The Comparison of the Accuracy of Short-Term Verbal Memory Between Positive and Neutral Emotion by Using T-test

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ABSTRACT. In this highly information‐based society, good memory can largely prevent people from forgetting important information. But many people have different levels of memory of different events. Previous studies have shown that human memory is not constant, but will change with the change of mood. However, at present, it is impossible to determine which emotion people can have the best short-term verbal memory. In order to get the answer to the puzzle, an online test was conducted focused on high school students or teenagers. Firstly, analyzed the direction of gentle and positive emotions, then selected the English vocabulary as the experimental standard, awakened the emotion with pictures, and analyzed the accuracy of the subjects' memory of words under different emotions. By using t‐test, the obvious trend of data is obtained and compared. Finally, it is concluded that people have better short-term verbal emory under neutral motion.

Keywords: shorterm verbal memory, efficient, positive emotions, neutral emotions

1 Introduction

Even though there are many high-tech products in today's society that can replace people to remember many cumbersome things, in real life, whether students, professors or businessmen still need to remember the contents of many words in the most primitive way. Having a good short-term memory of words is of great help in understanding and catch up with the content of various conversations in speeches and meetings. This can reduce the time for people to create various reminders or notes, and make the between people more efficient.

But the problem is that memory is difficult to quantify. The classification of different memories and the differences in different situations will also be different due to different groups or individuals. As a result, people cannot put forward policy solutions on how to improve memory.

According to the previous researches [1], first of all, memory can be divided into different types. This may be because different brain regions have different functions.

For example, the hippocampus can enhance long-term memory. Our focused short-term memory, which without many rounds of enhancements of stimulus generally lasts only 15-30 seconds, and some may last 10 minutes.[1] Interestingly, it seems that our memory is closely related   to our emotions in addition to different brain regions. Previous studies have often compared the level of memory by comparing positive and negative emotions. The shortage is that people can't always be in these two emotions in reality. On the basis of its research results, we explored the grey area between the two extremes, neutral emotion and short-term semantic memory.

We invited ten international high school students from Shanghai and Guangdong, to wake up their emotions by showing them pictures of neutral and positive emotions through online Power points in "Tencent Meeting" , and then gave them one and a half minutes to memorize 30 common English words, and then asked them to check the words they thought appeared on the next page mixed with interference items, Thus, we can get   the significant difference in the accuracy of word memory under the two emotions.

2   Goal and hypothesis

The goal of this experiment is to help teenagers find the most suitable and effective memory state and emotion, and make more effective use of the saved time. So, is brain activity caused by weak emotional changes affect memory coding?

Base on the research by McLeod, S. A. [3], simply can conclude that negative emotions can reduce the efficiency of coding informations that presented to them. Meanwhile the opposite condition, the positive seems performed better in memorizing. And also, short - term memory usually lasts over 15-30 seconds. In this experiment, we want to use a similar measure by presenting pictures and then showing them vocabularies than required them to recall these words by circle them from word list with mixed new words. For independent variables, we have to ensure the gender are evenly distributed within our participants. And the time of arousal of memory and the pictures used to evoke emotions are the same. Then the dependent variable, which the memory recall of vocabulary. Then we could start to test out whether the presentation of positive emotional images could enhances short-term verbal memory.

This requires at least 10 participants aged 15- 18. Participants were recruited from classmates at Banz in Shanghai and asked to report their age and gender.

