



The Effects of Mood and Valenced Information on Semantic Memory Retrieval

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Abstract. The relationship between emotion and memory has been widely studied. The present study aims to explore the effects of mood and valenced information on memory. Sixty undergraduate students aged 18–26 years were induced with positive or negative emotions and then completed the Positive and Negative Affect Scale and a memory task. The results revealed that in a positive mood group's participants were inclined to retrieve more positively-valenced semantic information whereas in a sad mood group's participants would be better at retrieving that negatively-valenced information. The results were more significant in the negative emotion group than the other two groups. It indicates that positive emotions have an improvement in short-term memory ability, so learning efficiency can be processed by guiding individual emotions to make them have positive emotions during learning.

Keywords: Emotional state · Semantic memory · Retrieval cues · Valenced information

1 Introduction

It has been extensively studied how affective states influence cognitive processes. In addition, numerous studies have examined memory from the viewpoint of affect and cognition. Generally speaking, these studies suggest that when people are in a happy mood, they prefer relational processing, while when they are in a negative mood, they prefer item-specific processing.

Individuals with positive affective states are more likely to rely on heuristics, stereotypes, and general knowledge structures that have been activated while those with negative affective states are more likely to focus on information specific to the situation at hand. The affect-as-information hypothesis (or feelings-as-information hypothesis) explains how mood affects memory and other cognitive processes [1, 2].

Several studies have examined the effects of affective state (i.e., mood) on cognitive processes [3–5]. Study after study has examined affective state and cognition in relation to memory [6–8].

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During the experiments Amanda performed, the mood of the participants affected their episodic memory [9]. This study examined whether mood affects metacognitive judgments associated with retrieving semantic information and generalizing this theory to semantic memory. A 2×2 mixed experiment was designed to test the influence of mood (happy versus sad) and question type (multiple-choice versus open-ended) as between-subject effects. Affective pictures from the International Affective Picture System were used to evoke participants' moods. Previous studies have shown that such photos are capable of eliciting affective responses. Especially, Amanda considered the limitations of picture-induced mood manipulations, the induction effect of which might wear off faster than that of video-based manipulations [9]. Intentionally, another mood manipulation was arranged in this study to "refresh" mood induction. Specifically, six different affective and neutral photos were shown to participants again after the first 100 general knowledge questions were answered, so the mood-inducing effect would last until the end of the experiment.

Admittedly, there exist several limitations to this paper. Considering this research focuses on the interplay between mood and retrieval of semantic information, however, the experiment design fails to distinguish the impact of mood on semantic information retrieval from the encoding process. The affective state might affect the encoding of semantic information recall of the identical memories, to a larger extent. Furthermore, in order to isolate the impact of the emotional state on semantic retrieval, all of the trivia questions were intended to be neutral in the valence of this study. Notwithstanding, the absence of valenced semantic information probably influences the retrieval of semantic information.

Chinese scholars also conduct considerable research on the relationship between the effects of mood and short-term memory. Yang et al. made an experimental study on the effect of positive emotion on the short-term memory of medical students [10]. It balanced the influence of gender and specialty of medical students and carried out pre-experiment to ensure that the experimenter had certain difficulty in memorizing words, which was convenient for the accuracy of the experiment and excluded irrelevant variables. With all the advantages mentioned above, there are also some disadvantages. Considering people's short-term memory capacity is 7 plus or minus 2. The experimenter used 70 words, which is too much. The experimental results are in the form of selection, which cannot avoid the possibility of speculation. Therefore, this study presented the participants with 15 words each time.

There is also a case where Zhao et al. investigated the effects of emotional states and materials on the short-term memory capacity of 42 college students under three kinds of emotions evoked by different video materials [11]. According to the findings, there were remarkable differences in the parameters of respiration rate and galvanic skin response under different emotional states. The effects of emotional states and memory materials were significant on short-term memory capacity and emotional states and memory materials had significant interaction. The effects of emotional states on letter short-term memory capacity were significant. Short-term number memory capacity was significantly higher than letter capacity under different emotional states.

Further, there would be some improvements in the present study. Specifically, the study would use the emotional scale to test participants' emotions instead. In case to

eliminate the sequential effect, the experimenter would add some simple oral calculations after the participants remembered the words and before they started to recall them.

