

The Theoretical Explanations of Cognitive Failures in Daily Life

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Abstract: People in daily life often show some behavior errors. For example, you are in the familiar street on the wrong direction, these phenomena that cognitive-based mistakes on simple tasks that a person normally should be capable of completing without error are known as cognitive failures. We summarize the four main theoretical explanations about cognitive failure: perceptual load theory, executive-attention theory, overload theory and complaint hypothesis. The purpose of this study is to provide some inspirations and references for the follow-up study.

1. Introduction

In daily life, we often have experiences like this: just leaving home, suddenly realizing that we have forgotten whether to close the door; I racked my brains in the supermarket but couldn't find what I wanted to buy, and those things were right in front of me. Norman refers to the phenomenon of action slips, which can be easily completed in daily life but cannot be successfully achieved due to certain factors, and divides them into three categories: errors in the formation of the intention, which is a descriptive error in the intended task. For example, because a friend's instructions are unclear, you sprinkle salt from the same packaging box into coffee as sugar; Faulty activation of schemas, including errors in capturing relevant information, fading intentions, and chaotic behavior, such as suddenly realizing that you have arrived in a certain room and forgetting what you are doing; Fault triggering, where the processing of behavior sequences is forced to be interrupted due to interference and intrusion. For example, when you originally wanted a waiter to have another cup of tea, suddenly received a phone call, and after the call ended, you went to do other things. Broadbent et al. further expanded the psychological scope of this type of behavioral negligence and formally proposed the concept of "cognitive failures", which refers to the phenomenon of individuals making mistakes when completing simple tasks that they are capable of in daily life based on cognitive factors. It encompasses all types of perceptual, memory, and behavioral failures, and its main feature is that the normal flow of individual cognitive function experiences are disrupted, leading to events not continuing as intended.[1]

Cognitive failure may seem common, but its negative impact on individual physical, mental, and

behavioral development cannot be ignored. Research has gradually shown that cognitive failure is prone to forming many negative psychological characteristics, such as increased susceptibility to stress [3] and decreased self-evaluation [4]. At the same time, cognitive failure may also reduce individual learning and work efficiency, leading to negative behavioral consequences [5] [6].

At present, the measurement of cognitive failure mainly includes subjective assessment and cognitive experiments. The widely used subjective assessment methods include the Cognitive Failures Questionnaire (CFQ) [2], Spouse ratings Diary method and Experience sampling method (ESM) [7] (i.e. requiring participants to carry electronic calling devices or self-reporting manuals with them, record their current behavior and thoughts while receiving electronic signals, and report the situational characteristics of the experience). At the same time, cognitive experiments such as GO NOGO tasks, anti-saccade, and psychomotor vigilance tasks are often used for the study of cognitive failure. From existing research, there is a high degree of consistency between subjective assessment and cognitive failure in cognitive experiments. However, so far, there is not sufficient evidence to suggest a clear substitutability relationship between the subjective assessment of cognitive failure and a specific cognitive experimental method. Therefore, the measurement of cognitive failure mostly adopts a combination of subjective assessment and laboratory tasks to compensate for the bias of a single method.

With the deepening of research, researchers have gradually focused on the generation mechanism of cognitive failure and proposed some theoretical explanations and hypotheses, including more representative ones: perceptual load theory [8] [9], executive attention theory, overload theory [10], and complaint hypothesis [11].

2. Theoretical explanation

2.1. Perceived load theory

The perceptual load theory suggests that the level of perceptual load in current tasks determines the allocation of resources in selective attention processes. In other words, the degree to which attention resources are consumed by the current task determines how much processing can be obtained from irrelevant interference stimuli [8]. On this basis, Forster and Lavie further explain the occurrence of cognitive failure: when completing tasks with lower perceptual load, individuals only consume a portion of their attention resources in the processing process, and excess attention resources will automatically overflow to process irrelevant information, causing individuals to distract their attention from the current task related information, resulting in interference effects, and ultimately leading to cognitive failure. Individuals with high-level cognitive failure tend to exhibit more mental lapses of consciousness awareness during the behavioral response process, and are more susceptible to distracting stimuli. On the contrary, if the perceptual load of the current task is high and the processing of task related information depletes limited attention resources, then irrelevant interference stimuli cannot receive perceptual processing and will not produce interference effects, thus reducing the occurrence of cognitive failure.

Forster and Lavie found in their study that in response competition tasks, when the interfering words (H/M/K/Z/W) were similar to the target words (X/N) and arranged randomly (with high perceptual load), there was no significant difference in the performance of individuals with high and low levels of cognitive failure. Under experimental conditions (low perceptual load) where there is no similarity between interfering words (Os) and target words, and the position is fixed, individuals with high-level cognitive failure have significantly higher reaction time and error rate than those with low-level cognitive failure. That is to say, there are differences in the performance of cognitive failure under different task difficulty (perceptual load) conditions. The increase in current task difficulty can effectively reduce the interference effect, thereby reducing the possibility of cognitive failure.