3   Method

Each participant completed a short-term verbal memory task using zoom where they were instructed to learn a set of 30 words for a total of 90 seconds. Before the words are   presented, six images are shown (for 2 sec each) that are either positive or neutral.[2] The order of positive and neutral conditions are counterbalance across participants. The memory test is given immediately after the words are presented during which 45 words (15 new, 30 old) are shown on a screen for 1 minute. [3]、 [4]、 [5]They are asked to circle the "OLD" words that were previously presented. After a 15-minute

break they then complete the other condition (positive or neutral) using the same task design. Words outside of the basic education syllabus were chosen to try to ensure that no participant had learned these words at school, making them unfamiliar to all of participants.
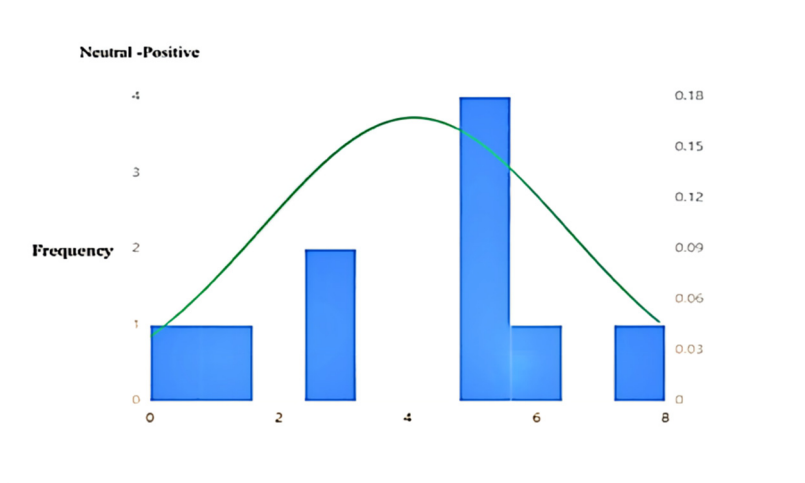
4   Data analysis

Fig. 1. T-table and Histogram of normality test

The Table 1 shows the results of the normality test for the difference data of quantitative variables neutral and positive. If the normality chart basically shows a bell shape (high in the middle and low at both ends), it indicates that the data is not absolutely normal, but it is basically acceptable to have a normal distribution.

Table 1. Paired difference normality test results

Group name	NO.	Mean	StDve	Skew	bk	S-W test	K-S test
Neutral	10	24.3	5.012	-0.367	-1.891	-------	-------
Positive	10	20.2	4.264	-0.431	-0.96	-------	-------
Neutral $_{Paired}$ Positive	10	4.1	2.378	-0.333	-0.076	0.938(0.528)	0.247(0.497)

analysis item: neutral paired positive sample n $<$ 5000, using s-w test, the significance p value is 0.528, which is not significant at the level, and the original hypothesis cannot be rejected. therefore, the data meet the normal distribution, the absolute value of kurtosis (-0.076) is less than 10, and the absolute value of skewness (-0.333)
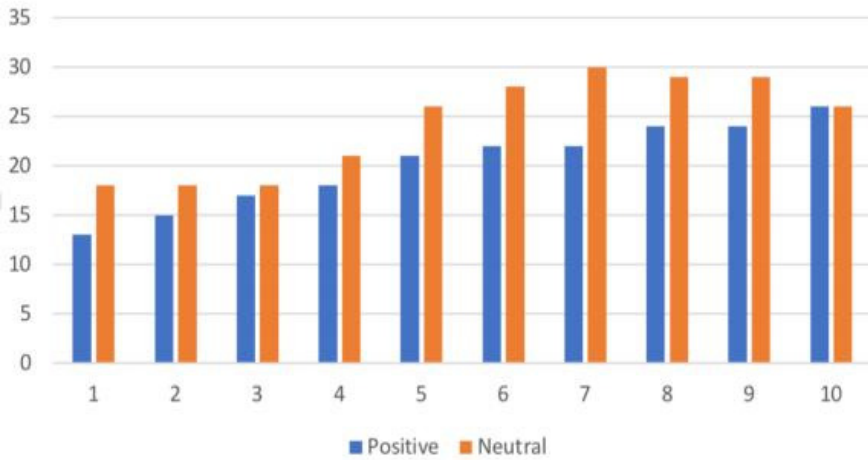
5   Results

Fig. 2. histogram of accuracy of each trial

Form the 10 participants, whose age were ranged from 15- 17, we've got their accuracy of recite the words by circle them on a screenshot of the page with distractions (other 15 words). Their gender was evenly distributed, half were males and half were females, even if their gender were seemingly not significantly decisive to affect the trend we obtained. Since all the words chosen is not too complicated, and everyone has the same level of education, the results are barely affected by these factors.

