The Role of Attentional Bias on the Relationship between Rumination and Anxiety: A

Modified Dot Probe Task Investigation

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Abstract

Objectives: Recent literature has been interested in examining the relationship between rumination and its associations to anxiety. Likewise, research has suggested cognitive functions, particularly attentional biases to impact this relationship however, the evidence is incomplete. The current study utilized a dot probe task measure to examine if negative attentional bias had a mediating impact within the relationship between rumination and anxiety. **Method**: Data was collected from an online sample of 94 participants, through use of questionnaire measures to examine levels of rumination (brooding and reflective pondering), trait, and state anxiety. Inquisit Web software was used to assess levels of negative emotional biases. The current study employed linear multiple regression analyses and mediational analyses using PROCESS macro extension model 7, v4.2**. Results**: Results indicated brooding to be positively predict both state and trait anxiety while reflective pondering negatively predicted both state and trait anxiety. No mediational impact of negative attentional bias was observed as demonstrated by the insignificant indirect effects. **Conclusion**: The current study found evidence to support the adaptive qualities of rumination through reflective pondering. Although no mediational effect was observed, future research must further examine this whilst focusing on reliable attentional bias measures.

Contents

Introduction

In recent years, there has been a growing amount of research focused on how aspects of emotional processing are connected to cognitive functions and how these two factors can interconnect to exacerbate the expression of psychopathologies (Joormann & Stanton, 2016; Watkins & Roberts, 2020). Rumination, defined as the process of recurrent negative-thinking patterns relating to self-beliefs and thoughts (Nolen-Hoeksema & Morrow, 1991), has been of recent interest regarding its relative functioning with various cognitive functions and psychopathologies (Kamenov et al., 2016). Whilst ruminative thinking can be visible in a number of mental disturbances, the link between anxiety and rumination has been of growing research (Hartley et al., 2014; McLaughlin & Nolen-Hoeksema, 2011; Wolkenstein et al., 2014). More precisely, research has aimed to identify the specific aspects of ruminative processes that contribute to anxiety, as well as to determine whether there are other cognitive factors involved (Hirsch et al., 2018; Krahé et al., 2019).

Whilst rumination is regarded as being an internal mechanism based upon repetitive thoughts, anxiety is considered to be externally based, characterised by an increased perception to perceived stimuli and physiological hyperarousal (Olatunji et al., 2013). Considering this, there is incomplete evidence to show what exact processes are leading to this cumulative transition from an internal process to an external process. Recent evidence suggests that attentional bias, the tendency to selectively attend to threatening stimuli, may be involved in this transition through an inability to disengage from aversive environmental stimuli (Grafton et al., 2016; Holas et al., 2018; Vălenaş et al., 2017). Correspondingly, various studies have also found anxiety to interact amongst attentional bias processes (Forster at al., 2015; Eysenck et al., 2007; Minnick et al., 2020). Thus, based upon these emerging perceptions, there is a clear reasoning to suggest that the translation between rumination and anxiety may be operationally influenced by attentional biases. Likewise, the current study will explore the mechanisms of this potential relationship and further delve into the domains of both rumination, and anxiety to account for their complex features.

The engagement in ruminative thought is known as a negative reaction to distress whilst simultaneously being overly consumed by these reactions thus leading to a recurrent emotional

cascade (Koster et al., 2013; Nolen-Hoeksema & Morrow, 1991; Whitmer & Gotlib, 2012). As such, rumination may be characterised as being a progressive cyclical process amongst negative mood states and negative perceptions (Ciesla & Roberts, 2007; Watkins & Roberts, 2020). Ruminating tendencies can also cause an individual to fixate on situations which often produce maladaptive cognitive functioning (Nolen-Hoeksema et al., 2008). Whilst the relationship between rumination and depression is foundational within theoretical literature, (Offredi et al., 2016; Rusting et al., 1991), there has been recent arguments made as to whether rumination should be regarded as a dysfunctional response to stress which is more closely associated to anxiety (Brinker et al., 2013). Furthermore, due to its discovered complexity, researchers have put forward that rumination must be considered as a multifaceted construct (Treynor et al., 2003). Through a series of factor analyses studies, two distinct components within rumination have been classified; brooding which involves an individual's instinctual tendency to generate comparisons between their current self and unachieved self, along with passively focusing on a negative mood state. The second component involves reflective pondering which is the tendency to inwardly isolate oneself to facilitate problem solving (Nolen-Hoeksema et al., 2008; Treynor et al., 2003).

Furthermore, these characteristics have gave rise to conflicting arguments which question if rumination should remain to be regarded as maladaptive due to the emergence of findings that reflective pondering may be considered adaptive through engagement of perspective taking (Burwell & Shirk, 2007; Kross, 2009; Treynor et al., 2003). Accordingly, this highlights the complexity of rumination and how it is imperative to isolate both aspects of brooding and reflective pondering to consolidate exactly which domains may be more strongly associated to psychopathologies and the nature of their connection. Likewise, the current study aims to identify both maladaptive and adaptive aspects of rumination to gain a better understanding of its characteristics and address gaps in past literature.

Nonetheless, due to the vast array of research already completed (Caselli et al., 2010; Dondzilo et al., 2016; Hartley et al., 2014), rumination may predominantly be known as a maladaptive regulative cognitive process. Additionally, rumination has been most extensively found to interlink with negative emotionality and is closely associated with the exacerbation of affect states including

sadness, dysphoria, and anxiety (Bushman & Gibson, 2011; Offredi et al., 2016; Vasquez et al., 2012). This can be exemplified amongst various studies which found experimentally induced rumination to both, delay recovery of an already negative state (Watkins, 2004) and increase future emotional sensitivity to stressful situations (Watkins et al., 2008).

Moreover, these factorial elements of rumination as mentioned above, along with a lack of internal reappraisal and reinforcement of negative affect-laden repetitive thoughts have all been found to have a transdiagnostic impact on anxiety disorder (Aldao & Mennin, 2012; Clayton et al., 2022; Kohl et al., 2012). Similarly, in a recent study by Silveira et al. (2020), they investigated patterns of rumination amongst a sample of individuals with various mood, anxiety, and psychotic disorders. Overall, their findings suggested rumination to be most highly associated with stress response symptomology and likewise postulates rumination to be a prominent contributor between the onset of stress exposure and the later internalization of anxiety psychopathologies.

Similarly, the stress response and appraisals are closely intricated with neurocognitive functions such as threat related attentional biases (Sandi & Richter-Levin, 2009; Wang et al., 2020). Likewise, the research is plentiful regarding the relationship between attentional biases to threatening stimuli and anxiety (MacLeod & Clarke, 2015; Van Bockstaele et al., 2014). Moreover, the presence of such cognitive biases is well documented in both the development and maintenance of anxious symptomology (Bar-Heim et al., 2007). However less documented, is the direction of this relationship and the associated causality. Furthermore, studies have begun to investigate the complexities of this connection through evaluating treatment outcomes of attentional bias modification (ABM) which aims to modify selective attentional responding to aversive stimuli and in turn, decrease anxiety (MacLeod & Clarke, 2015). However, due to the prematurity of these studies, concerns have been raised regarding their psychometric reliability (MacLeod et al., 2019; McNally 2019). Furthermore, arguments have alluded to doubts over common measures of attentional bias such as probe tasks and if they are accurately measuring shifts in attentional responses. Accordingly, further research must be conducted to further investigate this issue.

Correspondingly, recent ruminative research has suggested it to strongly impact upon neurocognitive components (Grafton et al., 2016). The most up to date explanatory reasoning

originates from Watkins and Roberts' (2020) H-EX-A-GO-N model which postulates a consumption of ruminative patterns produces a high cognitive load which impacts upon executive functioning competencies. Such competencies include cognitive flexibility and goal directed behaviour which also offer reasoning towards the inner reinforcement of rumination and narrowed attentional scope (Brinker et al., 2013; Cisler & Koster, 2010). Additionally, there have been questions as to whether a ruminative thought process increases an individual's cognitive load which depletes the resources needed for the effective processing of information (Watkins, 2008). Or contrastingly, if general defects of information processing such as poor attentional control increase the tendencies to ruminate (De Raedt & Koster, 2010; Koster et al., 2011; Whitmer & Branch, 2007). It is difficult to determine which hypothesise is most likely as these studies utilised cross-sectional designs which prevent the ability to make inferences regarding the causal relationship. Likewise, this argument may be benefitted by research targeting specific subsets of information processing such as attentional biases to gather a more complete understanding of the directional relationship.

