-Wallis tests found no significant differences among the conditions on any phase (all p's > 0.368).

DISCUSSION

Once again, the results from Experiment 2 were not as expected. Although the Pliance conditions now showed evidence of pliance, this was influenced to some extent by the presence of the Experimenter, who surprisingly facilitated less, rather than more, pliance. Consistent with Experiment 1, the Tracking condition also generated pliance.

With two studies now complete, both of which failed to replicate McAuliffe's findings with non-depressed participants (i.e. they engaged in tracking, but not pliance), it seemed appropriate at this point in the research sequence to attempt to replicate McAuliffe's research precisely to try to investigate further the possible sources of influence on the divergent outcomes thus far. This issue was addressed in Experiment 3, in which particular attention was paid to adherence to the original instructions and to the removal of the instructions after participants had read them.

EXPERIMENT 3

Because of the unexpected results from Experiment 1 and Experiment 2 and the inconsistencies between McAuliffe (2004) and Baruch et al. (2007), the aim of Experiment 3 was simply to replicate McAuliffe's research directly.

METHOD

Participants

Sixteen participants (eight males and eight females), aged between 18 and 24 years old (mean=19.6 years) participated in Experiment 3. All were undergraduates at NUIM selected from a list of potential volunteers thereafter contacted directly by the Experimenter. Each participant was randomly assigned to one of two conditions (see Table 5).

Table 5
An Overview of the Two Conditions in Experiment 3.

Experimental Conditions	
Tracking	*Pliance/Experimenter Absent*

Setting

The setting was identical to Experiment 2. However, because only the Tracking and Pliance/Experimenter Absent conditions were included, the Experimenter was not present at any time during the MTS tasks.

Apparatus and Materials

Experiment 3 employed the same apparatus and materials as the previous study, except for modifications to the instructions.

Corrective Feedback

The corrective feedback was identical to the previous studies.

Procedure

The experimental sequence was identical to previous studies. The key difference currently was the strict use of McAuliffe's instructions as follows:

> The computer will present you with a number of tasks. Each time a point is earned the computer will display '+1' point on the screen, along with the running total of points awarded. When you fail to earn a point the computer will deduct a point and '-1' point will appear on the screen, along with the running total of points awarded.
>
> As the experiment may take between 30-40 minutes to complete, you will be given a 3 minute break at the end of each phase. Do you have any questions?

In addition, the specific instruction presented to participants in Tracking was as follows:

> Please select the symbol most like the sample symbol at the top of the screen.
> Now read *silently* the instruction you have selected from the bag and then put it back in the bag.

Participants in Pliance/Experimenter Absent always selected the following instructions:

> *I want you to* select the comparison symbol most like the sample symbol at the top of the screen.
>
> Now read *aloud* the instruction you have selected from the bag. *I will be checking your performance at the end of each of the four phases.*

Participants then placed the specific instruction back in the bag and the bag was subsequently removed from the room. All instructions were removed from the experimental room at this time.

RESULTS

Psychological Measures

The outcomes on each of the psychological measures were analysed according to condition and the mean scores for each are presented in Table 6. All participants scored within the normal range and the means did not differentiate the conditions on any measure. Five separate one-way between-groups ANOVAs indicated a non-significant effect for condition on each measure (all p's > 0.119).

Table 6
The Means and Standard Deviations for Each Condition on the Psychological Measures in Experiment 3.

Condition	**Psychological Measures**				
	DASS (38.00)	*BDI* (7.65)	*STAI* (37.62)	*SPR* (9.94)	*BIDR* (11.75)
Tracking	19.50	8.88	34.00	12.25	11.88
SD	10.46	3.94	4.28	5.09	3.60
Pliance/Experimenter Absent	19.00	7.50	31.75	13.75	7.75
SD	12.34	3.33	5.73	5.95	4.86
Overall Means:	**19.26**	**8.19**	**32.88**	**13.00**	**9.82**
Overall SD	**11.12**	**3.49**	**5.02**	**5.40**	**4.65**

* The figure in brackets indicates the norm for each measure.

Rule-following Analyses

Figure 6 shows the median number of contingency-correct responses for participants in each condition across each phase (individual participant data are provided in Appendix XI). Again, in Phases 1 and 2, practically all participants demonstrated perfect

accuracy and response patterns then changed in Phase 3. Interestingly, the change observed with participants in Tracking was consistent with predictions and these individuals adapted quickly and reliably to the new contingencies (and abandoned the instructions) across both of the latter phases. Also consistent with predictions, the Pliance/Experimenter Absent participants did not adapt to the contingencies and continued to follow the instructions consistently across both phases.

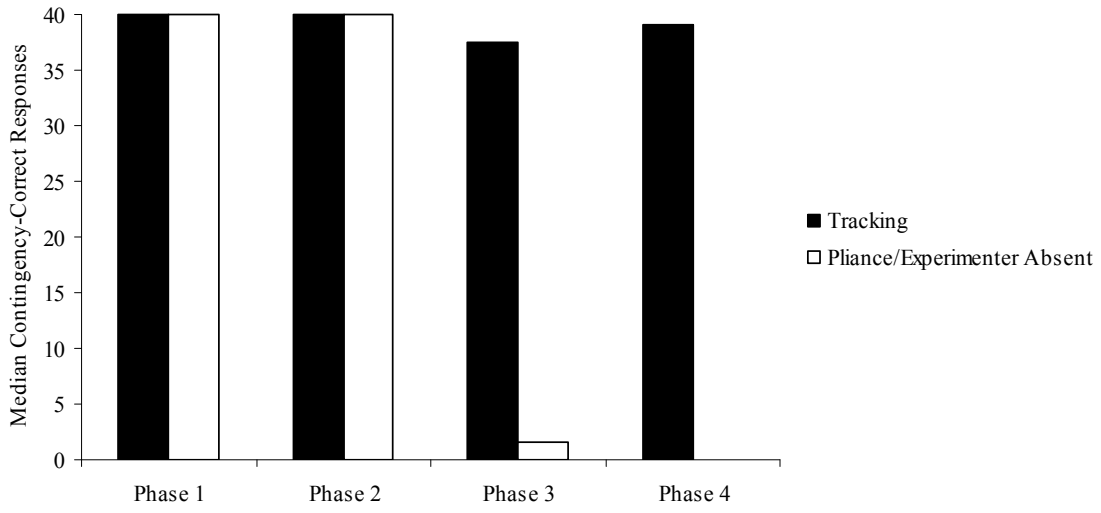

Figure 6. The median number of contingency-correct responses per condition in each phase in Experiment 3.

Within Participant Analyses. Two Friedman tests indicated that the differences among phases were significant for both conditions (both p's < 0.001). Wilcoxon Signed Rank tests (six per condition) also revealed significant differences between: Phases 1 and 3; and Phases 2 and 3 for both conditions (all p's < 0.011, all other p's > 0.104) and between Phases 1 and 4; and Phases 2 and 4 for Pliance/Experimenter Absent (both p's = 0.014) (all other p's > 0.504).

Between Participant Analyses. Four Mann-Whitney U tests (one per phase) revealed a significant difference between Tracking (n = 8, sum of ranks = 98.00) and Pliance/Experimenter Absent (n = 8, sum of ranks = 38.00) in Phase 3 (U = 2.0, p = 0.001) and Phase 4 (Tracking: n = 8, sum of ranks = 86.50; Pliance/Experimenter Present: n = 8, sum of ranks = 49.50; U = 13.5, p = 0.050; all other p's > 0.234).

DISCUSSION

Experiment 3 replicated McAuliffe's procedure exactly, and in particular without alteration to the original instructions and with the removal of the instructions after reading. Although in this study, we found perhaps the clearest distinction between pliance and tracking (participants in Tracking demonstrated tracking and Pliance demonstrated pliance), the outcomes were surprisingly identical to McAuliffe's depressed, rather than non-depressed, participants.

One of the key (although perhaps minor) differences between Experiments 1 and 2 compared with Experiment 3 concerned participants' retention of the instructions in the former, but not in the latter. In order to determine the extent to which this variable may have contributed to the divergent outcomes, Experiment 4 replicated Experiment 3, but removed the instructions immediately after participants had read them.

EXPERIMENT 4

The primary aim of Experiment 4 was to attempt to replicate the distinction between Pliance and Tracking observed in Experiment 3 and to examine the potential role of participants retaining the instructions on the putative outcome.

METHOD

Participants

Sixteen participants (eight males and eight females), aged between 18 and 28 years old (mean=19.8 years), were involved in Experiment 4. All were selected from a list of potential volunteers thereafter contacted directly by the Experimenter. Each participant was randomly assigned to one of two conditions (see Table 7).

Table 7
An Overview of the Two Conditions in Experiment 4.

Experimental Conditions	
Tracking	*Pliance/Experimenter Absent*

Setting, Apparatus and Materials

The setting, apparatus and materials were identical to Experiment 3.

Corrective Feedback

The corrective feedback was identical to that outlined in Experiment 1.

Procedure

All aspects of the procedure were identical to Experiment 3, except that all participants kept the instructions with them for the duration of the experiment.

RESULTS

Psychological Measures

The outcomes on each of the psychological measures were analysed according to condition and the mean scores for each are presented in Table 8. All participants scored within the normal range and the means did not differentiate the conditions on any measure. Five separate one-way between-groups ANOVAs indicated a non-significant effect for condition on each measure (all p's > 0.131).

Table 8
The Means and Standard Deviations for Each Condition on the Psychological Measures in Experiment 4.

Condition	**Psychological Measures**				
	DASS (38.00)	*BDI* (7.65)	*STAI* (37.62)	*SPR* (9.94)	*BIDR* (11.75)
Tracking	26.00	6.75	34.00	17.50	7.13
SD	9.86	1.28	8.35	5.73	4.85
Pliance/Experimenter Absent	19.50	4.75	30.38	15.25	10.88
SD	12.32	3.28	7.33	3.65	5.69
Overall Means:	**22.76**	**5.75**	**32.19**	**16.38**	**9.01**
Overall SD	**11.28**	**2.62**	**7.82**	**4.79**	**5.47**

* The figure in brackets indicates the norm for each measure.

Rule-following Analyses

Figure 7 shows the median number of contingency-correct responses for participants in each condition across each phase (individual participant data are provided in Appendix XII). Again in Phases 1 and 2, practically all participants demonstrated perfect responding and this pattern changed in later phases. Consistent with predictions, participants in Tracking showed the greater adaptation to the new contingencies, although this began to weaken in Phase 4. In contrast, participants in Pliance/Experimenter Absent were slower to adapt in Phase 3, but did better in this regard than Tracking in Phase 4.

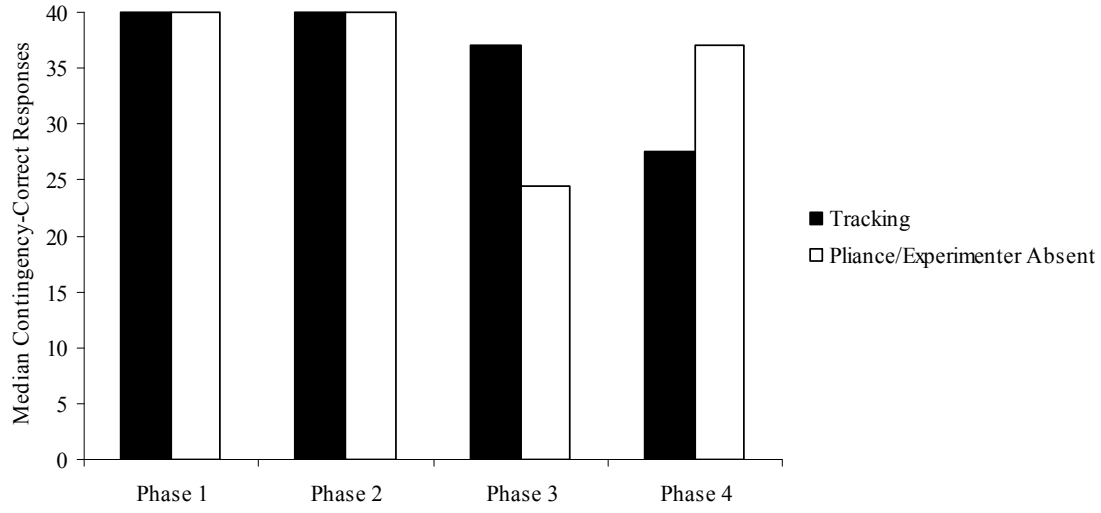

Figure 7. The median number of contingency-correct responses across participants in each condition in each phase in Experiment 4.

Within Participant Analyses. Two Friedman tests (one per condition) indicated significant differences among phases for both conditions (both p's < 0.000) and Wilcoxon Signed Rank tests revealed significant differences between: Phases 1 and 3; 1 and 4; 2 and 3; and 2 and 4 for both conditions (all p's < 0.027, all other p's > 0.176).

Between Participant Analyses. Four Mann-Whitney U tests (one per phase) found no significant difference between the conditions on any phase (all p's > 0.144).

DISCUSSION

One of the key (although perhaps minor) differences between Experiments 1 and 2 compared with Experiment 3 concerned participants' retention of the instructions in the former, but not in the latter. In order to determine the extent to which this variable may have contributed to the divergent outcomes, Experiment 4 replicated Experiment 3, but participants retained the instructions after they had read them. However, the data indicated a reduction in the distinction between pliance and tracking, with participants in Tracking showing increasing pliance and participants in Pliance showing increasing tracking.

GENERAL DISCUSSION

In spite of some empirical evidence for a functional distinction between pliance and tracking, both McAuliffe (2004) and Baruch et al. (2007) failed to distinguish clearly between these two types of rule-governed behaviour in non-depressed participants. The current chapter of research attempted to investigate this issue directly with a series of four studies that comprised a replication of, and modifications to, the procedure by McAuliffe using non-depressed undergraduates.

Experiment 1 primarily attempted to distinguish pliance and tracking in this sample. In particular, we attempted to explore pliance further by manipulating the presence of the Experimenter and the extent to which explicit reinforcement of rule-following might

facilitate greater pliance responding. For the most part, the procedure employed in Experiment 1 replicated McAuliffe's, with modifications to enhance the clarity of the generic experimental instructions (including participants retaining the instructions) and the additional manipulations of Experimenter-influence. As a result, we hoped to have more success than both McAuliffe (2004) and Baruch et al. (2007) in recording distinctions between pliance and tracking that were in accordance with experimental manipulations (i.e. we expected to observe tracking in the Tracking condition and pliance in the Pliance conditions) with a non-depressed sample. Furthermore, we anticipated that there would be perhaps greater pliance observed in conditions in which the Experimenter was more active. Although the results from Experiment 1 showed clear distinctions between pliance and tracking, responding within conditions was not as expected. In short, participants in Pliance showed evidence of tracking and participants in Tracking demonstrated pliance. Furthermore, the activities of the Experimenter appeared to have little influence across Pliance conditions.

Working on the assumption that the small sample sizes may have been a contributing factor, as well as feedback from participants indicating that the experimental instructions, particularly in Pliance conditions, were confusing, Experiment 2 attempted to replicate Experiment 1 with these issues addressed. Once again, however, the results were not as expected. Although the Pliance conditions now showed evidence of pliance, this was influenced to some extent by the presence of the Experimenter, who surprisingly facilitated less, rather than more, pliance. Furthermore, consistent with Experiment 1, the Tracking condition also generated pliance.

Because of the variability of data from the two previous studies, as well as the discrepancies between the original findings from both McAuliffe (2004) and Baruch et al. (2007), Experiment 3 replicated McAuliffe's procedure exactly, and in particular without any alteration to the original instructions and with the removal of the instructions after reading. Although in this study, we found perhaps the clearest distinction between pliance and tracking (participants in Tracking demonstrated tracking and Pliance demonstrated pliance), the outcomes were surprisingly identical to McAuliffe's depressed, rather than non-depressed, participants.

In order to determine the extent to which participants' retention of the instructions may have contributed to the divergent outcomes, Experiment 4 replicated Experiment 3, but participants retained the instructions after they had read them. However, the data indicated a reduction in the distinction between pliance and tracking, with participants in Tracking showing increasing pliance and participants in Pliance showing increasing tracking.

In spite of the range of variables manipulated in the current experimental chapter, we were unable to reliably establish adequate experimental control over pliance and tracking. For example, in Experiment 1 participants in the Pliance conditions displayed tracking and participants in Tracking displayed pliance. In summary, we had examined the potential influence of three main variables: the extent of Experimenter involvement; the retention of the instructions; and length/specificity of instructions.

The outcomes were equivocal with regard to the extent of Experimenter involvement. Specifically, in Experiment 1, the presence of the Experimenter was associated with reduced pliance and her explicit reinforcement of rule-following had little

or no impact on pliance. In contrast, in Experiment 2 the Experimenter's presence was associated with greater pliance.

Although we had not initially considered that the retention of the instructions would play a key role in any conditions, this did emerge as a potential issue, particularly in the latter studies. For instance, only Experiment 3 recorded sound experimental control obtained over pliance and tracking and this was the only study in which participants did not retain the instructions. Indeed, the retention of instructions in the replication in Experiment 4 resulted in a strong reduction in the previously clear distinction between pliance and tracking. Nonetheless, this latter outcome was not entirely consistent with Experiments 1 and 2, thus suggesting that retention was not the only critical variable.

