BOREDOM AND MEMORY FOR POSITIVELY AND NEGATIVELY VALENCED WORDS

by
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ABSTRACT

The purpose of the present study was to determine whether boredom affected memory for positively and negatively valenced words in addition to class names (e.g., History) that were presented in an auditory modality while participants listened to a recorded script. This was accomplished by comparing the recall of a doodling group, who were asked to shade in shapes while listening to a recorded script, with a non-doodling group, who simply listened to the script. The results indicated that participants in the non-doodling group recalled more class names (e.g. History) from the script than participants in the doodling group. In addition, when participants falsely remembered a word related to a word in the script, when the word in the script was positive, the non-doodling group was more likely to respond with an incorrect positive word, and the doodling group was more likely to respond with an incorrect negative word. These results could have implications for both basic research on divided attention as well as applied topics relating to how distractions in the classroom impact memory performance.

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Recent research has shown that boredom can have an effect on memory. Although it has been shown that the recall of information can be improved with activities to decrease boredom, there has not been much research into other effects of boredom on memory. While it is useful to achieve a better understanding of how boredom affects memory performance, for example, the influence that it has on topics such as academic and workplace performance, there are further reaching implications of boredom's influence on memory that have yet to be explored. One aspect that has yet to be explored is the influence of boredom on recall for positively and negatively valenced items. The primary purpose of the present study was to determine how boredom differentially affects recall for both positively and negatively valenced words. Along with providing more information on the effects of boredom on memory, the inclusion of valenced stimuli might provide information regarding the manner in which emotions and boredom interact to effect memory performance. In addition, we were also interested in determining whether a doodling task was capable of increasing or decreasing performance on a vigilance task.

In one study related to the effects of boredom on memory, Spataro, Mulligan, and Rossi-Arnaud (2013), attempted to determine whether or not divided attention could affect memory. The researchers were hoping to be able to find a positive effect of divided attention on memory encoding and later recall. In the first experiment of this study, the researchers had 27 participants, split in two groups, read and study words that were presented to them. While one group just read and studied the words (the full attention group), the other group (the divided attention group) was also asked to monitor the color of a small circle and record when it flashed an infrequently occurring color. After a brief distracter task, participants were asked to identify words that had been previously presented. The words were presented during this recall stage in sets of four. The researchers found that the divided attention group was able to recognize the previously presented words more accurately than the other group.

In the next two experiments, the researchers added another distractor. In Test 2, the researchers added non-words into the presentation, and in Test 3, word stems were added. The colored circle was still to be monitored by the participants in the divided attention group and not in the full attention group. Both tests were run using the same method as Test 1. The results of both of these tests showed that, once again, the divided attention group had a greater memory for the words, despite the added distraction of studying non-words or word stems.

A final test was conducted by the researchers in which participants were asked to not only monitor and remember words, but also hit a key to say whether a word presented was just a word or a first name. The same method was used as the previous experiments with the divided attention group monitoring circles and the full attention group not. The

results of this test showed that there was no significant difference between the two groups.

The researchers in this study were not conclusive as to why memory recall was greater in the first three tests for the divided attention group. They presented theories such as target co-occurrence leading to a memory boost and that the colored circle acted as a cue to pay more attention to the words being presented. Although the divided attention group was better at basic memory recall, when another factor about the word was added, there was no significant difference. This could possibly be explained by an excess of information encoding being done by the participant that hinders the amount of information he/she can store in the period during which the word is shown.

In a related 2013 study, Donohue, Appelbaum, Park, Roberts, and Woldorff looked to find a relationship between visual input and auditory input when both senses are activated at the same time. The researchers wanted to determine what effect both types of sensory input had on the other during multisensory events. To test this interaction, the researchers had participants run trials of modified Stroop task where a colored word was presented on a screen, and an audible color would be spoken during the presentation of the word. The audible color word would either match the colored word on the screen or it would be different. Participants were also instructed to pay attention to either the auditory stimulus or the visual stimulus. When analyzing the data, the researchers took into account both the accuracy and the reaction times of the participants' answers that were entered on a keyboard with the press of a single key. The researchers found overall slower reaction times when participants were to pay attention to the auditory stimulus. Thus, the main finding of the study was that when presented with

irrelevant visual information, participants input of relevant auditory information was more negatively affected than if irrelevant auditory information was presented with relevant visual information. The findings of this study are significant because they show that visual information can negatively impact memory. This, in turn, could be used to explain why a difference in recall between groups exists both in the presence and the absence of visual stimuli.