In an early study by Donaldson et al. (2007), they utilised the attentional probe task (MacLeod et al., 1986) to find rumination related to an automatic capturing of attentional bias toward negative information in a clinically depressed sample. However, this study's assessment approach did not consider the variations between negative attentional bias and could not account for the delineation between faster attentional engagement with negative information and inability to disengage from information (Grafton & MacLeod, 2013). The theoretical framework of impaired disengagement hypothesis (Koster et al. 2011), provides an explanatory stance towards this argument. This framework suggests that ruminative tendencies relate to a deficit in inhibitory control and a difficulty disengaging from negative information within a proximal location (Joormann & Stanton, 2016).

Supporting this hypothesis, Grafton et al. (2016), found impaired negative attentional disengagement was associated with ruminative tendencies. To find this, they employed a varied assessment presentation so that stimuli were either presented distally from the original fixation point to measure attentional engagement or proximally from the fixation point to measure attentional disengagement. Overall, this finding supported the persistence of rumination to be associated with a difficulty in disengaging from negative stimuli. Southworth at al. (2017) also employed a similar

investigative set up. However, they used a lab based set up to induce rumination using the same event exposure to each participant and then assessed their level of ruminative disposition. However, considering rumination is characterised as possessing fixational recurrent thoughts over a long-term capacity (Kühn et al., 2012), experimentally induced rumination may be difficult to accurately achieve. Hence, this may pose questions to ecological validity. Nonetheless, this study's findings support Koster et al.'s (2011) impaired disengagement hypothesis and therefore expand upon this correlational relationship between rumination and negative attentional bias.

Replicating and extending upon this finding, Vălenaş et al. (2017), investigated the correlational pathway between rumination and attentional bias through a mediational analysis while specifically looking at both state and trait anxiety as separate outcome variables. Likewise, they found attentional disengagement to significantly mediate the relationship between rumination and state anxiety whilst interestingly they found attentional engagement to not significantly mediate the same relationship. Furthermore, this study specifically examined students who were approaching an exam period and hence, levels of state anxiety were intrinsically higher. Accordingly, they found rumination to be more predictive of state anxiety than trait anxiety. However, considering the timepoint, participants most likely had much higher than typical state anxiety ratings which thus limits the results to a confined situational context. Similarly, these findings cannot account for more general interactions between typical environmental circumstances and cognitive or emotional appraisals within a typical population. Furthermore, the threat stimuli implemented within the dot probe attentional bias measure included very specific exam related words. Accordingly, these words were related to quite a distinct circumstance and thus, these findings may be incapable of extending to a broader range of contextual settings such as threat related social situations. Whilst these findings benefit the understanding of how attentional biases, rumination and anxiety interact, further research must be conducted to investigate these findings within a broader climate. Similarly, this further extends the need for additional research to not only include more typical threat related stimuli but also to examine a more representative population.

The Present Study

The current study adopted a modified version of the dot-probe task by Sutton and Altarriba (2011), which was adapted to assess a nonclinical population that investigates attentional bias processing of emotionally triggering words which produce threat within a wider population. The task involves presenting a negative and neutral word on either side of a fixation point on a computer screen for a brief period, followed by a dot probe (R or P) in the spatial location of one of the words, to which the participant must respond. Faster reaction times when the probe is in the negative location indicate greater automatic attention to negative stimuli (Sutton & Altarriba, 2011).

Likewise, the majority of studies adopting the dot-probe task to assess rumination and attentional biases have predominantly focused on a clinically depressed population of interest (Donaldson et al., 2007; Grafton et al., 2016; Holas et al., 2018; Sanchez-Lopez et al., 2019; Southworth et al., 2017). Consequently, their findings may have been impacted by various confounding variables such as the active use of pharmacological treatments. Therefore, there is a clear necessity for research to investigate a non-clinical sample to identify the relationship within the general population. Furthermore, whilst Vălenaş et al. (2017) investigated a non-clinical sample and accounted for the relationship between rumination and anxiety, their investigation was contextually specific to exam related anxiety. Thus, it is necessary to assess this potential mediational relationship between rumination, negative attentional bias, and anxiety on a more typical population under common real world threat evoking stimuli. To the researcher's knowledge, Vălenaş et al. (2017) was the only study to specifically investigate these three variables in isolation and thus, further mediational research must be conducted to gain a deeper conceptualization of how these variables interact with one another.

Overall, considering the key findings suggesting rumination to be related to an attentional disengagement bias (Donaldson et al. 2007; Grafton et al. 2016; Southworth et al. 2017) together with Vălenaş et al. (2017), providing preliminary evidence suggesting a relative mediational pathway with anxiety, this infiltrates the need to further examine this cumulative relationship to gain a deeper understanding of the underlying cognitive mechanisms operating. Unlike the prior research, the current study aims to separate the domains of rumination of both brooding and reflective pondering to

assess the relationship between rumination and anxiety more precisely whilst acknowledging the potential differences within a non-clinical population.

Therefore, the aim of the current study is to gain a greater understanding of the potential mediational impact of negative attentional bias on the relationship between rumination and anxiety. In doing so, this study will further explore the accuracy of the dot-probe task in measuring attentional bias towards a non-clinical population. Likewise, the current study also aims to specify the differences between the domains of rumination and symptoms of anxiety. In this regard, the current study can contribute to the current research field and hence provide a greater conceptualisation of the intersection between emotional regulation and cognitive mechanisms. Correspondingly, previous literature has found ruminative tendencies lead to poorer success and higher levels of relapse amongst widely used therapeutic interventions such as cognitive behavioural therapy (Kertz et al., 2015; Michalak et al., 2011). More specific to the current research area, if negative attentional biases are correspondent with rumination, then specific and targeted interventions towards attentional functioning may lead to heightened improvements. Accordingly, this demonstrates the significance of adding to this specific research area. Therefore, these aims produce the following research questions and hypotheses:

Research question 1: How does rumination in terms of both brooding and reflective pondering impact levels of state anxiety? Corresponding hypothesis (*H1*): higher levels of brooding and total rumination will be associated with higher levels of state anxiety. Whilst higher levels of reflective pondering will be associated with lower levels of state anxiety.

Research question 2: How does rumination including brooding and reflective pondering impact levels of trait anxiety? Corresponding hypothesis (*H2*): higher levels of brooding and total rumination will be associated with higher levels of trait anxiety. Whereas higher levels of reflective pondering will be associated with lower levels of trait anxiety.

Research question 3: How does negative attentional bias to valence specific stimuli mediate the relationship between levels of rumination and state anxiety? Corresponding hypothesis (*H3*): negative attentional bias will have a mediational impact upon the rumination and state anxiety relationship.

Research question 4: How does negative attentional bias to valence specific stimuli mediate the relationship between levels of rumination and trait anxiety? Corresponding hypothesis (*H4*): negative attentional bias will have a mediational impact upon the rumination and trait anxiety relationship.

Methodology

Participants

The current study consisted of 94 healthy individuals (10.9% male; 69.1% female) from the general population. Participants' ages ranged from 18 to 64 ($M = 27.27$ $SD = 11.44$). The required sample size was calculated using Tabachnick and Fidell's (2013) formula for calculating sample size for multiple regression analyses ($N > 50 + 8m$; n = number of participants, m = number of PVs). Thus, the minimum sample size was $n = 74$.

This study implemented non-probability, convenience, and snowballing sampling techniques to recruit participants. Conductive to achieving a sufficient sample size despite an inaccessibility to funding and shortage of time, this sampling methodology was the most appropriate for the current study (Howitt & Cramer, 2020). To reach potential participants, a concise description and link to the study was shared through the researcher's social media accounts (Instagram and WhatsApp). Individuals were also invited to share the link with further eligible participants.

Measures and Apparatus

The first part of the study consisted of a questionnaire comprised of demographic questions (see Appendix A) and three scales combined using Google Forms. To help gain an enhanced profile of the participants, demographic questions included their age, gender, and number in years of education completed.