In a similar manner, the length of instructions also emerged as a potentially important variable across studies. In simple terms, the experimental instructions in Experiments 1 and 2 were generally longer than in Experiments 3 and 4. In the former, there were higher levels of pliance overall compared with the latter, suggesting that perhaps longer instructions facilitated greater pliance. Taken together, the divergence in findings across the first four studies and a comparison of those with both McAuliffe (2004) and Baruch et al. (2007) suggests, at least, that any or all of these variables contributed to the different outcomes. Indeed, the divergence in the findings across all six existing studies clearly point to the temperamental nature of the pliance/tracking distinction, at least with non-clinical populations.

One overriding issue that may have contributed to the lack of robustness in the pliance/tracking distinction and experimental control of same may concern the possibility that the undergraduate participants here did not feel any great need to follow the rules. For

example, in such a simple experimental task one would not have needed the rules to derive how to respond correctly. Furthermore, punishment for responding incorrectly simply involved the loss of points. Thus, participants may have felt only limited motivation to follow the rules in any condition.

One experimental avenue that may be useful in determining whether such a suggestion may account for the discrepant findings thus far involves the creation of an experimental context in which the rules may be beneficial in reducing the aversiveness of the experimental task. Consider, for example, a clinical analogue study in which participants are provided with rules that help them cope with experimentally induced pain. In such a situation one might predict that the rules would be more salient to participants' responding and thus one may observe alternative or better distinctions between pliance and tracking. The experiments reported in the two subsequent empirical chapters of the current thesis address this issue.

Chapter 3

Using Radiant Heat Apparatus

to Study Rule-Following

Experiments 5 and 6

Chapter 3

Using Radiant Heat Apparatus to Study Rule-Following

Experiments 5 and 6

The four studies reported in Chapter 2 highlighted difficulties in demonstrating a clear empirical distinction between pliance-based and tracking-based rule-governed behaviour, particularly in non-depressed individuals. These difficulties were not inconsistent with the two key existing pieces of research in this area (Baruch et al. 2007; McAuliffe, 2004). Of the four studies conducted in the previous chapter, a number of potential variables were examined and even here it was difficult to determine their influence on the divergent outcomes. Taken together, there was evidence of pliance responding and evidence of tracking responding, but it was difficult to establish experimental control over either.

One overriding issue that may have contributed to the lack of robustness in the pliance/tracking distinction and experimental control of same may concern the possibility that the undergraduate participants employed for the studies did not feel any great need to follow the rules. Furthermore, punishment for responding incorrectly simply involved the loss of points. Thus, participants may have felt only limited motivation to follow the rules in any condition. Some support for this suggestion arises from the fact that in the McAuliffe findings the participants who were depressed (and who were well known to the Experimenter) did demonstrate a strong and reliable pliance vs. tracking distinction.

Rules in Experimental Analogue Studies

One experimental avenue that may be useful in determining whether such a suggestion can account for the discrepant findings thus far involves the creation of an experimental context in which the rules may be beneficial to participants in reducing the aversiveness of the experimental task. Consider, for example, a clinical analogue study in which participants are provided with rules that help them cope with experimentally induced pain. In such a situation one might predict that the rules would be more salient to participants' responding and thus one may observe alternative or better distinctions between pliance and tracking.

One of the few published studies in this area was reported by Hayes and Wolf (1984) and also involved undergraduate participants. Using the cold pressor task, these researchers manipulated pliance and tracking (which they referred to as Public and Private conditions), while also manipulating two types of rules (which they referred to as coping statements) which may help participants to tolerate the experimentally induced pain. Specifically, some participants were provided with Tolerance rules that encouraged them to simply endure the pain, while other participants received Subjectivity rules that attempted to alter their experience of the pain. In a manner that was almost identical to the four studies in the previous chapter, Hayes and Wolf created Pliance conditions in which participants showed their rules to the Experimenter. Furthermore, their Tracking conditions also involved participants reading the rules silently to themselves.

The results reported by Hayes and Wolf (1984) were almost entirely consistent with their predictions. First, the experimental rules (each participant selected only two) facilitated increases in pain tolerance for participants in all four active conditions, but not in

the Control condition. Second, the Pliance conditions both generated significant tolerance increases relative to Control. Although these did not differ significantly from the Tracking conditions, the increases were greater. On the whole, subjectivity-based rules were associated with greater pain tolerance than the tolerance-based rules, although these differences were not significant. Taken together, these researchers not only recorded pliance vs. tracking distinctions, but also demonstrated that pliance was associated with greater pain tolerance than tracking.

Although the outcomes reported by Hayes and Wolf (1984) were very positive, a number of researchers have highlighted methodological weaknesses in the use of the cold pressor task. Specifically, in a type of meta-analysis Mitchell, Mac Donald and Brodie (2004) identified the following problems: a lack of standardised equipment and 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 water temperature. A number of researchers have recently reported success with an alternative type of pain induction apparatus.

Radiant Heat Apparatus

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 and appears to offer a superior alternative to the cold pressor task. 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; (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.

Current Research

The current chapter reports two studies that were largely replications of the research reported by Hayes and Wolf (1984), primarily because there have been no reported replications of these effects. Because of the recent concerns of researchers regarding the cold pressor task, we replaced this pain induction methodology with the radiant heat apparatus, while retaining all other aspects of the original experiment. In short, we wanted to investigate the robustness of the pliance/tracking distinction in the context of experimental pain induction. In spite of the strong similarities between Experiment 5 and the original research, the outcomes of the former surprisingly contained tolerance decreases and a limited distinction between pliance and tracking. One issue that appeared to contribute to these weak effects was the continuous presence of the Experimenter, a variable to which we had been sensitised in the previous chapter. Indeed, it seemed very likely that this was a potentially important variable particularly in the context of pain induction, although admittedly the Experimenter had been present throughout the original

research reported by Hayes and Wolf. In order to address this issue, Experiment 6 replicated Experiment 5 but the Experimenter was not present at any point. Although the data from the second study did not include significant differences, there was a notable distinction between pliance and tracking, in which pliance was associated with tolerace increases and tracking was associated with decreases.

EXPERIMENT 5

METHOD

Participants

Forty-six participants were recruited for Experiment 5. Six were removed according to specific exclusion criteria (outlined below), leaving a sample of 40 for full participation and analyses. The participating sample were all aged between 18 and 46 years old (mean=19.5 years) and comprised of 20 males and 20 females. All were undergraduate students at NUIM selected from a list of potential volunteers thereafter contacted directly by the Experimenter. Each participant was assigned to one of five conditions (eight per condition) based on their Baseline heat tolerance (see Table 9).

Table 9.
An Overview of the Five Conditions in Experiment 5.

Experimental Conditions				
Control	*Pliance*		*Tracking*	
	Tolerance	Subjectivity	Tolerance	Subjectivity

Exclusion Criteria

A number of exclusion criteria were employed in the current study primarily to control for potential variability across conditions. First, participants were excluded if they showed evidence of pain-related disorders on a medical screening questionnaire (one removed). These participants were not exposed to the heat apparatus. Second, participants who demonstrated pain tolerance at baseline of at least two standard deviations above the mean for the total original sample (i.e. > 16.5 sec) were also removed. These individuals (two) were only exposed to the heat apparatus at baseline and were excluded from the analyses. Third, participants were removed if they were outliers on any of the psychological measures. These participants completed the experiment but were excluded from analyses (three removed).

Setting

Experiment 5 was conducted in the Experimental Room within the Department of Psychology at NUIM. The room contained a desk, a personal computer, a standard computer mouse, the radiant heat apparatus, a button box 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 Experimenter was seated opposite to the participant and in front of the computer throughout all experimental tasks.

Apparatus

The personal computer had a Pentium 4 (2.2Gh) processor; 256MB memory; 40GB hard drive; and 15in. LCD screen. The computer controlled the radiant heat apparatus. The heat *pad* was a square thermode (13.7cms²) 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 for temperature regulation. A number of Velcro pads connected the heat pad to digital scales, employed to control the amount of pressure exerted on the pad (see Figure 8). A one-button buzzer box enabled participants to communicate with the Experimenter (and allowed the Experimenter to respond instantaneously).

Figure 8. The radiant heat apparatus and scales employed in Experiment 5.

Materials

Participants completed an informed consent (see Appendix XIII), a medical screening questionnaire (adapted from research by Kehoe, 2008 -- see Appendix XIV), and

the Edinburgh Handedness Inventory (EHI, Oldfield, 1971-- see Appendix XV). The study also involved four standard psychological assessment measures: The Acceptance and Action Questionnaire Short Version (AAQ-2: Bond, & Bunce, 2003)**;** The Fear of Pain Questionnaire-III (FPQ-III: McNeil, & Rainwater, 1998); and the DASS and BIDR (from Experiments 1–4).

The *AAQ-2* is a printed self-report measure of an individual's level of emotional acceptance or avoidance. It comprises 10 statements that reflect an orientation towards emotional acceptance (e.g. "It's OK if I remember something unpleasant") or avoidance (e.g. "I'm afraid of my feelings"). Participants rate the degree to which they feel each statement applies to them using a 7-point Likert scale (1: NEVER TRUE to 7: ALWAYS TRUE). A high AAQ score indicates high acceptance/low avoidance (maximum score=70) and a low score indicates low acceptance/high avoidance (minimum score=7). 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). Because norms are not provided by the AAQ, the mean of the full participant sample in Experiment 5 was calculated (50.55, SD 7.72) and participants who scored at, or below, two standard deviations of the mean (< 35) were excluded from data analyses. A copy of the AAQ-2 is provided in Appendix XVI.

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 ($\alpha = 0.88$); Minor pain ($\alpha = 0.87$); Medical pain ($\alpha = 0.87$). 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) were removed from the analyses. A copy of the FPQ is provided in Appendix XVII.

Consistent with the four previous studies, Experiment 5 also involved a small white cloth bag that contained the target coping statements. Participants also received an instruction booklet with directions on how to complete the heat tests. The booklet also contained three separate sets of Distress Ratings (one for each heat test) in which participants rated their levels of sensation, unpleasantness and pain experienced during the tests (see Appendix XVIII). Rating involved placing an X on a Visual Analogue Scale (VAS) for each state (0: None at all to 10: Extremely).

Participants were also exposed to a set of adherence measures (see Appendix XIX) that assessed their use of the rules (as appropriate) provided to them (see Table 10). Specifically, they were asked: how pressurised they felt to use the rules (0: Not at all to 10: Extremely); how much they used the rules during the heat test (0: Not at all to 10: Very Much); and how useful they found the rules (0: Not at all to 10: Extremely). In addition, participants were asked about their level of overall experimental pain (0: None at all to 10: Very Much) and whether they would be willing to participate in a further heat test (Yes/No).

Table 10
The Adherence Measures Presented in Experiment 5.

Post-Experimental Adherence Measures
Pressure to Use Rules
Rule Use
Usefulness of Rules
Overall Pain
Willingness to Participate Further

Experimental Overview

An overview of the experimental sequence is provided in Figure 9. Stage 1 comprised of the consent form, medical screening questionnaire, EHI and psychological measures. Stage 2 involved the baseline heat test and distress ratings. In Stage 3, the experimental rules were presented across the four active conditions designed to aid participants in coping with the subsequent heat test. Stage 4 comprised the Post-Rule heat test and distress ratings. Stage 5 presented the post-experimental adherence measures.

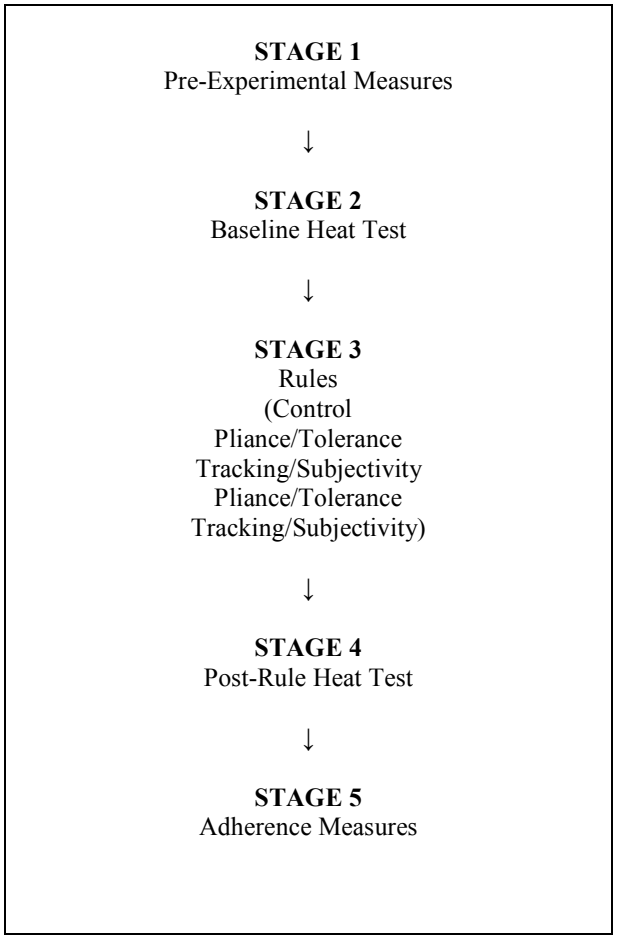

Figure 9. An overview of the experimental sequence employed in Experiment 5.

Procedure

Participation for each individual lasted approximately 40 min. and was always on an individual basis.

Stage 1: Pre-Experimental Measures. At the outset of the experiment, participants completed the consent form, the medical screening measure and the EHI as a short printed booklet (in that order) in the Experimental Room alone. These three measures were then taken to the Observation Room and checked, while participants had a short break. If

responding on either the medical screening questionnaire or the consent form was inappropriate for continuation, participants were thanked for their time and their participation was terminated. Alternatively, the Experimenter returned to the room and presented the participant with a second printed booklet containing the four psychological measures (the AAQ, the FPQ, the DASS and the BIDR, in that order). Participants who were considered as outliers on any of the psychological measures completed the experiment, but were not included in analyses.

Stage 2: Baseline Heat Test. A third printed booklet contained instructions for using the heat apparatus as follows:

> You will notice a radiant heat box beside you. The apparatus works by placing the 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 of these simply introduced the correct level of pressure and thus no heat was generated. The instructions were 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 gradual heat increases generated by the heat pad and the explicit measures of pain perception that would accompany the experimental heat tests. The maximum heat was now adjusted to 37°C (unlikely to be perceived as painful) and 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.
>
> Indicate to the Experimenter when you are ready to start the practice trial and you will slowly begin to feel the heat increase through your fingers. Please remove your hand whenever you wish. Once you have removed your hand, please immediately complete the three questions on the next page of the Instruction Booklet.

In order to determine participants' explicit perceptions of the pain generated by the practice heat trial, they were immediately asked to provide three VAS ratings of Sensation, Unpleasantness and Pain. A 2min. rest period then followed to ensure that participants' fingers returned to normal temperature.

The third practice trial was designed to familiarise participants with the use of the buzzer that would be used three times during each heat test. Specifically, participants were required to press the buzzer for the first time when they commenced a heat test (at which point the Experimenter initiated the heat). In this practice trial, the maximum temperature was 50°C (identical to an actual heat test). Once the pad began to heat up, participants pressed the buzzer a second time when they perceived the heat to be painful (referred to as *threshold*). They then pressed the buzzer a third time when they perceived the heat to be intolerable (referred to as *tolerance*). Throughout the study, *heat tolerance* was measured as the time taken (in seconds) between threshold and tolerance (see Kehoe, 2008). The

third practice trial, therefore, was identical to an actual heat test although the data were not analysed. The primary aim was to ensure that participants could accurately assess their individual threshold and tolerance levels and press the buzzer appropriately. 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 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 rated their levels of Sensation, Unpleasantness and Pain and a 2min. rest period followed. It is important to note that in 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.

The fourth exposure to the heat pad constituted each participant's baseline heat test. All aspects of this test were identical to the third practice trial, except that the data were employed for the purposes of analysis. All participants who exceeded a tolerance time of 16.5sec. at baseline participated in the experiment, but their data were not included in analyses.

Stage 3: Therapeutic Rules. As a result of their baseline heat tolerances, participants were assigned to one of the five conditions (Control; Pliance/Tolerance; Pliance/Subjectivity; Tracking/Tolerance; and Tracking/Subjectivity) across which the

target interventions (Tolerance rules vs. Subjectivity rules) were manipulated as well as the context in which these were presented (tracking vs. pliance).

As the term implies, the *Control* condition did not offer any explicit type of therapeutic rule and thus simply contained a passage about the Gate Control Theory of Pain (adapted from Hayes, & Wolf, 1984) as follows:

> Psychologists have attempted to understand how pain works. For example, the 'Gate Control Theory of Pain' suggests that part of our experience of pain involves evaluations and other associations, rather than just the subjective experience of pain itself.
>
> Gate Control Theory may explain some unusual reactions to pain that some people experience. For instance, soldiers who have escaped from battle deny feeling any pain in spite of having extensive wounds. So, pain sensations do seem to differ according to the evaluations or associations that accompany them.
>
> According to this theory, there are three different types of pain: 1) Transient, 2) Acute and 3) Chronic and all are differentially affected by various evaluations and associations. Transient pain describes pain for which it is generally unnecessary to seek help. An example of transient pain may be an injection for immunisation. Acute pain is pain that may last for a number of days or weeks, and may be seen after some type of injury or sickness. Chronic pain may last for a number of months or years and its duration may be affected by stressors and environmental factors. Chronic back pain is an example.

