

FALSE MEMORIES IN DEPRESSION: VULNERABILITY FACTOR OR SYMPTOM?

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**Title**

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## ABSTRACT

False memories are sometimes generated when recalling words from lists in which the words are conceptually related. People think of concepts that are associated with the lists but which were never presented. Previous research has shown that sad mood reduces false memories whereas depression increases false memories, especially to negative information. It is possible that false memories represent a cognitive characteristic that is present prior to depression. I hypothesized that depressed individuals and those vulnerable to depression would falsely recall more negative critical lures than controls. Depressed and vulnerable individuals were not expected to perform differently from each other. The results did not support these hypotheses. High ruminators recalled significantly fewer critical lures independent of mood or depression. This finding possibly suggests that ruminators may have a repetitive focus on the words in the lists and do not make extra-list associations.

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## FALSE MEMORIES IN DEPRESSION: VULNERABILITY FACTOR OR SYMPTOM?

Mood influences memory and can do so differently depending on the task at hand. In spatial memory tasks, Gray (2001) found that negative mood improved performance and positive mood impaired performance. In verbal tasks, Gray (2001) found that negative mood impaired performance and positive mood increased performance. Mood can also influence one's cognitive control. In depression, individuals' executive functions are compromised in such a way that they have to use much more effortful cognitive control than usual and that the process which regulates cognitive control is interconnected with the same process that regulates emotion (Banich et al., 2009).

False memories occur when an individual remembers something that never actually occurred or remembers something differently than the way it happened (Roediger & McDermott, 1995). The Deese-Roediger-McDermott (DRM) paradigm is a false memory paradigm that has been used to investigate differences in individuals' recall of words from lists of neutral, positive, or negative words (Roediger & McDermott, 1995). The DRM paradigm includes lists that are designed to lure individuals into recalling words that are never presented. One example is the list of words: castle, queen, horse, and moat. When an individual reads, learns, and then recalls the words in this list, they often also recall the *critical lure*. In this case, the critical lure would be "king", a word not in the list but highly associated with the four words in the list. Generally, the probability of recalling critical lures is equal to or greater than the probability of recalling the words on the lists (Roediger & McDermott, 1995).

Studies using the DRM paradigm have looked at the influence of mood on true and false memories. Storbeck and Clore (2005) induced healthy participants into either positive or negative mood states and also had a control condition of non-manipulated mood. In one

experiment, participants were instructed to write down only words that they remembered from the lists. Results revealed that those in the negative mood condition were less likely to recall false memories or critical lures than participants in the positive mood or non-manipulated conditions. Therefore, negative mood reduced levels of false memory. Storbeck and Clore (2005) attributed these results to the claims that negative affect prompts item-specific processing so that other items are less likely to come to mind during the task.

In contrast, it has been suggested that positive affect prompts global processing so it is more likely that other items will come to mind (Arndt & Reder, 2003; Hege & Dodson, 2004). In Storbeck and Clore's (2005) second experiment, participants were instructed to recall words from the list but to also report any other words that came to mind. This was done to determine if the effect of mood occurred at encoding or retrieval. Their results were the same as in the first experiment, thus revealing that the effect occurs at encoding of the words rather than at retrieval of the words. This can be concluded because the difference between mood groups in the number of reported critical lures stayed the same when participants were instructed to list both critical lures and list words. This shows that in the negative mood group, the critical lures were not as accessible at encoding as they were in the positive group. At encoding, fewer words were put in to memory rather than inhibited during retrieval.

An important consideration is how the concept of false memories may apply to individuals with emotional disorders. Depression is associated with memory impairments. Depressed participants typically recall less material than nondepressed controls (Burt, Zembar, & Niederehe, 1995) and are biased toward negative events when episodic memory is tested (Hertel, 2004). Depression is associated with difficulties in cognitive control, especially difficulty inhibiting irrelevant negative material as well as exhibiting attentional biases toward mood-



congruent material making mood-congruent material more memorable and mood-incongruent material less accessible (Burt, Zembor, & Niederehe, 1995; Hertel, 2004; Matthews & MacLeod, 2005). Because depressed individuals are more likely to think of negative self-ideas when sad, it is possible that the increased availability of negative ideas would lead to an increased likelihood of reporting false memories.

Joormann, Teachman, and Gotlib (2009) investigated this by using the DRM paradigm with a sample of healthy controls and individuals diagnosed with major depressive disorder (MDD). Individuals suffering from MDD recalled fewer words from all lists than the control group, but most prominently in the condition that consisted of positively valenced words. Also, the MDD participants falsely recalled significantly more critical lures in the negative word condition compared to controls, but not in the positive or neutral word conditions. These findings contradict those of Storbeck and Clore (2005) and suggest that depression is different from a general sad mood in its impact on memory.

Howe and Malone (2011) obtained similar findings. Participants with MDD compared to healthy controls recalled significantly more critical lures from the depression-relevant lists. They did not differ on correct recall of presented words in any of the conditions in comparison to controls. This replication is an important demonstration of the reliability of the false memory effect. Furthermore, the results of both studies are consistent with the idea that depression involves an increased availability and accessibility of negatively valenced semantic content. The increased availability and accessibility of that information makes it more likely for depressed individuals to falsely recall critical lures.

It has been observed that those who are depressed are more susceptible to false memories during the recall of negatively valenced words whereas healthy individuals induced into a sad

mood are less susceptible to false memories under the same conditions. The difference can be explained through the activation-monitoring framework where the encoding and retrieval of information are affected by the activation and monitoring processes (Roediger et al., 2001). During the encoding of a list, semantic activation processes can lead items to come to mind that were not presented in the list. When critical lures or other false memories come to mind, they can be encoded as having the same features as the words in the list. By presenting a list of words, an activation of information occurs where the individual creates associations in error (Roediger et al., 2001).

Difficulties in monitoring or determining the source of the words which come to mind may lead to memories of words which were thought of, but which were not seen in the list. At retrieval, words that were stored as having been seen due to a strong activation at encoding are recovered falsely (Jacoby et al., 1989). In sum, since the critical lures are strongly activated during encoding, monitoring them at retrieval deems more difficult and resulting in the production of false memories (Roediger et al. 2001).

Since depression is associated with an increased activation of negative material, one can assume that depressed individuals would have difficulties correctly encoding and retrieving information. The negative material presented may activate a large amount of information that may have similar features to the words presented so the individual stores those thought of words as actual list words. At retrieval, the depressed individual is then more likely to incorrectly monitor the source of the word since it was so strongly activated during encoding (Roediger et al., 2001).