State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983), is a 40-item self-report scale used to measure anxiety. It consists of two subscales: the 20-item State Anxiety Scale (S-Anxiety) and the 20-item Trait Anxiety Scale (T-Anxiety). The S-Anxiety subscale measures current subjective feelings of anxiety within the present moment, while the T-Anxiety subscale measures the

probable tendency and stability of an individual to identify with anxious symptomology across everyday life experiences. Participants rate each item on a 4-point Likert scale from 1 (almost never) to 4 (almost always). Within the S-Anxiety subscale, items 1, 2, 5, 8, 10, 11, 15, 16, 19, 20 are reversed scored and likewise in the T-Anxiety subscale, items 21, 23, 26, 27, 30, 33, 34, 36, 39 are reversed scored. Scoring is found through summing scores for items within each subset which can range from 20-80 (see Appendix B).

The STAI has demonstrated high levels of reliability and validity over time with alpha coefficients ranging from .86 to .95 and test-retest coefficients ranging from .65 to .75 on (Gustafson et al., 2020; Spielberger et al., 1983). In the current study, the Cronbach alpha coefficient for the S-Anxiety and T-Anxiety were reported as .92 and .93 respectively, which represents excellent internal consistency.

Ruminative Responses Scale

The Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991), is a 22-item questionnaire measuring an individual's inward reactions to negative mood states and coping methods. It uses a 4-point Likert scale to assess behaviours that individuals "generally do" when feeling sad or down, ranging from 1 (almost never) to 4 (almost always). The scale has two subscales, Brooding (5-items) and Reflective Pondering (5-items). Items examining Brooding include "think why do I always react this way?" (Item 10) and "think about a recent situation, wishing it had gone better" (item 13). Items examining Reflective Pondering include "analyse your personality to try to understand why you are depressed" (item 20) and "analyse recent events to try to understand why you are depressed" (item 21). Due to the current research being aimed at a non-clinical sample, this study altered the word "depressed" in both these questions to "sad", to avoid response confusion or misinterpretation. The scale calculates an overall total score, as well as separate scores for Brooding and Reflective Pondering. Higher scores indicate greater levels of rumination (see Appendix C).

RRS has demonstrated good levels of reliability and validity, with alpha coefficients ranging from .82 to .93 (Hasegawa, 2013; Lei et al., 2017). The current study also found high internal consistency with a Cronbach alpha coefficient of .92 for the overall scale, and acceptable internal

consistency with coefficients of .77 and .79 for the subscales of Brooding and Reflective Pondering, respectively.

Modified Version of the Emotion Word Dot Probe Task

The Emotion Word Dot Probe Task measures attentional bias towards emotional words, particularly negative words. It presents participants with two words (one emotional and one neutral) simultaneously, followed by a letter probe. Participants must indicate the location of the probe on the keyboard. The reaction time is measured and used to assess attentional bias towards emotional words (see Appendix D). The task is designed for nonclinical populations and consists of two blocks of trials: negative and positive words (see Appendix E). Modifications to the task were made by the researcher through recoding variables within the script including providing clear instructions and changing the presentation of words to reduce the impact of the Simon Effect (see Appendix F).

Design and Analyses

The current study adopted a quantitative approach and implemented a cross-sectional research design. Separate analyses were run for each of the research questions, examining the predictor variables, Total Ruminative Response Score, Brooding, Reflective Pondering and Negative Attention Bias and their relationship with State Anxiety and Trait Anxiety as the criterion variables (see Appendix G).

The 1st and 2nd research questions, were examined using a linear multiple regression analysis to assess the various relationships between total rumination, brooding and reflective pondering on the outcome variable of state anxiety and trait anxiety, respectively.

The 3rd research question was examined using a simple mediational analysis to assess if there was a mediational effect between rumination and state anxiety via negative attentional bias. This was conducted using Hayes' (2013) PROCESS macro extension model 7, v4.2 in SPSS which uses a bootstrapping method of 5000 samples to assess if there is a mediational effect of a mediator (M) variable between the independent variable (IV) and dependent variable (DV). According to Baron and Kenny (1986) a mediation occurs if the direct effect reduces to non-significant when the mediating variables enters. The 4th research question was examined using the same mediational analysis with

negative attentional bias as the mediator within the relationship between rumination (IV) and trait

anxiety (DV).

Procedure

The self-report data was obtained through creating an online questionnaire of the three scales

using Google Forms. Once this was completed the participant was asked to follow a link which

directed them to the Emotion Dot Probe Task which was made remotely accessible to the participant's

laptop through computation using Inquisit Web (Millisecond software). Prior to study completion, the

participant must have read the information sheet (see Appendix H) where the aims, purpose of the

study, participant's rights, inclusion, and exclusion criteria were outlined. Following this, a consent

form was signed prior to the study (see Appendix I) and a debriefing form was provided post study

completion (see Appendix J) which included a detailed description of the study and a lift of helpline

services. In total, the study took an average of 20 minutes to complete.

Ethical Considerations

This study was approved by the National College of Ireland's Ethics Committee and was

conducted in line with The Psychological Society of Ireland Code of Professional Ethics and the NCI

Ethical Guidelines and Procedures for Research involving Human Participants.

Although there was no obvious potential risk, the debriefing form included mental health

helplines. The consent form reminded participants of their right to withdraw, data storage and usage in

accordance with NCI's data retention policy, and data was kept confidential in an encrypted file

accessible only by the researcher.

Results

Descriptive Analyses

The descriptive details for the continuous variables of age, state anxiety, trait anxiety, total

rumination, brooding, reflective pondering, and negative attentional bias are presented in Table 1. A

significant result ($p < .05$) of the Kolmogorov-Smirnov statistic was found for age, education,

brooding, reflective pondering, and negative attentional bias indicating that these variables are non-

normally distributed. Likewise, inspection of the histograms portrays a slight negative skew in these

variables. However, according to the central limit theorem, there is a large enough sample size to assume that the sample means are well-approximated by a normal distribution (Lumley et al., 2002). Hence, the distribution of scores was considered as normal. After inspection of the boxplot, it was seen that age had several outliers but due to age not being a variable of interest within the inferential analyses, these outlying scores were retained. The remaining variables of state anxiety, trait anxiety and total rumination all followed assumptions of normality and inspections of histograms indicated that the data was normally distributed.

Table 1

Descriptive statistics for all continuous variables (N = 94).

Variable	M [95% CI]	SD	Range
Age	27.27 [24.92 – 29.61]	11.42	18 – 64
Education in Years	16.34 [15.99 – 16.69]	1.72	13 – 20
State Anxiety	43.55 [41.19 – 45.91]	11.52	20 – 72
Trait Anxiety	47.46 [45.04 – 49.88]	11.81	23 – 72
Total Rumination	51.79 [49 – 54.57]	13.61	26 – 82
Brooding	11.82 [11.1 – 12.54]	3.53	5 – 20
Reflective Pondering	11.49 [10.72 – 12.26]	3.75	5 – 20
Negative Attentional Bias	5.33 [-24.54 – 35.2]	141.8	-293.19 – 259.38

Inferential Analyses

The first research question was investigated using a multiple regression analysis to assess whether total rumination, brooding and reflective pondering were significant predictors of state anxiety. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. Tests for multicollinearity showed that the correlations between the predictor variables were examined and r values ranged from .26 to .69 and likewise all Tolerance and VIF values were in an acceptable range. These results indicated no violation of the assumption of

multicollinearity and that the data was suitable for inspection through multiple linear regression analysis.

The results of the regression indicated that the model explained 48% of the variance in state anxiety levels (F (3, 90) = 27.72, p < .001). All three variables included in the model were found to uniquely predict state anxiety scores to a statistically significant degree. The contribution of each predictor variable is reported in Table 2.

Table 2

Standard Multiple Regression Model of Predictors of State Anxiety.

Variable	R^2	B	SE	β	t	p
Model	.48***					
Total Rumination		.49	.14	.58***	3.4	.001
Brooding		.97	.46	.3*	2.11	.037
Reflective Pondering		-.88	.33	-.29**	-2.66	.009

Note: R^2 = R-squared; β = standardized beta value; B = unstandardized beta value; SE = Standard errors of B; N = 94; Statistical significance: *p < .05; **p < .01; ***p < .001

The second research question was investigated using a multiple regression analysis to assess how well levels of trait anxiety could be explained by the same three variables: Total rumination, brooding, and reflective pondering. Preliminary analysis confirmed that there were no violation of the assumptions of normality, linearity and homoscedasticity. The correlations between the predictor variables were assessed and r values ranged from .27 to .72. Tests for multicollinearity also indicated that all Tolerance and VIF values were in an acceptable range. These results indicate there was no violations of multicollinearity and that the data was suitable for examination through multiple regression analysis.