Participants were then required to give written examples (on the booklet) of previous personal experiences of pain in terms of transient, acute, or chronic.

Participants in the four therapeutic rule conditions received identical initial instructions. Although these also made reference to the Gate Control Theory of Pain, they emphasized the potential use of coping statements as a means of controlling perceived pain:

> Psychologists have attempted to understand how pain works. For example, the 'Gate Control Theory of Pain' suggests that it is possible to control or overwrite pain by attending to other things, which appear to interfere with the sensory input that induces pain. According to this theory, signals of pain are identified and evaluated before the pain action system is activated and interruption of these signals will result in alterations to the pain that is experienced.
>
> Gate Control Theory may explain some unusual reactions to pain that some people experience. For instance, soldiers who have escaped from battle deny feeling any pain in spite of having extensive wounds. So, pain sensations do seem to differ according to the evaluations or associations that accompany them.

> In line with this theory, psychological researchers have proposed that evaluations of pain may be manipulated via coping statements to enable individuals to alter the subjective pain they experience. How this "cognitive restructuring" works is that the individual learns to identify negative statements associated with the pain (e.g. "I can't stand this) and replaces them with alternative coping statements (e.g. "If I relax, I won't feel the pain). So, the purpose of our research is to investigate just how effective these coping statements are in controlling pain.

Thereafter, the four rule conditions were differentiated in terms of whether they received a tolerance or subjectivity rule and whether this was presented as tracking or pliance.

Participants in the *Pliance/Tolerance* condition were presented with a series of five tolerance-based coping statements or therapeutic rules, from which they randomly selected two from the white bag (see Table 11). Because of the public aspect of this condition, the Experimenter was explicitly aware of the selected rules. Participants were instructed as follows:

> The bag contains many different types of statements including neutral, coping and distracting statements. Please now take ***two*** statements from the bag. Please read the statements ***silently*** and memorise them. When you have done this please give the statements to the Experimenter so that she can read them.

Table 11
The Tolerance-based Rules Employed in Experiment 5.

Tolerance Rules
I can keep my hand on the heat pad in spite of the pain
Feelings can make me do anything, I can handle the situation even if the heat pad is very hot.
I'll just relax and I'll be able to keep my fingers on the heat pad.
I will keep my fingers on the heat pad even if the feeling is intense.
I can keep my fingers on the heat pad even if the pain tries to make me give in-I'm stronger than my pain.

Participants in the *Pliance/Subjectivity* condition received the same instructions, but five alternative rules that highlighted that pain was merely a subjective experience (see Table 12).

Table 12
The Subjectivity-based Rules Employed in Experiment 5.

Subjectivity Rules
I don't have to interpret the sensations as unpleasant.
I can just relax and it won't be so painful.
I can interpret the sensations as numbness rather than pain.
Pain is just a sensation-it doesn't have to be seen as bad or awful.
I can think of something pleasant and the pain won't be so bad-it's only in my mind.

The Pliance and Tracking conditions differed primarily in the fact that in the former the Experimenter read the selected rules, but in the latter she did not. Hence, participants in the Tracking conditions were instructed as follows (changes in text highlighted in bold):

> The bag contains many different types of statements including neutral, coping and distracting statements. Please now take *two* statements from the bag.
> **Please read the statements *silently* and memorise them.**
> **When you have done this put them back into the bag.**

Stage 4: Post-Rule Heat Test. Stage 4 was identical to the baseline heat test, but was naturally designed to assess the potential change in heat tolerance from Baseline to Post-Rule, that may have resulted from the therapeutic rules.

Stage 5: Adherence Measures. Phase 5 comprised of the completion of a set of adherence questions (outlined previously). Participants were then debriefed and thanked for their participation and all of their queries were answered as appropriate.

RESULTS

The general analytic strategy adopted in the current study and subsequent experiments differs from the previous chapter. Consistent with the use of the radiant heat apparatus, the four core types of data recorded and analysed were: outputs on the psychological measures, heat tolerance data, distress ratings and adherence measures. The results sections are divided according to these categories.

Psychological Measures

The outcomes on each of the psychological measures were analysed according to condition and the mean scores for each are presented in Table 13. All participants scored within the normal range (two standard deviations above or below the norm). As expected, four separate one-way between-groups ANOVAs (one per measure) indicated a non-significant result for condition on each measure (all p's > 0.135).

Table 13
The Means and Standard Deviations per Condition on the Psychological Measures in Experiment 5.

Condition	**Psychological Measures**			
	AAQ (50.55)	*FPQ* (78.20)	*DASS* (38.00)	*BIDR* (11.75)
Control	53.75	91.50	12.25	10.5
SD	7.17	13.67	5.04	6.35
Pliance/Tolerance	47.00	85.25	17.50	10.75
SD	7.33	18.72	10.27	5.72
Pliance/Subjectivity	47.25	85.75	13.50	8.00
SD	6.71	15.27	4.66	4.50
Tracking/Tolerance	49.50	89.63	13.50	11.25
SD	5.98	14.01	7.35	5.47
Tracking/Subjectivity	55.25	82.88	11.125	10.63
SD	8.12	13.86	5.29	5.67
Overall Means:	**50.55**	**87.01**	**13.58**	**10.23**
Overall SD	**7.68**	**14.76**	**7.64**	**5.30**

* The figure in brackets indicates the norm for each measure.

Tolerance Data

Between Conditions Tolerance Data. The tolerance data were collated according to condition and heat test and the means are provided in Figure 10. Contrary to predictions, the majority of conditions showed decreased heat tolerance from Baseline to Post-Rule, with the exception of Pliance/Subjectivity, who showed only a marginal increase. In short, the rules were associated with decreases, rather than increases, in heat tolerance.

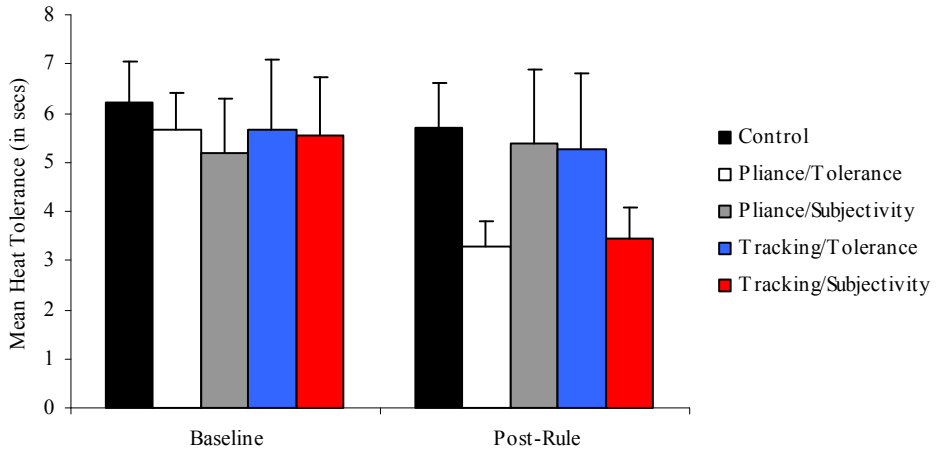

Figure 10. Heat tolerance means for each condition across heat tests in Experiment 5.

Surprisingly, a 5x2 mixed between-within ANOVA with condition as the between participant variable and heat test as the within participant variable found a significant main effect for heat test [$F (1, 35) = 7.071$, $p = 0.012$, $\eta_p^2 = 0.168$], but not for condition and no interaction effect (both p's > 0.181).

Planned Within Conditions Tolerance Data. Five repeated measures t-tests were conducted (one per condition) to determine the size of change (if any) in heat tolerance across the heat tests. Only Pliance/Tolerance showed a significant decrease [$t (7) = 3.523$, $p = 0.010$, $\eta_p^2 = 0.639$], although the decrease for Tracking/Subjectivity approached significance [$t (7) = 2.336$, $p = 0.052$, $\eta_p^2 = 0.438$], all other p's > 0.656.

Distress Ratings

Participants were required to rate their Sensation, Unpleasantness and Pain after each heat test and the results were collated according to condition and test (graphs and further analyses are only presented if significant main effects are obtained).

Sensation. The sensation ratings indicated little change across heat tests (see Figure 11). A 5x2 mixed between-within ANOVA revealed a near significant main effect for heat test [$F(1, 35) = 4.098$, $p = 0.051$, $\eta_p^2 = 0.105$], but not for condition and no interaction effect (both p's > 0.576). Five repeated measures t-tests (one per condition) indicated a significant increase only for Tracking/Tolerance [$t(7) = 2.646$, $p = 0.033$, $\eta_p^2 = 0.500$], (all other p's > 0.636).

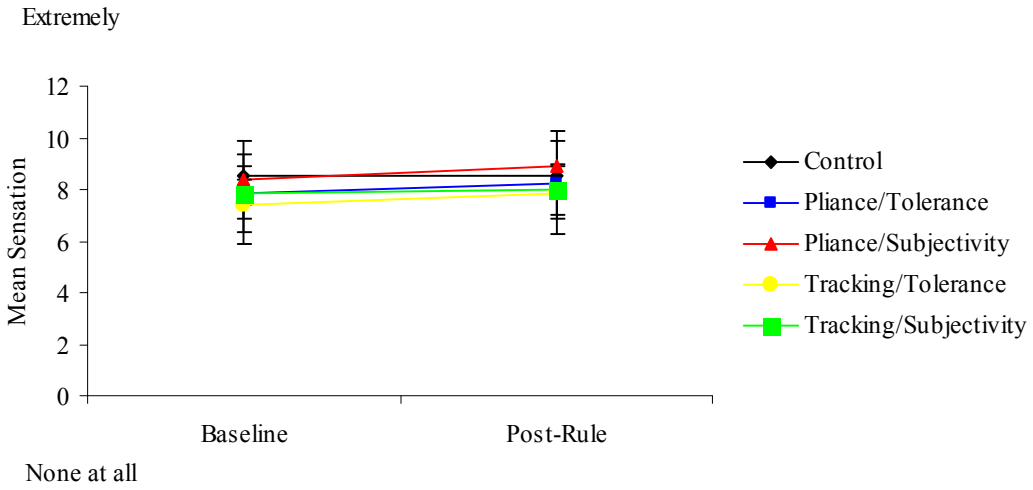

Figure 11. Mean sensation ratings for each condition across heat tests in Experiment 5.

Unpleasantness. There were little changes in the Unpleasantness ratings recorded across heat tests for all conditions. A 5x2 mixed between-within ANOVA revealed no significant main or interaction effects (all p's > 0.178).

Pain. All five conditions showed marginally increased pain ratings from Baseline to Post-Rule (see Figure 12). A 5x2 mixed between-within ANOVA revealed a significant main effect for heat test [$F(1, 35) = 8.161$, $p = 0.007$, $\eta_p^2 = 0.189$], but not for condition and no interaction effect (both p's > 0.207). Five repeated measures t-tests (one per

condition) indicated that the increase for Tracking/Tolerance approached significance [t (7) = 2.049, p = 0.080, $\eta_p^2 = 0.374$], all other p's > 0.195.

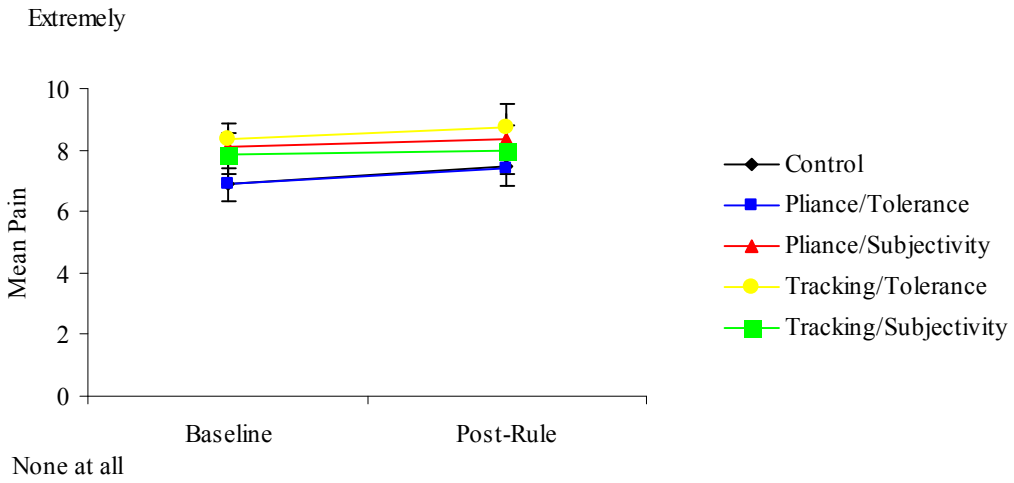

Figure 12. Mean pain ratings for each condition across heat tests in Experiment 5.

Adherence Data

The adherence data, collated by condition, are presented in Table 14. Participants did not feel strong pressure to use the rules (Table 14, first line), although they indicated greater than 50% use of same (second line). The conditions did not appear to differ in either regard and two one-way between groups ANOVAs (one per question) indicated that condition was not significant (both p's > 0.10). Interestingly, however, the conditions varied considerably in the extent to which they reported their rules as useful (third line). Pliance/Tolerance and Tracking/Subjectivity reported their rules as least useful. A one-way between groups ANOVA indicated that condition was highly significant [F (4, 35) = 3.709, p = 0.013, $\eta_p^2 = 0.297$]. Post-hoc analyses (Scheffe's) indicated significant differences between: Control and Pliance/Tolerance (p = 0.05); and between Control and

Tracking/Subjectivity (p = 0.05). The majority of participants reported their overall level of pain as considerable, with highest ratings in Pliance/Subjectivity and Tracking/Tolerance (bottom line). A one-way between groups ANOVA indicated that condition approached significance [F (4, 35) = 2.207, p = 0.088, $\eta_p^2 = 0.201$], but post-hoc tests revealed no significant differences (all p's > 0.374). Almost all participants indicated willingness to participate further and a one-way between groups ANOVA indicated that condition was not significant (p = 0.421).

Table 14
Adherence Question Means and Significance Values across Conditions in Experiment 5.

Adherence Question	**Condition**					**Sig**
	Control	*Pliance/ Tolerance*	*Pliance/ Subjectivity*	*Tracking/ Tolerance*	*Tracking/ Subjectivity*	
Ranging from O (Not at all) to 10 (Extremely)						
Pressure to Use Rules	-	4.25	2.88	5.56	3.13	p = 0.10
Rule Use	-	6.0	7.38	6.5	5.0	p = 0.29
Usefulness of Rules	7.38	4.63	6.13	5.5	4.63	p = 0.01
Overall Pain	6.38	6.13	7.75	7.75	6.0	p = 0.09
Rated as Yes/No						
Willingness to Participate Further	Yes 87.5%	Yes 100%	Yes 100%	Yes 100%	Yes 100%	p = 0.42

- Indicates that specific adherence questions did not apply.

Results Summary

The five conditions did not differ significantly on a range of pre-experimental measures, hence these variables could not account for subsequent potential differences in heat tolerance. Contrary to experimental predictions, the majority of conditions showed decreased heat tolerance from Baseline to Post-Rule. This decrease was significant for Pliance/Tolerance and approached significance for Tracking/Subjectivity. Only

Pliance/Subjectivity showed an increase in tolerance Post-Rule, but this was not significant. Although the adherence data indicated that all conditions reported relatively high levels of overall experimental pain, the tolerance changes could not be attributed to significant changes in the sensation, unpleasantness or pain associated with the heat tests. Only participants in the Tracking/Tolerance condition reported significant increases in both pain and sensation. While all conditions showed around 50% adherence to the experimental rules, participants in Control rated their strategy as significantly more useful than both Pliance/Tolerance and Tracking/Subjectivity (indeed, these had been the only two conditions associated with tolerance decreases). All conditions showed high levels of willingness for further participation.

DISCUSSION

Experiment 5 attempted to investigate the pliance/tracking distinction in the context of radiant heat pain induction, using the experimental design and manipulations reported by Hayes and Wolf (1984). In spite of the strong methodological similarities between the two studies, four of the five conditions in Experiment 5 showed tolerance decreases, with only a marginal tolerance increase reported in the Pliance/Subjectivity condition.

One issue that appeared to contribute to these weak effects was the continuous presence of the Experimenter, a variable to which we had been sensitised in the previous chapter, although this had not been of concern to Hayes and Wolf (1984). In order to address this issue, Experiment 6 replicated Experiment 5, but the Experimenter was not present at any point.

EXPERIMENT 6

METHOD

Participants

Fifty-one participants were recruited for Experiment 6. Eleven were removed according to the exclusion criteria outlined previously, leaving a sample of 40 for full participation and analyses. The participating sample were all aged between 18 and 24 years old (mean=20 years) and comprised of 20 males and 20 females. All were undergraduate students at NUIM selected from a list of potential volunteers thereafter contacted directly by the Experimenter. Each participant was assigned to one of five experimental conditions based on their Baseline heat tolerance, with eight per condition.

