



ARTICLE

Effects of Arousal on Type of Word Recalled

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Much research has been conducted on the different variables that can affect memory. The hypothesis in the present study was that more words that provoke negative emotion would be remembered under high arousal conditions, and more calm words would be remembered under low arousal conditions. Thirteen undergraduate university students in a lab section of a psychological methods research course at the University of California Los Angeles were tested to determine the effects of level of arousal and word type on recall. A 2 x 2 within-subjects design was used, in which the first independent variable was level of arousal, high or low, and the second independent variable was word type, emotional or calm. Each participant was given two lists of words, one for each level of arousal, and the dependent variable was amount of words correctly recalled from each list. The results were not significant, indicating that level of arousal and word type have no effect on word recall; $p > .05$. These findings imply that the level of arousal one is under when learning information and the type of information being learned have no impact upon each other, therefore there are no optimum conditions of these variables for learning.

Introduction

Memorization is a task that we are faced with daily. Students need to remember definitions, and parents need to remember when to pick up their children and pay the bills. It comes as no surprise, then, that much research has been conducted on memorization and under which conditions words and information are best recalled. Arousal is a variable that has often been tested in relation to many situations regarding memory, as different levels of arousal are often experienced in everyday life.

It makes sense that while experiencing a task in a high arousal condition, or a condition in which one is faced with a lot of noise, one would be less able to concentrate on the task at hand. Libraries are kept quiet for the purpose of allowing people to study to the utmost effect. To determine the effect of

arousal on stereotyping, Paulhus, Martin, and Murphy (1992) conducted a study in which they manipulated arousal to determine whether high levels of arousal enhanced levels of stereotyping when the subject was faced with consistent and inconsistent information regarding gender (Paulhus, Martin, and Murphy, 1992). The participants were asked to read a short description of an incident that either had four gender neutral behaviors or three gender neutral behaviors and one inconsistent behavior. They then had to rate ten traits of the individual, consisting of four of each stereotype relevant traits and stereotype irrelevant traits, along with two behavior relevant stereotypic traits, on an interval scale while listening to either the low arousal white noise or high arousal white noise, 40 db and 90 db respectively. The results

of the study showed a significant main effect for arousal, meaning that higher arousal produced greater stereotyping, in addition to a main effect for information, and an interaction between information and arousal. Arousal in this study enhanced stereotyping when the information presented was cognitively simple, meaning that the only information given in the description that was relevant to the study was the individual's gender. When the information was more complex, in this case stereotype-inconsistent, the participant was assumed to undergo a deeper level of cognitive processing, in which case arousal did not have an effect on the stereotyping tendency. It also did not magnify the tendency.

Paulhus et al. (1992) suggested the manipulation of arousal during the encoding phase in future studies rather than manipulation of arousal during the retrieval phase, which was done in the present experiment. In the present study, arousal was manipulated. Paulhus et al. suggested that the 90 db level of noise may have the ability to improve performance on easy tasks, based on previous research. We used similar conditions regarding the level of noise to see if using a loud noise improves correct recall of words from a given list. While Paulhus et al. tested sex stereotyping and arousal, the present study tested type of word recalled and arousal to see if the type of word that a participant is given has an interactive effect with level of noise.

Thomas and LaBar (2005) conducted a study in which they found that the emotional content of a word increased its level of repetition priming, basing their study on the assumption that people show better recall of emotionally arousing experiences than neutral experiences. Repetition priming refers to the idea that a subject will respond to a stimulus when it is presented with it again after seeing it initially. The researchers created a list of taboo, low arousing negative, and neutral words, and used these lists in addition to non-words, or words in which they changed one consonant, to test how quickly participants could respond as to whether the word was concrete or abstract. The dependent variable was the time it took to classify whether or not the word was concrete or abstract, however memory was a part of this dependent variable, because the experimenters suggested that, quite counter-intuitively, a participant would take longer to classify a word they had previously seen. They found a significant main effect for emotion. This means that it took a longer time for the participant to respond to the emotional taboo words as compared to the neutral words.

