INHIBITORY DEFICITS IN RUMINATION: A NEGATIVE PRIMING STUDY

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ABSTRACT

Rumination is a maladaptive coping style that has been found to be associated with several negative outcomes, including depression and anxiety. In particular, rumination has been found to be associated with deficits in inhibiting irrelevant information. This study examined the relationship of rumination to depression, anxiety, and stress and examined gender differences in these relationships. It also examined inhibitory deficits in rumination using a negative priming task with both short- and long-term components and evaluated the efficacy of a negative priming paradigm which utilised single presentations of stimuli that were not confounded by stimulus-response bindings. The results found that rumination was associated with higher levels of depression, anxiety, and stress, in line with the classification of rumination as maladaptive. It was also discovered that the predictors of rumination differed between males and females, with rumination being predicted by stress and depression for females and by anxiety for males, indicating possible gender differences in the explanation of rumination. The negative priming paradigm used in this study failed to produce any significant negative priming, and indeed produced significant positive priming meaning that no conclusions could be drawn from the data about inhibitory deficits and rumination. The results did however highlight the importance of the probe distractor in negative priming as it appears that a lack of competition between the probe distractor and the probe target may be a possible reason for the failure to observe negative priming.

CHAPTER 1: INTRODUCTION

1.1 Overview and Rationale

Rumination is a style of coping that is characterised by persistent, recurring and intrusive thoughts about distress, and the causes and consequences of it (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Trapnell & Campbell, 1999; Whitmer & Banich, 2007). It has been linked to multiple negative outcomes, particularly the onset of depression and the frequency and severity of depressive episodes (Johnston, Carter, & McLellan, 2011; Kuo et al., 2012; Nolen-Hoeksema et al., 2008; Whitmer & Banich, 2007). In fact, research has indicated that inhibition, one of the main cognitive deficits associated with depression, is the result of rumination and not the depression itself, with the deficits found in depression disappearing when rumination is controlled for (De Lissnyder, Koster, Derakshan, & De Raedt, 2010; Whitmer & Banich, 2007). It has been further proposed that deficits in inhibition cause and maintain rumination, as well as facilitating the relationship between rumination and depression (De Lissnyder et al., 2010; Whitmer & Banich, 2007; Zetsche, D'Avanzato, & Joormann, 2012).

The current study aims to further explore the relationship between rumination and its associated negative outcomes, particularly the observed inhibition deficits which will be examined in a non-depressed ruminator sample through the use of a negative priming paradigm. The following chapter provides details about rumination, its relationship to depression, and the emotional, physical, and cognitive outcomes associated with it. It also summarises existing research around negative priming and provides a more detailed account of the current study.

1.2 Rumination

To ruminate is to have persistent, recurring and intrusive thoughts about the self, prompted by the experience of distress (Nolen-Hoeksema et al., 2008; Trapnell & Campbell, 1999; Whitmer & Banich, 2007). Ruminative thoughts tend to focus on the symptoms of distress and on the possible causes and consequences of it (Nolen-Hoeksema et al., 2008), for example thinking about how tired and unmotivated one feels and worrying that this will interfere with work (Davis & Nolen-Hoeksema, 2000). This differs from the negative automatic thoughts prevalent in depressive states in that rumination is a style of thought, a stable trait, whereas negative automatic thoughts are thoughts with negative content (Joormann, 2006). Importantly, ruminative thoughts are passive, that is, they do not lead to active problem solving or positive action to alleviate the distressed state and as such it is often classified as a maladaptive coping style (Johnston et al., 2011; Nolen-Hoeksema et al., 2008). A ruminative response style has been shown to be associated with multiple negative outcomes in the emotional, social, physical and cognitive areas (Johnston et al., 2011; Kuo et al., 2012).

A study carried out by Lyubomirsky and Nolen-Hoeksema (1993) into what perpetuates rumination found that people who ruminate engage in less health-seeking behaviours, such as going to the doctors or engaging in pleasurable activities, even for those who believed they would enjoy themselves. Additionally, they found that people who ruminate believe that it is beneficial, in that it gives an enhanced sense of insight (Lyubomirsky & Nolen-Hoeksema, 1993). The authors proposed that the belief around the benefits of rumination prevented ruminators from carrying out health-seeking behaviours so that they would not lose the insight they believed they gained and that rumination was subsequently maintained by the lack of positive reinforcement normally received from such behaviours (Lyubomirsky & Nolen-Hoeksema, 1993).

1.2.1 Emotional Outcomes

Rumination has been found to be predict several psychopathologies, including general anxiety and posttraumatic symptoms, binge eating and the related bulimia nervosa, binge drinking and the related alcohol abuse, and non-suicidal self-harm (Mor & Winquist, 2002; Nolen-Hoeksema et al., 2008; Watkins, 2008). However, rumination is most commonly, and most strongly, been found to be associated with the experience of Major Depressive Disorder (Kuo et al., 2012).

1.2.2 Rumination and Depression

Rumination has been shown to predict the onset of depression and the frequency and severity of depressive episodes (Johnston et al., 2011; Kuo et al., 2012; Nolen-Hoeksema et al., 2008; Whitmer & Banich, 2007). There is also some evidence that rumination can predict the duration of depressive episodes with those who ruminate experiencing longer episodes, though the evidence for this is not consistent (Nolen-Hoeksema et al., 2008; Whitmer & Banich, 2007). For those with depression, rumination appears to increase the negative cognitive symptoms of depressive episodes, such as negative automatic thoughts and negative attentional biases, even after controlling for levels of depression (Nolen-Hoeksema et al., 2008). Rumination has also been shown to have a negative impact on problem solving and health-seeking behaviour and may potentially lead to the loss of social support as ruminators have been found to be less well liked than non-ruminators (Nolen-Hoeksema et al., 2008).

The relationship between rumination and depression is explained in the response styles theory (Nolen-Hoeksema, 1991). According to this theory, rumination increases the severity of depression and affects its onset and frequency through the increases it causes in negative cognitions and its negative impact on problem solving, health-seeking behaviours and social contact (Nolen-Hoeksema, 1991). These outcomes of rumination are proposed to increase the likelihood that depressive symptoms will result in an episode of Major

Depression (Nolen-Hoeksema, 1991). A review of the response styles theory carried out by Nolen-Hoeksema et al. (2008) found that most tenets of the response styles theory were well supported.

Rumination has also been found to mediate the gender difference that exists in the expression of Major Depressive Disorder (Johnson & Whisman, 2013; Nolen-Hoeksema & Jackson, 2001; Nolen-Hoeksema, Larson, & Grayson, 1999). Women are far more likely than men to both ruminate and become depressed, and it is this gender difference in rumination that is largely responsible for the gender difference seen in depression (Johnson & Whisman, 2013; Nolen-Hoeksema & Jackson, 2001; Nolen-Hoeksema et al., 1999). A study evaluating the source of the gender difference in rumination found that women's beliefs that negative emotions were more uncontrollable, that they were more responsible for the emotional tone of their relationships, and that they had less control over negative events than men fully mediated the relationship between gender and rumination (Nolen-Hoeksema & Jackson, 2001). Previous suggestions for the source of the gender difference, that women were more distressed and more emotionally expressive than men, were not upheld (Nolen-Hoeksema & Jackson, 2001).

1.2.3 Physical Outcomes

In a meta-analysis carried out by Brosschot, Gerin, and Thayer (2006) rumination was shown to have a physical impact with the cardiovascular, endocrinological, immunological, and neurovisceral systems all showing an increase in activity. These increases have been found to be associated with greater utilization of the health care system and, in the case of the cardiovascular system could potentially result in increased mortality (Brosschot et al., 2006). This is hypothesised to be a result of rumination prolonging the duration of the experience of distress and creating a highly vigilant state, resulting in chronic physiological activation (Brosschot et al., 2006).

1.2.4 Cognitive Outcomes

As well as increasing the negative cognitions associated with depression, rumination also has an impact on several other aspects of cognitive functioning, particularly the executive functions (Johnston et al., 2011; Nolen-Hoeksema et al., 2008). Rumination has been shown to interfere with people's attention, concentration, and, as mentioned before, their ability to problem solve (Johnston et al., 2011; Nolen-Hoeksema et al., 2008). There is also evidence of rumination having an association with negative attentional and memory biases, task-switching deficits, deficits in updating working memory, and inhibition of irrelevant material (Beckwé, Deroost, Koster, De Lissnyder, & De Raedt, 2014; De Lissnyder et al., 2010; Joormann, 2006; Kuo et al., 2012; Nolen-Hoeksema et al., 2008; Whitmer & Banich, 2007; Zetsche et al., 2012).

Evidence for negative biases come from a study carried out by Kuo et al. (2012), who found that those high in rumination displayed significantly enhanced recall for negative words compared to neutral words. In support of this negative bias, fMRI studies have found that ruminators show greater activation of the amygdala, the area of the brain associated with negative affect, when responding to negative stimuli than non-ruminators (Ray et al., 2005; Siegle, Steinhauer, Thase, Stenger, & Carter, 2002). Studies have also shown that ruminators tend to recall more negative autobiographical memories than non-ruminators (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998). Research carried out by De Lissnyder et al. (2010) suggests that these negative biases may be a result of deficits in cognitive control.

Cognitive control refers to three distinct cognitive functions: (1) the ability to switch between tasks, operations or mental sets (set shifting); (2) monitoring and updating the contents of working memory; and (3) inhibition of distracting information (inhibition) (De Lissnyder et al., 2010). Several researchers have examined the relationship between rumination and set shifting, as demonstrated through task-switching paradigms in which the

time difference between making a switch between tasks and not making a switch is examined (Beckwé et al., 2014; De Lissnyder et al., 2010; Whitmer & Banich, 2007). A study by Beckwé et al. (2014) found that high ruminators displayed a set shifting deficit, demonstrated by having a higher switching cost for negative words which were processed in a self-referential manner. Davis and Nolen-Hoeksema (2000) and De Lissnyder et al. (2010) also found that deficits in set shifting was associated with high rumination.

The experiment carried out by Davis and Nolen-Hoeksema (2000) examined whether a ruminative coping style was associated cognitive inflexibility using the Wisconsin Card Sorting Test (Grant & Berg, 1948), a test which measures participants ability to alter their strategy based on feedback. The study found that ruminators committed significantly more perseverative errors than non-ruminators, that is, they continued to utilize a strategy despite feedback that it was no longer relevant, indicating a general set-shifting impairment (Davis & Nolen-Hoeksema, 2000).

De Lissnyder et al. (2010) investigated set-shifting impairments in response to emotional and non-emotional material in ruminators using the Affective Switch Task (AST), a switching task using emotional faces in which participants have to switch between identifying the faces on emotion, gender, or colour. The results of this study found that the participants who were high in rumination showed set shifting impairments, as indicated by a larger shift cost when having to alter their method of identifying the emotional faces, this result was found to be irrespective of the affect of the faces used (De Lissnyder et al., 2010). The above studies indicate that rumination is associated with deficits in set-switching, which may contribute to the stability of rumination, with ruminators being unable to "switch" to a more adaptive coping style.

Interestingly, a study carried out by Whitmer and Banich (2007) found that set shifting deficits were only weakly related to rumination and that when inhibition was

controlled for the relationship disappeared, suggesting that set shifting deficits in ruminators may be a result of an inability to inhibit a previously relevant strategy rather than a deficit in the ability to switch between tasks. Further, the studies described above by De Lissnyder et al. (2010) and Davis and Nolen-Hoeksema (2000), in which they found set shifting deficits were related to rumination, also found that inhibitory deficits were strongly related to rumination, as indicated by difficulties that the high ruminators had in inhibiting the previously relevant strategy. The De Lissnyder et al. (2010) article found that this inhibitory deficit was related to affect with deficits being found only for the negative faces.

1.3 Inhibition

Cognitive inhibition is the ability to update the contents of working memory by removing no longer relevant material and to effectively inhibit the input of irrelevant distracting information into working memory (De Lissnyder et al., 2010; Joormann, 2006). Therefore, inhibition is necessary for a range of cognitive tasks, including concentration, attention, memory and problem solving (Joormann, 2006), leading some researchers to propose that cognitive deficits shown in these areas are a result of an overarching inhibitory deficit (De Lissnyder et al., 2010; Nolen-Hoeksema et al., 2008). In fact, it has been proposed by several researchers that rumination itself is caused and maintained by impaired cognitive inhibition (Hester & Garavan, 2005; Ursin, 2005; Watkins & Brown, 2002; Zetsche et al., 2012). It has also been proposed that inhibitory deficits may facilitate the relationship between rumination and depression (De Lissnyder et al., 2010; Whitmer & Banich, 2007; Zetsche et al., 2012). As such, much research has been conducted into the relationship between rumination and inhibition.

Research carried out by Joormann and Gotlib (2008) investigated the relationship between depression, rumination and deficits in the ability to update the contents of working

memory. In this experiment participants were first shown two lists of three words of either positive or negative affect, which they were to memorise, and were then subsequently told to ignore one of them. Their decision latencies were then recorded on a recognition task in which the participants were shown a word and asked to decide whether that word came from the relevant list (Joormann & Gotlib, 2008). The results of this experiment found that participants with depression showed greater decision latencies to irrelevant words of negative affect than the controls, indicating difficulties removing negative information from working memory (Joormann & Gotlib, 2008). These results were found to be highly correlated with rumination, even after levels of depression were statistically controlled for, suggesting that rumination is associated with impairments in removing negative irrelevant material from working memory, an impairment which is associated with an inhibitory deficit (Joormann & Gotlib, 2008).

Evidence of an inhibitory deficit associated with rumination also comes from a study by Zetsche et al. (2012) in which participants completed a modified Working Memory Selection Task to assess differences in the ability to inhibit no longer relevant information from working memory. In the Working Memory Selection Task participants are asked to memorise six words, they are then shown three of these words again and are instructed to forget them, finally a single word is presented and participants are asked to decide whether it is one of the three words they were to remember (Zetsche et al., 2012), an experiment similar to that carried out by (Joormann & Gotlib, 2008). The results of this experiment found that rumination was associated with impairments in removing no longer relevant information from working memory, an inhibitory dysfunction, and that this impairment predicted higher levels of rumination (Zetsche et al., 2012). This experiment also examined deficits in the ability to control the access to working memory in the first place, finding that this ability was not related to rumination. From these results Zetsche et al. (2012) suggests that high

ruminators and low ruminators differ in their likelihood to persevere with ruminative thoughts, due to an inhibitory deficit, and not in their likelihood of initiating negative ruminative thoughts.

Inhibitory deficits were also found for ruminators using a random number generation task, in which participants were asked to say the numbers one to nine in random order 100 times (Watkins & Brown, 2002). The results of this study found that depressive ruminations displayed less randomness in their number generation, indicating a deficit in inhibiting the habitual counting response (Watkins & Brown, 2002). The authors suggest that deficits in inhibition arise from competition for processing capacity, proposing that ruminators are already using much of their processing capacity with their ruminative thoughts, not leaving enough capacity for the inhibition of the other material and thus causing the observed deficits (Watkins & Brown, 2002).

Support for an inhibitory deficit associated with rumination also comes from fMRI results in a study carried out by Berman et al. (2011), which consisted of both an experimental component and an fMRI component. The experimental component utilised a directed forgetting task, similar to those carried out Joormann and Gotlib (2008) and Zetsche et al. (2012), the results of which showed that ruminators had significantly more difficulties removing negative words from short-term memory than non-ruminators, and that as rumination increased so did the level of difficulty (Berman et al., 2011). The fMRI results from this study support the experimental results in that ruminators exhibited significantly greater variance of activation in the left inferior frontal gyrus, an area that is associated with inhibiting irrelevant material, than non-ruminators, with ruminators showing a more diffuse pattern of activation, particularly for the negative affective words used (Berman et al., 2011).

Finally, a study carried out by Joormann (2006) examined deficits in inhibition using an affective negative priming task in which participants had to inhibit one word while

deciding if a target word was self-referential. This target word was either positive or negative in affect and in some trials was the word they had ignored in the previous trial. The study found that participants who scored low in rumination responded slower to both positive and negative words that they had been shown previously, signifying that inhibition of that word had occurred. However, participants who scored high in rumination exhibited no slowed responding for words that they had been shown before, indicating a deficit in inhibition, a result that was found to not be mediated by level of depression or the affect of the words (Joormann, 2006). This experiment was a follow-up to an earlier negative priming experiment which examined the relationship between depression and inhibition (Joormann, 2004). The results of this study found an inhibitory deficit for negative information in those with depression, as evidenced by a failure to produce slowed responding to repeated words compared with controls, a result that was found to be related to rumination and not depression in the subsequent study (Joormann, 2004, 2006). The article carried out by Joormann (2006) appears to be the only research to examine the relationship between rumination and inhibition using a negative priming paradigm.

1.4 Negative Priming

As described above, there are several methods that have the potential to directly test the degree of inhibitory functioning and measure individual differences. Of these designs, negative priming (Neill, Valdes, & Terry, 1995; Tipper, 1985) is commonly used while researching inhibition in depressed or dysphoric populations as it can quantify the strength of the inhibitory processes and allows for comparisons between different affective stimuli (Joormann, 2006). This makes negative priming an appropriate method for measuring inhibitory deficits in rumination. It also easily accommodates the use of verbal stimuli which is appropriate due to the verbal nature of ruminative thoughts (Beckwé et al., 2014). The

negative priming effect is defined as the reaction time difference between trials in which an ignored word subsequently becomes the target word (ignored repetition trials) and trials in which the ignored word is unrelated to the subsequent target word (unrelated control trials) (Henson, Eckstein, Waszak, Frings, & Horner, 2014; Joormann, 2006; Mayr & Buchner, 2007). The negative priming effect is typically displayed with a slowing of response time and/or more error-prone reactions for ignored repetition trials (Henson et al., 2014; Mayr & Buchner, 2007).

Typically negative priming experiments consist of a pair of trials, a prime trial and a probe trial (Christie & Klein, 2008; Joormann, 2004). In each trial a pair of stimuli (frequently words) are presented, one serving as a distractor, which participants are instructed to ignore, and one serving as a target, which participants are instructed to respond to (Joormann, 2004; Kramer & Strayer, 2001). The critical condition in negative priming is the ignored repetition condition in which the prime distractor, which was ignored, becomes the probe target, which is to be responded to (Christie & Klein, 2008; Grison & Strayer, 2001). As stated above, the negative priming effect is assessed by comparing the reaction times or error rates for the ignored repetition trials to the reaction times or error rates for the unrelated control condition trials, in which the prime distractor and probe target are unrelated to one another (Christie & Klein, 2008). Importantly, research has shown that the negative priming effect only occurs when participants are unaware of the ignored repetition condition, that is that they do not notice that prime distractors sometimes become probe targets, and when there is a probe distractor accompanying the probe target that is similar enough that they cannot be easily distinguished (Mayr & Buchner, 2007; Moore, 1994). In experimental conditions where participants can detect the relationship between prime distractors and probe targets or where the probe target is easily distinguished from the probe distractor negative priming does not occur and, indeed a facilitatory effect is often seen, as displayed by faster

responding to ignored repetition trials or positive priming (Mayr & Buchner, 2007; Moore, 1994).

The negative priming effect has been shown to particularly robust, having been observed with a range of populations, including older adults (Gamboz, Russo, & Fox, 2002), children (Pritchard & Neumann, 2004), schizophrenics (Moritz, Jacobsen, Mersmann, Kloss, & Andresen, 2000; Zabal & Buchner, 2006), and with a range of stimuli, including letters (Tipper & Cranston, 1985), words (Joormann, 2004), pictorial objects (Tipper, 1985), and even auditory stimuli (Banks, Roberts, & Ciranni, 1995; Zabal & Buchner, 2006). Negative priming has even been observed when the stimuli change modalities from prime to probe trial, for example from auditory to visual and vice versa (Buchner, Zabal, & Mayr, 2003; Driver & Baylis, 1993) and with a range of response types, such as naming (Grison & Strayer, 2001), localisation (Tipper, Brehaut, & Driver, 1990), and categorisation (Neumann, McCloskey, & Felio, 1999).

1.4.1 Theories of Negative Priming

The mechanisms through which negative priming occurs is a subject of much debate (Mayr & Buchner, 2007; Neumann et al., 1999; Tipper, 2001). At present there are two prevailing theories that strive to explain this effect; the distractor inhibition model (Houghton & Tipper, 1994; Tipper, 1985) and the episodic retrieval model (Neill & Valdes, 1992; Neill, Valdes, Terry, & Gorfein, 1992).

The distractor inhibition model posits that target information is enhanced through excitatory mechanisms while distractor information is simultaneously suppressed by an inhibitory mechanism, a theory which stems from the dual-process models of attention (Neumann et al., 1999; Tipper, 2001). This model holds that the negative priming effect is a result of the inhibitory mechanism, advancing that when a irrelevant distractor item is

presented it is actively inhibited to the degree that when the item becomes task relevant the processing of it continues to be impaired (Mayr & Buchner, 2007; Tipper, 2001).

The episodic retrieval model rejects the account that the inhibitory mechanism is responsible for negative priming and posits instead that it is the result of a retrieval mechanism (Mayr & Buchner, 2007; Neumann et al., 1999). According to this model, when an item is presented it cues the retrieval of previous episodes involving the same item to facilitate recognition. These previous episodes include information about the response that was made to that item, for example a distractor item would be associated with a "do not respond" tag (Tipper, 2001). In the case of negative priming, the probe target item cues the retrieval of the previously shown prime distractor and the "do not respond" tag, as there is a conflict between the response required for the probe and the items response tag the response to the probe is impaired, creating the negative priming effect (Mayr & Buchner, 2007).

While much research has been carried out on the two different models there is no definitive evidence for the accuracy of one model over the other (Mayr & Buchner, 2007; Tipper, 2001), largely because one of the difficulties in researching the two models is that they generally make the same predictions for negative priming outcomes (Neumann et al., 1999). An exception to this is in experiments that examine spreading activation, in which an underlying semantic network activates not only the item seen in the experiment but also related items (Mayr & Buchner, 2007). According to the distractor inhibition model inhibition can also spread, for example an ignored picture of a cat can cause a response delay to a picture of a dog, as shown in the original negative priming experiment carried out by Tipper (1985). This is different from the episodic retrieval model in which specific instances are retrieved, for example the item cat would activate a previous instance of a cat being shown and nothing else (Mayr & Buchner, 2007). Therefore, instances of negative priming as

a result of spreading inhibition support the distractor inhibition model and not the episodic retrieval model.

Spreading inhibition was researched in a cross-language priming study carried out by Neumann et al. (1999). This study consisted of two experiments, one unilingual (English) and one bilingual (English-Spanish), in which participants were required to name the target word aloud for the prime trial and then make a lexical decision about whether the probe target word was an actual word, in English for the first experiment and in Spanish for the second (Neumann et al., 1999). For both experiments, the target and distractor words were displayed one above the other with the target word being in lowercase letters and the distractor word in uppercase letters. The prime display was presented either centred on the screen or offset to the left or right slightly, while the probe display was always centred on the screen. The two experiments differed only in the language used for the probe target, English for the first experiment and Spanish for the second. For the ignored repetition trials of the second experiment the probe targets were the Spanish translations of the previously shown prime distractors. The two models make identical predictions for the outcome of the first experiment, that there will be a negative priming effect; however for the second experiment the predictions the models make are entirely different. For the second experiment the distractor inhibition model predicts that there will be negative priming due to spreading inhibition from the English words to the Spanish words. The episodic retrieval model predicts that there will no negative priming as the specific probe target used has never been seen before (Neumann et al., 1999). The results of this study support the distractor inhibition model with significant negative priming effects being observed for both the unilingual Experiment 1 and the bilingual Experiment 2, indicating spreading inhibition (Neumann et al., 1999).

Alternative evidence that inhibition occurs with salient but distracting stimuli comes from a neurophysiological measure of suppression (Gaspar & McDonald, 2014) in which event-related potentials are measured in the brain to see if ignoring a salient (eye-catching) distractor and attending to a target was the result of suppressing or inhibiting the distractor or of increasing the priority or activation of the target. The results showed that during a searching task the salient distractor elicited an electrophysiological suppression response that minimised the impact of the distractor on subsequent stages of processing (Gaspar & McDonald, 2014), a result very similar to what is proposed to occur during negative priming according to the distractor inhibition model (Grison, Tipper, & Hewitt, 2005; Tipper, 2001).

The main evidence for the episodic retrieval model comes from negative priming studies in which in the interval between the participant's response and the presentation of the next stimulus, the response-to-stimulus interval, is manipulated (Mayr & Buchner, 2007). Neill and Valdes (1992) discovered that when the response-to-stimulus interval was varied that the size of the negative priming effect was dependent not only on the size of the interval between prime and probe but also on the ratio of this interval to the preceding response-to-stimulus interval. This finding indicates that large priming effects should be found for trials with a short response-to-stimulus interval when they are preceded by trials with a long response-to-stimulus interval and little or no priming effects should be found when a trial with long response-to-stimulus interval is preceded by a trial with a short one (Mayr & Buchner, 2007). The results from the follow-up study carried out by Neill et al. (1992) support this claim with the largest priming effects being found when the response-to-stimulus intervals went from 4000ms to 500ms and the smallest when the intervals went from 500ms to 4000ms. This is a result that cannot be fully explained by the distractor inhibition model where negative priming should only depend on the response-to-stimulus interval between prime and probe (Mayr & Buchner, 2007).

