MAJOR RESEARCH PROJECT:

The causal role of appraisal biases upon negative repetitive thinking and emotional reactivity.

LITERATURE REVIEW: Do biases in appraisal biases casually influence the frequency of negative repetitive thought?

EMPIRICAL PAPER: What dimensions of attributional style influence mood and rumination? A factorial based cognitive-bias-modification experiment.

Submitted by **Kate Victoria Williams**, to the University of Exeter

as a thesis for the degree of **Doctor of Clinical Psychology**, May 2016

Signature: ……..

Author's Declaration

The literature review was completed independently by the author, with the exception of where papers were also independently checked by a second researcher for reliability purposes. All elements of the empirical paper were completed independently by the author.

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SCHOOL OF PSYCHOLOGY

DOCTORATE IN CLINICAL PSYCHOLOGY

LITERATURE REVIEW

Do biases in appraisal causally influence the onset and duration of negative repetitive thought?

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Abstract

Repetitive negative thought (RNT) has been established as a core process underlying various forms of psychopathology. Cognitive models hypothesize that RNT is, in part, activated and maintained by biases in appraisal. Recent research has experimentally manipulated appraisal to test whether appraisals causally influence RNT. This paper reviews this experimental research to answer the question: Do systematic appraisal biases influence the onset and duration of RNT?

A systematic search of OVID, EBSCO, Web of Science, PubMed, and Cochrane Trials databases took place between December 2015-January 2016 using terms describing appraisal biases and repetitive negative thought. Searches were limited to adult samples and must have included a manipulation of appraisal, measures of RNT pre-post manipulation, and direct analyses of the effect of condition trained upon RNT. Of the 4,794 titles and abstracts screened, 40 articles were read in full and 16 articles found to meet inclusion/exclusion criteria.

Overall, support was found for the hypothesised causal effect of appraisal upon RNT frequency, consistent with appraisal bias models. Similar patterns of effects were identified regardless of the appraisal manipulated (interpretation, concreteness or secondary appraisals) or the type of RNT outcome (rumination, worry intrusions, or intrusive thoughts). Failures to detect significant effects could potentially be explained by design limitations and low power. Future research is needed to further understand the nature of this effect, that is, to dismantle the active components involved, clarify the role of individual difference factors in moderating the effect, and ascertain the boundary conditions to its influence.

Keywords

Interpretational Bias, Attributional Bias, Repetitive Negative Thought, Cognitive Bias Modification of Interpretation, Rumination, Worry

Introduction

Repetitive negative thought (RNT) has been defined as “repetitive thinking about one or more negative topics that is experienced as difficult to control” (Ehring & Watkins, 2008, p. 193). Often initiated by an initial thought intrusion (Watkins, 2004), RNT includes constructs such as depressive rumination, defined as “repetitive and passive thinking about one’s symptoms of depression and the possible causes and consequences of these symptoms” (Nolen-Hoeksema, 2004, p.107), and worry, defined as “a chain of thoughts and images, negative emotion-laden and relatively uncontrollable” (Borkovec, Robinson, Pruzinsky, & DePree, 1983, p.10).

There is evidence that RNT causally contributes to a number of psychological disorders (e.g., depression, generalised anxiety disorder [GAD], social anxiety and post-traumatic stress disorder), and is, therefore, a strong candidate for being a “transdiagnostic” process (see Ehring et al., 2008; Harvey, Watkins, Mansell, & Shafran, 2004; Watkins, 2013 for reviews). Although there is clear evidence for the negative consequences of RNT, the mechanisms that underpin its development and maintenance are less well understood (Nolen-Hoeksema, Wisco & Lyubomirsky, 2008; Watkins, 2004). In particular, there remains the question of why some people engage in RNT more frequently and for longer than others, despite its negative consequences?

The way individuals appraise the meaning of life events is hypothesised as one factor that causally contributes to RNT frequency. Appraising information is “the act of making an evaluation…of whether or not what is happening is *relevant* to one’s values, goal commitments, beliefs about self and world, and situational intentions” (Lazarus, 2001, p.37). The most commonly considered forms of appraisal include interpretation, defined as “the product of the semantic

process by which ambiguity is resolved" (Hirsch, Meeten, Krahe & Reeder, 2016, p.282), and attribution, defined as "the processes by which people infer the causes for why particular outcomes occurred" (Harvey et al., 2004 p. 136). Biases in appraisal describe the tendency to appraise in a particular way, for example, a greater likelihood to reach negative conclusions than positive conclusions (Harvey, Town, & Yarkin, 1981; Mathews & MacLeod, 2005). Appraisal theories of emotion argue that these biases causally contribute to vulnerability or resilience to emotional disorders by influencing emotional reactivity and regulation (see Hertel & Mathews, 2011; Hirsch et al., 2016; Mathews & MacLeod, 2005 for reviews).

One hypothesized pathway by which biases in appraisal may influence vulnerability to emotional disorders is by impacting RNT onset and perseverance. For instance, the cognitive vulnerability-stress model of hopelessness depression (Abramson, Metalsky, & Alloy, 1989) implicates a negative appraisal style in the engagement and perseverance of depressive rumination (Abramson et al., 2002; Alloy & Abramson, 2007; Alloy, Abramson, Keyser, Gerstein, & Sylvia, 2008). Specifically, following a negative event, appraisals that include (a) the tendency to attribute events to stable (enduring) and global (widespread) causes, (b) the tendency to infer further negative consequences from the event, and (c) the tendency to consider the negative event as related to self-worth are hypothesised to increase the likelihood of engaging in depressive rumination (Abramson, et al., 2002; Alloy & Abramson, 2007). They are also hypothesised to reduce the individual's ability to disengage from depressive rumination because they impair his or her ability to generate solutions or selectively attend elsewhere, thereby, increasing hopelessness and vulnerability to depression (Abramson, et al., 2002; Alloy &

Abramson, 2007; Alloy, et al., 2008).

The extent to which the negative event construal is abstract, (characterized by general, decontextualized summaries of the meanings and consequences of events) versus concrete (characterized by detailed, specific, contextualized representations of events) is also hypothesized to influence RNT (Stöber, 1998; Watkins, 2008). Stöber (1998) hypothesised that abstract processing during worry operates as an attempt to avoid high emotional distress by moving away from the emotive details of the concern, but that this results in the unintended consequence of reducing the individual's ability to disengage from the worry, due to reduced problem solving and maintenance of attention upon threat (Borkovec, 1994; Borkovec, Alcaine, & Behar, 2004; Stöber, 1998).

Similarly, in relation to depression, the processing mode hypothesis proposes that the level of construal adopted during appraisal determines the extent to which self-focussed rumination is dysfunctional (Watkins et al., 2008). Specifically, an abstract evaluative processing mode is hypothesised to result in unhelpful consequences that prolong RNT, such as impaired problem-solving, greater emotional reactivity, and greater personal goal importance, relative to a concrete processing mode (Watkins & Baracaia, 2005; Watkins & Moulds, 2005; Watkins et al., 2008).

There is correlational evidence linking appraisal and RNT. Students high in self-reported depressive rumination make more negative interpretations of ambiguous scenarios than students low in self-reported depressive rumination (Hertel & El-Messidi, 2006; Mor, Hertel, Ngo, Schachar, & Redak, 2014). Similarly, the degree of concreteness during event processing has been associated with depressive rumination (Watkins & Moulds, 2005) and levels of worry (e.g., Behar et al., 2012). However, as this evidence is correlational, it

does not enable inference about whether appraisal biases causally influence RNT.

Cognitive-bias-modification (CBM) paradigms have been explicitly developed to manipulate cognitive biases, including appraisals, in order to test their causal role in emotional disorders (see Fox, Mackintosh, & Holmes, 2014; Hertel & Mathews, 2011; Woud & Becker, 2014 for reviews). CBM involves the presentation of multiple trials in which the participant is repeatedly trained to respond in a systematically biased manner, such that it becomes a learnt response (Mathews & MacLeod, 2011).

For example, “interpretive bias modification” involves the participant being trained to consistently disambiguate incomplete scenarios towards a benign or negative response across many trials (Eysenck, Mogg, May, Richards, & Mathews, 1991; Mathews & Mackintosh, 2000). A single trial involves the presentation of a scenario (e.g., “You wake up and realise your alarm hasn’t gone off. Perhaps you are late for work. As you look over at your clock you realise that getting to work on time will be…”) followed by either a benign or negative word fragment congruent with the relevant training condition (e.g., “f_ne” [i.e., fine] or “i_possible” [i.e., impossible] respectively). Participants are asked to complete the word fragment to disambiguate the appraisal made. They are then asked to answer a question regarding the appraisal made (e.g., Will you get to work on time?), and training-congruent answers are positively reinforced through feedback (correct/incorrect). For any training condition, there are many trials, of which 90-100% involve the same direction of disambiguation, such that over repeated trials, participants learn to make the type of response consistently reinforced.

CBM-appraisal paradigms have typically focussed upon manipulating

interpretational style, as described above (CBM-I; see Hirsch et al., 2016 for review). More recently, manipulations of construal style (abstract versus concrete; Watkins, 2004; Watkins, Baeyens, & Read, 2009; Watkins, Moberly & Moulds, 2008), attributional biases (Peters, Constans, & Mathews, 2011), and appraisals of the meaning of the emotional response to a situation or event (CBM-App; Woud, Holmes, Postma, Dagleish, & Mackintosh, 2012) have also been developed. Furthermore, CBM research has largely focussed upon testing the causal effect of appraisal biases on emotional reactivity, rather than other key cognitive symptomatology, such as RNT (Fox et al., 2014). A recently emerging body of research has examined the effects of CBM on RNT. For instance, CBM-I has been found to reduce depressive state rumination (Hertel, Mor, Ferrari, Hunt, & Agrawal, 2014), worry (Hayes, Hirsch, Krebs, & Mathews, 2010; Hirsch, Hayes, & Mathews, 2009), and frequency of intrusive thoughts or memories after recalling a distressing memory (Lang, Blackwell, Harmer, Davison, & Holmes, 2012) or watching a trauma film (Lang, Moulds, & Holmes, 2009; Woud et al., 2012).

However, not all studies have found an effect of manipulating appraisals on RNT (e.g., Mogoaşe, Brăilean, & David, 2013; Newby, Werner-Seidler, Holmes, & Moulds, 2014) and, to the author's knowledge, no review of this literature has been undertaken. As a newly emerging field, it is important to systematically and critically review the existing evidence base related to appraisal causing RNT, in order to establish the status of empirical support for this hypothesised causal effect. Thus, this review aims to critically evaluate the experimental literature to answer: Do biases in appraisal causally influence the onset and duration of RNT?

Method

The Preferred Reporting Items for Systematic reviews and Meta Analyses (PRISMA) Statement guidelines for reporting a systematic review were used to guide this review (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009).

Eligibility Criteria

Based upon the Participant, Intervention, Comparator, Outcomes (PICO) technique for developing clinical research questions (O'Connor, Green, & Higgins, 2011), the following review inclusion and exclusion criteria were identified.

Study factors. For inclusion, studies must feature experimental designs in which appraisal was manipulated, with an accompanying measure of RNT pre- and post-manipulation. Articles must be written or translated into English and published in a peer-reviewed journal to be considered.

Participants. Only studies using adult participants (aged 18-65 years) were included, to ensure sample homogeneity and reduce potential confounding effects of developmental differences in information processing. Participants were included from both clinical and non-clinical populations.

Intervention/Manipulation. Designs involving manipulation of either appraisal content (e.g., benign, neutral or negative interpretative training conditions; manipulations of attributional style) or the level of construal (i.e., abstract/evaluative versus concrete/experiential training conditions) were included. Manipulation must have utilised a CBM based training induction or similar training paradigm (CBM-I, CBM-Attribution [CBM-Att], CBM-App, Concreteness Training [CNT], or processing mode inductions).

Comparator. Training must make at least one of the following comparisons: (a) negative versus benign training conditions; (b) negative versus neutral training conditions; (c) benign versus neutral training conditions; (d) benign CBM training versus wait-list (passive control) or (e) CBM training versus non-CBM training (active control).

Outcomes. For inclusion within this review, the study must have measured RNT as an outcome variable pre- and post-manipulation. Relevant standardised measures of RNT included the Ruminative Response Scale of the Response Styles Questionnaire (RRS/RSQ; Nolen-Hoeksema, 1991), the Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990), and the Repetitive Thinking Questionnaire (RTQ10; McEvoy, Mahoney, & Moulds, 2010). In addition, studies utilising techniques to record RNT frequency were included (e.g., intrusive thought diary or thought listing procedures). Direct analyses of the effect of the CBM upon change in RNT must be included.

Information Sources

In December 2015-January 2016 computerised searches of the following databases took place: OVID[1], EBSCO[2], Web of Science®[3], PubMed[4], and Cochrane Trials. Given the relatively recent development of the CBM field, no time period was specified.

Search

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[1] The OVID database included searches in: PsycARTICLES, PsychINFO, Embase, Global Health, Health Management Information Consortium, Journals@OVID ,Your Journals@Ovid.

[2] EBSCO included searches in: EBSCO Host; CINAHL, AMED, PBSC.

[3] Web of Science database included searches in: Medline®, SciELO Citation Index and Biosis Citation Index and Web of Science core.

[4] Pubmed included searches in: Pubmed Central and Pubmed Health.

Search terms for the key constructs were identified and entered into each database. Appraisal bias terms were based upon descriptions provided by Harvey et al., (2004) and also included terminology used by Mathews and MacLeod (2005) and Hertel and Mathews (2011). RNT descriptors were identified based upon reviews by Watkins (2008), Davey (1993), and Smith and Alloy (2009; see Table 1). All search string characters were adapted according to each database's use of Boolean operators and each set of search criteria was separated by the word "AND". All searches were conducted in the "title" and "abstract" fields to ensure relevance to the research question.

To enhance comprehensiveness, the reference lists of all included articles were searched. In addition, bibliographies of seminal papers that reviewed either appraisal or RNT were searched (Fox et al., 2014; Hallion & Ruscio, 2011; Watkins, 2008; Woud & Becker, 2014). Finally, key authors were identified based upon having published >2 articles within the initial screening (Watkins, E. R., Holmes, E. H., Nolen-Hoeksema, S., Mor, N., Williams, A., Ehring, T., Goldwin, M., Blackwell, S., Hayes, S., and MacLeod, C.), and additional searches of each of these authors' works were conducted[5].

Study Selection

The titles and abstracts of all identified articles were initially screened against study eligibility criteria. The remaining articles were then read in full and evaluated against the aforementioned PICO inclusion/exclusion criteria.

Data Collection

[5] For the author search the following databases were used: Web of science and the HDAS health care databases (PsycINFO, Medline, EMBASE, CINAHL). Additionally, the author's webpage list of publications was reviewed (where applicable).

In addition to the overall study design and aim, data pertaining to PICO criteria were extracted from each study (O'Connor et al., 2011). Population involved sample characteristics including age, clinical status, and current psychiatric treatments. Intervention represented type of CBM manipulation paradigm utilised. Control referred to the comparison condition used (benign, neutral, negative, concrete/abstract, active/passive control). Outcomes included key findings regarding the success of manipulation and and changes in RNT.

Table 1

Search Terms Entered in Databases

	Appraisal	RNT's
Search Terms	Attribut* ADJ2 bias*, "Attribut* ADJ2 style*, Interpret* ADJ2 bias*, Interpret* ADJ2 style* Inferen* ADJ2 bias*, Inferen* ADJ2 style* Apprais* ADJ2 bias*, Apprais* ADJ2 style*, Reason* ADJ2 bias*, Reason* ADJ2 style*, Judgement* ADJ2 bias, Judgement* ADJ2 style, Cognitive bias modification ADJ2 appraisal, Cognitive bias modification ADJ2 interpretation CBM-I, Concrete*.	Repetitive thought*, Ruminat*, Brood*, Counterfactual thinking, Defensive pessimism, Habitual negative self-thinking, Preoccupat*, self-focus, repeated cognitive representations, mental simulation, Worr*, Intrus*

Note. ADJ2, searches key words adjacent within two words of each other. Syntax modified according to database syntax guide, e.g., ADJ2 replaced with NEAR2 within Web of Science. * = truncation used to ensure key terms with multiple variations of word ending identified.

Risk of individual study bias

Study quality and risk of bias were appraised according to the Effective Public Health Practice Project's Quality Assessment Tool for Quantitative Studies (QATQS; National Collaborating Centre for Methods and Tools, 2008; Appendix B), with component ratings (selection bias, study design, confounders, blinding, data collection method, withdrawals and drop-outs) and overall rating provided in Table 2.

To assess the reliability of the inclusion and exclusion criteria, following screening, 20% of studies (*n*=8) were reviewed by a second independent clinical researcher[6] and 100% agreement was obtained as to the final inclusion/exclusion decision made. To enhance reliability of quality assessment, the second independent clinical researcher also read, extracted and assessed a randomly selected 20% of studies against QATQS criteria for reliability purposes. Initial agreement was obtained across 94.4% of component ratings. In the one instance of disagreement on a QATQS subscale, reasons for this were discussed with a third reviewer[7] and a consensus was then reached.

Organisation of Review

Within each section, studies will be considered in relation to study design, with greater weight given to studies rated as strong according to the QATQS, compared to those rated moderate and weak, respectively.

[6] Phillip Bishop, Final year Clinical Psychology Trainee, University of Southampton.

[7] Professor Edward Watkins, Research Supervisor, University of Exeter.

Results

Study Selection

A total of 1,974 citations were identified from the database searches. Following removal of duplicates and screening of titles and abstracts, 28 full-text papers were read and assessed against the inclusion/exclusion criteria. Additionally, 4,611 citations resulted from the key author searches. Following screening and removal of duplicates, 10 additional articles were added for full text review. Finally, an additional two articles were identified from searching seminal papers, resulting in a total of 40 articles following screening. No further papers were identified through searching the reference lists of the 40 full-text articles identified through screening. Following full text review, a further 24 articles were excluded due to violations of eligibility criteria, leaving 16 studies included within the review (see Figure 1).

Study Characteristics

Participants. The included studies involved a total of 802 participants, including a total of 442 healthy undergraduates across seven analogue studies (see Table 2). There were also six studies where the majority of individuals met current diagnostic criteria for an emotional disorder (GAD *n*=1, Social Anxiety Disorder [SAD] *n*=1, and Major Depressive Disorder [MDD] *n*=4), and three studies with individuals experiencing sub-threshold emotional psychopathology (high worry *n*=1, dysphoric *n*=2).

Design. Eleven studies included in the review were experimental lab-based designs (mixed design *n*=10, cross-over design *n*=1) and five studies were controlled clinical trials.

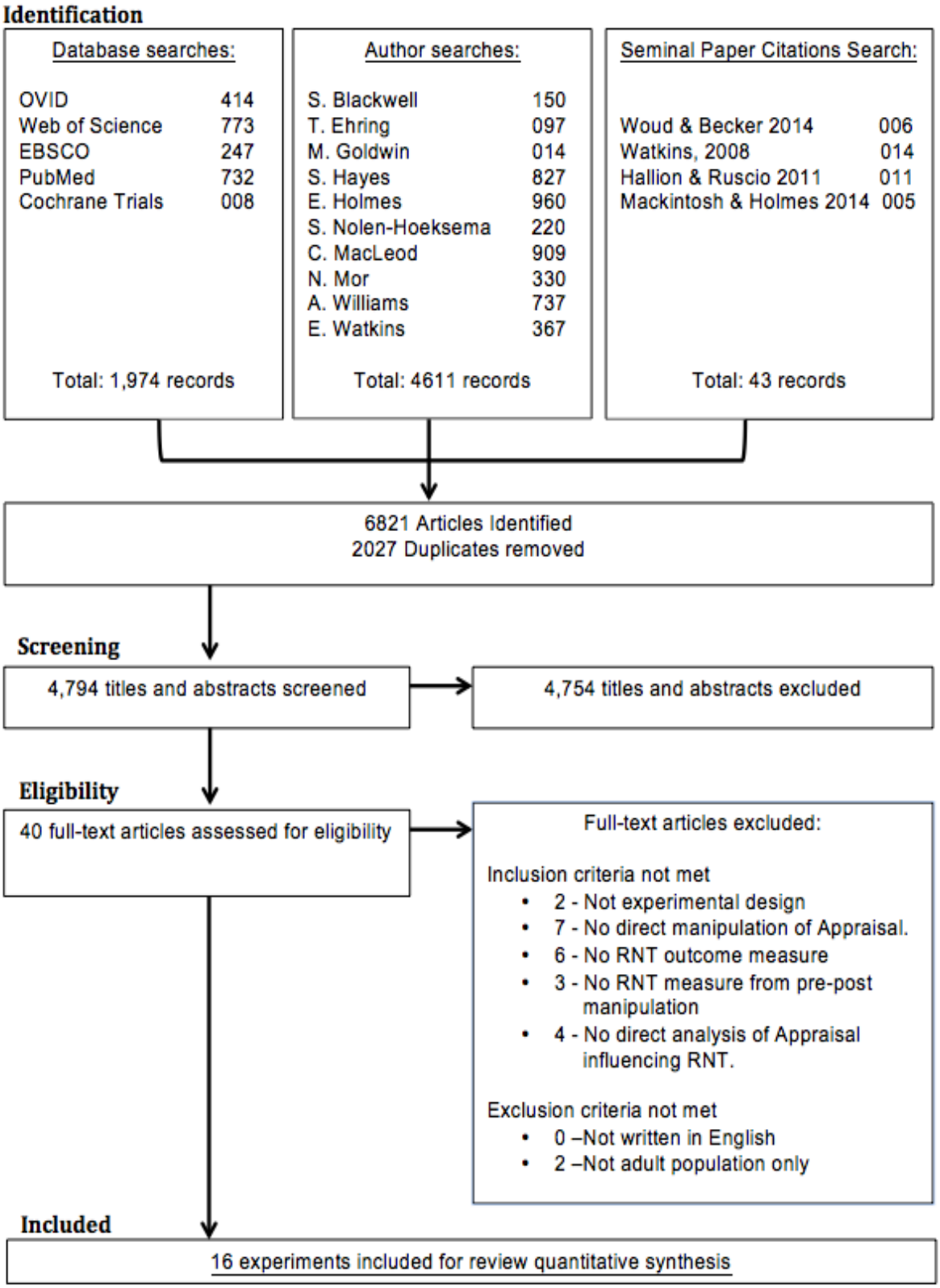

Figure 1. Flow diagram outlining search strategy and process of identification, screening, eligibility and inclusion for review following PRISMA guidelines.

Table 2

Studies included in the review, including study characteristics, relevant measures, relevant main findings and critical evaluation

Author	Design and Aims	Sample characteristics	Manipulation and comparisons	Key Outcome Measures	Relevant Outcomes and Effect Sizes	Evaluation	QATQS Ratings
Study #1: Ehring, Szeimies & Schaffrick (2009).	Experimental mixed design investigating the impact of concreteness of ruminative thought upon negative mood, arousal and thought intrusions following a distressing film.	83 u/g's, 65.5% female, age: *M*=24.08 (*SD*= 5.04).	Abstract ruminative style vs concrete ruminative style vs distraction conditions.	Manipulation check. 6 questions assessing concreteness (described as concreteness training questionnaire, CTQ) RNT outcome. Intrusions Questionnaire (intrusion frequency; vividness, distress).	Manipulation Check. No identified differences between conditions according to CTQ η_p^2=0.02. RNT Outcome. Abstract and concrete conditions did not differ with regards to intrusion frequency, η_p^2 = .07. Distraction condition resulted in significantly more thought intrusions than abstract or concrete conditions, *F*(2,79)=4.47, *p*=.05, η_p^2 .10.	Strengths. Experimental design. Standardised symptom induction. Good exclusion criteria. Stratification reducing confounders. Limitations**.** Manipulation check questionnaire yet to be psychometrically validated. Possible failed manipulation. Low task ecological validity with low personal relevance. Analogue sample limits generalisation.	A Moderate B Strong C Strong D Moderate E Weak F Strong **Overall:** **Moderate**
Study #2: Hayes, Hirsch, Krebs & Mathews (2010)	Experimental mixed design investigating whether inducing a benign interpretative bias decreased worry frequency generally and also following worry induction.	40 GAD sufferers in treatment (Medication and/or therapy). Benign condition, 80% female, age: *M*=43.0 (*SD*= 13.60). neutral condition 80% female, *M*=41.0 (*SD* = 9.32).	CBM-I: Homograph task and ambiguous scenarios test, (AST). Benign condition: 100% benign disambiguation trained. Neutral condition: 50% benign resolutions, 50% threat resolutions trained.	Manipulation check. Test trial fragment completion latencies and interpretations of ambiguous scenarios. RNT Outcome. Breathing focus task: RNT intrusions post-task + worry persistence following induction.	Manipulation Check. No interaction found between condition and valence for trial fragment completion latencies. However, benign training did result in greater benign ambiguity resolutions relative to controls η^2 =.03. RNT Outcome. Benign training = fewer negative intrusions than control across both breathing focus periods, η_p^2 =0.16.	Strengths. Good GAD generalisabilty. Outcome rated by participant and blind independent assessor. Combined homograph and AST training thus graded learning approach. Limitations. Potential treatment differences not measured, thus possible confounder. Combined homograph and AST training so cannot identify relative effects.	A Moderate B Strong C Strong D Strong E Moderate F Strong **Overall:** **Strong**

Author	Design and Aims	Sample characteristics	Manipulation and comparisons	Key Outcome Measures	Relevant Outcomes and Effect Sizes	Evaluation	QATQS Ratings
Study #3: Hertel, Mor, Ferrari, Hunt, Agrawal (2014) - Experiment 2.	Experimental mixed design investigating the effect of rumination congruent vs. non-ruminative Interpretation upon depressive rumination.	60 u/g's participants, 100% female. Mean age and standard deviation not reported.	CBM-I: AST. Negative condition: 100% negative disambiguation. Benign condition: 100% benign disambiguations trained. Neutral condition: 50% negative and 50% benign disambiguations trained.	Manipulation check. 9 ambiguous scenarios with open-ended sentences that potentiate both a ruminative and benign interpretation. RNT Outcome. State-Rumination (MRSI) following rumination induction.	Manipulation check. Expected main effect of negative training on interpretation, η_p^2 = 0.23. No differences between benign and neutral condition, η_p^2=0.00. RNT Outcome. Negative condition resulted in higher MRSI scores than other conditions, ηp^2 = 0.10. No difference in benign vs neutral conditions η_p^2=0.00.	Strengths. Strong design, inclusion of measure of 'far transfer' effect. Standardised measures. Use of open-ended questions improves ecological validity. Limitations. Low ecological validity. 100% female thus limited generalizability. Impact of memory task (prior to induction) thus unclear on effect size of training alone.	A Moderate B Strong C Strong D Strong E Strong F Strong **Overall:** **Strong**
Study #4: Hirsch, Hayes & Mathews (2009)	Experimental mixed design. Investigating the effect of inducing benign appraisal style on RNT intrusion frequency, anxiety and working memory.	40 u/g's and staff >56 on PSWQ. Benign condition, *n*=20, 80% female, age *M*=34.9 (*SD*=13.36). Neutral condition *n*=20, 80% female, age *M*=36.4 (*SD*=13.82).	CBM-I: Auditory homograph task + AST. Benign condition: 100% benign disambiguations. Neutral condition: 50% threat, 50% benign disambiguations.	Manipulation Check. None RNT Outcome: Breathing focus task measuring RNT intrusions following task and persistence of worry thoughts following worry induction.	Manipulation Check. N/A RNT Outcome. The benign condition had fewer thought intrusions than the neutral condition following training both prior to and following worry induction periods, η_p^2=0.28.	Strengths. RNT intrusion rated by both participant and independent assessor blind to condition. Limitations. Low ecological validity due to lab induction of worry. Mechanism of action unclear as no manipulation check. Combined manipulation tasks therefore cannot distinguish relative impact on outcome.	A Moderate B Strong C Strong D Strong E Moderate F Strong **Overall:** **Strong**