Overall, the experiment by Thomas and LaBar (2005) showed an interesting effect of emotionally arousing words, citing the fact that

participants only had to see the emotional word one time to actively remember it. They suggested that a possible reason for this outcome is that the biological significance of the word may cause the word to affect different information-processing mechanisms, or in simpler terms, the word is processed more readily because it might help keep the person out of danger. Furthermore, they suggested the possibility of a threshold affect, such that a certain threshold exists in which a certain amount of provocation will activate the brain to respond to the word and remember it better (Thomas and LaBar, 2005). This is a very interesting hypothesis regarding emotional words that needs further investigation. We hypothesized that more emotional words would be remembered under high arousal conditions, possibly due to this mechanism of a threshold effect. High arousal may cause the participant to feel more in danger at a subconscious level, thus increasing their capability to remember the emotional words under this idea of a threshold effect. Under low arousal conditions, the participant would more likely feel calm, thus the threshold that needs to be reached to better remember emotional words might not occur.

Dwivedi (1992) found that there was a significant effect of arousal level when testing recall of paired associations. He tested noise in relation to semantic or acoustic orienting tasks, and added another variable with the test of incidental or intentional learning. Half of the subjects received an immediate recall test in addition to a test the next day, and the other half received only the test the next day. The associations were remembered better for the short-term test under the low arousal condition (65 db of noise) than in the high arousal condition (85 db of noise). Another important finding was a significant effect of intentionality to learn, demonstrating that more associations were recalled when the participant was told to learn them. These findings led us to our study, in which we instructed the participants that they would have to remember as many words as possible, thus mimicking the intentionality portion of Dwivedi's study. Interestingly, this study found that for the high arousal condition in which the subject's learning was incidental, more associations were recalled on the long term memory test that was given the next day. This was an interesting find that allowed us to hypothesize that not all learning would be better under low arousal conditions; it is possible that the noise can be beneficial to learning.

The present study tested the effect of arousal on type of word recalled. Arousal was manipulated by using a low arousal condition of classical music played at a low volume, and a high arousal condition of upbeat music played at a high volume. Word type was also manipulated by having two lists of words

consisting of emotional words and calm words. The emotional words were described as words that provoked negative emotion and response, such as death or cancer, while the calm words consisted of words that would generally not provoke much emotion, such as desk or cat. An interaction was predicted between level of arousal and type of word recalled. It was hypothesized that more of the emotional words would be recalled in the high arousal condition because the participants may have felt more susceptible to emotions at a higher state of arousal, thereby remembering words that also went along with their state of being at the time. It follows, then, that more of the calm words would be correctly recalled in the low arousal condition, since participants would have felt more calm and relaxed, possibly leading to the better memory of words that follow that same pattern. Therefore, it was predicted that the way that a person felt while learning the words would affect the type of word recalled.

Method

Participants

Thirteen undergraduate university students (six men and seven women) participated in the experiment as a course requirement. The participant's ages ranged from 20 to 24 years, and all participants were in the same lab section of a psychological research methods course at the University of California, Los Angeles.

Design

A 2 x 2 within-subjects design was used in this experiment. The first independent variable was level of arousal, which consisted of a high arousal condition and a low arousal condition. The high arousal condition consisted of playing a selection of upbeat music at a high volume. The low arousal condition consisted of playing a selection of classical music at a low volume. The second independent variable was word type, which also had two conditions named the calm words and the emotional words. Calm words were defined by a consensus of the experimenters as words that do not provoke negative emotion; they either have no effect or a calming effect upon the subject. Emotional words were distinguished by their ability to provoke negative emotion, or elicit a response from the subject. The dependent variable was the number of words correctly recalled.