The three predictor variables explained 62.3% of the variance in trait anxiety levels (F (3, 90) = 49.55, p < .001) demonstrating that the model was a significant predictor of trait anxiety. Upon closer examination, the two significant predictors of trait anxiety were total rumination and reflective pondering. Total rumination was demonstrated to be the strongest predictor of trait anxiety (β = .93, p < .001) (see Table 3 for full details).

Table 3

Standard Multiple Regression Model of Predictors of Trait Anxiety.

| Variable	R^2	B	SE	β	t	p
Model	.610***					
Total Rumination		.81	.13	.93***	6.4	<.001
Brooding		.35	.40	.11	.87	.384
Reflective Pondering		-1.36	.29	-.43***	-4.7	<.001

Note: R^2 = R-squared; β = standardized beta value; B = unstandardized beta value; SE = Standard errors of B; N = 94; Statistical significance: ***$p < .001$

  The third research question was investigated using the Hayes' (2013) PROCESS macro extension model 7, v4.2 in SPSS. This extension uses a bootstrapping method and considers a mediator to have a mediational effect when the indirect effect (IE) of rumination on state anxiety via negative attentional bias is significant (i.e., IE = path a * path b; a = the effect of rumination on the negative attention bias mediator, b = the effect of negative attention bias on state anxiety). The bias is corrected to 95% confidence interval around the IE from 5000 bootstrap re-samples. Likewise, the IE may only be accepted as statistically significant if its bias corrected 95% confidence interval excludes zero. The independent variable is rumination (X), dependent variable is state anxiety (Y) and mediating variable is (M) (see Figure 1).

  Within path a, the results showed that rumination (IV) was not a significant predictor of negative attentional bias (M) (b = -.73, t = -1.23, p = .2234). Within path b, the results showed that negative attention bias (M) did not have a statistically significant impact on state anxiety (DV) (b = .02, t = 1.02, p = .3091). Next, while controlling for negative attentional bias (mediator), the results of the direct effect (c') pathway show that rumination was a significant predictor of state anxiety (DV) (b = .56, t = 7.43, p < .001). The results of the indirect effect *(a*b)* showed a non-significant indirect relationship between rumination and state anxiety mediated by negative attentional bias (b = -.01, Bootstrap CI_{95} = -.04 - .01). The indirect effect does not show to statistically remove the direct effect. As such, no mediational effect of attentional bias between rumination and state anxiety can be demonstrated. (See Table 4 for full details).

Figure 1

Simple Mediation Model – Rumination and State Anxiety by Negative Attentional Bias
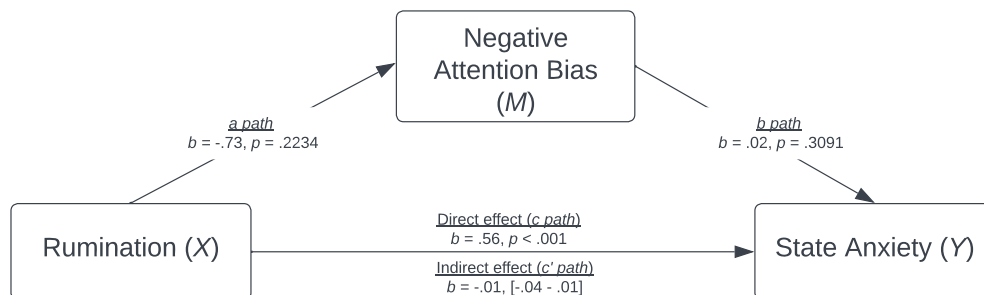
Table 4

Simple Mediation Analyses of Rumination and State Anxiety by Negative Attentional Bias based on 5000 bootstrap samples.

Variable / Effect	*b*	*SE*	*t*	*p*	95% Confidence Interval	
X → Y	.56	.08	7.43	< .001	.41	.71
X → M	-.73	.6	-1.23	.2234	-1.91	.45
X → M → Y	.01	.01	1.02	.3091	-.01	.04
Effects						
Direct	.56	.08	7.43	< .001	.41	.71
Indirect	-.01	.01			-.04	.01
Total	.55	.08	7.43	< .001	.41	.71

Note: X = Rumination (IV), M = Negative Attention Bias (Mediator), Y = State Anxiety (DV)

The fourth research question was analysed using Hayes (2013) PROCESS macro extension in SPSS. A bootstrapping method was implemented to assess whether negative attentional bias (mediator), mediated the relationship between rumination (IV) and trait anxiety (DV) (see Figure 2).

The results showed, path a (rumination and negative attentional bias) showed a non-significant relationship (b = -.73, t = -1.23, p = .2234) and likewise path b (negative attentional bias and trait anxiety) was not significant (b = .01, t = .44, p = .6628). The results showed that there was

both a significant direct effect (c') (b = .64, t = 9.32, p < .001) and total effect (b = .64, t = 9.4, p <
.001). However, the indirect effect (a*b) of rumination on trait anxiety via negative attentional bias (b
= -.01, Bootstrap CI95 = -.03 – 02) did not remove the direct effect. As such, no mediational effect
can be observed. Overall, this model found no statistically significant mediational effect of negative
attentional bias within the relationship between rumination and trait anxiety. (See Table 5 for full
details).

Figure 2

Simple Mediation Model – Rumination and Trait Anxiety by Negative Attentional Bias
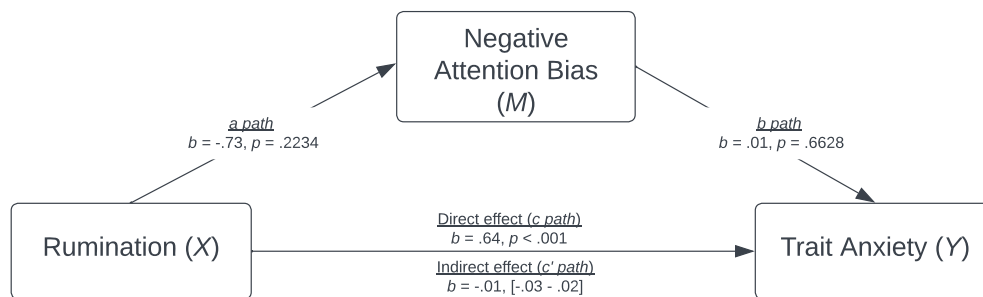
Table 5

Simple Mediation Analyses of Rumination and Trait Anxiety by Negative Attentional Bias based on
5000 bootstrap samples.

Variable / Effect	*b*	*SE*	*t*	*p*	*95% Confidence Interval*	
X → Y	.64	.07	9.32	< .001	.50	.78
X → M	-.73	.6	-1.23	.2234	-1.91	.45
X → M → Y	.01	.01	.44	.6628	-.02	.03
Effects						
Direct	.64	.07	9.32	< .001	.50	.78
Indirect	-.01	.01			-.03	.02
Total	.64	.07	9.4	< .001	.50	.78

Note: X = Rumination (IV), M = Negative Attention Bias (Mediator), Y = Trait Anxiety (DV)

Discussion

The current study was designed to investigate the relationship between ruminative tendencies, attentional bias, and anxiety. The study sought to gain deeper insight regarding the complex relationship between these three variables and the various domains of each through examining both brooding and reflective pondering and also state and trait anxiety. Moreover, the study's focus was to consolidate a potential mediational pathway where a preferential negative attentional bias mediated the rumination to anxiety pathway (Vălenaş et al., 2017; Southworth et al., 2017; Grafton et al., 2016). In doing so, the study aimed to extend upon previous research through a mediational approach.

The first hypothesis was based upon previous literature that (*H1*) higher levels of both brooding and total rumination would be associated with higher levels of state anxiety (Olatunji et al., 2013; Watkins & Roberts, 2020). Whereas higher levels of reflective pondering would be associated with lower levels of state anxiety (McLaughlin & Nolen-Hoeksema, 2011; Offredi et al., 2016). This was explored through a linear multiple regression analysis to analyse the total effect of rumination on state anxiety while also assessing the differences between ruminative subsets. Correspondingly, findings demonstrated a significant positive relationship between total rumination, brooding and state anxiety whilst there was a significant negative relationship between reflective pondering and state anxiety. Thus, these findings show that there are indeed differing variations within ruminative domains where high levels of brooding lead to high levels of state anxiety whereas contrastingly, high levels of reflective pondering led to lower levels of state anxiety. Therefore, the first hypothesis can be accepted.