Similarly, Andrade (2010), wanted to find out what influence doodling, aimlessly sketching patterns, can have on recall performance. The researcher attempted to determine whether doodling was a distraction to memory encoding or if it provides a way of aiding concentration and thereby improving memory for the information being presented. The study follows in the same vein of the two previously mentioned studies, but attempted to gather more information of the phenomenon by looking at a particular case of divided attention.

The researcher used 40 participants between the ages of 18 and 55. The participants were split into 2 groups: a doodling group and a non-doodling group. All of the participants listened to a recorded mock phone conversation about a party that included the names of people who would and would not be attending a party and the names of places. The recording was monotone to increase the boredom. While the mock conversation was played, the doodling group was allowed to shade in shapes at a pace they were comfortable with. All of the participants were instructed to write down the names of people attending the party (essentially a vigilance task). After the papers were collected that participants wrote down the names on, a brief interval passed, and the participants were asked to recall the names of the people who were going to the party and

the places mentioned in the recording (which they had not been told to monitor). The results indicated that for both the monitored information (the names of the people going to the party) and the incidental information (the places mentioned), the doodling group recalled significantly more correct information than the non-doodling group.

The researcher attributed the improved recall in the doodling group to an increased amount of concentration for the information, but they were unable to identify the mechanism by which this occurred. Andrade (2010) proposed two possibilities for the improved recall. One possibility suggested that the doodling increased arousal and reduced boredom. The other possibility the researcher proposed is that the doodling reduced daydreaming. Despite the inability to isolate the effect to a specific mechanism, the results provide an interesting insight into the influence of doodling on recall that can be further built upon in other studies that look into different aspects of the influence of boredom on recall.

In addition to studying the effects of boredom on memory, there has also been an attempt to determine whether word valance impacts recall performance. In one such study, Ferré (2003) attempted to determine whether valenced words were better remembered than neutral words. Even further, the researcher wanted to find if the memory for these valenced words was better or worse when the subject was instructed to pay attention to the valence of the words or the physical features of the word. The researcher conducted this study through three experiments.

In the first experiment, participants were instructed to either rate a word's 'pleasantness' (pleasant or unpleasant) or 'concreteness' (place, people, or thing). This experiment also contained neutral words as a control. The results showed that recall was

greater for words rated for both pleasantness and concreteness than the control, and also, it found recall was greater for the pleasantness condition than it was for the concreteness condition. The second experiment involved a within-subject design in which participants from the first experiment were presented with word stems of words that they had seen in the previous experiment. The participants were then instructed to try and complete the words that they believed completed the word stem. Once again, researchers found that the valenced words were more often used to finish the stems, and the valenced words from the higher processing condition, pleasantness, in the first experiment were used significantly more frequently than words with ostensibly lower levels of processing in the concreteness condition. In the third and final experiment, participants from the first two experiments were given a list of words that were associated with the words from the previous two tests. The researcher asked the participants to recall what word that was previously presented could be associated with the new word provided. In this study, no difference was found between words encoded with different levels of processing, but once again, recall for valenced words was greater than that of the neutral words.

Andrade's (2010) study demonstrated that valenced words do influence recall, and in the case of this study, the valenced words affect memory positively. These results provide a foundation for further investigation into the relationship between memory and valenced words, and what other factors could play a part in the relationship between these two.

