

# The Effects of Affective State and Valence of Words on L2 Vocabulary Memory Retrieval

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## ABSTRACT

The effects of affective state on the cognitive process have enjoyed substantial empirical attention. The research aims to investigate the effects of mood conditions and valence of words on L2 vocabulary memory retrieval. Twenty undergraduates participated in the experiment and completed memory retrieval tasks after mood manipulation. To investigate whether mood conditions exerted influences on L2 vocabulary memory retrieval, 2 (mood: happy, sad) x 3 (valence of words: positive, neutral, negative) repeated measures were conducted. The results indicated that neither the interaction between mood conditions and accuracy rates nor mood conditions and valence propensity of L2 vocabulary memory retrieval were significant. An unanticipated finding was the significant interaction between retrieval accuracy rate and reaction time. On average, participants' true responses accompany less reaction time and vice versa. This study provided evidence for the cognitive differences between L1 and L2 vocabulary memory retrieval.

**Keywords:** L2 vocabulary, Memory retrieval, Mood conditions, Valence of information.

## 1. INTRODUCTION

Investigating the effects of mood conditions on cognitive processes has been a continuing concern in recent years. Particularly, considerable scholars focus on the potential interactions between mood and memory. There has been disagreement on the effects of mood conditions on the retrieval of differently valenced words. Studies by Isen et al. Induced participants' mood conditions by winning or losing computer games and found that participants retrieved more positive personality trait words after winning the game [1]. Nevertheless, they failed to find significant differences between neutral and negative words. Teasdale and Russell replicated Isen et al.'s studies and reported that more positive words could be retrieved in the elated mood and vice versa [2]. In the contrast, Bower et al. conducted three experiments, which revealed no overall differences in the effects of mood conditions at recall on the retrieval of happy or sad plots of a story that participants have learned before [3]. In the three experiments, they chose positive or negative abstract nouns as experiment materials. The only evidence to support the effects of affective states on retrieval was that the valence of the first word recalled was in line with the induced moods. Regarding the contrasting findings, Teasdale and Russell explained that the different effects

of mood conditions on memory retrieval might depend on the nature of the materials [2]. Only if materials associated with participants' individual life experiences would the mood effects turn out to be significant. Among published reports, Isen used personality trait words like *ungrateful*, *helpful*, and *kind*, instead of abstract nouns used by Bower such as *humor*, *victory*, and *pleasure*. It seemed that personality trait words were more likely to trigger participants' attachment with their own life experiences.

Notwithstanding, previous studies have been limited in the retrieval of L1 (native language) positive, neutral, or negative words, while little attention has been paid to the L2 (second language) word retrieval. Considerable studies have been conducted in the field of L2 vocabulary Acquisition. Park demonstrated the importance of retrieval types and working memory in L2 vocabulary acquisition [4]. Marta et al. found a significant interaction between phonological short-term memory, phonological awareness, and L2 vocabulary acquisition for children [5]. In contrast, Martin provided evidence for the independent effects of phonological short-term memory and working memory on L2 vocabulary learning [6]. Josje and Paul shed light on the same memory mechanisms for L1 and L2 vocabulary acquisition in the natural setting [7]. Considering the potential differences between L1 and L2 cognitive processes, the present research attempts to cast

light on whether the effects of mood conditions would significantly affect the retrieval of L2 words with different valences. It was hypothesized that mood conditions and valence of words would significantly influence the quantity, reaction time, and accuracy rate of L2 vocabulary memory retrieval. Furthermore, there might exist an interaction between mood conditions and the valence of retrieved words.

**2. METHODS**

**2.1. Participants**

The participants were 21 graduate students (N=21, average age=23, Female=18, Male=3) majoring in E-C translation studies at the local university for a reward of 10RMB. They were all native Chinese speakers. In the experiment, they were induced in happy or sad emotion moods and then finished three memory retrieval tasks on Psychopy on different days. Ethical approval was granted by the School of Psychology Ethics Committee.