Author	Design and Aims	Sample characteristics	Manipulation and comparisons	Key Outcome Measures	Relevant Outcomes and Effect Sizes	Evaluation	QATQS Ratings
Study #5: Lang, Moulds & Holmes (2009)	Experimental mixed design. Investigating whether positive appraisal training reduces RNT intrusion frequency compared to negative appraisal following a depressive film.	48 u/g's in total. Positive condition, *n*=24, 54.0% female, age, *M*=28.5 (*SD*=9.86). Negative condition, *n*=24, 46% female, age, *M*=30.54 (*SD*=11.95).	CBM-App. Negative condition: 100% trials training maladaptive appraisals of intrusive thoughts. Positive condition: 100% of trials training benign appraisals of intrusive thoughts.	Manipulation check. Recognitions Test (Mackintosh et al., 2008). Rating ambiguous scenario to new descriptions (training congruent, incongruent, and two foils). RNT Outcomes. Intrusions: Impact of events scale (IES), intrusions subscale. Also diary follow-up – frequency of thought/verbal intrusions. Intrusion provocation task at follow-up.	Manipulation check. Positive training produced significantly more positive app-bias than the negative training, η_p^2=0.28. RNT Outcomes. Positive training (versus negative) resulted in: decreased diary verbal intrusions following session, η_p^2=0.16 and (to trend level) at follow-up, η_p^2=0.07. No significant differences in image-intrusion frequency at either time-point. No significant differences in IES intrusion score.	Strengths. Convergent measures of intrusion frequency utilised including standardised measures. Follow-up induction to test transfer longevity. Standardised negative event to induce intrusive symptomatology. Limitation. Reduced ecological validity due to use of distressing film to induce intrusions that is not personally relevant. Limited generalizability to clinical population. Lack of neutral / no-intervention condition to identify relative effects of training.	A moderate B strong C strong D strong E strong F strong **Overall:** **Strong**
Study #6: Lang, Blackwell Harmer, Davison & Holmes (2012)	Experimental mixed design. Investigating the impact of imagery based CBM-I on IB's, intrusions and mood following a distressing film for individuals with MDD.	26 participants with MDD. Positive condition: *n*=13, 70% Female, age, *M*=30.2 (*SD*=11.5), Control, *n*=13, 85% female, age, *M*=26.7 (*SD*=6.2).	CBM-I in either auditory or visual format (6/7 days). Also one session of CBM-App.	Manipulation Check. The scrambled sentences test (Wenzlaff, 1988) and The RSQ, (Nolen-Hoeksema, 1991). RNT Outcome. IES Intrusions subscale following trauma film.	Manipulation Check. Positive condition (relative to control) had more positive IB's η_p^2=0.08, and more positive intrusion app-biases, η_p^2=0.31. RNT Outcome. Positive training resulted in a significant decrease in IES intrusion score compared with control, η_p^2=0.20.	Strengths. Can be generalised to clinical populations. Week-long intensive training. Limitations. Small sample size limits generalizability. Combined CBM methodologies limits conclusions regarding mechanisms of action.	A Moderate B Strong C Strong D Strong E Strong F Strong **Overall:** **Strong**

Author	Design and Aims	Sample characteristics	Manipulation and comparisons	Key Outcome Measures	Relevant Outcomes and Effect Sizes	Evaluation	QATQS Ratings
Study #7: Mogoaşe, Brăilean & David (2013)	Controlled clinical trial aiming to test whether concreteness training alone a) improves mood and memory specificity b) reduces overgeneralisation, depressive rumination and global negative evaluations.	42 participants with stable dysphoria, 95% Female, age, *M*=22.87 (*SD*=4.27). Randomised to two groups: CNT group (*n*=21) or Wait-list (*n*=21).	CNT training. Initial experimental session followed by five daily training sessions (reported as "similar to Watkins et al., 2009").	Manipulation Check. Problem Elaboration Questionnaire (Stöber & Borkovec, 2002). Participant written problem descriptions are independently assessed via a 3-point concreteness scale. RNT Outcome. Trait Rumination (Ruminative Response Scale)	Manipulation Check. Participants in the CNT group provided significantly more concrete descriptions of problems than those in the control group, η_p^2=0.05. RNT Outcome. There were no differences between CNT and wait-list groups in rumination pre-post intervention, η_p^2=0.01.	Strengths: Standardised measures. Online design isolating effect of CNT. Generalizable to dysphoric population. Limitations: Possible insufficient power to detect smaller isolated training effect. CNT training identified as 'similar to Watkins et al., (2009, 2012)' however, no access to Watkins protocol granted therefore similarity questioned. Generalisability to clinical populations?	A Moderate B Strong C Strong D Moderate E Strong F Strong **Overall:** **Strong**
Study #8: Newby, Lang, Werner-Seidler, Holmes & Moulds (2014)	Controlled clinical trial aiming to evaluate the effect of positive CBM-App versus CB-Ed on mood and reductions of intrusive RNT in a dysphoric sample.	60 individuals, BDI >12 and experiencing depressive intrusions. CBM-App: *n*=20, 80% female, age, *M*=28.05 (*SD*=12.39). CB-Ed: *n*=20, 80% female, age, *M*=25.3 (*SD*=10.16). Control: *n*=20, 70% Female, age, *M*=25.5 (*SD*=7.01).	Positive CBM-App of intrusions (Lang et al., 2009). CB-Ed: psycho-education, cognitive challenging and two behavioural experiments targeting app-biases. Control condition: explanation of measures and diary only.	Manipulation Check. The Appraisals of intrusive memories questionnaire (Newby & Moulds, 2010) with lower scores indicating more positive appraisals. RNT Outcome. Intrusions. IES; Intrusive memory diary (Lang et al., 2009) including measure of intrusion frequency.	Manipulation Check. All conditions endorsed more positive intrusion related app-biases at follow-up, with no difference between groups, η_p^2=0.01. RNT Outcome. Significantly lower IES intrusion scores following training was found across all three groups, with no significant differences between groups η_p^2=0.04. Reporting inconsistencies therefore frequency of intrusions from diary excluded from review.	Strengths. Active control condition. Use of naturally occurring depressive intrusions improves ecological validity. Inclusion of standardised intrusion measures. Good identification of potential confounders. Limitations. Small sample size and sample heterogeneity - possible insufficient power to detect between groups differences of training alone. Potential confounders. Reporting inconsistencies.	A Moderate B Strong C Strong D Moderate E Strong F Strong **Overall:** **Strong**

Author	Design and Aims	Sample characteristics	Manipulation and comparisons	Key Outcome Measures	Relevant Outcomes and Effect Sizes	Evaluation	QATQS Ratings
Study #9: Nilsson, Lundh & Viborg (2012)	Experimental cross-over design to identify the effects of analytical and experiential self-focus upon RNT following a social event for individuals with SAD.	12 participants with SAD. Analytical-Experiential AB group: 33% female, age *M*=33 yrs (*SD*=10.1); Experiential-analytical group BA group: 67% female, age, *M*=32.2(*SD*=10.3).	Concreteness and self-focus induction involving reading a list of 28 items, (taken from Watkins & Teasdale, 2004).	Manipulation Check. None. RNT Outcome. Thought listing procedure (Cacioppo & Petty, 1981). Participants asked to "list those thoughts that you are thinking right now" which is rated by two independent assessors.	Manipulation Check. N/A. RNT Outcome. In phase one a trend was found, reflecting a decrease RNT for participants in the experiential condition compared with the analytical condition, η_p^2=0.15. No differences were found between groups in phase two following crossover.	Strengths. Use of clinical sample of patients with SAD. Limitations. Very small sample size, poor control of confounders, low statistical power limits conclusions generalizability issues. In-appropriate analytic strategy in parts.	A Weak B Moderate C Weak D Weak E Moderate F Strong **Overall:** **Weak**
Study #10: Santa-Maria, Reichert, Hummel & Ehring, 2012	Experimental controlled trial aiming to test the effects of abstract-evaluative vs. concrete-experiential thinking on intrusive memories.	Analogue u/g's (66.7% female, age *M*=21.2 (*SD*=3.9) who have experienced a distressing life event in the past 5yrs the memory of which remains distressing (>5/10 on distress Likert scale).	Concreteness induction. Experimental writing task (Watkins, 2004) with updated questions designed to induce abstract-evaluative (AE) or concrete-experiential (CE) thinking styles based on (Watkins, 2008) definitions).	Manipulation Check. LIWC programme used to analyse text for causal / sensory words. RNT Outcome. Intrusions Questionnaire; three items of IES intrusions scale ('Pictures about it popped into my mind', 'I thought about it when I didn't mean to' and 'other things kept making me think about it').	Manipulation Check. The AE condition wrote significantly more causal words, η_p^2=0.12, and less sensory words η_p^2=0.07 than in the CE condition. RNT Outcome. AE processing resulted in significantly longer persistence of sensory intrusive RNT's than in the CE processing, following training η_p^2=0.17 and at 36hr follow-up, η_p^2=0.15. No group differences were found in intrusive RNT's at any time-point, η_p^2=0.04.	Strengths. Greater ecological validity due to sample and personally relevant intrusion induction. Good identification relevant confounders. Good reporting and management of attrition. Limitations. No standardised outcome measures used for RNT. Manipulation may have involved some contamination in AE group limiting effects found, as writing is, in its self, a concrete process.	A Moderate B Strong C Strong D Strong E Weak F Strong **Overall:** **Moderate**

Author	Design and Aims	Sample characteristics	Manipulation and comparisons	Key Outcome Measures	Relevant Outcomes and Effect Sizes	Evaluation	QATQS Ratings
Study #11: Schaich, Watkins & Ehring, 2013	Whether the processing mode adopted prior to a trauma film influences the relationship between trauma-related rumination and PTSD.	68 healthy u/g, 100% female. 2 participants excluded from analysis resulting in 66 u/g, 100% female, age: *M*=20.05 (*SD*=2.74).	Concreteness induction, involving imagining 30 scenarios. Instructions worded to induce either concrete or abstract event processing (as per condition). Adapted from Moberly & Watkins (2006) and Watkins, Moberly, & Moulds (2008).	Manipulation Check. Interpersonal vignette (a disagreement with your boss) utilised from means-ends problem solving task (Platt & Spivack, 1972). RNT Outcome. Intrusion frequency following film via intrusions questionnaire and each day in the following week via sum of daily completion of IQ.	Manipulation Check. Concrete training responses were significantly more concrete than in the abstract condition, η_p^2=0.07. RNT Outcome. No direct effect of training on intrusion frequency during session or at follow-up, both η_p^2=0.00. However, within the abstract training condition, a positive relationship between trait rumination and trauma film intrusions was found across both time-points.	Strengths: Reasonable sample size for main effects. Acknowledgement and investigation of confounding variables. Limitations: No control condition. Analogue paradigm used, low ecological validity. Identified possible confounding effect of training upon trait rumination. Also possible confounding effect on imagery across conditions. No standardised manipulation check. No standardised outcome measures.	A Moderate B Strong C Strong D Strong E Weak F Strong **Overall:** **Moderate**
Study #12: Torkan et al., 2014.	Controlled clinical trial investigating the impact of CBM-I in Iranian patients with MDD in relation to mood and depressive rumination.	39 Iranian outpatients with MDD. Imagery CBM-I, *n*=13, F=62% age, *M*=26.4 (*SD*=7.82); CBM generic, *n*=13, F=77%, age *M*=25.9 (*SD*=7.27); No treatment, *n*=13, F=54%, age *M*=30.5 (*SD*=11.2).	CBM-I (Imagery and generic conditions). Positive training paragraphs (Blackwell & Holmes, 2010) translated into Farsi and minor alterations to fit with cultural norms.	Manipulation Check. Farsi translated version of Scrambled Sentences Test. Administered post training and at 7-day followup for CBM groups. RNT Outcome. Trait rumination (RRS) following training. Also RRS at 7-day follow-up for CBM-I imagery and CBM-I generic conditions.	Manipulation Check. Induction successful. Fewer negative IB's in CBM-I to CBM-G and no treatment, η_p^2=0.25, and from baseline, η_p^2=0.31. Increased IB's in CBM-G, η_p^2=0.08. RNT Outcome. Decreased rumination in CBM-I relative to CBM-G, η_p^2=0.20/no treatment, η_p^2=0.24. Decreased rumination over time for CBM conditions η_p^2=0.34.	Strengths: Clinical population. Proven CBM task and manipulation check. High ecological validity and good control of confounds within constraints of sample size. Standardised RNT measure. Active and no treatment control. Limitations: Small sample size thus possible confounders and power to detect effects. Significant attrition and no follow-up of control condition.	A Moderate B Strong C Strong D Strong E Strong F Moderate **Overall:** **Strong**

Author	Design and Aims	Sample characteristics	Manipulation and comparisons	Key Outcome Measures	Relevant Outcomes and Effect Sizes	Evaluation	QATQS Ratings
Study #13: Watkins, Baeyens & Read (2009)	Controlled clinical trial investigating whether repeated sessions of CNT reduces anxiety, low mood and ruination in dysphoric / depressed participants	60 participants with BDI >14. CNT, *n*=20, F=75%, age *M*=34.65 (*SD*=14.28). Wait List, *n*=20, F=65%, age *M*=39.05 (*SD*=16.86). BNT, (bogus CNT), *n*=20, F=55%, age *M*=31.15 (*SD*=12.52).	CNT: Initial session (1.5-2 hrs) + daily practice for a week involving 5m relaxation, 25m of concrete processing of 4 scenarios/autobiographical memories using mental imagery and problem solving.	Manipulation Check. Problem Elaboration Questionnaire with responses rated by independent rater blind to condition using Stöbers and Borkovec's (2002) concreteness Likert scale. RNT Outcome. Trait Rumination (RSQ).	Manipulation check. the concreteness of problem descriptions increased in the CNT but not BNT or WL conditions, η_p^2=0.15. RNT Outcome. Significant condition x time interaction, η_p^2=0.14. Post-hoc analysis revealed that CNT significantly reduced rumination relative to WL, however no difference found in rumination when comparing CNT to BNT.	Strengths: Reasonable sample size in sub/clinical population. Ecologically valid manipulation + design. Active control group allow identification of impact of non-specific intervention factors. Proven manipulation check, standardised outcome measures. Good management of attrition. Limitations: Multiple interpretation and other appraisal dimensions trained. Relaxation as part of CNT.	A Moderate B Strong C Strong D Strong E Strong F Strong **Overall:** **Strong**
Study #14: Watkins, Taylor, Byng, BAyens, Read, Pearson, & Watson, (2012).	Randomised control trial assessing the relative efficacy of CNT guided self-help for primary care patients with MDD compared with TAU. Also to test the mechanism of CNT in targeting depressive rumination and 'overgeneralisation' (OG).	121 patients with MDD (105) or sub-threshold MDD (16). TAU+ CNT, *n*=40 65.0% female, age *M*=46.37 (*SD*=12.71). RT+TAU, *n*=39, 74.4% female, age *M*=46.05 (*SD*=11.60). TAU, *n*=42, 54.8% Female, age *M*=46.38 (*SD*=12.30).	CNT (Watkins et al., 2009 protocol). 3 treatment conditions: CNT + TAU; TAU (passive control group) and TAU + RT (active control group).	Manipulation Check. Two positive, two negative questions from attributions Style Questionnaire (ASQ; Peterson et al., 1982). Also independent observer rating concreteness of causal description of negative events via 5 point Likert scale (consistent with Watkins et al., 2009). RNT measure. Trait rumination (RSQ).	Manipulation Check. Based upon ITT analyses: Relative to TAU only, TAU+CNT = significantly reduced OG, η^2 =0.05, and trend reductions in ASQ, η^2=.001. Also CNT+TAU resulted in significantly reduced OG, η^2 = 0.15, and ASQ scores, η^2 = 0.09 compared with RT+TAU. RNT Outcome: Rumination was significantly reduced in TAU + CNT relative to TAU (η^2 =0.12) and also to TAU + RT (η^2 =0.09).	Strengths. Randomised allocation to treatment arms. Matched baseline statistics including most potential confounders. Matched experimental and control treatments (i.e. active control) thus mechanism of action (change in concreteness) able to be tested. Self-report and blind independent observer ratings of concreteness. Sufficient power for relevant analyses. ITT analyses conducted. Limitations. Imperfect uptake of interventions (though still 80.9% uptake).	A Strong B Strong C Strong D Strong E Strong F Strong **Overall:** **Strong**

Author	Design and Aims	Sample characteristics	Manipulation and comparisons	Key Outcome Measures	Relevant Outcomes and Effect Sizes	Evaluation	QATQS Ratings
Study #15: Woud, Holmes, Postma, Dalgleish & Mackintosh (2012)	Experimental design investigating the potential therapeutic effect of positive and negative CBM of appraisals upon intrusion frequency and mood symptomatology following a trauma film.	72 healthy u/g's F=54% recruited and randomised to receive positive or negative CBM-APP training. 69 participants experienced intrusions, 53% female, age *M*=22.47yrs (*SD*=5.96).	Positive or negative CBM-APP. Sentence completion task involving disambiguations of positive/ negative appraisal biases of event related coping	Manipulation Check. Recognitions Test based upon Mackintosh et al (2008). PTCI (Foa, Ehlers, Clark, Tolin, & Orsillo, 1999). RNT Outcome. IES-R intrusions subscale and Trauma film intrusion frequency via 7 day diary.	Manipulation check. Bias index scores indicated successful induction for positive η_p^2=0.49, or negative, η_p^2=0.04 CBM-App conditions. On the PTCI positive CBM-App resulted in lower scores pre-post training η_p^2=0.02, and at follow-up, η_p^2=0.07. No changes in the negative CBM-App condition. RNT Outcome. Positive CBM-APP resulted in less frequent intrusions η_p^2=0.06 and lower IES-R scores η_p^2=0.06 compared to negative CBM-APP training.	Strengths. Good sample size. Proven trauma symptom induction. Proven manipulation and manipulation check tasks. Training generalisable as appraisal of common reaction to events rather than specific scenarios. Use of standardised outcome measures. Limitations. Low ecological validity as analogue sample with lab based induction. No control group, direction of effects unknown.	A Strong B Strong C Strong D Strong E Strong F Strong **OVERALL:** **Strong**

Author	Design and Aims	Sample characteristics	Manipulation and comparisons	Key Outcome Measures	Relevant Outcomes and Effect Sizes	Evaluation	QATQS Ratings
Study #16: Woud, Postma, Holmes & Mackintosh (2013)	Experimental design investigating the potential prophylactic effect of appraisal training upon appraisals of subsequent events, subsequent intrusion frequency and change in mood.	54 healthy u/g's, Positive condition, *n*=25, F=65%, age *M*=29.88 (*SD*=10.16). Negative condition: *n*=22, F=68%, age *M*=28.13 (*SD*=10.02).	CBM-APP (positive or negative conditions). Sentence completion task with disambiguations of positive or negative appraisals of event related coping.	Manipulation Check. PTCI (Foa et al., 1999); Recognitions Test based upon Mackintosh et al (2008). RNT Outcome. Trauma film intrusion frequency via 7 day diary.	Manipulation check. Bias index scores indicated successful induction for positive η_p^2=0.60, or negative, η_p^2=0.44 CBM-App conditions. Expected change on the PTCI in positive CBM-APP, η_p^2=0.60 and negative CBM-APP, η_p^2=0.44 baseline to follow-up but not at other time-points. RNT Outcome. No differences between groups in frequency of intrusions over 7 day follow-up η_p^2=0.25.	Strengths. Proven trauma symptom induction. Proven manipulation. Training generalisable as appraisal of common reaction to events rather than specific scenarios. Use of standardised outcome measures. Testing boundary effects of training. Limitations. Low ecological validity as analogue sample with lab based induction. No control group, direction of effects unknown. Use of own negative event as a reference for PTCI assessments.	A Strong B Strong C Strong D Strong E Strong F Strong **OVERALL:** **Strong**

Note. QATQS ratings: A = Selection Bias, B = Study Design, C = Confounders, D = Blinding, E = Data Collection Method, F = Withdrawals and Dropouts. Abbrieviations: MDD = Major Depressive Disorder; GAD = Generalised Anxiety Disorder; SAD = Social Anxiety disorder; PTSD = Post Traumatic Stress Disorder; DSM = Diagnostic and Statistical Manual of Mental Disorders; BDI = Beck Depression Inventory; u/g = undergraduates; IB = Interpretational bias; APP-bias = Appraisal bias; Att-bias =Attributional bias; CBM = cognitive bias modification; CBM-I = Cognitive bias modification for interpretations; CBM-G = generic (auditory based) cognitive bias modification; CBM-App= Cognitive bias modification of appraisals; OG = Overgeneralisation; WL = Wait list; TAU =Treatment as usual; CB-Ed= cognitive behavioural psycho-education session; CNT = concreteness training; AE = Abstract-Evaluative training; CE = Concrete-Experiential training; CTQ = concreteness training questionnaire; AST = variation of ambiguous Scenarios task; IES = Impact of events scale; IQ = Intrusions questionnaire; PSWQ= Penn State Worry Questionnaire; RSQ = Response styles questionnaire; MRSI = Momentary ruminative self-focus inventory; RRS = Ruminative Response Scale; PEQ = Problem Elaboration Questionnaire; AIMQ = Appraisals of intrusive memories questionnaire; MEPS = Means Ends Problem Solving task; SST = Scrambled sentences test; ITT = intention to treat.

Intervention. A number of specific appraisal modification paradigms were identified, including CBM-I (*n*=6), CBM-App (*n*=3), CNT (*n*=3) and processing mode inductions (*n*=4).

Outcome. All primary outcomes were standardised measures of RNT utilised pre-post intervention. Intrusions measures included the Impact of Events Intrusion subscale (Horowitz, Wilner, & Alvarez, 1979; Weiss & Marmar, 1997; *n*=4) and the Intrusions Questionnaire (Ehring et al., 2009; Zetsche, Ehring, & Ehlers 2009; *n*=3). Trait depressive rumination was measured using the Response Styles Questionnaire (Nolen-Hoeksema & Morrow, 1991; Treynor, Gonzalez, & Nolen-Hoeksema, 2003; *n*=3,) and, the Momentary Ruminative Self-focus Inventory (Mor, Marchetti, & Koster, 2013) was utilised to measure depressive state rumination (*n*=1). Techniques to measure RNT frequency included thought intrusions diary method (see Holmes & Bourne, 2008 for review; *n*=4), thought listing techniques (see Cacioppo & Petty, 1981; *n*=1), and breathing/worry focus techniques (adapted from Ruscio & Borkovec, 2004; *n*=2).

Discussion

Critical Appraisal

Overall the majority of studies evidenced an effect of manipulating appraisal upon RNT frequency (#2,3,4,5,6,10,12,13,15). In line with other CBM paradigm reviews (e.g. Hallion & Ruscio, 2011; Menne-Lothmann, et al., 2014), small to medium effects were observed. Similar effects were found regardless of the training paradigm utilised (CBM-I, CBM-App, CNT, or other concreteness induction) or the type of RNT outcome (depressive rumination, worry intrusions,

or intrusive thoughts). Six studies failed to identify expected effects of appraisal training on RNT, (#1,7,8,9,11,16).

Significant effects of appraisal training upon RNT frequency in analogue settings were identified across “healthy” undergraduates samples (i.e., low on indicators of emotional psychopathology; #3,6,10,15), samples with dysphoria (#13), and high worry (#4) and also within clinical samples with GAD (#2) and MDD (#12,14). In addition to analogue studies, three clinical trials (#12,13,14) all found beneficial effects of benign appraisal training in reducing RNT relative to wait-list or treatment-as-usual (TAU) conditions. Furthermore, via comparisons with another matched depression intervention technique (Relaxation training + TAU), Watkins et al. (2012) found a specific effect of CNT upon depressive rumination in the context of robust control for confounding factors.

Turning to the studies that failed to find the expected significant effect of manipulating appraisal on RNT frequency, methodological limitations may account for the null findings. Indeed, a clear pattern was identified whereby most failures to detect an effect were among studies that only achieved “moderate” or “weak” QATQS ratings.

In two experiments, null findings may be a direct consequence of a failure to effectively manipulate appraisal. For example, Ehring et al.’s, (2009) manipulation check indicated training failure (though use of a manipulation check instrument with unknown psychometric properties limits conclusions) and Newby et al., (2014) found that all conditions produced similar positive appraisal biases (CBM-I, CB-Education, and TAU) with no significant differences between conditions. In such cases, a failure to find change in RNT is not conclusive evidence against the hypothesized causal role of appraisal on RNT. Other

major design issues were noted. For instance, in Nilsson et al.'s, (2012) cross-over design, the absence of a "wash-out" period was identified as inappropriate, which, along with several other design flaws (underpowered, questionable measurement of RNT outcome) substantially increased the likelihood of a type II error.

Furthermore, in several studies, null findings may be due to a lack of power to detect all hypothesised effects. Mogoaşe et al. (2013) calculated their power based upon the findings of face-to-face training, but the study aimed to establish the effect of CNT training alone (i.e., without the effect of non-specific factors such as therapist contact time) via an online paradigm. As such, the power calculation was likely to be inappropriate and, given the small per-condition sample (*n*=21), the study was likely underpowered to detect such effects. A similar argument could be levelled at Watkins et al. (2009), which may have been underpowered to detect the likely smaller effect size between CNT and bogus training condition matched for other non-specific factors.

Accounting for potential methodological issues leaves two studies (from the original 16) that did not find the hypothesized effects (#11,16). These studies may provide important information regarding for whom, and in what contexts, modification of appraisal influences RNT. For instance, possible boundary effects were observed whereby an effect of CBM appraisals upon RNT was found if administered following a trauma film (Woud et al., 2012) but not prophylactically prior to the same trauma film (Woud et al., 2013). Furthermore, though Schaich et al. (2013) failed to find a direct effect of training on intrusion frequency, preliminary moderation analyses identified depressive trait rumination as a significant factor moderating the presence of this effect. Specifically, within the abstract condition, greater trait rumination was

associated with increases in intrusion frequency, but there was not a relationship between trait rumination and intrusions within the concrete training condition.

A limitation of this research field is the lack of brief, psychometrically valid and sensitive instruments to accurately measure the intended change in appraisal and, thus, training efficacy. In almost all the experiments reviewed, manipulation checks, if attempted at all, either utilised a limited selection of items from a longer psychometric instrument (e.g., Schaich et al., 2013) or, due to the absence of an appropriate brief and valid alternative, developed an instrument that is yet to be psychometrically tested (e.g., Ehring et al., 2009). Additionally, a number of studies utilised multiple CBM paradigms or multiple treatment components within the paradigm. Furthermore, appraisals involve multiple forms of bias (interpretation, attribution etc.) and each form of appraisal can be further broken down into multiple dimensions (e.g., internality, stability, and globality dimensions within attributional style; Abramson et al., 2002), yet there is a lack of consensus regarding which specific dimensions underlie the influence of appraisal upon RNT.

There are several limitations of the current review. Two studies involved an all-female sample, and a number of studies involved a high female to male ratio, thus making generalisation to males difficult (100% female, #3,11; >75% female, #2,4,6,7,8). Whilst risk of bias was identified and weighted at a within study level (using QATQS criteria), no formal analyses of possible publication bias or selective reporting of findings were undertaken. Only peer-reviewed articles were included in order to enhance study quality, however, this may have increased the risk of publication bias.

