

Relational Responding Task as an Implicit Measure of Depression and Psychological
Flexibility

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Abstract

The Relational Responding Task (RRT) is a novel implicit measure of beliefs. In this exploratory study, I sought to examine the utility of the RRT as an implicit measure of cognitive reactivity using a convenient sample of individuals without clinical symptoms of depression by replicating the study of Hussey and Barnes-Holmes (2012). Participants completed the RRT before and after a sad mood induction procedure, as well as questionnaires about depressive symptoms, psychological flexibility and rumination. The RRT asked participants to respond to antecedent-affect statements based on congruent and incongruent responding rules. The results showed that prior to mood-induction the normal and mild-moderate depressive groups displayed antecedent-affect congruent response bias. Post mood induction the normal group continued to display an antecedent-affect congruent response bias, whereas the mild-moderate depressive group displayed an antecedent-affect incongruent response bias. These were consistent with the study by Hussey and Barnes-Holmes (2012). However, the pattern of differential change was not found when groups were created using the Acceptance and Action Questionnaire II or the Rumination-Reflection Questionnaire, which is inconsistent with Hussey and Barnes-Holmes (2012). Therefore, my study provides an important first step toward validating RRT as an implicit measure of cognitive reactivity. The limitations of the current study and implications for future research are considered.

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Within the field of psychology there is an ever growing body of literature and research focused on cognition and depression. A depressed individual is commonly characterised as having a negative affect and negative bias towards themselves, the world and the future (Clarke, Beck, & Alford, 1999). However, depression is more than negative affect and negative bias. It is a mood disorder which can be described by both physical and psychological characteristics (Barlow & Durand, 2015). Dysphoric mood, anhedonia and suicidal ideation are common psychological characteristics of depression (Barlow & Durand, 2015). Whereas, a change in sleeping patterns, appetite and loss of energy are common physical characteristics of depression (Barlow & Durand, 2015). These characteristics are well established and supported by literature (see DSM-5; American Psychiatric Association, 2013) and depressed individuals can display a variety of characteristics which can also vary in severity which results in various depressive subtypes (see DSM-5 mood disorders; American Psychiatric Association, 2013). To understand the variability of depression, research has been dedicated to understanding risk factors associated with the onset, maintenance and recurrence of depression. Findings suggests factors associated with the onset are different from those associated with maintenance and recurrence of depression (Lewinsohn, Allen, Seeley, & Gotlib, 1999).

The recurrence of depression and depressive episodes is an intrinsic characteristic of depression. Research has shown, remitted depressed individuals remain vulnerable to future depressive episodes, which can be triggered by various life events and environmental stressors (Kendler, Thornton & Gardner, 2000; Mitchell, Parker, Gladston, Wilhelm & Austin, 2003). Unfortunately, the relationship between risk factors and the recurrence of depression and depressive episodes is dynamic and complex because it involves an interaction between biological, social and psychological factors (Segal & Dobson, 1992; Teasdale, 1988). This relationship is difficult to identify and define because risk factors that

trigger the recurrence of depression or depressive episode in some people, does not trigger it in others (Brown & Harris, 1978).

Despite the complex relationship, psychological and cognitive factors have shown to be good predictors for the recurrence of depression (Lau, Segal, & Williams, 2004). Research has indicated that formally depressed individuals' display dysfunctional patterns of beliefs and behaviours that are elicited within the context of a sad mood state. The dysfunctional reactivity to the sad mood has shown to be a good predictor to relapse of depression (see Lau et al., 2004). Cognitive reactivity (Lau et al., 2004), psychological flexibility (Bond et al., 2011) and rumination (Nolen-Hoeksema, 2000) are all cognitive approaches that can be utilized to explain the interaction between sad mood states and the recurrence of depression. Interestingly, all three of these concepts are intrinsically similar, therefore to avoid confusion each one will be described below.

Firstly, cognitive reactivity is one cognitive approach that refers to negative thinking patterns that are elicited by a low mood, in particular a sad mood is likely to elicit thinking patterns associated with previous sad moods (Segal, Williams, & Teasdale, 2002). These patterns of thinking are often identified as negative attitudes and biases which is an indicative characteristic of depression (Clarke et al., 1999).

Psychological flexibility is another cognitive approach that is very similar to cognitive reactivity. This concept refers to individuals being consciously present in the moment and depending on the situation, they are able to change or persist in behaviour that is congruent with values and goals (Bond et al., 2011). For instance, research has shown when depressed individuals experience undesirable thoughts and feelings caused by a sad mood, their behaviour becomes inflexible and can be difficult to change to match certain values or goals (Bond et al., 2011; Hussey & Barnes-Holmes, 2012). Whereas non-depressed individuals are able to experience undesirable thoughts and feelings caused by a sad mood, however their

behaviour remains flexible and can be changed to match certain values or goals (Bond et al., 2011; Hussey & Barnes-Holmes, 2012). The process of psychological flexibility is identified as a core functional component of depression (Bond et al., 2011) because depressed individuals are more likely to display inflexible thinking and behaviour that is biased towards negative attitudes and beliefs.

Finally, rumination is a cognitive concept that is strongly associated with psychological flexibility, both of these are susceptible to sad mood effects which increases previously depressed individuals' vulnerability to depression (Lo, Ho, & Hollon, 2007; Nolen-Hoeksema, 2000; Nolen-Hoeksema, Morrow, & Fredrickson, 1993). Rumination is defined as a tendency to repetitively think about aspects of an upsetting situation (Nolen-Hoeksema, 1991). Research has shown that previously depressed people display greater levels of rumination than non-depressed individuals, and these are exacerbated by sad mood (Lo et al., 2007; Nolen-Hoeksema et al., 1993; Nolen-Hoeksema, 2000).

In summary, research has shown that when previously depressed and never depressed individuals experience a sad mood, it has differential effects on cognitive reactivity, psychological flexibility and rumination. These differences help understand dysfunctional cognitive processes in depression, which provides support for cognitive theories (Clarke et al., 1999; Teasdale, 1988). To ensure these concepts are indeed risk factors to the recurrence of depression it is important to have valid measurement tools. However, before any tools are discussed, it is important to understand cognitive theories of depression.

Cognitive models

Becks Cognitive Model

Cognitive theories of depression assist in understanding the relationship between depressive cognition and recurrence of depression. Becks cognitive model of depression (Beck, 1967; Beck et al., 1979) is frequently used to explain how depressive individuals may

be cognitively vulnerable to depressive maintenance and relapse. Beck's model provides a cognitive triad (Beck et al., 1979) which characterises cognitive patterns of depression. The triad refers to an idiosyncratic cognitive pattern that results in the individual processing information about the self, the future and their experiences in a negative manner.

This cognitive model proposes that depressed individuals hold negative dysfunctional beliefs and schemas about the self, world and future. These negative beliefs and schemas arguably remain latent until they are activated by a severe life event that is congruent with the negative schema (Beck et al., 1979; Monroe & Simons, 1991). For instance, a formally depressed individual will display positive beliefs and schemas, but when they experience a negative event they will begin to display negative beliefs and schemas.

Beck's model further postulates that negative life events can elicit depressive cognition (e.g., negative beliefs and schemas), which impedes encoding, processing and retrieval of information (Beck, 1967; Beck et al., 1979). For instance, when a depressed individual's experience a negative life event, it will elicit dysfunctional cognitive processing. This results in a preferential bias towards negative schema-congruent information during encoding and retrieval (e.g., recalling sad memories and focusing on negative comments; Beck et al., 1979). Favouring negative information acts as a confirmation for the depressed individuals' negative beliefs and schemas. For example, when a remitted depressed person experiences a dysphoric mood they are likely to attribute any negative or unpleasant experiences to a psychological or physical inadequacy within themselves because it is congruent with their self-schema (Beck et al., 1979). The information processing bias reinforces depressed individuals negative dysfunctional beliefs and schemas which leads to symptoms of depression (Beck 1967; Beck et al., 1979).

In summary, Beck's model identifies there is a relationship between mood and dysfunctional cognition (e.g., information processing bias, negative schemas and beliefs)

which increases remitted depressed individuals vulnerability to future depressive episodes. Based on this model, we should expect to see differences between never depressed and formally depressed individuals' cognitive schemas (e.g., view of the self, words and future). Researchers have commonly used the Dysfunctional Attitude Scale (DAS; Weissman & Beck, 1978) as a measure of dysfunctional cognitions (e.g., "my value as a person depends greatly on what others think of me") to support Becks cognitive theory of identifiable cognitive differences. However, many studies using the DAS failed to find any reliable differences in cognition between individuals vulnerable to depression and those not vulnerable to depression (e.g., Hamilton & Abramson, 1983; Silberman, Silverman, & Eardley, 1984; Simons, Garfield, & Murphy, 1984; see Lau, Segal, & Williams, 2004 for more details). Furthermore, Becks model is unable to explain why no differences were found.

Differential Activation hypothesis

Teasdale's differential activation hypothesis (DAH; 1988) was developed upon Becks cognitive model as an additional account of cognitive vulnerability to depression. In addition to Becks model, Teasdale proposed recovered depressed patients are more likely to display differences in processing information which are activated by a dysphoric mood. Therefore, the DAH proposes there are differential mood effects on information processing between recovered depressed patients and non-depressed controls. Whereby, dysphoric mood activates maladaptive cognitive processes within recovered depressed patients but does not activate maladaptive cognitive processes within controls (not vulnerable to depression). This phenomenon is referred to as 'cognitive reactivity'.

Teasdale developed the DAH upon three assumptions. Firstly, the DAH assumes that depressed mood influences cognitive processes which results in a negative bias. Like Becks model, the negative bias results in maladaptive beliefs and interpretations about the self, the future and their experiences. Secondly, it is assumed depressed mood will affect information

processing which is likely to increase depression. It is proposed that current events and information retrieved from memory are interpreted negatively which results in increasing depression. This assumption is similar to Beck's model which proposed, the bias of negative information processing reinforces dysfunctional beliefs which results to symptoms of depression (Beck 1967; Beck et al., 1979). Finally, it is assumed that depression will affect cognitive processing in similar ways for some people, however there will be differences in the specific nature of how the cognitive processes are affected. This assumption is important because it can be used to explain the differences in severity and persistence of a depressive episode. In summary the DAH proposes that depressive mood affects information processing, which increases the likelihood and ease of accessing negative interpretations and schemas, which in turn increases the likelihood of depression reoccurring.

Mood-congruent (Blaney, 1986; Teasdale, 1983) and mood-dependent (Bower, 1981; Eich, 1995) memory research provides evidence for mood effects on information processing, which supports Teasdale's DAH. Mood-congruous memory refers to individuals displaying a bias when encoding or retrieving information that is congruent with the mood state of the individual (Blaney, 1986; Teasdale, 1983). For example, depressive individuals experiencing a dysphoric mood, are more likely to display a bias towards congruent negative information during encoding or retrieval than incongruent positive information. In addition, mood-dependent memory refers to the enhancement of retrieving information when the mood state at the time of retrieval is congruent with the mood state during the time of encoding, irrespective of the emotional valence of the information (Bower, 1981; Eich, 1995). For example, when an individual is experiencing a depressive mood, they are more likely to remember information that was encoded in a previously depressive mood, than information encoded during a non-depressive mood (Eich, 1995). Therefore, both mood-congruent and

mood-dependent research provides evidence of emotional states affecting information processing systems.

The DAH postulates that mood effects are able to account for the lack of identifiable differences in dysfunctional cognition in previous studies using the DAS (Hamilton & Abramson, 1983; Silverman, Silverman, & Eardley, 1984; Simons, Garfield, & Murphy, 1984). Previously studies only measured dysfunctional cognitions during an euthymic mood. According to the DAH, recovered depressed patients are likely to display normal cognitive processing when they are not experiencing a dysphoric mood. This accounts for the results of the aforementioned DAS studies. However, the DAH further predicts there will be differences in cognitive processes when the recovered depressed patients are experiencing a dysphoric mood. Studies using the DAS to compare dysfunctional cognition during neutral mood and sad mood provided support for the DAH. During neutral mood, recovered depressed patients did not differ from controls (not vulnerable to depression) on dysfunctional cognitions, as predicted by the DAH. In contrast, following a sad mood induction, recovered depressed patients displayed elevated dysfunctional cognitions when compared to controls (Miranda & Persons, 1988), also as predicted by the DAH. Therefore, evidence supporting the DAH, indicates negative cognitive processing and maladaptive thinking patterns are activated by a depressive emotional state which results in cognitive vulnerability to depression.

Using Teasdale's DAH, cognitive theorists have argued, the phenomenon of cognitive reactivity is able to account for the onset of depression even when there is no causal event (Segal et al., 2002; Segal, Williams, Teasdale, & Gemar, 1996). Teasdale (1988) had proposed there is a reciprocal relationship between depression and cognitive processing that results in a potential positive feedback mechanism. With each depressive episode, maladaptive cognitive processing becomes easier to activate and over time depressive mood

and cognitive process can reinforce each other and are able to trigger a depressive episode even in the absence of external triggers or immediate environmental inputs (Fennell, Teasdale, Jones, & Damlé, 1987; Segal et al., 2002; Segal et al., 1996).

Explicit Measures.