To help facilitate such investigations, Bradley and Lang (1999) set out to comprise a list of words with emotional ratings. The researchers wanted to be able to provide a list where standardized pleasure, arousal, and dominance ratings could be

attached to words for use in other research projects. The researchers used tests that they could score and then assign numerical value to the emotional ratings. Bradley and Lang used a participant pool balanced for gender and presented the participants with 100-150 words. The participants rated each word's arousal on a ScanSam (Self Assessment Manikin) sheet that allowed subjects to rate a word's pleasure, arousal, and dominance from 1-9. The ScanSam also included faces indicating emotion for the participants to gauge their emotional feelings towards the word.

The result of this study was the Affective Norms for English Words (ANEW) word list that is comprised of 600 wide-ranging words rated for pleasure, arousal, and dominance with a table that includes results for all subjects and two lists that breakdown male and female results for gender comparison. The ANEW list opens many doors for research because it allows researchers to control several potential confounding variables. This list is important for some memory studies because researchers can use the list to analyze the pleasure, arousal, and dominance of words that are used in experiments.

In an attempt to replicate and extend the work discussed above, the primary purpose of the present study was to determine whether boredom differentially affects positively and negatively valenced words. The experiment was conducted by having two groups of participants listen to a recorded script that contained common college course names (for example, English) and valenced words selected from the ANEW word list. One group was allowed to complete another task (doodling) while listening to the script and writing down the names of classes; the other group was instructed to simply write down the names of classes when they were spoken in the recording. After the recorded script was over and the participants completed a brief distracter task (to eliminate

rehearsing), participants were asked to recall the classes they had written and the words that were paired with them. The number of classes and words recalled, the valence of correct words recalled, and the valence of incorrect words recalled were all analyzed. It was hypothesized that the doodling group would recall more words than the non-doodling group, and the doodling group would recall more positive words and less negative words than the non-doodling group due to less boredom.

Method

Participants

60 undergraduate psychology students from the University of Mississippi participated in the experiment. Each student in the study received partial course credit for their participation.

Apparatus, Design, and Materials

The experiment comprised a 2 (condition: doodle vs. non doodle) X 2 (word valance: positive vs. negative) mixed design in which participants were either assigned to a doodling group or a non-doodling group (30 participants per group). The participants listened to a prerecorded simulation of one end of a phone conversation that included classes (for example, Biology) and positively or negatively valenced words associated with each class name (see Appendix 1). The valenced words were chosen from the ANEW word list (Bradley & Lang, 1999), and all the words selected to be used in the study were common and of significant positive or negative valence. While listening to the recording, the doodling group was allowed to shade in squares on a provided sheet and the non-doodling group simply listened to the recording. The primary dependent variable for the study was the number of positively and negatively valenced words that

participants were able to recall. Intrusions, words not presented but yet recalled, were also recorded. In addition, the total number of classes recalled, if the word recalled for the class was incorrect, and the valence of the incorrect word was recorded. Participants were also asked to estimate the time-length of the recorded script. Participants were tested two at a time, and they tracked their classes and recorded their recalled answers on provided sheets of paper. There was also a brief distracter task in which participants performed basic math problems on computers for 30 seconds.

Procedure

When participants entered the laboratory, they were first asked to sign a consent form. After signing the consent form, participants listened to the experimenter read the instructions aloud while they read them silently to themselves. For those who were randomly assigned to the doodling group, the participants were instructed to listen to a recorded script of a simulated phone conversation. While listening to the script, they were to shade in basic geometric shapes (squares) as they listened to the script and track/write down the names of school classes they heard. For the participants in the non-doodling group, they were simply instructed to listen to the recorded script and track/write down the names of classes they heard. After the instructions were read, the participants were either given a sheet of paper to record the classes they heard with shapes to shade it (for the doodling group) or a sheet to record the names of classes (for the non-doodling group). After this, the three minutes and thirty seconds long recorded script was played. While the script was playing, the participants were engaged in a vigilance task in which they were asked to listen for common university course names (e.g., Biology) and record them on the response sheet each time they heard one in the phone conversation. After the

script was finished, the sheets of paper were collected, and the participants were asked to complete basic math problems for 30 seconds to eliminate rehearsing of the information from the script. Once this interval passed, a surprise recall test was given in which participants were asked to remember as many classes from the recording as possible, the corresponding associated words, and the estimated time length of the recording. After this, the participants were debriefed, thanked, and received credit for their participation.