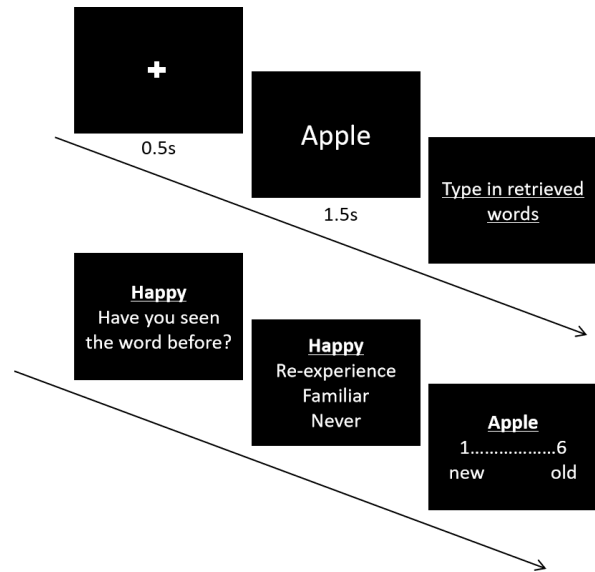
**2.2. Materials**

Participants signed up for a consent agreement for the experiment and personal data. First, participants were induced into a positive or negative mood by viewing respectively 6-minute video clips. These video clips adopted have been proved to be effective for mood induction by scholars [8]. Participants needed to finish the Positive and Negative Affect Schedule (PANAS) questionnaires before the mood induction (as the baseline) and after to examine whether the emotion manipulation worked. Then, Psychopy was used to run the semantic retrieval tasks to examine the effects of induced mood on the retrieval of previously encoded semantic information. Participants viewed a total of 60 words on Psychopy. Specifically, the 60 words were divided into two word lists (30 words/list) to display on different days. In a word list, it consists of 10 positive (M = 7.61), negative (M = 2.13) and neutral (M = 5.41) valenced words. All words shown to the participants attach with high frequency, which means that all participants have learned all of these words before. The emotionally-valenced words were taken from existing studies by Affective Norms for English Words (ANEW) proposed by Margaret and Peter [9]. A pilot study was conducted and the subjects in the pilot study did not participate in the main experiment.

**2.3. Procedure**

Having been familiar with the procedures involved, each participant was invited to sign an informed consent form. Participants completed the experiment in an office room free from distractors. They finished PANAS emotion questionnaires for the first time as their emotion baseline. Then these participants were led into a positive

or negative mood on different days. The order of the mood induction is random. On the first day, these participants were shown positive or negative video clips. Each mood induction lasted 7 minutes on average. On the second day, the alternative mood state was induced. Next, the participants finished the PANAS emotion questionnaires for the second time to judge whether emotion manipulation works. It is hypothesized that participants induced into a happy mood get significantly higher scores in Positive Affect Score, while participants induced into a sad mood get higher scores in Negative Affect Score.



**Figure 1** Flow chart of the experiment.

After the mood induction, participants finished a series of word retrieval tasks programmed on Psychopy. The complete experiment procedure was shown in Figure 1. Participants were shown 30 words including each 10 positive, negative and neutral valenced words. There appeared a cross as a central fixation point for 0.5s before the presence of each word. All words were presented one by one for 1.5 seconds each randomly to counterbalance the order across participants. The word lists displayed on different days were entirely different. Then, participants were asked to finish three memory retrieval tasks. In the first task, they recalled what they have seen as many as possible and typewrote the retrieved words on Psychopy. Then, they would press the ‘space’ to indicate that they could not retrieve anymore. In the second task, a series of words were displayed to participants one by one, including the 30 words they have seen and the other 30 words they haven’t seen before. A question was presented below the word, ‘have you seen the word before’, and participants needed to press ‘y’(yes) or ‘n’(no) in response. Their accuracy rate, reaction time, and the average of positively or negatively valenced words were recorded. In the third task, there appeared the same words as those in the second task, and participants were asked to choose from “Re-experience, familiar, or never” and give 1-6 for the feeling-of-knowing ratings.

“Re-experience” meant they were sure that they have seen the word before. “Familiar” meant that they were not sure whether they have seen the word before, but they thought that they might have seen it. “Never” meant that they were sure that they have not seen the word before. “1” meant that they felt (new) they haven’t seen the word, and “6” indicated (old) that they were confident they have seen it. Participants were thanked for their participation.

### 3. RESULTS

#### 3.1. Mood Manipulation

The data of a participant was excluded from analyses because of a technical problem. The findings from the mood questionnaires showed that mood induction was effective. A 2 (mood induction: happy, sad) x 2 (time of measurement: before or after the mood induction) repeated measures revealed that participants induced into a negative mood got significantly higher scores in negative affect score, and those induced into a positive mood got significantly lower scores in negative affect score,  $F(1,19) = 10.20, p < 0.01, \text{partial } \eta^2 = 0.35$ . Furthermore, participants induced into a negative mood got significantly lower scores in positive affect score, and those induced into a positive mood got significantly higher scores in positive affect score  $F(1,19) = 9.24, p < 0.01, \text{partial } \eta^2 = 0.33$ .

#### 3.2. Overall results

To investigate whether mood conditions exerted influences on semantic memory retrieval, 2 (mood: happy, sad) x 3 (valence of words: positive, neutral, negative) repeated measures were conducted. The dependent variables include the quantity, valence, reaction time, and accuracy rate of retrieved words. Specifically, the semantic retrieval quantity refers to the number of participants’ retrieved words in the retrieval task. Semantic retrieval valence was gauged through the percentage of positively, negatively, or neutrally valenced words that participants retrieved in happy or sad mood conditions. Semantic retrieval efficiency was measured with participants’ reaction time and accuracy rate which were recorded when they answered the given question “have you seen the word before” in the retrieval process.