These findings reconsolidate prior arguments regarding the imperativeness of delineating both subsets of rumination to depict accurate findings (Vander Zwalmen et al., 2022). Furthermore,

reflective pondering has been characterised as a purposeful inward-looking process which has been shown to facilitate a form of problem solving (Koster et al., 2013; Olatunji et al., 2013; Treynor et al., 2003). Comparatively, brooding is characterised as a maladaptive recurrent negative thinking loop which leads to an incapacity to cognitive problem solving (Treynor et al., 2003) Hence, there is reasoning to suggest reflective pondering may have some adaptive qualities. Similarly, this building conception may have future treatment implications when devising targeting ruminative thinking patterns (Burwell & Shirk, 2007; Sin et al., 2018).

Interestingly, Sin et al. (2018), found contrasts in ruminative patterns within both the dorsal lateral prefrontal cortex (DLPFC) and the anterior cingulate cortex (ACC), the two neural regions where rumination has been found to be associated with (Kühn et al., 2012; Späti et al., 2015; Wang et al., 2015). Their findings depicted brooding to have a positive impact on grey matter within the DLPFC and ACC whereas reflective pondering showed a negative impact on these structures. Thus, these findings support the current study's findings and provide insights into the differences between these subdomains at a neuroanatomical level.

However contrastingly, some studies have found a positive correlation between reflective pondering and depressive symptoms (Rude et al., 2007; Verhaeghen et al., 2005). While others have found rumination to be the most beneficial to those with high levels of depression and comparatively those with lower depressive symptoms find rumination to be not adaptively salient (Jamil & Llera, 2021). However, the variations in findings may represent the different populations being targeted with differing degrees of clinical severity. Additionally, these findings may be explained by reflective pondering component which may adaptively facilitating problem solving amongst a clinical population (Harding & Mezulis, 2017; Watkins, 2008). Future research would benefit from comparing

reflective pondering within a problem-solving context amongst a clinical and non-clinical population (Bartoskova et al., 2018). This would help to conceptualise what operational process is occurring within the current findings.

Additionally, whilst reflective pondering has been found to have adaptive functions in relation to clinically depressed samples, a significantly small amount of research has been carried out in relation to identifying how exactly reflective pondering may have a negative impact on anxiety symptoms (Kim & Newman, 2022). Considering the current study has demonstrated a correlational impact between the two, future research must consider the mechanistic process of how these constructs conjointly operate. This finding accentuates the need to avoid considering rumination as solely maladaptive (Cohen et al., 2014) and likewise, to ensure accuracy within findings, the subtypes of ruminative thinking must be identified and accounted for (Lask et al., 2021).

The second hypothesis was confirmed (*H2*) that brooding and total rumination would be associated with higher levels of trait anxiety where higher levels of reflective pondering would be associated with lower levels of trait anxiety, which was formulated based on prior research (Kross, 2009; Reilly et al., 2018). Likewise, what separates this hypothesis from the previous hypothesis is the existing research highlighting the prolonged features of both reflective pondering and brooding (Watkins & Roberts, 2020). Thus, the current study aimed to examine if this process would be instrumentalised in an individual who has high levels of trait anxiety. The hypothesis was investigated through linear multiple regression which revealed total scores of rumination and both reflective pondering and brooding to be much more strongly related to trait anxiety than state anxiety.

This finding suggests a continuous relationship between these variables, representing a potential internalisation of these functions (Bushman & Gibson, 2011; Vasquez et al., 2013).

Similarly, Watkins (2008) proposed this internalization to occur due to a constant polarized sequence

of negative thought related content occurring somewhat like a progressive cascade of negative mood

and negative cognition (Watkins & Roberts, 2020). Prior longitudinal research has assisted this

preposition suggesting rumination to exacerbate the propensity of developing psychopathologies over

time (Olatunji et al., 2013). More particularly, Drost et al. (2014) found rumination to be accountable

for the progressive transition of baseline fear disorders such as panic disorder and social anxiety to the

successive changes towards distress disorders such as generalized anxiety disorder. Likewise, Modini

and Abbott (2016), showed rumination to contribute to the maintenance of social anxiety finding

ruminative thinking to be active whilst processing during social interactions. Overall, these findings

are consistent with the current study's findings in that they support the deposition that rumination is

an active process throughout time and not only within momentary state events (Ciesla & Roberts,

2007).

The third hypothesis (*H3*), that negative attentional bias would have a mediational impact

upon the relationship between rumination and state anxiety, failed to be supported. This hypothesis

was based upon previous literature which suggested attentional bias processes to have an impacting

role between the relationship between rumination and anxiety through a preferential attending towards

negative stimuli (Grafton et al., 2016; Southworth et al., 2017; Vălenaş et al., 2017). This hypothesis

was investigated through mediational analysis however, the indirect effect of attentional bias on

rumination and state anxiety was non-significant. This contradicts past research suggesting attentional

bias to mediate this relationship (Vălenaş et al., 2017). However, defining the exact impact of

attentional processes on negative emotionality is difficult due to the complexity of attentional function

mechanisms and difficulties in identifying accurate assessment measures (MacLeod & Matthews, 2012).

Similarly, despite a significant amount of evidence linking threat perceptual attention bias to anxiety vulnerability (Armstrong & Olatunji, 2012; Price et al., 2016), there has been recent concernment over the reliability of anxiety linked attentional bias measures (Jones & Sharpe, 2017). Frequent arguments of the probe task measures have noted the high degrees of variability regarding the personal relevance of threat stimuli (Amir et al., 2009). Studies demonstrating such have identified attentional vigilance to vary dependent on specific disorders, with obsessive compulsive disorder characterised as favouring stimuli regarding obsessive threats (Olatunji et al., 2011) and panic disorder by stimuli regarding panic symptoms (Buckley et al., 2002). Similarly, whilst the current study was aimed at a non-clinical population which accordingly implemented general negatively valanced stimuli (Bradley & Lang, 1999), this may have given rise to a lack of sensitivity in detecting specific negative attentional biases towards personally relevant stimuli (Pergamin-Hight et al., 2015).

Similarly, findings have shown that individuals who have difficulties with emotional regulation tend to have a significantly higher cross-trial variability in attentional responding to negative stimuli (Bardeen et al., 2017) and likewise individuals with anxiety disorders tend to possess the same quality (Zvielli et al., 2014). Consequently, this may offer a further explanatory reasoning as to why attentional bias scores were found to be non-significant within the rumination and state anxiety relationship. Correctively, future studies should aim to focus on measurement through implementing both rigorous standardization measures within the testing environment (Schäfer et al., 2016; Stevens, 2009).

Despite limitations in assessing attentional processes, the current study used the dot probe task (MacLeod et al., 1986; Sutton & Altarriba, 2011) to investigate the mediational effect of attentional bias on emotion regulation. This was favoured by past findings suggesting attentional bias had a contributing role towards emotion regulatory processes (Donaldson et al., 2007; Grafton et al., 2016; Vălenaş et al., 2017; Whitmer & Gotlib, 2012) and similarly the current study aimed to further investigate the reliability of the dot probe task (Waechter et al., 2014). Likewise, considering the hypothesis failed to be accepted, the above evidence offers potential explanatory reasonings.

As with *H3,* the fourth hypothesis (*H4*) that negative attentional bias would have a mediational impact upon the rumination and trait anxiety relationship, also failed to be accepted. In contrast to state anxiety, if there was a significant finding with trait anxiety this would have portrayed a more foundational underlying mechanism towards the processes involved in emotional and attentional processing (Vălenaş et al., 2017). As with *H3*, there are explanatory reasonings to suggest why this mediational effect was not observed.

Past findings have demonstrated that attentional responding to threat is not stable and is subject to a degree of high variability, dependent on the individual's environmental context. While an individual may have an increased probability to attend to negative stimuli this is subject to fluctuation over time (Yuval et al., 2016; Zvielli et al., 2014). Comparably, this also has relevancy for Vălenaş et al.'s (2017) study which examined participants who were preparing for exams and were likely to rate higher than typical levels of state anxiety. While they found a significant mediational relationship, their findings cannot extend towards levels of overall trait anxiety thus, highlighting the need for increased research on trait anxiety to further build on the current findings.

