

Exploring the Influence of Anxiety and Motivation on Memory

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Abstract. This paper explores the effects of anxiety and motivation on memory, in which anxiety is an emotional state. According to various studies, anxiety can both hinder and promote memory operation. Motivation is the internal driving force for individuals to pursue goals. Relevant experiments have found that the motivation level is positively correlated with memory performance, that is, motivation has a positive impact on memory. In addition, both anxiety and motivation have interactive effects on memory. From the perspective of underlying mechanism and biology, the main finding is that the influence of anxiety on memory is closely related to the hippocampus, and a functional circuit formed by the NAcc and SN/VTA complex and the hippocampus is related with the effect of motivation on memory. Anxiety and motivation are also influenced by psychosocial factors, which are also linked to memory. These results suggest that anxiety and motivation are important factors affecting memory.

Keywords: Anxiety, Motivation, Memory

1. Introduction

The process of human learning is intricately intertwined with memory, which serves as a vast repository capable of storing copious amounts of information, including memorization, retention, recall and recognition. The goal of studying the effects of anxiety and motivation on memory is to better understand the mechanisms of learning and memory, find effective strategies to manage anxiety, improve motivation, and optimize memory outcomes. In addition, anxiety and memory problems are often associated with learning disabilities and mental health problems, which can better help people identify and solve related problems and help educators design more effective teaching strategies. This paper discusses how anxiety and motivation affect memory, verifies the effects of anxiety and motivation on memory through experiments conducted in various studies, introduces the underlying mechanism and biological basis, and analyzes related neuropsychological theories and studies. The question of how anxiety motivation is regulated by psychosocial factors and how these factors interact with memory is also studied.

2. The Influence of Anxiety and Motivation on Memory

According to relevant studies, anxiety symptoms have a double-sided effect on memory. Previous research has interfered with the memory operation of the elderly by the anxiety induced by the experimental situation, and confirmed that anxiety can lead to individual differences in the memory of the elderly. At the same time, they found that anxiety has no effect on young people, and even has a promotion effect on the conditioned memory of young people. According to the classic Yerkes-Dodson law, high anxiety levels promote easier tasks, while anxiety levels appropriate for more difficult tasks are relatively low. It can be seen that anxiety can both hinder and promote memory manipulation. This experiment enriches the research on memory aging, promotes the further understanding of source memory, and broadens the field of studying the influence of anxiety on memory.

2.1. The Positive Impact of Anxiety on Memory

During the interrogation of criminal suspects in China, domestic academic circles have paid attention to their anxiety. Some people believe that most criminal suspects who enter the detention environment for the first time will show physical and mental discomfort, which were mainly

manifested by anxiety and fear. Appropriate tension and anxiety can promote the suspect to think and solve his cognitive problems actively. Hence, anxiety has a positive effect on memory. The discussion of anxiety in this study provides a new way to achieve the goal of interrogation, which is the enrichment and extension of the psychological direction of interrogation methods under the current judicial environment.

2.2. The Negative Impact of Anxiety on Memory

From the perspective of memory imagery, Pile and Lau's study found that depressive symptoms and anxiety symptoms were related to the enhancement of vividness of negative memory imagery [1]. A study conducted by Moran revealed a consistent correlation between self-reported anxiety levels and decreased performance in working memory tasks. Additionally, both self-reported and experimentally induced anxiety were found to be linked with subpar performance across various tasks. Previous research has demonstrated that stress and anxiety can negatively impact both working memory and long-term memory [2-3]. From the perspective of memory bias, others used a combination of different induction methods conducted experiments using music to induce state anxiety and verbal estimation tasks to measure retrospective time interval judgment, and investigated the differences in retrospective time interval judgment after high and low state anxiety induction. At the same time, the free recall task was added to measure memory bias, and the mediating role of state anxiety in the influence of retrospective time span judgment on memory bias was investigated. The results showed that the memory bias of high state anxiety group was more negative than that of low state anxiety group. The findings of this investigation unveils the attributes of time interval assessment and memory partiality in individuals experiencing state anxiety, which are commonly observed in everyday situations. Future studies can broaden the research ideas and test the moderated mediation model found above from the perspective of different anxiety samples. To sum up, it can be seen that anxiety has some negative effects on memory.