Setting and Materials

The setting and materials were identical to the previous study, except that the Experimenter was not present in the room at any point for any condition.

Apparatus

The computer in the Observation Room controlled the heat apparatus in the experimental room. That is, unlike the previous study, participants' use of the buzzer box now signalled the Experimenter in the Observation Room. All other aspects of the apparatus were identical to Experiment 5.

Procedure

All aspects of the procedure were identical to Experiment 5, except that participants completed all heat tests alone.

RESULTS

Psychological Measures

The outcomes on each of the psychological measures were analysed according to condition and the mean scores for each are presented in Table 15. All participants scored within the normal range for each measure. Four separate one-way between-groups ANOVAs indicated a non-significant effect for condition on each measure (all p's > 0.340).

Table 15
The Means and Standard Deviations per Condition on the Psychological Measures in Experiment 6.

Conditions	**Psychological Measures**			
	AAQ (50.55)	*FPQ* (78.20)	*DASS* (38.00)	*BIDR* (11.75)
Control	49.38	85.00	8.50	9.50
SD	7.93	15.89	5.07	3.34
Pliance/Tolerance	49.38	85.63	8.63	7.75
SD	3.46	12.14	5.32	5.29
Pliance/Subjectivity	55.88	81.75	8.25	11.88
SD	5.33	15.80	7.03	5.19
Tracking/Tolerance	50.38	86.63	11.25	8.50
SD	9.10	17.88	4.62	4.38
Tracking/Subjectivity	50.63	78.00	11.00	11.00
SD	10.61	14.55	8.33	3.82
Overall Means:	**51.13**	**83.40**	**9.53**	**9.73**
Overall SD	**7.72**	**17.44**	**6.05**	**4.51**

* The figure in brackets indicates the norm for each measure.

Tolerance Data

Between Conditions Tolerance Data. The tolerance data were collated by condition and heat test and the means are provided in Figure 13. Pliance/Tolerance and Pliance/Subjectivity showed an increase in heat tolerance at Post-Rule, while Tracking/Tolerance, Tracking/Subjective and Control showed decreases in heat tolerance. A 5x2 mixed between-within ANOVA with condition as the between participant variable and heat test as the within participant variable found no significant main or interaction effects (all p's > 0.639).

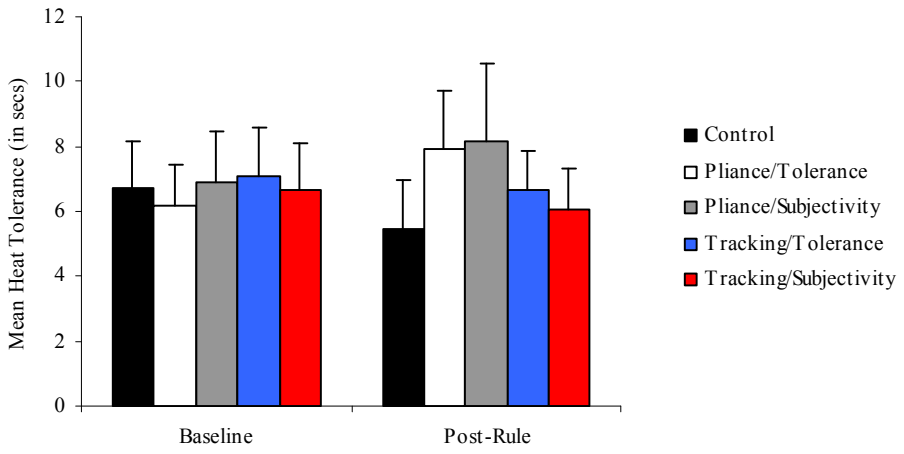

Figure 13. Heat tolerance means for each condition across heat tests in Experiment 6.

Distress Ratings

Sensation. The sensation ratings indicated some changes across the two heat tests (see Figure 14). Specifically, while the sensation rating of Control remained the same, Pliance/Subjectivity, Tracking/Subjectivity and Tracking/Tolerance decreased and Pliance/Tolerance was the only condition to report increased sensation at Post-Rule. A 5x2

mixed between-within ANOVA revealed a near significant main effect for heat test [F (1, 35) = 3.170, p = 0.084, η_p^2 = 0.083], but no effect for condition and no interaction effect (both p's > 0.576).

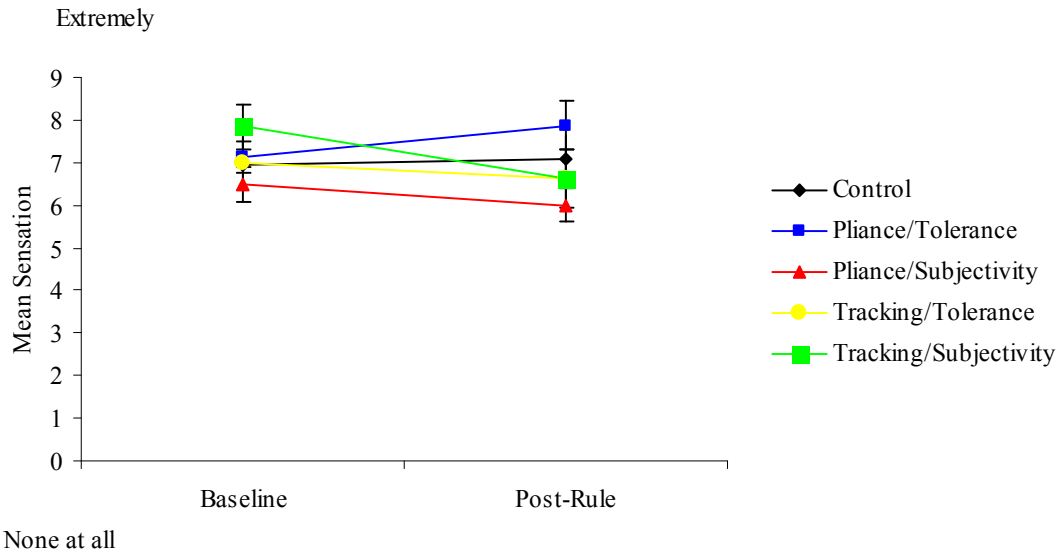

Figure 14. Mean sensation ratings for each condition across heat tests in Experiment 6.

Five repeated measures t-tests were conducted separately (one per condition) to determine the change in sensation ratings (if any) across heat tests. Pliance/Tolerance showed a significant increase in sensation from Baseline to Post-Rule [t (7) = 2.393, p = 0.048, η_p^2 = 0.500], while Tracking/Subjectivity showed a significant decrease [t (7) = 2.758, p = 0.028, η_p^2 = 0.520]. No significant differences were observed for any other condition (all p's > 0.170).

Unpleasantness. There were some changes in the unpleasantness ratings recorded across heat tests (see Figure 15). Pliance/Subjectivity produced stable ratings of unpleasantness, while Control, Tracking/Tolerance and Tracking/Subjectivity all showed

decreased unpleasantness. Only Pliance/Tolerance reported increases. A 5x2 mixed between-within ANOVA indicated no significant main effects for heat test or condition (both p's > 0.474), but the interaction effect was significant [F (4, 35) = 2.895 , p = 0.036, $\eta_p^2 = 0.249$].

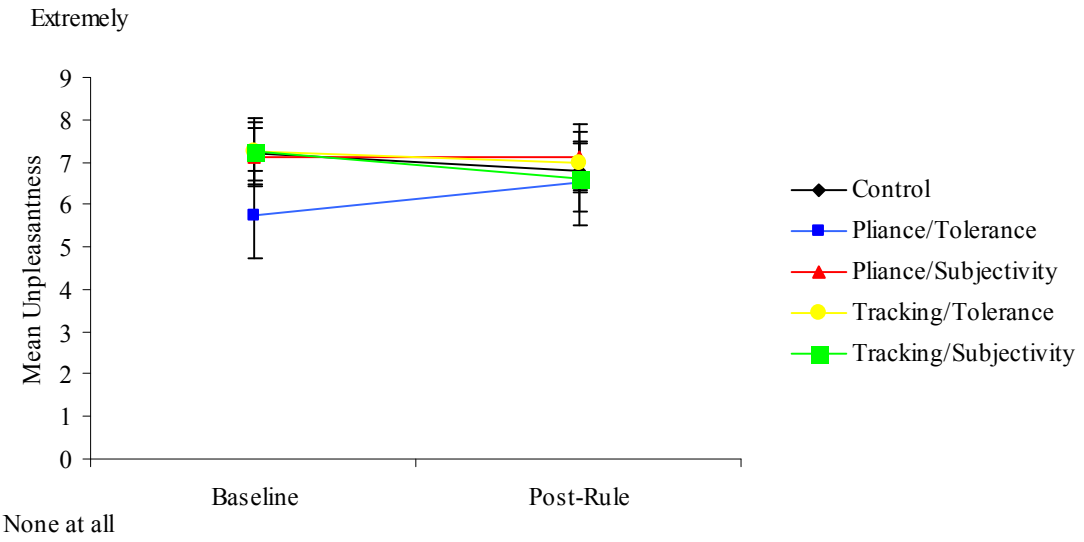

Figure 15. Mean unpleasantness ratings for each condition across heat tests in Experiment 6.

Five repeated measures t-tests were conducted (one per condition) to determine the change in unpleasantness (if any) across heat tests. The decrease from Baseline to Post-Rule for Control approached significance [t (7) = 2.049, p = 0.080, $\eta_p^2 = 0.375$], but there were no significant differences for any other condition (all p's > 0.174).

Pain. There were little or no changes in the Pain ratings across conditions or tests. A 5x2 mixed between-within ANOVA indicated no significant main or interaction effects (all p's > 0.498).

Adherence Data

The adherence data, collated by condition, are presented in Table 16. Participants did not feel strong pressure to use the rules (Table 16, top line), although most (except Tracking/Subjectivity) reported greater than 50% levels of use of same (second line). Two one-way between groups ANOVAs (one per question) indicated that condition was not significant (both p's > 0.163). Interestingly, however, the conditions varied considerably in the extent to which they reported their rules as useful (third line). Tracking/Tolerance and Tracking/Subjectivity reported their rules as least useful. A one-way between groups ANOVA indicated that condition was highly significant [$F(4, 35) = 3.895$, $p = 0.010$, $\eta_p^2 = 0.308$]. Post-hoc analyses (Scheffe's) indicated significant differences between: Control and Tracking/Tolerance ($p = 0.031$).

Table 16
Adherence Questions Means and Significance Across Conditions in Experiment 6.

Adherence Question	**Conditions**					**Sig**
	Control	*Pliance/ Tolerance*	*Pliance/ Subjectivity*	*Tracking/ Tolerance*	*Tracking/ Subjectivity*	
Ranging from O (Not at all) to 10 (Extremely)						
Pressure to Use Rules	-	4.25	2.88	5.56	3.13	p = 0.16
Rule Use	-	5.25	6.38	5.94	4.13	p = 0.32
Usefulness of Rules	7.06	5.25	6.38	3.31	4.38	p = 0.01
Overall Pain	5.94	5.50	7.25	6.75	5.75	p = 0.39
Rated as Yes/No						
Willingness to Participate Further	Yes 100%	Yes 100%	Yes 100%	Yes 100%	Yes 75%	p = 0.07

- Indicates that specific adherence questions did not apply.

The majority of participants (with the exception of Pliance/Subjectivity and Tracking/Tolerance) rated their overall pain as not considerable (fourth line). A one-way between groups ANOVAs indicated that condition was not significant ($p = 0.388$). While participants in four conditions indicated strong willingness to participate further, only 75% of Tracking/Subjectivity were willing. On a one-way ANOVA, condition approached significance [$F(4, 35) = 2.333$, $p = 0.075$, $\eta_p^2 = 0.210$], although post-hoc tests (Scheffe's) showed no significant differences (all p's = 0.236).

Results Summary

Once again, the conditions did not differ on the pre-experimental measures. Only the Pliance (Tolerance and Subjectivity) conditions showed an increase in heat tolerance at Post-Rule, all other conditions showed tolerance decreases. However, none of these differences were significant. On the distress ratings, Pliance/Tolerance showed a significant increase in reported sensation and Tracking/Subjectivity reported a significant decrease. The decrease in reported unpleasantness for Control approached significance. Again, adherence to the rules was in the region of 50%, but there were differences in reports of how useful they were. Control rated their strategy as significantly more useful than Tracking/Tolerance. Four conditions indicated strong willingness to participate further, except for Tracking/Subjectivity and the effect for condition approached significance.

DISCUSSION

Although recent concerns with the cold pressor task directed the current research

towards the use of radiant heat apparatus for the induction of experimental pain, the over-riding aim of Experiments 5 and 6 was to replicate the previous work by Hayes and Wolf (1984) who had reported a strong pliance/tracking distinction. That is, pliance was associated with significant pain tolerance increases, tracking was not. In spite of the methodological overlap between this original research and Experiment 5, the latter reported that three of the four rule conditions (and Control) were associated with reductions, rather than increases, in radiant heat tolerance. Interestingly, only the Pliance/Subjectivity condition reported a tolerance increase, although this was not significant from pre- to post-rule.

The presence of the experimenter has become a growing concern in clinical analogue studies in the years since Hayes and Wolf (1984) conducted their research (e.g. Roche, Forsyth, & Maher, 2007). Indeed, although one would assume that the presence of the Experimenter would enhance pliance effects (and thus may have contributed to Hayes and Wolf's positive outcomes), our data from the previous studies indicated that the influence of this variable may not be straight forward. Experiment 6 attempted to address this issue by replicating the previous study, but by removing the Experimenter from all conditions. Indeed, the data from the second study did suggest that the original outcomes were influenced to some extent by this variable when a stronger distinction emerged between the Pliance and Tracking conditions. Specifically, pliance was associated with tolerance increases and tracking was associated with tolerance decreases.

The clinical-experimental literature has recently witnessed strong growth in the area of analogue studies (e.g. Hayes, Bisset, Korn, Zettle, Rosenfarb et al., 1999). The majority of these have attempted to analogue therapeutic interactions by isolating specific

components and delivering them as brief experimental interventions (including, for example, the use of metaphor). On the whole, the majority of studies have reported positive experimental outcomes with these interventions, including increases in tolerance of brief electric shock, radiant heat pain and the Carbon Dioxide (CO^2) challenge. The use of acceptance-based interventions has been a particularly strong vein in this area and has of course been driven by growing reports of positive clinical outcomes using acceptance-based therapies (e.g. Acceptance and Commitment Therapy, ACT). Kehoe (2008), for example, reported strong radiant heat tolerance increases after brief automated acceptance-based interventions. Indeed, the automated delivery of the interventions in this study offered a potentially useful contribution to our understanding of the role of the experimenter in analogue outcomes. In fact, several researchers have argued that the automation of intervention delivery (or at the very least the absence of the experimenter) is a gold standard feature for future analogue research (Johnson, Stewart, Barnes-Holmes, Barnes-Holmes, Luciano et al., 2004).

Interestingly however, there has been only one published study to date that has attempted to compare the relative utility of analogue interventions vs. analogue rules. McMullen, Barnes-Holmes, Barnes-Holmes, Stewart, Luciano et al. (2008) systematically compared acceptance-based rules vs. interventions in the context of electric shock. Although both were associated with tolerance increases, the effects for the interventions were not surprisingly greater than those recorded for rules. One of the key aims of the experiments reported in the next chapter of the current thesis was to examine the relative impact of interventions and rules on radiant heat tolerance and to investigate the possible influence of the pliance/tracking distinction in such a context.

Chapter 4

Comparing Rules and Therapeutic Interventions for Coping with Radiant Heat

Experiments 7 and 8

Chapter 4

Comparing Rules and Therapeutic Interventions for Coping with Radiant Heat

Experiments 7 and 8

In one of the most comprehensive studies of acceptance-based interventions, Kehoe (2008) compared the relative utility of automated acceptance, distraction and placebo interventions on tolerance of radiant heat pain. All five studies consistently demonstrated that Acceptance was associated with a significant increase in heat tolerance. Distraction and Placebo were not. As well as providing clear evidence of the utility of acceptance, the research demonstrated the role of specific intervention components (including enhancing experimental values and using metaphor) that appear to have been influential on experimental adherence. This research was also the first to employ analogue interventions in the context of the radiant heat apparatus.

Only one published study to date has systematically compared analogue interventions with analogue rules (McMullen et al., 2008). In the context of brief electric shock, these researchers compared automated acceptance-based rules vs. interventions and distraction-based rules vs. interventions, while also incorporating a Placebo (no instruction) condition. The interventions were largely similar to those employed by Kehoe (2008), while the rules were abbreviated versions of same. The results indicated that only acceptance was associated with significant tolerance increases and the intervention was more effective than the rule in this regard (this was also the case for Distraction).