#### 3.3 Semantic Retrieval Quantity and Valence

To measure participants’ semantic retrieval quantity in the different affective states, repeated measures with mood and valence of words as independent variables, and the number of participants’ retrieved words as dependent variables were conducted. The analysis found no meaningful interaction between mood condition and semantic retrieval quantity ( $p = 0.41$ ). In average, happy participants retrieved 9.95 words (Positive=3.35 ± 1.63,

Negative=3.10 ± 1.48, Neutral=3.50 ± 1.19), and sad ones retrieved 10.75 words (Positive=3.75 ± 1.25, Negative=3.60 ± 1.73, Neutral=3.40 ± 1.47). Then, the valence percentage of retrieved words in different affective states was submitted to a 2 x 3 repeated measures with mood condition and valence of words as the independent variables, and the valence percentage of retrieved words as the dependent variable. The valence percentage of retrieved words means the respective percentage of positively, negatively, or neutrally valenced words that participants retrieved in a happy or sad mood. Results indicated no significant effect of mood conditions on the valence propensity of retrieved words ( $p = 0.76$ , happy participants: Positive=33.06% ± 11.33%, Negative=30.25% ± 10.63%, Neutral=36.69% ± 13.18%; sad participants: Positive=34.95% ± 9.23%, Negative=33.35% ± 12.52%, Neutral=31.70% ± 13.06%).

#### 3.4. Semantic Retrieval Efficiency

When dealing with the relationship between mood condition and semantic retrieval efficiency, namely, participants’ reaction time and accuracy rate, a series of follow-up repeated measures were conducted. The reaction time and accuracy rate were measured in line with participants’ answers to the given question “have you seen the word before.” In the first repeated measures, the independent variables were mood and valence of words, and the dependent variable was participants’ reaction time. No overall effect of mood ( $p = 0.54$ ) or valence of words ( $p = 0.09$ ) and no mood x valence of words interaction ( $p = 0.74$ ) were found. This suggests that the mood and valence of words are unlikely to influence the reaction time of retrieval. Follow-up repeated measures were carried out with mood and accuracy as independent variables, and the dependent variable of participants’ reaction time. This analysis suggested the significant effect of retrieval accuracy rate on participants’ reaction time,  $F(1,19) = 15.21, p < 0.001, \text{partial } \eta^2 = 0.45$ . As shown in Figure 2, participants’ true responses accompany less reaction time and vice versa. The main effect of mood ( $p = 0.56$ ) or the mood x accuracy ( $p = 0.77$ ) was not significant.

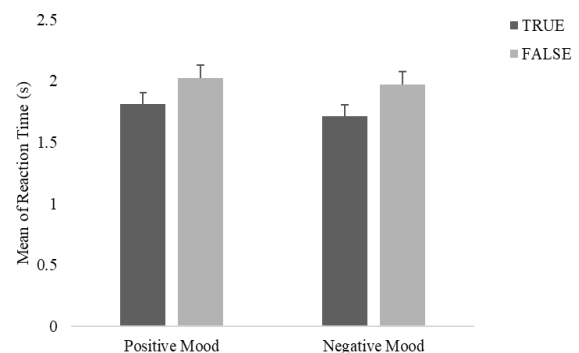


Figure 2 Mean of reaction time with true or false responses in different mood conditions.

#### 4. DISCUSSION

The purpose of this study was to explore the effects of mood conditions and valence of words on L2 vocabulary memory retrieval. It was hypothesized that different mood conditions would significantly influence the quantity, valence, and efficiency of L2 vocabulary memory retrieval. The results partially supported the hypothesis. Mood conditions did not affect participants' quantity of retrieved words. In terms of the valence propensity of retrieved L2 words, participants in different mood conditions did not show their word valence propensity in the retrieval process. Regarding the efficiency of L2 word retrieval, there not existed significantly statistical differences in the interaction between mood conditions and participants' reaction time to retrieve positively, negatively, or neutrally valenced words. However, participants' reaction time for accurate retrieval was significantly less than those for inaccurate retrieval.