Further evidence for the episodic retrieval model comes from studies which varied the contextual similarities between the prime and the probe and found that priming was greater when the prime and probe were more contextually similar (Fox & De Fockert, 1998; Mayr & Buchner, 2007). For example, Fox and De Fockert (1998) varied the intensities of the prime and probe targets, making them either bright or dim, and found that the priming effect was larger when the intensities matched, i.e. when both the prime and the probe were either bright or dim. This is held as evidence for the episodic retrieval model as priming was greater when participants were shown identical probes to the prime they were just shown, suggesting that they were retrieving specific target representations (Mayr & Buchner, 2007). However, it is important to note that a trend towards negative priming was still found in trials were the intensity of the prime and probe were changed, i.e. going from bright to dim or vice versa, indicating that some spreading activation was occurring (Fox & De Fockert, 1998), an event that is best explained by the distractor inhibition model.

It has been pointed out that the main difference between the two models is the temporal direction of the effect, with the distractor inhibition model acting from prime to probe, forward in time, and the episodic retrieval model acting from probe to prime, back in time (Neill et al., 1995). In light of this, it was put forward by Tipper (2001) that the two models differ only in the emphasis that they place on the sequence of the process, i.e. forward-acting (encoding) versus backward-acting (retrieving), and that, though they have been treated as such, the two theories are not mutually exclusive. He suggests that an integrated model of negative priming may be more accurate in which there is an episodic retrieval of prior inhibitory states (Tipper, 2001). Indeed, the author suggests that this integrated model can better explain those aspects of priming that have previously been used as evidence for the episodic retrieval model, such as negative priming found when the response-to-stimulus intervals and contextual similarities were varied (Tipper, 2001). Tipper

(2001) believes that this model is particularly important in explaining the existence of long-term priming, that the long delays between the display of the prime and the probe require both retrieval and inhibition.

Evidence of long-term priming has been found in several studies with delays ranging anywhere from seven seconds to one month (DeSchepper & Treisman, 1996; Grison et al., 2005; Tipper, Weaver, Cameron, Brehaut, & Bastedo, 1991). Tipper et al. (1991) showed that inhibition could last at least seven seconds after the display of the prime and that this was unaffected by intervening trials, using both identification and location tasks. Negative priming from novel shapes was found by DeSchepper and Treisman (1996), lasting across 200 intervening trials and with delays of up to a month, even without explicit memory of shapes ever being presented. Interestingly, this research found individual differences in priming with only those producing negative priming in the short-term producing it in the long-term. In fact, those participants who failed to produce priming at short intervals but still successfully ignored the prime distractor showed increased facilitation over time (DeSchepper & Treisman, 1996). Long-term Negative priming was also found across all participants after a delay of three minutes and with 56 intervening displays in a study carried out by Grison et al. (2005) using meaningful face and object stimuli. The three studies described above provide evidence for the existence of long-term priming, suggesting that memory traces can be formed even for irrelevant information and that these traces can effect behaviour over time (Grison et al., 2005).

All three teams of researchers agreed that the existence of long-term negative priming effects were likely due to long-term inhibitory traces being established on internal representations of distractors items and then retrieved as a result of contextual cues (DeSchepper & Treisman, 1996; Grison et al., 2005; Tipper et al., 1991). Their suggestion fits with the proposal by Tipper (2001) that the episodic retrieval of prior inhibitory states

occurs in negative priming. Indeed, the proposal by Tipper (2001) can also account for the individual differences identified by DeSchepper and Treisman (1996) between those who showed negative priming and those who do not, which cannot be explained by transient inhibition (distractor inhibition), which would not last for a month or through intervening trials, or by response tags (episodic retrieval), as items labelled with a "do not respond" tag would not result in facilitated responding (Grison et al., 2005)

1.4.2 Stimulus-Response Bindings

The integrated model proposed by Tipper (2001) implies that inhibitory and retrieval processes cannot be separated when explaining negative priming results, however a recent study carried out by Henson et al. (2014) suggested that the retrieval of response tags, which he called stimulus-response bindings, could be controlled for, meaning that any priming results found would be the result of inhibition. He stated that the results from negative priming experiments are confounded by the activation of stimulus-response bindings, making it difficult to ascertain whether negative priming effects are the result of inhibition or the result of the bindings (Henson et al., 2014). This makes it necessary to control for stimulus-response bindings when carrying out negative priming research in order to obtain a true measure of the negative priming effect. As such, Henson et al. (2014) recommended using different tasks for the prime and probe trials, suggesting that a naming task be used for one trial type and a classification task being used for the other, this would mean that the response tag for the prime distractor would not be in conflict with the response needed for the probe target as the action required is completely different. This is a method that has already been used successfully in the experiments carried out by Neumann et al. (1999), in which the participants named the prime target and then carried out a lexical decision (word or not a word) for the probe target. This further suggests that the results from the Neumann et al.

(1999) study can be attributed to the inhibitory mechanism, as stimulus-response bindings were controlled for.

1.4.3 Stimulus Repetition

Another area of debate in the realm of negative priming research has been whether negative priming can occur with only single presentations of a prime or whether multiple presentations are required (Mayr & Buchner, 2007). Malley and Strayer (1995) found negative priming effects when the stimuli were drawn from a limited pool of only 16 items and each word was frequently repeated but failed to find any negative priming effects when a large pool of stimuli was used with each item appearing only once. Grison and Strayer (2001) also found that negative priming was contingent upon stimulus repetition and Kramer and Strayer (2001) found that negative priming effects increased in magnitude with the repetition in stimuli. From this it was concluded that distractors are only inhibited if they are highly activated stimulus representations as stimulus representations with only a low activation level are not likely to interfere with responding and therefore do not need to be inhibited (Mayr & Buchner, 2007). However, several researchers have found that negative priming can occur after only a single presentation of a stimulus.

The experiment carried out by Grison et al. (2005), which found long-term negative priming after a delay of three minutes, used experimentally novel stimuli consisting of pictures of faces and objects that were presented only once. The long-term negative priming experiment carried out by DeSchepper and Treisman (1996) also used stimuli that were presented only once, in this case using shapes that were completely novel having been developed for the experiment. That the two long-term negative priming experiments used novel stimuli indicate that priming from a single presentation is not only possible but is incredibly robust (Mayr & Buchner, 2007). Further, the cross-language negative priming experiment by Neumann et al. (1999), which found both unilingual and bilingual negative

priming, used only singularly presented stimuli as well. These results call into question the conclusion that only highly activated distractors resulting from stimulus repetition can produce negative priming effects.

1.5 The Current Study

The current study aims to add to the literature on rumination and the negative emotional and cognitive outcomes it is associated with and will consist of two parts. The first part will explore the relationship between rumination and the negative emotional outcomes that have been identified in the literature, specifically depression, anxiety, and stress. It will also examine any influence that gender may have on these relationships. It will do this through the use of three different surveys, the first which measures rumination, the second which measures depression, anxiety, and stress, and the third which measures demographic characteristics such as gender. The second part of the study will explore the relationship between rumination and inhibition through the use of a negative priming task in which the priming effects of high ruminators and low ruminators are compared.

The negative priming paradigm used in this study is adapted from the Neumann et al. (1999) method which used a naming task for the prime and a lexical decision task for the probe trials, in line with the recommendation of Henson et al. (2014) for identifying true priming effects not confounded by stimulus-response bindings. The priming task will use words that are positive, negative, or neutral in affect and will have two conditions, the ignored repetition condition, in which the distractor becomes the target, and the unrelated control condition, in which the distractor and target are unrelated. The priming paradigm will also have some long-term priming trials as there appears to be no research examining long-term inhibitory effects in ruminators. Response times will be recorded and compared across conditions and across the participant groups.

The second part of the study also aims to add to the current literature in the area of negative priming around the methods necessary for the successful measurement of the negative priming effect. It will further examine the existence of priming effects with only single presentations of stimuli and will provide a measure of the priming effect that is not confounded by stimulus-response bindings.

The previous research described above has led to the formation of two hypotheses for the first part of the study. First, that rumination will be associated with higher levels of depression and anxiety, and second, that gender will mediate the relationship between rumination and depression. The previous research also led to the formation of three hypotheses for the second part of the study. Firstly, that high ruminators will show decreased negative priming compared with low ruminators as a result of an inhibitory deficit, as was discovered in the negative priming experiment of Joormann (2006). Secondly, that this reduction in negative priming will be greater when the ignored distractor is a negative word than when it is positive or neutral in affect, suggesting negative biases. Thirdly, that high ruminators will also show decreased long-term negative priming compared with low ruminators. A further two hypotheses pertain to the effectiveness of the negative priming method used. The first hypothesis is that the negative priming method used in this study will exhibit a negative priming effect, just as the Neumann et al. (1999) priming study did, and the second hypothesis is that this method will also produce long-term negative priming effects.

CHAPTER 2: METHOD I – QUESTIONNAIRES

2.1. Participants

Participants were recruited from amongst the students at the University of Canterbury from July to November 2014 via the university email system and university social media pages. A chance to win one of two $50 shopping mall vouchers was provided as an incentive to complete the survey. A total of 371 surveys were completed during that time with 290 being completed to the extent that they could be analysed. The participants included 79 males and 195 females with an average age was 23.88 (SD = 6.57). Informed consent was gained for each participant and permission to contact them for possible further participation was queried. The study itself and the surveys used were approved by the University of Canterbury Human Ethics Committee (Appendix A).

2.2 Measures

*Depression Anxiety Stress Scales (DASS)(*Lovibond & Lovibond, 1993). The DASS (Appendix B) is a 42-item questionnaire that contains three self-report scales measuring current ("over the past week") symptoms of depression, anxiety, and stress. The DASS has been found to be a reliable measure with excellent internal consistencies (Antony, Bieling, Cox, Enns, & Swinson, 1998; Clara, Cox, & Enns, 2001; Crawford & Henry, 2003; Page, Hooke, & Morrison, 2007) and favourable temporal stability (Brown, Chorpita, Korotitsch, & Barlow, 1997; Page et al., 2007). It has also been shown to have good construct and discriminant validity (Antony et al., 1998; Brown et al., 1997; Crawford & Henry, 2003; Lovibond & Lovibond, 1995), as well as convergent validity which is superior to other scales, including the commonly used and well-validated Beck Depression Inventory and Beck Anxiety Inventory (Brown et al., 1997; Crawford & Henry, 2003; Lovibond & Lovibond,

1995). The DASS was developed using, and normed on, non-clinical samples consisting predominately of Australian university students (Lovibond & Lovibond, 1995) making it an appropriate measure to use with this population.

Rumination-Reflection Questionnaire (RRQ) (Trapnell & Campbell, 1999). The RRQ (Appendix C) is a 24-item questionnaire that contains two scales, one assessing self-rumination and the other assessing self-reflection. This questionnaire defines rumination as recurrent thinking about the self, prompted by threats, losses, or injustices to the self (Trapnell & Campbell, 1999). It defines reflection as thinking about the self, motivated not by distress but by curiosity (Trapnell & Campbell, 1999). It has been shown to have good psychometric properties with excellent construct validity, convergent validity and internal consistency (Trapnell & Campbell, 1999). Similar reliability and validity have been demonstrated with a Japanese version of the scale (Takano & Tanno, 2009).

Demographic Questions. Participants were asked several demographic questions relating to their age, gender, university major, and whether or not they had ever been diagnosed with depression or another mental illness. They were also asked if they consented to being contacted for possible participation in the negative priming experiment, as well as a screening question relating to this.

2.3 Procedure

The recruitment blurb emailed to students and posted on social media pages contained a link to the survey website Qualtrics, on which all the questionnaires were run. Participants first read an information page and then filled out an online consent form. The participants filled out the DASS first, then the RRQ, and finally answered the demographic and follow-up experiment questions. For the DASS, participants were instructed to rate how much the 42 items applied to them over the past week on a four-point Likert scale from 0 (did not apply to

me at all) to 3 (applied to me very much, or most of the time). For the RRQ, participants were instructed to indicate their level of agreement or disagreement with the 24 items on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Results were then scored and those participants who received DASS scores of above 20 on the depression scale (severe) were contacted via phone to inform them of their results and suggest that they talk to their General Practitioner or a mental health professional, with an option also being given for at-risk participants to talk to a supervising clinical psychologist.

2.4 Data Analysis

This study assessed the relationship between rumination, depression, and gender using a hierarchical multiple regression in which the ability of rumination to predict depression was assessed, after controlling for gender. A standard multiple regression was also performed to assess the predictors of rumination, with rumination as the dependent variable and depression, anxiety, and stress as the predictor/independent variables. Two follow-up multiple regressions were performed for both the depression and the rumination regressions using the same variables, one with the female participants data and one with the male participants data.

The data was then split into two groups, high and low ruminators, with the differences between the two groups being examined on rumination, depression, anxiety, stress, age, and gender using a Mann Whitney-U test. Where significant results were obtained effect sizes were calculated using Cohen's d ($d = r/\sqrt{N}$) where a small effect size is 0.2, a medium effect size is 0.5, and a large effect size is 0.8, according to the guidelines laid out by Cohen (1988).

Before the analyses were carried out all relevant variables were examined for normality by performing visual checks of histograms and normality plots and by examining the skewness and kurtosis values to ensure that the appropriate test was being used. Other

assumptions of the relevant tests were checked statistically. Participants with missing data were excluded from the analyses. All analyses were performed using SPSS Statistics 22.

CHAPTER 3: RESULTS I – QUESTIONNAIRES

3.1 Distribution of Test Variables

The distributions of the rumination, depression, anxiety, and stress variables for the whole sample are presented in Appendix D, as is the distribution of gender. The skewness and kurtosis values are presented in Appendix E. The distribution of the rumination variable was approximately normal with a skewness value of -0.514 and a kurtosis value of -0.209. The remaining variables all had slight floor effects but were skewed in the same direction, a result that is expected due to the nature of the variables and the large sample size and does not violate assumptions of normality.

3.2 Descriptive Statistics

Descriptive statistics were calculated for each variable and are presented in Table 1 for the whole sample and for the male and female participants separately. The participants of this study had a mean of 3.46 (SD = 0.84) for rumination and a mean of 3.37 (SD = 0.73) for reflection, with the maximum average possible being five, this is similar to the averages found by the developers of the Rumination-Reflection Questionnaire in their original study (Trapnell & Campbell, 1999). The mean levels of rumination and reflection for males and for females were also similar to this. The average depression, anxiety, and stress scores for the whole sample were 6.52 (SD = 7.48), 5.09 (SD = 5.09), and 10.11 (SD = 7.13), respectively, out of a maximum of 42. These averages are similar to the Australian norms provided in the manual for the Depression Anxiety Stress Scales (DASS) (Lovibond & Lovibond, 1993). The male and female participants differed slightly on their mean scores with the males displaying higher mean levels of depression and slightly higher mean levels of anxiety and stress.

The manual for the DASS also provides severity categories ranging from normal to extremely severe (Lovibond & Lovibond, 1993) and the participants of this study were categorised according to their guidelines (Table 2). For depression, 77.6% (N = 225) of the participants were in the normal category, 8.3% were considered mild, 7.9% were moderate, 3.1% were severe and 3.1% (N = 9) were in the extremely severe category. For anxiety and stress the picture was similar with 75.9% and 79.3% respectively in the normal category. Males and females differed slightly in their severity categorisations with males showing greater percentages in the more severe categories for both depression and anxiety.

Based on the differences observed for males and females on the depression, anxiety, and stress scales independent means t-tests were carried out to examine any gender differences. The assumptions of a t-test, normality, homogeneity of variance and independence of observation, were examined and no violations were found. The results revealed no significant differences between the genders on any measure (all $t < 1$, ns), including rumination, reflection, depression, anxiety, stress, and age.

Table 1: Descriptive statistics for whole sample and female and male participants

Variable	**Whole sample**		**Females**		**Males**	
	N	Mean (SD)	N	Mean (SD)	N	Mean (SD)
Rumination	280	3.46 (0.84)	161	3.45 (0.813)	64	3.44 (0.964)
Reflection	274	3.37 (0.73)	160	3.30 (0.698)	63	3.33 (0.781)
Depression	290	6.52 (7.48)	165	5.65 (6.497)	67	7.67 (9.199)
Anxiety	290	5.09 (5.09)	165	4.78 (4.797)	67	5.33 (5.327)
Stress	290	10.11 (7.13)	165	9.76 (7.173)	67	10.03 (6.893)
Age	271	23.88 (6.66)	192	24.31 (7.147)	79	22.84 (5.168)

Table 2: Categorisation of DASS-42 scores for whole sample, and female and male participants

Variable	Category	Whole Sample	Females	Males
Depression	Normal	225 (77.6%)	132 (80%)	52 (77.6%)
	Mild	24 (8.3%)	15 (9.1%)	3 (4.5%)
	Moderate	23 (7.9%)	12 (7.3%)	5 (7.5%)
	Severe	9 (3.1%)	3 (1.8 %)	3 (4.4%)
	Extremely Severe	9 (3.1%)	3 (1.8 %)	4 (6%)
Anxiety	Normal	220 (75.9%)	124 (75.2 %)	53 (79.1%)
	Mild	22 (7.5%)	14 (8.4%)	2 (3%)
	Moderate	30 (10.4%)	19 (11.6%)	6 (8.9%)
	Severe	11 (3.8%)	5 (3%)	4 (6%)
	Extremely Severe	7 (2.4%)	3 (1.8%)	2 (3%)
Stress	Normal	230 (79.3%)	127 (77%)	55 (82.1%)
	Mild	26 (9.0%)	18 (10.9%)	4 (6%)
	Moderate	22 (7.6%)	13 (7.9%)	6 (8.9%)
	Severe	10 (3.4%)	7 (4.2%)	1 (1.5%)
	Extremely Severe	2 (0.7%)	0 (0%)	1 (1.5%)

3.3 Predictors of Rumination

Bivariate correlations were performed on the variables of interest to examine the relationship between rumination, depression and the other variables measured. The correlations of rumination and depression with age, reflection, and previous incidences of mental illness all failed to reach significance (all $r < 0.1$, ns.) and so these variables were not included in any analyses. The relationship between rumination and depression was significant

($r(262) = 0.393$, $p < 0.001$), as was ruminations relationship with anxiety ($r(262) = 0.401$, $p < 0.001$) and stress ($r(262) = 0.450$, $p < 0.001$). Depression was also significantly correlated with anxiety ($r(262) = 0.516$, $p < 0.001$) and stress ($r(262) = 0.628$, $p < 0.001$). These correlations are presented in Table 3, as are the correlations between gender, rumination and depression, although these were not significant.

Table 3: Bivariate correlations between rumination, depression, and other variables of interest (Pearson r; sig. 2-tailed)

Variable	**N**	**Rumination**	**Depression**
Rumination	262	r = 1.000	r = 0.393 (p < 0.001)
Depression	262	r = 0.393 (p < 0.001)	r = 1.000
Anxiety	262	r = 0.401 (p < 0.001)	r = 0.516 (p < 0.001)
Stress	262	r = 0.450 (p < 0.001)	r = 0.628 (p < 0.001)
Gender	211	r = -0.072 (p = 0.295)	r = 0.026 (p = 0.351)

On the basis of the significant correlations between rumination and depression, anxiety, and stress (Table 3) a standard multiple regression model was carried out to assess the relative contributions of these variables towards explaining the variance of rumination. Preliminary analyses were conducted to ensure that there were no violations of the assumptions of normality, linearity, multicollinearity, and homoscedasticity, and that the sample size was large enough for the number of predictors being analysed. The model explained 22.7% of the variance in rumination ($F(3, 261) = 26.494$, $p < 0.001$) with stress making the largest unique contribution (beta = 0.248, $p < 0.01$). Depression (beta = 0.158, $P < 0.05$) and anxiety (beta = 0.154, $p < 0.05$) were also found to make significant, though lesser, contributions. A follow-up model which included gender as a predictor was also run but this did not add anything to the explanation of rumination and gender was not found to be

a significant contributor (p = 0.269). The addition of gender to the model also did not alter the unique contribution that depression made to the explanation of rumination.

Based on the literature around gender differences in rumination and depression two further regressions were performed, one using only the data from female participants and the other using only the data from male participants. After checking for violations of the assumptions the two regressions were carried out using the same variables as the whole sample regression. The model of the female data was found to explain 24.9% of the variance in rumination (F (3, 153) = 17.93, P < 0.001) with depression (beta = 0.243, p < 0.05) and stress (beta = 0.280, p < 0.05) making significant unique contributions. Anxiety did not make a significant contribution to this model (p = 0.565). The model of the male data found that depression, anxiety, and stress explained slightly less of the variance in rumination with 22.2% (F (3, 56) = 6.338, p = 0.01). Interestingly, the only variable to make a significant contribution was anxiety (beta = 0.448, p < 0.05), the opposite result to that found in the female model. The above results suggest that depression, anxiety, and stress contribute to the explanation of rumination but that their relative contributions may differ between the genders, although this possible gender difference was not tested statistically.

3.4 Rumination, Gender, and Depression

A hierarchical multiple regression was used to assess the ability of rumination to predict levels of depression after controlling for the influence of gender. Preliminary analyses were again conducted and no violations were found. Gender was entered into the hierarchical regression at Step 1 and was not found to explain any of the variance in depression (R square = 0.001, F (1, 209) = 0.143, p = 0.706). Rumination was entered at Step 2 and was found to explain an additional 15.7% of the variance in depression after controlling for gender (R square change = 0.157, F change (1, 208) = 38.716, p < 0.001). In this model rumination

made the only significant contribution to the explanation of depression (beta = 0.397, $p < 0.001$), gender was not found to make a significant contribution ($p = 0.390$). These models suggest that for this sample gender did not predict level of depression, nor did it mediate the relationship between rumination and depression. A result that is perhaps not surprising given that t-tests indicated no gender differences in either rumination or depression.

Based on the significant correlations between depression and anxiety and stress (Table 3) a third step was added into the regression in which anxiety and stress were input as predictors. This third model explained an additional 26.8% of the variance in depression, after controlling of gender and rumination (R square change = 0.268, F change (2, 206) = 47.918, $p < 0.001$). This final model explained 41.4 % of the variance of depression ($F (4, 206) = 38.07$, $p < 0.001$) with stress again making the largest unique contribution to the explanation of depression (beta = 0.476, $p < 0.001$), followed by anxiety (beta = 0.147, $p < 0.05$) and rumination (beta = 0.123, $p < 0.05$). Gender once again did not make a significant contribution ($p = 0.311$).

Again, based on the literature around gender differences two further regressions, split by gender, were carried out using the same variables as the hierarchical regression. The female data regression explained 45.1% of the variances in depression with stress (beta = 0.459, $p < 0.001$) and rumination (beta = 0.181, $P < 0.05$) both making significant unique contributions. The male data regressions explained 49.9% of the variance in depression with only stress making a significant contribution (beta = 0.574, $p < 0.001$). These results suggest that the predictors of depression may also differ slightly between the genders, however again this has not been tested statistically.

3.5 Grouping

As the data will be split into ruminators and non-ruminators in order to assess the negative priming results in part II, the survey data was also split to explore any differences that may exist. The data was split using Visual Binning, a method of identifying suitable cut-off points based on percentages. The data was split into seven groups based on rumination scores with the bottom three being combined to form the non-ruminator group and the top three being combined to form the ruminator group, leaving a gap between the two groups. The non-ruminator group had ruminations scores that ranged between 1.17 and 3.42 and consisted of 96 participants. The ruminator group had scores ranging between 3.58 and 5.00 and consisted of 115 participants. The descriptive statistics of the two group's survey results are presented in Table 4 for the non-ruminator group and Table 5 for the ruminator group.

Table 4: Descriptive statistics for non-ruminator group

Variable	**N**	**Mean**	**SD**
Rumination	96	2.64	0.59
Reflection	117	3.29	0.72
Depression	96	3.53	4.57
Anxiety	96	2.93	3.74
Stress	96	6.83	5.69
Age	96	24.26	6.73

Table 5: Descriptive statistics for ruminator group

Variable	**N**	**Mean**	**SD**
Rumination	115	4.11	0.39
Reflection	140	3.36	0.76
Depression	115	9.08	0.82
Anxiety	115	6.84	5.35
Stress	115	12.93	7.29
Age	115	23.71	5.97

The distributions of the two groups on the rumination, depression, anxiety, and stress scores, and all selected demographic variables are presented in Appendix F. The skewness and kurtosis values for those variables are presented in Appendix G. As the distributions and skewness and kurtosis values revealed that most of the variables were non-normally distributed non-parametric tests were used to evaluate any group differences between ruminators, and non-ruminators, specifically the Mann Whitney-U test of significance.

Testing revealed that the two groups differed significantly on rumination ($U = 0.000$, $z = -13.928$, $p < 0.001$), the result was in the expected direction and produced a large effect ($r = 0.86$). The two groups also differed significantly on depression ($U = 4469.00$, $z = -6.592$, $p < 0.001$), anxiety ($U = 4467.00$, $z = -6.604$, $p < 0.001$), and stress ($U = 4205.00$, $z = -7.009$, $p < 0.001$), with the ruminator group showing significantly higher scores as indicated by the higher medians for that group (Table 6), all three differences produced a medium effect ($r = 0.41$, 0.41, and 0.43 respectively). The two groups did not differ significantly on age ($p = 0.345$) or on level of reflection ($p = 0.499$) and the proportion of males to females was the same in each group ($p = 1.000$). These results indicate that rumination is associated with higher levels of depression, anxiety, and stress.

Table 6: Median depression, anxiety, and stress scores for the ruminator and non-ruminator groups

Group	**Depression**	**Anxiety**	**Stress**
Non-ruminator	2.00	2.00	6.00
Ruminator	7.00	5.00	12.00

CHAPTER 4: METHOD II – NEGATIVE PRIMING

4.1 Participants

Participants were recruited from among those Part I participants who consented to be contacted for further participation via email or text, depending on the preference of the participant. This resulted in 90 participants (23 male; 67 female) with an average age of 24.70 (SD = 6.45). The participants were given a $10 shopping mall voucher as an incentive to take part and informed consent was obtained for each participant before beginning the experiment (Appendix H). This part of the study was also approved by the University of Canterbury Human Ethics Committee (Appendix A).