From the research, we can see that depression is associated with impaired memory when determining the source of negative material. Individuals with depression respond differently than

healthy controls in induced moods on false memory tasks. What we do not know is whether this difference in memory exists prior to experiencing depression or a result of depression. Do individuals who are vulnerable to depression have the same false memory impairments as individuals diagnosed with MDD? The present study sought to examine this question.

Rumination is a maladaptive form of self-reflection that occurs when individuals respond to a negative situation by repetitively focusing on potential causes and consequences of the situation without considering a solution (Nolen-Hoeksema, 1991; Mor & Winquist, 2002). Rumination has been shown to be associated with and predictive of depressive episodes. The Response Styles Theory states that ruminative tendencies remain stable in individuals who are depressed even when change in depression occurs (Nolen-Hoeksema, Morrow, & Fredrickson, 1993). Individuals who have a tendency to ruminate are more likely to interpret negative situations as more negative than they actually were (Nolen-Hoeksema, Morrow, & Fredrickson, 1993). It is also suggested that rumination might be associated with memory (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008).

Abela and Hankin (2004) found that individuals scoring higher on measures of rumination had a higher probability of experiencing a major depressive episode and episodes of greater duration when compared to individuals scoring low on measures of rumination. It is also suggested that having the tendency to ruminate impairs cognitive and behavioral performance along with worsening depressive symptoms (Auerbach, Webb, Gordiner, & Pechtel, 2013). Having a high tendency to ruminate should lead to a focus on negative information and an increased activation of negative constructs. Therefore, like depressed individuals, individuals who have a high tendency to ruminate, making them vulnerable to depression, would be

expected to perform similarly to depressed participants on the DRM, which is to show higher false memories on negatively valenced word lists.

Students who were low and high in rumination, but were not nor had ever been depressed were exposed to the DRM task under positive (content) and negative (sad) emotions. I hypothesized that those scoring high on a measure of rumination would perform in a pattern similar to the MDD participants in Joormann et al. (2009) and Howe and Malone (2011) when induced in a negative mood by recalling more negative critical lures than individuals scoring low on a measure of rumination who would report fewer critical lures in an induced negative mood. I also recruited a sample of depressed individuals. I hypothesized that those considered depressed would also report more critical lures on the negative list in comparison to those low in rumination, but would not differ from those who were high in rumination. Support for the above hypotheses may suggest that the memory impairments present in individuals with MDD began as a vulnerability factor for their depression rather than develop as a symptom of their depression.

## Method

### *Recruitment*

Undergraduate participants were recruited through a one-time online survey. The survey included a request for respondents to agree to be contacted for participation in a follow-up study. The screening surveyed 616 students.

A demographics questionnaire, a measure of the tendency to ruminate (Ruminative Responses Scale), a measure of depression (Beck Depression Inventory), and a substance abuse screening tool (CAGE Assessment) were administered in that order. These measures are described in detail below. Other measures for a separate study were included; however, they were not used in the analyses of this study so they will not further be mentioned. There were also

two questions concerning each individual's history of depression as follows: 1) Are you currently being treated for depression? and 2) Have you ever been depressed?

At the end of the survey, students were given an educational debriefing on research methods and the value of participating in research.

### *Participants*

Three types of individuals were recruited for participation in the laboratory study of memory. These included: 1) never depressed, low ruminating individuals, 2) those who scored high on the Ruminative Responses Scale (RRS) but have never been depressed, and 3) those who at the time reported high levels of depressive symptoms.

Individuals scoring 10 or above on the Beck Depression Inventory (BDI) were invited to participate. Individuals scoring across a continuum on the RRS and 3 or below on the BDI were also invited. Individuals who scored 2 or above on the CAGE were not invited to participate to rule out alcohol abuse as a potential confound. Individuals were excluded if they were not fluent in English, were not 18 years or older, or if they reported a history of severe head trauma. Full participant data can be seen in *Table 1*.

*Table 1. Characteristics of Participants*

Variable	Full Sample	Group		
		Low Ruminators	High Ruminators	Depressed
N (female)	82 (37)	28 (14)	30 (9)	24 (10)
Age (M, <i>SD</i> )	19.9 (3.37)	19.18 (.97)	20.93 (5.14)	19.46 (3.37)
% Caucasian	85.7	92.9	76.7	87.5
BDI (M, <i>SD</i> )	5.35 (7.79)	0.61 (1.01)	1.03 (1.05)	16.29 (5.94)
RRS (M, <i>SD</i> )	37.13 (11.37)	25.64 (2.27)	37.53 (5.48)	50.04 (8.80)

*Note.* BDI = Beck Depression Inventory; RRS = Ruminative Responses Scale.

### *Treatment of Human Subjects*

Informed consent was obtained from all participants and all were fully debriefed at the end of the experiment. All participants were treated in accordance with American Psychological

Association's ethical code of conduct and guidelines. Participants were awarded course credit or \$10 for participation.

All participants in the laboratory portion of the study were educated about the nature of depression. All participants were given a brochure that described depression, treatment options, and listed area resources. A graduate student trained in the assessment of depression and suicide risk provided individual feedback to those who fell in the depressed range on the screening measure of depression. Those who responded affirmatively to the suicide item on the BDI were further evaluated for suicide risk. If it was determined that the participant was not in imminent danger, a further debriefing was provided encouraging visiting the counseling center on campus. If the participant was in imminent danger, a discussion about the importance of intervention would ensue in order to solicit agreement to hospitalization. There were no incidents in which a participant needed hospitalization. If there had been such an incident, a plan was in place in accordance to university standards to have campus police be called to escort the participant to a local emergency room.

### *Materials*

*Ruminative Responses Scale (RRS)*. The RRS is a 22-item scale of the Response Styles Questionnaire. Respondents are asked to describe how they typically cope with negative mood by responding to items on a 4-point scale ranging from 1 (*almost never*) to 4 (*almost always*). A single total score is derived by summing the responses to the 22 items. Scores range from 22 to 88 with higher scores indicating more rumination. The RRS is a continuous measure so there is no distinct cut-off score. The items on the RRS describe responses that are self-focused, symptom focused, and focused on consequences of the individual's mood. The RRS has shown good construct validity and test-retest reliability, acceptable convergent, predictive and

discriminant validity, and high levels of internal consistency ( $\alpha > .89$ ) (Nolen-Hoeksema & Davis, 1999; Butler & Nolen-Hoeksema, 1994; Just & Alloy, 1997; Nolen-Hoeksema & Morrow, 1991).