Under such background research, the goal of this study is to confirm that emotion-laden words will be preferentially retrieved when participants are under the corresponding effect of affective state. For participants' recruitment, 30 undergraduates who meet certain criteria will be invited and divided into 3 groups all randomly. In the research process, they will complete the word recognition task with emotional arousal (positive/negative) by watching different video clips. The result of the experiment would be expected as participants with a negative affective state would show better short-term memory for negative words whereas participants with a positive affective state would show better short-term memory for positive words than for other words by number.

This study proposes that people in a cheerful mood are more likely to recover positively valenced semantic information, whereas sad participants are more likely to retrieve negatively valenced information, based on the affect-as-information theory. In addition, data on participants' reaction times for semantic retrieval replies will be captured in order to assess their semantic retrieval efficiency. Individuals in a cheerful mood are thought to use more heuristic processing than those in a sad state. Participants' replies should be faster when they are confident in their retrieval responses, according to this study.

2 Methods

2.1 Participants

The participants were 60 undergraduates including 44 girls and 16 boys randomly asked. The average age of the participants was 20.4. The selection method includes passing the English test (such as CET-4 and CET-6, IELTS or TOEFL test) and simple questions like whether they have experienced big events or trauma. The purpose was to reduce the impact on emotion, for example, some people may be depressed all the time. To balance the influence of specialty and gender, male and female students of each specialty were randomly divided into 3 groups.

2.2 Materials

2.2.1 Emotional Impact Materials

The positive clips were selected humorous videos, and the negative clips were war videos, all of which were 5 min long. The negative video adopted the film *Nanjing! Nanjing!* between 31 and 36 min. The positive video adopted the cartoon *Tom and Jerry* episode 39 from 5 to 10 min.

2.2.2 Positive and Negative Affect Schedule (PANAS)

The PANAS is a scale that consists of different words that describe feelings and emotions. It is used to assess the emotion after watching the videos. When using the PANAS, participants gauge their feelings and respond via a questionnaire with 20 items. A 5-point Likert scale is then used for scoring. Scores can range from 10 to 50 for both the

PANAS with the lower scores indicate lower degrees of positive/negative affect, whereas higher scores indicate larger levels of positive/negative affliction [12].

2.3 Procedure

First, please read and sign the experimental consent form of understanding and commitment. Second, led the 3 groups into 3 quiet laboratories. Third, before the experiment officially begins, the 3 groups of participants need to meditate for 5 min. The process of meditation can keep the participants from emotional fluctuations and maintain balance as much as possible, it also can make the positive and negative groups produce emotions better, and meet the general emotions of the control group at the same time. Then, let the general emotion group rest in the laboratory for 5 min. Play videos to the positive and negative emotion group respectively, the aim is to induce them to produce positive and negative emotions. After the video playback, distribute the emotion scale and let the 30 participants fill in it so that researchers can judge whether emotion leads to success. Finally, experiment with Psychopy and sort these data.

In the Psychopy, this study asked the participants to browse 15 words and record the number and nature of words they can remember. The present study set up 15 words (including 5 positive words, 5 negative words, 5 neutral words), these vocabularies were extracted from the vocabulary, and you can see the word list at the end of the article, this list has been used many times in many papers on emotion research. After the 15 words were presented, the participants needed to calculate 5 simple math problems. The purpose was to reduce sequence effects, like the primary effect and recency effect. Finally, the participants would be asked to write down the words they remembered and thanked them.

2.4 Data Analysis

Collected scale data and the words about the number and nature of participants written down on Psychopy. According to the emotion scale PANAS (the scale is designed to assess a person's positive and negative emotions, as well as how they are feeling at the time) filled by the participants, it was judged that the participants in the experimental group were in a certain state of positive and negative emotions.

After the participants left, the experimenter saved the data of the three groups of participants, viewed the detailed information in excel, looked at the memorized words they wrote down in the three groups, then checked their corresponding emotional scales, and judged whether the emotional materials had an impact. Finally, these valid data were imported into the SPSS analysis.

3 Results

3.1 Scalar Mood Manipulation

After emotion induction, participants completed the PANAS mood scale to investigate whether the emotion manipulation worked. Their mood scores were calculated based on 5-point Likert Scale. Results of the mood scale suggest that the mood induction was successful. Paired sample t-test was used for examine the discrepancy between scores of the experimental group and contrast group in both positive and negative mood groups. The paired sample t-test between the experimental group and the contrast group in the positive mood group revealed that the participants in the experimental group got higher scores in Positive Affect Score than when they were in the contrast group, while the negative group's participants who were assigned in experimental group got significantly higher scores in Negative Affect Score than when they were in the contrast group. The experimental group differs from contrast group in positive mood group is significant, $p < 0.01$. Moreover, the difference between experimental group and contrast group in negative mood group is significant either, $p < 0.001$. This proved that emotional control is effective.