One of the key aims of the two experiments reported in the current chapter was to examine the relative impact of interventions vs. rules on radiant heat tolerance. Experiment 7 employed a 2 x 2 design that manipulated acceptance vs. placebo and intervention vs. rule. In line with existing evidence, we predicted that acceptance would be associated with tolerance increases, while Placebo would not. Furthermore, we anticipated that the acceptance intervention would likely be more effective than the rule. Although the findings indeed demonstrated that both Placebo conditions were associated with tolerance decreases, the outcomes for Acceptance were not as expected. Specifically, the Acceptance Intervention resulted in marginal tolerance decreases, while the Acceptance Rule produced only marginal tolerance increases.

In line with our previous attempts to distinguish between pliance and tracking, the final Experiment 8 compared acceptance interventions and rules in pliance vs. tracking contexts to determine what impact this might have on tolerance and whether previous findings might be accounted for with this variable. Indeed, the data from Experiment 8 supported this suggestion when pliance was associated with greater tolerance increases than tracking and the intervention overall produced better tolerance than the rule.

EXPERIMENT 7

METHOD

Participants

Forty-seven participants were recruited for Experiment 7. Fifteen were removed according to the exclusion criteria (outlined in Chapter 3), leaving a sample of 32 for full participation and analyses. The participating sample were all aged between 17 and 25 years old (mean=19.1 years) and comprised 16 males and 16 females. All were undergraduate students at NUIM selected from a list of potential volunteers thereafter contacted directly by the Experimenter. Each participant was assigned to one of four experimental conditions (eight per condition) based on their Baseline heat tolerance (see Table 17).

Table 17
An Overview of the Four Conditions in Experiment 7.

Experimental Conditions			
Acceptance		*Placebo*	
Intervention	Rule	Intervention	Rule

Setting, Apparatus and Materials

All aspects of the setting, apparatus and materials were identical to Experiment 6, with several exceptions. (1) The computer in the Observation Room now controlled the computer in the Experimental Room by way of a KMV 2-way switch box. (2) In the VAS ratings, participants now rated Discomfort (0: None to 10: Very Much) and Anxiety (0: None to 10: Very Much), as well as Pain (see Appendix XX). (3) A computer program, written in Visual Basic (VB, Version 6), controlled the delivery of the video clip

interventions and rules. (4) Participants in the Acceptance conditions (Acceptance Intervention and Acceptance Rule) were exposed to adherence measures of their use and understanding of the strategy at Post-Intervention/Rule (see Table 18). This comprised three acceptance-based statements (e.g. "Notice any thoughts and feelings about pain or about a pleasant scene and continue with the task") and three distraction-based statements (e.g. "Try to get rid of your thoughts and feelings about pain by thinking of something else") statements, against which participants rated their level of usage in the previous heat test (0: Not at All to 8: All of the Time). The post-experimental adherence measures employed here included a question on: use of the target strategy in everyday life (0: Not at All to 10: Very Much); strategy use during the heat tests; strategy usefulness; overall level of pain; and willingness to participate in a further heat test.

Table 18
The Adherence Measures Employed in Experiment 7.

Adherence Measures
Post-Intervention/Rule Adherence Measures
3 Acceptance Statements
3 Distraction Statements
Post-Experimental Adherence Measures
3 Acceptance Statements
3 Distraction Statements
Strategy Use in Daily Life
Use of Strategy
Usefulness of Strategy
Overall Pain
Willingness

Experimental Overview

As before, Stage 1 of the current research comprised the consent form, medical screening questionnaire, EHI and psychological measures (see Figure 16). Stage 2 involved the Baseline heat test and distress ratings. In Stage 3, participants were exposed to the video interventions/rules. Stage 4 comprised the Post-Intervention/Rule heat test and distress ratings, followed by the Post-Intervention/Rule adherence measures (Acceptance participants only) to assess their use of acceptance at this point. Stage 5 provided participants with a brief automated reminder of the core intervention/rule or placebo message. In Stage 6, participants completed the Post-Reminder heat test and distress ratings. Finally, Stage 7 comprised the post-experimental adherence measures.

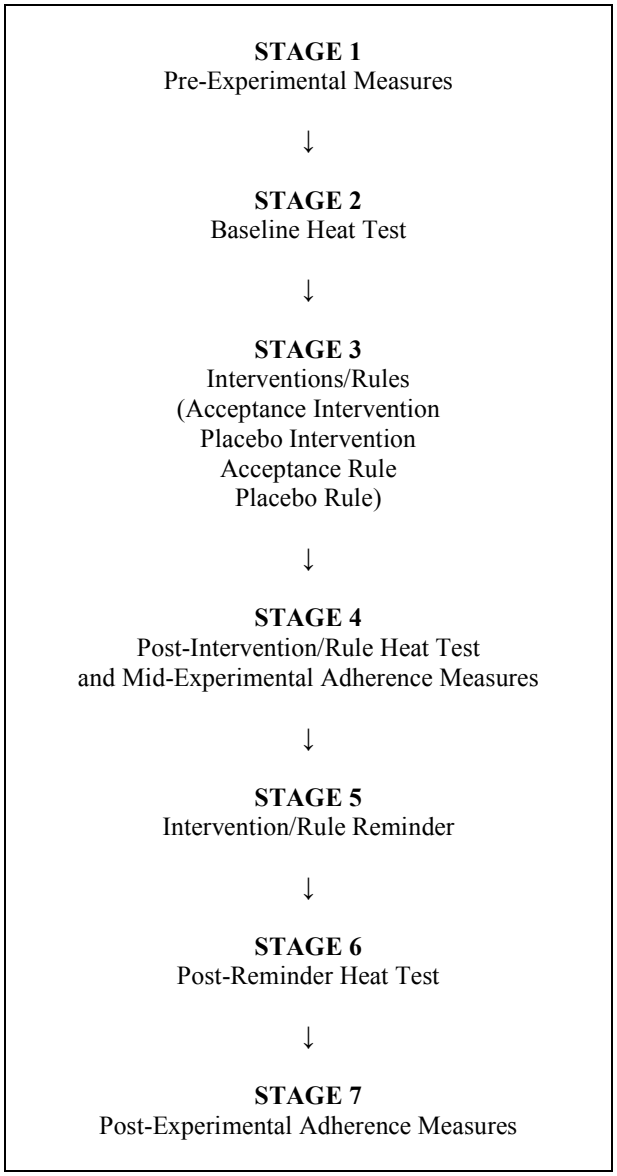

Figure 16. An overview of the experimental sequence in Experiment 7.

Procedure

Participation for each individual lasted approximately 50min.

Stages 1 and 2: Pre-Experimental Measures and Pre-Intervention Heat Test. Stages 1 and 2 were identical to Experiment 6, except that participants now provided VAS ratings of Discomfort, Pain and Anxiety.

Stage 3: Interventions/Rules. All participants were assigned to one of four conditions. The two *intervention* conditions (Acceptance Intervention and Placebo Intervention) each comprised a series of five automated clips, while the two *rule* conditions (Acceptance Rule and Placebo Rule) comprised a short printed passage, followed by one automated clip. The content of all four conditions was matched for length of required time taken to complete.

The *Acceptance Intervention* was specifically designed to provide participants with considerable exposure to therapeutic components often employed to facilitate acceptance. Specifically, the clips presented here encouraged participants to notice pain-related thoughts and feelings, without permitting either of these to control overt action.

The first clip of the acceptance intervention presented a Cards Exercise in which participants were encouraged to identify specific pain-related thoughts from the previous heat test and write them on separate pieces of card. This was presented 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.

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

> 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).
>
> (30sec. pause)
>
> *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).
>
> (20sec. pause)

In the third acceptance clip, participants were presented with the second part of the Walking Exercise in which they were instructed to walk around the room holding one of the cards containing a pain-related thought. Participants were also encouraged to note that thoughts about pain and pleasant imagery could occur *at the same time*, hence neither one needs to have greater hold over actions than the other. These instructions were 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, 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.

The third part of the Walking Exercise then explicitly drew an analogy between the Walking Exercise and the heat test as follows:

> 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.

The fourth 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 noticing 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 the same way that you can embrace all the horrible thoughts and feelings that show up while crossing the swamp, you could embrace all the negative thoughts that show up during the heat task. Notice all the thoughts that show up while you perform the pain task and carry them with you, because you can have whatever thoughts and act differently to what you think or feel.

The fifth acceptance clip further emphasised the analogy between the Swamp Metaphor and the heat test 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 that you want. You should think of the heat in this part of the study as being like the discomfort that stands in your way.

Although the Placebo and Acceptance interventions were matched in length and both were presented as a series of video clips, the clips for the *Placebo Intervention* contained content that was entirely geographical in nature (i.e. about birds) and thus made no mention of therapeutic components or the heat tests. The full content of the Placebo Intervention is provided in Appendix XXI.

The aim of the *Acceptance Rule* condition was to expose participants to acceptance, but only in the form of a brief rule (rather than as a more detailed intervention). However, in order to control for the length of time it would take participants to procede though the

full Acceptance Intervention (approx. 20mins.), participants in the Acceptance Rule were first provided with a placebo-like passage (see Appendix XXII). Thereafter, a short video clip summarised rule-based acceptance as follows:

> Research shows that the best way to succeed with the task is simply to accept that the heat is going to be unpleasant and there is nothing you can do to reduce the pain it causes you. In other words, simply accept that the heat is going to hurt and continue with the task for as long as possible.

The *Placebo Rule* was preceded by the placebo-like passage. Thereafter, however, participants were presented a brief rule about attending to the heat task (i.e. containing no therapeutic component) as follows:

> Research shows that the best way to succeed with the task is simply to pay close attention to the task. Paying close attention to the heat task will be correlated with your performance on the task. Specifically, the closer you attend to the task, the better will be your performance.

Stage 4: Post-Intervention/Rule Heat Test. The Post-Intervention/Rule heat test was identical to Stage 2, but was also accompanied by Post-Intervention/Rule adherence questions to determine whether participants (Acceptance only) had employed the strategy they had been given during the previous heat test.

Stage 5: Intervention/Rule Reminder. In Stage 5, all participants were presented with a brief reminder video clip of the intervention/rule they had been given in Stage 4. The reminder presented to participants in the Acceptance Intervention condition contained the following:

> Remember the heat is like the discomfort that appears to stand in the way of something you really want. You can keep performing the task 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 presented to participants in the Acceptance Rule condition contained the following:

> Remember the best way to succeed with the task is simply to accept that the heat is going to be unpleasant and there is nothing you can do to reduce the pain it causes you. In other words, simply accept that the heat is going to hurt and continue with the task for as long as possible.

Consistent with the placebo intervention, participants in this condition were simply presented with additional geographical information (see Appendix XXI). In contrast, the reminder presented to participants in the Placebo Rule condition contained the following:

> Remember the best way to succeed with the task is simply to pay close attention to the task. Paying close attention to the heat task will be correlated with your performance on the task. Specifically, the closer you attend to the task, the better will be your performance.

Stage 6: Post-Reminder Heat Test. The Post-Reminder heat test was identical to Stage 2 and was designed to determine the potential utility of the reminders in bolstering the possible impact of the interventions/rules.

Stage 7: Post-Experimental Adherence Measures. Stage 7 comprised the post-experimental adherence measures, designed to assess participants (Acceptance only) *overall* use of the target interventions/rules. The completion of the post-experimental adherence measures marked the end of participation for all.

RESULTS

Psychological Measures

The outcomes on each of the psychological measures were analysed according to condition and the mean scores for each are presented in Table 19. All participants scored within the normal range on all measures. Four separate one-way between-groups ANOVAs indicated a non-significant effect for condition on each measure (all p's > 0.184).

Table 19
The Means and Standard Deviations for Each Condition on the Psychological Measures in Experiment 7.

Condition	**Psychological Measures**			
	AAQ *(50.55)*	*FPQ* (78.20)	*DASS* (38.00)	*BIDR* (11.75)
Acceptance Intervention	53.13	90.35	9.75	8.63
SD	5.14	25.55	7.83	4.78
Placebo Intervention	54.50	83.25	12.63	8.13
SD	10.54	9.36	12.85	3.48
Acceptance Rule	57.88	84.00	13.13	9.63
SD	1.73	11.31	6.24	1.92
Placebo Rule	50.50	92.75	9.75	11.25
SD	5.83	20.84	4.68	5.68
Overall Means:	**54.00**	**87.56**	**11.31**	**9.41**
Overall SD	**6.83**	**17.64**	**8.21**	**4.18**

* The figure in brackets indicates the norm for each measure.

Tolerance Data

Between Conditions Tolerance Data. The tolerance data were collated according to condition and heat test and the means are provided in Figure 17. Acceptance Intervention showed a decrease in tolerance at Post-Intervention, which returned to baseline levels at Post-Reminder. In contrast, Acceptance Rule showed increased tolerance at Post-Rule, with a small decrease at Post-Reminder. Both Placebo Intervention and Placebo Rule showed decreased tolerance at Post-Intervention/Rule and again at Post-Reminder. A 4x3 mixed between-within ANOVA with condition as the between participant variable and heat test as the within participant variable found no significant main or interaction effects (all p's > 0.354).

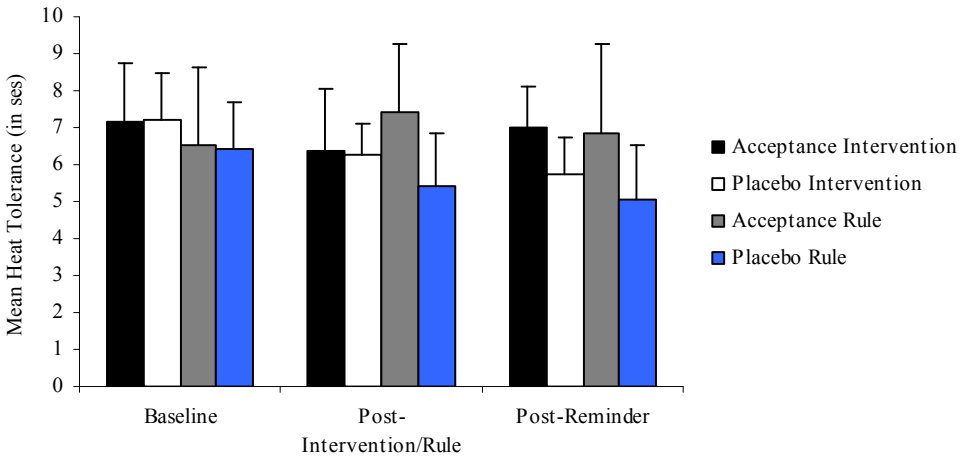

Figure 17. Heat tolerance means for each intervention across heat tests in Experiment 7.

Distress Ratings

There were little or no changes in the Discomfort, Pain or Anxiety ratings across conditions and heat tests and three 4x3 mixed between-within ANOVAs indicated that all main and interaction effects were non-significant on all three distress ratings (all p's > 0.158).

Adherence Data

The adherence data, collated by condition, are presented in Table 20. As would be expected, greater use of acceptance was associated with Acceptance Intervention, compared to Acceptance Rule at Post-Intervention and Post-Reminder (Table 20, first and second line). Nonetheless, two independent samples t-tests indicated that the conditions did not differ significantly (both p's > 0.361).

In addition, participants in all both acceptance conditions were also asked some general questions about the strategy they had been given (i.e. daily use, use in heat tests)

and two independent samples t-tests confirmed that the differences were not significant for both questions (both p's > 0.303).

Consistent with greater understanding and use of acceptance by the Intervention group relative to the Rule group, the former also rated the intervention as more useful (fifth line). Indeed, an independent samples t-test indicated that the difference between the conditions was highly significant [t (14) = 3.523, p = 0.009, $\eta_p^2 = 0.391$].

All four conditions were asked to rate the overall level of pain they experienced during the experiment (sixth line) and also their willingness to experience another heat test (seventh line). Two one-way ANOVAs revealed no significant effects for condition for either question (both p's > 0.141).

Table 20
The Mean Adherence Scores and Significance Values Across Conditions in Experiment 7.

Adherence Question	**Intervention/Rule**				**Sig**
	Acceptance Intervention	*Placebo Intervention*	*Acceptance Rule*	*Placebo Rule*	
Post-Intervention/Rule Adherence Question					
Use of Acceptance at Post-Intervention/Rule	15.00	-	12.38	-	0.41
Post-Experimental Adherence Questions					
Use of Acceptance at Post-Reminder	15.75	-	13.50	-	0.36
Strategy Use in Everyday Life	4.53	-	3.98	-	0.73
Use of Strategy	6.06	-	4.73	-	0.30
Usefulness of Intervention/Rule	7.21	-	4.18	-	0.01
Overall Level of Pain	6.16	5.53	6.13	5.60	0.17
Rated as Yes/No					
Willingness to Participate Further	Yes 87.5%	Yes 87.5%	Yes 87.5%	Yes 100%	0.14

Results Summary

Again, the conditions did not differ on pre-experimental measures. As expected, both Placebo conditions showed decreased tolerance across tests. However, this was also the case for Acceptance Intervention at Post-Intervention. Nonetheless, for this latter group tolerance returned to baseline levels at Post-Reminder. Acceptance Rule was the only condition to show increased tolerance at Post-Rule. While this group also recorded a small tolerance decrease at Post-Reminder, this was not a return to baseline levels. None of these changes were significant, nor could they be accounted for by significant changes in any of the subjective ratings. At both adherence points, Acceptance Intervention appeared to show greater use of acceptance than Acceptance Rule and this was also the case when they rated their own levels of overall strategy use. None of these differences were significant. Acceptance Intervention also rated their intervention as significantly more useful than Acceptance Rule. All conditions reported moderate levels of overall pain and high levels of willingness for further participation.