One unanticipated finding was the significant interaction between retrieval accuracy rate and reaction time. On average, the accuracy rate of participants' word retrieval was higher in less reaction time and those with more reaction time turned out to be less accurate performance. It seemed contrary to the Speed-Accuracy Trade-off (SAT), which claimed higher accuracy attached to a slower speed and vice versa. Previous scholars have also demonstrated the violation of the SAT [10]. Salinas stated that isolating the perception from motor planning under extreme time pressure demonstrated the independence of accuracy from decision time [11]. Zhang and Rowe also justified accuracy rate reached higher in faster speed while learning process [12]. Presumably, the result is attributed to participants' confidence in the retrieval process. Specifically, when participants were not entirely confident and hesitated whether they had seen the words on the screen, this would substantially delay their reaction time. With more reaction time, their answers were more likely to be wrong due to their failure of retrieval and lower confidence. In contrast, participants tended to give faster and more accurate responses if they succeeded in retrieving and recognizing the words with higher confidence in their answers.

It is somewhat surprising that no significant interaction was noted between induced mood and accuracy rates of L2 semantic memory retrieval. All valence of words accompanied by similar L2 retrieval accuracy rates in negative or positive mood conditions. This finding is partially contrary to the *affect-as-information hypothesis* [13], which suggests that positive mood conditions result in a higher rate of false memories [14,15], while the adverse effects enhance memory accuracy [16]. One possibility to account for the results might be the limited effects of mood induction. Although the mood induction is statistically significant, the effect

of mood induction turns out to be lower than expected (as seen in the Results sections), especially the effects of positive mood induction. Since the hypotheses were formed based on the effects of different mood conditions, the limited effectiveness of mood induction is likely to influence the experiment results.

Another possibility is the experiment environment. Previous studies on memory retrieval were almost carried out in the laboratory, while the current experiment was conducted in the office, a natural and real setting free of other distractors. The purpose of this was to avoid interference with the mood in the laboratory environment. Participants might unconsciously become nervous and uneasy in the laboratory, which might cause quite difficulties for positive mood induction. Notwithstanding, there might exist interfering factors in the natural experiment setting that influenced participants' performance. For example, they were likely to have paid much attention to other cognitive tasks like reading while waiting before the experiment. Then, the accuracy rate of their word retrieval could be affected.

The findings failed to provide evidence for the effects of moods on L2 vocabulary memory retrieval, which might demonstrate the significant differences in the L1 and L2 memory retrieval process. Further, the differences might not be susceptible to the effects of mood conditions. So far, scholars still hold controversial opinions about the differences in L1 and L2 processing. Clahsen and Felse proposed the *shallow structure hypothesis* to elaborate on the differences in the parsing process in the L1 and L2 [17,18]. If the hypothesis could apply to the word processing in L2, the findings of this study would support the essential differences between L1 and L2 cognitive processing. Furthermore, individual differences in working memory also play an important role in elaborating on the distinctions in L1 and L2 processing [19-22]. Recent research focuses on the computational mechanisms underlying cognitive processes [23-26]. Individual differences accounted for the differences in memory retrieval [27,28]. In other words, differences in memory retrieval lead to differences in L1 and L2 processing. The current results provided evidence for the differences in L1 and L2 semantic memory retrieval, which further contributed to the differences in L1 and L2 processing.

The research is not free of limitations. This study aimed to investigate the effects of mood conditions on L2 vocabulary memory retrieval. In the experiment design, mood induction was arranged before the encoding and retrieval process of the words, which means that it was hard to distinguish the effects of mood conditions on the encoding and the retrieval process of semantic information. Furthermore, all words shown to the participants attach with high frequency to ensure that they have learned these words before. In other words, these words have been early encoded in participants'

semantic memory. The participants were likely to have learned these words in different mood conditions. Given that, their different affective states during encoding may influence the effects of induced mood on retrieval during the experiment. Another limitation to be mentioned is the sample in this study which is limited and exists an imbalance between male and female participants.

For further study, more participants can be invited among English learners of different levels. To investigate and distinguish the effects of mood conditions on the encoding and retrieval process of semantic memory, future research could pay particular attention to the control of mood conditions during the encoding process. Additionally, scholars could design a contrast experiment to highlight the differences between L1 and L2 semantic memory retrieval. For example, a series of words could be shown to participants respectively in their native and non-native languages. The vast majority of studies have been conducted on the interaction between mood and memory retrieval, while yet little attention has been paid to the major differences between L1 and L2 memory retrieval. This study might contribute to a better understanding of the differences in L1 and L2 cognitive processing.

## 5. CONCLUSIONS

This research focused on the effects of affective state and valence of words on L2 vocabulary memory retrieval. The findings revealed that neither the mood conditions and accuracy rate nor the mood conditions and valence propensity of L2 vocabulary memory retrieval were significant. Additionally, although the mood did not affect the reaction time of L2 vocabulary memory retrieval, it was noticed that there existed significant interaction between accuracy rates and reaction time of L2 vocabulary memory retrieval. Taken together, these results provided evidence for the differences between L1 and L2 cognitive processing. The present study will serve as a base for future empirical studies on the comparison of L1 and L2 vocabulary memory retrieval.

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