The lowest score of score of positive (13) was belongs to a female student, she also performed the worst on the score under neutral emotion which was 18, which was the least score of neutral. However, form this histogram we can tell that the minimum score of positive is lower than the score of neutral.

A male participant contributed maximum score of neutral which is 30 corrected over 30 words presented. For this participant, his score achieved on positive 22 is the third highest (except one repeated of the second highest) which is not bad either. Nevertheless, this people may be born with good memory, his personal score form both emotions still can prove the accuracy of verbal memory when coded under neutral emotions are better than positive's.

Since either the value form two extreme suggested the coding of verbal memorynperformed better during neutral emotion, we than need to prove that result by taking statistics calculation. We used t-test in order to compare the significant difference in the accuracy of the coding of short-term verbal memory between the two groups of emotions from each sample.

The t-test results of paired samples show that based on the field neutral paired positive, the significance p value is significant at the level of 0.00*, rejecting the original hypothesis. Therefore, there is a significant difference between the words Neutral paired positive. The difference range Cohen'sd value is 1.724, and the difference range

is very large. This can lead to our conclusion that Neutral emotions, rather than positive ones, can enhance short-term memory.

6   Conclusion

Throughout the diagram and data, since the result of T-test has been proven there is a significant difference between the coding under positive and neutral emotions, and the comparison of mean value, we can conclude that short-term verbal memory processing is better if individual is in a neutral mood than positive one for teenagers. What's more, this was not affecting by individuals' personal ability of remembering words, because each score from neutral emotions is higher than the score achieved from positive emotions from the same participant. Simultaneously, gender is not making hidden physical factors to disturb this trend as everyone has lower score in their memory coding of positive emotions, even though there was one participant (male) got the exactly same score (26)   from both moods.

6.1   LIMITATIONS

The arousal of level of moods might not be ideally as predicted. From conversations with participants after doing experiment, many of them doubted that why they need looking to random pictures before memorizing words since not many purposes of the experiment was informed to them before our test started. However, even if explanation been made to them, they still reported they weren't feeling much emotions been aroused by these pictures. And the lack of professional equipment to detect whether the level and areas of activity of participants restricted our result to be imperfect.

Besides, the delay of network may cause the time of emotions arousal and memory coding varies to a certain extent. Since the whole process was conducted by using zoom meeting, the network or signals at deferent area may cause the time of showing pictures to be delayed. Whatever the emotion, the longer the time to code for a piece of memory, the better a individual can remember.

Last but not least, although all the volunteers have been told do not ever cheat, there remains a probability that they may somehow in someways to look the previous slide of words when circling them from disturbances since this process was conducted online. This can greatly influence our result if anyone of them cheated on one condition but not in the other especially on neutral.

6.2   FUTURE DIRECTION

In this experiment, we only compared two aspects of emotion with short-term memory under a relatively general framework. In the process of future experiments, we hope to have more professional instruments, such as MRI, to observe the brain activity of the sample offline, so as to ensure that the emotional arousal is successful. With offline observation, we can clearly know whether the volunteers cheated during the experiment.

Furthermore, we hope to test more kinds of emotions, such as more negative ones, like disgust. And also add in more compare for different kinds of memory for instance long- term memory, so as to draw a more complete theory of how emotion can effect on memories.

Finally, this experiment only focused on the encoding of emotion for short-term verbal memory, but ignored the gender group differences. In this overall experiment, there is no strong evidence to prove whether one gender is better than the other in encoding short- term verbal memory. However, due to different physiological structures, there may be   some differences between men and women, which may also be the focus of future research.

7   Reference

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