4.2 Inclusion Criteria

As part of the criteria, participants were required to have depression scores within the normal to mild range on the DASS (Lovibond & Lovibond, 1993) so that any results found could be attributed to rumination and not to underlying depression. Participants were also required to have English as their first language to ensure that they would have a large enough vocabulary to recognise the majority of the stimuli and minimise the number of errors. Those who had depression scores in the moderate and above range and those who did not speak English as a first language were excluded from recruitment.

4.3 Measures

Depression Anxiety Stress Scales – Depression scale (DASS-D)(Lovibond & Lovibond, 1993). As the DASS is a measure of current symptoms occurring within the past week, and as the delay between the participants filling out the online surveys and completing the experiment was often more than a week, the depression scale of the DASS was re-administered to the participants to ensure that their current level of depression was still in the

normal to mild range. The rumination scale was not re-administered as it is a trait measure whose validity is not time-limited.

4.4 Stimuli

The stimuli for Part II were selected from the Affective Norms of English Words (ANEW), a standardised set of affective words, developed at the Centre for the Study of Emotion and Attention (CSEA) at the University of Florida (Bradley & Lang, 2010). The ANEW gives the pleasure (affect; happy versus unhappy), arousal (excited versus calm), and dominance (controlled versus in-control) ratings of almost 2500 English words (Bradley & Lang, 2010). From this list 1688 words were selected for use in the experiment based on their length, their arousal rating, and their affective rating. The words selected were required to be between three and seven letters long to maximise the participants chances of recognising the words and correctly reading them aloud. The words were also required to have an arousal rating of less than 7.5 to ensure that participants were not presented with words that they might have a strong reaction to. The affective ratings of the words were important as the words were split into three main lists based on whether they had a positive, negative, or neutral affective rating, with an affective rating of six or more being required for the positive list, four or less for the negative list, and between four and six for the neutral word list. Based on the above criteria 1232 words were selected for the positive, negative, and neutral word lists with 411 words in both the negative and positive word lists and 410 words in the neutral list. A further 456 words were selected and were turned into non-word stimuli by switching the position of two consonants to create orthographically-legal (pronounceable) non-words. Descriptive statistics for the four word lists are provided in Table 7. The positive word list had an average valence of 6.76 (0.43) and an average arousal rating of 5.16 (0.61). The negative word list average valence was 3.02 (0.63) with an average arousal rating of 5.19

(0.82). The average valence of the neutral word list was 5.11 (0.58), with an average arousal rating of 5.14 (0.54). There was a statistically significant difference between the affective ratings of the three lists ($F(2, 1229) = 4709.48$, $p < 0.001$) and post-hoc tests confirmed that there was a significant difference between all three of the lists (all $p < 0.001$). The four lists did not differ on arousal rating ($F(3, 1684) = 0.177$, $p = 0.912$) or on average word length ($F(3, 1684) = 0.086$, $p = 0.968$) with the lists having average word lengths of 5.18 (0.93), 5.18 (1.11), 5.15 (1.05), and 5.16 (1.37), respectively.

Table 7: Descriptive statistics of word-list stimuli

Word list	**N**	**Valence M (SD)**	**Arousal M (SD)**	**Word Length M (SD)**
Positive	411	6.76 (0.43)	5.16 (0.61)	5.18 (0.93)
Negative	411	3.02 (0.63)	5.19 (0.82)	5.18 (1.11)
Neutral	410	5.11 (0.58)	5.14 (0.54)	5.15 (1.05)
Non-word	456	N/A	5.17 (1.18)	5.16 (1.37)

During the course of the experiment each individual target and distractor word/non-word were displayed only once, unless fulfilling the constraints of the ignored repetition condition. This was done to eliminate the possibility of familiarity effects and to ensure that any results would be true priming, as each word served only one capacity – an ignored repetition or an unrelated target.

4.5 Design and Procedure

This experiment assessed both short-term and long-term negative priming and had a between subjects factor (high or low ruminators) and two within subjects factors (Condition type [unrelated control or ignored repetition condition] and Word affect [positive, negative, or neutral affective word]). The layout and timing of the experiment was based upon the

negative priming protocol used in Experiment 1 of Neumann et al. (1999). In this negative priming task a fixation cross was presented for 500ms, the prime display was then presented for 200ms, followed by a blank screen presented for one second to give participants time to read the prime target aloud, and finally the probe display was presented until the participants made a lexical decision, whether the target was a word or not. The start of the next trial was signified by the return of the fixation cross. The prime and probe displays both consisted of two words, one above the other with the vertical space between the words being approximately 0.4° of visual angle apart. Target words were presented in lowercase letters and distractor words were presented in uppercase letters with the target words being presented on top 50% of the time. Prime displays were presented either centred on the computer screen or to the right or left of the centre, with the innermost edge of the stimuli about 2.0° of visual angle to the right or left of the centre point, respectively. The positions of the prime displays were determined, pseudo-randomly, in equal proportions for right, left, and centre. The probe displays were always presented in the centre of the screen. The experimental layout for each condition and each affect type is presented in Table 8. The whole protocol was designed and run with the E-Prime 2.0 software package and a serial mouse was used to accurately record response times, where the left button was clicked when the target was a word and the right button was clicked when the target was a non-word.

Table 8: Experiment Layout for each condition and affect, with display times

Affect	**Condition**	**500ms**	**200ms**	**1000ms**	**Until Lexical Decision is made**
Negative	Unrelated control condition	+	fury ALIEN	Blank Screen	CRUDE sewage
	Ignored repetition condition	+	culture EVIL	Blank Screen	evil HUMANE
Neutral	Unrelated control condition	+	TURTLE brother	Blank Screen	TOTBLE defiant
	Ignored repetition condition	+	COMMAND fear	Blank Screen	ENABLE command
Positive	Unrelated control condition	+	STORM vote	Blank Screen	HOCKEY attend
	Ignored repetition condition	+	GYMNAST gate	Blank Screen	PICNIC gymnast

In order to assess both short-term and long-term negative priming the experiment was partitioned into three sections, one after the other, with a brief reminder of the instructions between each section. Section I consisted of both short-term prime-probe couplets (the prime and the probe it is coupled with) and long-term primes, section II consisted of short-term prime-probe couplets and also acted as filler trials for the long-term priming condition, and section III displayed the long-term target probes as well as having further short-term prime-probe couplets.

All three sections followed the same layout and timing and consisted of 144 prime-probe couplets. In each section, 72 of the trials had word-targets and 72 had non-word targets.

For the word-target trials there were four conditions: (1) Short-term Unrelated control condition, in which all stimuli in both the prime and probe trials were different; (2) Long-term Unrelated control condition, which consisted of the unrelated control trials from section III; (3) Short-term ignored repetition condition, in which the probe target was the same as the prime distractor that immediately preceded it; and (4) Long-term ignored repetition condition, in which the probe target (presented in section III) was the same as a prime distractor presented in the first section of the experiment. Each condition also had three subtypes of words: positive, negative, and neutral affect, based on the affect of the probe target word, resulting in 12 trial types of interest. This was done to detect if the affect of the words influenced the magnitude of negative priming, and whether these were systematically affected by rumination status.

The words used in the experiment were sorted pseudo-randomly so that there were an equal number of positive, negative, and neutral word trials in each condition. The words were also sorted pseudo-randomly so that the number of affective words for the prime target and prime and probe distractors was also equal. For the prime display participants had to read aloud the target word while ignoring the distractor word and for the probe display the participants made a lexical decision (word or non-word) response by clicking the left button of the serial mouse if the target was a word and the right button if the target was a non-word, while ignoring the probe distractor, which was either a word or a non-word. Participants were instructed to try to name the lowercase prime word as fast as they could and also make the word/non-word decisions as fast as possible, but to try not to make any errors during the entire experiment. They were also told that the uppercase words were included to make the tasks more difficult and that the better they ignored the uppercase words, the faster and more accurately they would be able to name the lowercase words. Participants completed 24

practice trials prior to beginning the first section of the experiment and completed six buffer trials at the beginning of each of the three sections.

The 72 word trials in section I consisted of 36 short-term ignored repetition trials and 36 unrelated control trials, with 12 positive, negative, and neutral trials in each condition. The prime distractors for the 36 unrelated control trials also served as the primes for the long-term ignored repetition trials in section III. Section II of the experiment was the same as section I except that it did not have any long-term prime words. For section III the 72 word trials consisted of 12 unrelated control trials (four positive, four negative, and four neutral) serving as control trials for both the short- and the long-term priming, 24 short-term ignored repetition trials (eight positive, eight negative, and eight neutral), and the remaining 36 word trials were long-term ignored repetition trials (12 positive, 12 negative, and 12 neutral). These trials had as targets the 36 prime distractor words from the unrelated control trials in section I, creating the standard ignored repetition prime-probe couplets from section I and II except that, in this case, the section II trials acted as fillers between the prime and probe displays. The probe targets for the long-term ignored repetition trials were presented in the same order as they were in section I, i.e. the unrelated control prime distractor from trial number six in section I becomes the target for trial number six of section III. This resulted in there consistently being 299 intervening trials between the presentation of the long-term primes in section I and their presentation as targets in section III, with delay of approximately 18 minutes.

In order to establish that effects could be attributed to the negative priming manipulation and not to order-effects or the specific words used, two versions of the experiment were created. This was done by having the probe targets fulfil a different condition in each version, with ignored repetition probe targets becoming unrelated control probe targets and unrelated control probe targets becoming ignored repetition probe targets.

This results in each probe target word serving as an ignored repetition probe target in one version and an unrelated control probe target in the alternate version. Unfortunately, only the short-term priming trials were counterbalanced effectively with the long-term trials not being adequately counterbalanced to allow for a valid interpretation of the long-term priming results. The use of the two versions of the experiment was alternated and half of the participants did one version whereas the other half did the other version.

A catch trial was also inserted at the end of the experiment in which the participant was shown a prime display and then had to choose from two options what was the prime distractor they had just been shown. This was done in order to ensure that the prime distractor was in fact ignored. The correct answer (A or B) was different in the two counterbalanced versions of the experiment and three different words were alternated as the prime distractor. The position of the three different prime distractors was also alternated (centre, left, or right). This created nine different versions of the catch trial for each version of the experiment (18 versions in total) that were alternated for each participant, i.e. the first and tenth participant for each counterbalanced version did the first version of the catch trial, the second and eleventh participant did the second version, and so on. The multiple versions of the catch trial were created so that a chance level result (fifty percent correct) would indicate that the participants were not seeing prime distractor and were therefore guessing the answer.

4.6 Data Analysis

The responses to both the prime and probe targets of the word trials were recorded, but only trials in which the participant correctly named the prime target and made the correct lexical decision were included in the reaction time analysis. Trials with extreme reaction times (below 300ms and above 2500ms) were also removed from the analyses in accordance with standard procedures (Joormann, 2006). For each participant the median reaction times

were calculated for each condition, unrelated control, ignored repetition, long-term unrelated control, and long-term ignored repetition. Each condition was then divided into the three affects, negative, neutral, and positive.

Before the results were analysed the participants were split into two groups, non-ruminators and ruminators. This split was performed using visual binning, in which the data was split into seven equal percentage groups based on rumination scores with the bottom three being combined to form the non-ruminator group and the top three being combined to form the ruminator group, leaving a gap between the two groups. The non-ruminator group consisted of 44 participants and had an average rumination level of 2.60 (SD = 0.69). The ruminator group consisted of 39 participants and had an average rumination level of 4.06 (SD = 0.34).

The overall results were analysed using dependent means t-tests in which the unrelated control condition was directly compared to the ignored repetition condition. To analyse group differences, individual difference scores were calculated by subtracting the reaction times in the ignored repetition condition from the reactions in the unrelated control condition. These groups differences were then analysed using independent means t-tests and a one-way repeated measures ANOVA. Differences in affect were examined using both dependent and independent means t-tests for the short-term trials only as there were not enough long-term trials to analyse the impact of affect on long-term priming. Where parametric tests were inappropriate due to violations of normality, as assessed using histograms, normality plots, and skewness and kurtosis values, the equivalent non-parametric tests were used. For a dependent means t-test the Wilcoxon signed rank test was used instead, the Mann-Whitney U test was used instead of an independent means t-test, and a Friedman's test was used instead of the one-way repeated measures ANOVA. Power calculations were performed for all analyses in order to correctly identify whether or not differences exist.

Where significant results were obtained effect sizes were calculated using η^2 in which, according to Cohen (1988), 0.01 is a small effect, 0.06 is a medium effect, and 0.138 is a large effect. All analyses were carried out using IBM SPSS Statistics 22, except for the power calculations which were carried out using Statistica 12.

CHAPTER 5: RESULTS II – NEGATIVE PRIMING

5.1 Distribution of Test Variables

The distributions of the whole sample reaction times for the unrelated control condition and the ignored repetition condition are presented in Appendix I for both the short- and the long-term priming, as are the whole sample reactions times for the two conditions divided by affect and the distributions of the differences between the conditions. The skewness and kurtosis values are presented in Appendix J. The distributions for the two groups, non-ruminator and ruminator are provided in Appendix K, with the skewness and kurtosis data being presented in Appendix L. The distributions and skewness and kurtosis data for the error rates are provided in Appendices M and N, respectively. The distribution of the whole sample reactions times for the unrelated control condition was approximately normal (Figure 1) with a skewness value of 0.367 (Std. error = 0.154) and a kurtosis value of -0.533 (Std. error = 0.307). The distribution of the whole sample reaction times for the ignored repetition was also approximately normal (Figure 2) with a skewness value of 0.305 (Std. error = 0.154) and a kurtosis value of -0.425 (Std. error = 0.307). All other reaction times variables for both the whole sample and for the non-ruminator and ruminator groups were approximately normal. The majority of the error rate variables were not normally distributed, with the exception of the distributions of the differences, which were all normally distributed.

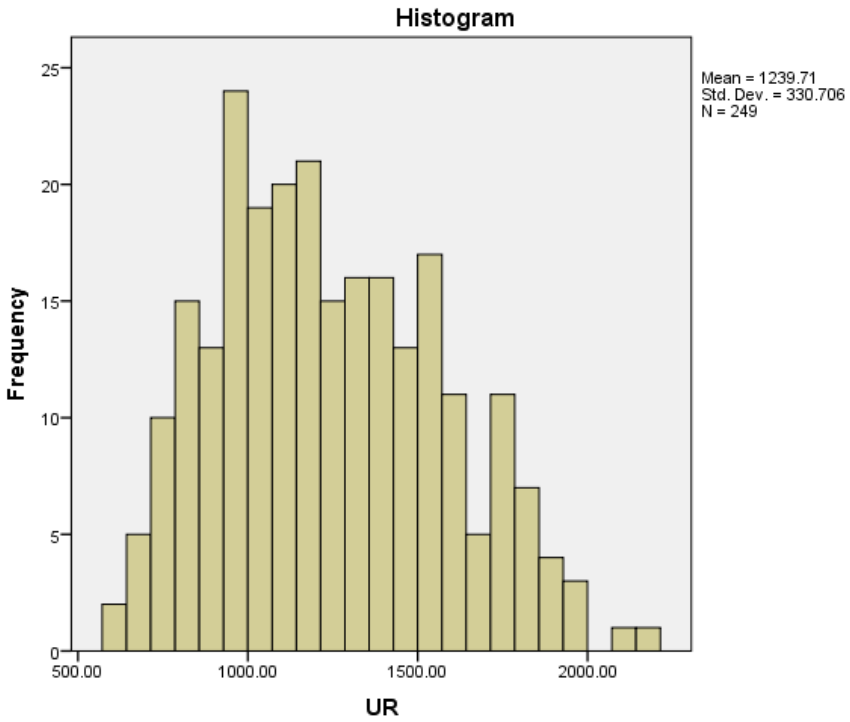

Figure 1: Distribution of the whole sample reaction times for the unrelated control condition

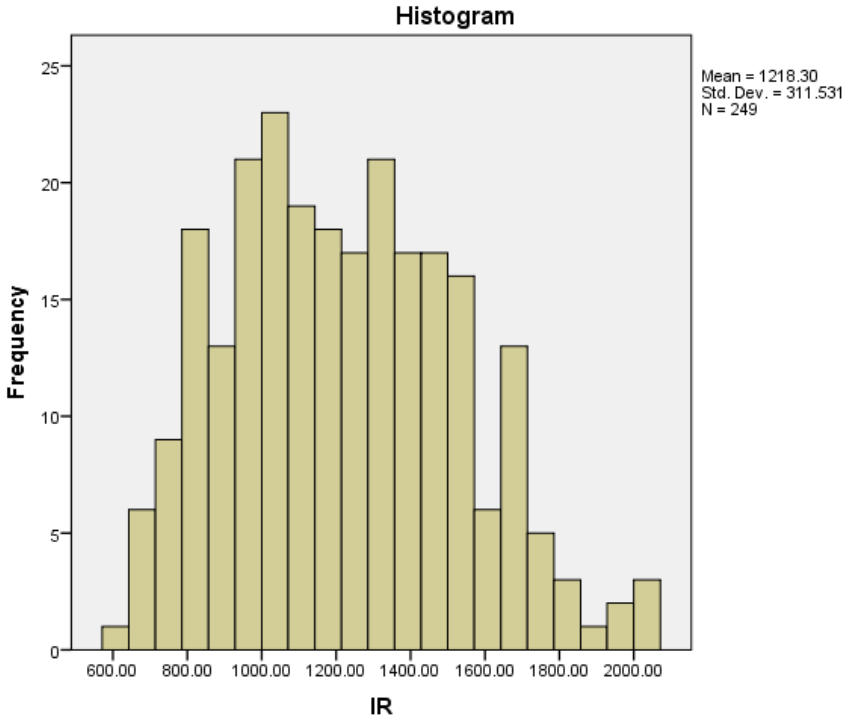

Figure 2: Distribution of the whole sample reaction times for the ignored repetition condition

5.2 Descriptive Statistics

Descriptive statistics for the whole sample reaction times are provided in Table 9 for both the short- and long-term negative priming trials and in Table 10 for the different affects, negative, positive, and neutral. The descriptive statistics of the difference scores are also provided. Overall the unrelated control condition had a mean of 1239.70 (SD = 330.71) and the ignored repetition trial had a mean of 1218.30 (SD = 311.53), yielding a mean difference of 21.41 (SD = 152.95) indicating a trend towards positive, and not negative, priming. Similar means are observed for the long-term trials with the unrelated control condition having a mean of 1121.04 (SD = 311.69) and the ignored repetition condition having a mean of 1079.51 (313.58), with the difference score for these conditions also indicating a trend towards positive priming (M = 41.52; SD = 215.76).

Table 9: Descriptive statistics for whole sample short-term trials and long-term trials

Condition	**N**	**Mean (SD)**
Unrelated control condition (UR)	249	1239.70 (330.71)
Ignored repetition condition (IR)	249	1218.30 (311.53)
Difference (UR – IR; DIFF)	249	21.41 (152.95)
Long-term unrelated control (LT UR)	249	1121.04 (311.69)
Long-term ignored repetition (LT IR)	249	1079.51 (313.58)
Long-term difference (LT DIFF)	249	41.52 (215.76)

Table 10: Descriptive statistics for whole sample short-term trials divided by affect

Affect	**Condition**	**N**	**Mean (SD)**
Negative trials	Unrelated control (UR NEG)	83	1227.70 (323.04)
	Ignored repetition (IR NEG)	83	1211.79 (316.73)
	Difference (NEG DIFF)	83	15.92 (157.78)
Neutral trials	Unrelated control (UR NEU)	83	1276.87 (651.22)
	Ignored repetition (IR NEU)	83	1249.96 (308.77)
	Difference (NEU DIFF)	83	26.92 (163.64)
Positive trials	Unrelated control (UR POS)	83	1214.54 (317.60)
	Ignored repetition (IR POS)	83	1193.15 (310.11)
	Difference (POS DIFF)	83	21.39 (137.92)

Descriptive statistics for the non-ruminator and ruminator groups are provided in Table 11. The non-ruminator group had a short-term mean difference of 20.29 (SD = 155.59) and a long-term mean difference of 43.13 (SD = 219.94). These mean differences are similar to those obtained for the ruminator group, 22.67 (SD = 150.93) in the short-term and 39.71 (SD = 211.87) in the long-term. These results do not appear to differ much from the means obtained from the whole sample.

Table 11: Descriptive statistics for the non-ruminator and ruminator groups

Group	**Condition**	**N**	**Mean (SD)**
Non-ruminator	Unrelated control condition (UR)	132	1246.10 (317.86)
	Ignored repetition condition (IR)	132	1225.81 (299.58)
	Difference (UR – IR; DIFF)	132	20.29 (155.59)
	Long-term unrelated control (LT UR)	132	1145.09 (298.10)
	Long-term ignored repetition (LT IR)	132	1101.96 (331.70)
	Long-term difference (LT DIFF)	132	43.13 (219.94)
Ruminator	Unrelated control condition (UR)	117	1232.50 (345.86)
	Ignored repetition condition (IR)	117	1209.83 (325.58)
	Difference (UR – IR; DIFF)	117	22.67 (150.93)
	Long-term unrelated control (LT UR)	117	1093.90 (325.50)
	Long-term ignored repetition (LT IR)	117	1054.19 (291.12)
	Long-term difference (LT DIFF)	117	39.71 (211.87)

5.3 Catch Trial Analysis

Before the negative priming results were analysed the catch trial responses were analysed to see if the proportion of participants who correctly identified the prime distractor was significantly different from chance level (50%), which would indicate that participants were attending to the words they were instructed to ignore. Of the 83 participants whose results were analysed, 40 participants (48.2%) correctly identified the prime distractor and 43 participants (51.8%) did not. A chi-square goodness-of-fit test indicated that the proportion of participants who correctly identified the prime distractor (48.2%) was not significantly different from chance level (50%, $p = 0.742$), suggesting that participants were successfully ignoring the prime distractor.

5.4 Overall Negative Priming

A dependent means t-test was carried out on the whole sample data to see if the differences between the unrelated control condition and the ignored repetition condition indicated by the means were significant. The results were first analysed to confirm that the assumptions of a t-test were upheld, that the distributions of the two variables and their difference scores were normally distributed and that the variances were homogenous. The results were significant for both the short-term ($t(248) = 2.209$, $p < 0.05$) and the long-term negative priming trials ($t(248) = 3.037$, $p < 0.01$), indicating that instead of negative priming, significant positive priming had occurred. The effect sizes of the short-term ($\eta^2 = 0.019$) and the long-term ($\eta^2 = 0.036$) priming trials were small and both tests achieved adequate power (97.19% and 99.74%, respectively). Further dependent means t-tests were carried out to examine differences between the unrelated control and the ignored repetition conditions in the short-term trials for the positive, negative, and neutral affects. The assumptions for these tests were checked and found to be upheld. No significant differences were found between the unrelated control condition and the ignored repetition condition for any of the three affects (all $t < 1$, ns). Power analyses for these three comparisons found that adequate power was achieved for the neutral and positive comparisons but not for the negative affect comparison, possibly explaining the lack of significant result. A follow-up one-way repeated measures ANOVA was carried out to see if there were any significant differences between the difference scores for the three affects, after checking that the additional assumption of sphericity was not violated. Again, the results were not significant ($p = 0.919$), however power was incredibly low for this comparison making interpretation difficult.

5.5 Group Effects

Independent means t-tests were carried out to check for group differences in priming response in both the short- and the long-term. After checking that the assumptions were not violated the t-tests were carried out revealing that there were no significant differences between the two groups on the difference scores in either the short- ($p = 0.903$) or the long-term trials ($p = 0.901$), however lack of power may have contributed to this result. Follow-up dependent means t-tests revealed that for both groups there was no significant difference when comparing the short-term unrelated control and ignored repetition conditions, contrary to what was found for the whole sample. Both tests were found to have power ratings of over 80% indicating that no short-term priming occurred for either group. Again instead of significant negative priming, significant positive priming was found for both the non-ruminator ($t(131) = 2.253$, $P = < 0.05$, $\eta^2 = 0.037$) and ruminator groups ($t(116) = 2.027$, $p < 0.05$, $\eta^2 = 0.034$) when the long-term priming trials were examined, with both tests achieving over 80% power. An independent means t-test was also carried out to see if there were any differences in the priming responses of males and females, the results were not significant for both the short- ($p = 0.751$) and the long-term priming trials ($p = 0.074$), although only the long-term comparison had adequate power. Finally, a two-way ANOVA was carried out to examine if there was any interaction between group, non-ruminator and ruminator, and affect, negative, neutral, and positive. The data used was normally distributed and the variance was homogenous so no assumptions were violated. No significant main effects were found for either group ($p = 0.903$) or affect ($p = 0.930$) and there was no interaction between valence and group ($p = 0.429$).

5.6 Error Rate Analysis

Due to a violation of the normality assumption the error rates were examined using the non-parametric alternatives of the tests above. The whole sample error rates were examined using a Wilcoxon signed rank test, revealing no significant negative priming in the short-term ($p = 0.069$) and significant positive, not negative, priming in the long-term ($Z = -2.438$, $p < 0.05$), a result which produced a small effect size ($r = 0.15$). Both tests achieved adequate power, with ratings of 98.51% and 99.96% respectively. A Mann-Whitney U test was performed to examine any group differences in the error rates, the results of which revealed no differences in either the short- or the long-term between the non-ruminators and ruminators ($p = 0.636$ and $p = 0.075$, respectively) or between males and females ($p = 0.323$ and $p = 0.154$, respectively), follow-up Wilcoxon signed rank tests confirmed this result. Unfortunately, the short-term results for group and gender did not achieve adequate power so results cannot be properly interpreted. Friedman's tests were used to examine any effect of valence on priming for the short-term trials, the results were not significant ($p = 0.177$), although again adequate power was not obtained. The expected significant negative priming was only found when comparing the short-term negative affect unrelated control and ignored repetition conditions ($Z = -2.446$, $p < 0.05$) with a small effect size ($r = 0.27$) and a power rating of 99.82%. However as this result contradicts the positive priming exhibited by all other significant analyses this is likely the result of a speed/accuracy trade off and thus the result is uninterpretable.