Since Becks cognitive model and Teasdale's DAH, numerous self-report measures of explicit cognitive reactivity have been developed. It is important to ensure the measurements are able to measure the subtle aspects of cognitive reactivity. The aforementioned DAS (Weissman, & Beck, 1978) was one of the first self-report measures of dysfunctional cognition. Although it has provided support for cognitive reactivity it is dependent upon a mood induction procedure. The process requires participants to complete the DAS questionnaire prior to and following a sad mood induction procedure (Moulds et al., 2008). The standard mood induction procedure requires the participants to listen to a sad piece of music while recalling a sad autobiographical memory. This procedure has proven to be effective in generating a sad mood within a large number of individuals (Clarke & Teasdale, 1985 see, Ingram, & Segal, 2005 for reviews). Unfortunately, this procedure is time-consuming and requires repeated administration of the DAS questionnaire.

To address the perceived difficulties of the DAS, Van der Does (2002) developed the Leiden Index of Depression Sensitivity (LEIDS). The LEIDS is an alternative time-effective self-report measure of cognitive reactivity in those with a history of depression. It is a validated self-report measure to index cognitive reactivity, that can be used by both clinicians and researchers. The LEIDS questionnaire comprises of 26 items across four factors (Negative Self-Evaluation, Acceptance/Coping, Indifference, and Risk Aversion) (Van der Does, 2002). Studies comparing recovered depressed and never depressed participants displayed identifiable differences on all four factors of the LEIDS (Van der Does, 2002; Van

der Does, 2005). In particular, recovered depressed individuals displayed higher LEIDS scores than never depressed individuals (Von der Does, 2005).

Explicit self-report measures rely on the participants' ability to respond honestly and accurately for all items on the questionnaire. This results in self-report measures having two inherent limitations. Firstly, self-report measures are commonly associated with socially desirable responding (Paulhus, 2002). This is when participants provide responses based on what is socially acceptable or desirable rather than what they actually believe. Socially desirable responding commonly results in participants enhancing positive qualities (e.g., I am kind) and denying negative qualities (e.g., I am mean; Paulhus & Reid, 1991). Therefore, a consequence of socially desirable responding is inaccurate representations of the concept being measured and biases the results. A second limitation, is the participants' ability to recognise the construct or processes being measured. For example, the DAS and LEIDS questionnaires rely on participants to engage in introspection to accurately respond about their cognitive processes in order to understand the relationship between cognition and depression. Social cognitive researchers have argued that some participants are unable to correctly identify higher cognitive processes that influence their behaviours and responses (Nisbett & Wilson, 1997). Therefore, if the participants are unable to engage in introspection, then their responses will not be true reflections of the constructs being measured (e.g., the relationship between cognition and depression). An alternative to explicit self-report measures are implicit measurement procedures.

Implicit Measurement Procedure

The development and application of implicit measures have been deemed a significant achievement for psychological science because of their ability to assess mental representations (Le Bel & Paunonen, 2011). There are varying opinions about what defines a measure as implicit. I favour the view that an implicit measure is a valid measure of a

construct (e.g., attitude, beliefs) under conditions of automaticity (e.g., participants have little time to respond, participants are unaware of the construct being measured, do not explicitly intend to express the construct being measured; see De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; De Houwer & Moors, 2012). Implicit measures were originally developed to study attitudes and beliefs. However, research has suggested these measures could be used to investigate psychopathological processes (De Houwer, 2002; Wiers, Teachman & De Houwer, 2007). Therefore, implicit measures provide the ability to investigate processes and constructs outside of conscious awareness and susceptible to social influences, which explicit measures are unable to do.

In general, implicit measures require participants to respond as quickly as possible to the stimuli presented on the screen using two response options. Instead of calculating the participants scores on explicit self-report measures, implicit measures analyse the ease or difficulty (e.g., reaction time in milliseconds) in which participants respond to the stimuli.

The validity of implicit measures has often been questioned (LeBel & Paunonen, 2011) because results found on implicit measures do not always correlate with explicit measures (Roefs et al., 2011). One explanation for this differences may be due to differences in methodology between implicit and explicit measures (O'Reilly, Roche, & Cartwright, 2014). However, others argue that implicit measures are able to assess and measure constructs that explicit measures are unable to (Barnes-Holmes, Barnes-Holmes, Stewart, & Boles, 2010). Implicit measures arguably capture attitudes, beliefs or actions that are favourably or unfavourably mediate by past experiences (Greenwald & Banaji, 1995).

Implicit measures have been utilised to provide support for cognitive theories of depression (Clarke, et al., 1999) that explicit measures were unable to. For instance, cognitive theories of depression have predicted there will be an interaction between stressful life events and low self-esteem (Clarke et al., 1999). Research measuring implicit self-esteem was able

to detect this interaction when comparing remitted depressed individuals to controls, when explicit measures were unable to (De Readts, Schacht, Frank, & De Houwer, 2006; Gemar, Segal, Sagrati, & Kennedy, 2001). Below I will discuss three types of implicit measures and its utility in depression research.

Implicit Association Task

The Implicit Association Task (IAT; Greenwald, McGhee & Schwartz, 1998) and its variants (see Roefs et al., 2011 for review) are a commonly used implicit measure to support cognitive theories of depression. The IAT presents one word at a time and participants are instructed to sort the stimuli into categories (e.g., the word 'good' would be sorted into the category of stimuli labelled 'I am'). The words are commonly evaluative (e.g., good, bad) and are related to the attitude or belief being measured (e.g., self-esteem, political belief, attitudes).

For example, if the IAT was measuring the belief 'I am good' the categories will be labelled, 'self' and 'other'. The IAT will measure the response latencies in two critical trial blocks (an example is illustrated in Figure 1). During the first block, one response option indicates the category 'I am' and positive evaluative words. The other response option indicates the category 'I am not' and negative evaluative words. During the second block the evaluative words are swapped. One response option indicates the category 'self' and negative evaluative words. The other response option indicates the category 'other' and positive evaluative words. The difference between the mean response latencies of the blocks is presumed to indicate which category is evaluated more positively or negatively. For this example, if participants respond faster during block one than block two, then it is presumed the participants' attitude towards the self is more positive (relative to 'others').

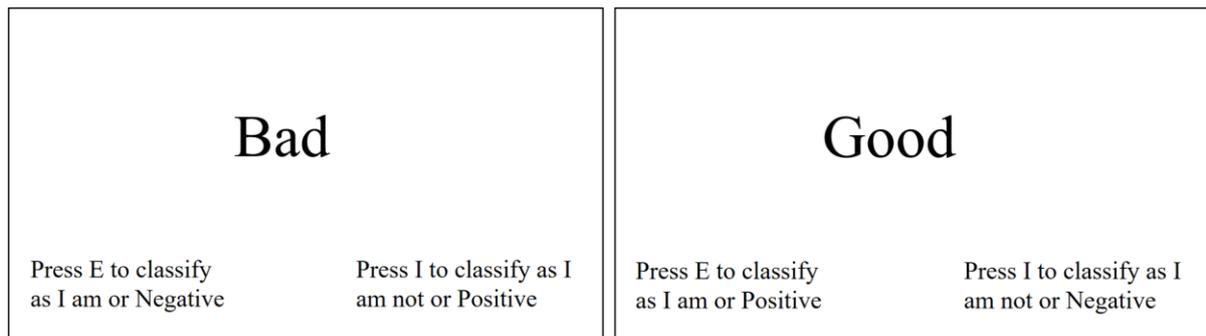


Figure 1. Two sample screen presentations of an IAT investigating self-associations.

Initially the IAT was developed to measure the association between two pairs of stimuli. However, it has been adapted to measure more complex implicit stimuli such as, self-esteem and self-concept (Greenwald & Farnham, 2000). The IAT is a widely used implicit measure because of its ability to be adapted to significantly assess a broad variety of associations (see, Greenwald & Nosek, 2001 for an overview), it has low attrition rates (Greenwald et al., 1998; Roefs et al., 2011) and has successfully been used within a variety of populations (see Nosek, Greenwald & Banaji, 2007 for review). Despite the success of the IAT it has one major limitation. The IAT is designed to capture individuals' beliefs or attitudes based on associations between concepts (e.g., 'self' and 'good' or 'self' and 'bad'). However, it is unable to identify the way these concepts are related (see, Hughes, Barnes-Holmes, & Vahey, 2012 for a detailed overview). For instance, an IAT measuring self-esteem would assess the belief 'I like myself'. Therefore, correct responses depend on the presence of specific stimuli (e.g., 'I', 'like', or 'myself') rather than how they are related (e.g., 'I like myself' or 'I want to like myself'). Despite this limitation, the IAT has provided evidence that formally depressed individuals display different implicit beliefs and attitudes than non-depressed individuals and mood effects can exacerbate these differences (Gemar et al., 2001; De Redts et al., 2006).

Implicit Relational Assessment Procedure

The Implicit Relational Assessment Procedure (IRAP; Barnes-Holmes et al., 2010) is an implicit measure that targets ‘brief and immediate’ relational responses. The IRAP emerged from Relational Frame Theory (RFT; Hayes, Barnes-Holmes, & Roche, 2001), which is a behavioural account of human language and cognition based on relational responding. According to RFT people respond to events or stimuli in certain ways depending on its relation to other events or stimuli. For example, when someone is asked “How are you?” their response will depend on who asked the question or the context it was asked in (e.g., Doctor, co-worker, therapy session). The IRAP has been designed to assess the relational responding defined by RFT and it provides the ability to differentiate between beliefs that differ only by the relational component (e.g., ‘I am good’ vs. ‘I want to be good’; see Barnes-Holmes et al., 2010 for an overview). The IRAP is able to identify this differentiation because correct response depends on the relation between the stimuli (e.g., the statement ‘I am good’ or ‘I want to be good’).

The IRAP presents a target word or phrase at the top of the screen and an evaluative word is presented in the centre of the screen. Two response options are presented in the lower corners of the screen and varies across trials. The participants are asked to quickly and accurately relate the target word or phrase with the evaluative word based on a responding rule. For example, if the IRAP is measuring the belief ‘I am good’, the phrase ‘I am’ or ‘I am not’ will appear at the top of the screen and an evaluative word will appear in the centre of the screen (e.g., good, bad). This results in four different trial types (e.g., I am + positive word, I am + negative word, I am not + positive word and I am not + negative word). Like the IAT, the IRAP compares the participants’ performance between two critical trial blocks (an example is illustrated in Figure 2). During the first blocks participants are instructed to select ‘correct’ when the trials are consistent with the belief and select ‘incorrect’ when the

trials are inconsistent with the belief. During the second block participants are instructed to select ‘correct’ when the trials are inconsistent with the belief, and select ‘incorrect’ when the trials are consistent with the belief. Difference in performance (e.g., response time), between the trial blocks is presumed to indicate the strength of the relational response being measured. For this example, if participants’ response faster during block one than block two, its presumed the participants hold a stronger belief ‘I am good’ (relative to ‘I am bad’).

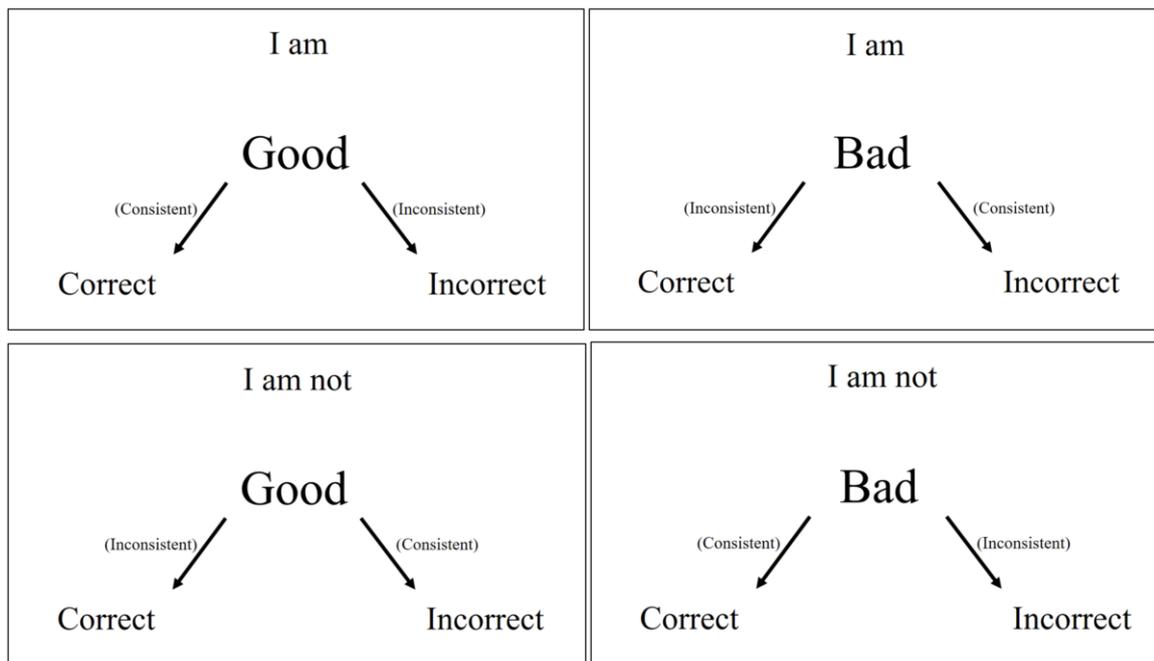


Figure 2. Four sample screen presentations of an IRAP investigating the belief 'I am good' in relation to the belief 'I am not good'. The 'consistent' and 'inconsistent' labels represent the pre-experimentally established responding rules. The bracted text and arrows are included for illustration and does not appear to participants.