*Beck Depression Inventory (BDI)*. The BDI is a 21-question multiple choice self-report questionnaire that measures the severity of depression. Each item consists of four sentences describing a particular symptom arranged in order of severity. Respondents choose the sentence that most closely describes their experience over the last two weeks. Each item is scored on a 0-3 scale. All items are summed to form a total score that can range from 0-63 with higher scores reflecting greater levels of depressive symptomatology. A score equal to or greater than 10 places an individual in the dysphoric range (Beck, 1978). The BDI has been shown to have good internal consistency with mean coefficient alphas of .81-.86. The concurrent validity of the BDI has also been found to be high with mean correlations of .60-.74 (Beck, Steer & Garbin, 1988).

*State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA)-State Version*. The STICSA-State is the 21-item state anxiety scale of the STICSA. It was created to measure the general cognitive and somatic symptoms of anxiety. The entire STICSA has been found to be more correlated with anxiety measures ( $r_s \geq .67$ ) and less correlated with depression measures ( $r_s \leq .61$ ) than the State-Trait Anxiety Inventory. Respondents are asked to rate the items asking how true each statement is of them on a 4-point scale ranging from 1 (*not at all*) to 4 (*very much so*). Scores are obtained by adding the responses to the 21 items. A cut-off score of 43 is used for determining clinically significant levels of anxiety, while a cut-off score of 40 is used to detect possible presence of anxiety disorders (Gros et al., 2007). Anxiety could influence performance on the memory task, so by including this measure we can statistically control for the effect.

*CAGE Assessment Substance Abuse Screening Tool.* The CAGE is a 4-item self-report tool used for screening alcohol abuse. Individuals respond “yes” or “no” to a question about their alcohol use regarding whether they have ever tried to cut back, have ever been annoyed or angered when questioned about their use, have ever felt guilty about their use, and if they have ever had an eye-opener to get started in the morning. Scores can be totaled by counting the times the participant responded yes and range from 0-4. A score of 2 or more indicates probable alcohol abuse with a sensitivity of 74% and a specificity of 91% (Buchsbbaum et al., 1991).

*Affect Grid.* The Affect Grid is a single-item scale used to assess affect and consists of a 9 x 9 grid with pleasure being rated from 1-9 on the horizontal axis and arousal being rated 1-9 on the vertical axis. Participants are asked to make a single rating by placing an x in one of the boxes on a 9 x 9 grid indicating their level of pleasure and arousal at that time. The Affect Grid has been shown to have adequate reliability, convergent validity, and discriminant validity for various uses as a state measure of mood (Russell, Weiss & Mendelsohn, 1989). Two scores are derived from this measure: ratings of experienced pleasure and arousal are taken from the position of the respondents mark and range from 1 - 9. Higher scores reflect more arousal and more pleasure. These ratings were used to assess the impact of the mood manipulation.

*DRM Word Lists.* A modified version of the Deese-Roediger-McDermott (DRM) paradigm was used to investigate the differences in recall of presented words, recall of non-presented words, and recall of critical lures in individuals who are not considered vulnerable to depression and those who are considered vulnerable to depression based on scores from a measure of rumination. Thirty lists were presented in each condition with 15 words in each list. Lists were taken from Storbeck and Clore (2005) and Joormann et al. (2009). Each list is associated with a critical lure which is never actually presented but is highly associated with the



words in the list. Five of the lists presented in each condition were positive, five were negative, with the remaining 20 being neutral. In each list, the first word presented was the most associated with the never presented critical lure. Then each word that was presented next became less associated with the critical lure, yet still related. The words were presented on a computer monitor for 250ms, one at a time. The presentation of stimuli for the memory task was programmed in E-prime. There was a 32ms delay between each word. After each list, participants were given 45s to list words recalled and words thought of by hand on the response sheet provided. At the end of 45s, a tone sounded that signaled the next list. All word lists were administered in the same manner.

A research assistant checked with participants if any responses were illegible before recording the final score. The primary dependent measure was critical lures. The dependent measures described in the analyses below were the proportion of critical lures recalled in the seen column for each word list type (negative, neutral, positive). Other measures including correct recall, inclusion, list words thought of, and non-list words thought of were noted to check for alternative memory effects. No effects were found and those measures were not investigated further.

### *Mood Induction*

For the participants in the non-depressed groups, mood was manipulated with music and pictures before each list was presented. The negative mood in this study was tailored to be consistent with the literature and was a low arousal, negative mood (sadness). To induce negative mood, participants listened to *Adagietto* by Mahler for eight minutes before beginning the first trial while viewing negatively valenced pictures from the International Affective Picture System (IAPS) (Lang, Bradley & Cuthbert, 2008). Niedenthal and Setterlund (1994) effectively induced negative mood with the Mahler piece. The positive mood in this study was also tailored to be

consistent with the literature and was a low arousal, positive mood (content). To induce positive mood, participants listened to *Eine Kleine Nacht Musik* by Mozart for eight minutes before beginning the first trial while viewing positively valenced pictures from the IAPS. Niedenthal, Halberstadt, and Setterlund (1997) effectively induced positive mood with the Mozart piece. Pictures were selected based on differences in pleasure ratings. Pictures rated high in pleasure were selected for the positive mood condition whereas pictures rated low in pleasure were selected for the negative mood condition. Participants listened to the same musical piece and viewed the same pictures relevant to assigned condition for one minute before every list following the first.

### *Procedure*

Participants were tested individually. Following informed consent, participants in the low and high rumination groups were randomly assigned to be induced into a negative mood or a positive mood before they began the task. Participants in the depressed group did not have a mood manipulation. Prior to receiving instructions and having mood manipulated, participants completed the BDI and the STICSA-State Version to assess current mood and the stability of depression. Only individuals whose scores on the BDI were consistent across the two measurement occasions (screening and lab administrations) were included in the final sample, bringing the total number of participants to 82. After the mood manipulation, participants in the mood manipulation conditions completed the affect grid to assess current mood.

In each condition, participants received instructions to try and remember the words presented as they would be asked to recall them later. They were also told to remember any words that came to mind during the list presentation, if they should occur. There were two columns on the response sheet for participants to write the words they remembered, one for

words from the presented list (labeled list words) and one for words that were thought of but not presented (words thought of). This was done to determine whether critical lures came to mind and if participants could monitor the source of the words correctly. Before the 30 lists were presented and before the mood induction, all participants began with 2 practice trials using two neutral lists, as suggested by Roediger and McDermott (1995). The order of lists was counterbalanced for each participant.