CHAPTER 6: DISCUSSION

6.1 Summary of findings and Interpretations

The current study examined the relationship between rumination and several of its associated negative outcomes. In part I of the study the impact of gender on the relationship between depression and rumination was examined. The relationship between rumination and the associated negative outcomes of depression, anxiety, and stress were also examined. Part II examined the relationship between rumination and the well-documented inhibitory deficit that is associated with it, through the use of a negative priming paradigm. It also examined the efficacy of the negative priming task which used only single presentations of stimuli and was not confounded by stimulus-response bindings.

Examination of the relationship between rumination and the variables of depression, anxiety, and stress found that the three variables were significant predictors of rumination, with stress making the largest unique contribution to the explanation of rumination. Depression and anxiety still made significant contributions to the explanation of rumination but less so than stress. A model which included gender as a predictor did not add the explanation of rumination and gender did not make a significant contribution to the model. When the model was divided by gender it was discovered that rumination was best predicted by different variables for men and women, with depression and stress making the only significant contributions for women and anxiety making the only significant contribution for men. Comparisons between ruminators and non-ruminators found that ruminators experienced significantly higher levels of depression, anxiety, and stress compared with non-ruminators.

Gender also did not significantly contribute to the explanation of depression, nor was it found to mediate the relationship between rumination and depression. When the predictors

of depression were analysed the results were very similar to those found for rumination with stress again making the largest contribution and anxiety and rumination making lesser unique contributions. When the predictors were analysed separately for the genders, stress was found to significantly predict depression for both males and females. Rumination was only found to make a significant contribution to the explanation of depression for females. Anxiety was not found to be a significant predictor for either males or females despite it being a significant predictor for the whole sample.

These results obtained for part I of this study are in the line with the hypothesis that rumination will be associated with higher levels of depression and anxiety, with these variables being both significant predictors of rumination and being more likely to occur in the ruminator group. The hypothesis that gender will mediate the relationship between rumination and depression however, was not supported. Gender was not a significant predictor of either depression or rumination and did not alter the unique level of contribution made by rumination in the explanation of depression. Further, there were no gender differences in the incidences of any of the variables, including depression and rumination.

Despite expectations, the negative priming paradigm used in this study failed to produce a significant and interpretable negative priming effect, with those results that were both significant and interpretable being indicative of positive priming. This shows that instead of the response delay expected when a previously ignored word became the target, facilitation of responding occurred. In the short-term priming trials, significant positive priming was found for the whole sample when the response times were analysed. Analysis of the influence of word affect on responding found that the magnitude of priming did not significantly differ between the three affects for both the response time and the error rate analyses. Further, no group differences were found when examining the response times and error rates of the non-ruminator and ruminator groups, with no significant priming being

found for either group. Significant negative priming also failed to occur in the long-term trials with significant positive priming being found for the whole sample with 299 intervening trials and a delay of 18 minutes, for both the response time and the error rate analyses. However, this result cannot be validly interpreted as the long-term trials were not fully counterbalanced. Once again, no group differences were found when examining the response times and error rates of the non-ruminator and ruminator groups, with equivalent levels of positive priming being exhibited for both groups when the response rates were analysed.

The lack of negative priming produced in both the short-term and the long-term trials of this study indicate that no inhibition occurred for either the non-ruminator or the ruminator group and as such no conclusions can be made regarding differences in the ability to inhibit information between non-ruminators and ruminators. The fact that this study produced positive priming where it should have produced negative priming indicates that the results obtained are likely due to a failure of the method, rather than a lack of inhibition, suggesting that the method used in this study was not an effective negative priming paradigm in either the short- or the long-term, contrary to our hypotheses. The failure of the negative priming effect also makes it difficult to conclude that the observed lack of influence of word affect on the magnitude of priming in this study was not also due to a failure of the priming paradigm. As a result of this failure of priming, the only conclusion that can be made is that the paradigm used in this study was not effective in obtaining a negative priming effect.

6.2 Relationship of Findings to Previous Research

The finding that rumination was associated with higher levels of depression, anxiety, and stress adds to the weight of evidence from previous research which has demonstrated the relationship between rumination and several negative emotional outcomes including stress,

anxiety, and depression (Brosschot et al., 2006; Kuo et al., 2012; Mor & Winquist, 2002; Nolen-Hoeksema et al., 2008; Watkins, 2008). The fact that rumination was found in this study to be predicted by stress, in particular, as well as depression and anxiety, indicates that rumination may occur in response to these variables, which fits with the research classifying rumination as a coping style (Johnston et al., 2011; Nolen-Hoeksema et al., 2008). The association of rumination with negative outcomes also provides further evidence that as a coping strategy it is maladaptive (Johnston et al., 2011; Nolen-Hoeksema et al., 2008).

The lack of gender differences in the level of rumination or depression and the failure of gender to be a significant predictor for them is contrary to the results of several studies that found that both ruminators and those with depression are much more likely to be female (Johnson & Whisman, 2013; Nolen-Hoeksema & Jackson, 2001; Nolen-Hoeksema et al., 1999). The finding that gender did not mediate the relationship between rumination and depression is also contrary to research that has found that the gender difference in rumination can fully explain the gender difference in depression (Johnson & Whisman, 2013; Nolen-Hoeksema & Jackson, 2001; Nolen-Hoeksema et al., 1999). This might simply be a result of the particular sample used in this study in which neither depression nor rumination showed gender differences, however, as rumination was found to have different predictors for men and women this seems to suggest that there may be a gender differences in the factors contributing to rumination. It is possible that women utilise rumination when they are stressed or depressed and that men utilise rumination when they are anxious, however as these possible gender differences were not tested statistically, conclusions cannot be made.

The lack of negative priming exhibited by the ruminator group in both the short- and long-term trials is actually in line with the findings of Joormann (2006), where no negative priming effect was found for the ruminator group. However, negative priming was exhibited by the non-ruminator group in the Joormann (2006) study, which indicated that the negative

priming method used was valid and enabled the conclusion that the group differences were the result of an inhibitory deficit for ruminators, whereas our study exhibited no negative priming effect and no group differences and thus did not allow conclusions to be drawn.

The failure of the negative priming effect in this study is surprising considering that the method used is based on the negative priming paradigm from Neumann et al. (1999) in which significant negative priming was found across two different experiments where stimuli were only presented once and the results were not confounded by stimuli-response bindings. Studies carried out by DeSchepper and Treisman (1996) and Grison et al. (2005) also showed that a negative priming effect could be found with the single presentation of a stimulus. The long-term trials of this negative priming paradigm failed to produce significant negative priming as well, despite negative priming being found to be quite robust to response delays in previous studies (DeSchepper & Treisman, 1996; Grison et al., 2005; Tipper et al., 1991). Indeed, significant negative priming has been found with delays of up to a month (DeSchepper & Treisman, 1996), a far greater amount of time than our own delay of approximately 18 minutes. However, DeSchepper and Treisman (1996) found in their long-term priming study that only those who produced negative priming in the short-term produced it in the long-term so perhaps our lack of long-term negative priming is not surprising given it was also not found in the short-term trials. Further, DeSchepper and Treisman (1996) found that those who failed to produce negative priming in the short-term showed increased facilitation over time, fitting with our findings of significant positive priming in the long-term trials.

All in all, the lack of negative priming and the production of significant positive priming is an unexpected result that is counter to several studies that have demonstrated significant negative priming in similar contexts. It is possible that the results are due to participants being able to identify that in some of the trials the prime distractor became the

probe target, a situation which has previously been shown to cause a failure of negative priming (Mayr & Buchner, 2007; Moore, 1994). This explanation however, is unlikely as the catch trial analysis indicated that the participants were no better than chance level at correctly identifying the prime distractor, which suggests that they were successfully ignoring the prime distractor and would not have been able to identify that at times the distractor became the target. It may be that the explanation of this failure of priming lies in the differences between the priming method utilised in this study, which found positive priming, and the Neumann et al. (1999) priming method on which it was based, which found significant negative priming. The main identifiable difference between the priming method used in the Neumann et al. (1999) study and the method used in this study is in the probe distractors. In the Neumann et al. (1999) word probe distractors were used for word trials only and non-word distractors were used for non-word trials only, whereas in this experiment half of the probe distractors were words and half were non-words for both the word and the non-word trials. The use of both non-word and word distractors for probe trials could result in distractors that are more easily distinguishable from the probe target, at least for half of the trials. Easily distinguishable probe targets have been found to be associated with a failure of negative priming and, in some studies, have been found to result in positive priming (Mayr & Buchner, 2007; Moore, 1994). It is also possible that the distance between the probe distractor and the probe target was too great, meaning again that the stimuli may have been too easily distinguishable with not enough competition between them. This could possibly explain why, contrary to the hypotheses, negative priming failed to occur in the present study, and indeed why positive priming occurred, despite it occurring in the negative priming paradigm that it was based upon. A further difference between the current study and the Neumann et al. (1999) study is in the size of the overall reaction times, with the reaction times for our study being approximately 300 ms longer. This suggests that there may have

been a further error in the negative priming paradigm or in the way the reaction times were recorded.

6.3 Key Implications of the Current Study

The results of the current study provide further evidence that rumination is a maladaptive coping style that is associated with several negative outcomes. They also seem to suggest that the contributing factors of rumination may differ between males and females. Further, the results appear to suggest that women ruminate in response to depression and stress and men ruminate in response to anxiety. This could possibly be a result of gender differences in the experience of distress with women being more likely to both ruminate and be depressed.

The presence of positive and not negative priming in this study further emphasises the importance of the probe distractor in studies attempting to measure the negative priming effect, indicating that without a probe distractor similar enough to the probe target to provide competition the negative priming effect may not occur.

6.4 Key Limitations and Strengths of the Current Study

The analyses performed in part I of this study examined the relationship of rumination to only a few differing variables and, as such, only a minority of the variance was accounted for in the rather simplistic models of rumination and depression. The analyses were also performed with an exclusively student sample in which the average age was less than 25 and the majority of the participants were female, limiting the generalizability of the results. Further, possible gender differences in the explanation of rumination and depression were not adequately tested meaning that conclusions around gender differences could not be made. Never the less, this part of the study did have a large sample size and the descriptive statistics

and severity categorisations of the variables measured could prove helpful to future researchers and clinical workers in New Zealand by providing norms of a New Zealand student sample.

The main limitation for part II is the lack of competition between the probe distractor and the probe target as a result of using both word and non-word distractors in the word trials, as described above. However, several other limitations may have contributed to the failure of priming that occurred. The counterbalancing errors described in the method, in which the short-term trials were fully counterbalanced but the long-term trials were not, are another major limitation of this study. This error meant that no valid conclusions could be drawn from the long-term trials as it is impossible to determine whether any effect found was the result of the negative priming effect or the particular words and the order in which they were used. It may also be the reason why negative priming failed to occur in the long-term trials with order effects possible influencing the reaction times. For some of the finer grained analyses for group differences and the impact of word affect there was insufficient power to safely make conclusions suggesting that more participants may have been needed in order to validly test for group and affect differences. However, of those results that were significant the effect sizes were unexpectedly small and the majority of the both significant and not significant analyses did have sufficient power indicating that perhaps with an adequate priming method the number of participants would have been sufficient. Further, there were not enough long-term trials so that the impact of negative, neutral, and positive word affect on the magnitude of priming could be analysed.

While the negative priming paradigm had several limitations, which contributed to the failure of priming and the interpretability of the results found, this study appears to be only the second attempt at analysing inhibitory deficits of ruminators using a negative priming task. It also appears to be the first-time that long-term inhibitory deficits have been measured

for ruminators. This experiment also sought to add to the evidence of what parts of the negative priming method are necessary for obtaining a negative priming effect.

6.5 Future Research Directions

While the current study found that depression, anxiety, and stress significantly predicted rumination, a further study which collects data on a wider range of variables could help to develop a model that explains significantly more of the variance in rumination and may provide clues as to why people develop a ruminative coping style and what might be done to help them develop a more adaptive coping style. Likely variables include those that have already been found to be associated with rumination, for example binge drinking and eating, and self-harm, as well as information around participants thinking styles, coping strategies, and their beliefs about rumination. There would also be advantages in recruiting a sample with more males and from a wider range of professions, thus making any results found more generalizable.

Understanding the link between rumination and inhibitory deficits is an important undertaking due to the evidence that suggests that inhibitory deficits may contribute to the negative outcomes associated with rumination. As such, future research which rectifies the limitations of the present study would be a valuable undertaking. In future the competition between the probe distractors and the probe targets would need to be increased by ensuring that only word distractors are used for the word trials and non-word distractors for the non-word trials. There would also need to be at least four versions of the experiment so that both the short- and the long-term trials could be sufficiently counterbalanced and so that any results found could be attributed to the negative priming effect. There would also need to be more long-term trials so that the impact of affect on the magnitude of priming could be analysed in both the short-term and the long-term trials. It might also be useful to increase the

number of groups from two to four so as to include depressed ruminators and depressed non-ruminators, which may help in explaining the relationship between inhibition, rumination, and depression. Previous studies examining the relationship between rumination and inhibitory deficits have used a range of methods, including set-shifting tasks, directed forgetting tasks, and negative priming paradigms. Therefore, a study which examined participant's performances on a range of inhibitory tasks could provide a deeper knowledge of inhibitory deficits in ruminators.

6.6 Conclusions

This study provided further evidence that rumination is a maladaptive coping style associated with several negative outcomes and also discovered some potential differences in the explanation of rumination for males and females. The complete failure of the negative priming effect in this study suggests that it may be vital that probe distractors are not easily distinguishable from probe targets in order for negative priming to occur.

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APPENDIX A

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

HUMAN ETHICS COMMITTEE

Secretary, Lynda Griffioen
Email: human-ethics@canterbury.ac.nz

Ref: HEC 2013/66/LR

7 August 2013

Caitlin Aberhart
Department of Psychology
UNIVERSITY OF CANTERBURY

Dear Caitlin

Thank you for forwarding your Human Ethics Committee Low Risk application for your research proposal "The short- and long-term negative priming effrects of affective stimuli".

I am pleased to advise that this application has been reviewed and I confirm support of the Department's approval for this project.

Please note that this approval is subject to the incorporation of the amendments you have provided in your email of 6 August 2013.

With best wishes for your project.

Yours sincerely

Lindsey MacDonald
Chair, Human Ethics Committee

APPENDIX B

Depression Anxiety Stress Scale (DASS)

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all

1 Applied to me to some degree, or some of the time

2 Applied to me a considerable degree, or a good part of the time

3 Applied to me very much, or most of the time

1.	I found myself getting upset by quite trivial things	0	1	2	3
2.	I was aware of dryness of my mouth	0	1	2	3
3.	I couldn't seem to experience any positive feeling at all	0	1	2	3
4.	I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5.	I just couldn't seem to get going	0	1	2	3
6.	I tended to over-react to situations	0	1	2	3
7.	I had a feeling of shakiness (e.g. legs going to give way)	0	1	2	3
8.	I found it difficult to relax	0	1	2	3
9.	I found myself in situations that made me so anxious I was most relieved when they ended	0	1	2	3
10.	I felt that I had nothing to look forward to	0	1	2	3
11.	I found myself getting upset rather easily	0	1	2	3
12.	I felt that I was using a lot of nervous energy	0	1	2	3
13.	I felt sad and depressed	0	1	2	3
14.	I found myself getting inpatient when I was delayed in any way (e.g. lifts, traffic lights, being kept waiting)	0	1	2	3
15.	I had feelings of faintness	0	1	2	3

16.	I felt that I had lost interest in just about everything	0	1	2	3
17.	I felt I wasn't worth much as a person	0	1	2	3
18.	I felt that I was rather touchy	0	1	2	3
19.	I perspired noticeably (e.g. hands sweaty) in the absence of high temperatures or physical exertion	0	1	2	3
20.	I felt scared without any good reason	0	1	2	3
21.	I felt that life wasn't worth while	0	1	2	3
22.	I found it hard to wind down	0	1	2	3
23.	I had difficulty in swallowing	0	1	2	3
24.	I couldn't seem to get any enjoyment out of the things I did	0	1	2	3
25.	I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	0	1	2	3
26.	I felt down-hearted and blue	0	1	2	3
27.	I found that I was very irritable	0	1	2	3
28.	I felt I was close to panic	0	1	2	3
29.	I found it hard to calm down after something upset me	0	1	2	3
30.	I feared that I would be "thrown" by some trivial but unfamiliar task	0	1	2	3
31.	I was unable to become enthusiastic about anything	0	1	2	3
32.	I found it difficult to tolerate interruptions to what I was doing	0	1	2	3
33.	I was in a state of nervous tension	0	1	2	3
34.	I felt I was pretty worthless	0	1	2	3
35.	I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
36.	I felt terrified	0	1	2	3
37.	I could see nothing in the future to be hopeful about	0	1	2	3
38.	I felt that life was meaningless	0	1	2	3
39.	I found myself getting agitated	0	1	2	3
40.	I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
41.	I experienced trembling (e.g. in the hands)	0	1	2	3
42.	I found it difficult to work up the initiative to do things	0	1	2	3

APPENDIX C

Rumination and Reflection Scale

Instructions:

For each of the statements located on the next two pages, please indicate your level of agreement or disagreement by circling one of the scale categories to the right of each statement. Use the scale as shown below:

Strongly Disagree				**Strongly Agree**
1	**2**	**3**	**4**	**5**

1. My attention is often focused on aspects of myself I wish I'd stop thinking about……...1 2 3 4 5

2. I always seem to be "re-hashing" in my mind recent things I've said or done……....1 2 3 4 5

3. Sometimes it is hard for me to shut off thoughts about myself…….....1 2 3 4 5

4. Long after an argument or disagreement is over with, my thoughts keep going back to what happened…….1 2 3 4 5

5. I tend to "ruminate" or dwell over things that happen to me for a really long time afterward…….……...1 2 3 4 5

6. I don't waste time re-thinking things that are over and done with…….1 2 3 4 5

7. Often I'm playing back over in my mind how I acted in a past situation.…1 2 3 4 5

8. I often find myself re-evaluating something I've done……1 2 3 4 5

9. I never ruminate or dwell on myself for very long……...1 2 3 4 5

10. It is easy for me to put unwanted thoughts out of my mind……...1 2 3 4 5

11. I often reflect on episodes in my life that I should no longer concern myself with…….1 2 3 4 5

12. I spend a great deal of time thinking back over my embarrassing or disappointing moments……...……...1 2 3 4 5

PLEASE CONTINUE ON THE NEXT PAGE...

Strongly Disagree 1	**Disagree 2**	**Neutral 3**	**Agree 4**	**Strongly Agree 5**

13. Philosophical or abstract thinking doesn't appeal to me that much…….1 2 3 4 5

14. I'm not really a meditative type of person……....1 2 3 4 5

15. I love exploring my "inner" self……1 2 3 4 5

16. My attitudes and feelings about things fascinate me……1 2 3 4 5

17. I don't really care for introspective or self-reflective thinking…….1 2 3 4 5

18. I love analysing why I do things……..…1 2 3 4 5

19. People often say I'm a "deep", introspective type of person……1 2 3 4 5

20. I don't care much for self-analysis……..….1 2 3 4 5

21. I'm very self-inquisitive by nature……....1 2 3 4 5

22. I love to meditate on the nature and meaning of things……..….1 2 3 4 5

23. I often love to look at my life in philosophical ways……...……1 2 3 4 5

24. Contemplating myself isn't my idea of fun……..……1 2 3 4 5

APPENDIX D

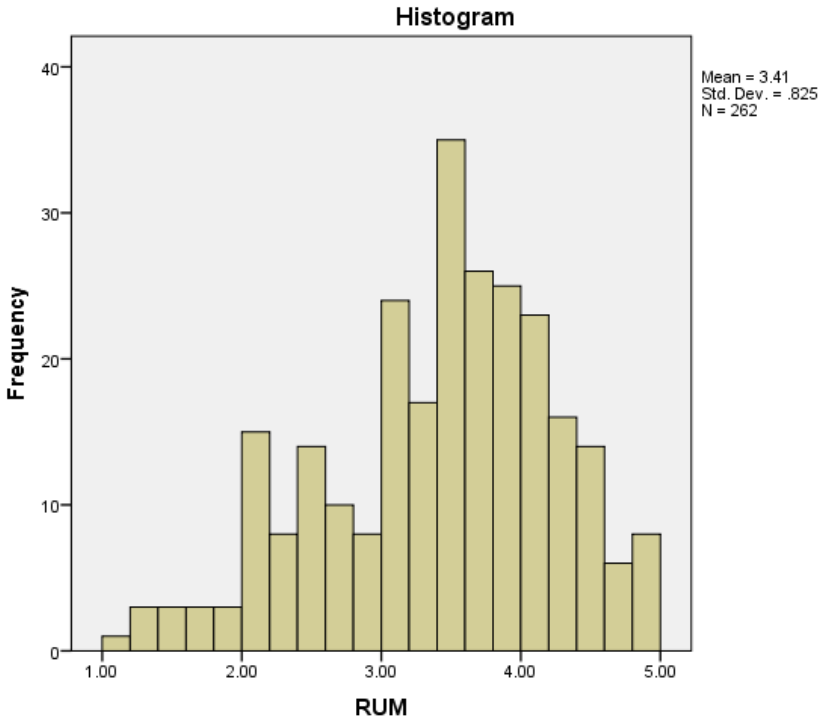

Figure 3: Distribution of rumination scores (N = 262)

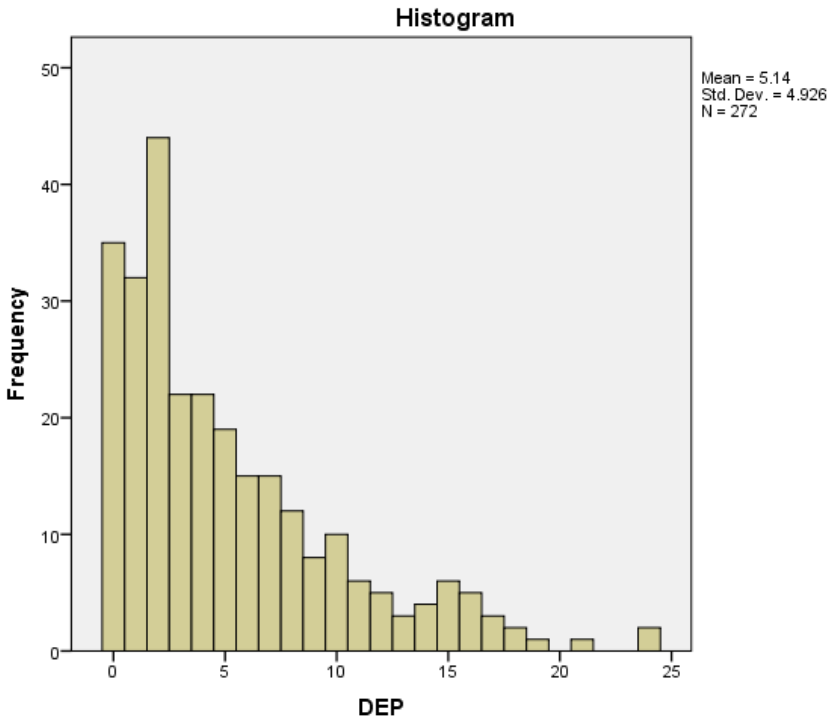

Figure 4: Distribution of depression scores (N = 272)

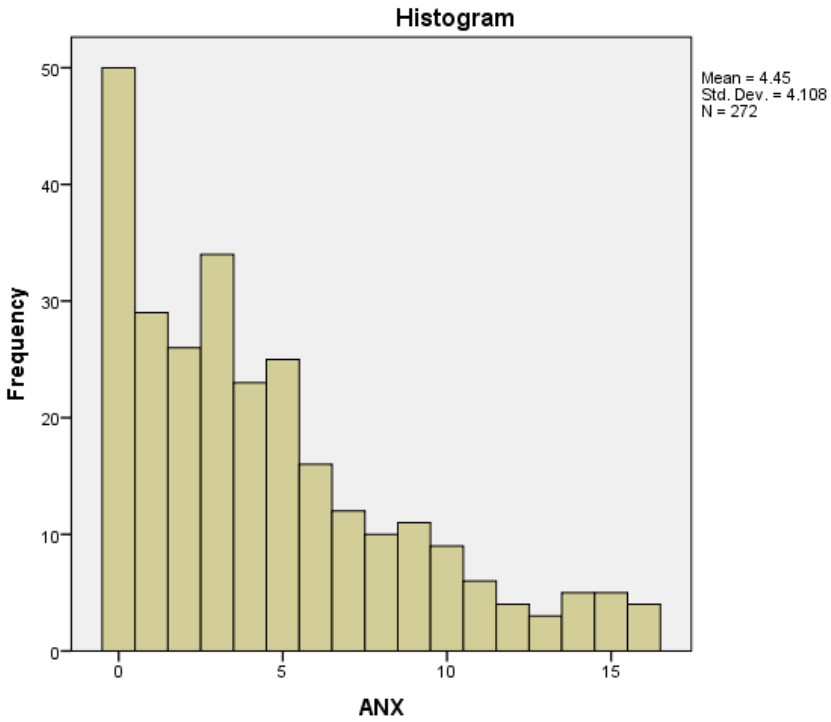

Figure 5: Distribution of anxiety scores (N = 272)