The IRAP has shown to be a valid measure in identifying differences in participants’ cognition and cognitive processes, and these differential effects cannot be easily faked (Barnes-Holmes et al., 2010; McKenna, Barnes-Holmes, Barnes-Holmes, & Stewart, 2007). The Relational Elaboration and Coherence (REC) model is often used to explain the effects of the IRAP as behavioural events that may occur publically or privately (see Barnes-Holmes et al., 2010; Hughes, Barnes-Holmes & De Houwer, 2011). The REC model is also used to

explain the divergence between implicit and explicit measures (see, Barnes-Holmes et al., 2010 for an overview).

Previous research has shown depressed and non-depressed individuals are likely to display differential responding on the IRAP. These differences provide support for cognitive theories, because depressed individuals are likely to display responses that are indicative of dysfunctional attitudes and beliefs (Beck et al., 1979; Teasdale, 1988, Barnes-Holmes et al., 2010). For instance, depressed individuals display a response bias towards negative future thinking whereas non-depressed individuals display a response bias towards positive future thinking (Kosnes, Whelan, O'Donovan, & McHugh, 2013).

Previous IRAP research in depression has predominantly focused on self-associations (De Raedt et al., 2006). Studies measuring implicit self-esteem and self-worth have shown that depressed and remitted depressed individuals display differences to non-depressed individuals, by favouring negative and dysfunctional attitudes or beliefs (De Raedt et al., 2006; Frank, De Raedt, Dereu, & Van den Abbeele, 2006).

A recent study by Hussey and Barnes-Holmes (2012), used the IRAP as an implicit measure of cognitive reactivity and psychological flexibility to explore the relationship between mood state dependent effects and vulnerability to depression. This was a novel study because it examined emotional reactions to events rather than self-associations. The results showed that depressive individuals were more susceptible to mood state dependent effects than non-depressive individuals. Depressive individuals' performance on the IRAP post-mood induction is commonly referred to as cognitive reactivity, the activation of negative thinking patterns by low mood (Lau et al., 2004). Performance on the IRAP also indicates depressive individuals display psychological inflexibility whereas non-depressive individuals display psychological flexibility. Psychological flexibility refers to participants' experiencing undesirable thoughts and feelings and being able to respond in a congruent manner, whereas

inflexibility refers to participants' experiencing undesirable thoughts and feelings and not being able to respond in a congruent manner (Bond et al., 2011). This study is important because it provides initial evidence that implicit measures are able to detect mood effects such as cognitive reactivity and psychological flexibility.

Although the IRAP has been successfully implemented within a variety of contexts (see, Barnes-Holmes et al., 2010; Hughes & Barnes-Holmes, 2013 for reviews), it contains certain limitations that constrain its utility. The IRAP is often difficult to complete because the responding options assigned to the keyboard keys typically varies from trial to trial (De Houwer, Heider, Spruyt, Roets, & Hughes, 2015). The difficulty of the IRAP is often associated with higher attrition rates and constrains its utility within certain populations (Remue, De Houwer, Barnes-Holmes, Vanderhasselt, & DenRaedt, 2013; see Hughes & Barnes-Holmes, 2013 for an overview). The next implicit measure, was developed in response to these limitations and limitations of the IAT.

Relational Responding Task

The Relational Responding Task (RRT; De Houwer et al., 2015) is a novel implicit measurement procedure, that was developed upon the IRAP and IAT. For this study, the RRT was selected as a novel implicit measurement procedure because it is arguably a better implicit measurement procedure than the IRAP (see De Houwer et al., 2015 for review). Both the IRAP and RRT are measures designed to assess beliefs as they are represented in relatively cognitively inaccessible and non-conscious ways, by having participants select correct responses based on the relation between different stimuli (e.g., the statement "I am good") rather than just the presence of specific stimuli (e.g., "I", "am", or "good") (De Houwer et al., 2015). Like the IRAP this provides RRT with the potential to identify individual beliefs that differ with regard to the relational component (for an overview, see Barnes-Holmes et al., 2010; De Houwer et al., 2015). It does so by examining differences in

response time to difference statements, using response time as an index of the accessibility of non-conscious cognitive propositions (De Houwer et al., 2015).

Therefore, the RRT retains the central aspect of the IRAP, specifically having participants respond in-line with the beliefs being measured. However, it differs in, presentation of stimuli, nature of instructions and task structure (De Houwer et al., 2015). The RRT presents stimuli as full statements displayed in the centre of the computer screen (e.g., “I am good” or “I am not good”); and the participants are presented with explicit instructions to respond “as if” they agree with statements that are consistent with a belief (e.g., “I am good”) and disagree with inconsistent statements (De Houwer, et al., 2015). As an example, during one block participants might be asked to respond as if they like animals by selecting ‘true’ when presented with statements that are consistent with this belief (e.g., “I like dogs”) and selecting ‘false’ when presented with statements that are inconsistent with this belief (e.g., “I hate dogs”). Then in a second block, the participants would be asked to respond as if they hate animals by selecting ‘true’ when presented with statements consistent with this belief (e.g., “I hate dogs”) and selecting ‘false’ when presented with statements inconsistent with this belief (e.g., “I like dogs”). De Houwer et al., (2015) argues the difference in response time between these two blocks is presumed to be a measure of the extent the participants hold the belief “I like animals” (relative to “I hate animals”).

The responding key for true and false remains constant throughout the entire RRT procedure. For instance, on every trial selecting one key (e.g., press the letter ‘I’) provides the ‘true’ response, whereas selecting another key (e.g., press the letter ‘E’) provides the ‘false’ response. To discourage changing the response key throughout the RRT, De Houwer et al., (2015) included inducer trials. The inducer trials are stimuli that refer to concepts of ‘true’ or ‘false’ (e.g., correct, wrong, accurate, or inaccurate). For instance, when participants are presented with stimuli consistent with the concept ‘true’ they are instructed to one key (e.g.,

press 'E') and when they are presented with stimuli consistent with the concept 'false' they are instructed to press another key (e.g., press 'I'; De Houwer, et al., 2015).

As a result of including the inducer trials, the task structure of the RRT differed from the IRAP but closely resembled that of the IAT, “four categories of stimuli are assigned to two responses in a way that varies across blocks” (De Houwer et al., 2015, p. 3). As a result of the structural similarities, De Hower et al., (2015) believe RRT will display the same success as the IAT by being easier than the IRAP to administer, have low attrition rates and have an ability to be administered on a large scale via the internet as well as to a variety of populations. These claims are promising, however, there is very little empirical support to validate that RRT is superior to IRAP. The study by De Houwer et al., (2015) has shown the RRT to be easier and faster to administer than IRAP and had low attrition rates.

Since the RRT has been developed recently there are very few published studies. However, like the IRAP the RRT has been developed to measure beliefs such as self-associations and racial beliefs. Therefore, the RRT should be able to utilised in the same way the IRAP has been used in previous research. To my knowledge there is currently no RRT research focused on implicit cognition within depression. Due to lack of RRT research within this area, this study should be seen as a proof of concept study, that explores the utility of the RRT in the detection of cognitive reactivity within a normative population.

The Current Study

The current study aims to examine the utility of the RRT as an implicit measure of cognitive reactivity, by replicating the aforementioned study of Hussey and Barnes-Holmes (2012).

As previously mentioned, the RRT and IRAP are similar in measuring relational responding, however they differ in the presentation of stimuli, nature of instructions and task structure. The RRT in the current study has utilised a proportion of the original IRAP stimuli

developed by Hussey and Barnes-Holmes (2012) to ensure the RRT continues to “target both positive and depressive emotional reactions to positive and depressing events” (p. 575). Due to the differences between the IRAP and RRT the original stimuli had to be adapted to meet the structure of the RRT. The original set of IRAP stimuli was developed as statements that take the form of a positive or negative antecedent, followed by a positive or negative emotional responses, which follow the general formula “When X happens ... I feel Y” (Hussey & Barnes-Holmes, 2012). Each statement was developed to correspond with the depression subscales from the Depression, Anxiety, Stress Scale (DASS; Lovibond and Lovibond, 1993). Therefore, Hussey and Barnes-Holmes (2012) IRAP stimuli consisted of 32 statements that corresponded with all seven depression subscales. Due to the technical limitations of the RRT, the original 32 statements were reduced to 20 statements that corresponded with five of the depression subscales. I removed the extra statements corresponding with ‘dysphoria’ because they were originally added to ensure the technical limitations of the IRAP were met. I also removed the statements corresponding with ‘devaluation of life’ and ‘inertia’ because the positive and negative responses were the least consistent with the formula “I feel Y” (see Hussey and Barnes-Holmes, 2012). This resulted in the remaining 20 statements corresponding with the depression subscales, dysphoria, hopelessness, self-depreciation, lack of interest/involvement and anhedonia (see Table 1).

The RRT measured the participants’ reaction time (as time in millisecond) to identify if they were faster at responding to antecedent-affect congruent stimuli (e.g., “When good things happen I feel happy” or “When bad things happen I feel sad”) or antecedent-affect incongruent stimuli (e.g., “When good things happen I feel sad” or “When bad things happen I feel happy”). Two explicit responding rules had to be developed for the RRT to reflect the differential rates of responding. For the purpose of this study, the antecedent-affect congruent responding rule requires the participants to ‘respond as if you have positive reactions to

positive events and negative reactions to negative events’, whereas the antecedent-affect incongruent responding rule requires the participants to ‘response as if they have negative reactions to positive events and positive reactions to negative events’.

The structure of the RRT is consistent with De Houwer et al., (2015), it involves both target trials and inducer trials that are presented across three trial blocks and two test blocks. The target trials involve the presentation of the statements that were either antecedent-affect congruent or antecedent-affect incongruent. The inducer trials involved the presentation of the synonyms of true and false used by De Houwer et al., (2015). The three practice blocks that contain either inducer or target trials only to teach the participants the responding rules. The two test blocks contain both inducer and target trials. In the first test block, participants were asked to respond to target trials based on the antecedent-affect congruent responding rule. In the second test block, participants were asked to respond to the target trials based on the antecedent-affect incongruent responding rule. The differences in average response time between the two test blocks will measure the extent the participants hold an emotional bias to antecedent-affect congruent stimuli (relative to the antecedent-affect incongruent stimuli).

The participants were screened using the DASS to ensure the sample was similar to Hussey and Barnes-Holmes (2012). The DASS was originally selected to screen participants because it provides the possibility to check depressive symptomology rather than psychopathology generally (Hussey & Barnes-Holmes, 2012). With reference to the classification system defined in the DASS (Lovibond & Lovibond, 1993) the participants were classified into ‘normal’ or ‘mild-moderate’ depressive groups. These groups represented high and low extremes of normative levels of depressive symptoms. Individuals with more extreme depression symptoms were screened out of the sample.

The design of the current study replicated Hussey and Barnes-Holmes (2012) and other previous research of cognitive reactivity exploring mood-state dependent effects (e.g.,

Gemar et al., 2001). Participants were assessed using the RRT before and after an experimentally induced sad mood state. The mood induction was conducted using the standard Musical and Autobiographical Recall Mood Induction Procedure (see Scher, Ingram, & Segal, 2005 for review). The participants were required to listen to a piece of sad music and recall a personal memory to induce the sad mood. Hussey and Barnes-Holmes (2012), selected the mood induction procedure because it has effectively induced positive and negative mood in majority of individuals (Hussey & Barnes-Holmes, 2012; Barnes-Holmes, Barnes-Holmes, Smeets, & Luciano, 2004; Cahill et al., 2007). The general hypothesis is the individuals characterised as normal and mild-moderate depressive will show the same differential reaction to the mood induction procedure as Hussey and Barnes-Holmes (2012). Specifically, I predict:

- Prior to the mood induction both the normal and mild-moderate depressive groups will respond faster to antecedent-affect congruent stimuli than antecedent-affect incongruent stimuli.
- Post-mood induction, the normal group will continue to respond faster to antecedent-affect congruent stimuli, whereas, the mild-moderate depressive group will respond faster to antecedent-affect incongruent stimuli.