DISCUSSION

Experiment 7 compared acceptance-based vs. placebo-based interventions and rules. Although the results were partly consistent with predictions when both Placebo conditions were associated with tolerance decreases, the outcomes for Acceptance were not as expected. Specifically, the Acceptance Intervention resulted in marginal tolerance decreases, while the Acceptance Rule produced only marginal tolerance increases. As well as demonstrating inconsistencies with current predictions, these outcomes were contrary to

those reported previously by Kehoe (2008) who had shown significant tolerance increases after the acceptance intervention.

The finding of a more positive outcome for the Acceptance Rule compared with the Acceptance Intervention was also contrary to previous evidence (McMullen et al., 2008). However, closer inspection of the experimental instructions and methodologies of Experiment 7 compared with the two previous studies suggested an interesting possibility that allowed us to re-investigate the potential distinction between pliance and tracking. Specifically, both previous studies required participants to write down brief summaries of what they had learned from each video clip contained within the interventions. However, this methodological feature had not been incorporated into Experiment 7 during some streamlining of the procedure. As a result, one might argue that these written summaries functioned in a manner similar to pliance, thus perhaps explaining why the Pliance conditions in Experiment 7 actually decreased, rather than increased, tolerance. In order to address this issue, Experiment 8 compared acceptance intervention and rules in pliance vs. tracking contexts.

EXPERIMENT 8

METHOD

Participants

Fifty participants were recruited for Experiment 8. Eighteen were removed according to the exclusion criteria, leaving a sample of 32 for full participation and analyses. The participating sample were aged between 17 and 27 years old (mean=21 years) and comprised 16 males and 16 females. All were undergraduate students at NUIM selected from a list of potential volunteers, thereafter contacted directly by the Experimenter. Each participant was assigned to one of four experimental conditions (eight per condition) based on their Baseline heat tolerance (see Table 21).

Table 21
An Overview of the Four Conditions in Experiment 8.

Experimental Conditions			
Pliance		*Tracking*	
Intervention	Rule	Intervention	Rule

Setting, Apparatus and Materials

The setting, apparatus and materials were identical to Experiment 7, except for a video camera used in the Pliance conditions.

Procedure

The basic experimental sequence employed in Experiment 8 was identical to the previous study, except for the pliance/tracking components. Participation for each individual lasted approximately 50min.

Stage 1 and Stage 2: Pre-Experimental Measures and Baseline Heat Test. Stages 1 and 2 were identical to these stages in Experiment 7.

Stage 3: Interventions/Rules. The acceptance-based interventions and rules that comprised Stage 3 here were identical to the previous study. In order to manipulate pliance vs. tracking, however, all participants received additional pre-intervention/rule instructions. It is important to note that in the Pliance conditions only, the Experimenter placed the video camera beside participants at this point in the procedure. All participants were instructed as follows:

> There are two strategies that have been found to increase people's tolerance of pain.
>
> One strategy is commonly known as Acceptance. And what this involves is simply letting yourself *accept the* thoughts and feelings that you might have. The key message is that you can have thoughts and feelings about pain and still do the task to the best of your ability.
>
> The other strategy that appears to increase people's tolerance of pain is commonly known as Distraction. And what this involves is simply trying to distract yourself from the thoughts and feelings that you might have. The key message is that you can have thoughts and feelings about pain and when these occur, you can *distract yourself* from them and still do the task to the best of your ability.
>
> The computer has randomly allocated one of these two strategies to one of the two boxes you see below. So, for example, Box 1 might contain more details of the Acceptance Strategy and Box 2 might contain more details of the Distraction Strategy. Or, the boxes and strategies may be the other way round. In a moment, you will be asked to select one of the boxes, after which you will then be given details on how to engage in the strategy that has been randomly allocated to the box you picked.

At this point in the procedure, the participants in the pliance and tracking conditions received different instructions about whether or not they should inform the Experimenter of

which box they had selected. It is important to note, however, that both on-screen boxes contained an acceptance strategy.

Prior to the selection of the target strategy, participants in the Pliance conditions were presented with pliance-based instructions as follows:

> Please remember that a computer program randomly paired the boxes and strategies just before you came into the room, so that the Experimenter does not know which strategy you will be following throughout the experiment. So, please tell the Experimenter which you have been given by saying either "Acceptance" or "Distraction" into the video recorder in front of you. Please now click on Box 1 or Box 2.

At this point, participants in the Pliance conditions selected Box 1 or Box 2, but were always presented with the following information:

> You have selected the Acceptance Strategy. Remember, it is important that you tell the experimenter the strategy that you have selected by saying "Acceptance" into the video camera in front of you. Please click on the box below and you will be provided with specific information concerning how to use this strategy to help you tolerate the pain during the task.

Prior to the selection of the target strategy, participants in the Tracking conditions were presented with tracking-based instructions as follows:

> Please remember that a computer program randomly paired the boxes and strategies just before you came into the room, so that the Experimenter does not know which strategy you will be following throughout the experiment. So, please do not tell the Experimenter which you have been given. Please now click on Box 1 or Box 2.

At this point, participants in the Tracking conditions selected Box 1 or Box 2, but were always presented with the following information:

> You have selected the Acceptance strategy. *Remember, it is important that the Experimenter does not know this***.** Please click on the box below and you will be provided with specific information concerning how to use this strategy to help you tolerate the pain during the task.

All participants were then presented with their interventions/rules, as appropriate.

Stage 4:Post-Intervention/Rule Heat Test. Stage 4 was identical to the same stage in Experiment 7 (including the Post-Intervention/Rule adherence measures).

Stage 5: Reminder Clip. The reminder clips presented to participants in the Intervention and Rule conditions were consistent with the previous study, as appropriate, and it is important to note that the Pliance and Tracking conditions were not differentiated at this point.

Stage 6: Post-Reminder Heat Test. Stage 6 was identical to Stage 2.

Stage 7: Post-Experimental Adherence Measures. The post-experimental adherence measures were identical to those presented in Experiment 7 for the Acceptance conditions.

RESULTS

Psychological Measures

The outcomes on each of the psychological measures were analysed according to condition and the mean scores for each are presented in Table 22**.** All participants scored within the normal range on all measures and four separate one-way between-group ANOVAs indicated a non-significant effect for condition (all p's > 0.104).

Table 22
The Means and Standard Deviations for Each Condition on the Psychological Measures in Experiment 8.

Condition	**Psychological Measures**			
	AAQ-II (50.55)	*FPQ* (78.20)	*DASS* (38.00)	*BIDR* (11.75)
Pliance Intervention	55.25	77.75	10.25	10.75
SD	8.17	30.30	5.97	4.10
Tracking Intervention	57.38	94.38	7.75	11.88
SD	6.82	20.87	6.45	4.52
Pliance Rule	49.63	85.38	5.50	11.00
SD	4.56	9.63	3.29	6.19
Tracking Rule	52.38	91.50	6.25	11.00
SD	5.26	14.43	2.66	5.48
Overall Means:	**53.66**	**87.25**	**10.19**	**11.16**
Overall SD	**6.74**	**20.39**	**6.29**	**4.90**

* The figure in brackets indicates the norm for each measure.

Tolerance Data

Between Conditions Tolerance Data. The tolerance data were collated according to condition and heat test and the means are provided in Figure 18. Only participants in the Pliance Intervention condition showed an increase in tolerance at Post-Intervention and this continued at Post-Reminder. In contrast, participants in the three remaining conditions displayed no obvious increases in tolerance. Specifically, Tracking Intervention increased slightly and then decreased again at Post-Reminder. A similar effect was recorded for Pliance Rule. Participants in the Tracking Rule condition showed steadily decreasing tolerance (albeit small) across the three heat tests. A 4x3 mixed between-within ANOVA found no significant main or interaction effects (all p's > 0.217).

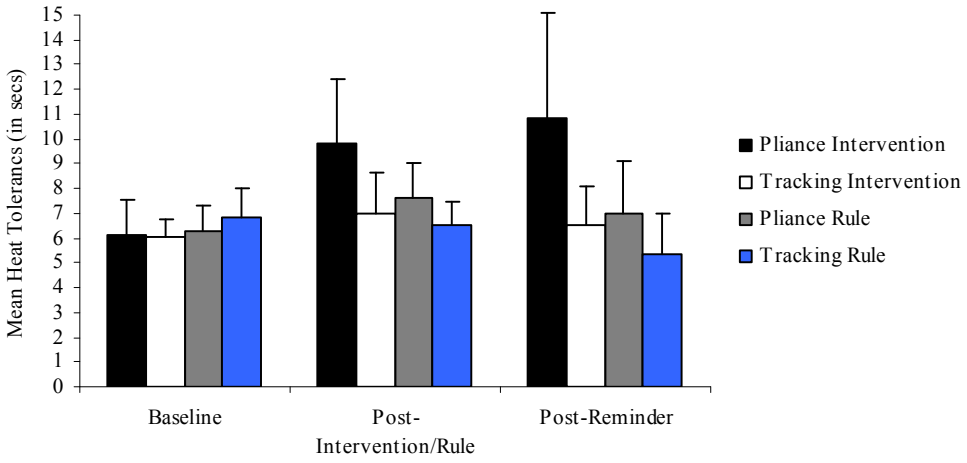

Figure 18. Heat tolerance means for each condition across heat tests in Experiment 8.

Distress Ratings

Discomfort ratings. The discomfort ratings indicated some changes across heat tests (see Figure 19). Most importantly, participants in the Pliance Intervention reported no change in discomfort across time. In the remaining conditions, discomfort decreased at Post-Intervention/Rule and increased again at Post-Reminder (Tracking Intervention and Tracking Rule), or increased steadily across time (Pliance Rule). A 4x3 mixed between-within ANOVA indicated a main effect for heat test [$F (2, 27) = 5.513$, $p = 0.010$, $\eta_p^2 = 0.290$], but not for condition and no interaction effect (both p's > 0.368).

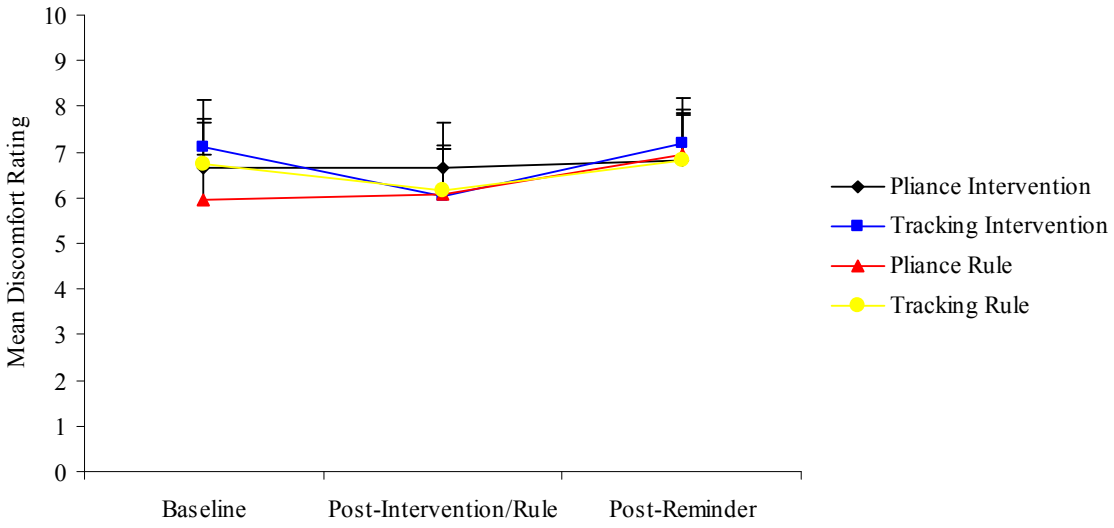

Figure 19. Mean discomfort ratings for each condition across heat tests in Experiment 8.

Four one-way repeated measures ANOVAs (one per condition) indicated that there was no significant effect for heat test (all p's > 0.107). In short, participants overall did not report significant changes in discomfort across heat tests and the change in tolerance (albeit non-significant) for Pliance Intervention could not be attributed to decreased discomfort.

Pain. The pain ratings indicated some changes across heat tests (see Figure 20). Participants in both Pliance conditions reported small and steady increases in pain across time. This was also the case for Tracking Rule, who then reported decreased pain at Post-Reminder. In contrast, participants in Tracking Intervention reported an initial decrease in pain, followed by an increase. A 4x3 mixed between-within ANOVA indicated a main effect for heat test [$F(2, 27) = 6.356$, $p = 0.005$, $\eta_p^2 = 0.320$], but not for condition and no interaction effect (both p's > 0.247).

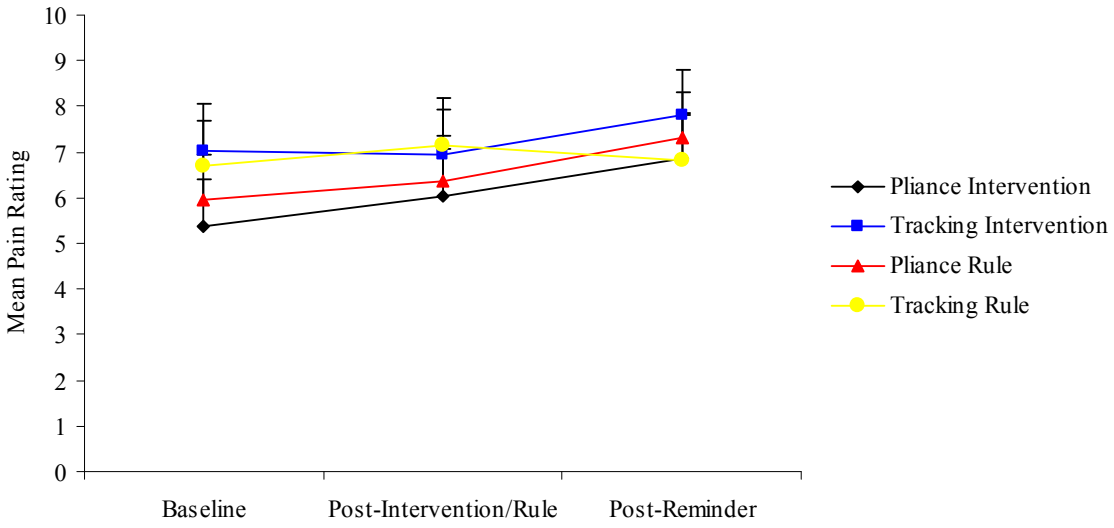

Figure 20. Mean pain ratings for each condition across heat tests in Experiment 8.

Four one-way repeated measures ANOVAs were conducted (one per condition) to determine the change in pain ratings (if any) across heat tests. For Pliance Intervention and Tracking Rule, heat test was not significant (both p's > 0.308). However, this variable was significant in both Tracking Intervention [$F (2, 14) = 8.810$, $p = 0.010$, $\eta_p^2 = 0.557$] and Pliance Rule [$F (2, 14) = 7.628$, $p = 0.007$, $\eta_p^2 = 0.521$]. In short, participants in Tracking Intervention and Pliance Rule reported significant increases in pain that was not reported in the other conditions.

Anxiety. The anxiety ratings also indicated changes across heat tests (see Figure 21). Participants in Pliance Intervention and Tracking Rule reported no change in anxiety across time. Tracking Intervention displayed decreased anxiety at Post-Intervention, but increased at Post-Reminder. Pliance Rule decreased across both heat tests. A 4x3 mixed between-within ANOVA indicated a main effect for heat test [$F (2, 27) = 4.414$, $p = 0.022$, $\eta_p^2 = 0.246$], but not for condition and no interaction effect (both p's > 0.451).

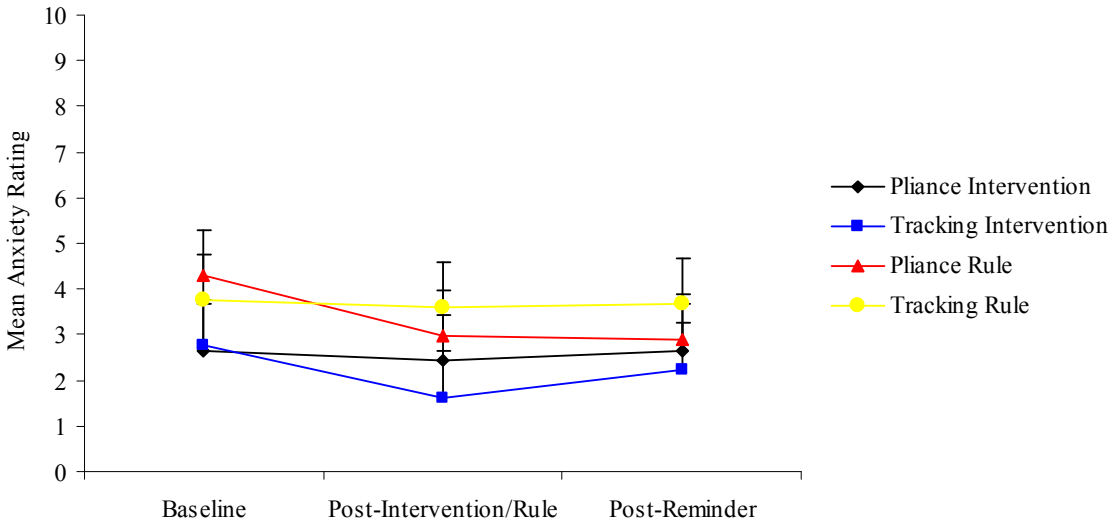

Figure 21. Mean anxiety ratings for each condition across heat tests in Experiment 8.