Overall, the review identifies strong support for the hypothesised causal effect of appraisal upon RNT frequency, as identified within appraisal bias models of emotion (see Mehu & Scherer, 2015 for review). Further, the effects of manipulating appraisal on RNT were found across CBM paradigms, regardless of the type of RNT outcome measured or clinical disorder type/status. This supports the argument that the effect of appraisal upon RNT may be transdiagnostic across emotional disorders.

The review also highlights the potential for CBM appraisal paradigms to be developed for therapeutic use. There is evidence for the feasibility, acceptability, and efficacy of home-based daily CBM appraisal in depressed samples for reducing RNT and related emotional psychopathology (#12,13,14). Furthermore, findings indicate that individuals experiencing high levels of RNT may particularly benefit from the therapeutic use of benign CBM appraisal-based interventions. In addition, Watkins et al. (2012) also provide evidence to suggest a specific benefit of CNT upon RNT processes, relative to another brief depression intervention.

Better understanding of the active mechanisms within appraisal that influence RNT could aid the development of more refined, targeted and, therefore, effective CBM-I methodologies and interventions. First, further empirical research is needed to verify the bi-directional nature of these effects. Indeed, there is evidence supporting an effect of appraisal upon RNT, as well as a number of findings of the potential therapeutic effect of benign training resulting in a reduction in RNT frequency. However, only one study reviewed tests the effect of the negative effect of training towards negative appraisals increasing RNT (Hertel et al., 2014). As such further empirical evidence would be beneficial to validate the proposed psychopathological involvement of

negative appraisal in increasing RNT. Second, use of mediation analyses could strengthen conclusions within studies that the change in the target appraisal mediates the effect of CBM training upon RNT (see Hayes et al., 2010 for example).

Dismantling studies are also needed to identify the relative effects of various training and appraisal components. Indeed, the clinical trials reviewed involve multiple components within their training package, for example inclusion of relaxation exercises (#7,13,14). Studies separating these components could clarify which of these training component(s) underlies the change on appraisal, and exclude the possibility that exercises like relaxation are impacting upon RNT frequency independent of appraisal change.

Furthermore, the clinical trials reviewed either utilised multiple forms of CBM-I (e.g., Torkan et al., 2014), or manipulate multiple appraisal dimensions; for instance, CNT training manipulates both the stability and globality dimensions of the internal processing of events (Mogoaşe et al., 2013; Watkins et al., 2009; 2012). Identification of the important aspects or dimensions of appraisal manipulation drive the observed effect on RNT frequency not only furthers theoretical understanding of the mechanisms of effect, but also may allow refinement of CBM training paradigms.

Overall this review supports the hypothesised causal effect of appraisal upon RNT frequency identified within appraisal bias models of emotion. Though some mixed findings were identified, these were found to relate to studies with lower methodological rigour, or findings that may be underpowered. Further work is needed to more clearly identify possible boundary conditions, individual difference factors and mechanisms of action that may influence and underlie this effect. Such work could advance our understanding of the therapeutic

impact of CBM appraisal, that is, what paradigm works best, for which populations, and why?

References

Abramson, L. Y., Alloy, L. B., Hankin, B. L., Haeffel, G. J., MacCoon, D. G., & Gibb, B. E. (2002). Cognitive vulnerability-stress models of depression in a self-regulatory and psychobiological context. In I. H. Gotlib & C. L. Hammen (Eds.), *Handbook of depression (*3rd ed., pp. 268-294). New York, NY: Guilford Press.

Abramson, L. Y., Metalsky, G. I., & Alloy, L., B. (1989). Hopelessness depression: A theory-based subtype of depression. *Psychological Review, 96,* 358-372. doi: 10.1037/0033-295X.96.2.358.

Alloy, L. B., & Abramson, L. Y. (2007). The adolescent surge in depression and emergence of gender differences: A biocognitive vulnerability-stress model in developmental context. In D. Romer & E. F. Walker (Eds.), *Adolescent psychopathology and the developing brain: Integrating brain and prevention science.* (pp. 284-314). New York, NY: Oxford University Press.

Alloy, L. B., Abramson, L. Y., Keyser, J., Gerstein, R. K., & Sylvia, L. G. (2008). Negative cognitive style. In K. S. Dobson & D. J. A. Dozois (Eds.), *Risk factors in depression* (pp. 237-262). San Diego, CA: Elsevier Academic Press.

Behar, E., McGowan, S. K., McLaughlin, K. A., Borkovec, T. D., Goldwin, M., & Bjorkquist, O. (2012). Concreteness of positive, negative, and neutral repetitive thinking about the future. *Behavior Therapy, 43,* 300-312. doi: 10.1016/j.beth.2011.07.002.

Blackwell, S. E., & Holmes, E, A. (2010). Modifying interpretation and imagination in clinical depression: A single case series using cognitive

bias modification. *Applied Cognitive Psychology, 24,* 338-350. doi: 10.1002/acp.1680.

Borkovec, T. D. (1994). The nature, functions, and origins of worry. In G. Davey & F. Tallis (Eds.), *Worrying: Perspectives on theory assessment and treatment* (pp. 5–33). Sussex, UK: Wiley & Sons.

Borkovec, T. D., Alcaine, O. M., & Behar, E. (2004). Avoidance theory of worry and generalized anxiety disorder. In R. G. Heimberg, C. L. Turk & D. S. Mennin (Eds.), *Generalized anxiety disorder: Advances in research and practice* (pp. 77–108). New York, NY: Guilford.

Borkovec, T. D., Robinson, E., Pruzinsky, T., & DePree, J. A. (1983). Preliminary exploration of worry: Some characteristics and processes. *Behaviour Research and Therapy*, *21*, 9-16. doi: 10.1016/0005-7967(83)90121-3.

Cacioppo, J. T., & Petty, R. E. (1981). Social psychological procedures for cognitive response assessment: The thought-listing technique. In T. V. Merluzzi, C. R. Glass, & M. Genest (Eds.), *Cognitive assessment* (pp. 309-342). Newport: Guilford Press.

Davey, G. C. (1993). A comparison of three worry questionnaires. *Behaviour Research and Therapy*, *31*, 51-56. doi: 10.1016/0005-7967(93)90042-S.

Ehring, T., Frank, S., & Ehlers, A. (2008). The role of rumination and reduced concreteness in the maintenance of posttraumatic stress disorder and depression following trauma. *Cognitive Therapy and Research, 32*, 488-506. doi: 10.1007/s10608-006-9089-7.

Ehring, T., Szeimies, A.K., & Schaffrick, C. (2009). An experimental analogue study into the role of abstract thinking in trauma-related rumination.

Behaviour Research and Therapy, 47, 285-293. doi: 10.1016/j.brat.2008.12.011.

Ehring, T., & Watkins, E. R. (2008). Repetitive negative thinking as a transdiagnostic process. *International Journal of Cognitive Therapy, 1,* 192-205. doi: 10.1521/ijct.2008.1.3.192.

Eysenck, M. W., Mogg, K., May, J., Richards, A., & Mathews, A. (1991). Bias in interpretation of ambiguous sentences related to threat in anxiety. *Journal of Abnormal Psychology*, *100*, 144-150. doi : 10.1037/0021-843X.100.2.144.

Foa, E. B., Ehlers, A., Clark, D. M., Tolin, D. F., & Orsillo, S. M. (1999). The Posttraumatic Cognitions Inventory (PTCI): Development and Validation. *Psychological Assessment, 11,* 303-314. doi: 10.1037/1040-3590.11.3.303.

Fox, E., Mackintosh, B., & Holmes, E. A. (2014). Travellers' tales in cognitive bias modification research: A commentary on the special issue. *Cognitive Therapy and Research*, *38*, 239-247. doi: 10.1007/s10608-014-9604-1.

Hallion, L. S., & Ruscio, A. M. (2011). A meta-analysis of the effect of cognitive bias modification on anxiety and depression. *Psychological Bulletin, 137*, 940-958. doi: 10.1037/a0024355.

Harvey, J. H., Town, J. P., & Yarkin, K. L. (1981). How fundamental is "the fundamental attribution error"?. *Journal of Personality and Social Psychology*,*40*, 346-349. doi:10.1037/0022-3514.40.2.346.

Harvey, A. G., Watkins, E. R., Mansell, W., & Shafran, R. (2004). *Cognitive behavioural processes across disorders.* Oxford: Oxford University Press.

Hayes, S., Hirsch, C. R., Krebs, G., & Mathews, A. (2010). The effects of modifying interpretation bias on worry in generalized anxiety disorder. *Behaviour Research and Therapy*, *48*, 171-178. doi:10.1016/j.brat.2009.10.006.

Hertel, P. T., & El-Messidi, L. (2006). Am I blue? Depressed mood and the consequences of self focus for the interpretation and recall of ambiguous words. *Behavior Therapy, 37,* 259-268. doi:org/10.1016/j.beth.2006. 01.003.

Hertel, P. T., & Mathews, A. (2011). Cognitive bias modification: past perspectives, current findings, and future applications. *Perspectives on Psychological Science, 6,* 521-536. doi:10.1177/1745691611421205.

Hertel, P., Mor, N., Ferrari, C., Hunt, O., & Agrawal, N. (2014). Looking on the dark side rumination and cognitive-bias modification. *Clinical Psychological Science*, *2,* 714-726. doi: 10.1177/2167702614529111.

Hirsch, C. R., Hayes, S., & Mathews, A. (2009). Looking on the bright side: accessing benign meanings reduces worry. *Journal of Abnormal Psychology*, *118*, 44-54. doi: 10.1037/a0013473.

Hirsch, C. R., Meeten, F., Krahe, C., & Reeder, C. (2016). Resolving ambiguity in emotional disorders: The nature and role of interpretation biases. *Annual Review of Clinical Psychology, 12,* 281-305. doi: 10.1146/annurev-clinpsy-021815-093436.

Holmes, E. A., & Bourne, C. (2008). Inducing and modulating intrusive emotional memories: A review of the trauma film paradigm. *Acta Psychologica*, *127*, 553-566. doi: 10.1016/j.actpsy.2007.11.002.

Horowitz, M., Wilner, N., & Alvarez, W. (1979). Impact of Event Scale: A measure of subjective stress. *Psychosomatic Medicine*, *41*, 209-218. Doi: 10.1097/00006842 – 197905000-00004.

Kappas, A. (2001). A metaphor is a metaphor is a metaphor: Exorcising the homunculus from appraisal theory. In K. R., Scherer, A. Schorr, T. Johnstone (Eds.), *Appraisal processes in emotion: Theory, methods, research. Series in affective science,* (pp. 157-172). New York, NY: Oxford University Press.

Lang, T. J., Blackwell, S. E., Harmer, C. J., Davison, P., & Holmes, E. A. (2012). Cognitive bias modification using mental imagery for depression: Developing a novel computerized intervention to change negative thinking styles. *European Journal of Personality*, *26*, 145-157. doi: 10.1002/per.855.

Lang, T. J., Moulds, M. L., & Holmes, E. A. (2009). Reducing depressive intrusions via a computerized cognitive bias modification of appraisals task: Developing a cognitive vaccine. *Behaviour Research and Therapy*, *47*, 139-145. doi: 10.1016/j.brat.2008.11.002.

Lazarus, R. S., & Smith, C. A. (1988). Knowledge and appraisal in the cognitive-emotion relationship. *Cognition and Emotion, 2,* 281-300. doi: 10.1080/02699938808412701.

Mackintosh, B., Woud, M. L., Postma, P., Dalgleish, T., & Holmes, E. A. (2008). *Can we alleviate post-traumatic intrusions using computerized cognitive bias modification (CBM)? Initial findings using the trauma film paradigm.* Manuscript submitted for publication.

MacLeod, C., & Mathews, A. (2012). Cognitive bias modification approaches to anxiety. *Annual Review of Clinical Psychology, 8,* 189-217. doi: 10.1146/annurev-clinpsy-032511-143052.

Mathews, A., & MacLeod, C. (2005). Cognitive vulnerability to emotional disorders. *Annual Review of Clinical Psychology*, *1*, 167-195. doi: 10.1146/annurev.clinpsy.1.102803.143916.

Mathews, A., & Mackintosh, B. (2000). Induced emotional interpretation bias and anxiety. *Journal of Abnormal Psychology*, *109*, 602-615. doi: 1754073915575406.

McEvoy, P. M., Mahoney, A. E., & Moulds, M. L. (2010). Are worry, rumination, and post-event processing one and the same?: Development of the Repetitive Thinking Questionnaire. *Journal of Anxiety Disorders*, *24*, 509-519. doi: 10.1016/j.janxdis.2010.03.008.

Mehu, M., & Scherer, K. R. (2015). The appraisal bias model of cognitive vulnerability to depression. *Emotion Review, 7,* 272-279. Doi: 1754073915575406.

Meyer, T. J., Miller, M. L., Metzger, R. L., & Borkovec, T. D. (1990). Development and validation of the Penn State Worry Questionnaire. *Behaviour Research and Therapy*, *28*, 487-495. doi: 10.1016/0005-7967(90)90135-6.

Moberly, N. J., & Watkins, E. R. (2006). Processing mode influences the relationship between trait rumination and emotional vulnerability. *Behavior Therapy, 37*, 281-291. doi: 10.1016/j.beth.2006.02.003.

Mogoaşe, C., Brăilean, A., & David, D. (2013). Can concreteness training alone reduce depressive symptoms? A randomized pilot study using an

internet-delivered protocol. *Cognitive Therapy and Research*, *37*, 704-712. doi: 10.1007/s10608-012-9514-z.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G. & The PRISMA group. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine, 6*, 1-6, doi: 10.1371/journal.pmed.1000097.

Mor, N., Hertel, P., Ngo, T. A., Shachar, T., & Redak, S. (2014). Interpretation bias characterizes trait rumination. *Journal of Behavior Therapy and Experimental Psychiatry*, *45*, 67-73. doi: 10.1016/j.jptep.2013.08.002.

Mor, N., Marchetti, I., & Koster, E. H. W. (2013). The momentary ruminative self-focus inventory (MRSI): Validation and psychometric evaluation. *Manuscript submitted for publication.*

National Collaborating Centre for Methods and Tools (2008). *Quality Assessment Tool for Quantitative Studies*. Hamilton, ON: McMaster University. Retrieved from http://www.nccmt.ca/resources/search/14.

Needles, D. J., & Abramson, L. Y. (1990). Positive life events, attributional style, and hopefulness: Testing a model of recovery from depression. *Journal of Abnormal Psychology, 99,* 156-165. doi: 10.1037//0021-843x.99.2.156.

Newby, J. M., Lang, T., Werner-Seidler, A., Holmes, E., & Moulds, M. (2014). Alleviating distressing intrusive memories in depression: A comparison between computerised cognitive bias modification and cognitive behavioural education. *Behaviour Research and Therapy, 56*, 60-67. doi: 10.1016/j.brat.2014.03.001.

Newby, J. M., & Moulds, M. L. (2010). Negative intrusive memories in depression: The role of maladaptive appraisals and safety behaviours.

Journal of Affective Disorders, 126, 147-154. doi: 10.1016/j.jad.2010.03.012.

Nielsson, J. E., Lundh, L. G., & Viborg, G. (2012). Effects of analytical and experiential self focus on rumination after a stress induction in patients with social anxiety disorder: a pilot study. *Cognitive Behaviour Therapy, 41*, 310-320. doi: 10. 1080/16506073.2012.682088.

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, *100*, 569-582. doi: 10.1037/0021-843X.100.4.569.

Nolen-Hoeksema, S. (2004). The response styles theory. In C. Papageorgiou & A. Wells (Eds.), *Depressive rumination: Nature, theory and treatment.* (pp. 107–123). Chichester; UK; Wiley.

Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and posttraumatic stress symptoms after a natural disaster: The 1989 Loma Prieta Earthquake. *Journal of Personality and Social Psychology*, *61*, 115-121. doi: 10.1037/0022-3514.61.1.115.

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science*, *3*, 400-424. doi: 10.1111/j.1745-6924.2008.00088.x.

O'Connor, D., Green, S., & Higgins, J. P. T. (2011). Cochrane handbook for systematic reviews of interventions, version 5.1. 0.

Peters, K. D., Constans, J. I., & Mathews, A. (2011). Experimental modification of attribution processes. *Journal of Abnormal Psychology*, *120*, 168-173. doi: 10.1037/a0021899.

Peterson, C., Semmel, A., von Baeyer, C., Abramson, L. Y., Metalsky, G. I., & Seligman, M. E. P. (1982). The Attribution Style Questionnaire. *Cognitive Therapy and Research, 6,* 287-299.

Platt, J. J., &z Spivack, G. (1975). *Manual for the Means-Ends Problem Solving Procedure (MEPS) A measure of interpersonal cognitive problem-solving skill.* Unpublished document, Philadelphia Hahnemann Community Mental Health/Mental Retardation Center, Philadelphia, PA.

Reisenzein, R., & Schönpflug, W. (1992). Stumpf's cognitive-evaluative theory of emotion. *American Psychologist, 47,* 34-45. doi: 10.1037/0003-066X.47.1.34.

Roseman, I. J., & Smith, C. A. (2001). Appraisal theory: Overview, assumptions, varieties, controversies. In K.R. Scherer, A. Schorr & T. Johnstone (Eds.), *Appraisal processes in emotion: Theory, methods, research*. (pp. 3-19). Oxford, UK: Oxford University Press.

Ruscio, A. M., & Borkovec, T. D. (2004). Experience and appraisal of worry among high worriers with and without generalized anxiety disorder. *Behaviour Research and Therapy*, *42*, 1469-1482. doi: 10.1016/j.brat.2003.10.007.

Santa-Maria, A., Reichert, F., Hummel, S. B., & Ehring, T. (2012). Effects of rumination on intrusive memories: Does processing mode matter? *Journal of Behavior Therapy and Experimental Psychiatry, 43,* 901-909. doi: 10.1016/j.jbtep.2012.01.004.

Schaich, A., Watkins, E. R., & Ehring, T. (2013). Can concreteness training buffer against the negative effects of rumination on PTSD? An experimental analogue study. *Journal of Behaviour Therapy and Experimental Psychiatry, 44*, 396-403. doi: 10.1016/j.jbtep.2013.03.006.

Smith, J. M., & Alloy, L. B. (2009). A roadmap to rumination: A review of the definition, assessment, and conceptualization of this multifaceted construct. *Clinical Psychology Review*, *29*, 116-128. doi: 10.1016/j.cpr.2008.10.003.

Stöber, J. (1998). Worry, problem solving, and suppression of imagery: The role of concreteness. *Behaviour Research and Therapy, 36*, 751-756.

Stöber, J., & Borkovec, T. D. (2002). Reduced concreteness of worry in generalized anxiety disorder: Findings from a therapy study. *Cognitive Therapy and Research*, *26*, 89-96.

Torkan, H., Blackwell, S. E., Holmes, E. A., Kalantari, M., Neshat-Doost, H. T., Maroufi, M., & Talebi, H. (2014). Positive imagery cognitive bias modification in treatment-seeking patients with major depression in Iran: A pilot study. *Cognitive Therapy and Research, 38*, 132-145. doi: 10.1007/s10608-014-9598-8.

Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination reconsidered: A psychometric analysis. *Cognitive Therapy and Research*, *27*, 247-259.

Watkins, E. R. (2004). Appraisals and strategies associated with rumination and worry. *Personality and Individual Differences*, *37*, 679-694. doi: 10.1016/j.paid.2003.10.002.

Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin, 134*, 163-206. doi: §0.1037/0033-2909.134.2.163.

Watkins, E., Moberly, N. J., & Moulds, M. L. (2008). Processing mode causally influences emotional reactivity: distinct effects of abstract versus concrete construal on emotional response. *Emotion*, *8*, 364-378.

Watkins, E. R. (2013). Cognitive mechanisms involved in therapeutic change for depression: Reducing abstraction and increasing concreteness. In D. Hermans, B. Rimé & B. Mesquita (Eds.), *Changing emotions.* (pp. 195-201). New York, NY: Psychology Press.

Watkins, E. R., Baeyens, C. B., & Read, R. (2009). Concreteness training reduces dysphoria: Proof-of-principle for repeated cognitive bias modification in depression. *Journal of Abnormal Psychology*, *118*, 55-64. doi: 10.1037/a0013642.

Watkins, E., & Baracaia, S. (2002). Rumination and social problem-solving in depression. *Behaviour Research and Therapy*, *40*, 1179-1189.

Watkins, E. D., & Moulds, M. (2005). Distinct modes of ruminative self-focus: impact of abstract versus concrete rumination on problem solving in depression. *Emotion*, *5*, 319-326.

Watkins, E. R., Taylor, R. S., Byng, R., Baeyens, C., Read, R., Pearson, K., & Watson, L. (2012). Guided self-help concreteness training as an intervention for major depression in primary care: A phase II randomized controlled trial. *Psychological Medicine*, *42*, 1359-1371. doi: 10.1017/S0033291711002480.

Watkins, E., & Teasdale, J. D. (2001). Rumination and overgeneral memory in depression: Effects of self-focus and analytic thinking. *Journal of Abnormal Psychology*, *110*, 353-357. doi: 10.1037/0021-843X.110.2.333.

Watkins, E., & Teasdale, J. D. (2004). Adaptive and maladaptive self-focus in depression. *Journal of Affective Disorders*, *82*, 1-8. doi: 10.1016/j.jad.2003.10.006.

Weiss, D. S., & Marmar, C. R. (1997). The Impact of Event Scale revised. In J. P. Wilson, & T. M. Keane (Eds.), *Assessing psychological trauma and PTSD* (pp. 399-411). New York, NY: Guilford Press.

Wenzlaff, R. M. (1988). Automatic information processing in depression. Paper presented at the International Conference on Self-Control, Nags Head, NC.

Woud, M. L., & Becker, E. S. (2014). Editorial for the special issue of cognitive bias modification techniques: An introduction to a time traveller's tale. *Cognitive Therapy and Research, 38,* 83-88. doi: 10.1007/s10608-014-9605-0.

Woud, M. L., Holmes, E. A., Postma, P., Dalgleish, T., Mackintosh, B. (2012). Ameliorating intrusive memories of distressing experiences using computerized reappraisal training. *Emotion, 12*, 778-784. doi: 10.1037/a0024992.

Woud, M. L., Postma, P., Holmes, E. A., & Mackintosh, B. (2013). Reducing analogue trauma symptoms by training considering a cognitive prophylaxis? *Journal of Behaviour Therapy and Experimental Psychiatry, 44,* 312-315. doi: 10.1016/j.jbtep.2013.01.003.

Zetsche, U., Ehring, T., & Ehlers, A. (2009). The effects of rumination on mood and intrusive memories after exposure to traumatic material: An experimental study. *Journal of Behavior Therapy and Experimental Psychiatry*, *40*, 499-514. doi: 10.1016/j.jbtep.2009.07.001.

Appendices

Appendix A: Journal Guidelines

Journal of Experimental Psychopathology

Scope of the Journal

The ***Journal of Experimental Psychopathology*** Psychopathology is an e-journal created to publish cutting-edge original contributions to scientific knowledge in the general area of psychopathology. Although there will be an emphasis on publishing research which has adopted an experimental approach to describing and understanding psychopathology, the journal will also welcome submissions that make significant contributions to knowledge using other empirical methods such as correlational designs, meta-analyses, epidemiological and prospective approaches, and single-case experiments. Theoretical and review articles addressing significant issues in the description, aetiology, and treatment of psychopathologies are also welcome.

The Editors and Associate Editors will make an initial determination of whether or not submissions fall within the scope of the journal and are of sufficient merit and importance to warrant full review.

Submitting Manuscripts

Authors should submit their manuscript electronically via the journal's editorial system (http//jep.textrum.com/). Your manuscript will then be allocated to an Associate Editor who will manage the peer review process. You should submit your manuscript in an editable version of WORD or a similar format (not as a pdf). You should also retain a copy of your manuscript because this may be needed for further processing should your manuscript be accepted for publication. DO NOT submit manuscripts or revised manuscripts with tracked changes or tracked comments on them, and do not submit manuscripts with other forms of mark ups on them (e.g. Endnote). This is be because your final uncorrected manuscript may be made publically available in press prior to typesetting in the event of it being accepted for publication.

There is no word-limit to articles that may be accepted for publication, but the Editors would expect presentation to be efficient, concise and informative. Most articles accepted for publication would usually be no more than 50 manuscript pages. â€¨Submission of an article implies that the work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in English or in any other language, without the written consent of the Editors.

Presentation of the Manuscript

The manuscript should follow American Psychological Association (APA) publication manual guidelines. All pages should be typed double-spaced and numbered (including pages containing the title, authors names and affiliation footnotes, abstract, acknowledgments, references, tables, and figure caption list)

Title Page: A title page should be provided and should include the full title of the article, the authors' names and affiliations, and a suggested running head. The affiliation should include the department, institution, city or town, and country. It should be made clear in which institution(s)

the research was carried out. The suggested running head should be no more than 80 characters. The title page should also clearly indicate the name, address, email address, fax number and telephone number of the corresponding author.

Abstract: An abstract following American Psychological Association guidelines should be provided and preferably be no longer than 150 words. The abstract page should also provide a list of 5-10 key words that accurately reflect the content of the article and can be used for indexing and search purposes.

Format of the article**:** Divide your article into clearly defined sections with the use of headings (non-numbered). The following headings are mandatory: Abstract, Introduction, Method, Participants, Procedure, Results, Discussion and References, but authors may include other headings where appropriate. Any subsection may be given a brief heading. Each heading should appear on its own separate line.

Figures & Illustrations: Photographs, drawings, diagrams, graphs and charts should be numbered in one consecutive series of Arabic numerals. Each individual figure or illustration should be accompanied by a clearly-worded caption or figure legend. All figures, tables, photographs, drawings, charts and diagrams should be submitted within the manuscript, preferably on separate pages at the end of the manuscript. If your manuscript is accepted for publication you may then be asked to submit your artwork in an electronic format and supply high-quality printouts in case conversion of the electronic artwork is problematic.

Tables: Tables should be numbered in one consecutive series of Arabic numerals. Each table should be typed on a separate page with the title centred above the table and all explanatory footnotes, etc. printed below.

Acknowledgements: Do not include acknowledgements on the title page. Place them on a separate page after the main body of the article and before the reference list.

References: Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Any references cited in the abstract must be given in full. Unpublished results and personal communications should not be in the reference list, but may be mentioned in the text. Citation of a reference as 'in press' implies that the item has been accepted for publication.

Citations in the text should follow the referencing style used by the American Psychological Association. You are referred to the Publication Manual of the American Psychological Association, the lastest can be found at http://www.apastyle.org.
References should be arranged first alphabetically and then further sorted chronologically if necessary. More than one reference from the same author(s) in the same year must be identified by the letters "a", "b", "c", etc., placed after the year of publication.

Examples reference formats include:
JOURNAL ARTICLES
Davey, G.C.L., Startup H.M., MacDonald C.B., Jenkins D. & Paterson K. (2005) The use of 'as many as can' stop rules during worrying. *Cognitive Therapy & Research*, 29, 155-169.

BOOKS
Davey G.C.L. & Wells A. (Eds) (2006) *Worry and its psychological disorders: Theory, assessment and treatment*. Chichester: John Wiley.