## Results

A manipulation check was conducted by looking for mean differences on the responses to the affect grid. A 2 (emotion) x 2 (group: low vs. high rumination) analysis of variance (ANOVA) was conducted on the pleasure ratings and arousal ratings from the affect grid. I hypothesized that participants would report more pleasure following the positive mood manipulation than the negative mood manipulation. There was a significant main effect for emotion for pleasure ratings,  $F(3, 57) = 122.29, p < .001$ . Participants in the positive mood condition rated their pleasure at an average of 8.04 ( $SD = 1.45$ ) whereas those in the negative mood condition rated their pleasure at an average of 3.19 ( $SD = 1.78$ ). No significant effects for rumination or the interaction of rumination and emotion were found for pleasure ratings (all  $ps > .05$ ). There were no effects found for arousal ratings (all  $ps > .05$ ). It appears that the mood induction had its intended effects as mood immediately following the induction differed between conditions in the appropriate direction.

Pearson correlation coefficients were calculated to determine if there was a relationship between the primary individual difference measures (i.e. the anxiety, depression, and rumination scores) and memory performance. Of particular interest was the correlation between anxiety and false memories, as this would indicate whether the level of anxiety should be taken into account

in further analyses. All Pearson correlation coefficients can be found in *Table 2*. Anxiety was not significantly correlated with the negative word lists memory score, the neutral word lists memory score, or the positive word lists memory score (all  $ps > .05$ ). Depression was not significantly correlated with the negative word lists memory score, the neutral word lists memory score, or the positive word lists memory score (all  $ps > .05$ ). Rumination was significantly correlated with the neutral word lists memory score and the positive word lists memory score, but not with the negative word lists memory score.

*Table 2. Pearson Correlation Coefficients among Dependent Variables*

	BDI	STICSA	RRS	NEG-CL	POS-CL	NEU-CL
BDI	1.000	.779***	.731***	-.104	-.120	-.201
STICSA	-	1.000	.649***	-.159	-.128	-.120
RRS	-	-	1.000	-.145	-.284**	-.336**
NEG-CL	-	-	-	1.000	.447	.529***
POS-CL	-	-	-	-	1.000	.625***
NEU-CL	-	-	-	-	-	1.000

*Note.* \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ . BDI = Beck Depression Inventory; STICSA = State Trait Inventory for Cognitive and Somatic Anxiety-State Version; RRS = Ruminative Responses Scale; NEG-CL = proportion of negative critical lures; POS-CL = proportion of positive critical lures; NEU-CL = proportion of neutral critical lures. Means are provided with standard deviations in parentheses.

A 2 (rumination: low vs. high) x 2 (emotion: negative vs. positive) x 3 (list type: negative, positive, neutral) mixed design ANOVA was conducted on the proportion of critical lures recalled, with list type as a repeated measure. A significant effect of rumination was found,  $F(1, 54) = 6.18, p = .016$ . High ruminators recalled fewer critical lures ( $M = .46, SD = .20$ ) in comparison to low ruminators ( $M = .58, SD = .17$ ). No significant effects for emotion,  $F(1, 54) = .49, p = .489$ , or the interaction of rumination and emotion,  $F(1, 54) = .75, p = .391$ , were found. There was no significant effect of list type,  $F(2, 108) = .84, p = .433$ , nor were the interactions of list type and rumination,  $F(2, 108) = 1.59, p = .209$ , list type and emotion,  $F(2, 108) = 1.45, p = .239$ , or list type, rumination and emotion,  $F(2, 108) = 1.20, p = .306$ , significant. The means and

standard deviations from this analysis are listed in *Table 3*. The results of this analysis do not confirm the hypothesis that those scoring high on a measure of rumination would recall more negative critical lures than those scoring low on a measure of rumination when induced into a negative mood.

*Table 3. Mean Critical Lures Recalled and (SDs) for Rumination x Emotion x List Type*

	Low Ruminators		High Ruminators	
	Negative Mood	Positive Mood	Negative Mood	Positive Mood
NEG-CL	.57 (.26)	.51 (.26)	.41 (.20)	.53 (.29)
POS-CL	.63 (.20)	.52 (.27)	.46 (.24)	.43 (.28)
NEU-CL	.66 (.18)	.60 (.20)	.49 (.19)	.42 (.23)

*Note.* Means are presented with standard deviations in parentheses. NEG-CL = proportion of negative critical lures; POS-CL = proportion of positive critical lures; NEU-CL = proportion of neutral critical lures.

A second model was tested to investigate the hypothesis that those in the depressed group would recall more negative critical lures than those in the low rumination group induced into a negative mood but not differ from those in the high rumination group induced into a negative mood. A 3 (group: low ruminators in negative mood vs. high ruminators in negative mood vs. depressed) x 3 (list type: negative vs. positive vs. neutral) mixed design ANOVA was conducted with list type as a repeated measure. There was no effect for group,  $F(2, 52) = 2.16, p = .126$ , list type,  $F(2, 104) = 1.74, p = .180$ , or their interaction,  $F(4, 104) = .40, p = .807$ . The results of this analysis do not confirm the hypothesis. See *Table 4* for values from this analysis.

*Table 4. Mean Critical Lures Recalled and (SDs) for Group x List Type*

	Group		
	LR-N	HR-N	DEP
NEG-CL	.54 (.27)	.44 (.20)	.46 (.25)
POS-CL	.59 (.17)	.49 (.28)	.43 (.26)
NEU-CL	.62 (.19)	.53 (.21)	.48 (.21)

*Note.* Means are presented with standard deviations in parentheses. NEG-CL = proportion of negative critical lures; POS-CL = proportion of positive critical lures; NEU-CL = proportion of neutral critical lures; LR-N = low ruminators under negative mood; HR-N = high ruminators under negative mood; DEP = depressed.

Since depression has been previously shown to be associated with an increase in the recall of negative critical lures (Joormann et al., 2009) and ruminative thinking styles have been related to difficulties in inhibiting attention to negative information (Joormann, Levens, & Gotlib, 2011), it is possible that these two variables would interact to influence false memories. Post-hoc analyses were conducted to further investigate this possibility. In a regression model, RRS and BDI scores along with their interaction were standardized and entered simultaneously as continuous variables predicting each list type. RRS, BDI, nor their interaction significantly predicted critical lures for the negative lists (all  $ps > .05$ ). When predicting critical lures for the positive lists, the overall model was significant,  $F(3, 81) = 2.969, p = .037$ . RRS was the only significant predictor,  $\beta = -.110, t = -2.725, p = .008$ . When predicting critical lures for the neutral lists, the overall model was significant,  $F(3, 81) = 3.553, p = .018$ . RRS was again the lone significant predictor,  $\beta = -.088, t = -2.636, p = .010$ . When controlling for depression, ruminators recall fewer critical lures. See *Table 5* for values from this analysis.