Four one-way repeated measures ANOVAs were conducted (one per condition) to determine the change in anxiety ratings (if any) across heat tests. Heat test was significant for Tracking Intervention $F(2, 6) = 6.722$, $p = 0.029$, $\eta_p^2 = 0.691$] and approached significance for Pliance Rule [$F(2, 6) = 4.287$, $p = 0.070$, $\eta_p^2 = 0.588$]. No significant effects were found for the other conditions (all p's > 0.722).

Adherence Data

The adherence data, collated by condition, are presented in Table 23. Unexpectedly, at Post-Intervention and Post-Reminder, Pliance Intervention indicated the least use of acceptance but Tracking Intervention indicated the most (first and second line). However, two one-way between-groups ANOVAs found that the groups did not differ significantly (all p's > 0.101). When asked about strategy use in everyday life, use of strategy in heat tests and strategy usefulness, three one-way ANOVAs indicated no significant effect for

condition (all p's > 0.501). When asked about overall pain (sixth line) and willingness to participate further (seventh line), two one-way ANOVAs revealed no significant effects for condition (both p's > 0.220).

Table 23
Adherence Questions Means and Significance Across Conditions in Experiment 8.

Adherence Question	**Intervention/Rule**				**Sig**
	Pliance Intervention	*Tracking Intervention*	*Pliance Rule*	*Tracking Rule*	
Post-Intervention/Rule Adherence Question					
Use of Acceptance at Post-Intervention/Rule	10.38	14.13	13.25	10.50	0.10
Post-Experimental Adherence Questions					
Use of Acceptance at Post-Reminder	11.13	13.75	12.75	11.38	0.61
Strategy Use in Everyday Life	3.85	4.06	3.64	5.01	0.78
Use of Strategy	5.35	5.66	4.41	6.20	0.50
Usefulness of Intervention/Rule	5.07	6.15	5.46	5.91	0.78
Overall Pain	5.85	7.16	5.88	7.08	0.22
Rated as Yes/No					
Willingness to Participate Further	Yes 75%	Yes 87.5%	Yes 100%	Yes 100%	0.33

- Indicates that specific adherence questions did not apply.

Results Summary

Again, the conditions did not differ on pre-experimental measures. Only Pliance Intervention showed steady increases in tolerance across heat tests. In contrast, the three remaining conditions demonstrated no obvious increases in tolerance. Interestingly, Tracking Intervention and Pliance Rule reported significant increases in pain and Tracking Intervention and Pliance Rule reported significant or near significant decreases in anxiety. At both adherence points, Tracking Intervention and Pliance Rule showed the greater use of acceptance, but there was greater variability in their reports of their own levels of overall

strategy use. There was strong similarity in the usefulness ratings. The Tracking condition reported greatest overall pain but this was not significant. The Intervention conditions showed the least willingness for further participation, but again this was not significant.

DISCUSSION

One of the key aims of the two experiments reported in the current chapter was to examine the relative impact of interventions vs. rules on radiant heat tolerance. Experiment 7 employed a 2 x 2 design that manipulated acceptance vs. placebo and intervention vs. rule. In line with existing evidence, we predicted that acceptance would be associated with tolerance increases, while Placebo would not. Furthermore, we anticipated that the acceptance intervention would likely be more effective than the rule. Although the findings indeed demonstrated that both Placebo conditions were associated with tolerance decreases, the outcomes for Acceptance were not as expected. Specifically, the Acceptance Intervention resulted in marginal tolerance decreases, while the Acceptance Rule produced only marginal tolerance increases.

In line with our previous attempts to distinguish between pliance and tracking, Experiment 8 compared acceptance intervention and rules in pliance vs. tracking contexts to determine what impact this might have on tolerance and whether previous findings might be accounted for with this variable. Indeed, the data from Experiment 8 supported this suggestion when pliance was associated with greater tolerance increases than tracking and the intervention overall produced better tolerance than the rule. These changes could not be readily attributed to concurrent changes in the pain, anxiety, or discomfort associated with

the heat tests. These findings were more in accordance with existing evidence than those reported in the previous study.

The two studies reported here, as well as those outlined in the two previous empirical chapters raise a number of methodological and conceptual issues that may have contributed to the effects observed as well as those reported in the existing literature. In conjunction with summaries of the eight studies and their data reported thus far in the current thesis, the concluding Discussion chapter that follows articulates and explores these issues to determine the contribution made by the empirical work here to the existing literature.

Chapter 5

General Discussion

Chapter 5

General Discussion

The current thesis investigated the methodological and clinical implications of rule-following behaviour. Specifically, the primary aim of the work was to record empirical evidence of a distinction between two types of rule-following, namely pliance and tracking. Although the existing literature contains some evidence of this distinction, the amount of studies is limited; the outcomes across same are inconsistent; and different populations have been investigated.

The most relevant research in this area (McAuliffe, 2004) and that which played a key role in the design of the studies reported in the earlier part of the current thesis, attempted to contrast the pliance vs. tracking sensitivities of non-depressed and depressed adolescents. In short, the data from McAuliffe's research demonstrated relatively robust distinctions between the two types of rule-following. As expected, the findings also showed a significantly greater propensity towards pliance in depressed male adolescents than their non-depressed counterparts. In a more recent and related study, Baruch et al. (2007), however, failed to replicate McAuliffe's outcomes and actually demonstrated a greater propensity towards pliance in *non-depressed* individuals.

At the outset of the experimental work conducted in the current thesis, there was a considerable dearth of empirical evidence in three related areas. (1) There was no unequivocal functional distinction between pliance and tracking. (2) There was no robust means of establishing experimental control over either. (3) There was no consensus on the propensities of clinical and non-clinical populations towards these two types of rule-

following. Before the third of these issues in particular could be addressed systematically, it appeared essential to examine pliance and tracking in non-clinical individuals. This was the overriding aim of the current thesis. Our methodological attempts in this direction and the range of outcomes these generated are summarised below in terms of Chapter 2 and then by combining Chapters 3 and 4. The specific theoretical issues raised by the empirical work in each chapter are then discussed within each section. Over-arching generic issues arising from the work are thereafter articulated.

Chapter 2: Summary of Findings

Experiment 1 was a preliminary investigation (n=16) that attempted to distinguish between pliance and tracking in non-depressed undergraduate participants using the MTS task developed by McAuliffe (2004). As an extension to the original research, Experiment 1 investigated pliance further by manipulating the presence of the Experimenter and the extent to which this individual explicitly reinforced rule-following. The key predictions of this first study were that: (1) modifications to enhance the clarity of the generic experimental instructions and to permit participants to retain these instructions would enhance the pliance/tracking distinction. (2) The manipulations of experimenter-influence might indicate the potential role of the experimenter at least with regard to pliance and might facilitate greater pliance in conditions in which the Experimenter was more active.

Although the results from Experiment 1 showed clear distinctions between pliance and tracking, responding within conditions was not as expected. In short, participants in Pliance conditions showed evidence of tracking and participants in Tracking conditions demonstrated pliance. Furthermore, the activities of the Experimenter appeared to have

little influence across Pliance conditions. We speculated that a number of variables may have contributed to these unexpected outcomes. (1) Relative to the original research, the sample sizes in Experiment 1 were small (four per condition). (2) Feedback from participants, particularly in the Pliance conditions, pointed to the possibility that they may not have fully understood the instructions, primarily because the perspective implied within the experimental rule was not clear. Specifically, the Pliance rule commenced with "I, the Experimenter . . ." and thus participants may have been unclear to whom "I" was referring.

These issues were addressed in *Experiment 2 (n*=24*),* which attempted to replicate Experiment 1, with minor modifications largely aimed at establishing more reliable experimental control over pliance and tracking. Once again, the results were not as expected. Although the Pliance conditions now showed evidence of pliance, this was influenced to some extent by the presence of the Experimenter, who surprisingly facilitated *less*, rather than *more*, pliance. Furthermore, consistent with Experiment 1, the Tracking condition also generated pliance. Hence, although we had now obtained pliance responding in Pliance conditions, the experimental distinction between pliance and tracking was weak.

With two studies thus far that had failed in some ways to distinguish experimentally between pliance and tracking and to replicate the original outcomes, *Experiment 3* (*n*=16) attempted to replicate McAuliffe's procedure exactly. Particular attention was paid to adherence to the original instructions and to the removal of these instructions after participants had read them, in the event that these two apparently minor variables had contributed in some way to the previous outcomes. Indeed, there was some evidence for this suggestion when the results of Experiment 3 displayed perhaps the clearest distinction between pliance and tracking. In short, participants in Tracking

demonstrated tracking and participants in Pliance demonstrated pliance. Although this was the most consistent outcome with the original research, it was surprisingly identical to McAuliffe's depressed, rather than non-depressed, participants.

One of the key (although perhaps minor) differences between Experiments 1 and 2 compared with Experiment 3 concerned participants' retention of the instructions in the former, but not in the latter. One possible reason for suggesting the potential role of instruction retention was that participants in Experiment 3 engaged in more reliable tracking when the instructions had been removed, whereas the Tracking conditions in the two previous experiments had recorded more pliance when the instructions were retained by participants. In order to address this issue, *Experiment 4* (n=16) replicated Experiment 3 directly, but participants retained the instructions after they had read them. Interestingly, the pliance/tracking distinction began to reduce again, with participants in Tracking showing increasing pliance and participants in Pliance showing increasing tracking. This latter evidence suggested that, at least to some extent, the presence of the instructions exerted some influence over levels of pliance and tracking and experimental control of same.

Methodological Issues Arising from Chapter 2

Perhaps the core experimental issue that we had not anticipated in the running and outcomes of Experiments 1-4 was the potential role played by apparently minor features of the methodology. In summary, we examined the potential influence of three main variables: the extent of experimenter involvement; length of instructions; and participant retention of the instructions.

Extent of Experimenter Involvement. With regard to the influence of the Experimenter's involvement, the outcomes were equivocal. Experiment 1 directly manipulated the presence of the Experimenter across two separate Pliance conditions and in both cases participants showed low levels of pliance. In a further manipulation of experimenter influence, Experiment 1 also contained a Pliance condition in which the Experimenter explicitly reinforced rule-following in all phases. Once again, however, these participants showed low levels of pliance. Taken together, the concordance of the data in the three initial Pliance conditions suggested that the Experimenter exerted little (if any) influence on pliance.

In conjunction with additional modifications to instructions to enhance clarity, Experiment 2 also compared Pliance conditions in which the Experimenter was present or absent. In this context, however, a greater influence was recorded for this variable. Specifically, greater pliance was unexpectedly associated with the Experimenter's absence than her presence. However, this difference was not significant and it is important to note that the Pliance/Experimenter Present condition demonstrated more pliance here than the same condition in Experiment 1.

The relationship between the Experimenter's absence and enhanced pliance was supported by the results of Experiment 3, where there was almost complete pliance in the Pliance-based Experimenter Absent condition. To complicate matters further, the results of Experiment 4 showed an increasing trend towards tracking in an almost identical Pliance-based Experimenter Absent condition and this appeared to undermine the possible influence of the Experimenter's absence in enhancing pliance.

It is important to emphasise, however, that other variables were being simultaneously manipulated across the four studies. Thus, perhaps the most that one can argue is that the relationship between the Experimenter's absence and pliance interacted in some way with other variables such as the retention of the instructions. On the contrary, the *least* that one can argue is that the experimental control of pliance in this context is far from robust. This issue was addressed again in Experiments 5 and 6, although the methodological context of this manipulation differed from Experiments 1-4.

Length of Instructions. In a similar manner, the length of instructions also emerged as a potentially important variable across studies. In simple terms, the instructions in Experiments 1 and 2 were generally longer than in Experiments 3 and 4. In the former, there were higher levels of pliance overall compared with the latter, suggesting that perhaps longer instructions facilitated greater pliance. Naturally, this makes intuitive sense because longer instructions create greater demands for their following. This outcome is also somewhat consistent with Hayes et al. (1986), who reported that participants who received only partially accurate instructions quickly learned to track (rather than ply), because they had learned from the outset not to depend upon the rule as an accurate guide to their behaviour. Lengthy rules, therefore, may function in a manner similar to accurate rules, where individuals come to rely on them early on and thus continue to assume that this is the case even when aspects of the task change. In short, perhaps the longer instructions in Experiments 1 and 2 facilitated greater pliance because participants came to rely heavily on them from the outset. Indeed, this would be particularly the case when the instructions would subsequently be removed.

Participant Retention of Instructions. In a similar vein, we had not initially considered that the retention of the instructions would play a key role in any conditions and yet this also emerged as a potential source of experimental control. Only Experiment 3 recorded sound control over pliance and tracking and indeed this was the only study in which participants did not retain the instructions. Indeed, the fact that the retention of instructions in the replication in Experiment 4 resulted in a strong reduction in the previously clear distinction between pliance and tracking supports the suggestion that the presence of the instructions in some way influenced participants' responding. However, it is difficult to decipher the nature of this influence because Experiments 1 and 2 both permitted the retention of the instructions and yet the data was inconsistent across them. Nonetheless, the findings do suggest that the retention of instructions was perhaps associated with greater pliance overall and thus this variable may have operated in a similar manner to the length of instructions. Again, the pattern of outcomes suggests that these variables perhaps interacted with one another in a complicated manner.

It is perhaps surprising that there are such inconsistencies in the outcomes of the data from Experiments 1-4 here, McAuliffe's (2004) research and the work by Baruch et al. (2007), given that the experimental task in all three works was almost identical. However, it may well be the case that the MTS methodology itself does not reliably facilitate the pliance/tracking distinction. Some evidence in support of this suggestion can be derived from the research by Zettle and Hayes (1983). These researchers examined pliance and tracking with speech-anxious students, who had been provided with various rules to help them cope in a public presentation. Again, pliance and tracking were simply distinguished by the level of Experimenter's knowledge about the coping rules that had been selected.

The results of the study indicated that participants in Pliance produced stronger speech performances with reduced anxiety, relative to both Tracking and Control. Indeed, similar outcomes have also been recorded by Hayes and Wolf (1984) using the cold pressor task.

Taken together, these latter studies raise possible questions about the use of the MTS methodology as a reliable experimental context in which to distinguish between pliance and tracking. Of course, one additional variable that relates the research by Zettle and Hayes (1983) and by Hayes and Wolf (1984) concerns the use of experimental rules that play a part in reducing some aversive aspect of the task. That is, it is perhaps important to create a task in which participants have a high motivation to respond to, if not follow, the experimental rules if one is to try to distinguish between pliance and tracking. In the two aforementioned studies, participants could derive significant benefit from following the experimental rules either in terms of reducing their anxiety and overcoming strong private fears, or by easing the pain induced by the cold pressor task. Indeed, the creation of such an experimental dynamic characterised the four studies subsequently reported in Chapters 3 and 4 of the current thesis. Here, we explored the use of a relatively new method of experimental pain induction as a viable context for examining pliance and tracking, using rules and interventions which participants would have high motivations to follow.

Chapters 3 and 4: Summary of Findings

Experiment 5 (n=40) attempted to replicate the research reported by Hayes and Wolf (1984). Because of recent concerns of researchers regarding the cold pressor task (Mitchell et al., 2004) this form of pain induction was presently replaced with the radiant heat apparatus, while retaining all other aspects of the original experiment. In short, we

wanted to investigate the robustness of the pliance/tracking distinction in the context of experimental pain induction. In spite of the strong methodological similarities between Experiment 5 and the original research, four of the five conditions in the former showed tolerance *decreases*, with only a marginal tolerance increase reported in the Pliance/Subjectivity condition. These outcomes contrasted starkly with the original research in which pain tolerance always increased in the Rule conditions and only Pliance was associated with significantly greater pain tolerance compared with Control.

One issue that may have contributed again to the weaker effects here concerned the continuous presence of the Experimenter and, of course we had been sensitised to this variable from previous studies in Chapter 2. And naturally, one would assume that the Experimenter exerted some influence in a context in which she directly administered pain to participants. It is interesting to note, however, that the Experimenter had been present throughout the original research reported by Hayes and Wolf (1984).

This issue was addressed in *Experiment 6* (n=40), which replicated Experiment 5 but without the Experimenter present at any point. The data from the second study demonstrated a more positive impact of the experimental rules on pain tolerance and showed a notable (but non-significant) distinction between pliance and tracking. Specifically, pliance was associated with tolerance increases, tracking was associated with tolerance decreases. Hence, the data from the second study did suggest that the outcomes from the previous study were influenced to some extent by the presence of the Experimenter, but again the nature of this influence is unclear and the variable possibly interacts, as before, with other variables (e.g. with the type of pain induction procedure employed). It is not surprising, therefore, that researchers have recently argued that the

absence of the experimenter should be a minimum gold standard feature of analogue research (Johnson et al., 2004).