The IRAP was used by Hussey and Barnes-Holmes (2012) as a functional approach to measure implicit cognition. The RRT will take the same approach. Hussey and Barnes-Holmes (2012) specified the concept of depression was not functional because it relied on syndromal classification, therefore they included an explicit measure that defines psychopathology functionally. Psychological flexibility has been identified as a core functional component within depression and other psychopathologies (Bond et al., 2011). Therefore, the Acceptance and Action Questionnaire II (AAQ-II; Bond et al., 2011) was selected as a functional explicit measure of psychological flexibility because of its association

with depression to explore the relationship between this concept and performance on the IRAP (Hussey & Barnes-Holmes, 2012). The original study differentiated the participants into high and low psychological flexibility groups. The results indicated that the two groups displayed differential reactions to the mood induction procedure that were similar to the depressive groups. As this study is replicating Hussey and Barnes-Holmes (2012) the AAQ-II (Bond et al., 2011a) was also included in the current study as a functional measure of psychological flexibility. This is to examine the relationship between this concept and performance on the RRT. I hypothesised that individuals' characterised as having either high or low psychological flexibility on the AAQ-II will show the same differential reaction to the mood induction procedure as Hussey and Barnes-Holmes (2012). Specifically, I predict:

- The high psychological flexibility group will show similar effects as the normal depressive group whereas the low psychological flexibility group will show similar effects as the mild-moderate depressive groups.
- Prior to the mood induction procedure, both the high and low psychological flexibility groups will respond faster to antecedent-affect congruent stimuli than antecedent-affect incongruent stimuli.
- Post-mood induction, the high psychological flexibility group will respond faster to antecedent-affect congruent stimuli. Whereas the low psychological flexibility group will respond faster to antecedent-affect incongruent stimuli.

To expand upon Hussey and Barnes-Holmes (2012), the current study has included the Rumination-Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999). The RRQ has been included because it measures the concept 'rumination' which has been established as a factor associated with the recurrence of depression (Nolen-Hoeksema, 2000). Previous research has shown that rumination is susceptible to mood-state dependent effects (Moulds et al., 2008) and is able to mediate the effects of negative cognitive styles within depression

(Lo, Ho & Hollon, 2007). Therefore, the current study will use the RRQ to explore the relationship between rumination and performance on the RRT. I have hypothesised individuals characterised as high and low rumination will show differential reaction to the mood induction procedure. Specifically, I predict:

- The low rumination group will show similar effects as the normal depressive group whereas the high rumination group will show similar effects as the mild-moderate depressive groups.
- Prior to the mood induction procedure, both the high and low rumination groups will respond faster to antecedent-affect congruent stimuli than antecedent-affect incongruent stimuli.
- Post-mood induction, the low rumination group will respond faster to antecedent-affect congruent stimuli. Whereas the high rumination group will respond faster to antecedent-affect incongruent stimuli.

Method

Participants

A sample of 22 undergraduate participants were recruited from the University of Canterbury Department of Psychology participant pool, in which students were provided with course credit as an incentive for participating. The potential participants were screened with the DASS-21 (see below; Lovibond & Lovibond, 1995) and those selected for further participation represented the high and low end respectively of normative levels of depressive symptoms. Participants who scored as ‘normal’ (depression scores ≤ 9) represented low normative levels of depressive symptoms and those who scored as ‘mild’ or ‘moderate’ (depression scores $10 \leq 20$) represented high normative levels of depression. Participants who scored as “severe” or “extremely severe” on the DASS-21 for the depressive, anxious or stress symptoms (depression scores ≥ 21 , anxiety scores ≥ 15 , stress scores ≥ 26 ; using adjusted

scores from Lovibond & Lovibond, 1993) were removed from the respective analyses for ethical reasons. Hereafter those participants scoring in the high normal range are referred to as ‘mild-moderate’ depressive group (but in a non-clinical sense), while the rest were the ‘normal’ group.

Based on their adjusted DASS-21 scores, 17 undergraduate participants were selected and completed the experimental phases of the current study and consisted of 4 males and 13 females aged 18 to 31 ($M = 21, SD = 4$). From this sample, 6% identified as Māori, 82% identified as New Zealand European / Pākehā and the remaining 12% identified as Asian. As noted above they were further divided into two groups to represent mild-moderate and normal levels of depressive symptoms. The ‘normal’ group consisted of participants who scored within the ‘normal’ depressive range (score = $\leq 9, M = 4.22, SD = 2.73$), and the ‘mild/moderate’ group consisted of participants who scored within either the ‘mild’ or ‘moderate’ depressive range (score = $10 \leq 20, M = 17.25, SD = 3.20$). Participants depressive DASS scores are presented in Table 1.

Table 1
Scores Obtained from the DASS Depression Scale, Including the Cut-off Scores Used to Divide Groups.

	Depression		
	Cut-off score	<i>n</i>	<i>M (SD)</i>
Normal	0 – 9	9	4.22 (2.73)
Mild/ moderate	10 - 20	8	17.25 (3.20)

Apparatus

The experimental procedure was administered using E-Prime (version: 2.0.10.356) on a Cyclone branded computer (Intel Core i7-2600, 3.4 Ghz processor, 8GB of RAM), running 64-bit Windows 7 enterprise edition. A Phillips Brilliance 241B monitor (24 inch diagonal, LED backlight, 1920 x 1080 resolution) positioned at eye level presented the experimental procedure. Participants used a standard US keyboard and mouse to respond. The musical

excepts were delivered using Genius HS-04SU headset with microphones (headband stereo headset, In-line volume control, 3.5mm jack plug).

The sessions were conducted in a small, quiet, dimly lit, temperature-controlled room at the University of Canterbury. The room contained three computers, for groups of participants to complete the experimental procedure. Each participant was individually seated at a computer that was partitioned for privacy to allow for each participant to complete the experimental procedure confidentially at their own pace.

Measures

Depression, Anxiety, Stress Scale (DASS-21; Lovibond & Lovibond, 1995). This is a shortened version of the DASS-42 and consists of 21 items constituting three self-report subscales for depressive, anxious and stress symptoms. Each scale contains 7 items rated on a 4-point Likert scale; 0 = *Did not apply to me at all* to 3 = *Applied to me very much, or most of the time*. Participants rate the extent each statement has applied to them in the previous week. All items relevant to the subscale are summed and multiplied by two to make them congruent with those obtained on the DASS-42 (Lovibond & Lovibond, 1995), with scores ranging from 0 – 42. The Depression scale assesses dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia and inertia with items such as: “I felt I wasn’t worth much as a person”. Scores within the range 0-9 are categorised as ‘normal’ depressive symptoms, scores within the range 10-20 are categorised as mild-moderate depressive symptoms and scores ≥ 21 indicated severe/extremely severe depressive symptoms. As noted above, those with scores ≥ 21 have been excluded from the study. The alpha reliability coefficients for the DASS-21 subscales have been examined in clinical and community samples and reported as .94 for depression, .87 for anxiety and .91 for stress (Anthony, Bieling, Cox, Enns & Swinson, 1998). Internal consistency for the current sample

was high for the depression (Cronbach's $\alpha = .78$) and stress (Cronbach's $\alpha = .65$) subscales, however it was low for the anxiety subscale (Cronbach's $\alpha = .01$).

Acceptance and Action Questionnaire II (AAQ-II; Bond et al., 2011a). The 7-item version of the AAQ-II was included as an exploratory measure of psychological inflexibility / experiential avoidance. Participants rated the extent each statement is true to them (e.g., "I'm afraid of my feelings") on a 7-point Likert scale; 1 = *never true* to 7 = *always true*. All of the items are then summed with totals ranging from 7 to 49; low scores indicate greater levels of psychological flexibility and higher scores indicate greater levels of psychological inflexibility. The alpha reliability coefficient for the AAQ-II has been examined in both clinical and community samples and reported a mean alpha coefficient of .84 (Bond et al., 2011a). Internal consistency for the current sample was high (Cronbach's $\alpha = .81$).

Rumination-Reflection Questionnaire (RRQ; Trapnell & Campbell, 1999). The RRQ utilises 24 items across two self-report scales, namely Rumination and Reflection. The RRQ has been included as an additional exploratory measure of psychological flexibility using the rumination scale. The rumination scale consists of 12-items that assess ruminative self-focus, i.e., "self-attentiveness motivated by perceived threats, losses, or injustices to the self", whereas the reflection scale contains 12-items that assesses adaptive self-curiosity and reflective thinking, i.e., "self-attentiveness motivated by curiosity or epistemic interest in the self" (Trapnell & Campbell, 1999, p. 297). Participants rate the extent they agree or disagree with each statement (e.g., "sometimes it is hard for me to shut off thoughts about myself") on a 5-point Likert scale using 1 = *strongly disagree* to 5 = *strongly agree*. The scores for reflection and rumination are calculated by summing the total scores for the relevant items including the reversed items, with higher scores indicating higher levels of rumination and reflection; total scores range from 12-60. The alpha reliability coefficients for the RRQ subscales has been examined within a community sample and reported as .90 for rumination

and .91 for reflection. Internal consistency for the current sample was high for both the rumination (Cronbach's $\alpha = .87$) and reflection subscale (Cronbach's $\alpha = .88$)

Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegan, 1988).

The PANAS consists of 20-items that are divided equally over two affect scales: positive affect and negative affect. The PANAS was used as a measure of the participants' mood at the moment in time when they completed the experiment (i.e., as a manipulation check for the mood induction). To complete the PANAS, participants rated the extent each word described their feeling at the present moment on a 5-point Likert scale; 1 = *very slightly or not at all* to 5 = *extremely*. The PANAS positive and negative affect scores are calculated by summing all of the relevant items, with total scores ranging from 10 – 50. Higher scores on the positive affect scale reflect higher levels of positive affect, whereas lower scores on the negative affect scale reflect lower levels of negative affect. The alpha reliability coefficients for the PANAS subscales have been examined by Watson, Clark & Tellegan (1988). For the Positive Affect scale the Cronbach alpha coefficient range from .86 to .90 and the Negative Affect scale ranged from .84 to .87. Internal consistency with the current sample was high for both the positive affect (Cronbach's $\alpha = .89$) and negative affect (Cronbach's $\alpha = .89$) subscales.

Procedure

Mood Induction and Relational Responding Task Procedure

Mood Induction Procedure. The musical and autobiographical recall mood induction procedure is the standard procedure used to study mood state dependent effects (Hussey & Barnes-Holmes, 2015; see Scher, Ingram & Segal, 2005, for review). The participants were provided with written instructions describing how to induce either a sad mood or a positive mood before being presented with the musical excerpts. To induce either a sad mood or a positive mood, two classical music excerpts have been digitally trimmed to exactly seven

minutes and presented to participants using the E-Prime software, at a volume that was reported as comfortable and clearly audible by participants. The musical excerpt: Albinoni's "Adagio in G Minor" was utilised during the sad mood induction procedure. The musical excerpt: Mozart's "Divertimento 136" was utilised during the positive mood induction procedure.

Relational Responding Task. (RRT; De Houwer, Heider, Spruyt, Roet, & Hughes, 2015). The RRT procedure presented all of the instructions, stimuli and recorded all of the participants' responses via computer monitor and keyboard. The RRT stimuli incorporates ten inducer words and twenty target statements presented throughout five blocks of trials. The ten inducer words consist of five synonyms of true and five synonyms of false (see Table 2). The twenty statements took the form of positive and negative antecedent- affect congruent or incongruent that followed the general formula "When X happens ... I feel Y". The statements were extracted from the original set of stimuli developed for an IRAP procedure (Hussey & Barnes-Holmes, 2012). The original set of stimuli statements were derived from the DASS model of depressive symptoms (Lovibond & Lovibond, 1993) using the seven subscales: dysphoria, hopelessness, devaluation of life, self-deprecation, lack of interest/involvement, anhedonia and inertia. Therefore, the original set of IRAP stimuli contained 32 statements. The RRT procedure requires only twenty stimuli, therefore due to technical limitations the original seven subscale statements have been reduced to five which reflect the depression DASS subscales: dysphoria, hopelessness, self-deprecation, lack of interest/involvement and anhedonia. The antecedent-affect statements and their corresponding DASS subscales are presented in Table 2.

Table 2

The Stimuli Employed in the RRT, Organized by Label and Target Type. Extracted from the Study by Hussey and Barnes-Holmes (2012)

Positive Antecedents	Negative Antecedents	Corresponding DASS subscale
When things go well	When things go badly	Dysphoria
When I'm successful	When I fail	Hopelessness
When people praise me	When people criticize me	Self-Depreciation
When I get involved	When I do nothing	Lack of interest/involvement
When good things happen	When bad things happen	Anhedonia
Positive Responses	Negative Responses	
I feel happy	I feel sad	Dysphoria
I feel positive	I feel hopeless	Hopelessness
I feel worthwhile	I feel worthless	Self-Depreciation
I feel enthusiastic	I feel uninterested	Lack of interest/involvement
I enjoy life	I can't enjoy life	Anhedonia
Response Option 1:	Response Option 2:	
TRUE	FALSE	
Positive Inducer words	Negative inducer words	
True	False	
Correct	Incorrect	
Right	Wrong	
Accurate	Inaccurate	
Confirm	Untrue	

Experimental Procedure

The participants were welcomed to the session and seated at a computer, then each one was assigned a number to preserve their confidentiality and asked to read the information form (Appendix A). The information sheet explained the purpose of the study as replicating the original study of Hussey and Barnes-Holmes (2012) by using the RRT as a novel implicit measure of a particular psychopathology and levels of psychological flexibility during a mood induction procedure, and that all of their answers would be recorded. The participants were also informed that participation was voluntary and they were able to withdraw at any

stage without penalty. Any questions were answered by the experimenter and once satisfied the participants signed the consent form (Appendix B). They then completed a short demographic form which asked for their: age, gender and country of birth and then completed the experimental procedure.