Results and Discussion

The responses from four participants were not included in the analyses due to a failure to follow instructions that could have influenced the results. Thus, both the doodling and the non-doodling groups included 28 participants in the analyses.

One of the tasks that participants were asked to engage in is to monitor the simulated phone conversation for common course names (like Chemistry). For the tracking of classes during the script, an independent samples t-test was run to determine whether doodling influenced participants' abilities to attend and respond to the course names. The results indicated that there was no significant difference in the number of classes recorded by the participants, regardless of whether they engaged in doodling or not, $t(54) = -1.37$, $p > .05$. This result is not surprising in light of the fact that most of the participants in both conditions were able to write down most of the words ($M = 7.54$ in the doodling condition vs. $M = 8.11$ in the non doodling condition).

Another dependent measure of interest was participants' retrospective ability to estimate the time of the simulated phone message. It was possible that participants in the doodling condition might have thought that time went by faster than those in the non-doodling condition. In other words, much in the way that a bored student in class might

doodle to help the time pass more quickly, doodling in this experimental situation might lead to smaller time estimates than not doodling. To determine whether or not participants in the two groups, doodling and non-doodling, reported experiencing different lengths of time for the script, an independent samples t-test was conducted. The results indicated that there were no significant differences in estimated time length between the two groups, $t(49) = -.69$, $p > .05$. Thus, at least in this case, doodling did not seem to make the time pass more quickly. There are at least two possible explanations for this outcome. First, it is possible that doodling does not make time pass more quickly. Second, it is possible that the simulated phone message was not boring (perhaps because it involved evaluations of university courses which students may find interesting) leading to a case in which any additional distraction added by doodling may not have influenced participants perception of passing time.

For the class and associated word recall, a series of independent t-tests were conducted to determine if there was a difference between the groups' recall for not only correct and incorrect responses, but also for whether or not the participant incorrectly recalled an associated word that was of positive or negative valence. In this case, an 'associated word' indicates an extra-list intrusion such as remembering a course name that was not actually mentioned or a positively or negatively valenced word that did not appear in the simulated phone message. An independent t-test showed that participants in the non-doodling group recalled significantly more of the paired words than the doodling group, $t(54) = -2.08$, $p < .05$. In other words, participants who listened to the message while doodling were more likely than other participants to recall positively and negatively valenced words that did not appear on the list. It is possible that participants

in the non-doodling condition, because of a lack of distraction, were able to more accurately monitor the conversation and form relationships between words leading to better recall. Thus, a lack of distraction may have led to a decrease in intrusions. In addition, an independent samples t-test also found that the doodling group incorrectly responded with significantly more negative words when the paired word was actually positive, $t(54) = 2.61$, $p < .05$. This means that not only did the participants incorrectly recall the word, but they also responded with a word of the wrong valence.

This provides some further evidence that the divided attention caused by the doodling task could have possibly led to weaker connections between the classes and paired words when listening to the script. These findings of better recall in the non-doodling group go against findings of earlier studies, e.g. Spataro, Mulligan, & Rossi-Arnaud (2013), that showed a possible increase in correct recall for divided attention groups. It is possible that the doodling participants allocated more attention to the doodling task which lead to weaker connections being formed between the words during encoding which resulted in a worse performance than the non-doodling group on the recall portion of the experiment.

Finally, an independent t-test found that there was a marginally significant difference in that the non-doodling group recalled more positive words when the correct paired word was positive, $t(54) = -1.72$, $p < .10$. Although a marginally significant difference, this result could provide slightly more evidence that non-divided attention groups (the non-doodling group in this study) have better memory recall than divided attention groups. All other t-tests analyzing the various differences between recall for

positively and negatively valenced words resulted in non-significant results (all p's > .05).