Between the design of the first four experiments and the seventh, the clinical-experimental literature had witnessed strong growth in the area of analogue studies (e.g. Masedo, & Esteve, 2007). The majority of these attempted to analogue therapeutic interactions by isolating specific components and delivering them as brief experimental *interventions* (including, for example, the use of metaphor). Furthermore, the use of acceptance-based components had been a particularly strong vein in this area and these had been associated with positive and robust outcomes, in terms of increases in the tolerance of experimentally-induced pain. Indeed, in this intervening period, two pieces of research relevant to the current thesis also emerged. McMullen et al. (2008) systematically compared acceptance-based rules vs. interventions in the context of electric shock. Although both were associated with tolerance increases, the effects for the interventions were greater than for rules. And, Kehoe (2008) produced evidence of strong radiant heat tolerance increases after brief automated acceptance-based interventions.

In an integration of these two pieces of research, *Experiment 7* (n=32) attempted to examine the relative impact of acceptance-based interventions vs. rules on radiant heat tolerance. In line with previous evidence, we predicted that acceptance would be associated with tolerance increases, while Placebo would not. Furthermore, we anticipated that the Acceptance Intervention would likely be more effective than the Rule. Although the results were partly consistent with predictions when both Placebo conditions were associated with tolerance decreases, the outcomes for Acceptance were not as expected. Specifically, the

Acceptance Intervention resulted in marginal tolerance *decreases*, while the Acceptance Rule produced only marginal tolerance increases.

Closer inspection of the experimental instructions and methodologies of Experiment 7 compared with the studies by Kehoe (2008) and McMullen (2008) suggested an interesting possibility that allowed us to re-investigate the potential distinction between pliance and tracking. Specifically, both previous studies required participants to write down brief summaries of what they had learned from each video clip contained within the interventions. However, this methodological feature had not been incorporated into Experiment 7 during some streamlining of the procedure. As a result, one might argue that these written summaries functioned in a manner similar to pliance, thus perhaps explaining why the Acceptance Intervention condition in Experiment 7 actually decreased, rather than increased, tolerance.

This issue was addressed in *Experiment 8* (n=32) which compared acceptance interventions and rules in pliance vs. tracking contexts to determine what impact this might have on tolerance and whether previous findings might be accounted for with this variable. Indeed, the data from Experiment 8 supported this suggestion when Pliance was associated with greater tolerance increases than Tracking and the Intervention overall produced better tolerance than the Rule. These changes could not be readily attributed to concurrent changes in the pain, anxiety, or discomfort associated with the heat tests. These findings were more in accordance with existing evidence than those reported in the previous study.

Theoretical Issues Arising from Chapters 3 and 4

A number of theoretical issues emerged from the running and analyses of the four experiments that comprised Chapters 3 and 4. These can be summarised under two headings: the presence of the experimenter and acceptance: interventions vs. rules. Each of these is discussed separately below.

Presence of the Experimenter. Experiments 5 and 6 directly manipulated the presence of the Experimenter, as we had done previously in Chapter 2. Although the Experimenter had been present throughout the original research by Hayes and Wolf (1984) and Experiment 5, the outcomes across the two studies were contradictory. Specifically, the latter three of the four Rule conditions (and Control) recorded reductions, rather than increases, in radiant heat tolerance. Interestingly, only the Pliance/Subjectivity condition reported a tolerance increase, although this was not significant from pre- to post-rule.

The subsequent data from Experiment 6 (Experimenter absent), however, suggested that the former outcome may have been influenced to some extent by the presence of the Experimenter, when a stronger distinction now emerged between Pliance and Tracking conditions. Specifically, Pliance was associated with tolerance increases and Tracking with tolerance decreases. This was more in line with the original research to the extent that Pliance there increased tolerance more than Tracking (although both were associated with increases). In the second of our studies, therefore, the absence of the Experimenter facilitated greater pliance and this was also consistent with the outcomes from Chapter 2.

It would naturally seem counter-intuitive to conduct clinical analogue research in a context in which the experimenter is absent, given that therapy traditionally involves face-to-face dialogue. However, the primary aim in the development of automated interventions

was precisely to see what role is played by the experimenter, rather than assuming that the experimenter is functioning in the same way as a therapist. Indeed, the role of the experimenter in analogue research may not only be different from therapy, but may also be different from alternative procedures such as MTS and may differ further across different types of pain induction. The data here repeatedly suggest that these are not simple issues. Furthermore, the current findings also indicate that positive outcomes can be attained in a pain induction context even with the experimenter absent. This is consistent both with recent developments in home-based therapy packages (e.g. Hayes, & Smith, 2005), and the more traditional use of therapy homework (Kazantzis, Deane, & Ronan, 2000).

A related issue that was addressed extensively in the research by Kehoe (2008) and to a lesser degree here is the possibility that even if the presence of the Experimenter may not have directly influenced participant responding, her presence or absence may indirectly influence adherence to experimental demands. For example, Kehoe (2008) reported generally low adherence in experiments in which the Experimenter was absent. In support of this, the highest self-reported use of the strategy provided to participants in the Rule conditions across Experiments 5-8 was recorded in Pliance/Subjectivity in Experiment 5, which was the only study to include the Experimenter. However, overall across experiments adherence was not notably high and did not generally vary across experiments in a manner that reliably reflected the presence or absence of the Experimenter. Specifically, one might argue that adherence was influenced by Pliance because it is possible that there is some overlap between these concepts. However, in Experiment 8 participants' in the Tracking Intervention reported a greater understanding of acceptance than the Pliance Intervention, even though the latter showed better tolerance. At the very

least, the current research is consistent with previous evidence in highlighting the difficulties in obtaining sound experimental adherence and using qualitative measures to ascertain participants' understanding and use of what they have been instructed.

The use of automated interventions in analogue research offers an innovative means of circumventing spurious experimenter influences and may add to the debate on the role of the experimenter in different contexts (e.g. McMullen et al., 2008). Indeed, the automation of intervention delivery may be viewed as even more abstract than an absent experimenter and not at all similar to traditional therapy. Again, however, PC-based therapy packages have become increasingly common (Christensen, Griffiths, & Jorm, 2004) and increasing numbers of the population interact regularly with friends and acquaintances in this type of environment. Furthermore, the existing evidence, including that reported here, does suggest that positive tolerance outcomes may be acquired in this context and Johnson et al. (2004) also argued that automated interventions should be another gold standard in analogue research.

The success, or at least smooth execution, of automated deliveries may depend, to some extent, on the type of pain induction procedure. For example, the radiant heat apparatus is itself automated and is thus easily integrated with automated interventions and absent experimenters. In contrast, it is difficult to see how the cold pressor task could be adjoined to automated interventions or could be conducted without an experimenter, while retaining experimental coherence. Although there were some data inconsistencies between the research here and the original work by Kehoe (2008), all experiments were easy to conduct with almost no difficulties working with the apparatus, no data loss and no problems reported by participants. The current research, therefore, also contributes to the

small body of evidence supporting the use of radiant heat induction with humans and in analogue situations.

Acceptance: Interventions Vs. Rules. There is now a wealth of empirical research to support the utility of acceptance-based strategies in pain tolerance in both clinical and non-clinical contexts (Gutierrez, Luciano, Rodriguez, & Fink, 2004; Hayes et al., 1999; Levitt, Brown, Orsillo, & Barlow, 2004). The current outcomes add to this growing literature, with the data from Experiment 8 particularly consistent with existing evidence. Although there is currently little or no empirical evidence to suggest that such interventions produce lasting experimental or clinical change, they do attest to the power of the acceptance message, even in a very abbreviated and automated form. One useful avenue for future research may involve examining the extent to which pliance or tracking play a role in acceptance. For example, one might argue that acceptance should encourage tracking over pliance because clients are often encouraged to focus on their experiential histories for a direction for future action, rather than relying on thoughts or feelings. This is also consistent with the values-based focus in ACT. In contrast, however, acceptance-based therapies are often intense and build strong and trusting interpersonal relations between therapist and client, which one might argue fosters pliance on the part of the client, at least initially. Future research, therefore, might tease apart the optimal use of tracking vs. pliance in acceptance-based interventions and their outcomes.

One of our aims in Experiments 7-8 was to determine if the acceptance message could be simply condensed into a powerful rule that might work just as well as a lengthy intervention. In addition, Experiments 5 and 6 offered a useful insight into the utility of therapeutic rules, even though they were not acceptance-based. After all, the existing

literature has reported positive benefits for condensing lengthy therapeutic techniques and exchanges into brief automated interventions that work even when an experimenter is not present and Hayes and Wolf (1984) reported sound rule-based outcomes.

Across Experiments 5 and 6, two out of four Subjectivity Rule conditions increased tolerance post-rule, compared with only one of the Tolerance conditions. By comparison, two out of three Acceptance Rule conditions across Experiments 7 and 8 showed increased tolerance across heat tests. Consider also that the Placebo Rule in Experiment 7 decreased tolerance. Taken together, these data suggest that some tolerance benefit can be derived from brief rules, of which acceptance rules are perhaps the most effective.

Now consider the interventions in Experiment 7 and 8. Although the Acceptance Intervention decreased tolerance in Experiment 7, it reliably increased tolerance in Experiment 8. Indeed, the Pliance-based Acceptance Intervention in Experiment 8 recorded the most substantive increases in tolerance across all four studies. Furthermore, when Tracking and Pliance were compared (Experiments 5, 6 and 8), Tracking was associated with tolerance decreases, while Pliance was associated with increases. First, these data suggest that acceptance interventions are more effective than rules, but second they suggest that the difference is influenced to some extent by pliance and tracking.

The former conclusion is consistent with the positive acceptance intervention outcomes reported by Kehoe (2008) and others, although the less positive findings from Experiment 7 are worth noting and do suggest the need for future research. Perhaps more interestingly, Experiment 8 was only the second study to directly compare interventions and rules and the data here were consistent with McMullen (2008) in recording superiority for intervention over rule. However, this latter outcome was not straight-forward because

of the outcome of the Pliance/Tracking manipulation. In short, the data suggested that Pliance was more favourable to increased tolerance than Tracking and a combination of Pliance and Intervention was the most effective. As only the first study in this area, it is difficult to speculate on the reliability of this finding. Indeed, it is difficult to speculate even intuitively about whether interventions require more pliance than rules because they are longer and more intense. Alternatively, they may require less pliance because an intervention contains more advice that is informative and thus requires less blind following. Furthermore, it might even be argued that interventions require a mix of pliance and tracking, where a participant commences with pliance, but then begins to track more as the intervention progresses, much akin to the way in which natural therapy likely works. In any case, this is a potentially rich vein of future research with important clinical implications that is only tentatively started by the current research.

Generic Issues Arising from the Current Thesis

A number of generic theoretical issues straddle the body of empirical work contained within the current thesis. These may be summarised under two headings that concern rule-following: pliance as contingency-insensitivity/rigidity and processes underlying sanity and insanity. Each of these is discussed separately below.

Pliance as Contingency-Insensitivity/Rigidity. The distinction between contingency-governed vs. rule-governed behaviour has attracted considerable interest of behaviour analysis since the 1960's and there is little doubt about the validity of this conceptual distinction. However, operationally defining this difference and identifying potential process differences in these two key types of behavioural outcome has been more difficult

than might previously have been anticipated. This is perhaps one reason why the literature on rule-following is limited relative to the importance of the subject. Indeed, much of the existing research in this area may be categorised as demonstration research that has simply sought to demonstrate that rules can control behaviour and thus produce some degree of contingency insensitivity. However, identifying functionally how these behaviours differ is another matter.

In identifying the processes that may be responsible for rule-governed behaviour, Hayes et al. (1989) offered a distinction among pliance, tracking and augmenting in order to capture the different levels of environmental influence that may be impacting on rule-following. For example, tracking behaviour continues to be under a strong degree of environmental control, whereas pliance is a more social response. As a result, one might imagine that these two relatively distinct types of rule-following would be easily separated in an experimental context. Of the few existing studies that have attempted to do this, it is fair to say that the outcomes are variable and the experimental control of pliance vs. tracking is far from simple.

In line with previous research, Chapter 2 of the present work showed considerable variability in the control of pliance and tracking, with experimental control observed only in Experiment 3 and no clear picture of the critical variables. However, perhaps the data from Chapter 2 are simply an example of contingency-insensitivity rather than rule-rigidity or pliance and thus raises questions about whether or not these are the same concept. For instance, perhaps when participants are presented with a relatively brief experimental rule, they simply follow it because of the context they are in.

The outcomes from Chapters 3 and 4 show stronger distinctions between pliance and tracking. Specifically, participants in the Tracking Rule conditions never increased tolerance and thus it is difficult to derive whether or not they were following the rule. In contrast, participants in Pliance showed more consistent tolerance increases, which suggest dominance of the experimental rules. Unfortunately the adherence data did not separate the two types of rule-following conditions reliably.

Taken together, the distinction between rule-rigidity and contingency-sensitivity is not easy to resolve. Perhaps in fact, although there were experimental difficulties, the changing demands of the initial MTS task is a better context in which to test this distinction because when the task demands do not change, it is difficult to determine whether or not participants are adapting to new contingencies. However, a constantly changing task, almost by definition, would continually undermine the following of experimental rules. Furthermore, perhaps progression through any experiment by virtue of time spent simply encourages more tracking than pliance because the rule is forgotten (especially if it is removed). As a result, it is fair to conclude that the research area lacks a robust experimental platform for the reliable control of rules vs. contingencies, which thereafter makes distinctions between pliance and tracking impossible. Indeed, without the former it is almost impossible to generate clear empirical evidence that the latter distinction is conceptually viable.

Processes Underlying Sanity and Insanity. One of the core issues that is known to separate depressed persons from non-depressed persons is the strong (perhaps excessive) sensitivities of the former to the opinions and approval of others. For example, depressed individuals report persistent concerns that others disapprove and in part are believed to

have low-activity schedules in order to avoid doing anything wrong. In short, there appears to be a paradox between their public behaviour which is slow and limited and their private behaviour which is rampant and ceaseless as they worry about others. One possible experimental path, therefore, would be to manipulate the public vs. private context more explicitly to determine the impact this would have on depressed vs. non-depressed individuals. Indeed, one might simply believe that the pliance vs. tracking distinction is a technical manifestation of the difference between public vs. private contingencies.

Research by McAuliffe (2004) sought to differentiate pliance and tracking in depressed and non-depressed participants. Results showed that depressed participants were more likely to follow the rule in a social context, even when feedback indicated that this was the wrong choice. In contrast, Baruch et al. (2007) found that depressed participants were more likely to adapt to the contingencies of the task. However, neither study found significant differences between pliance and tracking in non-depressed participants. In fact both reported contrasting results for both populations.

The present research went back to basics by looking at non-depressed participants' rule-following behaviour. In effect, the impetus of the current research program was to examine rule-following with non-psychopathological participants to thereafter develop a sound basis for differentiating rule-following in terms of psychopathology. The results of Chapter 1, however, display the same problems inherent in previous studies. Specifically, the outcomes for Pliance and Tracking were somewhat unreliable, even chaotic, across the four experiments. A more consistent pattern of results and a clearer distinction between pliance and tracking occurred across Chapters 3 and 4. Specifically, participants in the

Tracking rule conditions never increased tolerance of the heat pain, whereas participants in the Pliance conditions more reliably increased tolerance across experiments.

Perhaps one can only conclude that both non-depressed and depressed individuals display both rigid rule-following and sound tracking. The former do so because of flexible social and emotional repertoires in which a range of strategies are available to them. The latter perhaps do so because they are overwhelmed by cues and rules about others that sensitise them to both pliance and tracking in an ever-growing need to be alert to the demands of others. In a sense, the two populations behave the same but for different reasons. Indeed, two variables that may influence potential differences between these populations that would support the speculation above is the presence of a particular other and the type of task presented. For example, perhaps a more aversive task makes both populations ply more, but an extremely aversive task would generate more pliance amongst depressed than non-depressed participants? Indeed, participants in Experiments 5-8 did not rate their overall pain as severe, thus suggesting that the task was not extremely aversive to them. Perhaps a more authoritative experimental figure would generate more pliance in depressed participants than non-depressed? The data from Baruch et al. (2007), however, do not support this. It is clear that a great deal of future research will be needed on each population and indeed on rule-following in general in order to tease apart these very complex issues.

Concluding Comments

The current thesis undoubtedly raises more questions than it answers. There were many inconsistencies across studies and in comparison with existing evidence. Different

variables were manipulated and different procedures employed. In fact, it is difficult to draw specific conclusions about any aspects of the research because it raised so many interlocking issues and questions. Although it rarely appears in the published literature, there is likely a vast wealth of theses like this that raise questions about published work and concepts. But because of its outcomes, it is almost never published. However, this does not detract from its importance as a caution to published evidence and as an important guide to future research. Naturally, when researchers are asking questions about pivotal aspects of our behaviour, such as the following of rules, the answers will not be clear-cut and the outcomes here certainly support this simple conclusion. Indeed, if nothing else, we have been reminded of the infinite complexities of human behaviour and its very strong relationship with the environment.

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Appendices