BOOK CHAPTERS
Davey G.C.L. (2006) A mood-as input account of perseverative worrying. In G.C.L. Davey & A. Wells (Eds) *Worry and its psychological disorders: Theory, assessment and*

treatment. Chichester: John Wiley. Pp217-237
AUTHORED WEB-PAGE
Lecce S. (2005) Should egalitarians be perfectionists? Retrieved January 30, 2008, from http://www.blackwell-synergy.com/doi/abs/10.1111/j.1467-9256.2005.00237.x?cookieSet=1&journalCode=ponl UN-AUTHORED WEB-PAGE

New child vaccine gets funding boost. (2001). Retrieved March 21, 2001, from

http://news.ninemsn.com.au/health/story_13178.asp

Supplementary Files:
The Editors of the ***Journal of Experimental Psychopathology*** are keen to ensure that all published articles come with downloadable supplementary material that will enable readers and researchers to fully appreciate how the research was conducted and analyzed. We believe this will facilitate replication and further research.
Depending on the nature of the published article authors will be encouraged to provide supplementary material in a form that can be downloaded and used by students and researchers. These materials might include copies of questionnaires used in the research or developed by the research, instruction sheets, experimental protocols, stimuli and images, audio and visual media clips, computer programs (executables or source code), data analysis macros or scripts if an unusual analysis has been done, scripts for specialist software (e.g., data processing scripts for ERP or EEG data, eprime scripts etc.), photographs of custom-built apparatus, colour images that illustrate data (e.g., fMRI scans, ERP curves) etc. In order to ensure that supplementary material is directly usable, please ensure that data are provided in a file format suitable for downloading.
After an article has been accepted for publication, authors will be approached and encouraged to provide what supporting materials they can make available.
There will be no transfer of copyright for any of the materials deposited in the Tools & Materials Repository, and this will allow authors to retain copyright of any materials they may have developed themselves or over which they have current copyright ownership.
There will be no obligation for authors to provide materials for the repository, and a willingness to provide tools and materials will not be a factor taken into account when deciding whether a manuscript is accepted for publication. **Copyright:** Upon acceptance of an article, an e-mail will be sent to the corresponding author confirming receipt of the manuscript together with a link to a Journal Publishing Agreement form. If excerpts from other copyrighted works are included, the author(s) must obtain written permission from the copyright owners and credit the source(s) in the article. **Proofs:** When your manuscript is received by the Publisher it is considered to be in its final form. Proofs are not to be regarded as 'drafts'. One set of page proofs will be sent electronically to the corresponding author, to be checked for typesetting/editing. No changes in, or additions to, the accepted (and subsequently edited) manuscript will be allowed at this stage. Proofreading is solely your responsibility. The Editors reserve the right to proceed with publication if corrections are not communicated.

Blind Review: Authors requesting blind review should explicitly request this when loading their manuscript up to the journal editorial system. The manuscript should also be submitted in a form appropriate to this process (see the APA Publication Manual).

Appendix B: Quality Assessment Tool for Quantitative Studies

COMPONENT RATINGS

A) SELECTION BIAS

(Q1) Are the individuals selected to participate in the study likely to be representative of the target population?

Very likely
Somewhat likely
Not likely
Can't tell

(Q2) What percentage of selected individuals agreed to participate?

80 - 100% agreement
60 – 79% agreement
less than 60% agreement
Not applicable
Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

B) STUDY DESIGN

Indicate the study design

Randomized controlled trial
Controlled clinical trial
Cohort analytic (two group pre + post)
Case-control
Cohort (one group pre + post (before and after))
Interrupted time series
Other specify _____
Can't tell

Was the study described as randomized? If NO, go to Component C.

No Yes

If Yes, was the method of randomization described? (See dictionary)

No Yes

If Yes, was the method appropriate? (See dictionary)

No Yes

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

C) CONFOUNDERS

(Q1) Were there important differences between groups prior to the intervention?
Yes
No
Can't tell

The following are examples of confounders:
Race
Sex
Marital status/family
Age
SES (income or class)
Education
Health status
Pre-intervention score on outcome measure

(Q2) If yes, indicate the percentage of relevant confounders that were controlled (either in the design (e.g. stratification, matching) or analysis)?

80 – 100% (most)
60 – 79% (some)
Less than 60% (few or none)
Can't Tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

D) BLINDING

(Q1) Was (were) the outcome assessor(s) aware of the intervention or exposure status of participants?
Yes
No
Can't tell

(Q2) Were the study participants aware of the research question?
Yes
No
Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

E) DATA COLLECTION METHODS

(Q1) Were data collection tools shown to be valid?
Yes
No
Can't tell

(Q2) Were data collection tools shown to be reliable?
Yes
No
Can't tell

RATE THIS SECTION	STRONG	MODERATE	WEAK
See dictionary	1	2	3

F) WITHDRAWALS AND DROP-OUTS

(Q1) Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?
Yes
No
Can't tell
Not Applicable (i.e. one time surveys or interviews)

(Q2) Indicate the percentage of participants completing the study. (If the percentage differs by groups, record the lowest).
80 -100%
60 - 79%
less than 60%
Can't tell
Not Applicable (i.e. Retrospective case-control)

RATE THIS SECTION	STRONG	MODERATE	WEAK	
See dictionary	1	2	3	Not Applicable

G) INTERVENTION INTEGRITY

(Q1) What percentage of participants received the allocated intervention or exposure of interest?
80 -100%
60 - 79%
less than 60%
Can't tell

(Q2) Was the consistency of the intervention measured?
Yes
No
Can't tell

(Q3) Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?
Yes
No
Can't tell

H) ANALYSES

(Q1) Are the statistical methods appropriate for the study design?
Yes
No
Can't tell

GLOBAL RATING

COMPONENT RATINGS

Please transcribe the information from the gray boxes on pages 1-4 onto this page. See dictionary on how to rate this section.

A	**SELECTION BIAS**	**STRONG**	**MODERATE**	**WEAK**	
		1	**2**	**3**	
B	**STUDY DESIGN**	**STRONG**	**MODERATE**	**WEAK**	
		1	**2**	**3**	
C	**CONFOUNDERS**	**STRONG**	**MODERATE**	**WEAK**	
		1	**2**	**3**	
D	**BLINDING**	**STRONG**	**MODERATE**	**WEAK**	
		1	**2**	**3**	
E	**DATA COLLECTION METHOD**	**STRONG**	**MODERATE**	**WEAK**	
		1	**2**	**3**	
F	**WITHDRAWALS AND DROPOUTS**	**STRONG**	**MODERATE**	**WEAK**	
		1	**2**	**3**	**Not Applicable**

GLOBAL RATING FOR THIS PAPER (circle one):

1 STRONG (no WEAK ratings)

2 MODERATE (one WEAK rating)

3 WEAK (two or more WEAK ratings)

With both reviewers discussing the ratings:

Is there a discrepancy between the two reviewers with respect to the component (A-F) ratings?

No Yes

If yes, indicate the reason for the discrepancy

1 Oversight

2 Differences in interpretation of criteria

3 Differences in interpretation of study

Final decision of both reviewers (circle one):

1 STRONG

2 MODERATE

3 WEAK

Appendix C: QATQS Dictionary

The purpose of this dictionary is to describe items in the tool thereby assisting raters to score study quality. Due to under-reporting or lack of clarity in the primary study, raters will need to make judgements about the extent that bias may be present. When making judgements about each component, raters should form their opinion based upon information contained in the study rather than making inferences about what the authors intended.

A) SELECTION BIAS

(Q1) Participants are more likely to be representative of the target population if they are randomly selected from a comprehensive list of individuals in the target population (score very likely). They may not be representative if they are referred from a source (e.g. clinic) in a systematic manner (score somewhat likely) or self-referred (score not likely).

(Q2) Refers to the % of subjects in the control and intervention groups that agreed to participate in the study before they were assigned to intervention or control groups.

B) STUDY DESIGN

In this section, raters assess the likelihood of bias due to the allocation process in an experimental study. For observational studies, raters assess the extent that assessments of exposure and outcome are likely to be independent. Generally, the type of design is a good indicator of the extent of bias. In stronger designs, an equivalent control group is present and the allocation process is such that the investigators are unable to predict the sequence.

Randomized Controlled Trial (RCT)

An experimental design where investigators randomly allocate eligible people to an intervention or control group. A rater should describe a study as an RCT if the randomization sequence allows each study participant to have the same chance of receiving each intervention and the investigators could not predict which intervention was next. If the investigators do not describe the allocation process and only use the words ‘random’ or ‘randomly’, the study is described as a controlled clinical trial.

See below for more details.

Was the study described as randomized?

- Score YES, if the authors used words such as random allocation, randomly assigned, and random assignment.
- Score NO, if no mention of randomization is made.

Was the method of randomization described?

- Score YES, if the authors describe any method used to generate a random allocation sequence.

- Score NO, if the authors do not describe the allocation method or describe methods of allocation such as alternation, case record numbers, dates of birth, day of the week, and any allocation procedure that is entirely transparent before assignment, such as an open list of random numbers of assignments.
- If NO is scored, then the study is a controlled clinical trial.

Was the method appropriate?

- Score YES, if the randomization sequence allowed each study participant to have the same chance of receiving each intervention and the investigators could not predict which intervention was next. Examples of appropriate approaches include assignment of subjects by a central office unaware of subject characteristics, or sequentially numbered, sealed, opaque envelopes.
- Score NO, if the randomization sequence is open to the individuals responsible for recruiting and allocating participants or providing the intervention, since those individuals can influence the allocation process, either knowingly or unknowingly.
- If NO is scored, then the study is a controlled clinical trial.

Controlled Clinical Trial (CCT)

An experimental study design where the method of allocating study subjects to intervention or control groups is open to individuals responsible for recruiting subjects or providing the intervention. The method of allocation is transparent before assignment, e.g. an open list of random numbers or allocation by date of birth, etc.

Cohort analytic (two group pre and post)

An observational study design where groups are assembled according to whether or not exposure to the intervention has occurred. Exposure to the intervention is not under the control of the investigators. Study groups might be non-equivalent or not comparable on some feature that emotions outcome.

Case control study

A retrospective study design where the investigators gather ‘cases’ of people who already have the outcome of interest and ‘controls’ who do not. Both groups are then questioned or their records examined about whether they received the intervention exposure of interest.

Cohort (one group pre + post (before and after)

The same group is pretested, given an intervention, and tested immediately after the intervention. The intervention group, by means of the pretest, act as their own control group.

Interrupted time series

A time series consists of multiple observations over time. Observations can be on the same units (e.g. individuals over time) or on different but similar units (e.g. student achievement scores for particular grade and school). Interrupted

time series analysis requires knowing the specific point in the series when an intervention occurred.

C) CONFOUNDERS

By definition, a confounder is a variable that is associated with the intervention or exposure and causally related to the outcome of interest. Even in a robust study design, groups may not be balanced with respect to important variables prior to the intervention. The authors should indicate if confounders were controlled in the design (by stratification or matching) or in the analysis. If the allocation to intervention and control groups is randomized, the authors must report that the groups were balanced at baseline with respect to confounders (either in the text or a table).

D) BLINDING

(Q1) Assessors should be described as blinded to which participants were in the control and intervention groups. The purpose of blinding the outcome assessors (who might also be the care providers) is to protect against detection bias.

(Q2) Study participants should not be aware of (i.e. blinded to) the research question. The purpose of blinding the participants is to protect against reporting bias.

E) DATA COLLECTION METHODS

Tools for primary outcome measures must be described as reliable and valid. If ‘face’ validity or ‘content’ validity has been demonstrated, this is acceptable. Some sources from which data may be collected are described below:

> Self reported data includes data that is collected from participants in the study (e.g. completing a questionnaire, survey, answering questions during an interview, etc.).
>
> Assessment/Screening includes objective data that is retrieved by the researchers. (e.g. observations by investigators).
>
> Medical Records/Vital Statistics refers to the types of formal records used for the extraction of the data.
>
> Reliability and validity can be reported in the study or in a separate study. For example, some standard assessment tools have known reliability and validity.

F) WITHDRAWALS AND DROP-OUTS

- Score YES if the authors describe BOTH the numbers and reasons for withdrawals and drop-outs.
- Score NO if either the numbers or reasons for withdrawals and drop-outs are not reported.

The percentage of participants completing the study refers to the % of subjects remaining in the study at the final data collection period in all groups (i.e. control and intervention groups).

G) INTERVENTION INTEGRITY

The number of participants receiving the intended intervention should be noted (consider both frequency and intensity). For example, the authors may have reported that at least 80 percent of the participants received the complete intervention. The authors should describe a method of measuring if the intervention was provided to all participants the same way. As well, the authors should indicate if subjects received an unintended intervention that may have influenced the outcomes. For example, co-intervention occurs when the study group receives an additional intervention (other than that intended). In this case, it is possible that the effect of the intervention may be over-estimated. Contamination refers to situations where the control group accidentally receives the study intervention. This could result in an under-estimation of the impact of the intervention.

H) ANALYSIS APPROPRIATE TO QUESTION

Was the quantitative analysis appropriate to the research question being asked?

An intention-to-treat analysis is one in which all the participants in a trial are analyzed according to the intervention to which they were allocated, whether they received it or not. Intention-to-treat analyses are favoured in assessments of effectiveness as they mirror the noncompliance and treatment changes that are likely to occur when the intervention is used in practice, and because of the risk of attrition bias when participants are excluded from the analysis.

Component Ratings of Study:

For each of the six components A – F, use the following descriptions as a roadmap.

A)SELECTION BIAS

Strong: The selected individuals are very likely to be representative of the target population (Q1 is 1) and there is greater than 80% participation (Q2 is 1).

Moderate: The selected individuals are at least somewhat likely to be representative of the target population (Q1 is 1 or 2); and there is 60 - 79% participation (Q2 is 2). 'Moderate' may also be assigned if Q1 is 1 or 2 and Q2 is 5 (can't tell).

Weak: The selected individuals are not likely to be representative of the target population (Q1 is 3); or there is less than 60% participation (Q2 is 3) or selection is not described (Q1 is 4); and the level of participation is not described (Q2 is 5).

B) DESIGN

Strong: will be assigned to those articles that described RCTs and CCTs.

Moderate: will be assigned to those that described a cohort analytic study, a case control study, a cohort design, or an interrupted time series.

Weak: will be assigned to those that used any other method or did not state the method used.

C) CONFOUNDERS

Strong: will be assigned to those articles that controlled for at least 80% of relevant confounders (Q1 is 2); or (Q2 is 1).

Moderate: will be given to those studies that controlled for 60 – 79% of relevant confounders (Q1 is 1) and (Q2 is 2).

Weak: will be assigned when less than 60% of relevant confounders were controlled (Q1 is 1) and (Q2 is 3) or control of confounders was not described (Q1 is 3) and (Q2 is 4).

D) BLINDING

Strong: The outcome assessor is not aware of the intervention status of participants (Q1 is 2); and the study participants are not aware of the research question (Q2 is 2).

Moderate: The outcome assessor is not aware of the intervention status of participants (Q1 is 2); or the study participants are not aware of the research question (Q2 is 2); or blinding is not described (Q1 is 3 and Q2 is 3).

Weak: The outcome assessor is aware of the intervention status of participants (Q1 is 1); and the study participants are aware of the research question (Q2 is 1).

E) DATA COLLECTION METHODS

Strong: The data collection tools have been shown to be valid (Q1 is 1); and the data collection tools have been shown to be reliable (Q2 is 1).

Moderate: The data collection tools have been shown to be valid (Q1 is 1); and the data collection tools have not been shown to be reliable (Q2 is 2) or reliability is not described (Q2 is 3).

Weak: The data collection tools have not been shown to be valid (Q1 is 2) or both reliability and validity are not described (Q1 is 3 and Q2 is 3).

F) WITHDRAWALS AND DROP-OUTS

Strong: will be assigned when the follow-up rate is 80% or greater (Q2 is 1).

Moderate: will be assigned when the follow-up rate is 60 – 79% (Q2 is 2) OR Q2 is 5 (N/A).

Weak: will be assigned when a follow-up rate is less than 60% (Q2 is 3) or if the withdrawals and drop-outs were not described (Q2 is 4).

SCHOOL OF PSYCHOLOGY

DOCTORATE IN CLINICAL PSYCHOLOGY

EMPIRICAL PAPER

What dimensions of attributional style influence mood and rumination? A factorial cognitive-bias-modification experiment.

Trainee Name: **Kate Williams**

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Target Journal: Journal of Experimental Psychopathology

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Abstract

Attributional style is hypothesised to causally contribute to depression vulnerability through influencing both emotional response and rumination following life events. Consistent with this hypothesis, Peters et al. (2011) found that training individuals towards a pessimistic attributional style, characterised by internal-stable attributions for negative events and external-unstable attributions for positive events, resulted in greater negative mood and emotional reactivity to perceived failure, relative to training a resilient attributional style characterized by the reverse pattern of attributions. To date, however, the relative contribution of the internal-external and stable-unstable dimensions, their interaction, and their application to positive or negative events upon influencing emotional response and, by theoretical extension, risk for depression, remains unresolved.

To resolve this question, 80 participants received training manipulating attributional style along four dimensions (i.e., internal versus external attributions for negative events; internal versus external attributions for positive events; stable versus unstable attributions for negative events; stable versus unstable attributions for positive events) in a 2^4 orthogonal factorial design. Participants then completed a perceived failure induction task. Measures of emotion and state rumination were completed pre-manipulation, post-manipulation, and post-induction.

The internality dimension for positive and, separately, negative events influenced both immediate emotional response and emotional reactivity. Stable attributions for negative events increased negative emotional response and moderated the effect of internal attributions for negative events: internal attributions to negative resulted in greater emotional reactivity relative to

external attributions, but only in the context of stable attributions for negative events. Both internal and stable dimensions also had independent effects.

These findings identifying the active components driving the effect of attributional style upon emotional reactivity suggest slight revisions and refinements to attribution models of depression vulnerability. Furthermore, it provides further evidence that attributional style can be modified and furthers understanding of how CBM-attribution training could be developed as a potential intervention for the treatment of depression.

Key Words:

Attribution, Cognitive-bias-modification, factor analyses, emotion, emotional reactivity, rumination.

Introduction

Two students at the same university fail their final exams; one becomes seriously depressed, the other only mildly discouraged. What accounts for this difference in depression vulnerability?

One factor hypothesized to influence depression risk is the way that individuals ascribe the causes, consequences, and meaning of life events, that is, their "attributional style" (Alloy, Abramson, & Francis, 1999). A "pessimistic explanatory style" is the tendency to attribute negative events to reasons that are internal (related to the self), global (apply across multiple contexts and situations), and stable (unlikely to change and applies across time); for example, "I failed the viva because I am stupid". It is also characterized by positive event attributions that are external (related to the setting, environment or others), local (limited to this one specific situation) and unstable (temporary, likely to change, does not apply across time); for example, "I passed the viva because my examiner was in a good mood" (Seligman, 1984).

This negative attributional style has been hypothesized to produce learned helplessness (Abramson, Seligman, & Teasdale, 1978) and hopelessness (Abramson, Metalsky, & Alloy, 1989), therefore contributing to the development of depression (Abela, Auerbach, & Seligman, 2008). Consistent with this, the Temple-Wisconsin Cognitive Vulnerability to Depression Project (Alloy et al., 2000; Alloy et al., 2007), a large-scale longitudinal prospective study, found that individuals that were selected for their pessimistic attributional style were more likely to experience an episode of major depression over the 2.5 year follow-up.

In contrast, a "self-serving" or "enhancing attributional style" is characterized by individuals making more internal, stable, and global

attributions regarding the causes, consequences, and implications of positive events, and the reverse for negative events (Needles & Abramson 1990; Seligman et al., 1984). It has been proposed as an adaptive mechanism that is associated with both mental wellbeing and physical health (Anderson, Krull, & Weiner, 1996; Campbell & Sedikides, 1999; Greenberg, Pyszczynski, & Solomon, 1982; Sedikides & Strube, 1995). A meta-analytic review identified a pattern whereby the self-serving attributional bias was found among healthy participants but was reduced among individuals with psychopathology, especially those experiencing depression (Mezulis, Abramson, Hyde, & Hankin, 2004). Furthermore, prospective research has found the self-serving attributional style to predict recovery from depression among clinically depressed inpatients (Johnson, Han, Douglas, Johnenet, & Russel, 1998; Voelz, Haeffel, Joiner, & Wagner, 2003) and dysphoric community samples (Edelman, Ahrens, & Haaga, 1994).

These prospective studies however, precluded a direct test of the hypothesized causal effect of attributional style upon depression risk as they were correlational in design. To enable a strong inference of causal direction, studies need to experimentally manipulate attributional style to determine whether this results in changes to depression symptoms or relevant analogues, such as negative mood.

Cognitive bias modification (CBM) is an experimental methodology that affords a direct empirical test of the proposed causal effect of attributional style upon emotional response (MacLeod & Clarke, 2013). It involves “the direct manipulation of a target cognitive bias, by extended exposure to task contingencies that favor pre-determined patterns of processing selectivity” (MacLeod & Mathews, 2012, p. 190). For example, one variant of CBM-

Interpretations (CBM-I) involves participants reading text describing ambiguous situations. The meaning of the event remains ambiguous until the final word, which is presented as a word fragment requiring completion by the participant. Completion of this word fragment disambiguates the meaning of the passage, resulting in a positive or negative scenario interpretation, which is then further reinforced by feedback to a question about the event. A particular interpretational style is trained through repeatedly reinforcing the same positive or negative disambiguation across multiple trials (Hirsch, Meeten, Krahe, & Reeder, 2016; Mackintosh, Mathews, Yiend, Ridgeway, & Cook, 2006; Mathews & Mackintosh, 2000; Yiend, Mathews, & Mackintosh, 2005).

Meta-analytic and narrative reviews provide evidence supporting the efficacy of CBM paradigms for manipulating cognitive biases (Hallion & Ruscio, 2011; Hirsch et al., 2016). However, it remains unclear whether these cognitive biases confer depression vulnerability through directly influencing emotional state, subsequent emotional reactivity following an emotional event, or both (Mehu & Scherer, 2015). Hallion and Ruscio's (2011) meta-analytic review suggests only a small, marginally significant effect of CBM upon direct emotion, with more robust effects for emotional reactivity following a stressor (e.g., threatening video, perceived failure task or upcoming exam). Mehu and Sherer, (2015), however, defend the importance of attributions in directly influencing both emotional state and emotional reactivity in conferring depression vulnerability. Thus, within this study, both direct changes in emotion as well as emotional reactivity were considered.

In order to test whether attributional biases causally influence mood and emotional reactivity, Peters, Constans and Mathews (2011) adapted the traditional CBM-I procedure to train two distinct attributional styles in

undergraduate participants. In the “vulnerability condition”, participants were trained towards making internal-stable attributions to negative events and external-unstable attributions to positive events, matching the pessimistic attributional style. In the “resiliency condition”, participants were trained towards making external-unstable attributions to negative events and internal-stable attributions to positive events, consistent with a self-serving attributional style. As hypothesized, participants in the vulnerability condition reported a greater increase in negative mood directly following training and in response to a subsequent perceived failure task, relative to those in the resiliency condition. This study, therefore, provided the first direct evidence indicating that attributional style causes changes in emotional state and emotional reactivity.

Peters et al., (2011) manipulations were multi-dimensional, combining both the internal-external and stable-unstable attribution dimensions for both positive and negative events. Therefore, an important theoretical and clinical question is which of these dimensions, independently or in combination, and whether applied to positive or negative events or both, underpin the effects of attributional style on emotional response and, by theoretical extension, vulnerability to depression.

One possibility is that the tendency towards making stable attributions is the primary dimension influencing emotional reactivity (Fresco, Alloy, & Reilly-Harrington, 2006; Johnson et al., 1998; Needles & Abramson, 1990), hereby referred to as the “Stable Attribution Model”. For example, the hopelessness model of depression vulnerability suggests that a general tendency to attribute negative events to stable causes contributes to a maladaptive style, increasing feelings of hopelessness, thus depression vulnerability (Abramson et al., 1989).

An extensive related literature has implicated the tendency to construe

and represent negative events in an abstract, decontextualized, and overgeneral way in the onset and maintenance of depression (Watkins, 2008). Supporting evidence for this is found in longitudinal prospective studies (Carver, 1998; Dykman, 1996; Edelman et al., 1994), experimental studies examining emotional reactivity to stressful events (Brown & Dutton, 1995; Kernis, Brockner, & Frankel, 1989; Watkins, Moberly, & Moulds, 2008; Welzlaff & Grozier, 1988), and clinical trials (Watkins, Baeyens & Read, 2009; Watkins et al.,2012).

Such abstract processing involves representing the “gist” and implications of events without the contextual details, thus facilitating both stable (i.e., abstracting what happened at one event across time to future events) and global attributions (i.e., abstracting what happened in one situation across contexts to other situations). Because of this shared involvement of stable-unstable and global-local dimensions within abstract processing, it can be difficult to disentangle these attributional dimensions. The current study follows Peters et al. (2011) in focusing upon the stable-unstable dimension and not the global-local dimension.

A second possibility is that the tendency to make internal attributions regarding the causes and consequences for events is the primary dimension influencing emotional reactivity, hereby described as the “Internal Attribution Model”. Internality of attributions is identified within the hopelessness theory as “a tendency to infer that the occurrence of a negative event in one’s life means that one is deficient, flawed or unworthy (e.g., I was fired from my job so I must be worthless)” and is considered to increase hopelessness and, subsequently, depression risk (Alloy, Abramson, Keyser, Gerstein, & Sylvia, 2008, p.237). However, empirical research is yet to test the distinct causal impact of this

dimension upon emotion.

A third possibility is that an impact upon emotional response and emotional reactivity requires the interactive effect of both dimensions, referred to here as the ‘Conjoint Internal-Stable Attribution model’. This is consistent with the earlier descriptions of a negative explanatory, or pessimistic, attributional style as influencing depression risk (Seligman et al., 1984).

Finally, the relative contribution (or interaction) of attributional style dimensions by event valence also remains untested. For each model outlined above, there are variants where the effects could occur when applied to negative events (e.g., Stable Attribution for Negative; Internal Attribution for Negative), when applied to positive events (e.g., Internal Attribution for Positive) or only when the two valences interact (e.g., Stable Attribution for negative; Unstable attribution for positive).

Evidence suggests that pessimistic and enhancing attributional styles may represent independent constructs that co-exist within individuals (Needles & Abramson, 1990; Voelz, et al., 2003). Indeed, consistently low correlations are found between attributional styles for positive versus negative events (Haeffel & Vargas, 2011; Zautra, Guenther, & Chartier, 1985). A meta-analytic review concluded attributional style for negative events is more strongly associated with depression onset than attributional style for positive events (Sweeney, Anderson, & Bailey, 1986). Furthermore, recent prospective studies have evidenced mixed findings. For instance, Voelz et al.,(2003) found that an interaction between pessimistic and enhancing attributional styles predicted inpatient adolescent hopelessness at discharge, whereas Haeffel and Vargas (2011) found that a pessimistic attributional style predicted depression vulnerablity, regardless of levels of enhancing attributional style.

Taken together, the primary aim of this study was to expand upon Peters et al. (2011) findings through use of a factorial design to test which attributional elements (or their combination) are important in directly impacting emotion and in influencing emotional reactivity following perceived failure.

Attributional style has also been implicated in the onset and maintenance of rumination (Abramson et al., 2002; Alloy & Abramson, 2007; Alloy et al., 2008). Rumination is hypothesized to be triggered as a consequence of unresolved goals and maintained until the goal is either achieved or abandoned (Martin & Tesser, 1996). A pessimistic attributional style is hypothesized to interfere with the problem-solving necessary to achieve the goal and/or with the ability to disengage from the goal by making it more personally important and, thus, prolonging rumination (Abramson et al., 2002)

Similarly, the processing mode theory hypothesizes that the consequences of rumination are determined by the level of construal adopted (Moberly & Watkins, 2006; Watkins, Moberly & Moulds, 2008). Specifically, an abstract-evaluative mode of processing when thinking about negative events, characterized by a stable-global attributional style, confers greater vulnerability to depression. Consistent with this, training a more abstract relative to concrete processing style resulted in greater emotional reactivity (Watkins et al., 2008; Watkins & Moulds, 2005) and worse problem-solving (Watkins, Moulds, 2005; Watkins & Baracaia, 2002), which, in turn, leads to prolonged rumination (Watkins, 2008). Furthermore, recent CBM-I research found that training negative interpretations of ambiguous events resulted in greater state rumination, relative to those trained to interpret events in a neutral or benign manner (Hertel, Mor, Ferrari, Hunt, & Agrawal, 2014). However, as the hypothesized causal effect of attributional style on state rumination has not yet

been tested, this is the second aim of this study.