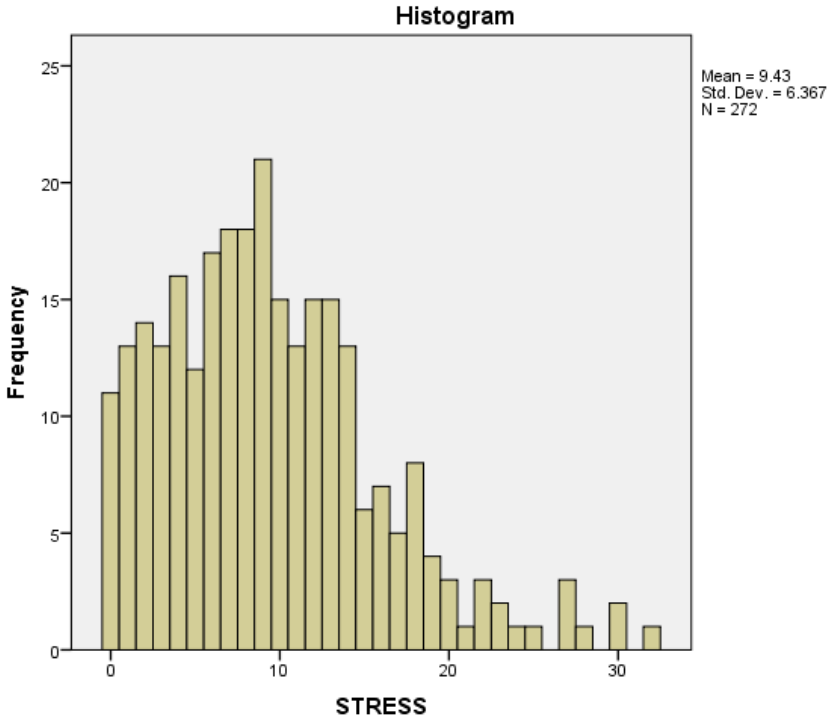

Figure 6: Distribution of stress scores (N = 272)

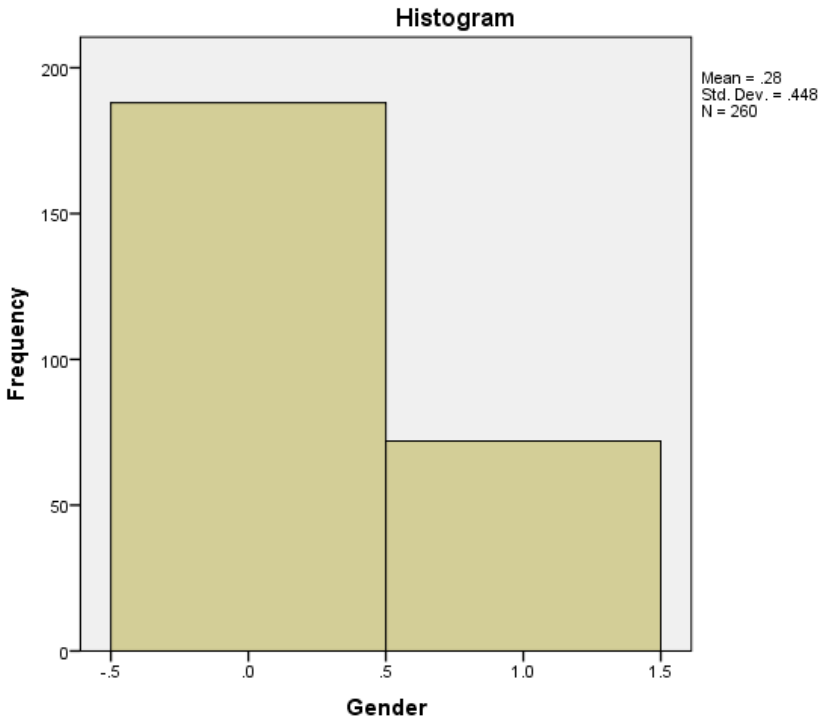

Figure 7: Distribution of gender (N = 260)

APPENDIX E

Table 12: Whole sample skewness and kurtosis values

Variable	**N**	**Skewness (Std. error)**	**Kurtosis (Std. error)**
Rumination	262	-0.514 (0.150)	-0.209 (0.300)
Depression	272	1.304 (0.148)	1.420 (0.294)
Anxiety	272	1.010 (0.148)	0.343 (0.294)
Stress	272	0.859 (0.148)	0.832 (0.294)

APPENDIX F

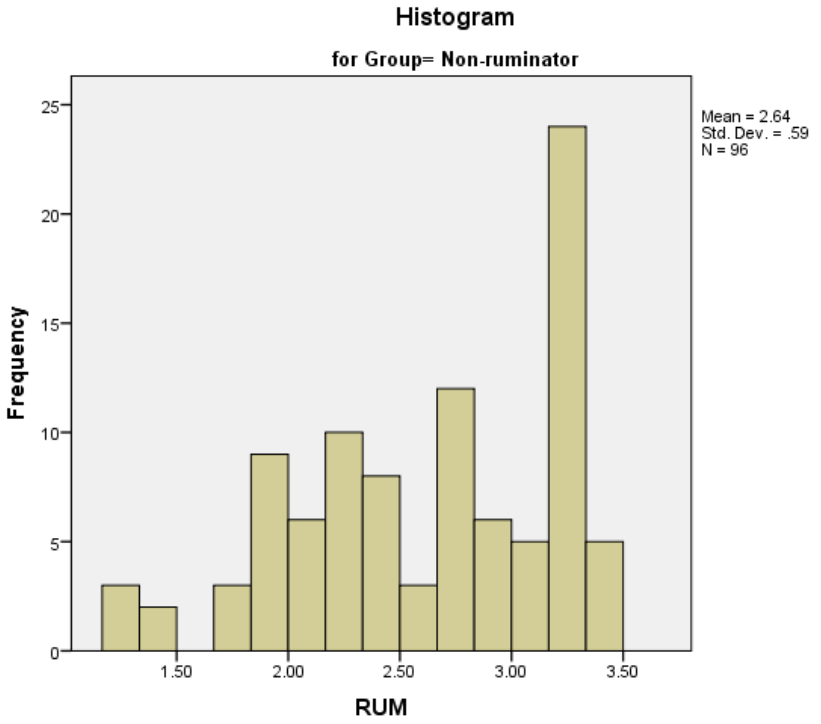

Figure 8: Distribution of Non-ruminators rumination scores (N = 96)

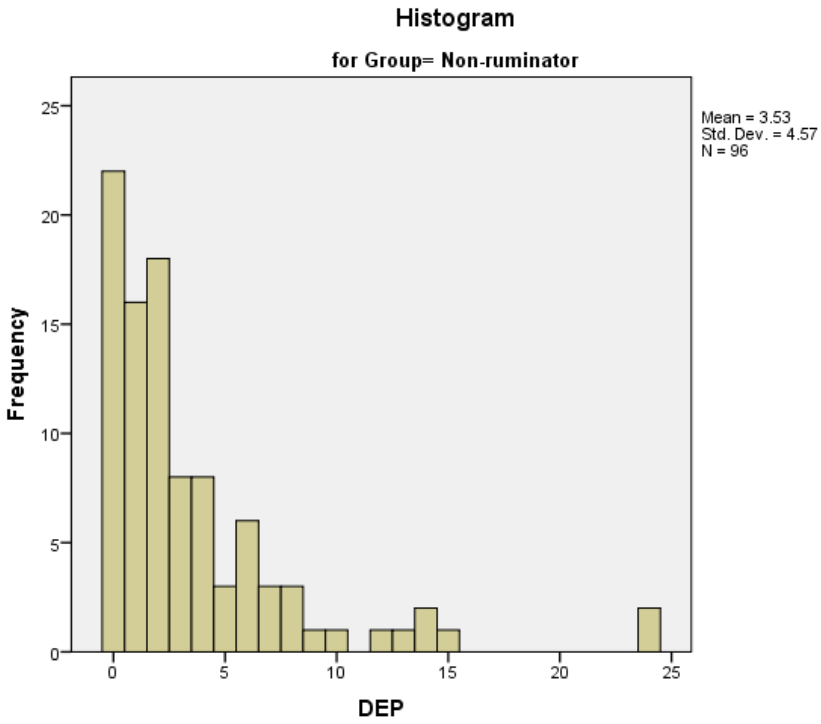

Figure 9: Distribution of Non-ruminators depression scores (N = 96)

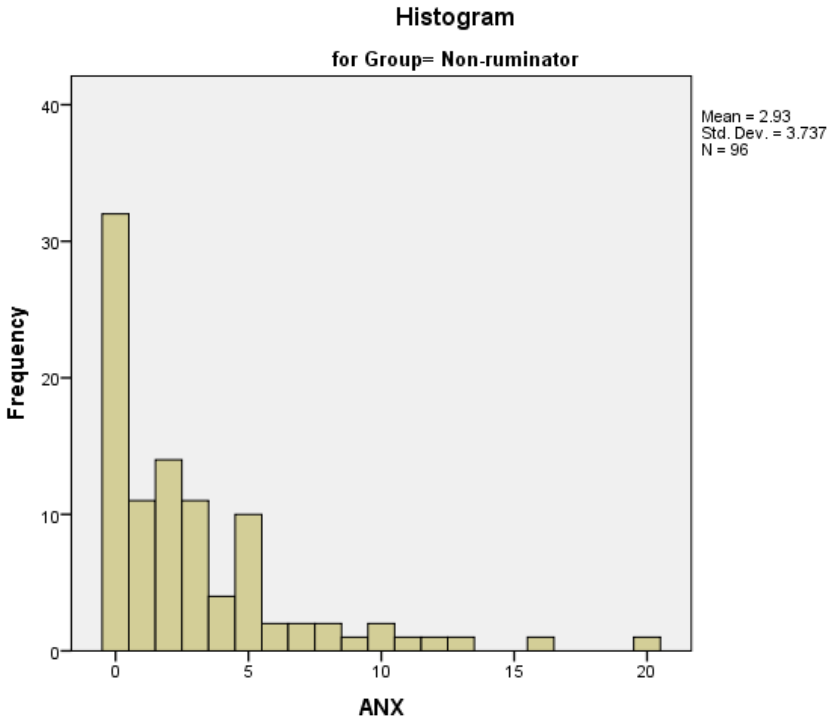

Figure 10: Distribution of Non-ruminators anxiety scores (N = 96)

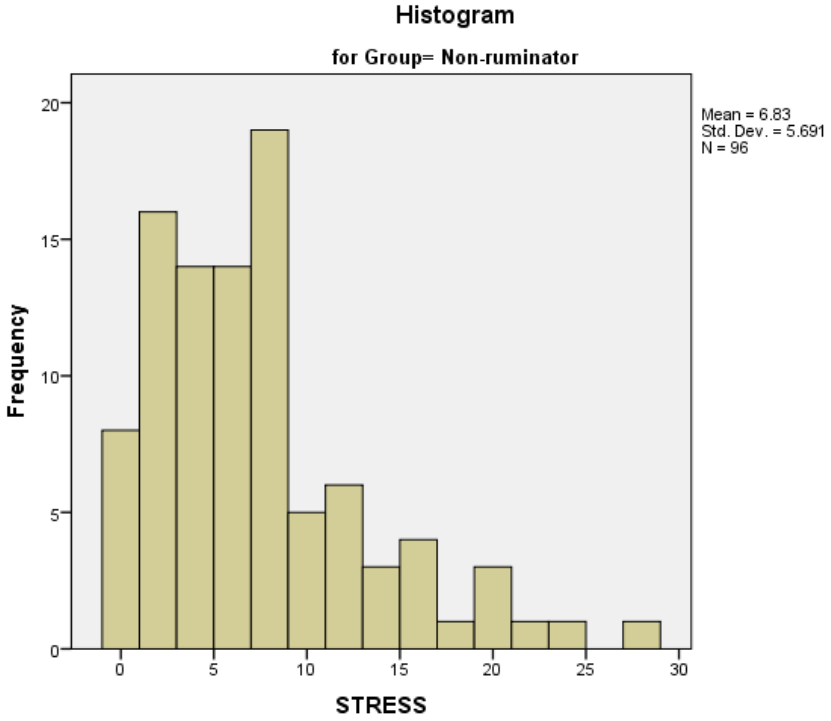

Figure 11: Distribution of Non-ruminators stress scores (N = 96)

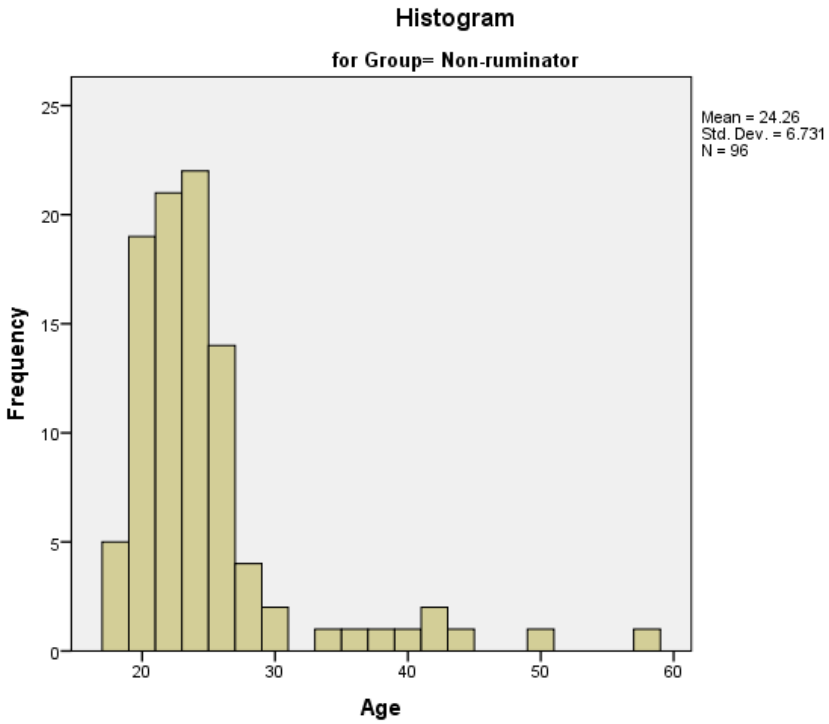

Figure 12: Distributions of Non-ruminators ages (N = 96)

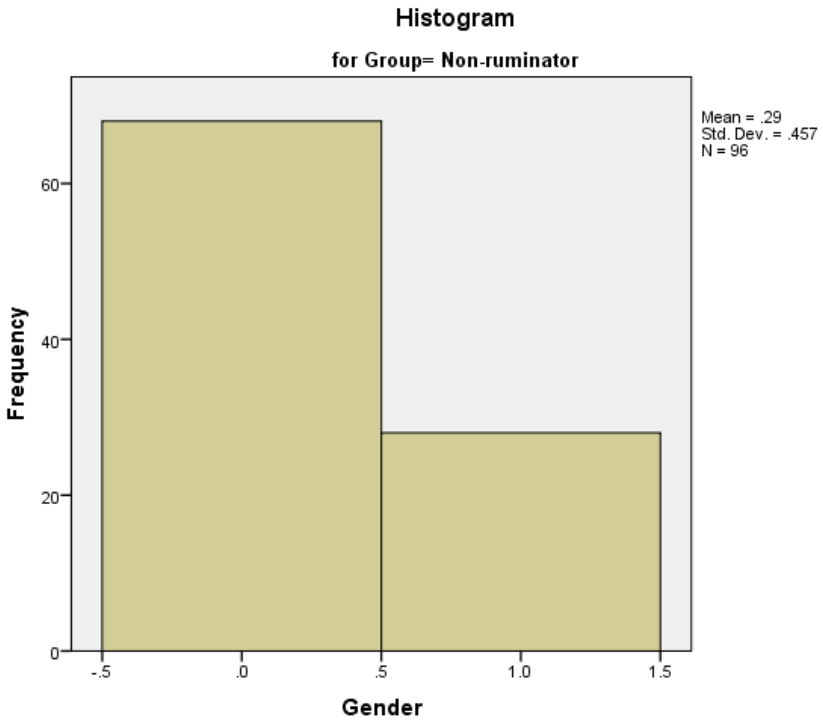

Figure 13: Distribution of Gender for Non-ruminators (Female = 0; Male = 1; N = 96)

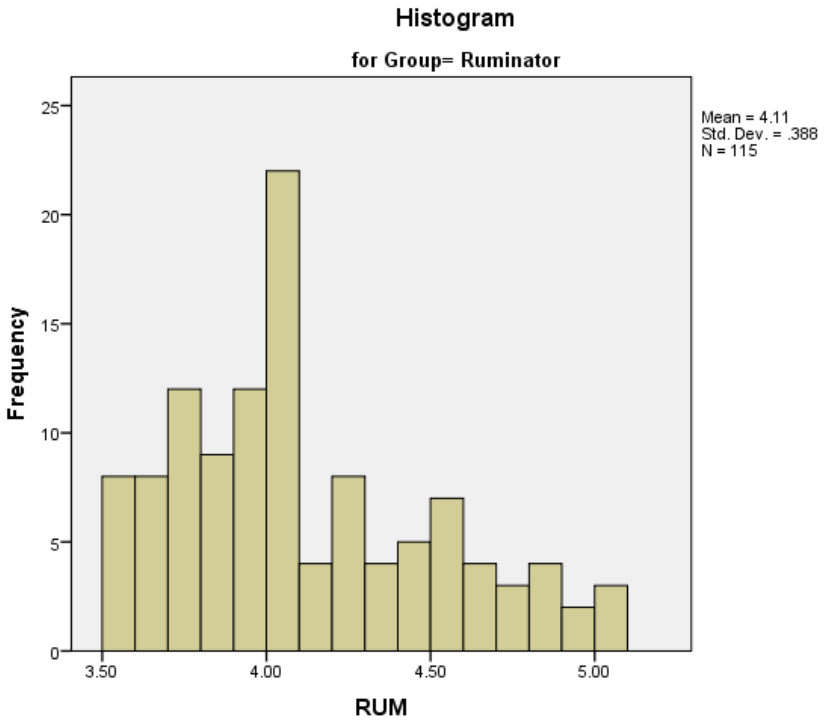

Figure 14: Distribution of Ruminators rumination scores (N = 115)

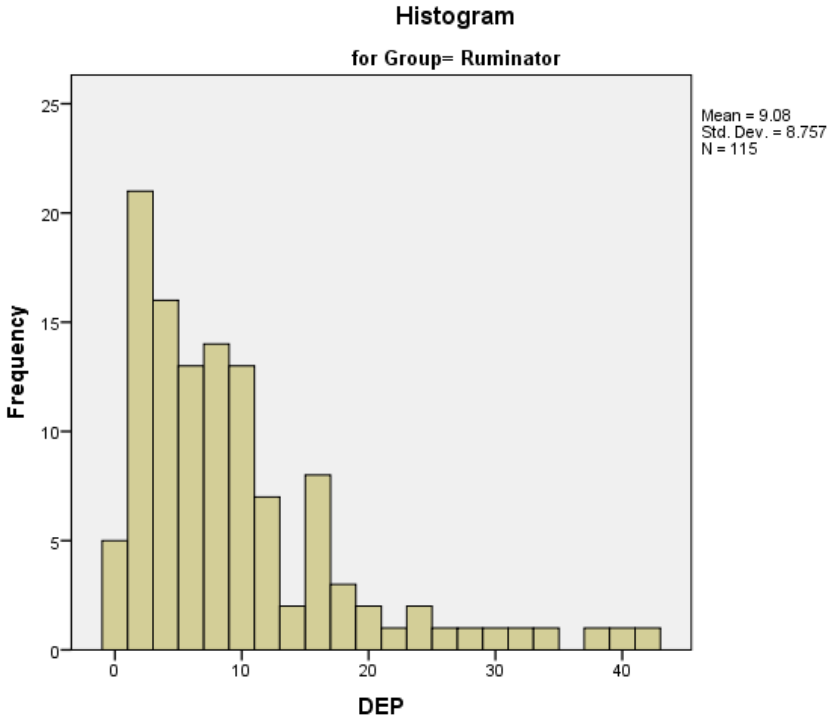

Figure 15: Distribution of Ruminators depression scores (N = 115)

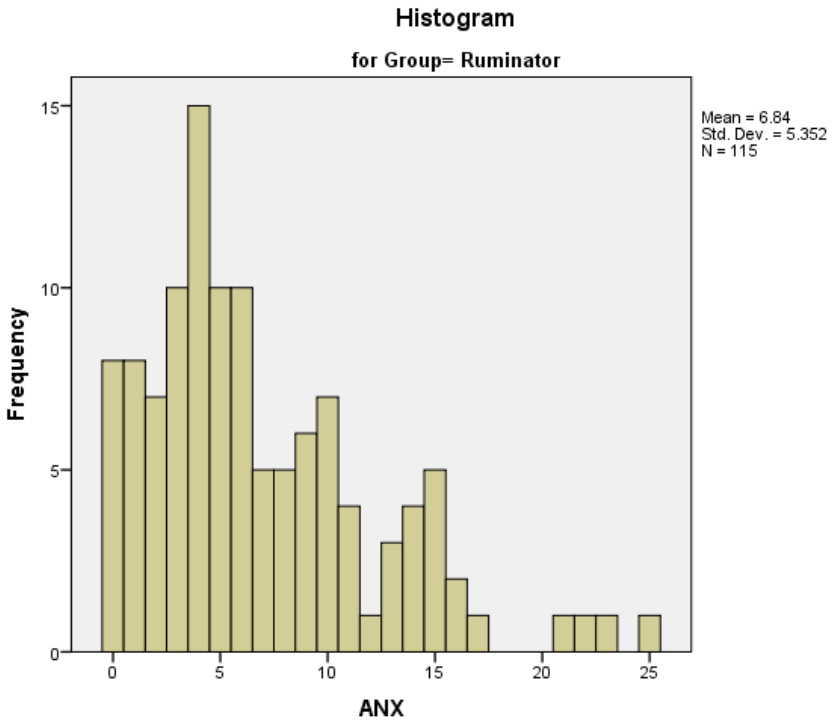

Figure 16: Distribution of Ruminators anxiety scores (N = 115)

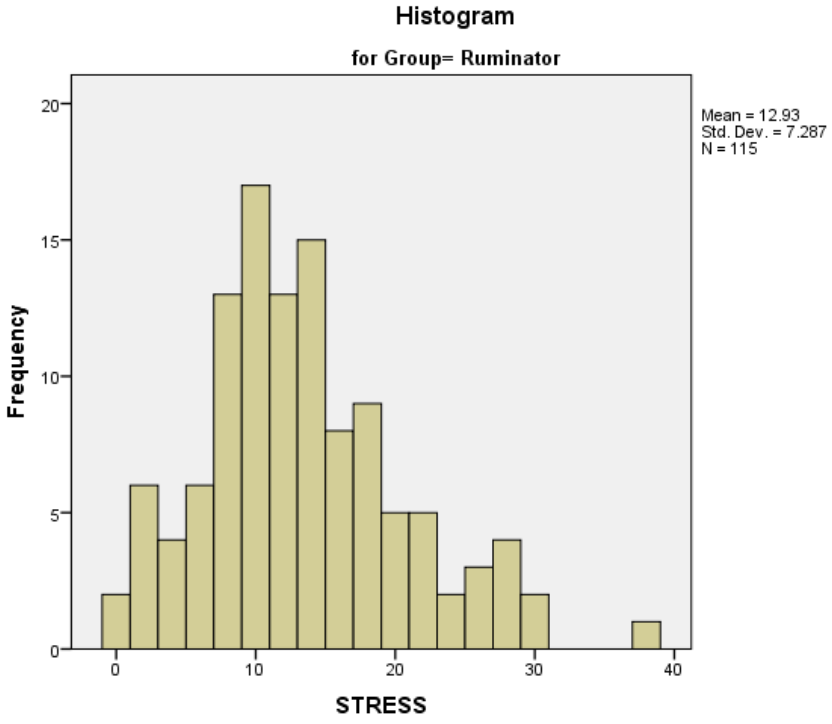

Figure 17: Distribution of Ruminators stress scores (N = 115)

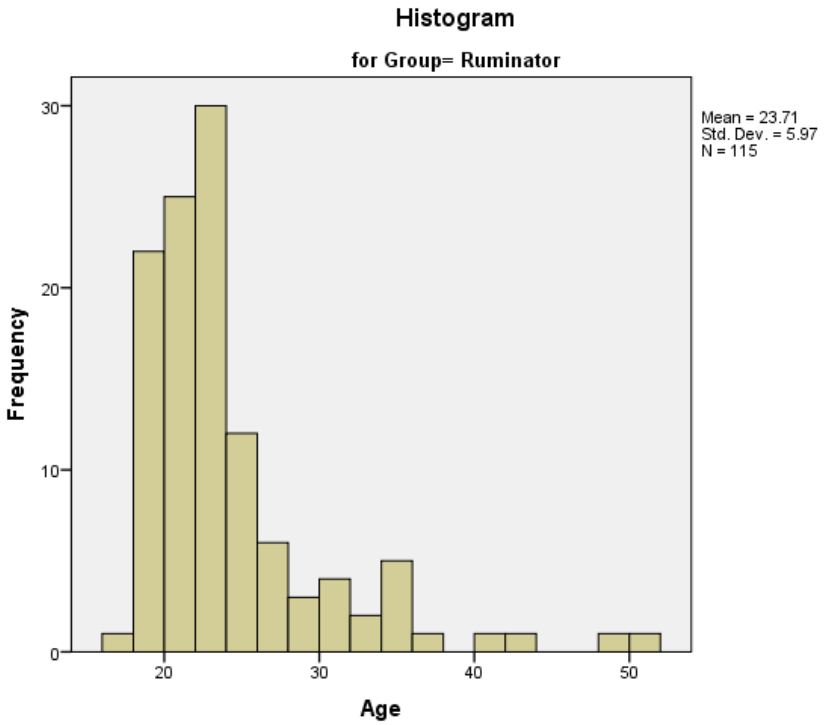

Figure 18: Distribution of Ruminators ages (N = 115)