The experimental procedure replicated the procedure used in the study of Hussey and Barnes-Holmes (2012) and was divided into three phases (a) baseline measurement prior to mood induction, (b) sad mood induction, and (c) measurement post-mood induction.

Phase 1: Baseline Measurement.

Participants first completed the DASS-21, AAQ-II, RRQ and PANAS questionnaires. They were then introduced to the RRT program which presents instructions that describe the stimuli used for the trial blocks and method of response. They were informed they will be presented with either words in orange that are synonyms of true and false or statements in blue of situations and associated emotional response which follows the general formula “When X happens ... I feel Y” (Hussey & Barnes-Holmes, 2012). Based on responding rule given before each trial block, participants were asked to respond to the stimuli as either “true” (by pressing the right control key) or “false” (by pressing the left control key) as quickly and accurately as possible.

The order of the trials for each block were random, however no words or statements were presented on two consecutive trials. Each trial begun with the presentation of a word or statement in the centre of the screen and it remained until the correct response to the rule was registered. Any incorrect responses were followed by the presentation of a red cross which remained on screen until the correct response was provided. The next trial started 750ms after a correct response was produced. The statements presented to participants belong to one of four different trials types: (a) positive antecedents with congruent affect responses, (b) positive antecedents with incongruent affect responses, (c) negative antecedents with

incongruent affect responses and (d) negative antecedents with congruent affect responses (see Figure 3; Hussey & Barnes-Holmes, 2012). The RRT procedure consisted of three practice blocks and two test blocks.

The first block contained 40 trials where each of the 10 inducer words were presented 4 times as practice. Participants were asked to categorise the words presented on the screen as either synonyms of “true” (by pressing the right control key) or “false” (press the left control key). The second block contained 40 trials, where 20 target statements were presented twice and were asked to respond if the statement on the screen was “true” or “false” based on the rule: *respond as if you have positive reactions to positive events and negative reactions to negative events*. The third block contained 60 trials. 20 target statements were presented once and the 10 inducer words were presented twice in two consecutive repetitions and were asked to respond to the stimuli in accordance with the rules practiced in the preceding two blocks. The fourth block was identical to block two, however the responding rule for each statement changed and were asked to respond to the statements as “true” or “false” based on the reversed rule: *respond as if you have negative reactions to positive events and positive reactions to negative events*. The fifth and final block was identical to the third block, however participants are asked to respond to the target statements in accordance with the rule learnt in the previous block; However, they were asked to continue responding to the inducer words in accordance with the previous trials because this rule did not change.

Phase 2: Sad Mood Induction.

An adaption of the musical ad autobiographical recall mood induction procedure used by Hussey & Barnes-Holmes (2012) and Barnes-Holmes, Barnes-Holmes, Smeets, & Luciano (2004) was used to establish a sad mood. The following instructions used in the previous studies were presented on screen for the participants to read before listening to the musical excerpt:

“You will now be asked to listen to a piece of classical music. This section of music should help you to develop a sad mood. However, music alone cannot create the desired mood, so you should try to think about something that makes you sad. You may find it especially useful to concentrate on sad events that you have personally experienced.”

Once the participants indicated they had read the instructions, they were provided with a set of headphones which played the sad musical excerpt which was Albinoni’s – Adagio in G Minor.

Phase 3: Measurement.

Once the mood induction procedure was completed, they then completed the PANAS as an explicit measure of mood. The participants then completed the RRT procedure for a second time. This includes the practice blocks and the test blocks. To mediate any negative mood as a result of the sad mood induction procedure, then they completed a second musical and autobiographical recall mood induction procedure to establish a positive mood. To induce a positive mood, the participants were presented with the following instructions on the screen:

“You will now be asked to listen to a piece of classical music. This section of music should help you to develop a happy mood. However, music alone cannot create the desired mood, so you should try to think about something that makes you happy. You may find it especially useful to concentrate on happy events that you have personally experienced.”

Once the participants had indicated they had read the instructions, they used the headphones that were previously provided, which played the positive musical excerpt, which was, Mozart’s – Divertimento 136. Once the positive mood induction procedure was completed, the participants were provided with a debrief form (Appendix C). The debrief

form explained the purpose of the study and provided contact information for support services in case the participants experienced any adverse feelings as a result of participating in the study. They were then thanked for their participation and released from the session, and receive course credit for participating.

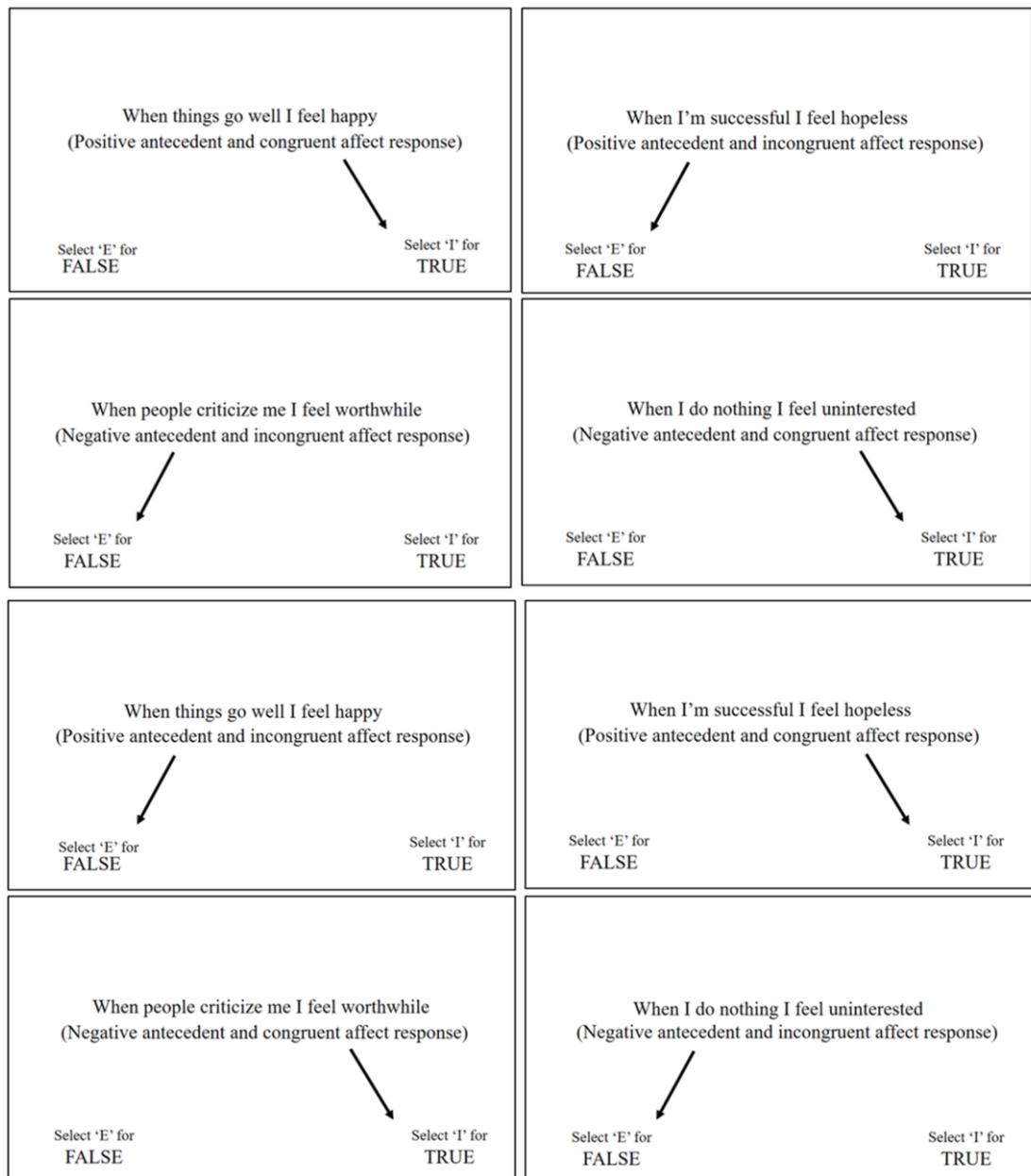


Figure 3. Examples of the four RRT trial types. Bracketed text and arrows are included for illustration and did not appear to participants in the actual RRT. The top two rows have arrows which indicate the correct response for the rule in block two and three. The bottom two rows have arrows which indicate the correct response for the rule in block four and five.

Results

RRT Data Preparation

The data produced by the RRT program were raw latency scores (i.e., their response time) from each participant's trials, defined as the time in milliseconds between the presentation of the stimulus and the emission of the correct response. In accordance with recent RRT research (De Houwer et al., 2015), only the target statements from the test blocks were analysed by transforming the raw latency scores using the same improved D-algorithm (D1) utilised by De Houwer et al., (2015), which Greenwald, Nosek, and Banaji (2003) developed for the IAT. The D1 algorithm was selected because the RRT procedure records the reaction time until the correct response is emitted, therefore it does penalise incorrect responses on trials as other algorithms do (see Greenwald, Nosek, and Banaji, 2003 for review). For the purpose of this study the transformed raw latency scores are referred to as 'D_{RRT} scores'. Table 3 shows the D1 algorithm steps involved in transforming the raw latencies into D_{RRT} scores. To put it simply, the D_{RRT} score is a measure of difference in response latencies between the antecedent-affect congruent trial block and the antecedent-affect incongruent trial block and the overall D_{RRT} scores are calculated as either positive or negative scores.

In summary, the overall positive D_{RRT} scores indicate faster correct antecedent-affect congruent responses than incongruent responses. Therefore, participants are faster to correctly response to antecedent-affect congruent statements (e.g., 'bad events make me feel sad') than incongruent statements (e.g., 'bad events make me feel happy'). In contrast the overall negative D_{RRT} scores indicate faster correct antecedent-affect incongruent responses than congruent responses. Therefore, participants are faster to correctly respond to antecedent-affect incongruent statements (e.g., 'bad events make me feel happy') than congruent statements (e.g., 'bad events make me feel sad').

The D_{RRT} scores are standardized scores (i.e., they are in SD units). A descriptive analysis of the D_{RRT} scores showed that prior to the mood induction D_{RRT} scores ranged from -0.44 to 0.92, with a mean D_{RRT} score of .22 ($SD = .39_{SD}$). In contrast, the D_{RRT} scores following the sad mood induction ranged from -0.80 to 0.57, with a mean score of .12 ($SD = .39_{SD}$).

Table 3
Calculation for D_{RRT} Scores Used in Recent RRT Research

<u>Step</u>	<u>Description</u>
1	Only the data from the target statements for the test blocks are used.
2	Latencies over 10,000ms are removed from the dataset.
3	Two mean latencies are calculated for each participant. One for the congruent block and one for the incongruent block.
4	One ‘inclusive’ standard deviation for the congruent and incongruent blocks is calculated for each participant.
5	One mean difference is calculated for each participant. The mean latency of the congruent block is subtracted from the mean latency of the incongruent block.
6	One D_{RRT} score is calculated is then calculated for each participant. The mean difference calculated in step five is divided by the corresponding standard deviation calculated in step four. Resulting in one D_{RRT} score for each RRT procedure.
Mathematically, $D_{RRT} = \frac{Mincongruent - Mcongruent}{SDcongruent \& incongruent}$	

Notes. One D_{RRT} score is calculated for each RRT procedure, e.g., pre and post mood induction

Correlational Analysis

Bivariate Pearson’s correlations between the D_{RRT} scores pre- and post-mood induction and the questionnaires are shown in Table 4. Interestingly, the D_{RRT} scores pre-mood induction displayed a non-significant correlation with the D_{RRT} scores post-mood induction ($r = .15, p > .05$). This suggests there are changes in D_{RRT} scores which may be caused by mood, which will be analysed further below. In addition, prior to mood induction the D_{RRT}

scores were not significantly correlated with DASS depression scores ($r = -.29, p > .05$), However, the D_{RRT} scores post-mood induction displayed a strong significant positive correlation with the DASS depression scores ($r = .61, p < .05$). This suggests sad mood may have had an impact on depressive individuals' D_{RRT} scores; again, this will also be analysed later. Both the D_{RRT} scores pre- and post-mood induction did not significantly correlate with the remaining questionnaires ($p = 0.27$ to 0.99). Finally, the AAQ-II displayed a strong significant correlation with the RRQ-rumination scale ($r = .69, p < .01$). This suggests the RRQ-rumination is measuring similar aspects of psychological flexibility to the AAQ-II.

Table 4
Correlations Between D_{RRT} Scores and Questionnaires

	1	2	3	4	5	6	7	8
1 D_{RRT} Pre	-	0.15	-0.29	-0.00	0.01	0.05	0.06	-0.05
2 D_{RRT} Post		-	-0.61**	0.17	-0.33	0.04	0.09	0.09
3 DASS –Depression			-	0.35	0.58*	0.08	0.03	-0.22
4 DASS - Anxiety				-	0.35	0.21	0.18	-0.18
5 DASS – Stress					-	0.26	0.42	-0.12
6 AAQ-II						-	0.69**	0.35
7 RRQ-Rumination							-	0.18
8 RRQ-Reflection								-

** $p < .01$ (two-tailed)

* $p < .05$ (two-tailed)

PANAS Mood Induction Manipulation Check

The PANAS was included as a mood manipulation check by comparing PANAS scores before and after the sad mood induction. The PANAS has two subscales which measure positive and negative affect with scores ranging from 10-50 on both. Higher scores on the positive affect subscale represent higher levels of positive affect, whereas lower scores on the negative affect subscale represent lower levels of negative affect.