There are a number of potentially complementary, nested hypotheses concerning which dimensions of attributional style are actively involved in conferring change in emotional response, emotional reactivity and rumination.

The Stable Attribution Model hypothesizes that manipulating the stable versus unstable attribution dimension will directly influence negative emotion and positive emotion, and will influence emotional reactivity and rumination following a failure task. More specifically, the Stable Attribution to Negative model hypothesizes that training to make stable attributions to negative events will directly increase negative emotion and reduce positive emotion and increase emotional reactivity and rumination following a failure task, relative to training to make unstable attributions to negative events. The Stable Attribution to Positive model hypothesizes that training to make unstable attributions to positive events will directly increase negative emotion and reduce positive emotion and increase emotional reactivity and rumination following a failure task, relative to training to make stable attributions to positive events. The Stable Attribution Conjoint Valence model hypothesizes that the combination of training to make stable attributions to negative events and unstable attributions to positive events will directly increase negative emotion, reduce positive emotion and increase emotional reactivity and rumination following a failure task, relative to training to make unstable attributions to negative events and stable attributions to positive events.

The Internality Attribution Model hypothesizes that manipulating the internal versus external attribution dimension will directly influence negative emotion and positive emotion, and will influence emotional reactivity and rumination following a failure task. More specifically, the Internal Attribution to

Negative model hypothesizes that training to make internal attributions to negative events will directly increase negative emotion and reduce positive emotion and increase emotional reactivity and rumination following a failure task, relative to training to make external attributions to negative events. The Internal Attribution to Positive model hypothesizes that training to make external attributions to positive events will directly increase negative emotion and reduce positive emotion and increase emotional reactivity and rumination following a failure task, relative to training to make internal attributions to positive events. The Internal Attribution Conjoint Valence model hypothesizes that the combination of training to make internal attributions to negative events and external attributions to positive events will directly increase negative emotion and reduce positive emotion and increase emotional reactivity and rumination following a failure task, relative to training to make internal attributions to negative events and external attributions to positive events.

The Combined Internality-Stability Model hypothesizes that manipulating the internal-stable versus external-unstable attribution dimensions will directly influence negative emotion and positive emotion, and will influence emotional reactivity and rumination following a failure task. More specifically, the Internal-Stable Attribution to Negative model hypothesizes that training to make internal-stable attributions to negative events will directly increase negative emotion and reduce positive emotion and increase emotional reactivity and rumination following a failure task, relative to training to make external-unstable attributions to negative events. The Internal-Stable Attribution to Positive model hypothesizes that training to make external-unstable attributions to positive events will directly increase negative emotion and reduce positive emotion and increase emotional reactivity and rumination following a failure task, relative to

training to make internal-stable attributions to positive events. The Internal-Stable Attribution Conjoint Valence model hypothesizes that the combination of training to make internal-stable attributions to negative events and external-unstable attributions to positive events will directly increase negative emotion and reduce positive emotion and increase emotional reactivity and rumination following a failure task, relative to training to make external-unstable attributions to negative events and internal-stable attributions to positive events.

Method

Design

A factorial design was chosen as it allows examination of the main effects and interactions between the each of the attributional dimensions, thus providing a test of the multiple nested hypotheses under investigation (Collins, Dziak, Kugler, & Trail, 2014). It is efficient in terms of sample size and power, as all participants contribute to all conditions, thus increasing study feasibility (see Appendix A). Within full factorial designs, experimental conditions are formed by systematically varying the levels of two or more factors in such a way that all combinations of the levels are created (Collins et al,. 2014; Dziak, Coffman, Lanza, & Li, 2012). Within the current study, there were four between subjects factors, reflecting each of the attributional dimensions of interest: internal versus external attributions for negative events (IE-); internal versus external attributions to positive events (IE+); stable versus unstable attributions to negative events (SU-) and stable versus unstable attributions to positive events (SU+). For each factor, participants received one of two levels: internal-attributions-to-positive-condition (IA+) versus external-attributions-to-positive-condition (EA+); the stable-attributions-to-positive-condition (SA+) versus unstable-attributions-to-positive-condition (UA+); the internal-attributions-to-

negative-condition (IA-) versus external-attributions-to-negative-condition (EA-); and the stable-attributions-to-negative-condition (SA-) versus unstable-attributions-to-negative-condition (UA-). The two levels of each of the four factors were organised in a 2^4 balanced orthogonal design[8], resulting in a total of 16 training conditions (see Table 1).

There was also the within subjects factor of time, set at three levels (pre-training, post-training, post-failure task). The dependent variables were positive emotion, negative emotion and state rumination.

Participants

The sample consisted of 80 students or community volunteers connected with the University of Exeter (see Table 3). The study was advertised via poster and email communication and students received 1.5 course credits for participation. Participants were required to have normal or corrected to normal vision and speak fluent English. Participants would have been excluded if they expressed suicidal ideation[9], but none did. The study was approved by the

[8] Effect coding is preferred to dummy coding when conducting a factorial design with dichotomous factors (Collins et al., 2014). When using dummy coding if there are substantial higher-order interactions lower-order effects cannot be interpreted due to their correlation. However, the resulting orthogonality of effect coding within a full factorial design means that a main effect is not contaminated and rendered uninterruptable by higher-order interactions. Given the research aims to investigate both main effects and separately interactions, effect coding was therefore utilized. Each of the levels within the factor was assigned the code +1 or -1 in preparation for analysis. For example the factor IE+ involves the level IA+ that was effect coded as +1 with the dichotomous training condition EA+ being coded as -1.

[9] At screening, participant's scores on the PHQ9 for item 9 "thoughts that you would be better off dead or of hurting yourself in some way" were checked for suicide risk. Scores >2 would have led to exclusion and risk protocols being followed. All participants scored <1.

University Of Exeter Department Of Psychology Ethics Committee (see Appendix B).

Table 1.

Factorial design indicating the four main attribution factors manipulated, as organised into the 16 training combinations participants could be randomised to.

Combination	IE+	SU+	IE-	SU-
1. PISNIS	+1	+1	+1	+1
2. PISNIU	+1	+1	+1	-1
3. PISNES	+1	+1	-1	+1
4. PISNEU	+1	+1	-1	-1
5. PIUNIS	+1	-1	+1	+1
6. PIUNIU	+1	-1	+1	-1
7. PIUNES	+1	-1	-1	+1
8. PIUNEU	+1	-1	-1	-1
9. PESNIS	-1	+1	+1	+1
10. PESNIU	-1	+1	+1	-1
11. PESNES	-1	+1	-1	+1
12. PESNEU	-1	+1	-1	-1
13. PEUNIS	-1	-1	+1	+1
14. PEUNIU	-1	-1	+1	-1
15. PEUNES	-1	-1	-1	+1
16. PEUNEU	-1	-1	-1	-1

Note. Conditions: IE+=internal-attributions-to-positive-events; SU+=stable-attributions-to-positive-events; IE-=internal-attributions-to-negative-events; SU-=stable-attributions to positive events. Training combinations: P=positive; N=negative; I=internal; E=External; S=stable; U=unstable. Effect codes: +1 =training towards internal/stable; -1= training towards external/unstable attributions.

Materials and measures

Negative emotion. Items within the expanded PANAS negative affect (10-item scale) and sadness subscales (5-item scale; Watson & Clark, 1994) were aggregated to measure momentary negative emotional state (PANAS NE). Participants rated words describing sad/negative mood (e.g. “blue”, “dejected”) on a 5-point Likert scale from one (very slightly/not at all) to five (extremely) in response to the question “to what extent you feel this way right now, that is, at the present moment”. Both negative emotion and sadness scales demonstrate high internal consistency, (α = .85 and .86 respectively; Watson & Clark, 1994). Within the current sample the negative emotion scale demonstrated good internal consistency at each time-point (α = .80, .86 and .93 respectively).

Positive Emotion. The PANAS positive affect subscale (Watson, Clark, & Tellegen, 1988) was used to measure momentary positive emotion (PANAS PE). Participants were asked to rate 10 positive-emotion words (e.g., “enthusiastic”, “inspired”) on a scale of one (very slightly/not at all) to five (extremely), in response to the question “to what extent you feel this way right now, that is, at the present moment”. This scale demonstrates good internal consistency (α=.88) as well as excellent convergent and discriminant validity (*r*=.94 and -.02, respectively; Watson & Clark, 1994). Within the current sample the positive emotion scale demonstrated good internal consistency at each time-point (α = .84, .93 and .90 respectively).

State Rumination. The Momentary Ruminative Self-Focus Inventory (MRSI; Mor, Marchetti & Koster, 2013) is a six-item questionnaire developed to assess state rumination. Participants were asked to indicate their degree of agreement (1= strongly disagree, 7= strongly agree) with statements such as

"right now, I wonder why I react the way I do," and "right now, I am conscious of my inner feelings." The MRSI demonstrates good internal reliability (α = .81) and has been found to be sensitive to changes following the experimental manipulation of rumination (Hertel et al., 2014; Mor et al., 2013). Within the current sample the MRSI scale demonstrated good internal consistency at each time-point (α = .83, .89 and .88 respectively).

Attributional style. The efficacy of CBM-I training was assessed using scenarios from the expanded Attributional Styles Questionnaire (ASQ; Peterson, 1989; 1991). Two variants were used (pre- versus post-manipulation), each with two positive and two negative events. Participants read an event description, imagine themselves in this event and write one major cause for this event. They then rated this cause according to three 7-point Likert scales, where higher scores reflected a more internal, stable and global attributional style respectively. This resulted in the generation of six subscales, measuring internality to positive events (ASQ-internal-positive), stability to positive events (ASQ-stable-positive), globality to positive events (ASQ global-positive), internality to negative events (ASQ-internal-negative), stability to negative events (ASQ-stable-negative), and globality to negative events (ASQ-global-negative).

Attributional style CBM training task. The CBM training task used was adapted from Peters et al. (2011) and involved 120 event descriptions commonly experienced by undergraduate students. Within each trial (see Figure 1) participants were presented with a one-sentence event description, either positive (e.g., "I received a high grade in the exam") or negative (e.g., "I received a low grade on the exam"). Each description was then modified by a second sentence that included an attribution for the cause of the event, with the

final word presented as a fragment to be completed (e.g., “This must mean I am sm_rt”). Participants were asked to identify the first missing letter of the word (e.g., “a”), thus, forcing them to disambiguate the situation towards a particular attribution (e.g., “this must mean I am smart” forces an internal-stable attribution to positive events). Following each scenario disambiguation, participants were presented with a comprehension question (e.g., “does gaining a good grade on the exam relate to factors particular to you?”), and asked to make a “yes/no” response (Y key/ N key) to further re-enforce the attributional style targeted. Computer feedback stating whether the answer was “correct” or “incorrect” to further reinforce the attributional style being trained.

Four versions of each scenario were created enabling training towards making internal-stable, internal-unstable, external-stable or external-unstable attributions to the event (See Table 2 for example of trial variations).In each of the 16 conditions, participants were forced to make one type of attributional disambiguation for all 60 negative trials and another type of attributional disambiguation for all 60 positive trials. All materials were presented on a 17-in (43.2cm) monitor and data acquisition controlled by E-Prime experimental software (Psychology Software tools, Pittsburgh, PA).

Anagram Stressor Task. A stressful anagram task was used to induce perceived failure, involving seven difficult and seven insolvable anagrams taken from Tresselt and Meyznerner (1966; Appendix E) and presented on a 17-in (43.2cm) monitor. Participants were informed that the anagram task was a measure of cognitive ability and were given 3 minutes to complete as many as they could.

Procedure

Following an opportunity to re-read the information sheet and ask any questions, participants were asked to provide verbal and written consent (Appendix E2). They were then randomised to one of the 16 experimental training conditions according to the randomisation plan (created via the online generator http://www.randomisation.com). Following initial assessment of attributional style, baseline mood, and state-rumination (pre-training), participants completed the computer-based CBM task. They then completed a further assessment of attributional style to confirm the intended manipulation, and mood and state-rumination measures to assess any direct effects of attributional training upon emotion (post-training). Participants then completed the anagram task and repeated the mood and state rumination measures (post-failure task). Finally, participants were debriefed (Appendix G), which included explaining the purpose of the tasks and insolubility of half of the anagrams to ensure no ongoing performance-related distress.

Table 2.

Example of possible variations of attributional training.

Attributional combination	Example Trial Variation	Correct response
Sentence 1: I can solve the most difficult math problem on the test (Positive).		
Internal-stable-to-positive	This success shows that my math abilities must be s_rong.	t
Internal-unstable-to-positive	This success shows that I must have been having a good d_y.	a
External-stable-to-positive	This success shows that my math's tutor is very good at tea_hing.	c
External-unstable-to-positive	This success shows that the exam was easier than nor_al.	m
Sentence 1: I can't solve the easiest math problem on the test (Negative).		
Internal-stable-to-negative	This shows that my math abilities must be w_ak.	e
Internal-unstable-to-negative	This shows that I didn't spend enough time preparing for the t_st.	e
External-stable-to-negative	This shows that my math's tutor is very bad at tea_hing.	c
External-unstable-to-negative	This shows that the exam was harder than nor_al.	m

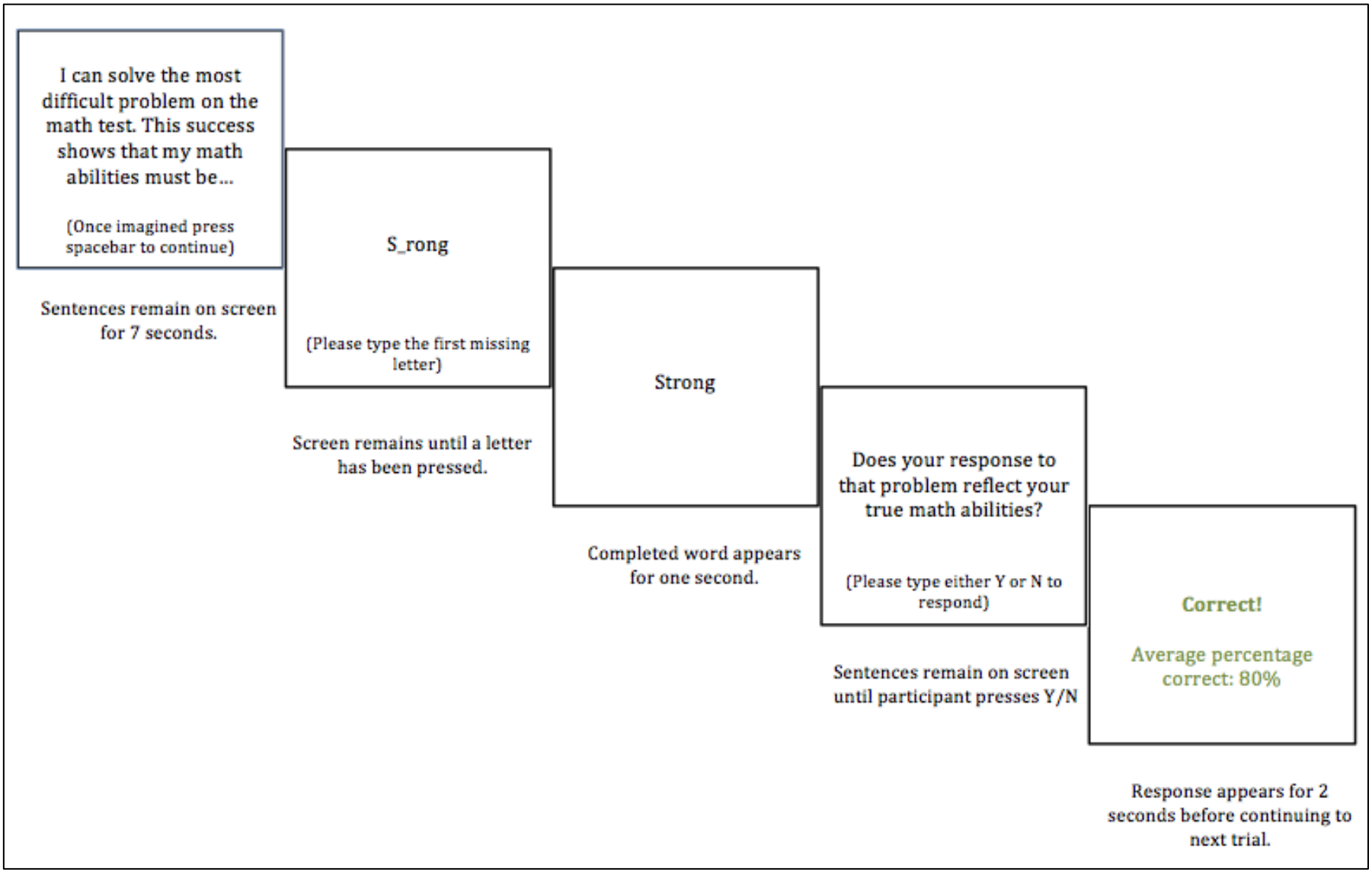

Figure 1. Diagram (not scaled to size) showing a single trial within the CBM attribution task.

Results

Data Screening

Five cases were excluded for not meeting the a-priori criterion of ≥70% comprehension accuracy, suggesting insufficient understanding of the training task instructions. For all continuous data, outliers were detected through inspection of standardised scores (z-scores > ±3.29 SD). Difference scores were calculated for all dependent variables pre-post training and post-training to post-failure time-points. These were then inspected according to each level of each study factor for homogeneity and normality, using Levene's test, the Kolmogorov-Smirnov test, and via visual inspection of histograms.

The homogeneity criterion was met for all difference scores, with the exceptions of the ASQ-internal-positive, negative-stable and positive-global subscales. Following Keppel and Wickens' (2004) recommendations, further inspection of the extent of heterogeneity was undertaken using the F_{max} test. Findings indicated sufficient homogeneity[10] for the use of ANOVAs without adjusting alpha values (Keppel & Wickens, 2004; O'Brian, 1981).

Assumptions of normality and homogeneity of variance were met for all difference scores, with the exception of the negative emotion difference scores pre-post training, where a positive-skew was identified across all levels of each factor manipulated. This was resolved via a square-root transformation therefore square-root values were used for this specific Analysis of Variance (ANOVA).

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[10] For the ASQ-internal-positive subscale F_{max} =1.25, ASQ-stable-negative subscale F_{max} =1.08, ASQ-global-positive subscale F_{max} =0.62. All *F* values <1.96, which indicates sufficient heterogeneity given the sample size to conduct ANOVA's (O'Brien, 1981).

Participant Characteristics

A univariate 2 (IE+: internal vs external) x 2 (SU+: stable vs unstable) x 2 (IE-: internal vs external) x 2 (SU-: stable versus unstable) ANOVA revealed no significant differences in participant age between the two levels of any of the factors manipulated, all *F's*<2.95, *p's*>.091[11]. Chi-square analyses also revealed no significant differences between the two levels of each factor manipulated in terms of the distribution of gender, all X^2<5.03, *p*>.071, ethnicity, all X^2*'s*<8.61, *p's*>.102, or education, all X^2*'s*<2.76, *p's*>.252, (Table 3).

A series of 2 (IE+: internal vs external) x 2 (SU+: stable vs unstable) x 2 (IE-: internal vs external) x 2 (SU-: stable vs unstable) ANOVA's were conducted for each of the dependent variables at baseline. No significant differences between the two levels of each training condition were found for five out of the six ASQ subscales all *F*<1.55, *p*>.218. For the ASQ-internal-negative subscale, there was a main effect of the manipulation of SU+, *F*(15,59)=6.09, *p*=0.017, reflecting more internal attributions for positive events at baseline for individuals randomised to the SA+ condition (*M*=10.20, *SD*=0.34), relative to those randomised to the UA+ condition (*M*=9.03, *SD*=0.32)[12].

[11] Age was significantly positively skewed. Both the raw data and data following square-root and log transformations aiming to reduce the positive skew within age produced equivalent patterns of results. A bootstrapping technique was therefore employed on the uncorrected data. Mann-Whitney U analyses were also performed for age across each dimension and equivalent results were found.

Table 3.

Sample Demographic statistics with frequency and percentage scores (in parentheses) per each level of the manipulated training dimensions.

Baseline Variable	IA+	EA+	SA+	UA+	IA-	EA-	SA-	UA-
N	35	40	40	35	37	38	38	37
Age*	21.29 (4.96)	22.56 (6.21)	21.93 (5.22)	22.50 (6.00)	23.16 (6.25)	21.22 (4.63)	20.25 (5.49)	22.30 (5.67)
Gender (female)	36 (90.0)	26 (75.3)	31 (77.5)	31 (88.6)	31 (81.6)	31 (83.8)	34 (89.5)	28 (75.9)
Ethnicity								
White British	29 (72.5)	27 (77.1)	34 (85.0)	22 (62.9)	25 (67.6)	30 (78.9)	29 (76.3)	27 (73.0)
Other white	7 (17.5)	0 (0.0)	0 (0.0)	7 (20.0)	5 (13.5)	6 (15.8)	8 (21.1)	3 (8.1)
Chinese	1 (2.5)	2 (5.7)	1 (2.5)	2 (5.7)	1 (2.7)	2 (5.3)	0 (0.0)	3 (8.1)
Indian	1 (2.5)	0 (0.0)	1 (2.5)	2 (5.7)	1 (2.7)	1 (2.6)	0 (0.0)	2 (5.4)
Other Asian	1 (2.5)	2 (5.7)	4 (10.0)	2 (5.7)	0 (0.0)	3 (7.9)	1 (2.6)	2 (5.4)
Qualifications								
Bachelors Level	30 (75.0)	25 (71.5)	27 (67.5)	28 (80.0)	25 (67.6)	30 (78.9)	29 (76.3)	26 (70.3)
Masters Level	1 (2.5)	0 (0.0)	1 (2.5)	0 (0.0)	0 (0.0)	1 (2.6)	0 (0.0)	1 (2.7)
Doctoral Level	9 (22.5)	10 (28.6)	12 (30.0)	7 (20.0)	12 (32.4)	7 (18.4)	9 (23.7)	10 (27.0)

Note.*=Mean and standard deviation (in parentheses) reported per condition trained. IA+=internal-attributions-to-positive-condition; EA+=external-attributions-to-positive-condition; SA+ =stable-attributions-to positive-condition; UA+=unstable-attributions-to-positive-condition; IA-=internal-attributions-to-negative-condition; EA-=external-attributions-to-negative-condition; SA-=stable-attributions-to-negative-condition; UA- =unstable-attributions-to-negative-condition.

As expected, no significant differences were found across the PANAS PE and NE scales between the two levels of any of the factors at baseline, all $F<3.73$, $p>.058$. However, a significant baseline difference in MRSI score was found for the manipulation of SU+, $F(15,59)=10.80$, $p=.002$, qualified by a significant SU+ by SU- interaction, $F(15,59)=8.00$, $p=.006$. These effects were further qualified by a SU+ by SU- by IE- interaction, $F(15,59)=8.00$, $p=.006$[13].

Manipulation Check of Attributional Style Training

To test the effect of attributional training upon change in attributional style endorsed, a series of 2 (IE+: internal vs external) x 2 (IE-: internal vs external) X 2 (SU+: stable vs unstable) X 2 (SU-: stable vs unstable) X 2 (Time: pre-attribution training, post-attribution training) ANOVAs were conducted on each of the six ASQ subscales. As the primary aim of the manipulation check is to test the effect of training upon change in attributional style, only post-hoc analyses of interactions involving the dependant variable of time will be presented. Overall, the expected effects of training were found; the majority of

[13] Simple effects analyses were conducted to further investigate this three-way between subjects' interaction, holding the manipulated SU- dimension constant. When set at the UA- position, there was no main effect of manipulation of SA+, $F(1,33)=0.10$, $p=.757$, $\eta_p^2=.00$, or internal attributions to negative events (IA-), $F(1,33)=0.20$, $p=.661$, $\eta_p^2=.07$. An interactive effect of manipulation of SU+ by IE- approached significance, $F(1,33)=4.04$, $p=.053$, $\eta_p^2=.01$. Mean scores suggested lower state-rumination for those in the unstable attribution to negative (UA-) training condition who were also trained towards SA+ and IA- conditions at baseline ($M=12.78$, $SD=3.06$) relative to those in the UA- condition also receiving UA+ and external attributions to negative events (EA-) training conditions ($M=15.13$, $SD=3.31$). When set at the SA- condition, no main effects or interactions were found based on manipulation of: SU+, $F(1,37)=.399$, $p=.532$, $\eta_p^2=.01$, IE-, $F(1,37)=0.29$, $p=.596$, $\eta_p^2=.01$, or SU+ by IE-, $F(1,37)=1.72$, $p=.532$, $\eta_p^2=.01$.

dimensions of attributional style assessed within the ASQ subscales were only influenced across time by the matching manipulation of the corresponding attributional dimension.

For the ASQ-internal-positive subscale, a significant main effect was found for the manipulation of IE+, $F(15,59)=5.73$, $p=.02$, $\eta_p^2=.09$, which was qualified by a IE+ by time interaction, $F(15,59)=4.76$, $p=.033$, $\eta_p^2=.08$. As predicted, this reflected a significantly greater increase in ASQ stability for positive events for those in the IA+ condition than those in the EA+ condition (see Table 4). There were no significant main effects or interactions on the ASQ-internal-positive subscale in response to all other manipulations, all *F's*<3.16, *p's*>.08.

For the ASQ-stable-positive scale, a significant main effect was found for manipulating SU+, $F(15,59)=10.43$, $p=.002$, $\eta_p^2=.15$, which was qualified by a SU+ by time interaction, $F(15,59)=10.43$, $p=.002$, $\eta_p^2=.15$. As expected, this reflects a significantly greater increase in ASQ stability for positive events for those in the SA+ condition relative to the UA+ condition (see Table 4). Unexpectedly, a significant main effect for manipulating IE+ was also found, $F(15,59)=4.51$, $p=.037$, $\eta_p^2=.07$, reflecting overall higher ASQ stability for positive events for those in the IA+ condition than those in the EA+ condition (see Table 4). As expected, no significant main effects or interactions were found on the ASQ-stable-positive subscale in response to all other manipulations, *F's*<1.55, *p's*>.218.

For the ASQ-internal-negative subscale, a significant main effect was found for time $F(15,59)=4.47$, $p=.039$, $\eta_p^2=.70$, reflecting a significant decrease in internal attributions for negative events on the ASQ pre-post manipulation (Table 4). Also a main effect of manipulation of IE- was found, $F(15,59)=6.90$,

p=.011, η_p^2 =.11. The expected IE- by time interaction approached significance, *F*(15,59)=3.80, *p*=.057, η_p^2=.060, reflecting a greater decrease in ASQ internality for negative events for those in the EA- training condition than those in the IA- training condition (see Table 4). Additionally, a significant between-subjects interaction was found between IE+ by SU+, *F*(15,59)=7.94, *p*=.007, η_p^2 = .12, which was qualified by a further interaction between IE+ by SU+ by IE-, *F*(15,59)=7.53, *p*=.008, η_p^2 = .11. Other significant main effects or interactions were found on the ASQ internal-negative subscale in response to the manipulations of other attributional dimensions (all *F's*<3.62, *p's*>0.62).