To accomplish this, future research should prioritise taking a multiple measures approach on an attentional task or by taking the same measure on a number of occasions. This will help reduce the degree of variability and overall can better classify the stability of the relationship of attentional bias and emotional responding. Similarly, prior studies examining anxiety-linked attentional bias have recorded eye gaze (Amir et al., 2016) or EEG measures (Kappenman et al., 2014) along with probe response times and have offered a greater level of insight regarding this relationship. In the context of the ruminative relationship with attentional bias perception, research should prioritise taking such an approach (Enock et al., 2014; McNally, 2019). Thus, this will help reduce the degree of variability within single assessment measures and allow for improved specificity regarding the cognitive and emotional processes at work.

Another explanatory perspective is the possibility that additional attentional factors are impacting upon the relationship between ruminative and anxiety, which may help to account for the current study's failure to find a significant mediational impact. Recent evidence has portrayed that participant's attentional control capability has been found to moderate the expression of attentional bias to threat stimuli (Gorlin & Teachman, 2015). Demonstrating such, Taylor et al. (2016) found that poor attentional control was associated with more anxiety-linked attentional bias in participants, while high attentional control was linked to the absence of such bias, but only when statistically accounting for their attentional control score. Likewise, prospective research could examine the impacting role of attentional control on the potential relationship between rumination, attentional bias, and anxiety. This could involve conducting moderation analyses to assess the extent to which attentional control influences this relationship

Strength and Limitations

Notwithstanding the valuable insights and nuanced perspective this research provides, it is important to identify some limitations to the current research to benefit developing research. Firstly, even though this research used a cognitive task which provided a more thorough insight into attentional function, the study had a cross-sectional design. Thus, this design is unable to generate causal inferences and cannot rule out alternative explanations for the observed associations. Similarly, it is possible that the relationship between rumination, attentional bias, and anxiety may be influenced by unmeasured confounding variables.

Although mediational analyses manifest the same limitations, this study's direct strength was conducting such analysis for a more in-depth investigation of the sequential association between variables. Likewise, this may be beneficial for identifying future potential interventional targets. Although attentional bias didn't have a significant mediating effect, further intervention studies may reveal more conclusively regarding this result. Relevant to the current study, the use of the recently developed attentional bias modification (ABM) intervention (MacLeod & Clarke, 2015; MacLeod & Grafton, 2016), may provide further explanatory gains in the context of rumination and anxiety. Accordingly, future research may also implement randomised control trials (RCTs) to examine the effectiveness of interventional techniques, to try to identify if the theorised pathway relationship is true and to thus distinguish how strong this hypothesised relationship may be.

Secondly, the dot probe task was administered in a remote setting meaning each participant completed the task via a link on their own computer or laptop through Inquisit software. Moreover, because this was conducted outside of a laboratory setting, this raises some potential limitations to the current study. The remote setting could not allow for rigorous control over environmental influences

and extraneous variables like distractions and noise, making it difficult to ensure equal conditions for

all participants. Consequently, these factors had the potential to influenced the results and may pose

questions towards internal validity (Cohen, 2013).

However, due to the limited time frame and lack of funding to reach a wide population, the

most feasible method to gain the largest sample size possible was to implement an online testing

measure. Similarly, the large sample size considering the use of a cognitive task, represents a clear

strength to the current study. This lends to a more representative sample and thus produces an

increased generalizability of the findings to the population (Shadish et al., 2002). Interests to future

research may carry out comprehensive validation measures of Inquisit web software to ensure that

findings from both laboratory settings and remote settings produce the same results which provide

future practical implications for cognitive testing in research.

Practical Implications

The current study found findings to support rumination to have contrasting adaptive qualities

with reflective pondering found to be associated with lower levels of both state and trait anxiety.

Likewise, this raises the necessity to potentially reconsider what rumination is defined as. This finding

has relevance for research on treatments such as rumination-focused cognitive behavioural therapy,

which may consider ways on how to integrate and promote these adaptive qualities. Furthermore, the

current study highlights a need to examine the reliability of probe task measures and to research ways

of improving these measures to accurately assess attentional biases (MacLeod et al., 2019). This

would help address the limitations of the current measure and provide insights on how to resolve these

shortcomings.

Conclusion

To conclude, the current study found reflective pondering linked to less state and trait anxiety, and brooding linked to higher levels. This study lends to the expansion of the current understanding regarding the subsets of rumination in relation to anxiety. Whilst a mediational impact of attentional bias was not found to consolidate these findings, future research must explore this relationship further. Similarly, due to the concerns over probe task measures, more rigorous attentional bias testing must be developed along with the inclusion of multiple measures of assessment. Overall, the research domain of portrays how integrative rumination is in many psychopathologies however, what is apparent from this study is the misconceptions of rumination being a purely maladaptive form of emotional regulation. Similarly, with the recent interest of examining the links between emotional and cognitive informational processing, the current study is fitting and lends to the present research evidence. Understanding the cognitive operations behind externalized symptoms through prospective research in rumination may inform therapeutic practices in the future.

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Appendix A

Demographic Questionnaire

Age:

_____

Gender:

⊙ Female

⊙ Male

⊙ Prefer not to say

Number in years of education completed:

Primary school = 8 years

Junior Certificate = 11 years

Leaving Certificate = 14 years

Undergraduate Degree = 17 or 18 years

Master's degree 18, 19, or 20 years

PhD = > 20 years

_____

Appendix B

State-Trait Anxiety Inventory

STAI-S

Some statements that people have used to describe their feelings are given below. Read each statement and then circle the response option to the right to indicate how you feel right now, that is, at this moment. Do not spend too much time on any one statement, but give the answer which seems to describe your present feelings best.

1 = Not at all, 2 = Somewhat, 3 = Moderately so, 4 = Very much so

1. I feel calm

2. I feel secure

3. I am tense

4. I feel strained

5. I feel at ease

6. I feel upset

7. I am presently worrying about possible misfortunes

8. I fee satisfied

9. I feel frightened

10. I feel comfortable

11. I feel self-confident

12. I feel nervous

13. I am jittery

14. I feel indecisive

15. I am relaxed

16. I feel content

17. I am worried

18. I feel confused

19. I feel steady

20. I feel pleasant

STAI-T

Some statements that people have used to describe their feelings are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you generally feel. There are no right or wrong answers. Do not spend too much time on a single statement, but give the answer that comes closest to how you generally feel.

1 = Almost never, 2 = Sometimes, 3 = Often, 4 = Almost always

21. I feel pleasant

22. I feel nervous and restless

23. I feel satisfied with myself

24. I wish I could be as happy as others seem to be

25. I feel like a failure

26. I feel rested

27. I am "calm, cool, and collected"

28. I feel that difficulties are piling up so that I cannot overcome them

29. I worry too much over something that really doesn't matter

30. I am happy

31. I have disturbing thoughts

32. I lack self-confidence

33. I feel secure

34. I make decisions easily

35. I feel inadequate

36. I am content

37. Some unimportant though runs through my mind and bothers me

38. I take disappointments so keenly that I can't put them out of my mind

39. I am a steady person

40. I get in a state of tension or turmoil as I think over my recent concerns and interests

Appendix C

Ruminative Response Scale

People think and do many different things when they feel depressed. Please read each of the items below and indicate whether you almost never, sometimes, often, or almost always think or do each one when you feel down, sad, or depressed. Please indicate what you *generally* do, not what you think you should do.

1 = Almost never, 2 = Sometimes, 3 = Often, 4 = Almost always

1. think about how alone you feel

2. think "I won't be able to do my job if I don't snap out of this"

3. think about your feelings of fatigue and achiness

4. think about how hard it is to concentrate

5. think "What am I doing to deserve this?"

6. think about how passive and unmotivated you feel.

7. analyse recent events to try to understand why you are depressed

8. think about how you don't seem to feel anything anymore

9. think "Why can't I get going?"

10. think "Why do I always react this way?"

11. go away by yourself and think about why you feel this way

12. write down what you are thinking about and analyse it

13. think about a recent situation, wishing it had gone better

14. think "I won't be able to concentrate if I keep feeling this way."

15. think "Why do I have problems other people don't have?"

16. think "Why can't I handle things better?"

17. think about how sad you feel.