Table 5. *Summary of Regression Analysis*

	B	SE	$\beta$	$t$	Sig. ( $p$ )
<b>NEG-CL</b>					
BDI	.027	.053	.108	.509	.612
RRS	-.040	.041	-.158	-.460	.340
BDIxRRS	-.027	.035	-.130	-.770	.444
<b>POS-CL</b>					
BDI	.071	.052	-.278	1.365	.176
RRS	-.110	.040	-.430	-2.725	.008
BDIxRRS	-.024	.035	-.112	-.694	.490
<b>NEU-CL</b>					
BDI	.035	.043	.163	.807	.422
RRS	-.088	.033	-.412	-2.636	.010
BDIxRRS	-.015	.024	-.085	-.531	.547

*Note.* NEG-CL = proportion of negative critical lures; POS-CL = proportion of positive critical lures; NEU-CL = proportion of neutral critical lures.

## Discussion

The present study was designed to investigate whether individuals who are vulnerable to depression perform in a pattern similar to those diagnosed with major depressive disorder on a false memory task. In particular, it was hypothesized that being depressed or scoring high on a measure of rumination but having never been depressed would be associated with increased false recall of negative material, in particular negative critical lures when induced into negative mood.

Studies have been done to look at how healthy individuals induced into mood states (Storbeck & Clore, 2005) and depressed individuals (Joormann et al., 2009) perform on a DRM task. The results have been opposing. In healthy individuals, Storbeck and Clore (2005) found that positive or neutral mood led to more false recall of critical lures than a sad mood. The authors attributed this finding to positive mood typically creating relational or global processing, whereas negative mood creates item-specific processing. Global processing allows for more things to come to mind (increased activation) and is less focused on particular stimuli, whereas item-specific processing does not allow for as much activation of related concepts. I did not find a similar effect.

My findings show that regardless of what mood participants were in, they did not differ from one another because of it. There was an overall effect of rumination, such that high ruminators recalled fewer critical lures overall. It is curious to think about why high ruminators would recall fewer critical lures. It is possible that high ruminators may be more likely to engage in item-specific processing, regardless of mood. In other words, a ruminative thinking style may be associated with the repetitive focus on the specific content of the lists without making extra-list associations.

Joormann and colleagues (2009) and Howe and Malone (2011) looked at depressed individuals compared to healthy controls and found the opposite of Storbeck and Clore (2005). Depression was associated with a higher probability of falsely recalling negative critical lures. I, again, did not find such an effect. There were no differences among my participants among the various list types.

The findings of Joormann et al. (2009) suggest that the cognitive biases associated with depression influence performance on this memory task in a way that is different from healthy individuals induced into mood states. What their findings do not tell us, however, is how this memory difference comes about. Is it that people with depression develop this as a symptom of their depression? Or is it something that preexists and contributes to the development of the disorder? This study intended to investigate that question. Being able to answer this question would also allow us to learn more about the causes and consequences of depression.

My results suggest that rumination influences the false memory effect independently of emotion and depression. In the future we need to learn more about how particular individuals think about the world and continue to do research on depression and its vulnerability factors. I found that rumination influenced false memories but independently of mood and depression. If my findings are valid, they tell me that the false memory effect in depression may have more to do with thinking style than with emotion. We could think in terms of semantic networks and how people think about categories of things regardless of what mood they are in. If future studies with sound samples and methods find that the proposed hypotheses are not supported, it is possible that one could assume the memory impairment is a symptom of depression. We could assume the impairment does not pre-exist the depressive episode and is not a vulnerability factor. Further studies need to be done in order to make a more accurate and confident assumption.



There are a couple of important limitations to this study which preclude any strong conclusions. The first is that the memory deficit sought is a relatively small effect which was difficult to detect given the sample size. The group that was considered to be “depressed” was not a clinical sample and may not be comparable to the diagnosed samples with more severe levels of depression. It has been shown that mild to moderate levels of depression may not change cognitive functioning in the same way clinical depression would (Rokke et al., 2002). Future studies may find a clearer picture of this effect with the use of a clinical sample and wider range of rumination scores in the non-depressed sample. Lastly, mood was measured with an affect grid immediately following manipulation. I am unable to know how long the mood induction carried on throughout the experiment as the participants saw 30 lists of 15 words each presented in a random order. It is possible that the mood effect wore off before it was able to influence responses to the emotional lists.

It is possible that the null hypotheses of this study are true. I replicated the methods of previous studies and enhanced particular components but did not get any of the same effects. The previous findings of Storbeck and Clore (2005) and Joormann et al. (2009) are potentially unreliable and unable to be replicated. It could be that individuals who are depressed exhibit the false memory effect and individuals who are not depressed do not exhibit that same effect, even when considered vulnerable to depression.

The question this study intended to investigate is still an important one and future studies that are able to obtain a larger sample with a more accurate representation of rumination scores and depressed individuals will be able to help answer that question. Is the false memory effect that is present in depression a vulnerability factor for depression or a symptom of depression?

Knowing the answer to this question could help us to identify those who are at risk for a depressive episode or to help better treat those suffering from depression.

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## APPENDIX A. CONSENT FORM

**Title of Research Study:** False Memories in Depression: Vulnerability Factor or Symptom?

**This study is being conducted by:** Samantha Myhre, B.A., North Dakota State University, Graduate Student, Department of Psychology, samantha.myhre@my.ndsu.edu, and Paul Rokke, Ph.D, North Dakota State University, Department of Psychology, Principal Investigator, paul.rokke@ndsu.edu.

**Why am I being asked to take part in this research study?** You have been invited to participate in this study based on your responses to survey questionnaires. We want to ensure our participants represent a full range of responses to questionnaires about mood and coping styles. We have invited people who have had things going well or not so well as well as people who cope with negative events by thinking about them or distracting themselves from them. You are eligible to participate in this study because you are enrolled in an undergraduate psychology course that includes research participation as a requirement or offers extra-credit for participating. You must be at least 18 years old and fluent in English to participate.

**What is the reason for doing the study?** Memory can be affected in many ways. Individuals therefore differ in the kinds of things they remember. Sometimes we remember things as they happen and other times we remember things differently from the way they happened. This study is being conducted to learn more about how individuals differ in the way they remember things.