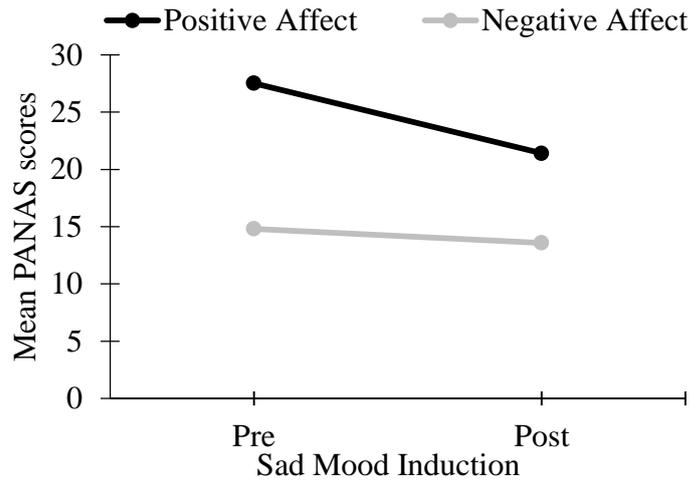


Figure 4. Mean overall PANAS scores for the positive and negative affect subscales, pre and post the sad mood induction procedure.

Figure 4 shows the mean PANAS positive and negative affect scores before and after the sad mood induction. As we can see this displays a substantial decrease in positive affect between pre-mood induction ($M = 27.53$, $SD = 8.09$) and post-mood induction ($M = 21.41$, $SD = 6.06$). This is confirmed by a significant paired t-test, $t(16) = 4.54$, $p < .01$, 95% CI [3.26, 8.97], which suggest that the sad mood induction significantly decreased the positive valence. However, we can also see there is no substantial change in negative affect between pre-mood induction ($M = 14.82$, $SD = 5.53$) and post-mood induction ($M = 13.59$, $SD = 4.56$). This is confirmed by a non-significant paired t-test ($p > .20$), which suggests the sad mood induction had no substantial effect on the negative valence.

Depressive Groups Status and RRT

I conducted a 2x2 [2 levels of depression (between-subjects) and 2 times of measurement (within-subjects), pre- and post-mood induction] ANOVA (with repeated measures on the time factor) to examine the effect of the sad mood induction procedure on mean D_{RRT} scores as a function of Depression symptom levels. The D_{RRT} scores were the dependent variable, the assigned depressive groups were the between-subjects independent variable and the pre-post mood induction was the within-subjects' independent variable.

Mauchley’s test of sphericity yielded no significant results, therefore, homogeneity of variance between groups can be assumed. No substantial differences were found between the overall mean D_{RRT} scores before and after the sad mood induction procedure. This is confirmed by the non-significant effect of time of measurement in the 2x2 ANOVA ($p > .40$).

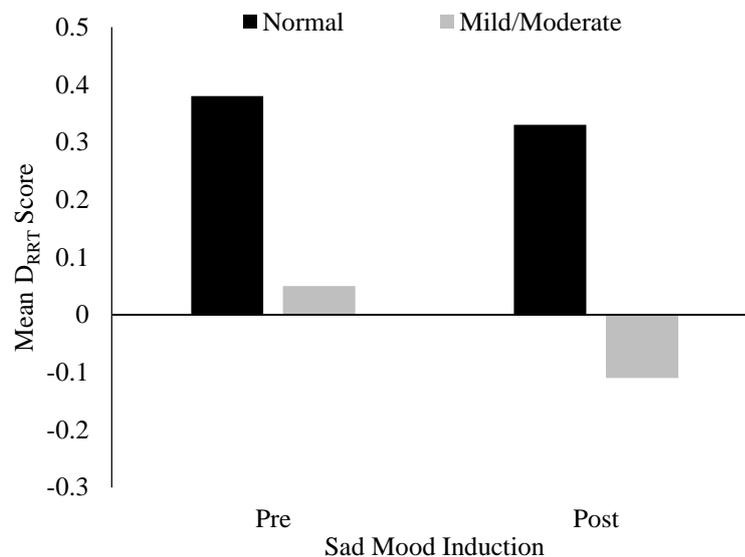


Figure 5. Depression groups emotional response biases on the RRT pre and post mood induction. Positive D_{RRT} scores mean participants were faster to provide correct ‘antecedent-affect’ congruent responses (e.g., ‘when things go well, I feel happy’) than incongruent responses. Negative D_{RRT} scores mean participants were faster to provide correct ‘antecedent-affect’ incongruent response (e.g., ‘when things go well, I feel sad’), than congruent responses.

Figure 5 shows the mean D_{RRT} scores for the depressive groups before and after the sad mood induction. The normal group displayed an antecedent-affect congruent response bias both before and after the sad mood induction. In contrast the mild-moderate depressive group initially displayed an antecedent-affect congruent response bias pre-mood induction, then an incongruent response bias post-mood induction. Figure 5 illustrates the mean D_{RRT} scores which are trending towards an interaction between the sad mood induction and depressive groups. This trend towards an interaction is from the normal group maintaining an antecedent-affect congruent response bias post-mood induction, whereas the mild-moderate depressive group shifts from a congruent response bias to an incongruent response bias

following the mood-induction procedure. This trend, however, was not statistically significant as confirmed by the non-significant interaction between time of measurement and depressive group in the 2x2 ANOVA ($p > .60$). However, we can see there is a substantial difference between the normal and mild-moderate depressive groups' means, suggesting the depressive groups display differences in responding. This is confirmed by the significant main effect of depressive group in the 2x2 ANOVA, $F(1,15) = 12.25, p < .05, \eta_p^2 = .45$. Furthermore, the partial eta squared suggests a large effect on the group on responding.

Two additional independent t-tests were conducted to compare depressive group mean D_{RRT} scores before and after the mood induction. I also conducted Levene's homogeneity of variance tests and when the data violated the assumption of homogeneity, I did not assume equality of variance. During the pre-mood induction, the normal ($M = .38, SD = .28$) and mild-moderate ($M = .05, SD = .43$) depressive groups displayed a small difference in mean D_{RRT} scores. The independent t-test confirms there was no significant difference between the two groups prior to mood induction ($p > .05$). However post-mood induction, the normal ($M = .33, SD = .22$) group displayed higher mean D_{RRT} scores than the mild-moderate ($M = -.11, SD = .42$) depressive group. The independent t-test confirmed there was a significant difference between the two groups post-mood induction, $t(15) = 2.73, p < .05, 95\% CI [.10, .78]$.

In summary, the sad mood induction procedure showed no significant interaction with depressive group status, however, the sad mood induction procedure did effect the mild-moderate depressive groups' responding on the RRT, which resulted in the change from a congruent to an incongruent response bias. This change was also significantly different from the normal group.

AAQ-II and RRT

The AAQ-II was included as an exploratory measure of psychological flexibility. The AAQ-II is scored from 7 to 49, with lower scores representing higher levels of psychological flexibility and higher scores representing lower levels of psychological flexibility. The AAQ-II mean was 22.12 ($SD = 6.70$) with scores ranging from 11 to 33, and overall distribution relatively close to normal (skewness = -0.01). The participants were divided into two post-hoc groups based on their AAQ-II scores using a mean split (Graddy, 2015). Participants with overall AAQ-II scores below the mean were defined as the ‘high flexibility’ group ($n = 10$, $M = 17.40$, $SD = 3.80$). The remaining participants with AAQ-II scores above the mean were defined as ‘low flexibility’ group ($n = 7$, $M = 28.86$, $SD = 2.73$).

As can be seen by the frequencies cross tabulated in Table 5, there is no significant relationship between the DASS depressive groups and the AAQ-II psychological flexibility groups $\chi^2 = .08$, $p > .70$. In summary five of the nine normal participants were grouped as high flexibility and the remaining four were grouped as low flexibility, whereas five of the eight mild/moderate depressive participants were grouped as high flexibility and the remaining three were grouped as low flexibility.

Table 5
Cross-tab of the AAQ-II Groups and DASS Depression Groups.

DASS Depressive Groups	AAQ-II Group		Total	
	Normal	High Flexibility		Low Flexibility
	Normal	5	4	9
	Mild/Moderate	5	3	8
	Total	10	7	17

The same 2x2 ANOVA (with repeated measures on the time factor) analysis used previously to examine the effect of depression symptom status on D_{RRT} scores was used to examine the joint effect of the sad mood induction and psychological flexibility on D_{RRT} scores. The D_{RRT} scores were the dependent variable, the assigned psychological flexibility

group was the between-subjects independent variable and the pre-post mood induction was the within-subjects' independent variable. Mauchley's test was non-significant, therefore sphericity could be assumed. No substantial differences were found between the overall mean D_{RRT} scores before and after the sad mood induction, as confirmed by the non-significant effect of time of measurement in the 2x2 ANOVA ($p > .40$).

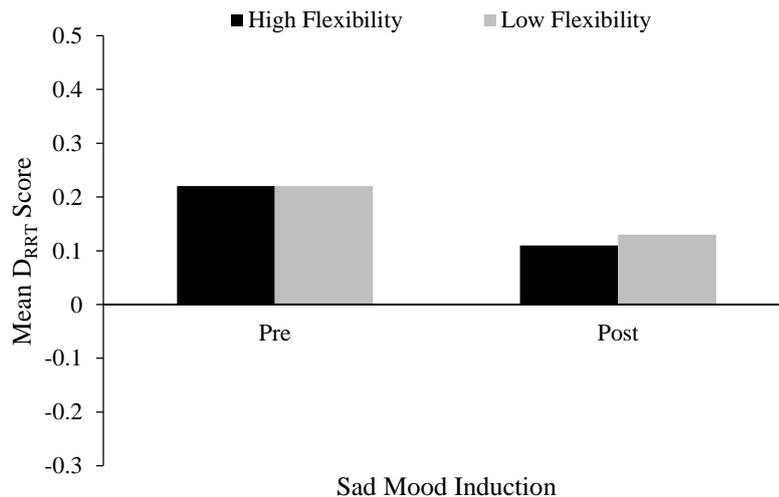


Figure 6. AAQ-II high flexibility and low flexibility groups emotional response biases on the RRT pre and post mood induction. Positive D_{RRT} scores mean participants were faster to provide correct 'antecedent-affect' congruent responses (e.g., 'when things go well, I feel happy') than incongruent responses. Negative D_{RRT} scores mean participants were faster to provide correct 'antecedent-affect' incongruent response (e.g., 'when things go well, I feel sad') than incongruent responses.

Figure 6 shows the mean D_{RRT} scores for the psychological flexibility group before and after the sad mood induction procedure. The graph shows that both high and low psychological flexibility groups display an antecedent-affect congruent response bias before and after the mood induction procedure. The lack of substantial difference between the two group means suggests there were no substantial group difference in responding on the RRT. The 2x2 ANOVA confirms this, as the main effect of psychological flexibility was non-significant ($p > .95$). In addition to the lack of difference between the group means, the psychological flexibility groups both displayed similar decreases in mean D_{RRT} scores post-mood induction, suggesting the sad mood induction did not interact with psychological

flexibility and there was no significant interaction between time of measurement and psychological flexibility group ($p > .90$). In summary, there was no significant difference between the high and low psychological flexibility groups mean D_{RRT} scores before or after the sad mood induction procedure.

RRQ and RRT

The RRQ was also included as an exploratory measure of rumination. For the purpose of this study only the rumination subscale is of interest. RRQ rumination subscale scores range from 12 to 60, with higher scores reflecting greater levels of rumination. The participants' rumination scores ranged from 25 to 56 with a mean of 44.24 ($SD = 8.07$). The overall distribution of the ruminant scores was asymmetrical, negatively skewed towards lower rumination scores (skewness = -0.82). The participants were divided into two post-hoc groups based on their RRQ rumination scores, using a mean split (Graddy, 2015).

Participants rumination scores below the mean were defined as the 'low rumination' group ($n = 6, M = 36.00, SD = 6.93$) and the remaining participants with scores above the mean were defined as the 'high rumination' group ($n = 11, M = 48.73, SD = 4.15$). As can be seen by the frequencies cross tabulated in Table 6, there is no significant relationship between the depressive groups and the rumination groups, $\chi^2 = .70, p > .40$. In summary, four of the nine normal participants were grouped as low rumination and the remaining five were grouped as high rumination, in contrast two of the eight mild/moderate participants were grouped as low rumination and the remaining six were grouped as high rumination.

Table 6
Cross-tab of the Rumination Groups and DASS Depression Groups.