3.2 Semantic Retrieval Quantity

Paired sample t-test was also used to examine the semantic retrieval quantity difference between post- and pre-measurement in each group. The result indicated that there is no significance in the positive mood group ($p > 0.05$), and significant result was found in the negative mood group ($p < 0.01$). Meanwhile, the independent sample t-test was used to examine the semantic retrieval quantity difference for the experimental group and the contrast group between the large two groups (the Positive mood group and the Negative mood group). The quantity of the words reminded by participants in positive mood was significantly more than the quantity of the words reminded by the negative mood group ($p < 0.001$). Moreover, the insignificant result indicated that there was no significant difference in the memory ability of the participants in the two groups ($p > 0.05$), which further proved the validity of the final results.

3.3 The Valence of Retrieved Words

Results of the paired sample t-test for numbers of words in valence rate between the experimental group and the contrast group in the Positive mood group indicated an effect of positive mood condition on the valence rate of retrieved words ($p < 0.05$). The result also suggests that participants in positive moods are inclined to retrieve less negatively valenced words than when they were in a calm mood ($p < 0.05$). However, there was no significance in positive emotion words. These relationships are depicted in Fig. 1. An ANOVA with mood as the independent variable and participants' retrieved quantity of different valenced words as the dependent variable was conducted and it showed no significance of all the variables.

The result from a paired sample T-test for numbers of words in valence rate between the experimental group and the contrast group in the Negative group showed the main

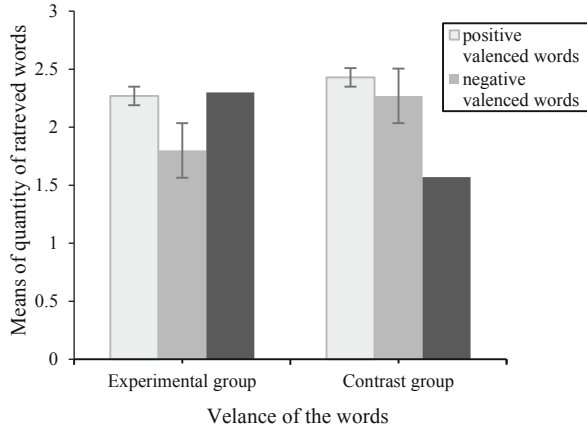


Fig. 1. The means of positively, negatively or neutrally valenced words that participants retrieved in neutral or positive mood condition.

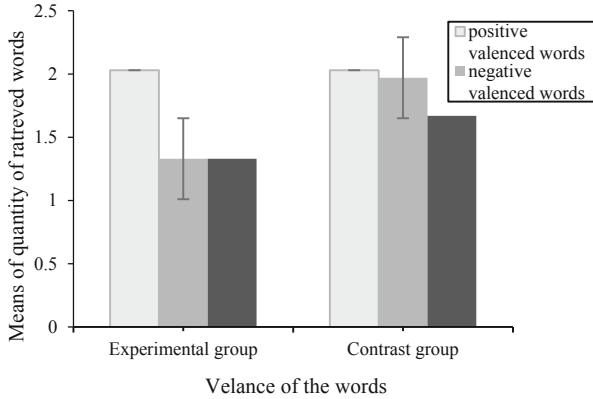


Fig. 2. The means of positively, negatively, or neutrally valenced words that participants retrieved in neutral or negative mood condition.

effect that participants retrieved more negative words when they are in a negative mood than when they were in a calm mood ($p < 0.05$) and no significance was found in positive valenced words and neutral words. These relationships are depicted in Fig. 2. The following ANOVA showed that the retrieved negative words were significantly more than positive words and neutral valenced words ($p < 0.05$).

The result of an independent sample t-test between the quantity of different valenced words that were retrieved by participants in positive and negative mood indicated a significant difference between the quantity of negative words (the negative group retrieved more than the positive group), and there was no difference between the positive words (see Fig. 3).