Unlike previous studies, the purpose of this study was not to look at the relationship between memory for valenced words and memory for neutral words, but rather the relationship between positively and negatively valenced words. It is possible that the lack of a significant difference in the time perception correlated to a lack of difference in boredom between the groups. This could provide a reason as to why the hypothesis that the doodling group would remember more positive and less negative words was found to be incorrect. However, Ferré (2003) presented interesting results about the differences between recall for valenced words, and future research could further investigate this relationship by attempting to find differences between positively and negatively valenced words. This could be done by checking to see if there is a correlation between recall for valenced words and boredom, stress, and individual differences.

Overall, the results of this experiment did provide some results that point to a better recall for non-divided attention groups. This study presents an opposing side to the findings of Andrade (2010) that suggested that doodling could lead to better recall. With these conflicting results, more research is needed to investigate the relationship between divided attention (doodling) and recall. The participants and script of this experiment limits the results to a student population since the participants were students and the script was school relevant. It is possible that with participants and a script that were not relevant to each other, different results could have been found in this study that would be more in agreement with the findings of Andrade (2010) and other studies that have shown an increased recall in divided attention groups. It is also possible that the recall of

significantly less paired words by the doodling group could be explained by the results of Donahue et al. (2013) that presented that visual input can interfere with the encoding of auditory information. The doodling task may have provided enough visual stimuli that encoding was affected. However, if this is true, it begs the question as to why this was not a factor in the Andrade (2010) study. Future studies should investigate this relationship further and possibly include the addition of the influence of motor tasks on encoding and recall.

As for the relevance of this study to students who doodle, this study has provided information that suggests doodling while taking in auditory information (ex: lecture) may not be in the best interest of the student as it negatively influences recall. While the results of this study differ from those of Andrade (2010), the design of this study makes the information more relevant to a classroom/lecture hall type setting. The results showed that when the participants were informed of what information to track (the classes in the script), the difference between the doodling and non-doodling groups was insignificant. The incidental memory of the paired words was significantly influenced though. This could be applied to mean that if a student were to be doodling during a lecture, he/she could remember major topics or themes, but the memory for specific information, such as what is often tested during evaluations, is negatively affected. It is also worth noting that in this study, words were selected from the ANEW words list that were of significant valence (Bradley & Lang, 1999). It was shown by Ferré (2003) that these valenced words are often remembered better. It is likely that the information presented in many lectures is not of a significant positive or negative valence, which could lead to the assumption that the more neutral information of a lecture would be recalled even less than the valenced

words in this study. With the information of previous studies and this current study, evidence suggests that students are better off not doodling during class time.

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TABLE 1
Average Time, Class, and Word Recall

AVERAGES	Time	Class Recall		Total Word Recall	
		Correct	Incorrect	Correct*	Incorrect
Doodling	4.27	7.54	0.29	2.82	1.75
Non-Doodling	4.55	8.11	0.18	3.93	1.43

** denotes statistically significant difference*

TABLE 2
Average Recall of Valenced Paired Words

AVERAGES	(+) Word Recall		Incorrect Recall for (+)		(-) Word Recall		Incorrect Recall for (-)	
	Correct	Incorrect	Positive**	Negative*	Correct	Incorrect	Positive	Negative
Doodling	1.46	0.71	0.32	0.32	1.43	1.04	0.29	0.71
Non-Doodling	2.00	0.68	0.64	0.04	1.93	0.79	0.11	0.61