18. think about all your shortcomings, failings, faults, mistakes

Appendix D

Emotion Dot-Probe Task Experimental Set Up

```
EXPERIMENTAL SET-UP
_____

2 emotions x 2 probe congruences are tested in a mixed design (emotions are blocked)
The order of the 'positive' and 'negative' blocks is counterbalanced by groupnumber.
Odd groupnumbers run order "Negative -> Positive"
Even groupnumbers run order "Positive -> Negative"

Practice Block:
* Each test block is preceded by a practice block that presents 6 practice trials to adjust to the task.
* In this script practice trials will turn into test trials without further interruption.
* word pairs are fixed but presented in random order
* locations of words is selected randomly with replacement
* location of probe is selected randomly with replacement
* 50% of the probes during practice trials are randomly selected to be probe1 (R)

Test Block:
* 14 trials
* word pairs are fixed but presented in random order
* 50% of the probes in each test block are randomly selected to be probe1 (R)
* 50% of the test trials in each block present congruent probes (sit in place of emotion words)

across both test blocks (see Sutton & Altarriba, 2011, p.741):
* the emotion word (EW) is located on the left(above) half the time (and half of the left EW are followed by a probe)
Note: this script balances congruence x EWlocation across the two test blocks (due to the number of trials it's not
possible to achieve balance within one test block). If the number of trials per block is changed to 16 (for example),
complete balancing across 1 block would be possible.

Trial Sequence:
Fixation (default: 500ms) -> Word Pair (default: 180ms) -> Mask (optional, default: 0ms)-> Probe (until response)->errorfeedback for 500ms (if incorrect
Note: if no response occurrs within 2000ms, a response reminder is flashed onto the screen.
```
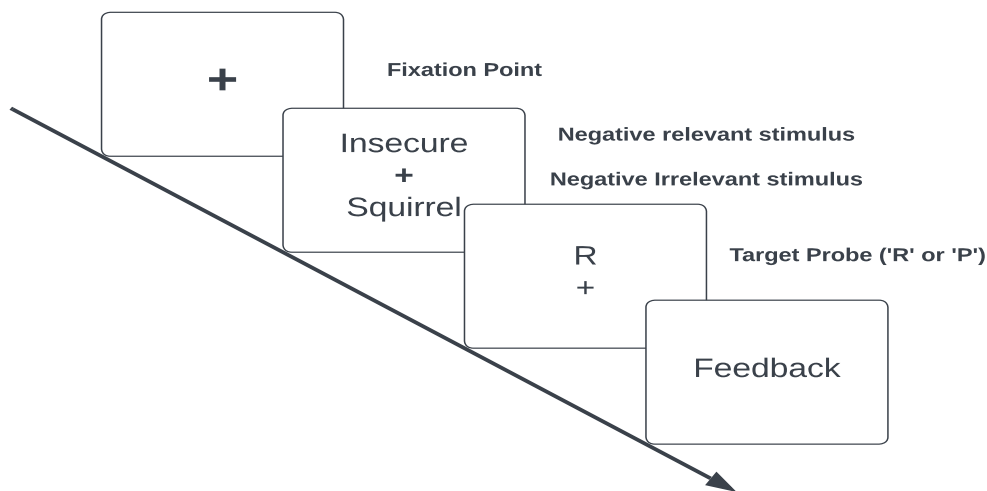

The Emotion Word Dot Probe Task (Sutton & Altarriba, 2011) is used to measure attentional bias processing towards emotional words which is designed towards a nonclinical population. This task aims to examine the automatic capturing of attention towards both positive and negative emotionally laden words, however negative emotion words was the outcome of interest. The task consists of two blocks of trials; the first block consists of negative emotional words and the second

block consists of positive emotional words. In each trial within the blocks, there are two words presented simultaneously above and below the centred fixation cross, one valence specific word (negative or positive) and one neutral word. In total there are 28 neutral words (zebra, stick), 14 negative words (gloom, hostile) and 14 positive words (cheer, lucky). The words that were presented simultaneously in each set are specifically chosen to have similar mean values for word frequency and word length (Lund & Burgess, 1996). Similarly, the set words are also equated on lexical decision latency and word naming latency in correspondence with data produced by the English Lexicon Project (Balota et al., 2002). The neutral words consisted of two categories, sports equipment items are matched with negative words and animal items are matched with positive words. The valence and arousal ratings for both categories of emotion words were acquired from the Affective Norms for English Words (Bradley & Lang, 1999). For negative items, the mean valence rating and arousal rating based on the Self-Assessment Manikin (Lang, 1980), was 2.23 and 5.97, respectively. For positive items, the mean valence rating and arousal rating was 7.85 respectively, where scale ratings begin from 1 ("unhappy"/ "wide-eyed") to 9 ("happy"/"wide-eyed").

The words are presented for approximately 30ms whereby they are then masked and replaced by a probe being either the letter "R" or "P" for 150ms. The participant must then respond by pressing the letter "R" or "P" on the keyboard dependent on which letter appears. These letters may either be presented in the congruent location (same location as the emotion word) or incongruent condition (same location as the neutral word). Thus, response reaction time is taken for both locations and emotional attention bias is measured based on the difference in reaction times between the congruent and incongruent conditions.

Appendix E

Negative, Positive, and Positive Word Stimuli

Words		Neutral words	
Negative emotion	*Positive emotion*	*Sports equipment*	*Animals*
agony	affection	arrow	bird
anger	cheer	baseball	deer
fear	delight	basketball	elephant
gloom	excitement	clubs	fox
grief	hopeful	football	horse
guilty	jolly	glove	lion
hatred	joy	helmet	monkey
horror	lucky	mask	moose
hostile	lust	saddle	squirrel
insecure	merry	shoes	tiger
jealously	passion	skates	turkey
mad	pleasure	socks	whale
misery	proud	spikes	wolf
sad	safe	stick	zebra

Appendix F

Modifications of Emotion Dot Probe Task

Within the current study, a number of changes were made to the Sutton & Altarriba's (2011) original emotion word dot task paradigm. These changes were computed by recoding editable variables within the original data script and were validated through use of Inquisit 6.0 software. These modifications included providing clear instructions prior to task onset, thus, ensuring clarity of comprehension for the participant. This was carried out through coding and validating instructions into the script so that they would be displayed both before and in-between the two blocks of trials. Additionally, the script was recoded to convert the location of word presentation from left and right of the fixation cross to a vertical presentation, where the words are presented top and bottom of the fixation cross. This change was executed to reduce the impact of Simon Effect which relates to Stimulus-Response Compatibility (Simon & Rudell, 1967), which conceptualises the variances in reaction time dependent on the stimulus and response set-up. More specifically if the stimulus (word presentation) was presented in the same location as the response (keyboard response) this may lead to discrepancies in response times in comparison to incompatible conditions. Hence, vertical word presentations would reduce this discrepancy, where word stimuli and response keys lay on perpendicular axes.

Appendix G

Evidence of SPSS Data File and Output

LG Data Set .sav [DataSet1] - IBM SPSS Statistics Data Editor

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
45	RRS_D1	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
46	RRS_D2	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
47	RRS_D3	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
48	RRS_D4	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
49	RRS_B5	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
50	RRS_D6	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
51	RRS_R7	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
52	RRS_D8	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
53	RRS_D9	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
54	RRS_B10	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
55	RRS_R11	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
56	RRS_R12	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
57	RRS_B13	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
58	RRS_D14	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
59	RRS_B15	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
60	RRS_B16	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
61	RRS_D17	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
62	RRS_D18	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
63	RRS_D19	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
64	RRS_R20	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
65	RRS_R21	Numeric	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
66	RRS_D22	Numeric ...	8	0		{1, Almost ...	None	8	Right	Ordinal	Input
67	AB_NEG	Numeric	12	10		None	None	8	Right	Scale	Input
68	sanxiety	Numeric	8	2	state anxiety	None	None	10	Right	Scale	Input
69	tanxiety	Numeric	8	2	trait anxiety	None	None	10	Right	Scale	Input
70	Brooding	Numeric	8	2	brooding	None	None	10	Right	Scale	Input
71	Reflect	Numeric	8	2	reflective pon...	None	None	10	Right	Scale	Input
72	TotalRRS	Numeric	8	2	total rumination	None	None	10	Right	Scale	Input
73											