Materials

Two lists were used in this experiment, labeled as list one and list two. To create the lists, a

calm word was chosen at random by the experimenter to be placed on list one. Then, another calm word matching in number of syllables and number of letters was added to list two. An emotional word with the same number of syllables and letters was then added to list one, followed by a similar emotional word added to list two. Once a group of four words, equal in their syllables and number of letters, had been established, a new calm word was chosen to begin the process again. A consensus by the experimenters was used to determine that the word was either calm or emotional, meaning that all four experimenters had to agree that the word either did or did not provoke negative emotion. The words in each list were then randomly assigned a number, which determined the order in which they appeared on the list. Two speakers and ipods were used to play the music that served to arouse the subjects. Packets of paper were distributed to each participant. The first sheet of the packet either directed the subject to room H or L, which stood for the high and low arousal rooms. The second sheet either had word list one or list two, followed by two blank sheets of paper. The first blank sheet was for the subject to write down numbers counting backward from 1000, and the other was for the subject to write down the words they could recall. Following the two blank sheets of paper came the other word list and two more blank sheets of paper for the same purpose.

Procedure

Packets were randomly distributed to the participants. Half of the packets instructed to go to room H, and half instructed to do to room L. Half of the packets had list one first and the other half had list two first, thus in each room, half the participants received list one and the other half list two to control for confounding which list was received first with the arousal condition. One experimenter stayed in the high arousal room and two stayed in the low arousal room. Once arriving at the room, participants were instructed to sit down as the experimenters read the instructions. The music was started immediately upon the subject's arrival to the room. Participants were told that when told to begin, they would be given 30 seconds to memorize the words on the next page in the packet. They were then told to begin. When 30 seconds had passed, they were told to stop and turn the page over. They were then given one minute to write down the numbers counting backwards from 1000 on the blank sheet of paper in the packet. After one minute had passed, the participants were told to flip to the next page of the packet and write down any word that they had remembered from the list they had just seen. They were given 30 seconds to complete

the task before being told to go to the next room. In the next room, the participant received the list of words that they had not seen in the previous room. The same procedure was conducted in both rooms, the only difference was that in the H room, upbeat music was played at a loud volume and in the L room, classical music was played at a low volume.

Results

Figure 1 presents the mean number of items correctly recalled under low arousal and high arousal conditions and as a function of type of word. Looking at the pattern of results displayed in figure 1, it appears that items, in general, were recalled the same when presented under low arousal and under high arousal conditions. The number of items correctly recalled showed no significant difference for emotional words versus calm words. The degree to which recall was affected by level of arousal does not appear to depend on type of word.

To test the hypothesis, the data were analyzed using a 2 x 2 within-subjects ANOVA, which revealed no significant main effect of level of arousal, such that average correct recall was not significantly different when items were presented under high arousal conditions ($M=3.39$, $SD=1.47$) than when presented under low arousal conditions ($M=3.42$, $SD=1.41$), $F(1, 12)=.011$, $MSE=1.69$, $p>.05$. There was also no significant main effect of

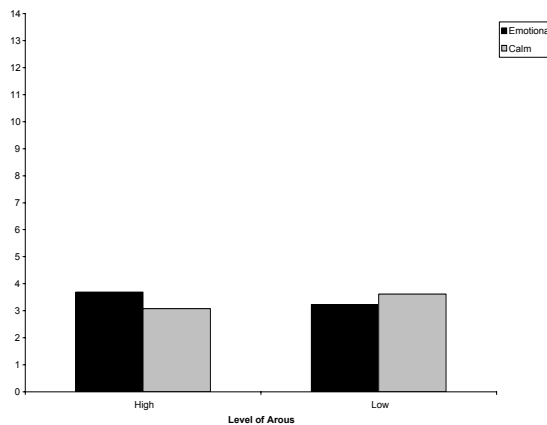


Figure 1. Mean number of words recalled as a function of type of word and level of arousal.

word type, such that the average correct recall was not significantly different for emotional words ($M=3.46$, $SD=1.33$) and calm words ($M=3.35$, $SD=1.45$), $F(1, 12)=.16$, $MSE=1.09$, $p>.05$. Additionally, there was no significant interaction between level of arousal and type of word, $F(1, 12)=1.22$ $MSE=2.67$, $p>.05$.