For the ASQ-stable-negative subscale, an SU- by time interaction approached significance, *F*(15,59)=3.76, *p*=.057, η_p^2=.06. As predicted, this reflects an increase in ASQ stability for negative events for those in the SA- condition and a decrease in ASQ stability for negative events for those in the UA- condition (Table 4). Additionally, a significant interaction was found for IE- by SU-, *F*(15,59)=7.25, *p*=.009, η_p^2 =.11, which was qualified by a further three-way interaction for IE- by SU- by time, *F*(15,59)=6.89, *p*=.011, η_p^2=.11. Simple-effects analyses were conducted holding IE- constant. When IE- manipulation was set at IA−, no significant main effects were found for manipulation of SU-, *F*(1,35)=2.42, *p*=.129, η_p^2=.07, or time, *F*(1,35)=.394, *p*=.534, η_p^2=.01, however a significant interaction was found for SU- by time, *F*(1,35)=18.11, *p*=.001, η_p^2=.34. Thus, participants receiving the IA− condition, who also received the SA− condition showed a greater increase in stable attributions for negative events on the ASQ (pre-training, *M*=7.50, *SD*=1.82; post-training, *M*=8.56, *SD*=1.76) than those who received the IA- and UA- conditions (pre-training, *M*=9.42, *SD*=1.43; post-training, *M*=8.00, *SD*=1.37).

Table 4.

Means and standard deviations of Attributional bias (ASQ) scores pre and post attribution training by two levels of the attributional dimensions manipulated.

	Pre-attribution training, Mean (SD)								Post-attribution training, Mean (SD)							
	IA+	EA+	SA+	UA+	IA-	EA-	SA-	UA-	IA+	EA+	SA+	UA+	IA-	EA-	SA-	UA-
ASQ-internal-positive	10.05 (2.10)	9.71 (2.24)	9.68 (1.89)	10.14 (2.44)	9.87 (2.11)	9.92 (2.23)	9.42 (2.11)	10.37 (2.13)	11.3 (1.96)	9.54 (2.56)	10.50 (2.49)	10.46 (2.36)	10.36 (2.46)	10.61 (2.39)	10.34 (2.68)	10.62 (2.12)
ASQ-stable-positive	10.48 (1.80)	9.57 (2.20)	9.67 (2.19)	10.49 (1.77)	10.14 (2.00)	9.97 (2.09)	10.07 (2.27)	10.07 (1.79)	10.30 (2.09)	9.66 (1.85)	10.58 (1.55)	9.34 (2.35)	9.95 (1.72)	10.05 (2.25)	10.11 (2.24)	9.89 (1.73)
ASQ-global-positive	9.25 (1.89)	9.40 (2.25)	9.12 (1.89)	9.54 (2.24)	8.92 (1.95)	9.71 (2.10)	9.08 (2.28)	9.57 (1.79)	8.50 (2.34)	8.17 (2.85)	8.40 (2.92)	8.29 (2.16)	8.41 (2.58)	8.29 (2.62)	8.21 (2.48)	8.49 (2.71)
ASQ-internal-negative	9.60 (2.23)	9.71 (1.93)	10.02 (2.13)	9.03 (1.87)	9.76 (2.17)	9.56 (2.02)	9.76 (2.10)	9.54 (2.09)	9.00 (2.91)	8.46 (3.26)	8.90 (3.25)	8.57 (2.88)	9.62 (2.54)	7.89 (3.32)	8.39 (3.11)	9.11 (3.03)
ASQ-stable-negative	8.20 (1.51)	8.70 (2.34)	8.50 (2.28)	8.34 (1.49)	8.49 (1.89)	8.37 (2.02)	8.32 (1.93)	8.54 (1.97)	7.78 (1.86)	8.83 (2.06)	8.38 (2.03)	8.14 (2.02)	8.27 (1.57)	8.27 (2.39)	8.71 (2.13)	7.21 (1.81)
ASQ-global-negative	7.03 (2.75)	7.74 (2.89)	7.58 (2.81)	7.11 (2.86)	7.16 (2.77)	7.55 (2.89)	7.50 (2.83)	7.22 (2.85)	6.78 (2.71)	7.43 (3.04)	7.43 (2.92)	6.69 (2.81)	7.24 (2.79)	6.92 (2.97)	7.50 (2.75)	6.65 (2.96)

Note. IA+=internal attributions to positive events; IA+=internal-attributions-to-positive-condition; EA+=external-attributions-to-positive-condition; SA+ =stable-attributions-to positive-condition; UA+=unstable-attributions-to-positive-condition; IA-=internal-attributions-to-negative-condition; EA-=external-attributions-to-negative-condition; SA-=stable-attributions-to-negative-condition; UA- =unstable-attributions-to-negative-condition.

In contrast, when IE- manipulation was set at EA-, only a main effect of SA- was found, $F(1,35)=6.04$, $p=.019$, $\eta_p^2 = .14$, reflecting higher ratings of stability for negative events on the ASQ in the SA- condition (pre-training, $M=9.05$, $SD=1.76$, post-training, $M=8.86$, $SD=2.46$) relative to the UA- condition (pre-training, $M=7.61$, $SD=2.06$, post-training, $M=7.61$, $SD=2.20$). No significant main effect of time, or SU- by time interaction was found, $F(1,35)=.054$, $p=.817$, $\eta_p^2=.00$. A significant main effect of IE attributions for positive events was also found, $F(15,59)= 4.33$, $p=.042$ $\eta_p^2=.07$, reflecting higher overall scores on the ASQ-stable-negative subscale in the EA+ condition ($M=8.77$, $SD=2.20$) relative to IA+ condition ($M=8.00$, $SD=1.69$). As expected, no significant main effects or interactions were found on the ASQ-stable-negative subscale, all $F's<2.26$, $p's>.138$)[14].

Emotional and ruminative response to training: Pre-to-post training

In order to test the effect of attribution training upon mood and rumination, a series of 2 (IE+: internal vs external) x 2 (IE-: internal vs external) x 2 (SU+: stable vs unstable) x 2 (SU-: stable vs unstable) x 2 (Time: pre-attribution training, post-attribution training) ANOVAs were conducted, with positive emotion, negative emotion, and state rumination as the respective dependent variables. Given the primary focus of these analyses was to test the effect of training the upon the dependant variables pre-post training, simple-

[14] Given the relationship between stability and globality within attribution and processing mode models, and difficulty separating these contracts within training scenarios, additional analyses on the ASQ globality subscales were conducted. No between subjects differences were found (positive-globality all $F's<3.23$, $p's>.077$, negative globality all $F's<1.75$, $p's>.191$, indicating that the current manipulations did not influence the global dimension.

effects analyses are only reported for interactions involving the dependant variable of time.

Negative Emotion. A significant interaction was found between SU- by time, $F(15,59)=8.11$, $p=.006$, $\eta_p^2=.12$, reflecting an increase in negative emotion pre-post training for those in the SA- condition, and a reduction in negative emotion pre to post training for those in the UA- condition (see Table 5). A significant between subjects interaction was also found for IE+ by SU+ by IE-, $F(15,59)=10.13$, $p=.002$, $\eta_p^2=.15$. No other significant main effects or interactions were found across any combination of attribution dimension factors or time, all *F's*<3.82, *p's*>.055).

Positive emotion. A significant main effect of time was found, $F(15,59)=13.13$, $p=.001$, $\eta_p^2=.18$, reflecting an overall reduction in positive emotion from pre-training ($M=27.95$, $SD=6.15$) to post-training ($M=25.69$, $SD=8.89$). A significant interaction was found between IE+ and time, $F(15,59)=6.33$, $p=.015$, $\eta_p^2=.10$, reflecting a significantly greater decrease in positive emotion for those in the EA+ condition than those in the IA+ condition (Table 5). A significant interaction was also found between IE- and time, $F(15,59)=7.26$, $p=.009$, $\eta_p^2=.11$, reflecting a significantly greater decrease in positive emotion in the IA− condition relative to those in the EA− condition. No other significant main effects or interactions were found for any of the other attributional dimensions, all *F's*<3.78, *p's*>.057.

State rumination. A significant main effect of time was found, $F(15,59)=126.14$, $p=.001$, $\eta_p^2=.681$, reflecting an overall increase in state rumination from pre-training ($M=13.97$, $SD=2.65$) to post-training ($M=26.05$, $SD=8.29$). No other significant main effects or interactions were found across any combination of manipulated factors, all *F's*<3.74, *p's*>.058, that is, none of

the manipulations of attributional style dimensions directly influenced state rumination.

Emotional and ruminative reactivity to failure: post-training to post-failure

In order to investigate the effect of the attributional training upon change in emotion and state rumination in response to the failure task, a series of 2 (IE+: internal vs external) x 2 (IE-: internal vs external) x 2 (SU+: stable vs unstable) x 2 (SU-: stable vs unstable) x 2 (Time: post-training, post-failure) ANOVA's were conducted, with positive emotion, negative emotion and state rumination as the respective dependent variables. Given the primary focus of these analyses was to test the effect of training the upon the dependant variables post-training to post-failure, only post-hoc analyses are presented for interactions that involve the within subjects variable of time i.e. post-training-post-failure.

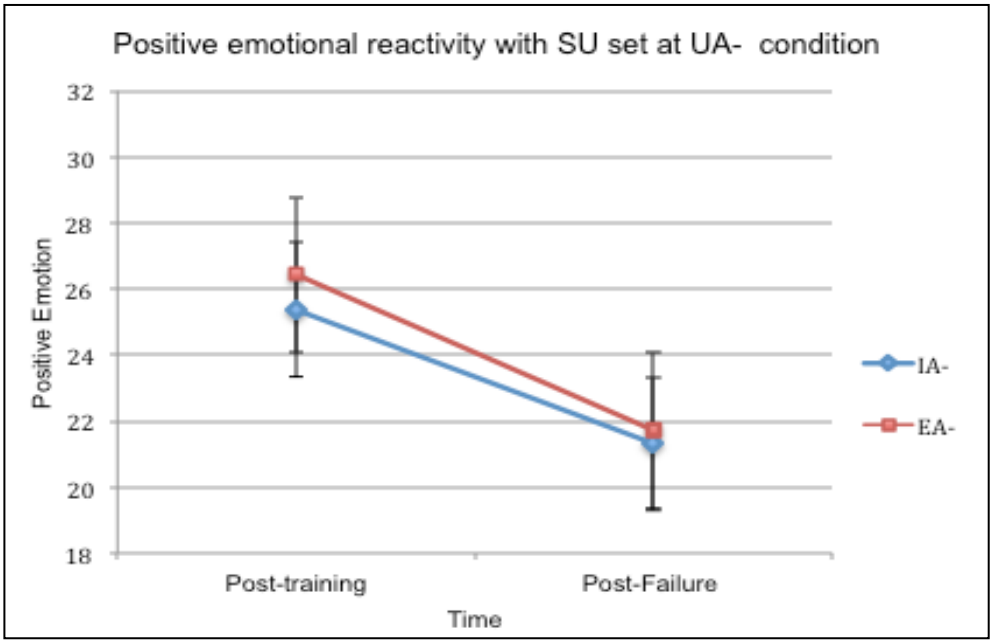
For negative emotion, a significant main effect of time was found, $F(15,59)=52.38$, $p=.001$, $\eta_p^2=.47$, reflecting an increase in negative emotion from post-training ($M=18.44$, $SD=6.30$) to post-failure ($M=24.04$, $SD=8.76$), indicating that the failure induction was successful. A three-way between subjects interaction was found for IE- by IE+ by SU+, $F(15,59)=7.77$, $p=.007$, $\eta_p^2=.067$. No other significant main effects or interactions were found across any combination of factors, all $F's<3.82$, $p's>.055$, and, critically, there was no interaction of manipulated attribution dimension with time for negative emotion.

For positive emotion, a significant main effect of time was found, $F(15,59)=41.69$, $p=.001$, $\eta_p^2=.41$, reflecting a decrease in positive emotion from post-training ($M=25.69$, $SD=8.87$) to post-failure ($M=21.15$, $SD=7.53$), confirming the efficacy of the failure induction. A significant interaction was also

found between IE+ by time, $F(15,59)=4.23$, $p=.044$, $\eta_p^2=.067$, reflecting a smaller decrease in positive emotion for those in the IA+ condition relative to those in the EA+ condition (Table 5). Furthermore, a significant IE- by time interaction was found, $F(15,59)=7.21$, $p=.009$, $\eta_p^2=.11$, which was qualified by a three-way interaction between IE-, SU- and time, $F(1,74)=4.76$, $p=.037$, $\eta_p^2=.07$, (see Table 6). To further understand this three-way interaction, simple effects analyses were conducted holding SU- constant. When SU- was set at SA-, a significant main effect of time was found, $F(1,36)=22.39$, $p=.001$, $\eta_p^2=.38$, which was qualified by a significant interaction between IE- and time, $F(1,36)=10.06$, $p=.003$, $\eta_p^2=.22$. This reflected greater decreases in positive emotion among those in the SA- condition who also received IA- training (post-training, $M=28.30$, $SD=10.25$, post-failure, $M=21.72$, $SD=7.34$), relative to those in the SA- condition also receiving EA- training (post-training, $M=22.39$, $SD=8.51$,post-failure, $M=20.89$, $SD=7.54$; Figure 2a). When set at UA-, a significant main effect of time was found, $F(1,35)=22.59$, $p=.001$, $\eta_p^2=.39$, reflecting decreases in positive emotion across time (post-training, $M=25.91$, $SD=8.05$, post-failure, $M=21.52$, $SD=7.91$). No significant main effects were found for IE-, $F(1,35)=.09$, $p=.765$, $\eta_p^2=.00$, or between IE- and time, $F(1,35)=.132$, $p=.719$, $\eta_p^2=.00$; Figure 2b). No other significant main effects or interactions were found across any combination of factors, all *F's*<1.66, *p's*>.203.

State rumination following failure. A significant main effect of time was found, $F(15,59)=15.25$, $p=.001$, $\eta_p^2=.21$, reflecting overall increases in state rumination from post-attribution training ($M=26.05$, $SD=8.29$) to post-failure task ($M=28.87$, $SD=7.66$). No other significant main effects or interactions were found, all *F's*<2.49, *p's*=>.120.

(a)



(b)

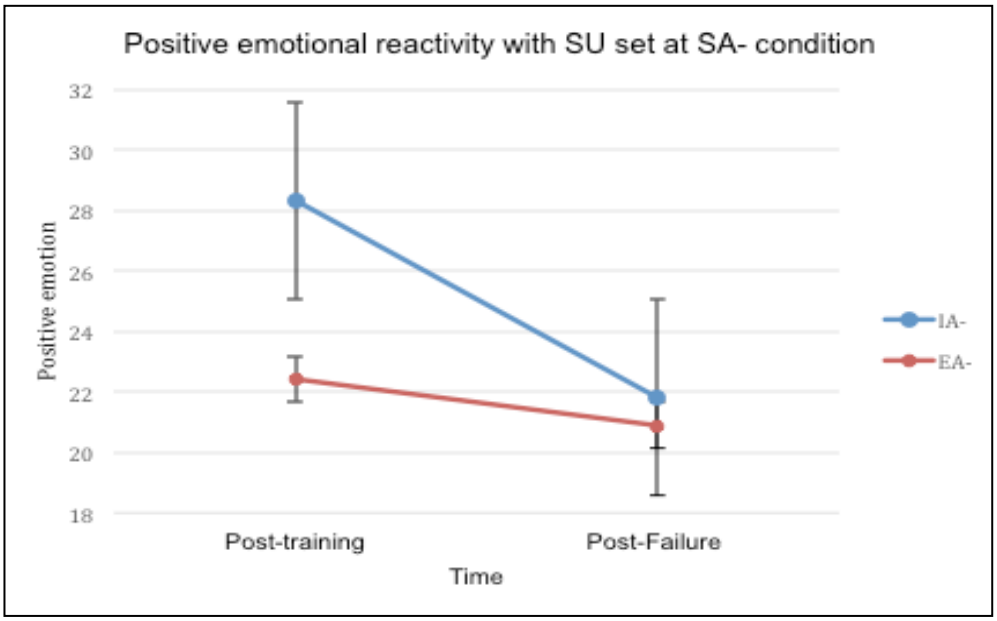


Figure 2. Simple slopes of the change in positive emotional reactivity for IA- versus EA- when SU is set at (a) SA- and (b) UA-.

Table 5.

Means and standard deviations (in parentheses) for each dependent variable for each training condition at each time-point.

	IA+	EA+	SA+	UA+	IA-	EA-	SA-	UA-
Pre-attribution training								
Positive Emotion	28.63 (6.24)	27.17 (6.05)	27.75 (6.25)	28.17 (6.13)	27.84 (5.99)	28.05 (6.40)	27.97 (6.80)	27.92 (5.51)
Negative Emotion	18.20 (3.97)	19.29 (4.64)	18.72 (3.87)	18.69 (4.81)	18.46 (4.18)	18.95 (4.45)	18.24 (4.23)	19.18 (4.38)
Momentary Rumination	13.15 (2.14)	14.91 (2.87)	13.93 (2.76)	14.03 (2.55)	13.81 (2.88)	14.13 (2.43)	13.87 (2.35)	14.08 (2.95)
Post-attribution training								
Positive Emotion	27.85 (8.66)	23.23 (8.60)	26.13 (8.86)	25.20 (9.02)	23.92 (8.41)	27.42 (9.10)	25.50 (9.81)	25.89 (7.96)
Negative Emotion	17.45 (3.39)	19.57 (8.40)	16.04 (7.05)	18.60 (5.40)	18.64 (5.63)	18.24 (6.95)	19.21 (7.16)	17.65 (5.24)
Momentary Rumination	25.15 (8.39)	27.09 (8.16)	26.27 (7.83)	25.80 (8.89)	25.70 (7.95)	26.39 (8.70)	27.97 (7.92)	24.08 (8.30)
Post-failure task								
Positive Emotion	22.10 (7.95)	20.06 (6.96)	21.20 (7.96)	21.09 (7.11)	21.11 (7.34)	21.18 (7.80)	20.79 (7.33)	21.51 (7.80)
Negative Emotion	23.82 (9.07)	24.29 (9.63)	22.35 (8.80)	25.97 (9.56)	23.05 (8.94)	25.00 (9.54)	24.87 (9.54)	20.19 (8.97)
Momentary Rumination	26.88 (7.99)	31.15 (6.66)	29.38 (6.89)	28.29 (8.52)	27.81 (7.68)	29.89 (7.60)	29.79 (7.23)	27.92 (8.06)

Note. IA+=internal-attributions-to-positive-condition; EA+=external-attributions-to-positive-condition; SA+ =stable-attributions-to positive-condition; UA+=unstable-attributions-to-positive-condition; IA-=internal-attributions-to-negative-condition; EA-=external-attributions-to-negative-condition; SA-=stable-attributions-to-negative-condition; UA- =unstable-attributions-to-negative-condition.

Discussion

The primary aim of this study was to empirically investigate several potentially complementary nested hypotheses regarding which attributional dimensions underlie the causal effect of attribution style upon direct emotion and on emotional reactivity following a failure task.

With respect to direct influence on emotion, the current findings were consistent with the Stable Attribution for Negative hypothesis, as indexed by a change in negative emotion. Training stable attributions to negative events directly resulted in increased negative emotion, relative to training unstable attributions. No support was found for the Stable Attribution to Positive hypothesis or the Stable Attribution Conjoint Valence hypothesis.

The findings were also consistent with parts of the Internal Attribution for Negative and Internal Attribution to Positive hypotheses for direct impact on positive emotional response and also on emotional reactivity following failure. Specifically, relative to training external attributions to positive events, making internal attributions to positive events reduced positive emotion directly following training and lowered positive emotional reactivity following a subsequent failure task. No support was found for the Internal Attribution Conjoint Valence hypothesis.

The findings were also consistent with the Combined Internal-Stable Attribution to Negative hypothesis for emotional reactivity. Specifically, the differential effect of training internal attributions versus external attributions to negative events on emotional reactivity was only significant if stable attributions were also trained, but reduced to non-significance if unstable attributions were also trained, suggesting that making internal-stable attributions to negative events is particularly problematic. No support was found for the Internal-Stable

Attribution to Positive or the Internal-Stable Attribution Conjoint Valence hypotheses.

The second aim of this study was to investigate the differential impact of attributional style dimensions upon engagement in state-rumination following training and in response to a perceived failure induction. Contrary to all attribution models, no support was found for any of the nested hypotheses.

The observed effects of manipulating the internality dimensions are consistent with the hypothesis within helplessness and hopelessness theories whereby attributions of negative events as evidence of negative self-worth are a "proximal contributory cause" of hopelessness and subsequent depression (Abramson et al., 1989, p. 360; Abramson et al., 1978). In addition, the relevance of both internality and stability is congruent with the theories of both pessimistic and enhancing attributional styles, as they include the combination of these dimensions (Abramson, et al., 1978; Alloy & Abramson, 1984; Needles & Abramson, 1990; Seligman et al., 1984).

Furthermore, these findings advance and refine these theoretical models by indicating that specific attributional dimensions are active in influencing emotion, whereas others are less active. The findings suggest that there are independent effects of making internal vs. external attributions to negative events and to positive events, on both positive emotion and also emotional reactivity. This is important in highlighting how such attributions to both positive and negative events may underpin the impact of the pessimistic attributional style. Further, although attribution based recovery theories (e.g., Needles & Abramson, 1990) proposed internal attributions to positive events will improve mood relative to external attributions, that is, act to enhance positivity to things going well, the current findings also suggest that being external to positive

events is a risk factor for greater emotional reactivity to a negative event (failure), relative to being internal to positive events. Thus, both internal attributions to negative events and external attributions to positive events may independently confer risk for worse mood in response to a negative event, indicating a slight revision of attributional theories for depression.

Whilst we found that manipulating the stability of attributions for negative events influenced negative emotion and moderated the effect of internal attributions on reactions to negative events, manipulating the stability of attributions to positive events did not causally influence any change in emotion or emotional reactivity. This differential effect is consistent with the evidence that greater stability to negative events confers emotional vulnerability (Watkins et al., 2009, 2012), whereas there is only weak support for the association between attribution style to positive events and depression onset (Sweeney et al., 1986). It may be greater stability of attributions to positive events confers greater enhancement of positive mood in the context of positive events, but has less effect on change in mood for negative events.

Contrary to Peters et al. (2011), attributional training did not influence negative emotional reactivity following the failure task. This may be because we did not directly replicate their selected combinations, but rather sought to examine effects of distinct dimensions within attributional styles. There was also a difference in the indices used: Peters et al., (2011) utilised the D-POM's depression-dejection subscale (Shacham, 1983), whereas the current study used the combined PANAS Negative-Emotion and Sad-Mood subscales to measure negative emotion (Watson & Clark, 1994).

Findings were consistent with Mehu and Shearer's (2015) attributional model in that training particular attributional style components resulted in a

direct change in emotion, as well as further causally influencing emotional reactivity following a stressful task. Internality to positive events was found to independently decrease direct positive emotion and also emotional reactivity. Additionally, internality to negative events and stability to negative events was found independently to reduce positive emotion, however, a further interactive effect was found between these components in response to a stressor task.

Overall, there were noticeably fewer effects of training attributional dimensions on change in negative emotion relative to positive emotion. This may be because of a floor effect as this relatively healthy, non-dysphoric sample may have been less likely to show changes in negative mood and more likely to report changes in positive emotion. Caution may be required in generalizing these findings, as there may be different effects of training attributional dimensions in sub-threshold versus clinical populations.

Additionally, the current manipulation checks found significant effects for the training conditions on attributional dimensions for positive events, but not always for attributional dimensions for negative events. This may reflect the naturally occurring positivity bias common to healthy individuals (see Mezulis et al., 2004). This reduced training effect may partially account for the limited effects of attribution training on changing negative emotion, especially with regard to responses to the failure task. In the absence of significant evidence that the manipulation of internal and stable attributions to negative events was effective, the current null effects regarding negative emotion need to be interpreted with caution.

The failure to see any effect of attributional dimensions on state rumination was surprising, given the hypothesis that attributional style has a causal influence in determining the extent of engagement in and perseverance

of depressive ruminative thought (Abramson & Alloy, 2007; Abramson et al., 2002; Alloy et al., 2008). For some participants, the combination of the attributional training conditions differed from those that typically occur naturally. Thus, the task may have been too mentally taxing and confusing therefore obscuring results. In addition, it is noted that the MRSI is only a brief measure capturing one index of ruminative frequency; other measures capturing alternative dimensions, such as intensity, usefulness, and repetitiveness, may be required to confirm that attributional training has no effect upon rumination.

A major strength of this work is use of a factorial design to dismantle the combinations of attributional dimensions simultaneously manipulated within Peters et al. (2011). This is important as it holds both theoretical and clinical implications. Indeed, it provides a direct test of which attributional style dimensions underlie the causal effects observed, thus providing detail to theoretical attribution models that underlie cognitive intervention techniques. Such detail advances clinical knowledge as to the types of attributional bias that may be most beneficial to target when utilising cognitive re-appraisal techniques within CBT treatments. Specifically, findings suggest that clinical focus should be upon enhancing the degree to which clients appraise positive events as internal and negative events as external and unstable is most likely to result in reductions in emotional vulnerability.

Furthermore, findings indicate that CBM attribution training may hold potential for development as a clinical intervention in its own right. In line with Peters et al., (2011) conclusions, the results provide further evidence that attributional style can be modified using CBM approaches. Also, the study design allows identification as to how CBM methodology can be refined to

maximise the effect of a single training session in reducing emotional vulnerability to a stressor. Indeed, the findings suggest that inclusion of training components aiming to promote greater internality to positive events and/or greater external-unstable attributions to negative events contribute to reductions in emotional vulnerability thus maximizing intervention efficacy. However, as stability to positive events did not influence emotional response or reactivity, findings suggest that this component may not hold any added benefit, therefore would not provide added benefit to a CBM attribution training intervention.

A further study strength is the inclusion of a measure of positive emotion as, which to our knowledge, this provides the first direct experimental investigation of the proposed causal role of attributional biases upon a loss of positive emotion. This is important clinically, as a loss of pleasure constitutes a core symptom unique to depression (Clarke & Watson, 1991). The findings of a direct causal effect of attribution upon extent of loss of positive emotion provides promise for the potential utility of developing CBM-attribution paradigms as a possible clinical intervention targeting symptoms of anhedonia within depression.

A number of study limitations should be noted. First, though the current study identified independent effects of a number of components, the size of each effect upon emotional response or reactivity was small and it is unclear to what extent these translate into clinically meaningful changes in emotional response and reactivity. Furthermore, analyses of the effects of emotional reactivity were undertaken at the time points of post training – post stressor task. This analysis was considered appropriate as it was considered to increase ecological validity, following Mehu and Shearers (2015) assertion that

attributions likely influence trait disposition to general emotional states which acts to moderate the effect of a stressor upon emotional reactivity. However, this means that emotional levels before the stressor task was not balanced across conditions, therefore findings should be interpreted with this caveat.

The study could be extended in several ways. For example, expansion of CBM-attribution experiments to dysphoric samples (within ethical constraints) would increase the generalizability of findings to more clinically relevant populations. Furthermore, this would provide a test of the feasibility and acceptability of CBM based attributional training as a potential intervention. Further research could also consider the impact of attributional training upon emotional reactivity to a perceived achievement or pleasurable task. Such work may advance our understanding of whether CBM-attributions are worth investigating as a potential adjunctive intervention alongside behavioural activation (i.e., maximising the gains from engaging in pleasurable activities) or even as a stand-alone treatment for depression, similar to Watkins et al. (2009) CNT for interpretation biases.

In summary, understanding the mechanisms of action underlying CBM attribution advances our knowledge concerning theories of depression vulnerability, and aids the refinement of CBM-attribution paradigms. Such work is imperative if, as with other CBM paradigms, CBM-attribution is to be developed as a brief intervention for individuals suffering from depression.