2.2. Execution attention theory

The executive attention theory suggests that goal maintenance is extremely important for selecting the correct response when stimuli are related to competitive responses [12]. Kane et al. proposed based on the theory of executive attention that cognitive failure is a general failure of cognitive control, which is the result of whether attention resources can continue to think or act towards the target under the constraints of internal psychological events and external distractions. This result directly reflects the size of an individual's cognitive control ability, especially in complex environments, manifested as the maintenance and recovery of target related information.

Stawarczyk et al. used SART experiments and asked participants to complete thought probes during each group of experiments. They found that the laboratory performance was significantly better when participants were fully focused on the current task than when they were distracted or disturbed by external stimuli. Once an individual is faced with distractions or focus shifts, they are unable to maintain their acquisition of target information. That is to say, when their attention shifts from the current task to other external stimuli or internal thoughts, it may lead to cognitive failure [13]. On the contrary, if an individual is able to control and guide the attention resources required to execute the target task at the conscious level during this process, effectively suppress the interference of distracting stimuli, and focus their attention on information related to the task, then the target task can be successfully achieved according to their wishes. It can be seen that this theory can explain the phenomenon in daily life where the original intention cannot proceed smoothly due to sudden interruptions from others or sudden thoughts generated within an individual.

2.3. Overload theory

The overload theory is an integration of theories related to psychological fatigue and exhaustion of psychological resources, which holds that human psychological resources are limited and have both sides. On the one hand, it is available for consumption required by individual activities; On the other hand, it can be supplemented by resting and filling to ensure the recovery of consumption [10]. Maintaining vigilance towards target tasks requires attention and therefore relies on psychological resources. So, whether an individual has the ability to maintain focused attention to target related information depends on the amount of available psychological resources. When individuals complete tasks, psychological resources are consumed much faster than they are replenished. Once psychological resources are excessively consumed (or consumed in other activities), resulting in insufficient resources, individuals are unable to maintain focused attention to the target task and process relevant information, leading to cognitive failure in their actions. Head and Helton used an improved version of the SART experiment, followed by embedding oral free recall tasks, and found that after adding a second task, the performance of the subjects significantly deteriorated, indicating that the failure of sustained attention mainly came from limited psychological resources rather than simple task monotony. In addition, when an individual's psychological resources are insufficient, fatigue (stress response) is prone to occur. In a state of fatigue, the individual's emotions and motivation will weaken, thereby affecting normal behavioral performance and increasing the likelihood of cognitive failure [6]. The overload theory can serve as a supplement to the executive attention theory, taking into account the impact of psychological state on cognitive failure and providing a good explanation for the phenomenon of "the busier the more wrong" in daily life.

2.4. Complaint hypothesis

The complaint hypothesis is based on the personality trait level of cognitive failure, which suggests that self-awareness with neurotic tendencies may increase individuals' self-reported cognitive failure.

Because individuals with neurotic personalities are prone to functional disorders of self-awareness - poor self-intention or lack of confidence, exhibiting an inappropriate anxiety that is like complaining about objectively existing cognitive irrationality. This type of self-complaint can increase individuals' retrieval of memory related to cognitive failure, as negative self-correlation patterns enhance the activation of idiosyncratic failure fragments, which are to some extent unaffected by the absolute or relative frequency and intensity of this part of memory, leading to the preferred retrieval of that part of the individual's memory events, and deviating the level of cognitive failure reported by individuals [11]. Doorn et al. also believe that cognitive failure may be a negative core self-evaluation, a tendency for individuals to evaluate their values and functions in a negative way. Psychological characteristics associated with low self-intention, such as neuroticism and anxiety, can lead to higher cognitive failure [4].

3. Issues and prospects

The four theoretical hypotheses introduced above have explained the phenomenon of cognitive failure from various perspectives, but none of them can comprehensively and systematically explain it. The occurrence of cognitive failure is mainly based on cognitive factors, covering all types of perceptual, memory, and behavioral failures. On the other hand, cognitive failure is also seen as a negative core self-evaluation, which greatly overlaps with the self-evaluation structure in the Core Self evaluations questionnaire (CSE) that reflects individual general values and functions [4]. Moreover, the stability and high heritability of CFQ cross time tests have led many researchers to believe that cognitive failure is more inclined towards a personality trait [14]. However, the differences in individual cognitive failure under different task loads and stress environments seem to indicate that cognitive failure is not a trait but a state [3]. From this, it can be seen that the occurrence of cognitive failure is not only related to a single factor, but is caused by the joint action of a large number of factors. Some factors independently act on cognitive failure, while others indirectly affect cognitive failure through mediating or regulating variables. At the same time, there may also be interactions between various factors, which makes it difficult to accurately and clearly present the role played by each factor in the process of cognitive failure. Therefore, future research on the mechanism of cognitive failure should integrate multiple internal and external influencing factors, study the forms through which each factor acts on cognitive failure from a holistic perspective, and construct an intuitive and clear relationship model, in order to gradually develop more comprehensive theoretical hypotheses in subsequent research.

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