**What will I be asked to do?** You will be asked to respond to questions about depressive and anxious symptoms. You will then be asked to complete a computerized memory task. You will be asked to memorize lists of words and be asked to recall them after. Before and during the task, you might listen to music and be presented with slides of pictures.

**Where is the study going to take place, and how long will it take?** The study will be conducted in the Psychology Lab in Minard Hall. The study will take approximately one hour and fifteen minutes to complete.

**What are the risks and discomforts?** It is not possible to identify all potential risks in research procedures, but we have taken reasonable safeguards to minimize any known risks. One foreseeable risk is that there may be questions which you do not feel comfortable answering.

**What are the benefits to me?** By participating in this research study, you may learn something about research methods in Psychology. You are not expected to benefit directly in any other way as a result of participating in this study.

**What are the benefits to other people?** We are conducting this study so that we may learn about how individuals, in particular college students, respond to a memory task. It is hoped that the knowledge gained will contribute to our understanding of individual differences in memory and may someday benefit people with memory problems.

**Do I have to take part in the study?** Your participation in this research is your choice. If you decide to participate in the study, you may change your mind and stop participating at any time without penalty or loss of benefits to which you are already entitled.

**What are the alternatives to being in this research study?** There are other studies to participate in besides this one. In addition, every psychology instructor will have specified alternative means for satisfying course requirements or earning extra credit. Please see your course syllabus or visit with your instructor to learn about these options.

**Who will see the information that I give?** All information collected in this study will remain completely confidential. All forms and data will be marked with a unique code. Names and identifying information will not be stored with the data. Only authorized research personnel will have access to the data. When reporting on the results of this study the data will be reported only in summary form, combining the information collected from all participants.

**Will I receive any compensation for taking part in this study?** Participants in this study may choose to receive either \$10.00 or 5 points of credit for participating in this study.

**What if I have questions?** Before you decide whether to accept this invitation to take part in the research study, please ask any questions that might come to mind now. Later, if you have any questions about the study, you can contact the researcher, Samantha Myhre, at [samantha.myhre@my.ndsu.edu](mailto:samantha.myhre@my.ndsu.edu) or the principal investigator, Paul D. Rokke, at [Paul.Rokke@ndsu.edu](mailto:Paul.Rokke@ndsu.edu), or 701.231-8626.

**What are my rights as a research participant?** You have rights as a participant in research. If you have questions about your rights, or complaints about this research [may add, “or to report a research-related injury” if applicable], you may talk to the researcher or contact the NDSU Human Research Protection Program by:

- Telephone: 701.231.8908 or toll-free 1.855.800.6717
- Email: [ndsu.irb@ndsu.edu](mailto:ndsu.irb@ndsu.edu)
- Mail: NDSU HRPP Office, NDSU Dept. 4000, PO Box 6050, Fargo, ND 58108-6050.

The role of the Human Research Protection Program is to see that your rights are protected in this research; more information about your rights can be found at: [www.ndsu.edu/irb](http://www.ndsu.edu/irb).

**Documentation of Informed Consent:**

You are freely making a decision whether to be in this research study. Signing this form means that

1. you have read and understood this consent form
2. you have had your questions answered, and
3. you have decided to be in the study.

You will be given a copy of this consent form to keep.

\_\_\_\_\_  
Your signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Your printed name

\_\_\_\_\_  
Signature of researcher explaining study

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed name of researcher explaining study



## APPENDIX B. RUMINATIVE RESPONSES SCALE (RRS)

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

1 almost never 2 sometimes 3 often 4 almost always

1. think about how alone you feel
2. think "I won't be able to do my job if I don't snap out of this"
3. think about your feelings of fatigue and achiness
4. think about how hard it is to concentrate
5. think "What am I doing to deserve this?"
6. think about how passive and unmotivated you feel.
7. analyze recent events to try to understand why you are depressed
8. think about how you don't seem to feel anything anymore
9. think "Why can't I get going?"
10. think "Why do I always react this way?"
11. go away by yourself and think about why you feel this way
12. write down what you are thinking about and analyze it
13. think about a recent situation, wishing it had gone better
14. think "I won't be able to concentrate if I keep feeling this way."
15. think "Why do I have problems other people don't have?"
16. think "Why can't I handle things better?"
17. think about how sad you feel.
18. think about all your shortcomings, failings, faults, mistakes
19. think about how you don't feel up to doing anything
20. analyze your personality to try to understand why you are depressed
21. go someplace alone to think about your feelings
22. think about how angry you are with yourself

## APPENDIX C. CAGE ASSESSMENT

C

Have you ever tried to Cut back on your use?

A

Have you ever been Annoyed/Angered when questioned about your use?

G

Have you ever felt Guilt about your use?

E

Have you ever had an Eye-opener to get started in the morning?

APPENDIX D. BECK DEPRESSION INVENTORY (BDI)

Date \_\_\_\_\_

S# \_\_\_\_\_

On this questionnaire are groups of statements. Please read each group of statements carefully. Then pick out the one statement in each group which best describes the way you have been feeling the PAST WEEK, INCLUDING TODAY! Circle the number beside the statement that you picked. If several statements in the group seem to apply equally well, circle each one. Be sure to read all the statements in each group before making your choice.

1. 0 I do not feel sad.  
1 I feel sad.  
2 I am sad all the time and I can't snap out of it.  
3 I am so sad or unhappy that I can't stand it.
2. 0 I am not particularly discouraged about the future.  
1 I feel discouraged about the future.  
2 I feel I have nothing to look forward to.  
3 I feel that the future is hopeless and that things cannot improve.
3. 0 I do not feel like a failure.  
1 I feel I have failed more than the average person.  
2 As I look back on my life, all I can see is a lot of failures.  
3 I feel I am a complete failure as a person.
4. 0 I get as much satisfaction out of things as I used to.  
1 I don't enjoy things the way I used to.  
2 I don't get real satisfaction out of anything anymore.  
3 I am dissatisfied or bored with everything.
5. 0 I don't feel particularly guilty.  
1 I feel guilty a good part of the time.  
2 I feel quite guilty most of the time.  
3 I feel guilty all of the time.
6. 0 I don't feel I am being punished.  
1 I feel I may be punished.  
2 I expect to be punished.  
3 I feel I am being punished.
7. 0 I don't feel disappointed in myself.  
1 I am disappointed in myself.  
2 I am disgusted with myself.  
3 I hate myself.

8. 0 I don't feel I am any worse than anybody else.
  - 1 I am critical of myself for my weaknesses or mistakes.
  - 2 I blame myself all the time for my faults.
  - 3 I blame myself for everything bad that happens.
  