References

Abela, J. R., Auerbach, R. P., & Seligman, M. E. P. (2008). Dispositional pessimism across the lifespan. In K. S. Dobson, & D. J. A. Dozois (Eds.), *Risk factors in depression.* (pp. 195-220). San Diego, CA: Elsevier Academic Press.

Abramson, L. Y., Alloy, L. B., Hankin, B. L., Haeffel, G. J., MacCoon, D. G., & Gibb, B. E. (2002). Cognitive vulnerability-stress models of depression in a self-regulatory and psychobiological context. In I. H. Gotlib & C. L. Hammen (Eds.), *Handbook of depression (*3rd ed., pp. 268-294). New York, NY: Guilford Press.

Abramson, L. Y., Metalsky, G. I., & Alloy, L., B. (1989). Hopelessness depression: A theory-based subtype of depression. *Psychological Review, 96,* 358-372. doi: 10.1037/0033-295X.96.2.358.

Abramson, L. Y., Seligman, M. E., & Teasdale, J. D. (1978). Learned helplessness in humans: Critique and reformulation. *Journal of Abnormal Psychology, 87,* 49-74. doi: 10.1037/0021-843X.87.1.49

Alloy, L. B., & Abramson, L. Y. (2007). The adolescent surge in depression and emergence of gender differences: A biocognitive vulnerability-stress model in developmental context. In D. Romer & E. F. Walker (Eds.), *Adolescent psychopathology and the developing brain: Integrating brain and prevention science.* (pp. 284-314). New York, NY: Oxford University Press.

Alloy, L. B., Abramson, L. Y., & Francis, E. L. (1999). Do negative cognitive styles confer vulnerability to depression? *Current Directions in Psychological Science, 8,* 128-132. doi: 10.1111/1467-8721.00030.

Alloy, L. B., Abramson, L. Y., Hogan, M. E., Whitehouse, W. G., Rose, D. T., Robinson, M. S., Kim, R. S., & Lapkin, J. B. (2000). The Temple-Wisconsin Cognitive Vulnerability ot Depression (CVD) Project: Lifetime history of axis I psychopathology in individuals with high and low cogntivie vulnerability to depression. *Journal of Abnormal Psychology, 109*, 403-418. doi: 10.1037/0021-843X.109.3.403.

Alloy, L. B., Abramson, L. Y., Keyser, J., Gerstein, R. K., & Sylvia, L. G. (2008). Negative cognitive style. In K. S. Dobson & D. J. A. Dozois (Eds.), *Risk factors in depression.* (pp. 237-262). San Diego, CA: Elsevier Academic Press.

Alloy, L. B., Abramson, L. Y., Whitehouse, W. G., Hogan, M. E., & Panzarella, C., & Rose, D. T. (2006). Prospective incidence of first onsets and recurrences of depression in individuals at high and low cognitive risk for depression. *Journal of Abnormal Psychology, 115,* 145-156. doi: 10.1037/0021-843X.115.1.145.

Anderson, C. A., Krull, D. S., & Weiner, B. (1996). Explanations: Processes and consequences. In E. T. Higgins & A. W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles.* (pp. 271–296). New York: Guilford Press.

Brown, J. D., & Dutton, K. A. (1995). The thrill of victory, the complexity of defeat: Self-esteem and people's emotional reactions to success and failure. *Journal of Personality and Social Psychology, 68,* 712-722. doi: 10.1037/0022-3514.68.4.712.

Campbell, W. K., & Sedikides, C. (1999). Self-threat magnifies the self-serving bias: A meta-analytic integration. *Review of General Psychology, 3,* 23–43. doi: 10.1037/1089-2680.3.1.23.

Carver, C.S., & Scheier, M.F. (1998). *On the self-regulation of behavior.* New York, NY: Cambridge University Press.

Clark, D. A. (2011). Implementing NICE guidelines for the psychological treatment of depression and anxiety disorders: The IAPT experience. *International Review of Psychiatry, 4,* 318-327. doi: 10.3109/09540261.2011.606803.

Clarke, P. J., Notebaert, L., & MacLeod, C. (2014). Absence of evidence or evidence of absence: Reflecting on therapeutic implementations of attentional bias modification. *British Medical Clinical Psychiatry, 14,* 8. doi: 10.1186/1471-244X-14-8.

Clark, L. A., & Watson, D. (1991). Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology, 100,* 316–336. doi: 10.1037/0021-843X.100.3.316.

Collins, L. M., Dziak, J. J., Kugler, K. C., & Trail, J. B. (2014). Factorial experiments: Efficient tools for evaluation of intervention components. *American Journal of Preventative Medicine, 47,* 498-504. doi: 10.1016/j.amepre.2014.06.021.

Dykman, B. M., & Johll, M. (1998). Dysfunctional attitudes and vulnerability to depressive symptoms: A 14-week longitudinal study. *Cognitive Therapy and Research, 22,* 337-352.

Dziak, J. J., Coffman, D. L., Lanza, S. T., & Li, R. (2012). *Sensitivity and specificity of information crieteria.* The Methodology Center and Department of Statistics, Pennsylvania State University.

Edelman, R. E., Ahrens, A. H., & Haaga, D. A. F. (1994). Inferences about the self, attributions, and overgeneralization as predictors of recovery from

dysphoria. *Cognitive Therapy and Research, 18*, 551-566. doi: 10.1007/bf02355668.

Fox, E., Mackintosh, B., & Holmes, E. A. (2014). Travellers' tales in cognitive bias modification research: A commentary on the special issue. *Cognitive Therapy and Research*, *38*, 239-247. doi: 10.1007/s10608-014-9604-1.

Fresco, D. M., Alloy, L. B., & Reilly-Harrington, N. (2006). Association of attributional style for negative and positive events and the occurrence of life events with depression and anxiety. *Journal of Social and Clinical Psychology, 25*, 1140-1159. doi: 10.1521/jscp.2006.25.10.1140.

Greenberg, J., Pyszczynski, T. A., & Solomon, S. (1982). The self-serving attributional bias: Beyond self presentation*. Journal of Experimental Social Psychology, 18,* 56–67. doi: 10.1016/0022-1031(82)90081-6.

Haeffel, G. J., & Vargas, I. (2011). Resilience to depressive symptoms: The buffering effects of enhancing cognitive style and positive life events. *Journal of Behaviour Therapy and Experimental Psychiatry, 42*, 3-18. doi:10.1016/j.jbtep.2010.09.003.

Hallion, L. S., & Ruscio, A. M. (2011). A meta-analysis of the effect of cognitive bias modification on anxiety and depression. *Psychological Bulletin*, *137*, 940-958. doi: 10.1037/a0024355.

Hammen, C., & Watkins, E., (2013). *Depression.* Sussex, UK: Psychology Press.

Hertel, P., Mor, N., Ferrari, C., Hunt, O., & Agrawal, N. (2014). Looking on the dark side rumination and cognitive-bias modification. *Clinical Psychological Science*, *2,* 714-726. doi: 10.1177/2167702614529111.

Hirsch, C. R., Meeten, F., Krahe, C., & Reeder, C. (2016). Resolving ambiguity in emotional disorders: The nature and role of interpretation biases.

Annual Review of Clinical Psychology, 12, 281-305. doi: 10.1146/annurev-clinpsy-021815-093436.

Johnson, J. G., Han, Y. S., Douglas, C. J., Johnenet, C. M., & Russel, T. (1998). Attributions for positive life events predict recovery from depression among psychiatric inpatients: An investigation of Needles and Abramson model of recovery from depression. *Journal of Consulting and Clinical Psychology, 66*, 369-376. doi: 10.1037//0022-006x.66.2.369.

Keppel, G., & Wickens, T. D. (2004). *Design and analysis: A researchers handbook (5th ed.)*. Englewood Cliffs, NJ: Prentice Hall.

Kernis, M. H., Brockner, J., & Frankel, B. S. (1989). Self-esteem and reactions to failure: The mediating role of overgeneralization. *Journal of Personality and Social Psychology, 62,* 707-714. doi: 10.1037/0022-3514.57.4.707.

MacLeod, C., & Clarke, P. J. F. (2013). Cognitive Bias Modification: A new frontier in cognition and emotion research. In M. D. Robinson, E. Watkins & E. Harmon-Jones (Eds.), *Handbook of cognition and emotion*. (pp. 540-562). New York, NY: Guilford Press.

MacLeod, C., & Mathews, A. (2012). Cognitive bias modification approaches to anxiety. *Annual Review of Clinical Psychology, 8,* 189-217. doi: 10.1146/annurev-clinpsy-032511-143052.

Mackintosh, B., Mathews, A., Yiend, J., Ridgeway, V., & Cook, E. (2006). Induced biases in emotional interpretation influence stress vulnerability and endure despite changes in context. *Behavior Therapy, 37*, 209-222. doi: 10.1016/j.beth.2006.03.001.

Martin, L., & Tesser, A. (1996). Some ruminative thoughts. In R. S. Wyer (Ed.), *Ruminative thoughts: Advances in social cognition, volume IX*. (pp. 1-47). Mahwah, NJ: Lawrence Erlbaum Associates.

Mathews, A., & Mackintosh, B. (2000). Induced emotional interpretation bias and anxiety. *Journal of Abnormal Psychology*, *109*, 602-615. doi 10.1037/0021-843X.109.4.602.

Mehu, M., & Scherer, K. R. (2015). The appraisal bias model of cognitive vulnerability to depression. *Emotion Review, 7,* 272-279. doi: 1754073915575406.

Mezulis, A. H., Abramson, L. Y., Hyde, J. S., & Hankin, B. L. (2004). Is there a universal positivity bias in attributions? A meta-analytic review of individual, developmental, and cultural differences in the self-serving attributional bias. *Psychological Bulletin, 130,* 711-747. doi: 10.1037/0033-2909.130.5.711.

Moberly, N. J., & Watkins, E. R. (2006). Processing mode influences the relationship between trait rumination and emotional vulnerability. *Behavior Therapy, 37*, 281-291. doi: 10.1016/j.beth.2006.02.003.

Mor, N., Marchetti, I., & Koster, E. H. W. (2013). The momentary ruminative self-focus inventory (MRSI): Validation and psychometric evaluation. *Manuscript submitted for publication.*

National Institute for Health and Clinical Excellence. (2009). *Depression: The treatment and management of depression in adults.* Leicester, UK: British Psychological Society.

Needles, D. J., & Abramson, L. Y. (1990). Positive life events, attributional style, and hopefulness: Testing a model of recovery from depression. *Journal of Abnormal Psychology, 99,* 156-165. doi: 10.1037//0021-843x.99.2.156.

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, *100*, 569-582. doi: 10.1037/0021-843X.100.4.569.

O'Brien, R. G. (1981). A simple test for variance effects in experimental designs. *Psychological Bulletin, 89,* 570-574. doi: 10.1037/0033-2909.89.3.570.

Peters, K. D., Constans, J. I., & Mathews, A. (2011). Experimental modification of attribution processes. *Journal of Abnormal Psychology*, *120*, 168-173. doi: 10.1037/a0021899.

Peterson, C. (1991). On shortening the Expanded Attributional Style Questionnaire. *Journal of Personality Assessment, 56,* 179-183. doi: 10.1207/s15327752jpa5601_16.

Peterson, C., & Villanova, P. (1988). An Expanded Attributional Style Questionnaire. *Journal of Abnormal Psychology, 97,* 87-89. doi : 10.1037/0021-843X.97.1.87.

Psychology Software Tools, Inc. (2012). *E-Prime 2.0.* Retrieved from: http://www.pstnet.com.

Rimes, K. A., & Watkins, E. (2005). The effects of self-focused rumination on global negative self-judgements in depression. *Behaviour Research Therapy, 43,* 1673-1681. doi: 10.1016/j.brat.2004.12.00.

Schaich, A., Watkins, E. R., & Ehring, T. (2013). Can concreteness training buffer against the negative effects of rumination on PTSD? An experimental analogue study*. Journal of Behaviour Therapy and Experimental Psychiatry, 44*, 396-403. doi: 10.1016/j.jbtep.2013.03.006.

Sedikides, C., & Strube, M. J. (1995). The multiply motivated self. *Personality and Social Psychology Bulletin, 21,* 1330–1335. doi: 10.1177/01461672952112010.

Seligman, M. E. P., Peterson, C., Kaslow, N. J., Tenenbaum, R. L., Alloy, L. B., & Abramson, L. Y. (1984). Attributional style and depressive symptoms among children. *Journal of Abnormal Psychology, 93,* 235-241. doi: 10.1037/0021-843X.93.2.235.

Shacham, S. (1983). A shortened version of the profile of mood states. *Journal of Personality Assessment, 47*, 305-306. doi: 10.1207/ s15327752jpa4703_14

Slavin, R. E. (2007). *Educational research in an age of accountability.* Boston, MA: Allyn & Bacon.

Sweeney, P. D., Anderson, K., & Bailey, S. (1986). Attributional style in depression: A meta-analytic review. *Journal of Personality and Social Psychology, 50,* 974–991. doi: 10.1037/0022-3514.50.5.974.

Tresselt, M. E., & Meyznerner, M. S. (1966). Normative solution times for a sample of 134 solution words and 378 associated anagrams. *Psychonomic Monograph Supplements, 1*, 293-298.

Voelz, Z. R., Haeffel, G. J., Joiner, T. E., & Wagner, K. D. (2003). Reducing hopelessness: The interaction of enhancing and depressogenic attributional styles for positive and negative life events among youth psychiatric inpatients. *Behaviour Research and Therapy, 41*, 1183-1198. doi: 10.1016/S0005-7967(03)00030-5.

Watkins, E. (2004). Appraisals and strategies associated with rumination and worry. *Personality and Individual Differences*, *37*, 679-694. doi: 10.1016/j.paid.2003.10.002.

Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin, 134*, 163-206. doi: 10.1037/0033-2909.134.2.163.

Watkins, E. R., Baeyens, C. B., & Read, R. (2009). Concreteness training reduces dysphoria: Proof-of-principle for repeated cognitive bias modification in depression. *Journal of Abnormal Psychology*, *118*, 55-64. doi: 10.1037/a0013642.

Watkins, E., & Baracaia, S. (2002). Rumination and social problem-solving in depression. *Behaviour Research and Therapy*, *40*, 1179-1189.

Watkins, E., Moberly, N. J., & Moulds, M. L. (2008). Processing mode causally influences emotional reactivity: Distinct effects of abstract versus concrete construal on emotional response. *Emotion, 8*, 364-378. doi: 10.1037/1528-3542.8.3.364.

Watkins, E., & Moulds, M. L. (2005). Distinct modes of ruminative self-focus: Impact of abstract versus concrete rumination on problem solving in depression. *Emotion, 5*, 319-328. doi: 10.1037/1528-3542.5.3.319.

Watkins, E. R., Taylor, R. S., Byng, R., Baeyens, C., Read, R., Pearson, K., & Watson, L. (2012). Guided self-help concreteness training as an intervention for major depression in primary care: A phase II randomized controlled trial. *Psychological Medicine*, *42*, 1359-1371. doi: 10.1017/S0033291711002480.

Watson, D., & Clark, L. A. (1994). *The PANAS-X: Manual for the Positive and Negative Affect Schedule-Expanded Form.* Ames, IA: The University of Iowa.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS Scales.

Journal of Personality and Social Psychology, 47, 1063–1070. doi: 10.1037/0022-3514.54.6.1063.

Wenzlaff, R. M., & Groziwe, S. A. (1988). Depression and the magnification of failure. *Journal of Abnormal Psychology, 97,* 90-93. doi: 10.1037/0021-843X.97.1.90.

Yiend, J., Mackintosh, B., & Mathews, A. (2005). Enduring consequences of experimentally induced biases in interpretation. *Behaviour Research and Therapy, 43*, 779-797. doi: http://dx.doi.org/10.1016 /j.brat.2004.06.007.

Zautra, A. J., Guenther, R. T., & Chartier, G. M. (1985). Attributions for real and hypothetical events: Their relation to self-esteem and depression. *Journal of Abnormal Psychology, 94, 530-540.* doi: 10.1037/0021-843X.94.4.530.

List of Appendices

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    3. PANAS Subscales.
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Appendix A. Power Calculation

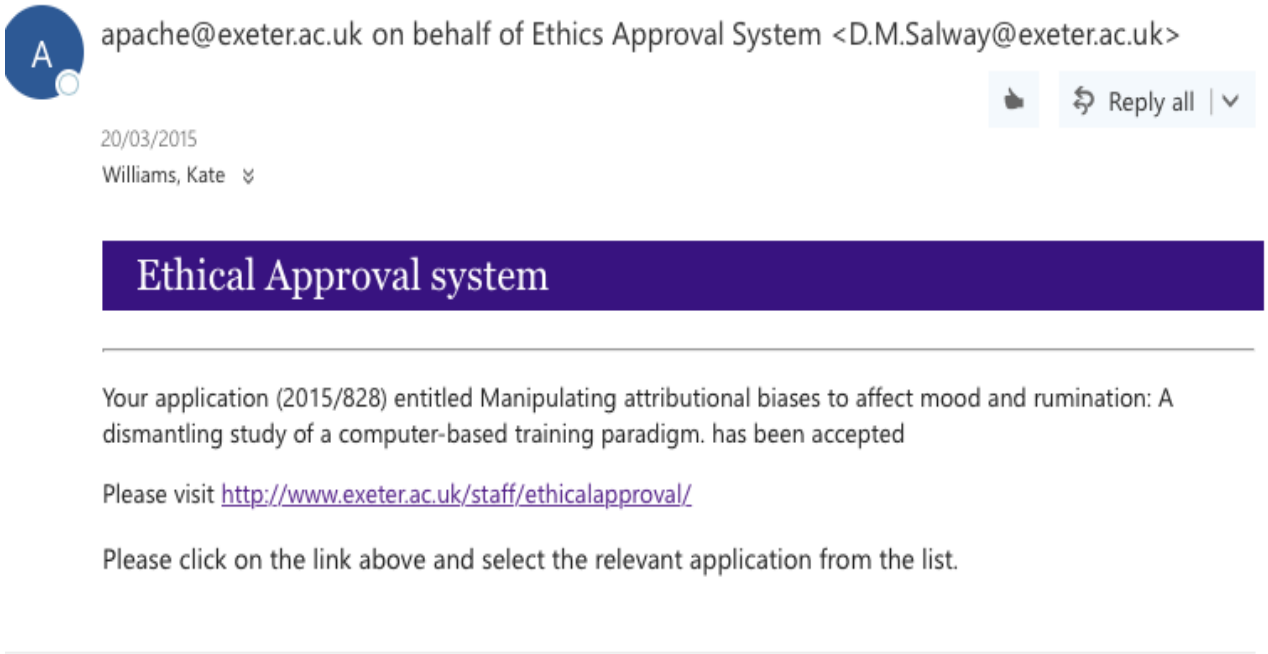
The logic that underpins power within factorial experiments is fundamentally different from the logic used in order to power a traditional experiment with multiple-arm comparisons. Indeed, for traditional experiments effects are estimated through direct comparison of means of each experimental condition, therefore statistical power is dependent upon the per-condition *n*. As such, within traditional designs the addition of each additional experimental condition means that the total *n* must also be corresponding increase in order to provide power for this additional comparison. On the other hand, factorial designs are specifically intended to estimate main effects and interactions. Though these designs look superficially the same as traditional experimental designs, where individuals are randomised to one of several conditions, analysis involves a factorial approach, that is, each main effect comparison utilises the whole sample, rather than pairwise comparisons between each of the conditions.

Peters et al., (2011) 'traditional' experimental design involves two conditions (i.e. a hypothesised attributional vulnerability condition and resiliency condition). Each condition represents the manipulation of all four factors within this study towards one of the two levels. That is, the attributional vulnerability condition involved training more stable, internal attributions to negative events and unstable, external attributions to positive events whereas attributional resiliency condition involved the opposite pattern. This studies orthogonal factorial design breaks down this combination of attributional dimensions down into four factors, (stability to positive events; stability to negative events; internality to positive events and internality to negative events) each with two levels (e.g. stability to positive events = training stable attributions to positive

events versus training unstable attributions to positive events). Though this results in 16 conditions representing all possible training combinations, power is calculated based upon the main effect of each factor, rather than each training condition. As such power needed for this design would be expected to be equivalent to that found within Peter's et al., (2011) design.

Peter's et al., (2011) found η_p^2= 0.14, thus the effect size *f*=0.40. Utilising these statistics, a sample size of 52 is required in this study to detect an effect at 80% power and an alpha of 0.05. Given the aim of ascertaining a balanced orthogonal design (even numbers in each condition), a minimum total *n* of 64 was needed. Furthermore, given the potential unknown impact of minor changes to the CBM-attribution material (in order to create trial variations) upon training efficacy (thus size of effects), and also the potential loss of data for several reasons (low accuracy scores etc.) a conservative n of 80 was set, resulting in 5 participants per condition.

Appendix B. Confirmation of university ethical approval



apache@exeter.ac.uk on behalf of Ethics Approval System <D.M.Salway@exeter.ac.uk>

Reply all

20/03/2015

Williams, Kate

Ethical Approval system

Your application (2015/828) entitled Manipulating attributional biases to affect mood and rumination: A dismantling study of a computer-based training paradigm. has been accepted

Please visit http://www.exeter.ac.uk/staff/ethicalapproval/

Please click on the link above and select the relevant application from the list.

Appendix C. Questionnaires

Appendix C1. Demographic Questionnaire

Demographics

1. What is your age? .....

2. What is your gender? (Please circle) Male / Female / Other

3. How would you describe the ethnic group to which you belong?

White	*Black African/Caribbean or Black British*	*Asian / Asian British*	*Other Ethnic Groups*
☐ English ☐ Welsh ☐ Scottish ☐ Northern Irish ☐ British ☐ Irish ☐ Traveller ☐ Gypsy / Romany ☐ Any white other please specify:	☐ Black British ☐ Caribbean ☐ African ☐ Other Black/African /Caribbean, please specify:	☐ Indian ☐ Pakistani ☐ Bangladeshi ☐ Chinese ☐ Any other Asian please specify:	☐ Any other ethnic group - Please specify ....

2. Qualifications

What qualification are you currently studying for?

☐ NVQ level: ..... ☐ BTEC level: ..... ☐ Higher national certificate/Diploma

☐ Bachelors degree ☐ Masters degree ☐ Doctoral degree

☐ Other (Please specify): .....

What topic are you currently studying .....

Appendix C2. Scenarios from ASQ (Version A)

Cognitive Reasoning Questionnaire (1)

Please try to imagine yourself in the situations that follow. If such a situation happened to you, what would you feel would have caused it?

While events may have many causes, we want you to select and write down what would be **the major cause of the event** if if it happened to you.

Next we want you to answer three questions about the cause you provided. First, is the cause of this event something about you or something about other people or circumstances? Second, is the cause of this event something that will persist across time or something that will never again be present? Third, is the cause of this event something that affects all situations in your life or something that just effects this type of event?

To summarise we want you to:

1. Read each situation and **vividly imagine** it happening to you.

2. **Decide what you feel would be one major cause** if this happened to you and write this cause down

3. **Answer three questions** about the cause that you wrote down.

Scenario 1: You give an important talk in front of your peer group, and the audience reacts negatively.

1. Imagine this has happened to you...

2. Write down the one major cause for this in the space below

.....

.....

3. Answer the following questions about the major cause you have written above:

Is the cause of this audience reaction something **about other people or circumstances or about you**? (circle one number)

The cause is totally due to other people or circumstances	1	2	3	4	5	6	7	The cause is totally due to me

In the future, **will this cause for the audience reaction again be present?** (Circle one number)

The cause will never again be present	1	2	3	4	5	6	7	The cause will always be present

Is this cause of the audience reaction something that just affects giving talks or does it also **influence other areas of your life**? (Circle one number)

The cause influences just this particular situation	1	2	3	4	5	6	7	The cause influences all situations in my life

Scenario 2: You meet a friend who acts hostilely to you.

1. Imagine this has happened to you...

2. Write down the one major cause for this in the space below

.....

.....

3. Answer the following questions about the major cause you have written above:

Is the cause of your friends hostility due to something **about other people or circumstances or about you**? (circle one number)

The cause is totally due to other people or circumstances	1	2	3	4	5	6	7	The cause is totally due to me

In the future with your friend, **will this cause again be present?** (Circle one number)

The cause will never again be present	1	2	3	4	5	6	7	The cause will always be present

Is this cause something that just affects your friendships or **does it also influence other areas of your life**? (Circle one number)

The cause influences just this particular situation	1	2	3	4	5	6	7	The cause influences all situations in my life

Scenario 3: You apply for a position you want very much (important job / university place etc.) and you get it

1. Imagine this has happened to you...

2. Write down the one major cause for this in the space below

.....

.....

3. Answer the following questions about the major cause you have written above:

Is the cause of you getting the position due to something **about other people or circumstances or about you**? (circle one number)

The cause is totally due to other people or circumstances	1	2	3	4	5	6	7	The cause is totally due to me

In the future when applying for a position, **will this cause again be present?** (Circle one number)

The cause will never again be present	1	2	3	4	5	6	7	The cause will always be present

Is this cause something that just influences applying for positions or **does it also influence other areas of your life**? (Circle one number)

The cause influences just this particular situation	1	2	3	4	5	6	7	The cause influences all situations in my life

Scenario 4: Your partner/family member has been treating you more lovingly

1. Imagine this has happened to you...

2. Write down the one major cause for this:

.....

.....

3. Answer the following questions about the major cause you have written above:

Is the cause of this person treating you more lovingly due to something **about other people or circumstances or about you**? (circle one number)

The cause is totally due to other people or circumstances	1	2	3	4	5	6	7	The cause is totally due to me

In future interactions with this person, **will this cause again be present?** (Circle one number)

The cause will never again be present	1	2	3	4	5	6	7	The cause will always be present

Is this cause something that just affects how this person treats you or **does it also influence other areas of your life**? (Circle one number)

The cause influences just this particular situation	1	2	3	4	5	6	7	The cause influences all situations in my life

STOP – Please tell the researcher you have completed the second set of questionnaires. Thank you!

Appendix C3. PANAS subscales

PANAS Questionnaire (1)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. **Indicate to what extent you feel this way right now, that is, at the present moment.**

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

1. _____ Interested
2. _____ Distressed
3. _____ Excited
4. _____ Upset
5. _____ Strong
6. _____ Guilty
7. _____ Scared
8. _____ Hostile
9. _____ Enthusiastic
10. _____ Sad
11. _____ Proud
12. _____ Alone
13. _____ Irritable
14. _____ Blue
15. _____ Alert
16. _____ Ashamed
17. _____ Inspired
18. _____ Downhearted
19. _____ Nervous
20. _____ Determined
21. _____ Lonely
22. _____ Attentive
23. _____ Jittery
24. _____ Active
25. _____ Afraid

Thank you for completing this questionnaire. Please inform the researcher that you are ready to move to the next task.

For Researcher only:

PA _____
NA _____
SM _____

Appendix C4. Momentary Ruminative Self-Focus Questionnaire

MRSI (1)

Read each item carefully. Using the scale shown below, please indicate to what extent each item is applicable to you **right now**.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Agree	Strongly agree
Right now, I am conscious of my inner feelings							
Right now, I am reflective about my life							
Right now, I am aware of my innermost thoughts							
Right now, I am thinking about how happy or sad I feel							
Right now, I wonder why I react the way I do							
Right now, I am thinking about the possible meaning of the way I feel							

Appendix C5. ASQ Scenario Questions (Version B)

Cognitive Reasoning Questionnaire (1)

Please try to imagine yourself in the situations that follow. If such a situation happened to you, what would you feel would have caused it?

