

The Physiological Basis of Creativity

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Abstract: Although creativity is a complex concept and our understanding of its physiological basis is not complete, existing studies have indeed revealed the association between brain structure and function and creativity. Some studies have shown that creativity may be related to the network communication and coordination of the brain. People with higher levels of creativity may show better cross-brain regional connectivity and information transmission. This advantage of cross-regional connectivity may promote the generation of innovative thinking and creativity. In addition, creativity is also related to the activity of some brain regions. For example, the activities of the prefrontal cortex and parietal lobe are considered to be related to creative thinking and innovation ability. Some studies have shown that the gray matter density and functional activity levels in these regions may be related to the level of creativity. In addition, neurotransmitters and neural regulatory systems may also play a role in the process of creativity.

Keywords: Creativity; Network; Prefrontal Cortex; Neurotransmitters

Introduction

Creativity is usually defined as the ability to produce novel and useful (or influential) ideas in a specific social environment. Researchers use AUT (alternative uses task) to measure individual creativity. Previous studies have shown that differences in individual performance in creative tasks are mainly caused by differences in personal traits and their physiological basis.

According to the different levels of behavior in real life, creativity is divided into daily creative activities and creative achievements. The former mainly refers to the individual 's creative behavior, also known as daily creativity or small c ; the latter mainly refers to the socially recognized achievements or big c. This paper will provide evidence from various studies to explore the reasons for the differences in individual creativity from the physiological basis.

Prefrontal cortex

The prefrontal cortex plays a vital role in creativity. The prefrontal cortex is the anterior region of the brain and is closely related to advanced cognitive function. Here are some important functions of the prefrontal cortex in the process of creativity :

Divergent thinking : The prefrontal cortex is involved in the divergent process of creative thinking. Divergent thinking refers to the way of thinking that emanates multiple ideas and concepts from one point. By providing flexibility and innovative thinking, the prefrontal cortex helps us generate diverse ideas in creative tasks.

Planning and executive control : The prefrontal cortex is involved in the planning, decision-making, and executive control processes in creative tasks. Creative tasks often require guiding and controlling related cognitive processes, such as selecting and organizing information, taking action, and adjusting strategies. The prefrontal cortex helps us make plans and actions in creative tasks and flexibly adapt to different needs and situations.

Innovative inspiration : The prefrontal cortex plays an important role in the generation of innovative inspiration. These inspirations may be derived from the interaction of the prefrontal cortex with other brain regions, generating new ideas and ways of thinking by integrating different thinking patterns and concepts. The prefrontal cortex plays a key role in guiding creative thinking and creativity generation.

Social and emotional regulation : The prefrontal cortex is also closely related to social and emotional regulation. Emotion is closely related to creativity, and positive emotional state contributes to the development of creative thinking. The prefrontal cortex is involved in the regulation of emotion and the cognitive process of social interaction, and promotes the performance of creativity by creating a positive emotional atmosphere and a cooperative environment.

Executive control network

Executive control network plays an important role in creativity. The executive control network consists of multiple brain regions,

including prefrontal cortex, parietal lobe and temporal lobe. The following are several key functions of the executive control network in creativity :

Flexibility and Cognitive Control : The executive control network helps us maintain flexibility and cognitive control in creative tasks. This includes selecting, maintaining and switching different thinking patterns and strategies to adapt to different creative task requirements. By executing the control network, we can inhibit impulsive thinking and focus on key aspects of the task.

Working memory and information integration : The executive control network helps maintain and operate working memory. Working memory is the ability to store and process information in a short time, which is essential for the integration of thinking processes and concepts in creative tasks. The implementation control network helps us connect different concepts and information to generate new ideas and innovative solutions.

Self-monitoring and evaluation : The executive control network helps us monitor and evaluate ourselves in creative tasks. This includes active monitoring of creative thinking and judging its effectiveness and applicability. Through the executive control network, we are able to feedback and adjust the results of creative thinking, thereby improving creativity and creative performance.

Inhibition and stimulation conflict management : The executive control network plays a key role in dealing with inhibition and stimulation conflicts in creative tasks. Creative thinking requires us to restrain the limitations of traditional and habitual thinking, and actively explore new thinking patterns and ideas. The implementation control network helps us maintain creative flexibility while resisting impulsive responses and dealing with conflicts.

Neurotransmitters

Neurotransmitters play an important role in creativity. Neurotransmitters are chemicals in the brain that transmit information. They transmit signals between neurons and regulate brain function and behavior. Here are the possible roles of several neurotransmitters in creativity:

Dopamine : Dopamine is an important neurotransmitter associated with the reward system and motivation. Studies have shown that moderate dopamine levels can promote creative thinking and stimulate innovation. It can improve attention and concentration, and increase interest in novel and innovative ideas.

Acetylcholine : Acetylcholine is a widely distributed neurotransmitter in the brain, which is related to attention, learning and memory. Acetylcholine can promote the flow and integration of information and provide the basis for flexibility and creative thinking.

Glutamate : Glutamate is an excitatory neurotransmitter involved in the process of synaptic transmission. It plays an important role in creative thinking and promotes information exchange and integration between different brain regions.

γ -aminobutyric acid (GABA) : GABA is an inhibitory neurotransmitter that helps to balance and regulate nerve excitability. Appropriate GABA levels can improve the integration of information in the brain, which is critical for creativity.

Hemispheric differences in the brain

Traditionally, the left hemisphere of the brain is considered to be related to logic, language and analytical ability, while the right hemisphere is considered to be more related to intuition, pictorial thinking and creative ability. The following are several key functions of the right hemisphere in creative thinking :

Non-verbal expression ability : Creative thinking often involves non-verbal information processing and expression. The right hemisphere is better at processing images, spatial information, and perceptual dimensions. It helps us to generate creative ideas and concepts through images, images and intuition.

Identifying patterns and associations : The right hemisphere has a stronger ability to identify and process patterns, associations and metaphors. This ability enables us to see the connections between things, discover new perspectives and ways of thinking, and thus promote creative thinking and creativity.

Intuition and Inspiration : The right hemisphere is concerned with the production and use of intuition. Intuition plays an important role in creative thinking. It can help us quickly obtain information, identify patterns, and generate new insights and creative solutions.

Creative problem solving : The right hemisphere plays a role in creative problem solving. It helps us to solve problems from different perspectives and introduce new ideas and methods. The creative thinking ability of the right hemisphere enables us to escape from the traditional thinking mode and produce innovative solutions.

Conclusion

Creativity is an extremely complex process, which is influenced by many factors. In addition to the physiological basis, such as the

structure and function of the brain, there are many other factors that also play an important role in creativity.

Environmental factors are one of the important factors affecting the development of creativity. An environment that stimulates creativity can provide creative stimulation, an atmosphere that supports free thinking, and opportunities to encourage experimentation. A good educational and cultural background can also foster creativity by providing support in terms of knowledge, skills and creative thinking.

Individual experience and learning also have a profound impact on creativity. By accumulating knowledge, engaging in creative activities and experiencing diverse experiences, individuals can improve the level of creativity. Experience can broaden the thinking and vision, stimulate the inspiration of creative thinking.

In addition, the individual's emotional state and psychological quality may also affect the performance of creativity. Positive emotional state and mental health contribute to creativity, while negative emotions and stress may have a negative impact on creative thinking.

Because creativity is such a complex concept, understanding its physiological basis is only a part of understanding creativity. A comprehensive understanding of creativity requires taking into account many aspects, including the interaction of biological, psychological, sociological and cultural factors. An in-depth study of how these factors influence each other will help to understand and promote the development of creativity more comprehensively.

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