9. 0 I don't have any thoughts about killing myself.
  - 1 I have thoughts of killing myself, but I would never carry them out.
  - 2 I would like to kill myself.
  - 3 I would kill myself if I had the chance.
  
10. 0 I don't cry any more than usual.
  - 1 I cry more now than I used to.
  - 2 I cry all the time now.
  - 3 I used to be able to cry, but now I can't even though I want to.
  
11. 0 I am no more irritated now than I ever am.
  - 1 I get annoyed or irritated more easily than I used to.
  - 2 I feel irritated all the time now.
  - 3 I don't get irritated at all by the things that used to irritate me.
  
12. 0 I have not lost interest in other people.
  - 1 I am less interested in other people than I used to be.
  - 2 I have lost most of my interest in other people.
  - 3 I have lost all of my interest in other people.
  
13. 0 I make decisions about as well as I ever could.
  - 1 I put off making decisions more than I used to.
  - 2 I have greater difficulty in making decisions than before.
  - 3 I can't make decisions at all anymore.
  
14. 0 I don't feel I look any worse than I used to.
  - 1 I am worried that I am looking old or unattractive.
  - 2 I feel that there are permanent changes in my appearance that make me unattractive.
  - 3 I believe that I look ugly.
  
15. 0 I can work about as well as before.
  - 1 It takes an extra effort to get started at doing something.
  - 2 I have to push myself very hard to do anything.
  - 3 I can't do any work at all.
  
16. 0 I can sleep as well as usual.
  - 1 I don't sleep as well as I used to.
  - 2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
  - 3 I wake up several hours earlier than I used to and cannot get back to sleep.

17. 0 I don't get more tired than usual.  
1 I get tired more easily than I used to.  
2 I get tired from doing almost anything.  
3 I am too tired to do anything.

18. 0 My appetite is no worse than usual.  
1 My appetite is not as good as it used to be.  
2 My appetite is much worse now.  
3 I have no appetite at all anymore.

19. 0 I haven't lost much weight, if any, lately.  
1 I have lost more than 5 pounds.  
2 I have lost more than 10 pounds.  
3 I have lost more than 15 pounds.

I am purposely trying to lose weight. Yes \_\_\_\_ No \_\_\_\_

20. 0 I am no more worried about my health than usual.  
1 I am worried about physical problems such as aches and pains; or upset stomach; or constipation.  
2 I am very worried about physical problems and it's hard to think of much else.  
3 I am so worried about my physical problems that I cannot think about anything else.

21. 0 I have not noticed any recent change in my interest in sex.  
1 I am less interested in sex than I used to be.  
2 I am much less interested in sex now.  
3 I have lost interest in sex completely.

APPENDIX E. STATE TRAIT INVENTORY FOR COGNITIVE AND SOMATIC ANXIETY  
(STICSA-STATE VERSION)

*Instructions*

Below is a list of statements which can be used to describe how people feel.

Beside each statement are four numbers which indicate how often each statement is true of you (e.g., 1 \_ *not at all*, 4 \_ *very much so*). Please read each statement carefully and circle the number which best indicates how you feel right now, at this very moment, even if this is not how you usually feel.

1 Not at all    2 A little    3 Moderately    4 Very much so

1. My heart beats fast. 1 2 3 4
2. My muscles are tense. 1 2 3 4
3. I feel agonized over my problems. 1 2 3 4
4. I think that others won't approve of me. 1 2 3 4
5. I feel like I'm missing out on things because I can't make up my mind soon enough. 1 2 3 4
6. I feel dizzy. 1 2 3 4
7. My muscles feel weak. 1 2 3 4
8. I feel trembly and shaky. 1 2 3 4
9. I picture some future misfortune. 1 2 3 4
10. I can't get some thought out of my mind. 1 2 3 4
11. I have trouble remembering things. 1 2 3 4
12. My face feels hot. 1 2 3 4
13. I think that the worst will happen. 1 2 3 4
14. My arms and legs feel stiff. 1 2 3 4
15. My throat feels dry. 1 2 3 4
16. I keep busy to avoid uncomfortable thoughts. 1 2 3 4
17. I cannot concentrate without irrelevant thoughts intruding. 1 2 3 4
18. My breathing is fast and shallow. 1 2 3 4
19. I worry that I cannot control my thoughts as well as I would like to. 1 2 3 4
20. I have butterflies in the stomach. 1 2 3 4
21. My palms feel clammy. 1 2 3 4