While events may have many causes, we want you to select and write down what would be **the major cause of the event** if if it happened to you.

Next we want you to answer three questions about the cause you provided. First, is the cause of this event something about you or something about other people or circumstances? Second, is the cause of this event something that will persist across time or something that will never again be present? Third, is the cause of this event something that affects all situations in your life or something that just effects this type of event?

To summarise we want you to:

1. Read each situation and **vividly imagine** it happening to you.

2. **Decide what you feel would be one major cause** if this happened to you and write this cause down

3. **Answer three questions** about the cause that you wrote down.

Scenario 1: You give an important talk in front of your peer group, and the audience reacts negatively.

1. Imagine this has happened to you...

2. Write down the one major cause for this in the space below

.....

.....

3. Answer the following questions about the major cause you have written above:

Is the cause of this audience reaction something **about other people or circumstances or about you**? (circle one number)

The cause is totally due to other people or circumstances	1	2	3	4	5	6	7	The cause is totally due to me

In the future, **will this cause for the audience reaction again be present?** (Circle one number)

The cause will never again be present	1	2	3	4	5	6	7	The cause will always be present

Is this cause of the audience reaction something that just affects giving talks or does it also **influence other areas of your life**? (Circle one number)

The cause influences just this particular situation	1	2	3	4	5	6	7	The cause influences all situations in my life

Scenario 2: You meet a friend who acts hostilely to you.

1. Imagine this has happened to you...

2. Write down the one major cause for this in the space below

.....

.....

3. Answer the following questions about the major cause you have written above:

Is the cause of your friends hostility due to something **about other people or circumstances or about you**? (circle one number)

The cause is totally due to other people or circumstances	1	2	3	4	5	6	7	The cause is totally due to me

In the future with your friend, **will this cause again be present?** (Circle one number)

The cause will never again be present	1	2	3	4	5	6	7	The cause will always be present

Is this cause something that just affects your friendships or **does it also influence other areas of your life**? (Circle one number)

The cause influences just this particular situation	1	2	3	4	5	6	7	The cause influences all situations in my life

Scenario 3: You apply for a position you want very much (important job / university place etc.) and you get it

1. Imagine this has happened to you...

2. Write down the one major cause for this in the space below

.....

.....

3. Answer the following questions about the major cause you have written above:

Is the cause of you getting the position due to something **about other people or circumstances or about you**? (circle one number)

The cause is totally due to other people or circumstances	1	2	3	4	5	6	7	The cause is totally due to me

In the future when applying for a position, **will this cause again be present?** (Circle one number)

The cause will never again be present	1	2	3	4	5	6	7	The cause will always be present

Is this cause something that just influences applying for positions or **does it also influence other areas of your life**? (Circle one number)

The cause influences just this particular situation	1	2	3	4	5	6	7	The cause influences all situations in my life

Scenario 4: Your partner/family member has been treating you more lovingly

1. Imagine this has happened to you...

2. Write down the one major cause for this:

.....

.....

3. Answer the following questions about the major cause you have written above:

Is the cause of this person treating you more lovingly due to something **about other people or circumstances or about you**? (circle one number)

The cause is totally due to other people or circumstances	1	2	3	4	5	6	7	The cause is totally due to me

In future interactions with this person, **will this cause again be present?** (Circle one number)

The cause will never again be present	1	2	3	4	5	6	7	The cause will always be present

Is this cause something that just affects how this person treats you or **does it also influence other areas of your life**? (Circle one number)

The cause influences just this particular situation	1	2	3	4	5	6	7	The cause influences all situations in my life

STOP – Please tell the researcher you have completed the second set of questionnaires. Thank you!

Appendix D. Anagram-based Perceived Failure Task

Cognitive Ability Task

This task assessing cognitive-ability is an anagram-solving task. You are required to re-arrange jumbled letters to make a word in the English dictionary. You have three minutes to try to complete as many anagrams as you can.

1. oldme .....
2. jutan .....
3. datir .....
4. tinga .....
5. tanbo .....
6. yenpo .....
7. hugol .....
8. aitop .....
9. rigon .....
10. gaton .....
11. baroc .....
12. rdcei .....
13. aebrl .....
14. nrcui .....
15. glaei .....

Appendix E. Study Information

SCHOOL OF PSYCHOLOGY
Study Information Sheet

Descriptive Title of Project
Investigating different forms of comprehension

Researchers:
Kate Williams
Professor Ed Watkins

Name and address
School of Psychology
University of Exeter
Washington Singer Laboratories
Perry Rd
Exeter EX4 4QG

Beginning date: Jan 2015

Ending date: August 2016

WHAT THIS STUDY INVOLVES
This study investigates the relationship between different forms of comprehension and reasoning ability. You will be asked to complete 2 different computerised tasks that assess comprehension by asking you to read short scenarios and then to answer questions. You will also be asked to complete a short anagram task. We will ask you about your mood and thoughts during this study. The study should take just over an hour.

Because the comprehension tasks involve thinking about happy and sad events, and sometimes involve difficult judgements, there is a small chance that they can sometimes temporarily influence mood and make you feel slightly sad, although sometimes they have no effect on mood depending on the individual. Any effect on mood is short-lived, typically less than 5-10 minutes.

WHO IS ORGANISING THIS RESEARCH?
The research is being conducted by clinical psychology researchers in the Mood Disorders Centre at the University of Exeter. The Mood Disorders Centre promotes research, practice and training of benefit to people with mood disorders. The research is being conducted by a Trainee Clinical Psychologist under the supervision of one of the professors at the Mood Disorders Centre.

WHAT WILL HAPPEN TO THE INFORMATION YOU GIVE?
Your answers to the questionnaires and all data gathered by the computer will be identifiable only through an ID number (and not your name). No one else will see this data apart from the research team and we will not communicate any of this information to anybody else. Your name and contact details will be stored separately from any personal information that you provide on the questionnaires. All information collected during the study will be kept in a secure place and will remain confidential and anonymous.

WHAT WILL HAPPEN TO THE RESULTS OF THE STUDY
When complete, the researchers will communicate the results of the study to the wider community of researchers. This is typically achieved through writing up the results in an academic journal, presenting the results at conferences and other outlets. This will NOT involve identification of individuals who took part.

ASSENT/CONSENT
If you agree to take part, please indicate this to the experimenter who will ask you to sign an Assent/Consent Form. If you have any questions you should ask them now before signing this form. Even if you sign the form, you remain free to withdraw from the study at any time.

THANK YOU FOR READING THIS INFORMATION SHEET.

Appendix E1. Participant Information Sheet

Appendix E2. Participant Consent Form.

UNIVERSITY of EXETER

SCHOOL OF PSYCHOLOGY

ASSENT / CONSENT FORM

Investigating different forms of comprehension

Name of Researchers: Professor Ed Watkins, Professor in Clinical Psychology

Kate Williams, Trainee Clinical Psychologist

Please tick box if you agree with the statement

1. After reading the Study Information Sheet for the above study I agree to take part. I have had the opportunity to ask questions. ☐

2. I understand that my participation is voluntary and that I am free to leave the experiment at any time, without needing to give a reason. ☐

_____	_____	_____	_____
Participant signature	Date	Print name	Date of birth

_____	_____	_____
Researcher signature	Date	Print name

Appendix E3. Debriefing information

SCHOOL OF PSYCHOLOGY
Debriefing Information Sheet

Descriptive title of study:
Investigating different forms of comprehension

Summary
Thank you again for taking part in the study, your time and effort in participation is most appreciated.

The purpose of the current study is to investigate how different attributional styles influences an individual's emotional reactivity. It was not investigating comprehension and reasoning ability as per the explanation provided within the information sheet. An element of deception was necessary in the study in order to assess emotional responses related to individuals' attributional style in an unbiased manner. This debriefing information explains the exact detail and rationale for the deception, as well as the aim of the research.

Deception
The anagram task entitled 'cognitive ability task' was in fact a task designed to induce a mild level of performance related stress and perceived failure. It was not, as inferred by the information sheet and task title, a measure of cognitive ability. Performance on this task is not useful as a measure of cognitive ability, or an indicator of academic performance. In fact to promote performance stress the task involved anagrams known to be very difficult to solve. In a recent study using similar anagrams for such purposes participants only managed to solve between 0-1 anagrams (Peters et al., 2011). It was necessary however to deceive participants, in order to promote performance related stress, important for the study rationale.

Purpose of the Study
The study aims to investigate how different forms of attributional style influence an individual's emotional reactivity to stress. An attribution is the way in which we process information or situations and determine how we explain the causes of events. The way that we make event attributions can vary on a number of dimensions. For instance, the cause can be considered internal (e.g. because of you) or external (because of someone/something else). We can also consider the cause as stable (e.g. a cause that is unlikely to change over time, such as due to intelligence) or unstable (a temporary cause such as tiredness).

Lots of research has identified a relationship between attributional style and depression, with theories suggesting that the way we attribute the cause of events relates to our vulnerability or resilience to depression. However, only recently research has directly tested the direction of the relationship that is whether attributional style actually causes a change in the emotional reaction to events. Peters et al., (2011) investigated this using a cognitive training procedure in which participants were trained towards particular attributional styles. The study found that people trained to make internal-stable to positive events and negative external-unstable attributions did not experience as big a

events and negative external-unstable attributions did not experience as big a drop in mood after a stressful anagram completion task relative to individuals trained in the opposite pattern.

The current study builds on the Peters study by breaking down and investigating each of the elements in his two training conditions. This is important in order to find out what aspect of the training (or combination of aspects) drove the change in emotional response following the stressful anagram task, that is, what aspects of attributional style are important in influencing emotional reactivity in the context of stressful events. For example, in Peters et al (2011) one could not tell whether the changes in emotional response were due to increasing internal or increasing stable attributions to positive events or due to increasing external or increasing unstable attributions to negative events, or some combination of these effects.

The current study randomized participants to 16 different training conditions, reflecting all the possible combinations of the different attribution dimensions to positive and negative events. The first comprehension task was designed to train participants into a particular attributional style, by repeated completions of a particular response. Please ask your experimenter if you would like to know the type of attributional training you received. This was then followed by the anagram task designed to act as a mildly stressful event, where individuals experience perceived failure. Participants ware expected to make attributions as to the cause of this failure in line with the attributional training they received. It is hypothesised that emotional reactivity and degree of negative repetitive thought (as measured by the questionnaires before and after the anagram task) will differ according to the training combination that they received. A positive mood induction task was then completed to prevent any lasting impact of the stressor task on mood.

We hope that this research will be useful in furthering our understanding of some of the factors that can make individuals vulnerable to depression and the dimensions of attributional training that will be most beneficial and effective in reducing emotional reactivity.

Thank you for taking the time to take part in this research. If you would like any further information or have any questions at any time please do get in touch.

Further information and support

If you have any questions or concerns, please do not hesitate to ask the researcher either now or at a later point. The researcher can be contacted using the email address: kvw203@exeter.ac.uk

If you have been upset by any of the issues raised and are worried about depression, details of numerous support services are listed below.

Appendix E4. Debriefing E-mail for Excluded Participants

SCHOOL OF PSYCHOLOGY
Study Information Sheet

Descriptive Title of Project
Investigating different forms of comprehension

Thank you for completing the questionnaire and for your interest in taking part in the study.

Unfortunately, scores from the questionnaire indicate that you may be experiencing some symptoms common during the experience of low mood. If you are experiencing low mood, and feel that it is negatively impacting upon your well-being we would recommend that you contact your GP in the first instance to discuss these symptoms further. Additionally, we enclose information about local sources of support for your wellbeing that may be of interest.

We really appreciate your interest and support of the study. However, we are currently only looking for participants who are not experiencing symptoms associated with low mood. This is because that though we understand that the study may result in some individuals experienced a short-lived lowered mood, we do not know how the study might impact the mood of individuals who are already experiencing symptoms associated with a pre-existing low mood. As such, to minimise the possible negative effects of the study on any individuals, we must exclude any individual currently experiencing symptoms that are associated with low mood, such as you.

We would like to take the time to thank you for your interest in the study. If you would like information about the results of the study, or have any further questions about the study please do get in touch with myself.

Best wishes,

Kate Williams
DClinPsych Trainee

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Appendix F. Tables denoting statistical information summarised in text

Table F1.

Table displaying main effects for the study demographic information and also each of the outcome measures at baseline.

	IE+	SU+	IE-	SU-
N	75	75	75	75
Age	F(1,74)=0.19, P=.668	F(1,74)=0.13, p=.725	F(1,74)=2.95, p=.091	F(1,74)=0.08, p=.780
Gender	χ^2(1, n=75) = 5.03, *p* =.071	χ^2(1, n=75) = 2.01, *p* =.366	χ^2(1, n=75) = 1.32, *p* =.517	χ^2(1, n=75) = 4.57, *p* =.102
Ethnicity	χ^2(1, n=75) = 4.19, *p* =.523	χ^2(1, n=75) = 6.38, *p* =.271	χ^2(1, n=75) = 4.58, *p* =.470	χ^2(1, n=75) = 8.61, *p* =.126
Qualifications	χ^2(1, n=75) = 1.18, *p* =.555	χ^2(1, n=75) = 2.01 *p* =.366	χ^2(1, n=75) = 2.76, *p* =.252	χ^2(1, n=75) = 1.20, *p* =.548
ASQ-internal-positive	F(1,74)=0.18 P=.676	F(1,74)=1.10, P=.298	F(1,74)=0.15, P=.699	**F(1,74)=3.73 P=.058**
ASQ-internal-negative	F(1,74)=0.01, P=.979	**F(1,74)=6.09, P=.017**	F(1,74)=0.30, P=.587	F(1,74)=0.50, P=.486
ASQ-stable-positive	F(1,74)=3.10, P=.083	F(1,74)=2.37, P=.129	F(1,74)=0.14 P=.713	F(1,74)=0.01, P=.911
ASQ-stable-negative	F(1,74)=0.86, P=.359	F(1,74)=0.27, P=.609	F(1,74)=0.02, P=.901	F(1,74)=.047, P=.496
ASQ-global-positive	F(1,74)=0.20, P=.659	F(1,74)=0.98, P=.326	**F(1,74)=3.74, P=.058**	F(1,74)=1.84, P=.180
ASQ-global-negative	F(1,74)=0.79, P=.379	F(1,74)=0.45, P=.507	F(1,74)=0.19, P=667.	F(1,74)=0.19, P=.667
Baseline PANAS PE	F(1,74)=0.70, P=.303	F(1,74)=0.11, P=.704	F(1,74)=0.03, P=.863	F(1,74)=0.01, P=.999
Baseline PANAS NE	F(1,74)=1.06, p=.313	F(1,74)=0.01 P=.944	F(1,74)=0.07 P=.788	F(1,74)=0.55, P=.466
Baseline MRSI	**F(1,74)=10.80, P=.002***	F(1,74)=0.30 P=.668	F(1,74)=0.95, p=.335	F(1,74)=0.53, p=.468

Table F2.

Table showing the within-subjects statistical results (main effect of time and interactions) for mixed measures factorial ANOVA for each of the ASQ subscales.

ASQ	Internal-Positive			Stable-Positive			Global-Positive			Internal-Negative			Stable-Negative			Global-Negative		
	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2
T	2.03	.160	.033	.009	.769	.00	8.41	.005	.13	4.47	.039	.07	0.08	.779	.00	0.44	.509	.01
T*IE+	**4.76**	**.033**	**.075**	0.08	.784	.00	0.52	.475	.01	0.51	.477	.01	1.72	.194	.03	0.00	.965	.00
T*SU+	0.91	.343	.015	**10.43**	**.002**	**.15**	0.63	.432	.01	0.84	.364	.01	0.04	.852	.00	0.09	.771	.00
T*IE-	0.13	.724	.002	0.35	.555	.01	1.87	.177	.03	**3.78**	**.057**	**.06**	0.05	.828	.00	0.90	.347	.02
T*SU-	0.58	.448	.01	0.03	.874	.00	0.57	.052	.19	0.70	.406	.01	**3.76**	**.057**	**.06**	0.56	.458	.01
T*IE+*SU+	0.12	.733	.00	0.36	.550	.01	1.94	.169	.03	0.23	.631	.00	1.06	.307	.02	0.00	.965	.00
T*IE+*IE-	0.22	.825	.01	0.12	.728	.00	**0.51**	**.008**	**.45**	0.80	.374	.01	1.13	.292	.02	0.49	.486	.01
T*IE+*SU-	2.85	.096	.05	1.13	.292	.02	1.63	.207	.03	0.63	.431	.01	0.61	.438	.01	0.00	.998	.00
T*SU+*IE-	0.02	.881	.00	1.55	.218	.03	0.20	.653	.00	0.30	.587	.01	0.19	.663	.00	0.62	.433	.01
T*SU+*SU-	0.80	.374	.01	0.96	.330	.02	0.70	.408	.01	0.63	.431	.01	0.61	.438	.01	0.00	.998	.00
T*IE-*SU-	1.13	.292	.02	0.13	.723	.00	0.66	.422	.01	0.22	.641	.00	6.89	.011	.10	0.39	.536	.01
T*IE+*SU+*IE-	0.02	.881	.00	0.40	.532	.01	0.51	.479	.01	0.44	.510	.01	1.20	.278	.02	1.75	.191	.03
T*IE+*SU+*SU-	0.57	.455	.01	0.53	.468	.01	0.39	.537	.01	0.02	.890	.00	1.56	.216	.03	0.75	.390	.01
T*IE+*IE-*SU-	1.13	.295	.02	0.36	.550	.01	0.13	.711	.00	0.34	.564	.01	1.49	.228	.03	0.06	.807	.01
T*SU+*IE-*SU-	0.50	.485	.01	1.23	.271	.02	0.52	.475	.01	0.23	.641	.00	1.06	.307	.02	0.56	.458	.01
T*IE+*SU+*IE-*SU-	0.02	.900	.00	0.75	.390	.01	0.78	.381	.01	0.12	.726	.00	0.32	.576	.01	0.24	.623	.00

Note. Significant baseline differences are denoted in bold. *=interacting with

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Table F3.

Table showing the between-subjects statistics (main effects and interactions) for the mixed measures factorial ANOVA's conducted for each of the ASQ subscales.

ASQ	Internal-Positive			Stable-Positive			Global-Positive			Internal-negative			Stable-Negative			Global-Negative		
	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2
IE+	5.73	**.020**	.98	**4.54**	**.037**	**.07**	0.01	.919	.00	0.50	.483	.01	**4.33**	**.042**	**.07**	1.10	.298	.02
SU+	0.29	.617	.09	0.45	.501	.01	0.17	.683	.00	3.62	.062	.06	0.22	.643	.00	1.04	.313	.02
IE-	0.63	.432	.01	0.00	0.99	.00	0.88	.352	.02	**6.86**	**.011**	**.11**	0.00	.986	.00	0.02	.896	.00
SU-	3.16	.081	.05	0.08	.776	.00	1.20	.278	.02	6.89	.958	.00	0.43	.516	.01	1.10	.300	.02
IE+*Su+	1.87	.177	.03	0.05	.825	.00	0.56	.455	.01	0.00	.349	.02	0.54	.463	.01	0.63	.432	.01
IE+*IE-	1.64	.204	.03	0.05	.830	.00	3.23	.077	.05	0.89	.557	.01	0.43	.513	.01	0.32	.576	.01
IE+*SU-	0.18	.675	.00	0.11	.737	.00	1.75	.191	.03	0.35	.110	.04	0.34	.562	.01	0.07	.787	.00
SU+*IE-	1.49	.277	.02	0.47	.497	.01	1.79	.187	.03	2.63	.806	.00	2.26	.138	.04	0.00	.964	.00
SU+*SU-	1.21	.276	.02	0.30	.588	.01	0.01	.919	.00	**0.06**	**.007**	**.12**	0.69	.410	.01	0.38	.540	.01
IE-*SU-	0.01	.751	.00	0.01	.915	.00	0.04	.844	.00	7.94	.657	.00	7.25	.009	.11	1.30	.260	.02
IE+*SU+*IE-	1.49	.227	.03	0.01	.938	.00	1.79	.187	.03	**0.20**	**.008**	**.11**	1.02	.318	.02	0.15	.698	.00
IE+*SU+*SU-	0.00	.992	.00	1.36	.248	.02	0.66	.421	.01	7.53	.598	.01	2.15	.148	.04	0.01	.922	.00
IE+*IE-*SU-	0.32	.574	.01	0.01	.920	.00	0.14	.711	.00	0.28	.388	.01	0.41	.523	.01	0.93	.339	.02
SU+*IE-*SU-	1.54	.219	.03	1.63	.206	.03	0.36	.554	.01	0.76	.837	.00	1.11	.296	.02	0.01	.944	.00
IE+*SU+*IE-*SU-	0.23	.631	.00	1.01	.318	.02	0.19	.669	.00	0.04	.880	.00	0.07	.783	.00	0.13	.720	.00

*=interacting with, Significant statistics indicated in bold.

Table F4.

Table showing the within-subjects statistical results (main effect of time and interactions) for mixed measures factorial ANOVA for each of outcome measures pre-post training (T1-T2)_and post-training to post failure (T2-T3).

	Negative Emotion T1-T2			Positive Emotion T1-T2			Rumination T1-T2			Negative Emotion T2-T3			Positive Emotion T2-T3			Rumination T2-T3		
	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2
T	0.06	.799	.00	**13.13**	**.001**	**.18**	**126.1**	**.000**	**.68**	**52.38**	**.000**	**.47**	**41.69**	**.000**	**.41**	**15.25**	**.000**	**.21**
T*IE+	1.26	.267	.02	**6.33**	**.015**	**.10**	0.00	.968	.00	1.16	.286	.02	**4.23**	**.004**	**.07**	2.49	.120	.04
T*SU+	0.28	.602	.01	1.69	.198	.03	0.08	.775	.00	3.82	.055	.06	0.70	.408	.01	0.08	.783	.00
T*IE-	1.16	.287	.02	**7.26**	**.009**	**.11**	0.00	.995	.00	1.97	.166	.03	**7.21**	**.009**	**.11**	0.80	.374	.01
T*SU-	**5.68**	**.020**	**.09**	0.32	.572	.01	3.74	.058	.06	0.00	.992	.00	0.00	.977	.00	1.89	.174	.03
T*IE+*SU+	0.03	.876	.00	0.17	.685	.00	0.62	.435	.01	0.01	.921	.00	0.25	.620	.00	0.61	.437	.01
T*IE+*IE-	0.03	.876	.00	0.27	.608	.00	0.50	.483	.01	1.53	.221	.03	0.75	.389	.01	0.48	.493	.01
T*IE+*SU-	0.84	.364	.01	0.12	.913	.00	0.03	.872	.00	1.04	.312	.02	1.66	.203	.03	1.01	.319	.02
T*SU+*IE-	3.45	.068	.06	3.78	.057	.06	0.77	.383	.01	0.67	.417	.01	1.93	.170	.03	0.00	.985	.00
T*SU+*SU-	1.55	.219	.03	0.03	.861	.00	0.00	.981	.00	0.15	.704	.00	0.13	.718	.00	0.26	.610	.00
T*IE-*SU-	0.25	.618	.00	2.24	.140	.04	0.01	.944	.00	3.49	.067	.06	4.58	.037	.07	0.24	.628	.00
T*IE+*SU+*IE-	1.06	.307	.02	1.98	.164	.03	0.48	.491	.01	1.38	.246	.02	0.19	.671	.00	1.86	.178	.03
T*IE+*SU+*SU-	0.94	.337	.02	0.18	.672	.00	0.00	.982	.00	0.00	.982	.00	0.13	.718	.00	0.16	.692	.00
T*IE+*IE-*SU-	1.12	.293	.02	1.57	.215	.03	2.30	.135	.04	0.16	.690	.00	0.28	.601	.01	0.08	.774	.00
T*SU+*IE-*SU-	1.21	.277	.02	0.28	.596	.01	0.16	.694	.00	0.03	.864	.00	0.24	.627	.00	0.86	.357	.01
T*IE+*SU+*IE-*SU-	1.64	.205	.03	0.18	.672	.00	0.03	.870	.00	0.63	.431	.01	1.47	.230	.02	0.00	.985	.00

Note. Significant baseline differences are denoted in bold.

Table F5.

Table showing the between-subjects statistics (main effects and interactions) for the mixed measures factorial ANOVA's conducted for each of the dependant variables pre-post training (T1-T2) and post-training to post failure (T2-T3).

	Negative Emotion T1-T2			Positive Emotion T1-T2			Rumination T1-T2			Negative Emotion T2-T3			Positive Emotion T2-T3			Rumination T2-T3		
	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2	F	P	η_p^2
IE+	**5.73**	**.020**	**.98**	**4.54**	**.037**	**.07**	0.01	.919	.00	0.50	.483	.01	**4.33**	**.042**	**.07**	1.10	.298	.02
SU+	0.29	.617	.09	0.45	.501	.01	0.17	.683	.00	3.62	.062	.06	0.22	.643	.00	1.04	.313	.02
IE-	0.63	.432	.01	0.00	0.99	.00	0.88	.352	.02	**6.86**	**.011**	**.11**	0.00	.986	.00	0.02	.896	.00
SU-	3.16	.081	.05	0.08	.776	.00	1.20	.278	.02	6.89	.958	.00	0.43	.516	.01	1.10	.300	.02
IE+*Su+	1.87	.177	.03	0.05	.825	.00	0.56	.455	.01	0.00	.349	.02	0.54	.463	.01	0.63	.432	.01
IE+*IE-	1.64	.204	.03	0.05	.830	.00	3.23	.077	.05	0.89	.557	.01	0.43	.513	.01	0.32	.576	.01
IE+*SU-	0.18	.675	.00	0.11	.737	.00	1.75	.191	.03	0.35	.110	.04	0.34	.562	.01	0.07	.787	.00
SU+*IE-	1.49	.277	.02	0.47	.497	.01	1.79	.187	.03	2.63	.806	.00	2.26	.138	.04	0.00	.964	.00
SU+*SU-	1.21	.276	.02	0.30	.588	.01	0.01	.919	.00	**0.06**	**.007**	**.12**	0.69	.410	.01	0.38	.540	.01
IE-*SU-	0.01	.751	.00	0.01	.915	.00	0.04	.844	.00	7.94	.657	.00	7.25	.009	.11	1.30	.260	.02
IE+*SU+*IE-	1.49	.227	.03	0.01	.938	.00	1.79	.187	.03	**0.20**	**.008**	**.11**	1.02	.318	.02	0.15	.698	.00
IE+*SU+*SU-	0.00	.992	.00	1.36	.248	.02	0.66	.421	.01	7.53	.598	.01	2.15	.148	.04	0.01	.922	.00
IE+*IE-*SU-	0.32	.574	.01	0.01	.920	.00	0.14	.711	.00	0.28	.388	.01	0.41	.523	.01	0.93	.339	.02
SU+*IE-*SU-	1.54	.219	.03	1.63	.206	.03	0.36	.554	.01	0.76	.837	.00	1.11	.296	.02	0.01	.944	.00
IE+*SU+*IE*SU-	0.23	.631	.00	1.01	.318	.02	0.19	.669	.00	0.04	.880	.00	0.07	.783	.00	0.13	.720	.00

Note. Significant baseline differences are denoted in bold.

Appendix G: Dissemination statement

The results of this study will be disseminated to interested parties through feedback, journal publication and presentation.

Dissemination to participants.

As per ethical approval, participants who provided an email address on their consent form and requested a copy of the results will be sent a summary of the study findings.

Wider Academic and Clinical Community

In June 2016, my research findings will be presented to an academic audience, for peer review, as part of the Doctorate in Clinical Psychology at the University of Exeter. I intend on submitting a reduced research paper for publication in a peer-reviewed journal (Journal of Experimental Psychopathology).