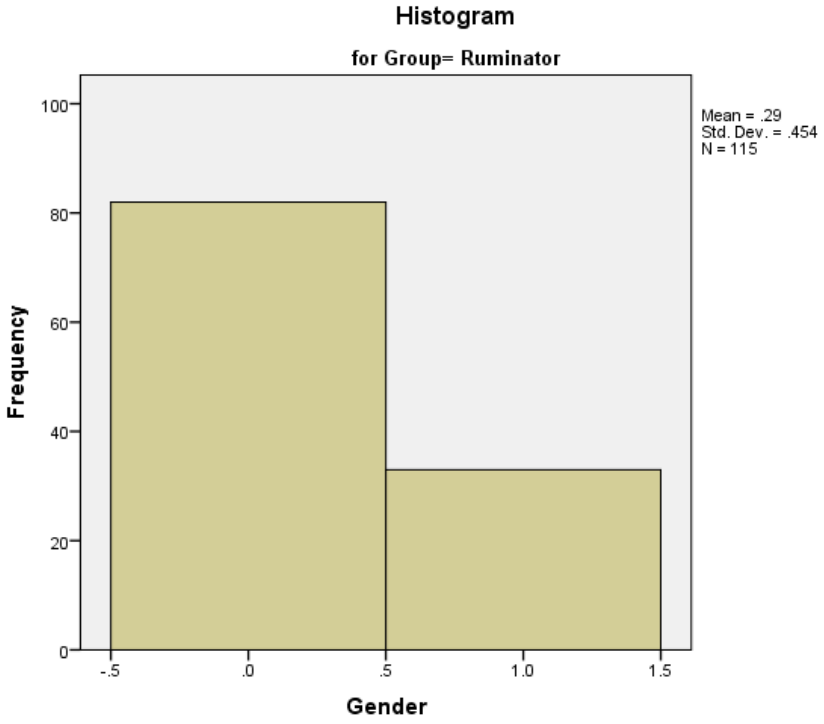

Figure 19: Distribution of gender for Ruminators (Female = 0; Male = 1; N = 115)

APPENDIX G

Table 13: Skewness and kurtosis values for non-ruminator and ruminator groups

Variable	Group	N	Skewness (std. error)	Kurtosis (std. error)
Non-ruminator	Rumination	96	-0.528 (0.246)	-0.606 (0.488)
	Depression	96	2.483 (0.246)	7.554 (0.488)
	Anxiety	96	2.080 (0.246)	5.334 (0.488)
	Stress	96	1.205 (0.246)	1.428 (0.488)
	Age	96	2.670 (0.246)	8.641 (0.488)
Ruminator	Rumination	115	0.682 (0.226)	-0.498 (0.447)
	Depression	115	1.710 (0.226)	2.988 (0.447)
	Anxiety	115	1.093 (0.226)	1.068 (0.447)
	Stress	115	0.675 (0.226)	0.396 (0.447)
	Age	115	2.195 (0.226)	5.812 (0.447)

APPENDIX H

Telephone: + 64 3 364 2987 ext. 6166

Email: caitlin.aberhart@pg.canterbury.ac.nz

Date: 20th July 2013

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Differences in the Short- and Long-Term Negative Priming Effects of Emotional Words

Information Sheet

This study is being carried out as part of a thesis project by Caitlin Aberhart in the Psychology Department under the supervision of Dr Ewald Neumann and Dr Janet Carter. The study looks at differences in the short- and long-term negative priming effects between ruminators and non-ruminators using emotional words

Before deciding whether or not to take part, please read the information below, which outlines the tasks, and feel free to ask questions about anything you do not understand:

- Complete a short questionnaire
- Say a range of words aloud while ignoring another word that is present
- Make word/non-word decisions about one item while ignoring another
- This task will take around 40 minutes

Please note that your participation in this study is optional and that you withdraw out at any time, without penalty. If you withdraw your data will be removed from the study.

All the data collected for this study is confidential and will remain anonymous in any publications. All the data from this study will be securely stored in locked cabinets for five years following the study. It will then be destroyed.

The results of this study will be published as part of a Master's Thesis and you may receive a summary of these results if you choose.

This proposal has been reviewed and approved by the Department of Psychology, University of Canterbury and the University of Canterbury Human Ethics Committee Low Risk Approval process

If you have any questions or concerns about this study please feel free to contact Caitlin Aberhart at the email address above. You may also contact Dr Ewald Neumann (ewald.neumann@canterbury.ac.nz), Dr Janet Carter (janet.carter@canterbury.ac.nz), or the human ethics committee (human-ethics@canterbury.ac.nz) if you have a complaint.

If you feel that depression may be a problem for you please contact your General Practitioner (GP) or the student health centre (03 364 2402)

If you agree to take part, please fill out the attached form and return it to me before the start of the study.

Thank you for taking part in this study.

Caitlin Aberhart

Telephone: +64 3 364 2987 ext. 6166

Email: caitlin.aberhart@pg.canterbury.ac.nz

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Differences in the Short- and Long-Term Negative Priming Effects of

Consent Form

I have been given a full explanation of this project and have been given an opportunity to ask questions.

I understand what will be required of me if I agree to take part in this project.

I understand that my participation is voluntary and that I may withdraw at any stage without penalty.

I understand that any information I provide will be kept confidential to the researcher and that any published or reported results will not identify me.

I understand that all data collected for this study will be kept in locked and secure facilities at the University of Canterbury and will be destroyed after five years.

I understand that I can request a report on the findings of this study. I have provided my email details below for this purpose.

I understand that if I require further information I can contact the researcher, Caitlin Aberhart. If I have any complaints, I can contact Ewald Neumann or the Chair of the University of Canterbury Educational Research Human Ethics Committee.

This proposal has been reviewed and approved by the Department of Psychology, University of Canterbury and the University of Canterbury Human Ethics Committee Low Risk process

By signing below, I agree to participate in this research project.

Name: _____

Date: _____

Signature: _____

Email address (optional): _____

Please return this completed consent form to Caitlin Aberhart before the start of the experiment

APPENDIX I

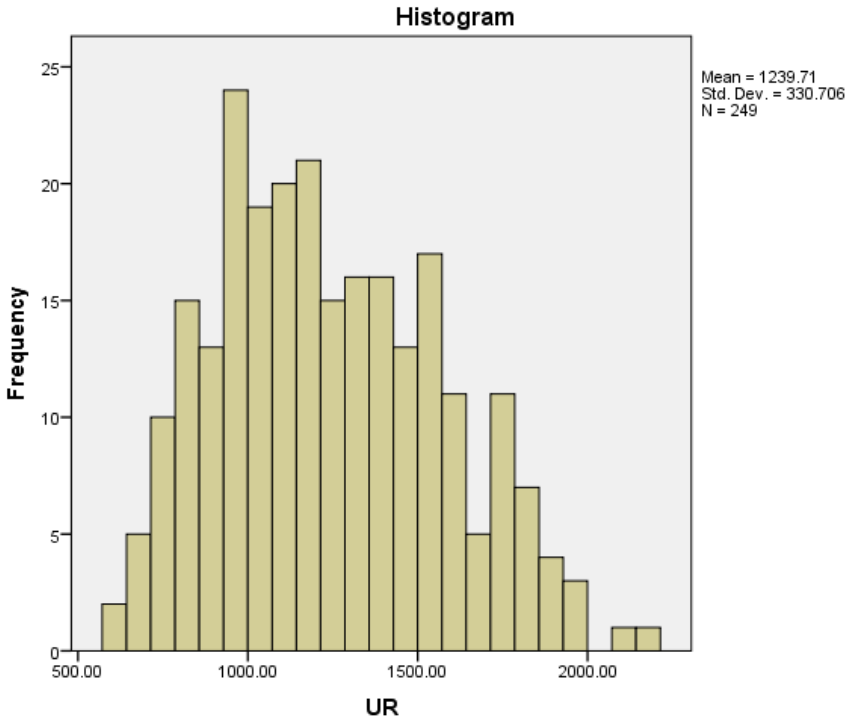

Figure 20: Distribution of the whole sample response times for the unrelated control condition (UR)

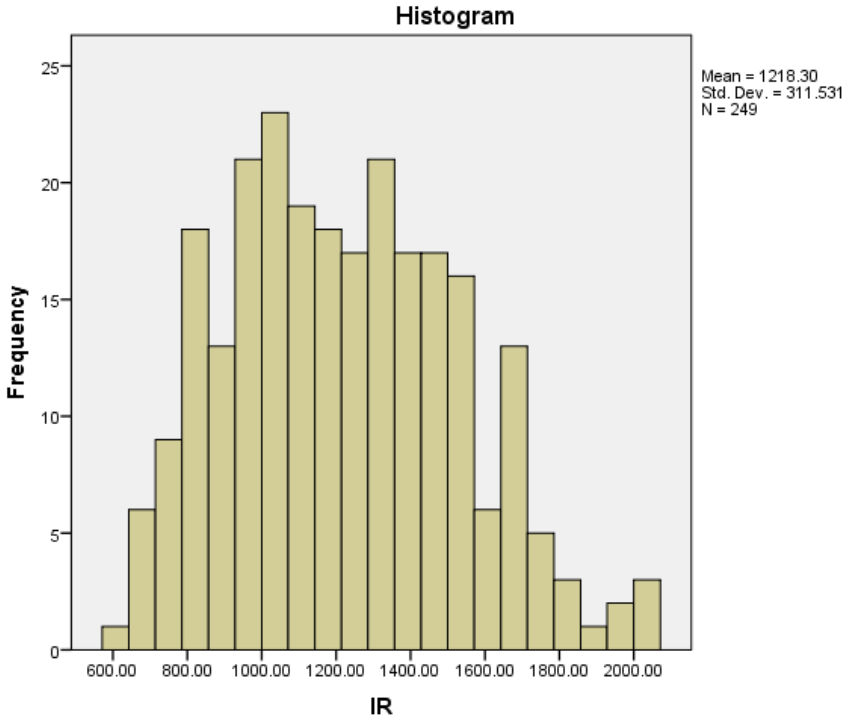

Figure 21: Distribution of the whole sample response times for the ignored repetition condition (IR)

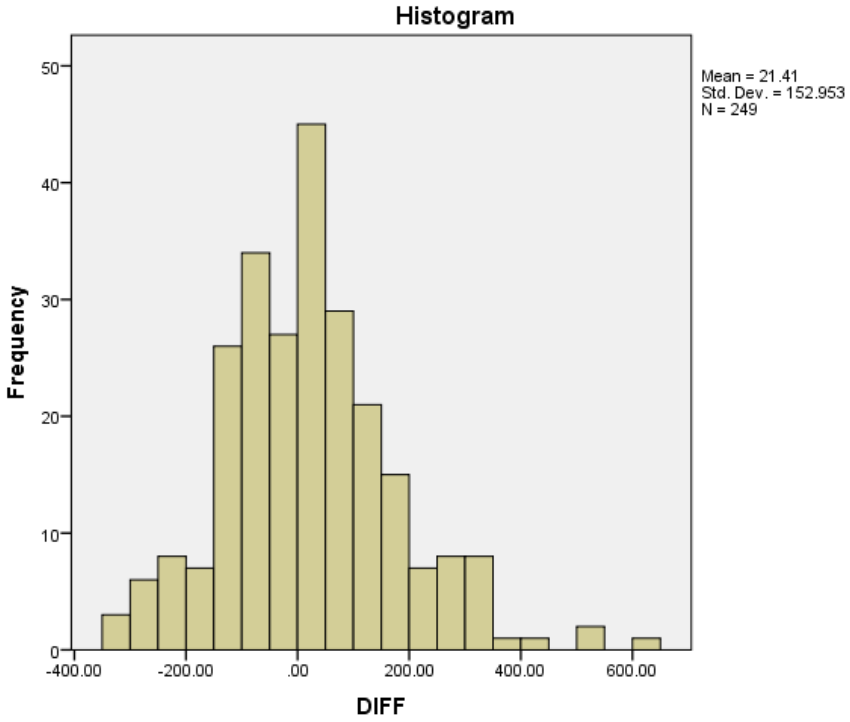

Figure 22: Distribution of the differences in response time between the unrelated control condition and the ignored repetition condition (DIFF)

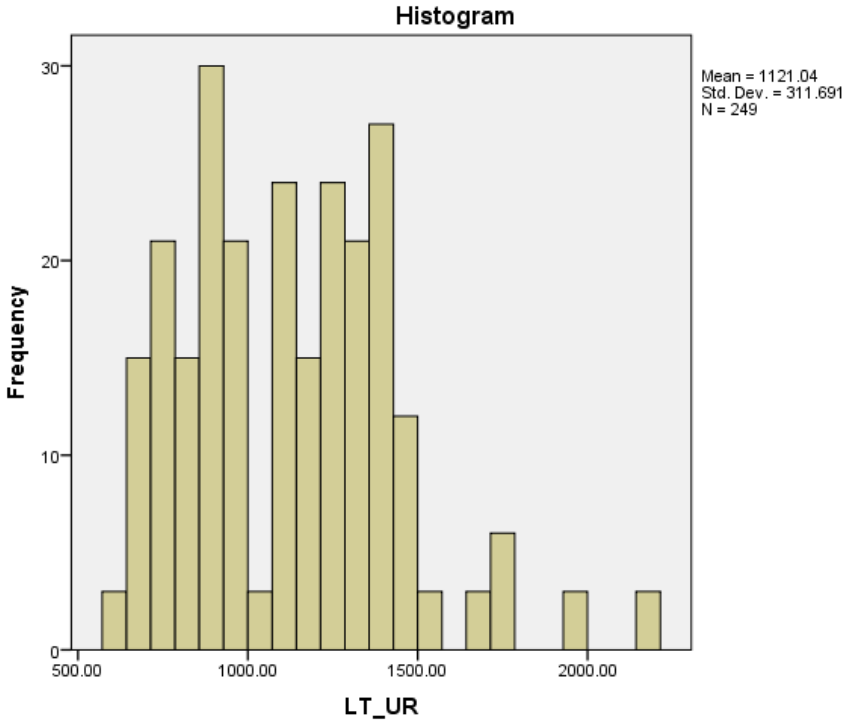

Figure 23: Distribution of the whole sample response times for the long-term unrelated control condition (LT UR)

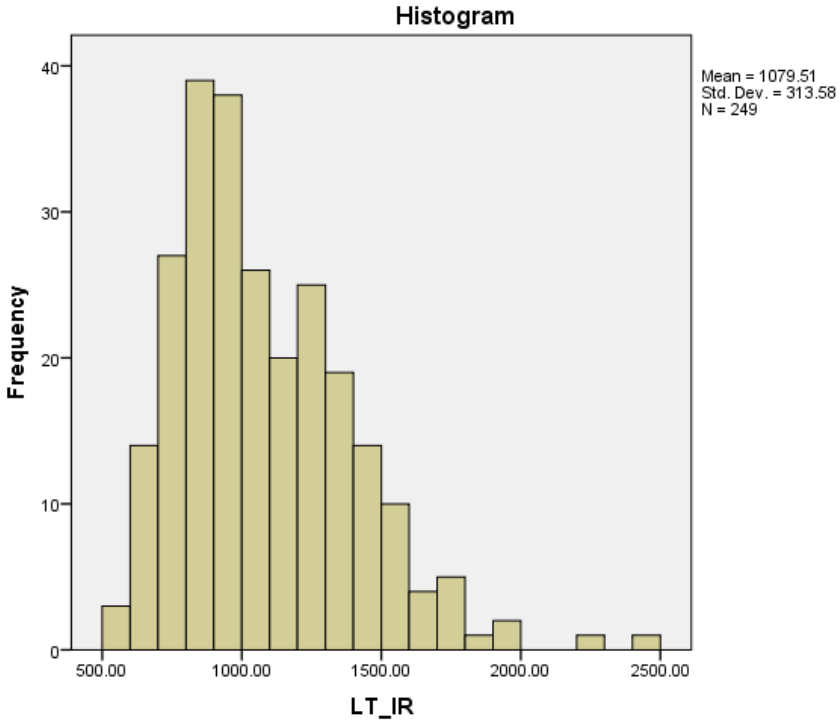

Figure 24: Distribution of the whole sample response times for the long-term ignored repetition condition (LT IR)

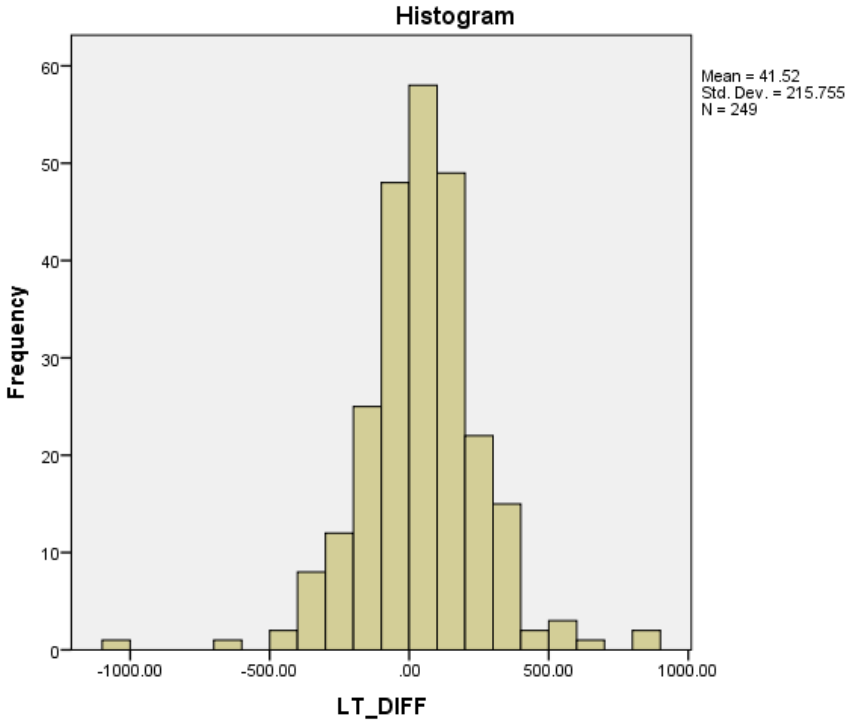

Figure 25: Distribution of the differences in response time between the long-term unrelated control condition and the long-term ignored repetition condition (LT DIFF)

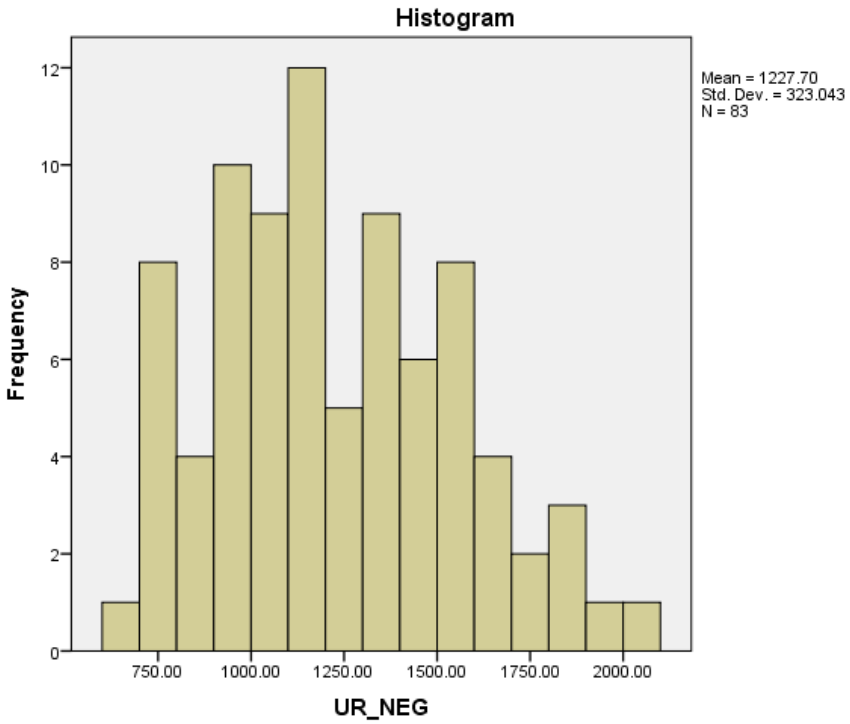

Figure 26: Distribution of the whole sample response times for the negative affect unrelated control trials (UR NEG)

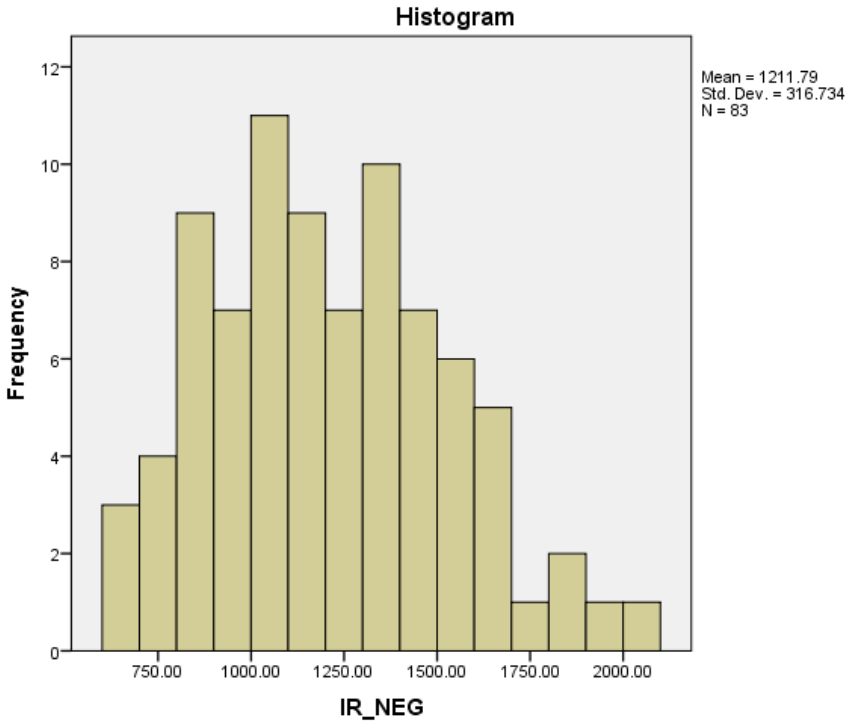

Figure 27: Distribution of the whole sample response times for the negative affect ignored repetition trials (IR NEG)

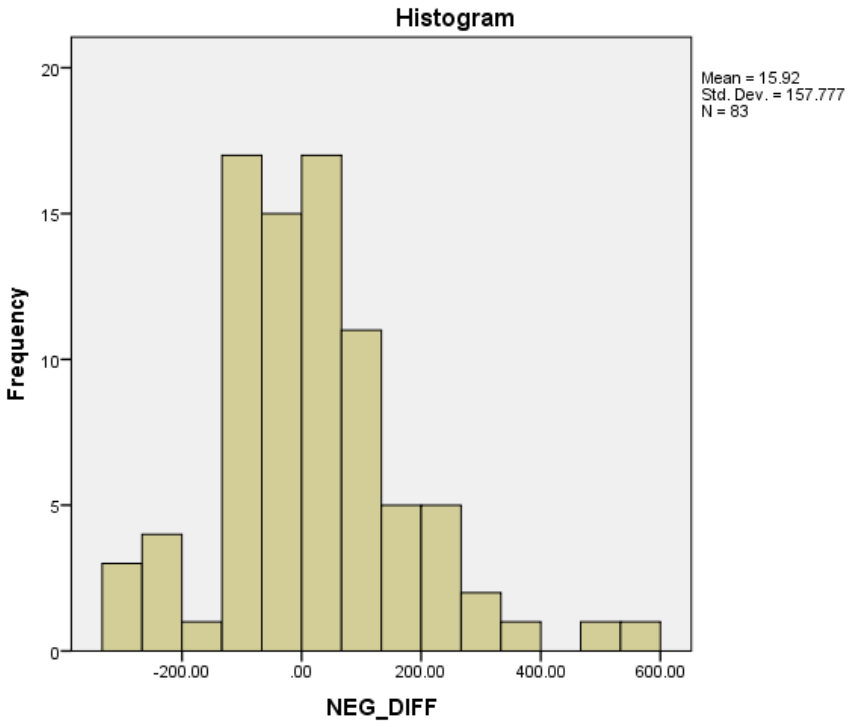

Figure 28: Distribution of the whole sample response times for the difference between the negative affect unrelated control trials and the ignored repetition trials (NEG DIFF)