		RRQ Rumination Groups		Total
		Low Rumination	High Rumination	
DASS Depressive Groups	Normal	4	5	9
	Mild/Moderate	2	6	8
	Total	6	11	17

The same 2x2 ANOVA (with repeated measures on the time factor) analysis used previously to analyse D_{RRT} scores was used to examine the effect of the sad mood induction on the rumination groups D_{RRT} scores. The D_{RRT} scores were the dependent variable, the assigned rumination group was the between-subjects independent variable and the pre-post mood induction was the within-subjects' independent variable. Mauchley's test was non-significant, therefore sphericity could be assumed. No substantial differences were found between the overall mean D_{RRT} scores before and after the sad mood induction, as confirmed by the non-significant effect of time of measurement in the 2x2 ANOVA ($p > .60$).

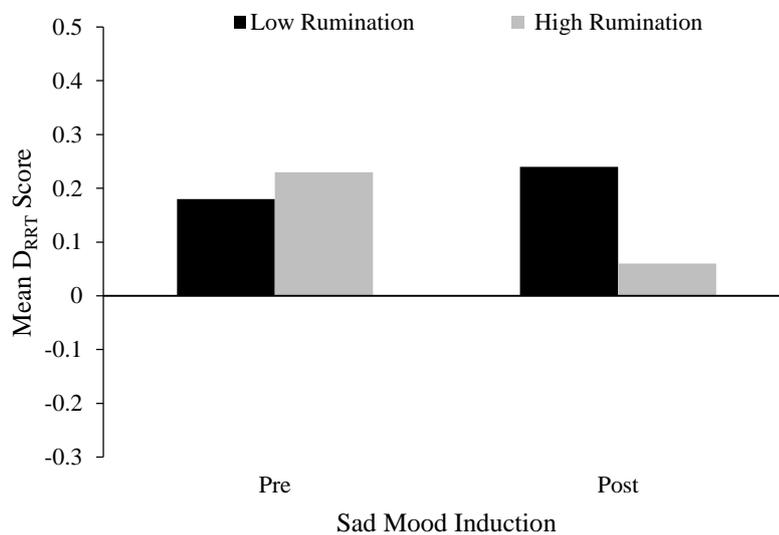


Figure 7. RRQ-rumination groups emotional response biases on the RRT pre and post mood induction. Positive D_{RRT} scores mean participants were faster to provide correct ‘antecedent-affect’ congruent responses (e.g., ‘when things go well, I feel happy’) than incongruent responses. Negative D_{RRT} scores mean participants were faster to provide correct ‘antecedent-affect’ incongruent response (e.g., ‘when things go well, I feel sad’) than incongruent responses.

Figure 7 shows the mean D_{RRT} scores for the rumination groups before and after the sad mood induction. The graph shows the both high and low rumination groups display antecedent-affect congruent response biases both before and after the sad mood induction. At first glance it would appear there is small difference between group means at pre-mood induction, and a larger difference between group means post-mood induction, however, these group differences are very small, suggesting there is no substantial difference in responding

between groups, confirmed by the lack of a statistically significant effect of group on responding ($p > .70$). The graph also appears to show a decrease in D_{RRT} scores post-mood induction for the high rumination, and an increase in D_{RRT} scores for low rumination. This would suggest an interaction between the sad mood induction and the rumination groups, however, there was no significant interaction between the sad mood induction procedure and the rumination groups ($p > .30$). In summary, there was no significant difference between the high and low rumination groups mean D_{RRT} scores before or after the sad mood induction procedure.

Specificity of RRT to Depressive Symptoms

Previous analysis showed there was no significant interaction between sad mood induction and the depressive groups D_{RRT} scores. However, there was a significant difference in D_{RRT} scores post-mood induction. Therefore, I conducted additional analyses to examine the specificity of the RRT as an implicit measure of any relationship between mood induction and depression levels by comparing the data assorted by anxiety and stress DASS scores rather than depression. As for the depressive groups factor, the participants stress and anxiety scores were used to create ‘normal’ and ‘mild-moderate’ post-hoc groups using the cut off values taken from the DASS manual (Lovibond & Lovibond, 1993). Participants’ anxiety and stress scores are presented below in Table 7.

Table 7
Scores Obtained from the DASS Stress and Anxiety Scales, Including the Cut-off Scores Used to Divide Groups.

	Anxiety			Stress		
	Cut-off Score	<i>n</i>	<i>M (SD)</i>	Cut-off Score	<i>n</i>	<i>M (SD)</i>
Normal	0 – 7	9	4.67 (1.73)	0 - 14	12	10.00 (4.18)
Mild/ moderate	8 - 14	7	10.86 (2.54)	15-25	5	20.80 (3.63)

The same two 2x2 [2 levels of anxiety or stress (between-subjects) and 2 times of measurement (within-subjects), pre- and post-mood induction] ANOVA analyses (with repeated measures on the time factor) as used previously were conducted separately for the anxiety and stress groups. This was to examine the effect of the sad mood induction procedure on the D_{RRT} scores when participants were differentiated by anxiety and stress rather than depression. The results showed there was no significant effect of sad mood for either the stress group ($F(1,15) = 1.79, p > .20, \eta_p^2 = .11$) or the anxiety group ($F(1,14) = 1.18, p > .30, \eta_p^2 = .08$). There was also no significant interaction found for either the stress group ($F(1,15) = .47, p > .50, \eta_p^2 = .03$) or the anxiety group ($F(1,14) = .17, p > .60, \eta_p^2 = .01$). Therefore, the results suggest the RRT may indeed be an implicit measure of the relationship between sad mood induction and depression levels, and cannot be generalised to stress and anxiety. This is expected considering that the RRT stimuli was originally developed from the DASS depression scale (see Hussey and Barnes-Holmes, 2012).

Discussion

The current study is a pilot study that sought to examine the utility of the RRT as an implicit measure of cognitive reactivity using a convenience sample of individuals without clinical symptoms of depression by replicating Hussey and Barnes-Holmes (2012). My overall hypotheses were that, as a result of the sad mood induction procedure, the depressive, psychological flexibility and rumination groups would all display similar patterns of differential change in emotional responses to life events. However, anxiety and stress groups were predicted to display no patterns of differential change in emotional responses to life events. Furthermore, these patterns would be consistent with the findings by Hussey and Barnes-Holmes (2012), which found differential responding patterns of change in response to the sad mood induction, for both depressive and psychological flexibility groups.

Results of the current study indicated the sad mood induction was effective at inducing a sad mood. However, effects on the RRT can be attributed to a decrease in positive affect rather than an increase in negative valence. The depressive participants were the only groups to display results that were consistent with Hussey and Barnes-Holmes (2012) by displaying the differential responding patterns of change in response to the sad mood induction. Whereas, the psychological flexibility and rumination groups did not display any differential responding patterns of change in response to the sad mood induction, which is inconsistent with the findings by Hussey and Barnes-Holmes (2012).

DASS Groups

Prior to the mood induction procedure both normal and mild-moderate depressive groups displayed an antecedent-affect congruent response bias, however, after the mood induction procedure, the normal depressive group continued to display an antecedent-affect congruent response bias; whereas the mild-moderate depressive group shifted to display an antecedent-affect incongruent response bias. The pattern of differential change displayed by the depressive groups supports the hypothesis. These results show that the mood induction procedure impacted on the emotional responses of participants demonstrating mild-moderate levels of depressive symptoms but not participants demonstrating normal levels of depressive symptoms. The relationship between sad mood and depressive group is further supported by the significant correlation between the post-mood induction D_{RRT} scores and the depression subscale scores. These findings are consistent with Hussey and Barnes-Holmes (2012), which conceptually suggests mild-moderate depressive individuals' emotional reactions to life events are sensitive to mood state effects. It also provides promising evidence that the RRT is a valid measure of cognitive reactivity.

On the other hand, comparing groups separated by anxiety and stress scores on the DASS rather than by depression revealed no pattern of differential change in response to the

mood induction. These findings confirm the hypothesis and therefore are consistent with Hussey and Barnes-Holmes (2012) and also suggests that mood state dependent effects on the RRT can be attributable to depressive symptoms specifically rather than psychopathology generally. As Hussey and Barnes-Holmes (2012) suggested, a lack of differential changes is unsurprising considering the stimuli was derived from the DASS depression scale, and sad mood effects have been established within depression (Roefs et al., 2011; Gemar et al., 2001). In summary, the effects on the RRT for the depressive, anxiety and stress groups are all consistent with Hussey and Barnes-Holmes (2012), which suggests the RRT is indeed a reliable measure of cognitive reactivity.

It is important to note that this conclusion is pertinent only to the RRT task when the stimuli presented are contrived to be specific to depression. It is conceivable that an RRT task with anxiety (or stress)-related sets of stimuli, and a mood-induction procedure designed to induce anxiety (or stress) might demonstrate that the RRT, as an implicit responding task, was able to detect response biases resulting from implicit beliefs in domains other than depression. This possibly needs further investigation. Such generality of implicit response tasks is intrinsic to general theories of the relationship between (implicit) cognition and action, and such a demonstration would strengthen the wider theory linking the two phenomena.

These results tentatively suggest the more an individual is experiencing the symptoms of depression, the more susceptible they are to mood state dependent effects, which is consistent with previous literature (Teasdale, 1988; Hussey & Barnes-Holmes, 2012). In essence, this means that during a normal emotional state, depressive individuals are likely to favour emotional reactions that are consistent with the event (e.g., When good things happen, I feel happy). However, while experiencing a sad mood, they are likely to favour emotional reactions that are inconsistent with the events (e.g., When good things happen, I feel sad).

These findings are consistent with Hussey and Barnes-Holmes (2012), which indicates that the RRT is able to detect and measure cognitive reactivity. Specifically, the RRT is able to detect the negative responding patterns activated by the sad mood in the mild-moderate depressive participants, which is not seen in normal depressive participants.

Psychological Flexibility

The results of dividing the sample by levels of psychological flexibility showed that, prior to the mood induction procedure, both the high and low psychological flexibility groups displayed an antecedent-affect congruent response bias. After the mood induction procedure, both groups continued to display the antecedent-affect congruent response bias. Therefore, these results do not support the study hypothesis because there is no pattern of differential change found between the psychological flexibility groups. The lack of change can be attributed the mood induction procedure having no impact on the emotional responses of the participants demonstrating high or low levels of psychological flexibility. These results, tentatively suggest the high and low psychological flexibility individuals are not susceptible to mood state effects. In essence, this means the individuals are likely to favour emotional reactions that are consistent with the event (e.g., When good things happen, I feel happy), regardless of their emotional state. These findings are inconsistent with previous literature (Bond et al., 2011, Hussey & Barnes-Holmes, 2012) and suggests the RRT is not a valid implicit measure to detect cognitive reactivity. Specifically, the RRT was unable to detect any significant changes in responding patterns caused by the sad mood induction, however, the differences between my study and Hussey and Barnes-Holmes (2012) may be due to limitations of my study rather than the RRT.

One explanation for the difference between Hussey and Barnes-Holmes (2012) and this study could be the differences between our psychological flexibility groups and the questionnaires used to create them rather than the RRT. The differences between our studies

are as follows. Hussey and Barnes-Holmes (2012) sample consisted of 18 participants defined as low psychological flexibility and 12 participants defined as high psychological flexibility (post-hoc) based on the 10-item AAQ-II (Bond et al., 2011), whereas my sample consisted of 7 participants defined as low psychological flexibility and 10 participants defined as high psychological flexibility post-hoc based on the 7-item AAQ-II (Bond et al., 2011a). The 7-item AAQ-II was selected for this study because it displayed better psychometric consistency than the 10-item AAQ-II (Bond et al., 2011a). Although both samples were created using similar measures of psychological flexibility, Hussey and Barnes-Holmes (2012) groups reflected more extreme levels of high and low psychological flexibility because the groups were separated by > 2 standard errors. Whereas in my study, the two groups of psychological flexibility were closer to the mean because they were separated by a mean split and therefore the two samples were less well differentiated on the psychological flexibility dimension.

Another explanation for these differences could be the overlap between the depressive groups and the psychological flexibility groups in our studies. Hussey and Barnes-Holmes (2012) high psychological flexibility group was relatively similar to the normal depressive group and the low psychological flexibility group was relatively similar to the mild-moderate depressive group. The consistency between these groups is one explanation for why Hussey and Barnes-Holmes (2012) were able to find similar IRAP effects. Whereas in my study the high and low psychological flexibility groups were different to the normal and mild-moderate depressive groups. The lack of overlap between the groups within my study may be a result of using the 7-item AAQ-II. These differences could be addressed in future research by increasing the sample size to increase power and reduce type two errors, use the original 10-item AAQ-II to group participants and separate the groups by at least >2 standard errors.

Rumination

Prior to the mood induction procedure both the high and low rumination groups displayed an antecedent-affect congruent response bias. After the mood induction procedure, both groups continued to display the antecedent-affect congruent response bias. Therefore, these results do not support the study hypothesis, because there was no pattern of differential change found between the rumination groups. This is a result of the mood induction procedure having no impact on the emotional responses of the participants demonstrating either high or low levels of rumination and tentatively suggests that the high and low rumination individuals are not susceptible to mood state effects. In essence, this means that individuals are likely to favour emotional reactions that are consistent with the event regardless of their emotional state, independent of their tendency to ruminate. These findings are inconsistent with previous literature (Hussey & Barnes-Holmes, 2012; Moulds et al., 2008; Lo, Ho, Hollon, 2007), and again tentatively suggests that the RRT may not be a valid implicit measure of cognitive reactivity for individuals differentiated by rumination level. Specifically, the RRT was unable to detect any significant change in responding patterns caused by the sad mood as a function of rumination levels.