2.3. The Positive Impact of Motivation on Memory

Based on pertinent research, memory is positively influenced by motivation. For example, previous study found that the lifelong development of prospective memory, selecting children, adults and the elderly as subjects, and found that age, importance of task and motivation all had an impact on prospective memory. In a study, the research center requested participants to send postcards back at a specified time (8 weeks later) in exchange for payment. The findings indicated that almost half of the individuals in the high-motion group adhered to the deadline and demonstrated better prospective memory performance compared to those in the low-motion group. In another study, the participants were allocated into a reward group and a punishment group. The reward group was told that the subjects did not get any reward before the experiment, but they could get 1 yuan reward for correctly completing an irregular prospective memory task. There were 20 tasks in total, and the maximum reward was 20 yuan. The punishment group gave 20 yuan in advance as a reward, but if they forgot or miscompleted an irregular prospective memory task, 1 yuan was deducted. The findings indicated that the performance of irregular prospective memory could be significantly enhanced by both punitive measures and incentives. And the motivational promotion effect would spread to the non-directly enhanced prospective memory task. The experiment showed that the motivational boost was not limited to the non-regularity. Prospective memory, also reflected in temporal confirmation tasks, demonstrates the importance of motivational arousal and enhancement of prospective memory tasks that are directly related to experimental performance.

Some studies have found that individual traits may change memory performance by influencing the motivational role of reward [4], a study aimed to investigate the differential impact of reward prediction error (RPE) on item and associative memory, as well as its underlying metamnesia mechanism. They specifically manipulated the titer and prominence of RPE in their experiments. The finding showed that compared with those who were less motivated by reward motivation, those who were more motivated by reward motivation had higher associative memory performance when faced

with RPE positive titer. Others used the irrelevant choice paradigm to investigate the memory of a given picture in healthy people under the conditions of choice and non-choice and examined the level of intrinsic motivation in healthy people by taking the accuracy rate and reaction time of remembering pictures as indicators. The results showed that the improvement of intrinsic motivation under the conditions of choice significantly improved the memory performance of healthy people. To sum up, motivation has a positive impact on memory.

2.4. The Interactive Effect of Anxiety and Motivation on Memory

Similar to how Eysenck's processing efficiency theory predicts, worry will first use up some cognitive resources, which will reduce the amount of resources available for memory-related activities [5]. At the same time, worry may also increase drive to succeed so that extra cognitive resources may be actively utilized to counteract any potential negative consequences. Elder persons often have less cognitive resources available to make up for the negative consequences of anxiety since cognitive resources tend to deteriorate with age. For young individuals, the cognitive resources that worry uses up are either not a danger to the total at all or the resources that are still available to them are quite plentiful. It is sufficient to offset the detrimental consequences of worry, and even more than those detrimental effects, to promote memory operation. Future research can expand the idea, transform the influencing factors, and conduct further experiments on the role of motivation in the influence of anxiety on memory.

2.5. Potential Mechanism and Biological Basis

2.5.1. Mechanism of the Effect of Anxiety on Memory

The impact of stress on memory can be attributed to its influence on hippocampal function which serves as a potential mechanism for consolidating working memory [6]. According to research reports, the pathogenesis of anxiety depression primarily involves dysregulation of the hypothalamic-pituitary-adrenal axis, injury to the limbic system, and other contributing factors. Subsequent cascading reactions ultimately lead to hippocampal damage. Stress often improves overall memory performance when it occurs during the initial stages of long-term memory consolidation [7]. When stress occurs subsequent to the initial consolidation of long-term memory but prior to retrieval, diminished activity in the medial temporal lobe and hippocampus hampers memory performance [8].