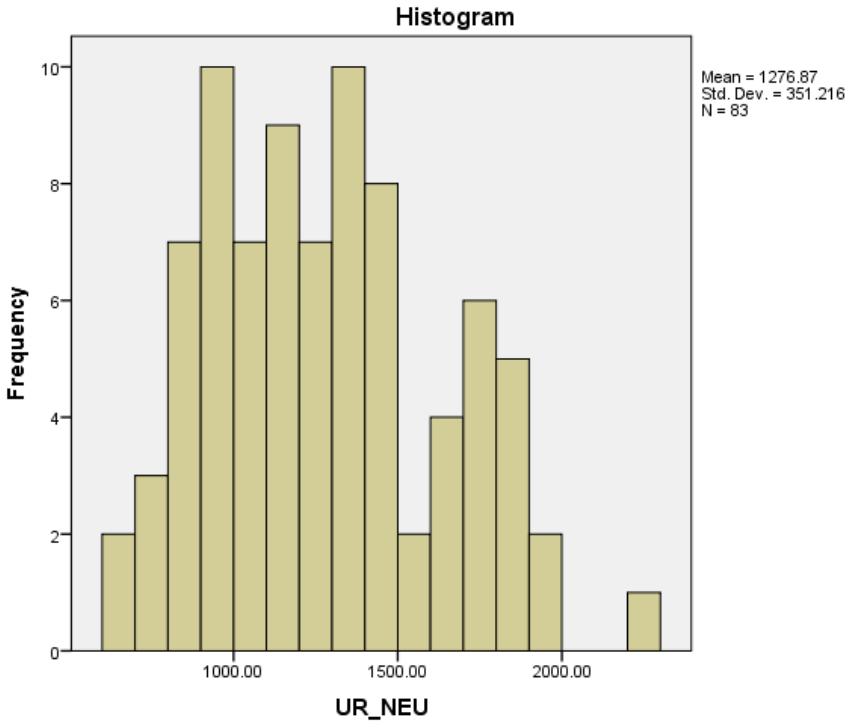

Figure 29: Distribution of the whole sample response times for the neutral affect unrelated control trials (UR NEU)

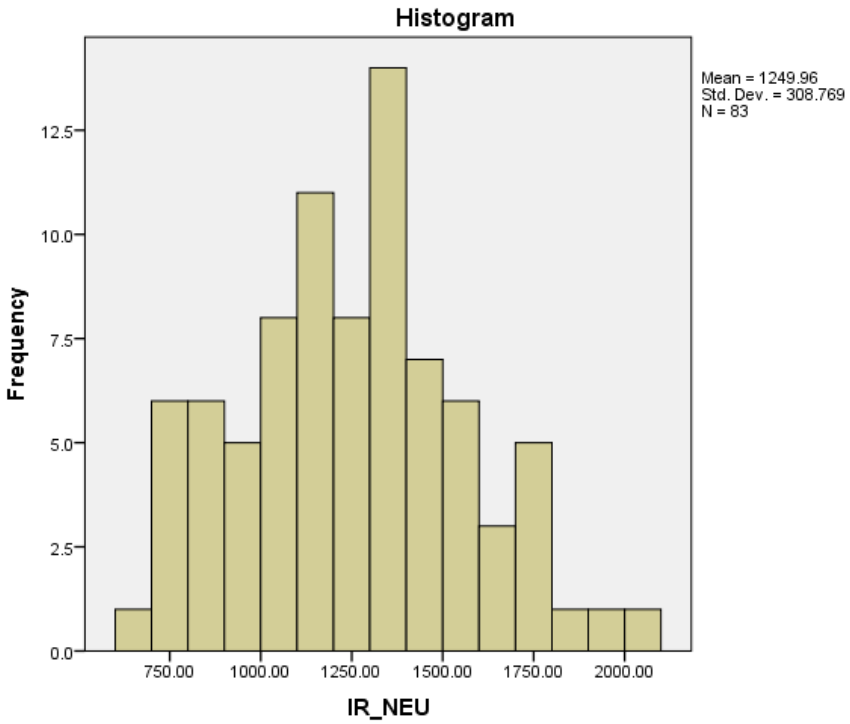

Figure 30: Distribution of the whole sample response times for the neutral affect ignored repetition trials (IR NEU)

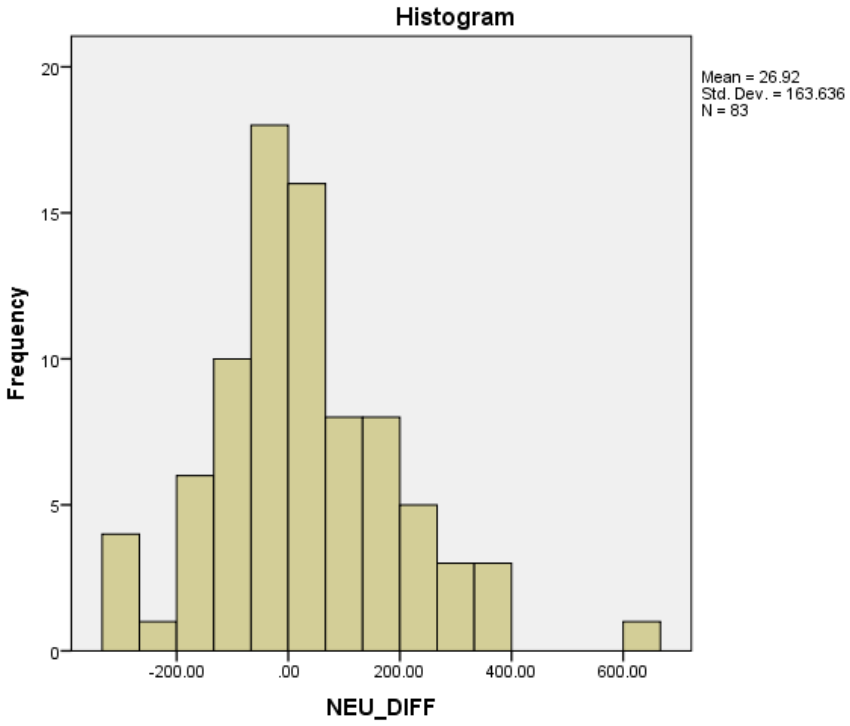

Figure 31: Distribution of the whole sample response times for the difference between the neutral affect unrelated control trials and the ignored repetition trials (NEU DIFF)

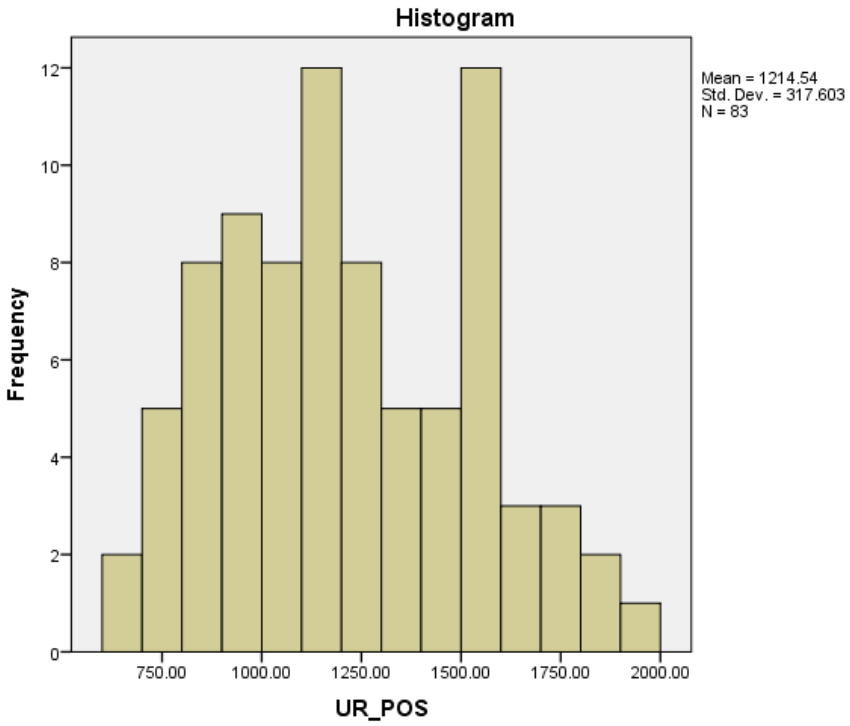

Figure 32: Distribution of the whole sample response times for the positive affect unrelated control trials (UR POS)

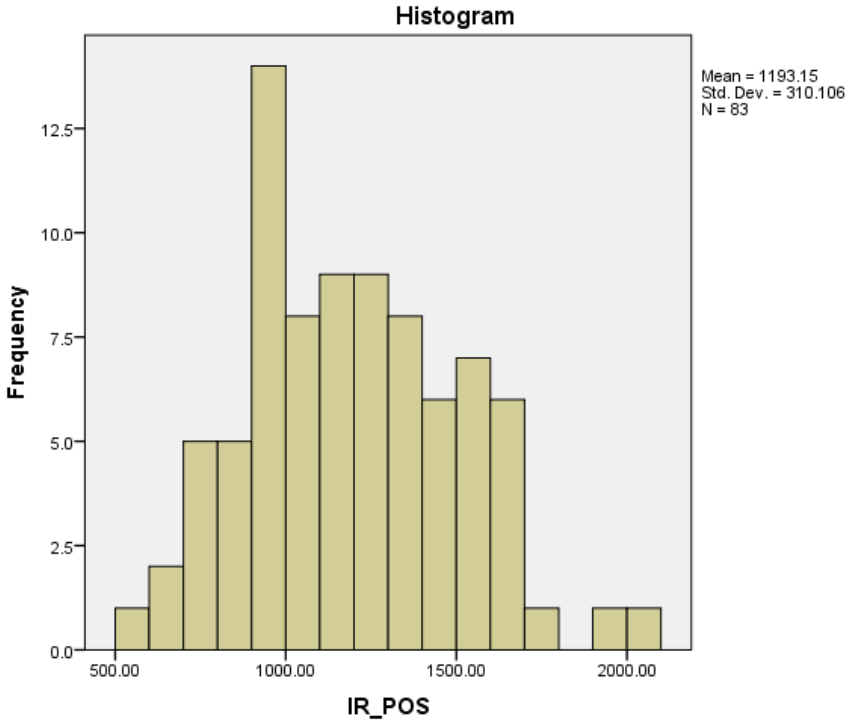

Figure 33: Distribution of the whole sample response times for the positive affect ignored repetition trials (IR POS)

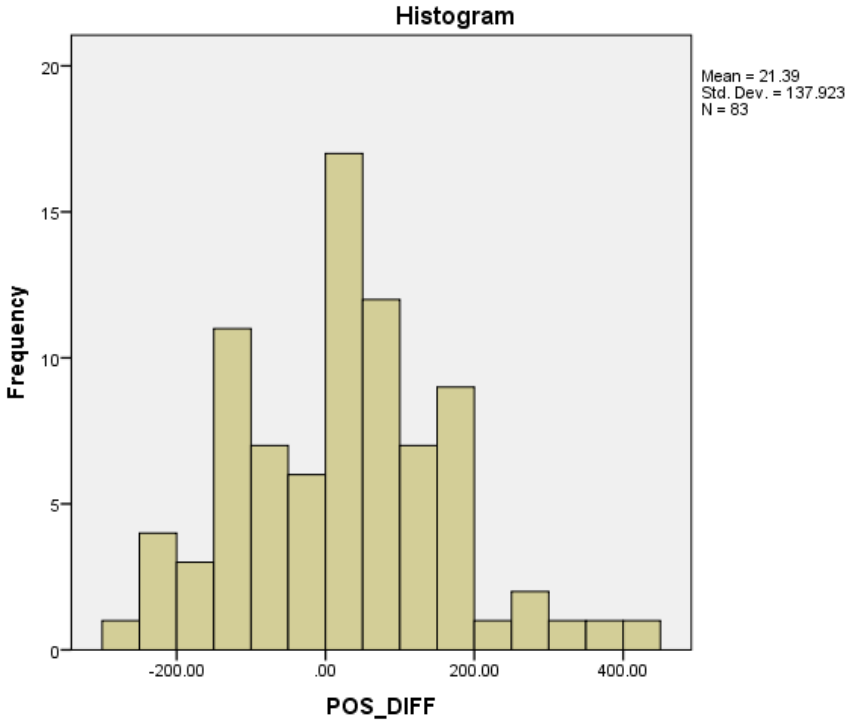

Figure 34: Distribution of the whole sample response times for the difference between the positive affect unrelated control trials and the ignored repetition trials (POS DIFF)

APPENDIX J

Table 14: Whole sample skewness and kurtosis values

Condition	**N**	**Skewness (Std. error)**	**Kurtosis (Std. error)**
Unrelated control	249	0.367 (0.154)	-0.533 (0.307)
Ignored repetition	249	0.305 (0.154)	-0.425 (0.307)
Difference	249	0.583 (0.154)	1.242 (0.307)
Long-term unrelated	249	0.679 (0.154)	0.497 (0.307)
Long-term ignored repetition	249	0.972 (0.154)	1.427 (0.307)
Long-term difference	249	-0.283 (0.154)	4.277 (0.307)
Unrelated negative	83	0.415 (0.264)	-0.345 (0.523)
Ignored repetition negative	83	0.365 (0.264)	-0.382 (0.523)
Negative difference	83	0.751 (0.264)	1.542 (0.523)
Unrelated neutral	83	0.359 (0.264)	-0.619 (0.523)
Ignored repetition neutral	83	0.238 (0.264)	-0.388 (0.523)
Neutral difference	83	0.634 (0.264)	1.574 (0.523)
Unrelated positive	83	0.275 (0.264)	-0.694 (0.523)
Ignored repetition positive	83	0.331 (0.264)	-0.469 (0.523)
Positive difference	83	0.248 (0.264)	0.166 (0.523)

APPENDIX K

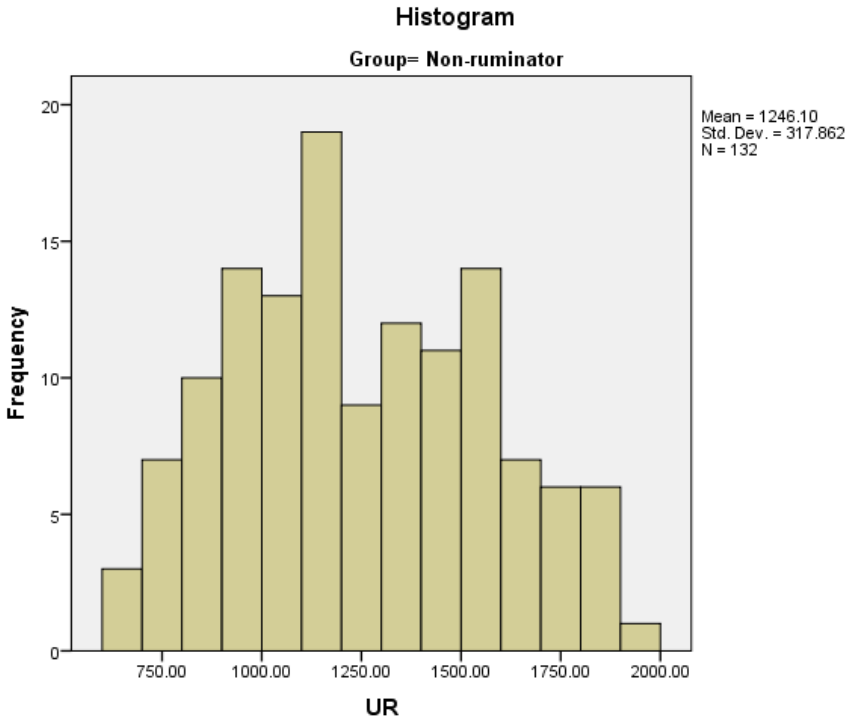

Figure 35: Distribution of the unrelated control condition for the non-ruminator group

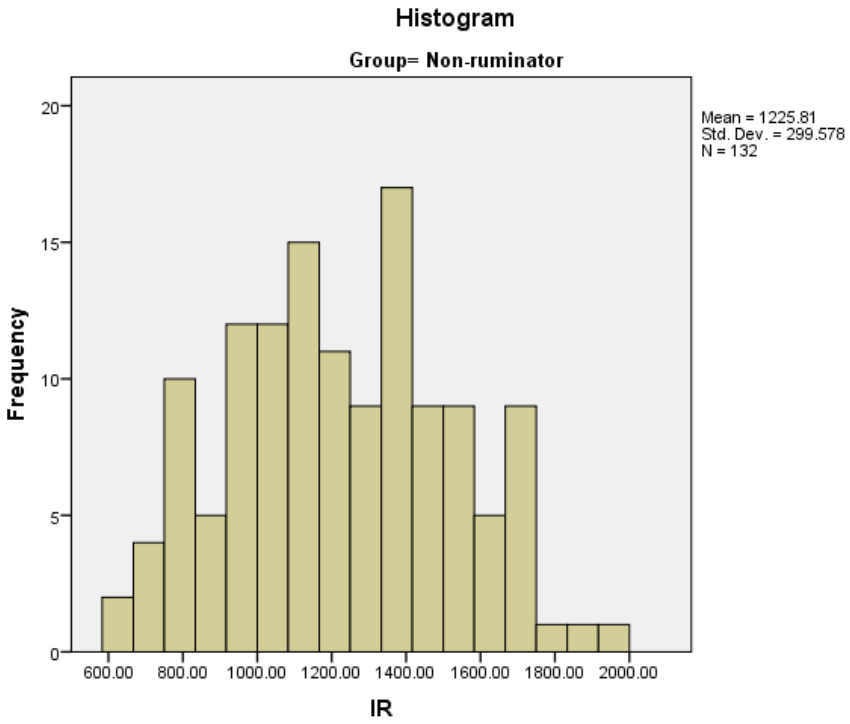

Figure 36: Distribution of the ignored repetition condition for the non-ruminator group

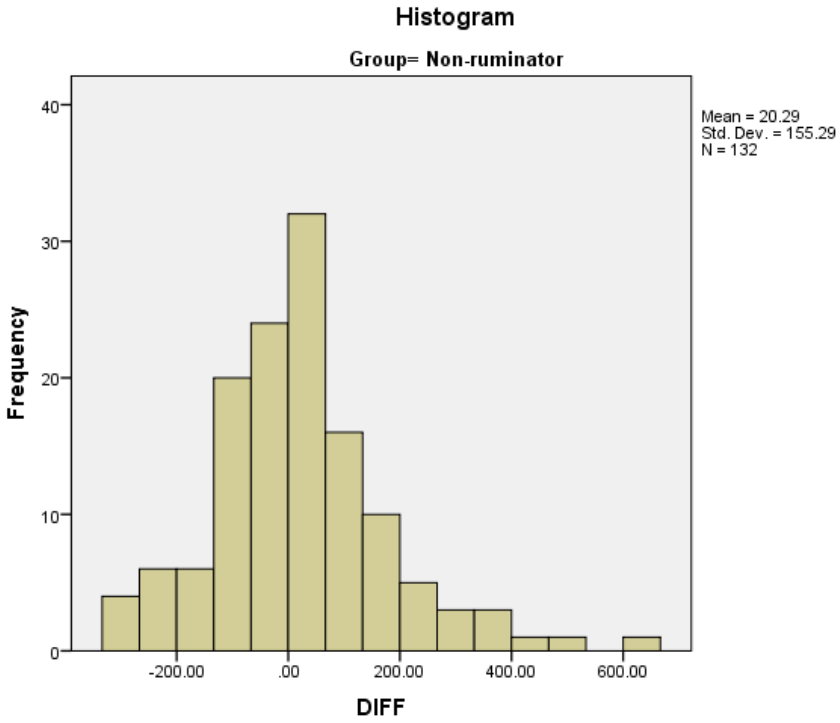

Figure 37: Distribution of the difference between the unrelated control condition and the ignored repetition condition for the non-ruminator group

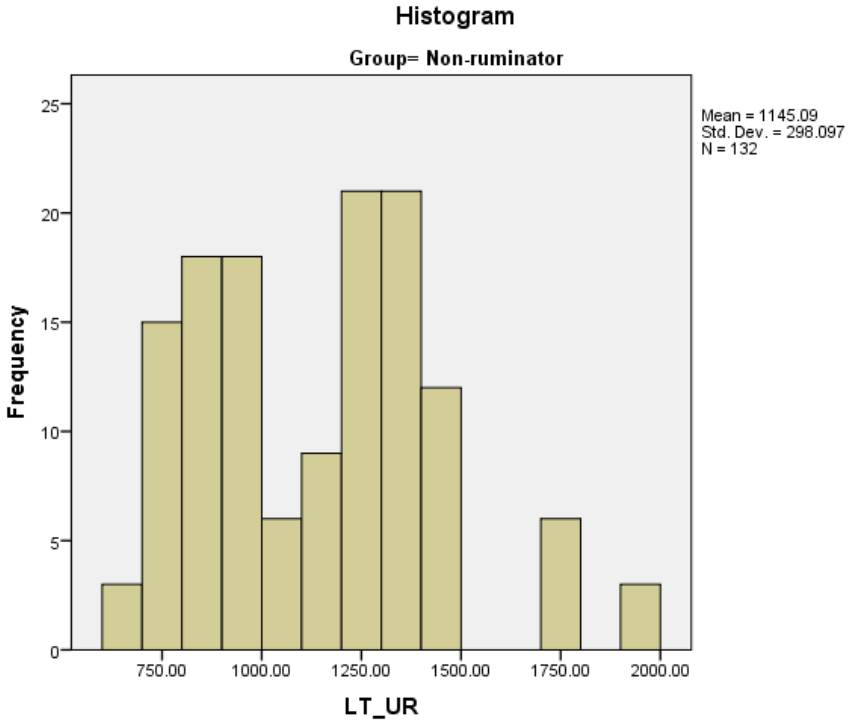

Figure 38: Distribution of the long-term unrelated control condition for the non-ruminator group

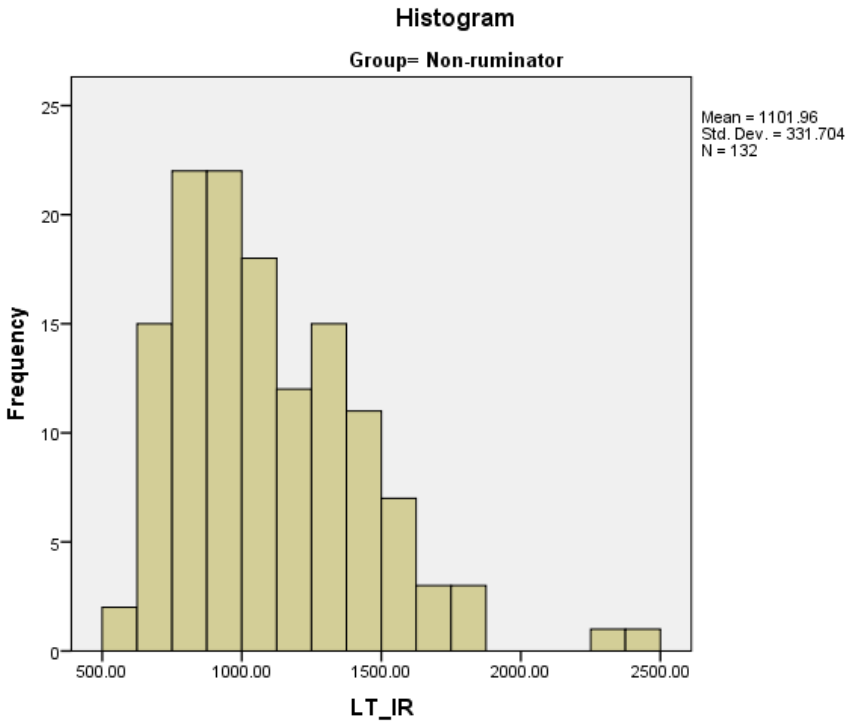

Figure 39: Distribution of the long-term ignored repetition condition for the non-ruminator group

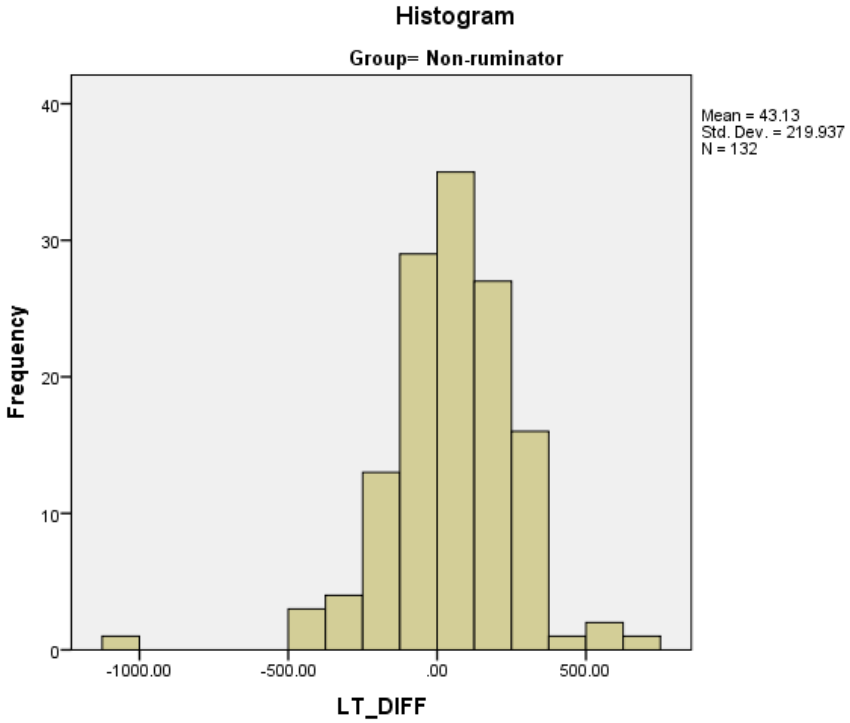

Figure 40: Distribution of the difference between the long-term unrelated control condition and the long-term ignored repetition condition for the non-ruminator group