Data View   Variable View

FYP output finished .spv [Document2] - IBM SPSS Statistics Viewer

```
Run MATRIX procedure:

************** PROCESS Procedure for SPSS Version 4.2 beta **************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
       Documentation available in Hayes (2022). www.guilford.com/p/hayes3

***********************************************************************
Model : 4
    Y  : sanxiety
    X  : TotalRRS
    M  : AB_NEG

Sample
Size: 94

***********************************************************************
OUTCOME VARIABLE:
 AB_NEG

Model Summary
          R       R-sq       MSE        F        df1        df2          p
      .1359      .0185  5117.4149     1.5054     1.0000    80.0000      .2234

Model
             coeff        se         t         p       LLCI       ULCI
constant   31.8053    32.1567     .9891     .3256   -32.1887    95.7993
TotalRRS    -.7285      .5937   -1.2270     .2234    -1.9101      .4531

Standardized coefficients
              coeff
TotalRRS    -.1359


***********************************************************************
OUTCOME VARIABLE:
 sanxiety

Model Summary
          R       R-sq       MSE        F        df1        df2          p
      .6412      .4111    80.2906    27.5789     2.0000    79.0000      .0000

Model
             coeff        se         t         p       LLCI       ULCI
constant   14.5669     4.0524    3.5946     .0006     6.5007    22.6332
TotalRRS     .5575      .0751    7.4268     .0000      .4081      .7069
AB_NEG       .0143      .0140    1.0236     .3091     -.0135      .0422

Standardized coefficients
              coeff
TotalRRS     .6472
AB_NEG       .0892
```

Appendix H

Participant Information Sheet

You are offered the chance to participate in a research study. If you are interested in taking part, please take a moment to read over this document explaining the purpose of carrying out this research and what it would involve for you. If you have any queries or questions regarding the study, please get in touch with me through the contact details provided below.

Before deciding to partake in this study it is important that you understand both the purpose of this study and what it will mean for you as the participant. Please carefully read the provided information regarding the details of the study and if you seek clarification surrounding any aspects of the research, please do not hesitate to make contact through the details provided below. Please ensure all the details below are comprehensively understood before making the decision to participate in this study.

What is this study about?

I am currently a third year student in the BA in Psychology programme at National College of Ireland. Currently, I am conducting an independent research study as part of my final year thesis. The aim of this study is to examine the relationship between aspects of emotion regulatory strategies and attentional functioning processes.

What will taking part in the study involve?

Taking part in this research will firstly involve completing a questionnaire that should take 15-20 minutes to complete, taking longer if needed. The questionnaire is divided into three separate sections. The first will include questions regarding how you feel in the present moment and the second two will ask you questions in regards to how you generally feel, over a longer period of time. Lastly, you will be asked to follow a link which brings you to an attention functioning task, known as the Emotion Dot Probe Task (Sutton & Altarriba, 2011). This will require you to download the Inquisit app installer on a laptop, instructions will be provided and it is a simple process. This will be 6 minutes in duration and provides clear instructions as to how to complete the task prior to completion.

Who take part?

You can take part if you are over 18 years of age. You cannot partake in the study if you have a clinical diagnosis of either an attentional disorder, anxiety disorder or a mood disorder.

Do I have to take part?

Study participation is completely voluntary, and you do not have to take part, the decision is completely yours to make. If you decide to take part, you can withdraw from participating in the study at any timepoint, even after data has been collected, there will be no consequences. The questionnaires being used within the study asks for you to reflect on your thoughts, moods and feelings of experiences anxiety and self-concepts. There is a small risk that these questions may cause some individuals to be upset. If you do not feel comfortable with this or feel that there may be a possibility of you experiencing a significant level of distress, you are advised not to take part in the study.

What are the possible risks and benefits of taking part?

There are no immediate benefits to you for taking part in this study. However, this research provides a greater depth of knowledge regarding cognitive functioning and their relationship with emotional states and regulation. This study may possibly assist in future investigations and will contribute to the research field. For you as the participant, if research is an area that interests you, this study benefits you as a way of experiencing the conduction of a cognitive task. There are minor risks within this study. Some of the questions within the questionnaire ask about topics that require reflection of thoughts and feelings involving sadness and worry, however nothing that would be beyond experienced in everyday life. If this is something you would prefer to avoid, please be mindful of this when considering to take part. If you decide to withdraw from the study, you can do this by closing the browser and exiting the questionnaire, but only up until the point of submitting your data. Once your data is submitted it will not be possible to withdraw your data due to all the data being kept anonymous.

Will taking part be confidential and what will happen to my data?

Any information that is provided will remain entirely confidential and data collected will be originally identified due to the necessity to link both the questionnaire and task aspect of the study

together. However, once these two are linked the possible identifiable information will be immediately discarded. The questionnaires that you complete will be uploaded to Google Forms where which the data will be protected and stored. When your data is uploaded into a data file it will be completely anonymised and will be encrypted and password protected by which the research will only have granted access. From there, the data will be statistically analysed where averages will be calculated, providing more confidentiality towards your personal data. There is also a possibility that the data provided will be archived for secondary data used in future research within the National College of Ireland.

What will happen to the results of the study?

The results of this study will be presented in my final dissertation, which will be submitted to National College of Ireland. Additionally, the results of my project may be presented at conferences or potentially submitted to an academic journal for publication.

Who should you contact for further information?

Lucy Graham (researcher), National College of Ireland

Email: x20411272@student.ncirl.ie

Dr David Mothersill (supervisor), National College of Ireland

Email: david.mothersil@ncirl.ie

I HAVE READ THIS INFORMATION AND WOULD LIKE TO CONTINUE ☐

Appendix I

Participant Consent Form

Please read this consent form carefully before you decide to participate in this study. Please ask any questions or concerns to the researcher before signing the form.

- I understand that if a agree to participate now, I can withdraw or refuse to participate at any point before data submission by closing my browser window, without any possible consequences.

- The method proposed for this study has been approved by the Departmental Ethics Committee within the National College of Ireland. Thus, the committee does not have any concerns regarding the procedure as described by the researcher. It is the researcher's responsibility to abide by ethical guidelines in their interactions with participants and the collection of data.

- Once the point of data submission and once the test has finished and my questionnaire and test responses are linked, due to the nature of the information being un-identifiable I cannot retract my data.

- I have read the purpose of the study and voluntarily agree to participate, with no concerns.

- All data from the study will be treated with confidentiality and that the data will be statistically analysed and submitted in a report to the Psychology Department in the School of Business.

- I understand that my information will be retained and managed in accordance with the NCI data retention policy, and that my de-identified information may be archived within an online data repository and may possibly be used for secondary data analysis.

- I understand that if I have any concerns or general questions regarding any aspect of the research, that they will be fully addressed by the individuals involved in the research.

By clicking this box, you are confirming that you have read, and agree with all the above

details and that you are suitable to take part in the study according to the inclusion criteria ☐

By clicking this box, you are providing informed consent to partake in the study ☐

Appendix J

Participant Debriefing Sheet

This research is designed to investigate the relationship between emotional states regarding ruminating tendencies and attentional functioning. The first two sections of the questionnaire were taken from the State Trait Anxiety Inventory (STAI) (Spielberger, 1983), which measures levels of characteristic anxiety. The last section was taken from the Ruminative Response Scale (RRS) (Nolen-Hoeksem   §a & Morrow, 1991), which measures emotion regulation coping strategies and in particular ruminative tendencies. The Emotion Dot Probe Task (Sutton & Altarriba, 2011) was designed to measure attentional biases towards valence specific stimuli. The research will employ correlational statistical analyses where the participant's responses will be inputted.

This study and your participation will contribute and benefit to the research surrounding negative emotional regulation coping strategies and their influence with attentional capacities. As such, with this research and more, it may assist in developing better strategies to manage emotion.

To further reiterate, all the information that you have provided throughout this study will remain anonymous once your questionnaire and task responses have been linked, in line with utmost confidentiality.

If you have been in any way affected by the included topics in this session, please see the details of some free helplines that provide safe places to share concerns or worries helping to promote healthy mental well-being.

www.aware.ie

www.turn2me.ie

www.irishadvocacaynetwrok.com

www.iacp.ie – list of registered counsellors & psychotherapists practicing in Ireland

I would like to thank you for taking the time to be part of my research, it is greatly appreciated. If you have any further questions or concerns, please don't hesitate to contact me through my email: x20411272@student.ncirl.ie, or my academic supervisor Dr David Mothersill by email: David.mothersill@ncirl.ie. Thank you.