** denotes statistically significant difference*
*** denotes marginally significant difference*

FIGURE 1

Total Paired Word Recall

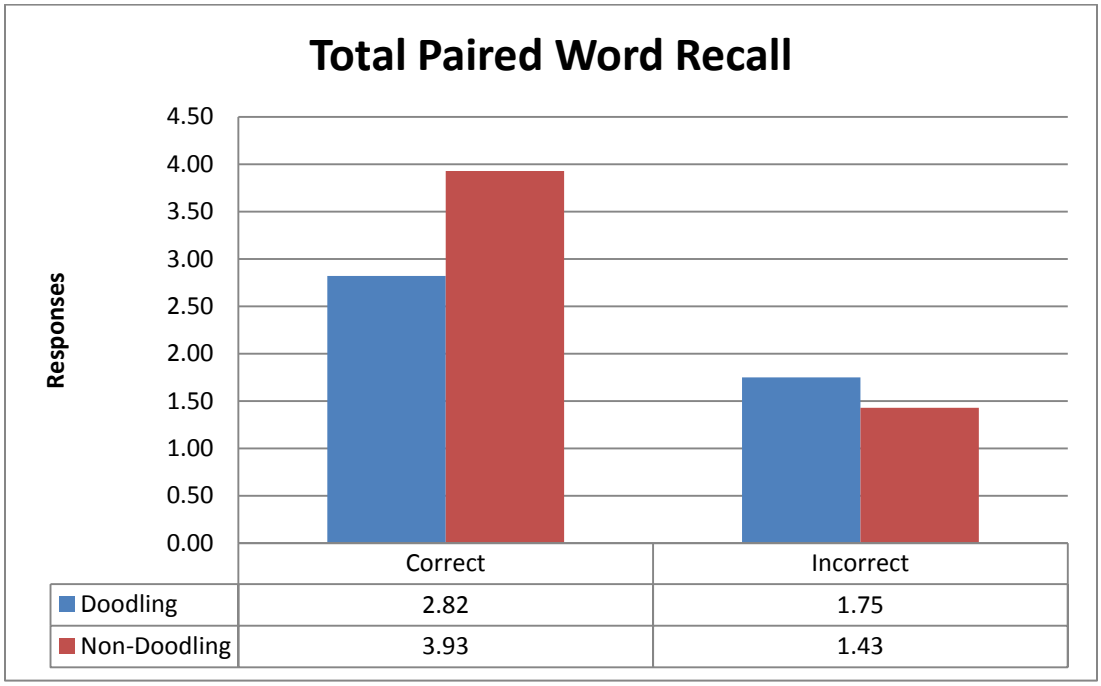
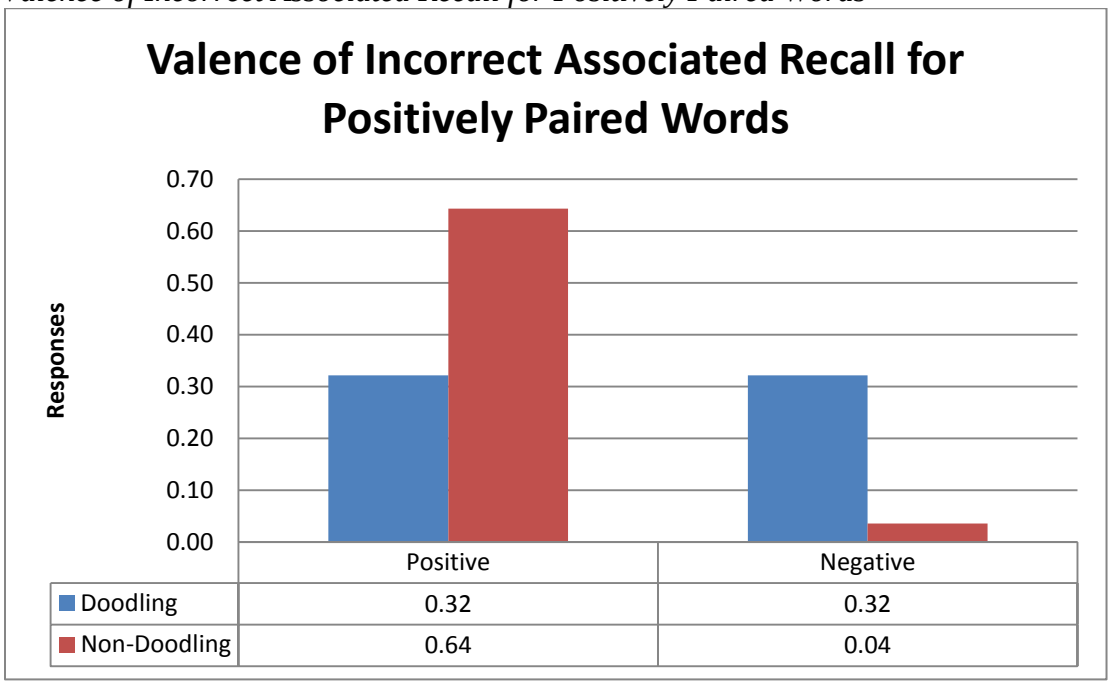