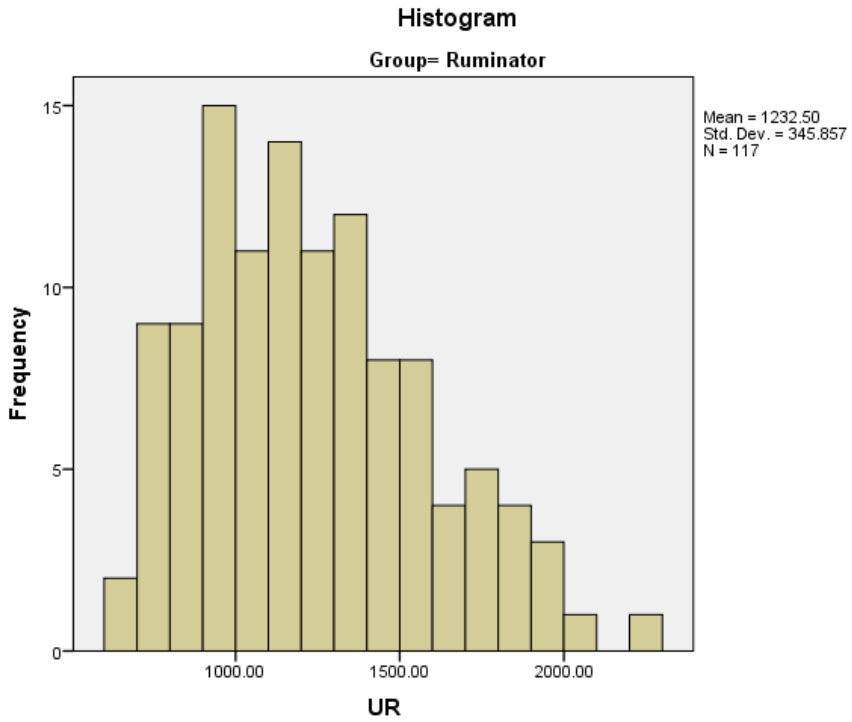

Figure 41: Distribution of the unrelated control condition for the ruminator group

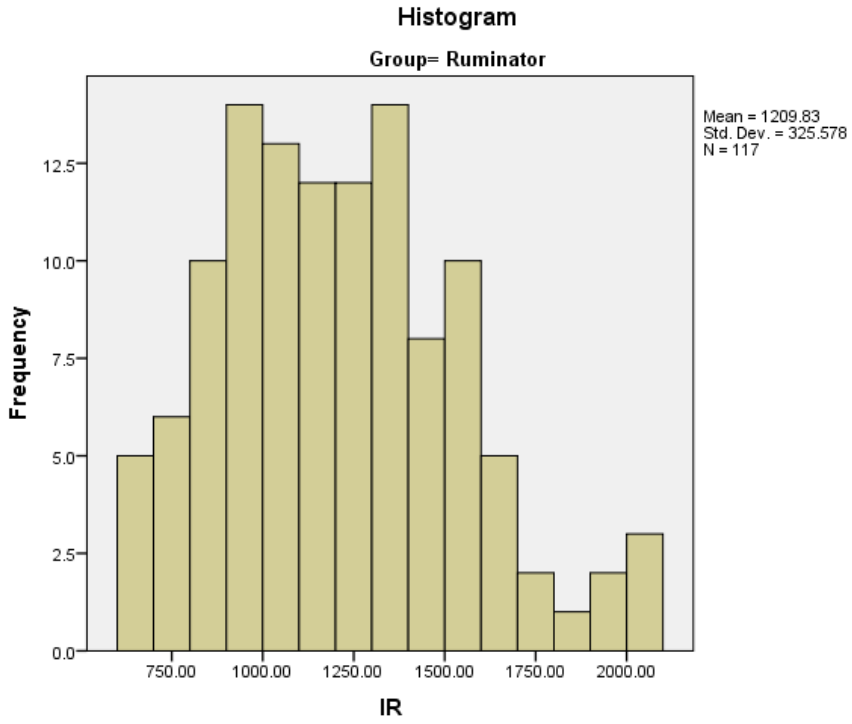

Figure 42: Distribution of the ignored repetition condition for the ruminator group

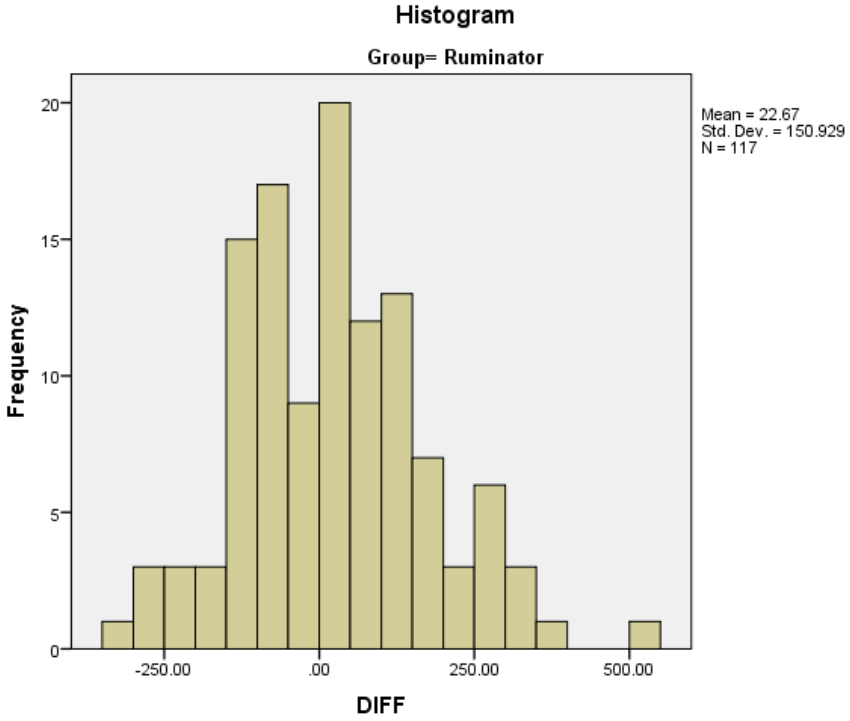

Figure 43: Distribution of the difference between the unrelated control condition and the ignored repetition condition for the ruminator group

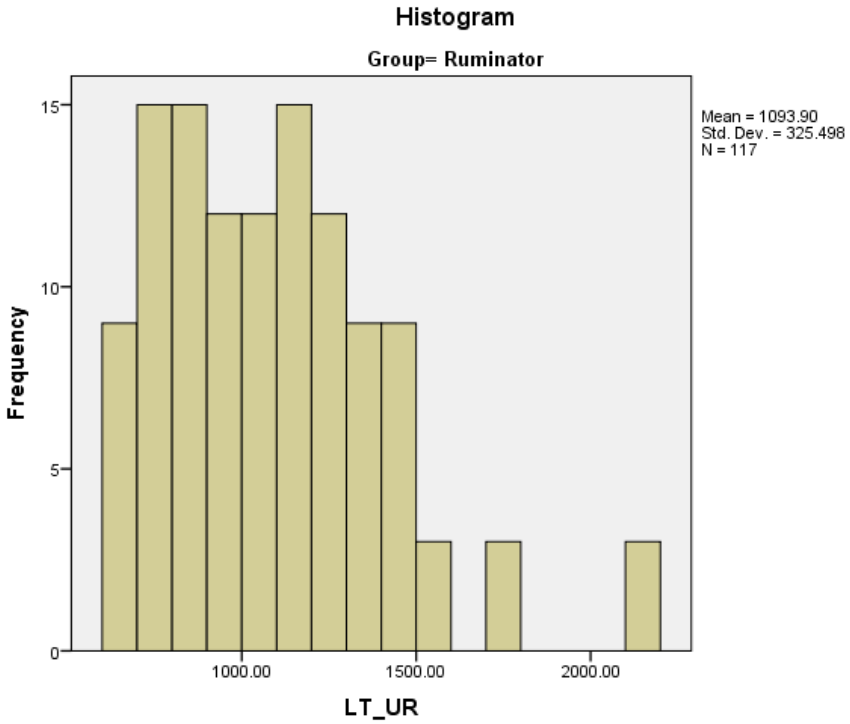

Figure 44: Distribution of the long-term unrelated control condition for the ruminator group

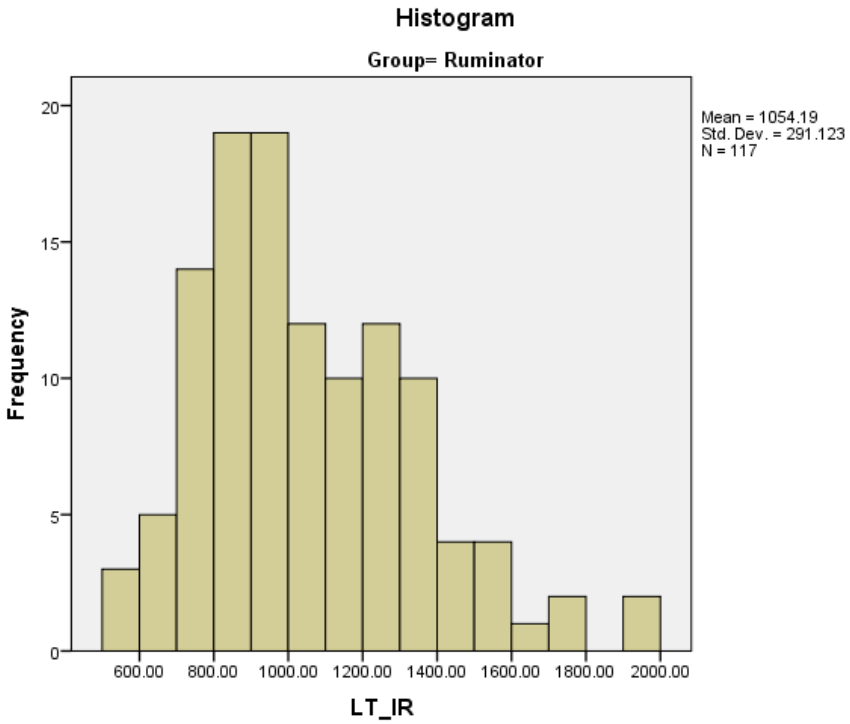

Figure 45: Distribution of the long-term ignored repetition condition for the ruminator group

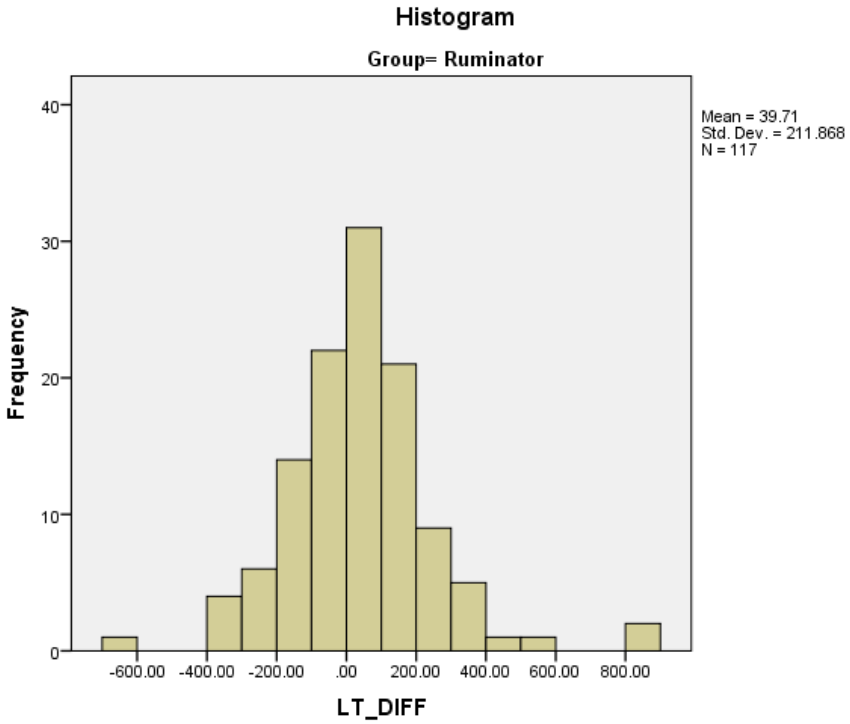

Figure 46: Distribution of the difference between the long-term unrelated control condition and the long-term ignored repetition condition for the ruminator group

APPENDIX L

Table 15: Skewness and kurtosis values for non-ruminator and ruminator groups

Group	**Condition**	**N**	**Skewness (Std. error)**	**Kurtosis (Std. error)**
Non-ruminator	Unrelated	132	0.166 (0.211)	-0.823 (0.419)
	Ignored repetition	132	0.082 (0.211)	-0.767 (0.419)
	Difference	132	0.772 (0.211)	1.881 (0.419)
	Long-term unrelated	132	0.452 (0.211)	-0.168 (0.419)
	Long-term ignored repetition	132	1.069 (0.211)	1.807 (0.419)
	Long-term difference	132	-1.000 (0.211)	4.984 (0.419)
Ruminator	Unrelated	117	0.557 (0.224)	-0.269 (0.444)
	Ignored repetition	117	0.516 (0.224)	-0.153 (0.444)
	Difference	117	0.360 (0.224)	0.551 (0.444)
	Long-term unrelated	117	0.935 (0.224)	1.257 (0.444)
	Long-term ignored repetition	117	0.752 (0.224)	0.385 (0.444)
	Long-term difference	117	0.620 (0.224)	3.642 (0.444)

APPENDIX M

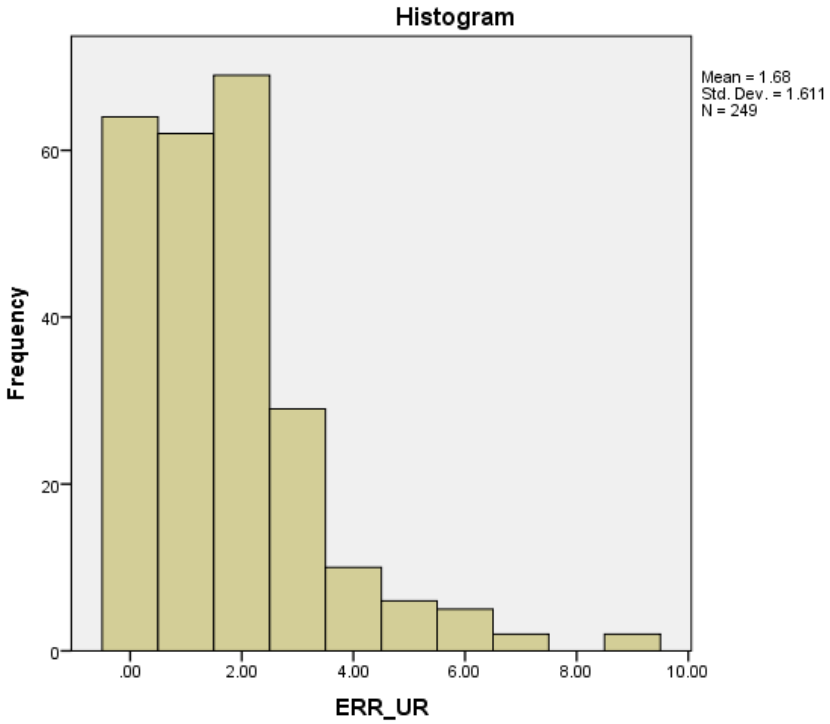

Figure 47: Distribution of the whole sample error rates for the unrelated control condition

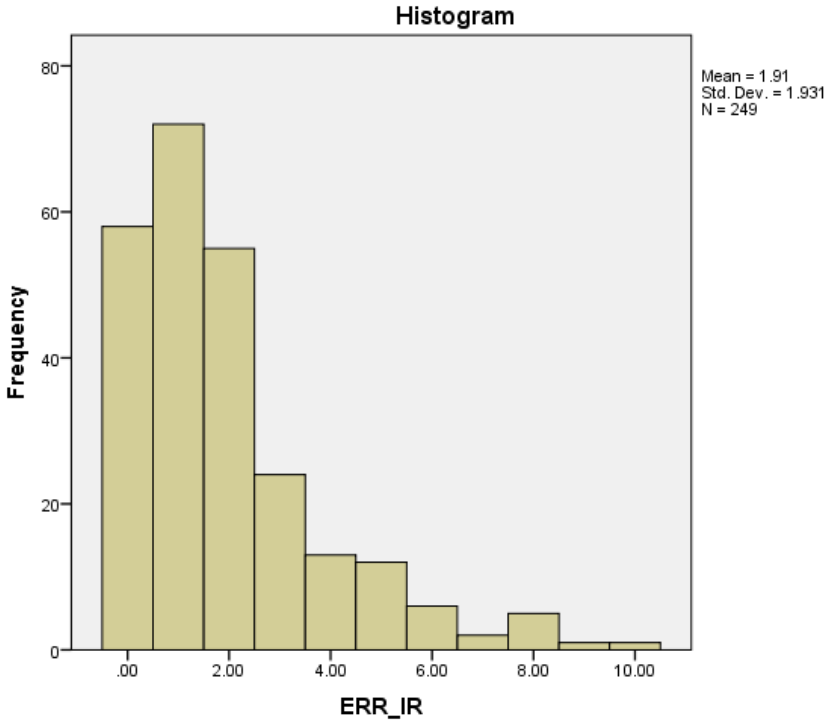

Figure 48: Distribution of the whole sample error rates for the ignored repetition condition

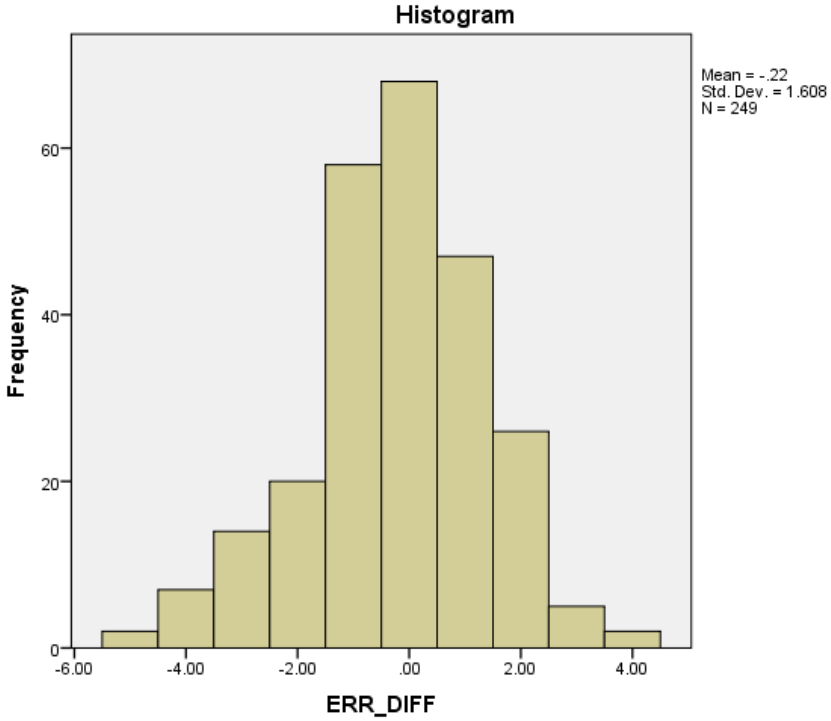

Figure 49: Distribution of the difference in error rates between the unrelated control condition and the ignored repetition condition

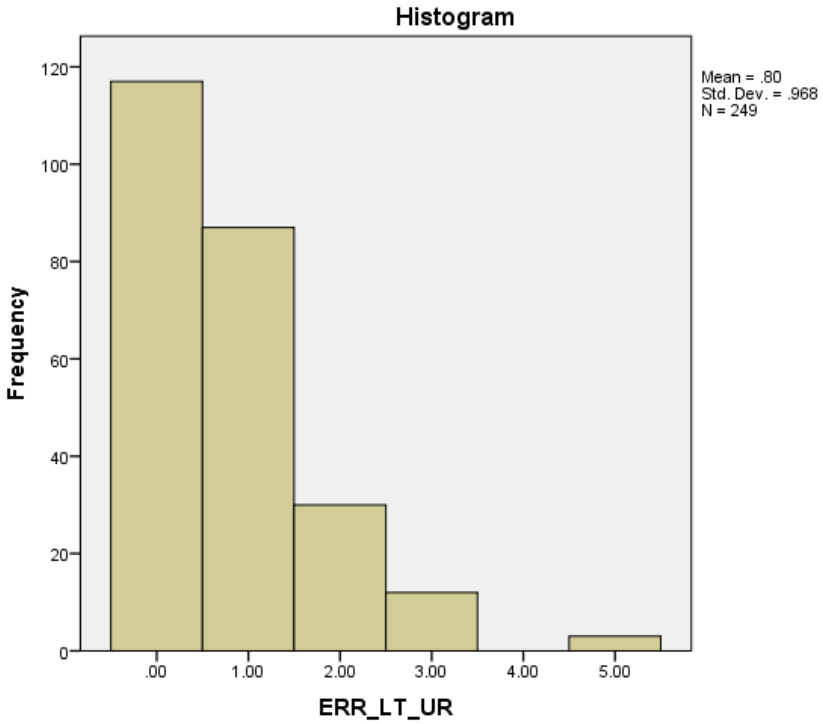

Figure 50: Distribution of the whole sample error rates for the long-term unrelated control condition

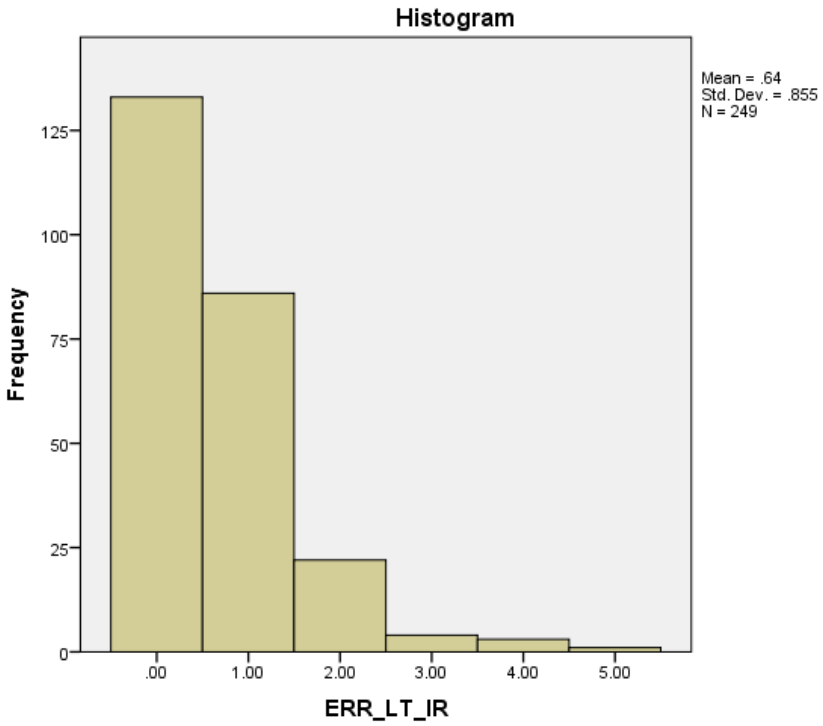

Figure 51: Distribution of the whole sample error rates for the long-term ignored repetition condition

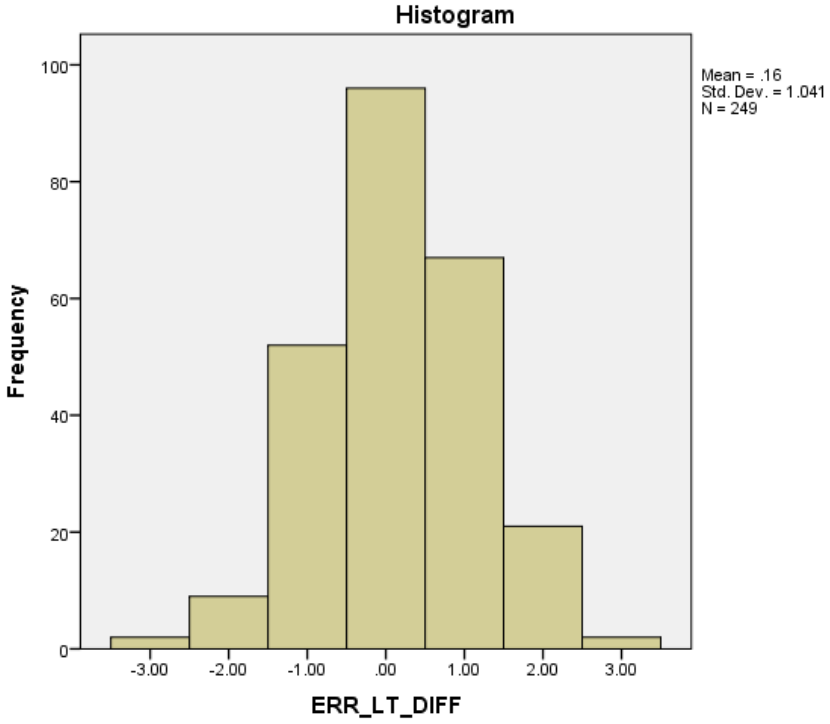

Figure 52: Distribution of the difference in error rates between the long-term unrelated control condition and the long-term ignored repetition condition

APPENDIX N

Table 16: Skewness and kurtosis values for error rates

Variable	**N**	**Skewness (Std. error)**	**Kurtosis (Std. error)**
Error unrelated control	249	1.529 (0.154)	3.519 (0.307)
Error ignored repetition	249	1.547 (0.154)	2.587 (0.307)
Error difference	249	-0.333 (0.154)	0.318 (0.307)
Error long-term unrelated control	249	1.549 (0.154)	3.219 (0.307)
Error long-term ignored repetition	249	1.783 (0.154)	4.435 (0.307)
Error long-term difference	249	-0.059 (0.154)	0.103 (0.307)