2.5.2. Mechanisms of the Effect of Motivation on Memory

Because the NAcc and SN/VTA complexes create a functional circuit with the hippocampus, research on the link between external motivation and memory shows that the motivated state itself can increase learning and memory. Researchers have seen higher activity of both NAcc and SN/VTA as well as the hippocampus in the presence of signals that anticipate high rewards (external incentives including money), as well as improved memory for associated events. Not only did the SN/VTA and hippocampal functional connections increase under high reward circumstances during the memory coding phase, but it also happened during the consolidation of memories following learning. Extrinsic motives such as rewards and penalties [9-10], from a physiological standpoint, Reward Anticipation Bias (RPE) has been shown to either enhance or reduce dopamine production in the ventral tegmental region depending on the titer. Transient memory traces may become more temporally persistent once this dopamine is added to the hippocampus. As a result, before or during encoding, associative memory is promoted. Associative memory performs worse at this moment when RPE has a negative titer because there is less input of resources. It is proved that the intrinsic motivation of individuals making choices can induce the anticipatory activation of striatum, and the striatum enhances the memory under selection conditions through its interaction with the hippocampus, and the memory will be better under the condition of intrinsic motivation.

2.6. The Influence of Psychosocial Factors

Anxiety and motivation are also influenced by psychosocial factors, which are also linked to memory. For example, gender factors have different effects on anxiety. Girls have a higher anxiety level than men, which may be due to the greater physiological burden on women and the higher probability of anxiety during their menstrual period. Girls have more delicate and rich emotions, so they are more likely to be upset and anxious when they encounter some problems. The literature suggests that chronic stress experienced during adolescence may have detrimental effects on learning ability and neuroplasticity in adult females. Conversely, maternal immune activation appears to impair cognitive function exclusively in adult males. It is currently acknowledged that sex differences do exist in certain memory tasks, particularly those involving spatial abilities and multiple approaches, females and females prefer landmark cues, while males and males prefer spatial cues. It also turns out that across species, males on average show significantly better memory on spatial tasks than females. In addition, social approval, as a motivational factor in personality, plays a role in an individual's emotional, cognitive and behavioral tendencies. Subjects are susceptible to the effect of social approval, which leads to the inadequacy of research methods on memory bias [11]. In summary, relevant psychosocial factors will directly or indirectly affect memory by influencing anxiety or motivation. The impact of these social factors on memory and the influence of gender differences on memory cannot be disregarded if we aim to enhance our understanding of the role played by social factors in shaping one's own memory.

3. Summary

To sum up, anxiety can both hinder and promote memory operation. According to the results of various studies, anxiety has been proven to damage memory. The higher the level of anxiety, the poorer the memory performance, the more vivid the negative memory performance and the more negative memory bias. The modulation of hippocampal activity can effectively regulate anxiety. In addition, anxiety may have a positive effect on memory, with moderate levels of anxiety motivating people to think positively and solve cognitive problems, and high levels of anxiety promoting easier tasks. On the other hand, motivation is the internal driving force for individuals to pursue goals, and the level of motivation is positively correlated with memory performance, that is, motivation has a positive impact on memory. According to various studies, motivation has been found that it can enhance the performance of irregular prospective memory. Additionally, it has been observed that improving intrinsic motivation under specific conditions can lead to a substantial enhancement in the memory performance of individuals with normal cognitive functioning. When stimulated by motivation, the NAcc, SN/VTA complex and hippocampus are activated and enhanced, and the memory of related events is also enhanced. Further analysis showed that anxiety and motivation have an interaction on memory, that is, anxiety may stimulate the motivation to avoid failure, so as to use additional cognitive resources to actively compensate for the possible adverse effects. In addition, anxiety and motivation can be influenced by psychosocial factors, such as higher levels of anxiety in women than in men and differences in memory tasks. The social approval effect also leads to the deficiency of memory bias research methods. These results suggest that anxiety and motivation are important factors affecting memory. At present, there are still many differences and shortcomings in the research of prospective memory in cognitive psychology, and the internal mechanism of many of them is not very clear and needs further research. In order to better serve People's Daily life, so that people will not easily forget the planned things, improve the quality of personal life. At the same time, it is necessary to explore the coding process, timing and context of internal reward and external reward in the follow-up research, so as to ensure that the learning process is a self-driven and self-growing process.

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