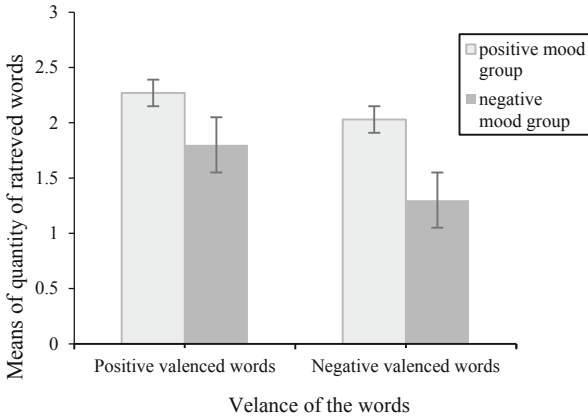


Fig. 3. The means of positively or negatively valenced words that participants retrieved in positive and negative mood group.

4 Discussion

4.1 Overall Findings

This study focuses on two questions. The first is whether the participants have a better retrieval quantity of valenced words in certain affective states correspondingly. The second is whether different affective states enhance short-term memory capacity temporarily. For the first mentioned of two, the answer seemed to be yes. The data collected confirmed the hypothesis: individuals with negative emotions would more focus on negative valenced words whereas individuals with positive emotions are more likely to remember positive valenced words. As for the latter question, short-term memory capacity did enlarge with positive emotion was aroused in a short period according to the statistic result in the former part.

4.2 Interpretation

In this study, the negative mood group’s data had primarily proved the hypothesis with the positive mood group had less significant statistic figures in semantic retrieval quantity at the same time. Based on the statistical figures, participants in a positive mood had no obvious contrast between positive valenced words and neutral valenced words. The neutral valenced emotion words showed significance in retrieval quantity in the positive mood group, which can be read as positive valenced words turned into intervening variables that caused the non-significant. As for the unnoticeable result of positive valenced words quantity in the group, it can be resolved into Chinese characteristics which is the overall emotional expression is more implicit culturally, as is emotional arousal.

4.3 Limitation and Future Research

Given the design and participants' selection limitations, there were certain limitations in the study. First, this research was designed to have Chinese college students as participants and use English in the words recognition task, so there were certain degrees of semantic differences with the cross-language condition. Furthermore, some errors may come from the association between the words that we presented. Pavlov believes that association is a temporary neural connection caused by the simultaneous or continuous action of two or more stimuli. This procession is similar to memorizing because people maybe treat these associated words as a chunk so that they can remember more words than they expected. Additionally, an unanticipated situation had occurred: a few cases of misspelling and recalling words never showed, negative mood group in especial. Participants in a negative affective state did miswrite several neutral valenced words into negative valenced words, which would be interpreted in two ways. First, the influence of negative emotion strengthens memory retrieval of negative valenced words which even affects the short-term memory of word recognition. Second, participants misspelled these cases in common with another pure misspelling, the other undirected cases. Yet, based on the significant result of the negative group, prior interpretation is more possible. Besides, there are also cases when participants retrieve negative valenced words that are not in the words list, which can be explained by the former theory of retrieving words chunk to a certain degree. Moreover, gender was not discussed in this study, of the unbalanced sex ratio. Females tend to accept emotional influence more tellingly than males according to certain research, which may lead to more obvious results in this study for the proportion of females was significantly high.

The relationship between positive emotion and negative emotion is not simply as one falls, another rises. They can be independent variables, increasing and decreasing at the same time [13, 14]. So, it would be interesting to have further research to study the short-term memory retrieval of people under both positive and negative emotions either.

Research shows positive emotions have an improvement in short-term memory ability. Given this, learning efficiency can be processed by guiding individual emotions to make them have positive emotions during learning, that is, memory encoding, to improve the efficiency and capacity of short-term memory.

5 Conclusion

Generally, the whole quantity of retrieved words has significant difference between the positive group and negative group. Specifically, in the Positive mood group, participants in the positive mood retrieved fewer negative valenced words and more neutral valenced words than when they were in the calm mood, in the Negative mood group, the participants in the negative mood retrieved more negative valenced words than when they were in the calm mood. This supported the hypothesis mentioned before, that is, individuals in positive affective states are more likely to rely on previously activated heuristics, stereotypes, and generic knowledge structures, whereas those in negative affective states are more likely to concentrate on information unique to the situation at hand (the negative information). In this research, the participants in a positive mood retrieved more negative valenced, and this may be because the negative valenced words always weigh

more than other kinds of words, in other words, individuals are more likely to worry about something horrible happens. The significance of neutral valenced words may be explained as: since there is no difference between the positive valenced words in the positive group and the storage quantity of the short-term memory is stable and finite, and in traditional Chinese culture, becoming quite active is not encouraged, so they tend to remember more neutral valenced words to fulfill the quantity.

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