Discussion

The present study found no interaction between level of arousal and type of word recalled. No main effects of level of arousal were found, nor were there any main effects of word type. This does not support our hypothesis. The original hypothesis was that more of the emotional words would be recalled in the high arousal condition and more of the calm words would be recalled in the low arousal condition, since type of word recalled would match the participant's feelings at the time of the study. The results do not support any previous research on the topics of recall and arousal tendencies.

Paulhus et al. (1992) exhibited that level of arousal had implications on levels of stereotyping, more specifically that arousal enhanced sex stereotyping. One of the reasons why the present study may not have found such an effect of arousal is that the mechanisms of the brain that control sex stereotyping may be different than the brain functions required for memorizing a list of words. Furthermore, they cited the importance of a 90 db level of noise in simplifying cognitive tasks, and the present study could not replicate this exact number. Memorizing a list of words, however, is hard to discern as either a cognitively simple task or a difficult task; therefore, it is unknown if using the 90 db and 50 db conditions that Paulhus et al. employed would have yielded different results for the present study. A problem with the present study was the lack of using discrete volume measurement, specifically decibel measurements, due to the inability of the experimenters to obtain a high quality decibel measurer. The present study merely utilized loud noise or soft noise, which is not as scientific as previous research has been.

As previously discussed regarding the study conducted by Thomas and LaBar (2005), a threshold effect was thought to be a possible cause of better recall of emotional words. In the present study, such results were not obtained. A possible reason for this difference is that the present study presented high arousal in the form of upbeat, Spanish music, which most likely did not have the dangerous connotation that loud white noise has for participants. Their study focused on the importance of brain mechanisms that are pre-wired for emotional words to be better recalled based on fear, but in our study the necessary fear that needs to be invoked to cause these passages to work was most likely not there. Another possible issue could be that with the short time that the participant spent in each condition, they may not have been at a truly high or low state of arousal. Future research might allow for more time to be spent

in each room so that the participant has time to adapt to the level of arousal in each condition.

While Dwivedi (1992) found that high arousal noise could be beneficial for long term learning, the present study could not confirm this result. A possible reason for this is that Dwivedi conducted a recall test after a one day delay, and the present study only gave participants a one minute delay before recalling the previously learned words. It would be interesting to conduct future studies in which various delays of time were employed as an independent variable in a recall test, to see if the optimum level of arousal changes with delays in time of the recall test.

A confounding variable in the present study may have been the different music types presented in the high arousal and low arousal conditions. Due to unforeseen circumstances, the upbeat music played in the high arousal condition contained Spanish lyrics, while the classical music played in the low arousal condition did not have any words. The words in the high arousal condition may have affected the memorization of the list of words. For future studies, it would be beneficial to have a high arousal condition and low arousal condition with the same type of noise or music, and merely change the volume so that the music type does not confound the results. Furthermore, a limitation of this study was the small number of participants, although since the results were not close to significant, adding more subjects may not yield the hypothesized results. It may also be interesting to introduce the arousal only for the retrieval phase of the words, which is the manner in which Paulhus et al. (1992) tested levels of arousal.

Since the present study did not find any main effects or interaction between level of arousal and word type, not many implications can be drawn. Assuming from our findings that there truly are no effects of level of arousal and word type on correct recall of words, it would not matter whether or not learning took place in a high or low arousal environment, nor would the type of information being learned increase its likelihood of being remembered. Thus, school classrooms could be noisy and it would not make a difference in learning. The matching hypothesis that was introduced in the beginning of the study showed no merit, therefore learning material that goes along with one's state of being at the time will not help it to be remembered. This has implications for nullifying learning techniques that employ this method; trying to learn emotional material under a high state of arousal will not be any more beneficial than learning the same material under low arousal, based on the results of the study. These findings imply that the level of

arousal one is under when learning information and the type of information being learned have no impact upon one another, therefore there are no optimum conditions of these variables for learning. Future research should be conducted with more scientific means and a longer time frame to determine if there are any effects of these variables.

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