Although the RRT was unable to detect any significant changes pre and post mood induction between the high and low rumination groups, it was able to detect some changes. As expected the high rumination group displayed a decrease in antecedent-affect congruent responses bias by trending towards an incongruent response bias however this change did not reach statistical significance. This suggests that the RRT is able to detect differences in cognitive reactivity between groups and the lack of any significant relationship may be a result of the limitations of the current study rather than the RRT. The small sample within the current study was not normally distributed and is one potential explanation for a lack of substantial differential change. A small sample lacks power to identify significant effects

because it is susceptible to type two errors. Another potential explanation could be method used to create the rumination groups and how these groups overlapped with the depressive groups. The rumination groups were created post-hoc using a mean split based on the participants' rumination scores. Therefore, the two groups may not have distinctively represented high and low rumination groups independent of depression symptoms. Although it must be noted that high levels of rumination are thought to be a vulnerability factor to depression (Nolen-Hoeksema, 2000), suggesting that these are not independent dimensions of individual difference. In addition, both rumination groups consisted of normal and mild-moderate depressive participants. Therefore, it is unsurprising that the effects on the RRT for the rumination groups were not similar to the depressive groups. To address these limitations, I would recommend increasing the sample size and creating two rumination groups that represent greater extremes of high and low rumination.

Comparison of RRT and IRAP

The RRT was selected as the implicit measurement procedure because of its advantages over the IRAP (see De Houwer et al., 2015). All participants successfully completed the RRT procedure, and no participants were removed due to their performance on the RRT. Therefore, the low attrition rate found in my study is consistent with previous RRT research (De Houwer et al., 2015). The completion and attrition rates for the IRAP were not reported by Hussey and Barnes-Holmes (2012). Therefore, we were unable to confirm if the RRT has lower attrition rates than the IRAP. Previous research has suggested the RRT requires less time to complete than the IRAP (De Houwer et al., 2015). Unfortunately, Hussey and Barnes-Holmes (2012) did not report the amount of time participants spent completing the IRAP, therefore, I am unable to confirm if the RRT requires less time to complete than the IRAP. In addition, the administration of the RRT is identified as another advantage over IRAP. The IRAP used by Hussey and Barnes-Holmes (2012) did not have

any explicit responding rules which increases the difficulty of the procedure. As a consequence, while the participants individually completed the IRAP the experimenter had to be seated near the participant during the instructional phases to provide assistance. In contrast the RRT has explicit responding instructions and in my study, participants were able to complete the RRT procedure in groups. This is an advantage of the RRT because collecting data is less time consuming than the IRAP. In summary, performance on the RRT in my study is consistent with previous research (De Houwer et al., 2015) which suggests that the RRT does have advantages over the IRAP, however, I am unable to confirm these advantages due to insufficient information provided by Hussey and Barnes-Holmes (2012).

Limitations, Applications, Future Research and Conclusions

The purpose of this study was to examine the validity of the RRT as an implicit measure of cognitive reactivity. However, limitations of the current study may provide explanations as to why I was unable to replicate the findings of Hussey and Barnes-Holmes (2012). These limitations are not necessarily specific to the RRT as an implicit measure but rather a result of the design of the current study. Two limitations, namely the small sample size and group analysis have already been noted above and recommendations to address them in future research have been provided. Another limitation which has not been highlighted is the lack of measurement validity of the RRT. As mentioned in my introduction, statements corresponding with the DASS subscales, ‘dysphoria’, ‘devaluation of life’ and ‘inertia’ were removed from the original set of stimuli to meet the technical limitations of the RRT. Removing the stimuli, may be one explanation for why the findings in the current study were inconsistent with previous literature. This limitation could be addressed in future research by validating which stimuli are most susceptible to sad mood effects within samples differentiated along depressive, psychological flexibility and rumination dimensions.

My exploratory study has provided some evidence that the RRT can be used as an implicit measure of cognitive reactivity. However, the findings of the current study do not provide strong support for this proposition. However, these results are inconsistent with previous research may be caused by the limitations of the study rather than the RRT itself. Therefore, my study provides initial evidence that the RRT could be applied as an implicit measure of cognitive reactivity. More research is needed to validate the utility of the RRT as an implicit measure of cognitive reactivity.

Due to the lack of research verifying the utility, validity and employability of the RRT as an implicit measure, a large number of recommendations could be made, however, based on the findings of the current study, I have suggested the following recommendations. As previously mentioned addressing the limitations of the current study is the first recommendation. This would help determine if the results of the current study are inconsistent with previous literature due to the small sample size and group analysis rather than the RRT.

The current study utilised a convenience sample of undergraduate students. I suggest future research could replicate the design of the current study using samples of people classed as depressed and remitted-depressed based on clinical history. This would provide evidence for the utility of the RRT as an implicit measure of cognitive reactivity within various populations.

The current study identified that prior to the mood induction there was no difference in responding between groups. These findings are consistent with previous research (Hussey & Barnes-Holmes, 2012; Gemar et al., 2001). Therefore, if any research seeks to replicate the study there is established literature to accept the premise that the negative mood is necessary to observed group differences and future research would be able to use a shorter paradigm that begins with a mood induction procedure followed by a post-induction task.

To conclude, this study sought to explore the utility of the RRT as an implicit measure of cognitive reactivity by replicating the study by Hussey and Barnes-Holmes (2012). Its purpose was to examine if the RRT is able to implicitly measure cognitive reactivity and display patterns of differential change that were similar to those observed using the IRAP. As expected, the individuals differentiated by levels of depression symptoms displayed patterns of differential change while those differentiated by anxiety and stress symptoms did not. These findings are consistent with Hussey and Barnes-Holmes (2012), which suggest the RRT is a potentially valid implicit measure of cognitive reactivity, however, the psychological flexibility and rumination groups unexpectedly displayed no patterns of differential change. Although these results were inconsistent with previous research, they may be due to limitations of the current study rather than the RRT. These findings provide initial evidence for the RRT being an implicit measure of cognitive reactivity. However, this study was exploratory and more research is clearly needed to validate the utility of the RRT as a measure of cognitive reactivity within various populations. Furthermore, research could compare the RRT with other implicit measures of cognitive reactivity, to explore the advantages and utility of the RRT.

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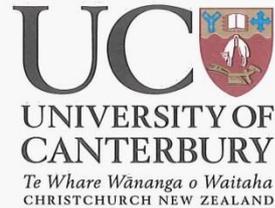
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Appendix A: Information Form

College of Science

Department of Psychology
Tel: +64 3 364 2902, Fax: +64 3 364 2181
Email: psychology@canterbury.ac.nz
www.psyc.canterbury.ac.nz



Relational Responding Task as a Measure of Implicit Depression and the Role of Psychological Flexibility Information Sheet for Participants

I am Grace Walker and I am a Master's thesis student at the University of Canterbury. The purpose of my research is to repeat a previous experiment designed to find out if an implicit measure (a measure that taps into non-conscious processes) is useful in the detection of psychological distress and psychological flexibility for people who have no current psychological diagnosis. The difference between the previous study and my study is that I will use the Relational Responding Task as a novel implicit measure of a specific psychopathology and psychological flexibility during a mood induction procedure.

If you choose to take part in this study, your involvement in this project will require you to complete the tasks individually. You will complete multiple questionnaires, two implicit quick reaction tasks and listen to music to induce a sad mood and a happy mood. All of your answers will be recorded automatically on the computer for later analysis.

There is a potential risk the sad mood induction procedure will produce distress from the sad mood or memories. A second positive mood induction procedure will be provided to mitigate any risk of distress of sadness. Information for helplines and counsellors will also be provided at the end of the study.

Participation is voluntary and you have the right to withdraw at any stage without penalty. You may ask for your raw data to be returned to you or destroyed at any point prior to when I begin the analysis of the data. If you withdraw before then, I will remove information relating to you. If you do not withdraw your data, it will be amalgamated with all other participants and the identity of any individual's data will not be known and I will not be able to remove your data.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation. To ensure anonymity and confidentiality, all identifying information such as names and student identification numbers will be removed from the data set then recoded. The data will be securely stored on password protected computer folders and will only be accessible from the researcher and their supervisor. The data collected in this study may be used in further postgraduate research or published and therefore the data may be stored up to 10 years on the University of Canterbury servers. A thesis is a public document and will be available through the UC Library.

Please indicate to the researcher on the consent form if you would like to receive a copy of the summary of results of the project.

The project is being carried out as a requirement for a Master's thesis in Psychology by Grace Walker under the supervision of Neville Blampied who can be contacted at

Neville.blampied@canterbury.ac.nz and Janet Carter who can be contacted at Janet.Carter@canterbury.ac.nz. They will be pleased to discuss any concerns you may have about participation in the project.

This project has been reviewed and approved by the University of Canterbury Human Ethics Committee, and participants should address any complaints to The Chair, Human Ethics Committee, University of Canterbury, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).

If you agree to participate in the study, you are asked to complete the consent form and return it to the instructor in the room before beginning any tasks.

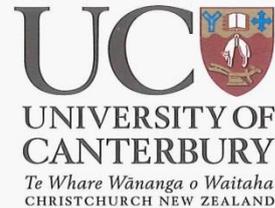
Grace Walker.

Department of Psychology
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Email: grace.walker@pg.canterbury.ac.nz

Appendix B: Consent Form

College of Science

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Relational Responding Task as a Measure of Implicit Depression and the Role of Psychological Flexibility Consent Form for Participants

- I have been given a full explanation of this project and have had the opportunity to ask questions.
- I understand what is required of me if I agree to take part in the research.
- I understand that participation is voluntary and I may withdraw at any time without penalty. Withdrawal of participation will also include the withdrawal of any information I have provided should this remain practically achievable.
- I understand that any information or opinions I provide will be kept confidential to the researcher and their supervisors and that any published or reported results will not identify the participants.
- I understand that a thesis is a public document and will be available through the UC Library.
- I understand that all data collected for the study will be kept in locked and secure facilities and in password protected electronic form and may be stored indefinitely.
- I understand the data from this study may be used in further postgraduate research and therefore may be stored up to 10 years.
- I understand the risks associated with taking part and how they will be managed.
- I understand that I am able to receive a report on the findings of the study by contacting the researcher at the conclusion of the project
- I understand that I can contact the researcher Grace Walker at grace.walker@pg.canterbury.ac.nz, or the supervisors Neville Blampied at Neville.blampied@canterbury.ac.nz; or Janet Carter at janet.carter@canterbury.ac.nz, for further information. If I have any complains, I can contact the Chair of the University of Canterbury Human Ethics Committee, Private Bag 4800, Christchurch (human-ethics@canterbury.ac.nz).
- I would like a summary of the results of the project.
- By signing below, I agree to participate in this research project.

Name: _____ Signed: _____ Date: _____

Email address for report findings: _____

Please return the consent form to the instructor in the room.

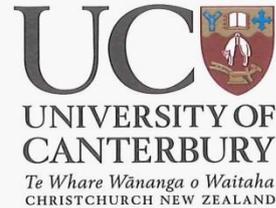
Thank you,
Grace Walker

Department of Psychology
Telephone: +64 03 366 7001 (extension: 7704)
Email: grace.walker@pg.canterbury.ac.nz

Appendix C: Debrief Form

College of Science

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Relational Responding Task as a Measure of Implicit Depression and the Role of Psychological Flexibility Participant Debrief

Previous research has suggested mood may be a contributing factor to relapse in depression because of its effect on psychological flexibility. This study is designed to find out if mood affects the relationship between depression and psychological flexibility by repeating previous studies using a new research method.

This new method is the Relational Responding Task (RRT), a measure of your psychological flexibility, which measures your ability to change your responding based on the rules presented during the RRT procedure. We also obtained your depression score from the Depression, Anxiety, Stress Scale (DASS-21) so that we could work out where you lie on the range of no depression to mild depression.

As part of the procedure we also exposed you to a mood induction procedure through exposing you to music of different kinds. This was to examine if mood affects psychological flexibility differently for those with mild to moderate depression scores compared to those with low/no depression scores.

Based on previous research, I expect participants with low/no depression scores to show similar psychological flexibility to participants with mild to moderate depression scores before inducing a sad mood. However, after inducing the sad mood, I expect participants with low/no depression scores to show higher psychological flexibility than participants with mild to moderate depression scores.

This study has been designed to induce a sad mood in participants, which was necessary to examine if mood affects the relationship between depression and psychological flexibility. To mitigate any negative emotions from inducing this sad mood, we included a positive mood induction at the end of the study. However, if you have experienced any personal distress, sadness or unwanted feelings as a result of this experiment please do not hesitate to seek help or someone to talk to. Please contact any of the following to help with any personal distress:

Counsellors at the University of Canterbury

Location: UC Health Centre
Phone: +64 3 364 2402

Youthline

Free call: 0800 376 633
Free txt: 234
Website: www.youthline.co.nz

Lifeline

Free call: 0800 543 354

Please feel free to ask any questions or express any concerns you may have about the study to the researcher in the room. Alternatively, you can email the researcher at

grace.walker@pg.canterbury.ac.nz.

Department of Psychology

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