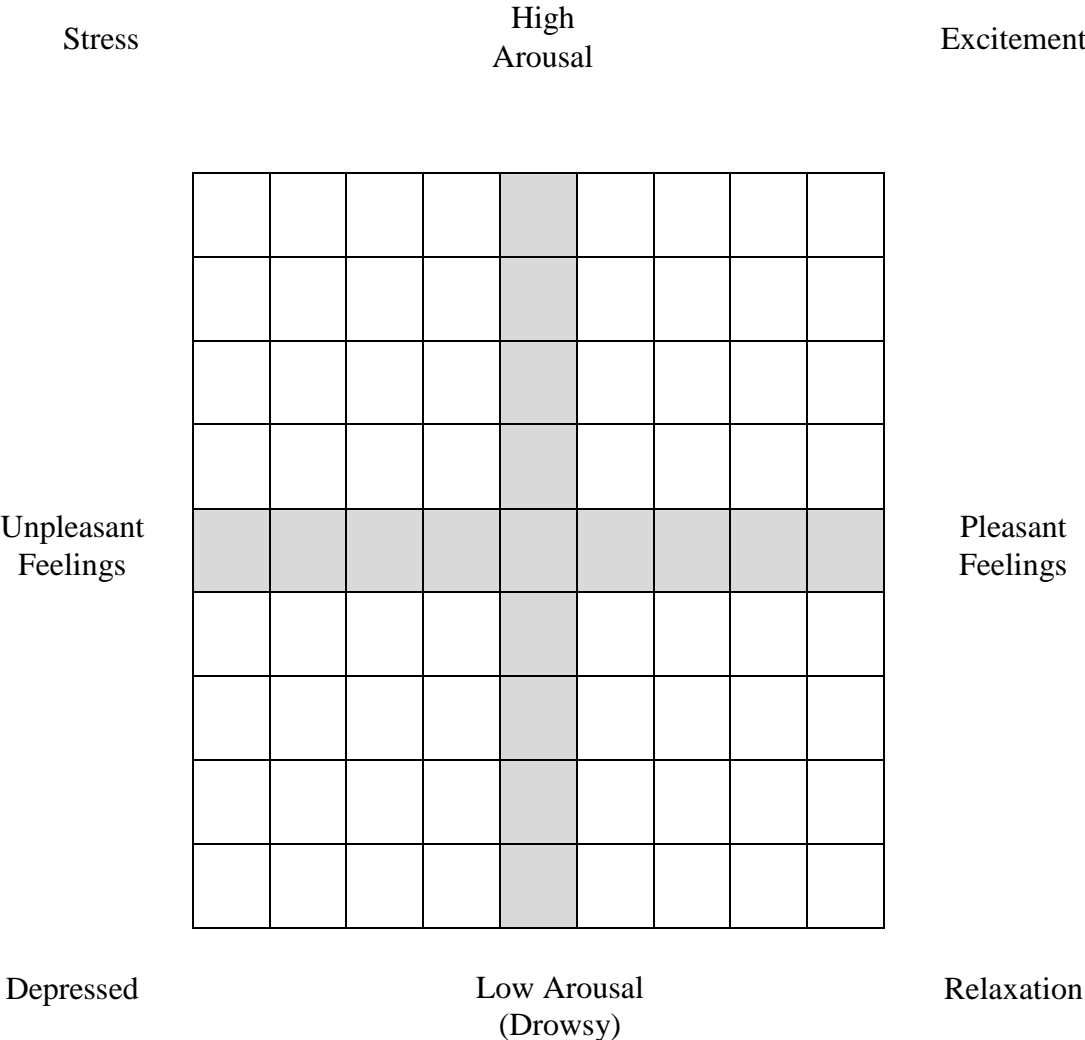
APPENDIX F. AFFECT GRID

Participant #: \_\_\_\_\_

Date: \_\_\_\_\_

Condition:

**Affect Grid**



## APPENDIX G. WORD LISTS

### Negative Word Lists:

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<b>ANGER</b>	<b>TRASH</b>	<b>BLACK</b>	<b>SAD</b>	<b>THIEF</b>
mad	garbage	white	unhappy	steal
fear	waste	dark	bad	robber
hate	can	cat	cry	crook
rage	refuse	charred	miserable	burglar
temper	sewage	night	triste	money
fury	bag	funeral	death	cop
ire	junk	color	lonely	bad
wrath	rubbish	grief	misery	rob
happy	sweep	blue	sorrow	jail
fight	scraps	death	sorry	gun
hatred	pile	ink	dejected	villain
mean	dump	bottom	downcast	crime
calm	landfill	coal	good	bank
emotion	debris	brown	tear	bandit
enrage	litter	gray	lonesome	criminal

### Positive Word Lists:

---

<b>HAPPY</b>	<b>GIRL</b>	<b>SOFT</b>	<b>SWEET</b>	<b>MUSIC</b>
content	boy	hard	sour	note
gay	dolls	light	candy	sound
glad	female	pillow	sugar	piano
joy	young	plush	bitter	sing
birthday	dress	loud	good	radio
pleased	pretty	cotton	taste	band
smile	hair	fur	tooth	melody
good	niece	touch	nice	horn
laugh	dance	fluffy	honey	concert
life	beautiful	feather	soda	instrument
melody	cute	furry	chocolate	symphony
calm	date	downy	heart	jazz
miserable	aunt	kitten	cake	orchestra
sunshine	daughter	skin	tarte	art
wonderful	sister	tender	pie	rhythm



Neutral Word Lists:

<b>WINDOW</b>	<b>SMELL</b>	<b>SMOKE</b>	<b>SLEEP</b>	<b>DOCTOR</b>
door	nose	cigarette	bed	nurse
glass	breathe	puff	rest	sick
pane	sniff	blaze	awake	lawyer
shade	aroma	billows	tired	medicine
ledge	hear	pollution	dream	health
sill	see	ashes	wake	hospital
house	nostril	cigar	snooze	dentist
open	whiff	chimney	blanket	physician
curtain	scent	fire	doze	ill
frame	reek	tobacco	slumber	patient
view	stench	stink	snore	office
breeze	fragrance	pipe	nap	stethoscope
sash	perfume	lungs	peace	surgeon
screen	salts	flames	yawn	clinic
shutter	rose	stain	drowsy	cure

<b>CHAIR</b>	<b>CITY</b>	<b>CUP</b>	<b>MOUNTAIN</b>	<b>PEN</b>
table	town	mug	hill	pencil
sit	crowded	saucer	valley	write
legs	state	tea	climb	fountain
seat	capital	measuring	summit	lead
couch	streets	coaster	top	quill
desk	subway	lid	molehill	felt
recliner	country	handle	peak	bic
sofa	new york	coffee	plain	scribble
wood	village	straw	glacier	crayon
cushion	metropolis	goblet	goat	cross
swivel	big	soup	bike	tip
stool	chicago	stein	climber	marker
sitting	suburb	drink	range	red
rocking	county	plastic	steep	cap
bench	urban	sip	ski	letter

<b>RIVER</b>	<b>CAR</b>	<b>RUBBER</b>	<b>BREAD</b>	<b>SHIRT</b>
water	truck	elastic	butter	blouse
stream	bus	bounce	food	sleeves
lake	train	gloves	eat	pants
mississippi	automobile	tire	sandwich	tie
boat	vehicle	ball	rye	button
tide	drive	eraser	jam	shorts
swim	jeep	springy	milk	iron
flow	ford	foam	flour	polo
run	race	galoshes	jelly	collar
barge	keys	soles	dough	vest
creek	garage	latex	crust	pocket
brook	highway	glue	slice	jersey
fish	sedan	flexible	wine	belt
bridge	van	resilient	loaf	linen
winding	taxi	stretch	toast	cuffs

<b>HIGH</b>	<b>FRUIT</b>	<b>LION</b>	<b>ROUGH</b>	<b>FLAG</b>
low	apple	tiger	smooth	banner
clouds	vegetable	circus	bumpy	Americans
up	orange	jungle	road	symbol
tall	kiwi	tamer	tough	stars
tower	citrus	den	sandpaper	anthem
jump	ripe	cub	jagged	stripes
above	pear	Africa	ready	pole
building	banana	mane	coarse	wave
noon	berry	cage	uneven	raised
cliff	cherry	feline	riders	national
sky	basket	roar	rugged	checkered
over	juice	fierce	sand	emblem
airplane	salad	bears	boards	sign
dive	bowl	hunt	ground	freedom
elevate	cocktail	pride	gravel	pendant