FIGURE 2

Valence of Incorrect Associated Recall for Positively Paired Words



APPENDIX 1

Script of Recorded Simulated Phone Conversation

‘‘Hi! How are you doing? Are you doing OK after yesterday? I was at Emily’s house last week and she was complaining about how hard her schedule is. It’s not like ours isn’t way worse. We were trying to get some stuff done on a group project and she kept messing around and asking questions like, “If you could turn into any animal you wanted, what would it be?” I told her a ‘butterfly’ because it was the first thing that came to mind. It made me think about my classes and what the first word that comes to mind for each class would be.

What are you taking this semester? Your first class is **Biology**? At 8:00? That’s way too early to have to get up. When I think of Biology, the first thing that comes to mind is *‘stress’*. Dr. Wilkens made the class way harder than it had to be and no one really did well in it. Plus, there was this guy who sat beside me and took pictures of the slides everyday and it was really annoying. I’m glad that I only had to take one of those and never think about it again. The first class that I have is **Economics**. This is the one class that I’m taking that makes me think of the word *‘hope’*. If I can just get a good grade in this class and finish up my minor, my dad says that I won’t have any trouble getting a good job when I graduate. It can be a little hard sometimes, but the teacher is good at explaining things.

What else are you in right now? **Psychology**? That one makes me think of the word *‘death’*. Every time I would sit in there it would just drag on and on and I couldn’t wait for it to be over. It was really depressing and I don’t know how people can stand that stuff. I’m taking a **Theatre** class this semester too and when I think about that one, it makes me think of the word *‘freedom’*. It’s so nice to do something different for once

and all that we get graded on is writing response papers to things that the teacher talks about. I didn't know what to expect when I signed up for it, but it's like my most fun class this semester.

What else are you in? **History**? That one makes me think of the word *'war'*. Different concepts competed with one another and the stuff on the test didn't match up with the lectures. I've got my last **English** class this semester and that one makes me think of the word *'progress'*. One more semester to go and I'm out of here. I'll probably miss it a little, but it will definitely be a relief to be done with everything.

What else do you have? **Math**? That one makes me think about the word *'fear'*. I was always really bad in that class and right before the teacher handed out the final, I remember getting this weird sort of sick feeling in my stomach. Sometimes I guess you have to be happy with a 'C'. I'm trying to remember what else I've got this semester. Oh yeah, I'm taking a **Music** class. This one is kind of hard, but I guess when I think about it that class makes me think of the word *'beautiful'*. Just the way that everything fit together and really made sense.

Are you taking anything else? You have **Astronomy** this semester? That one makes me think of the word *'alone'*. I don't remember much of what we talked about in there, but sometimes I feel like everyone else understood it except for me. I know I'm taking one other thing too, what is it, wait, oh yeah, **Physics**. Believe it or not, that one makes me think of the word *'easy'*. I've been dreading it for, like, three years and now I have no idea why. Maybe the teacher is just good at explaining stuff. Anyway, I'm getting bored talking about school and I've got to get going. I'll call you later, OK?

Bye!

APPENDIX 2

Words used from ANEW words list along with related data (Bradley & Lang, 1999)

NEGATIVE WORDS	VALENCE	AROUSAL	FREQUENCY
Alone	2.41	4.83	195
Death	1.61	4.59	277
Fear	2.76	6.96	127
Stress	2.09	7.45	107
War	2.08	7.49	464

POSITIVE WORDS	VALENCE	AROUSAL	FREQUENCY
Beautiful	7.60	6.17	127
Easy	7.10	4.48	125
Freedom	7.58	5.52	128
Hope	7.05	5.44	178
Progress	7.73	6.02	120