

Cognitive Science Research on The Relationship Between Personality and Emotion

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Since Galen described temperament in terms of emotions in his theory, it has been recognized that there is a close relationship between personality and emotions. The relationship between personality and emotions has been recognized since Galen described temperament in his theory. ^[2] Early research on the relationship between personality and emotions was based on several simple biological models. Biological models assume that each person feels emotions differently, and the relationship between personality and emotions is based on simple biological models. Emotions, this difference is predetermined by each person's brain. However, some experimental studies and clinical practice have found that cognitive processes of emotion and distortions in thinking are related to personality. In recent years, many scholars have begun to explore the relationship between personality and emotion using cognitive science models and have made many interesting findings. These studies have been conducted in three main areas: cognitive neuroscience, connectionism, and interacting stress processes.

2. A Study of The Relationship Between Personality and Emotions in A Cognitive Science Framework

The cognitive science framework originated from the study of artificial intelligence, with the basic idea that both human and artificial systems can be explained at different levels of cognition, and that different phenomena require different levels of explanation. These levels include: 1, Neural level. For humans, the neural level refers to the neurons that determine the operation of the system. It is at this level that the consequences of brain damage can be studied. The neu-

ral level can help people understand the information processing process to some extent, but this level cannot fully describe the information processing function of people. 2, Cognitive-architectural level. The cognitive-architectural level describes the support of processing by programming language and real-time computing. In order to understand computer software, a language (e.g., C++) is required to interpret operations, information storage, and input and output. In the case of psychology, a cognitive structure is needed to describe the codes that represent information and the components of processing based on these codes, the rules of operation, and the control of information transfer between the components. 3, Knowledge level. The level of knowledge is related to the purpose of the system, its intent, and the design of the actual problem to be solved. In the case of human beings, the level of knowledge is interpreted in terms of the individual's goals and the internal guidelines to achieve them. Matthews (1997) applied the cognitive science framework to the study of the relationship between personality and emotion.^[4] He suggested that personality and emotion phenomena also require multiple levels of explanation, some of which can be explained by neural processing, some by information processing, and others by people's self-knowledge and motivation. He illustrated the multiple levels at which a personality trait affects an emotional state (negative emotion).

In addition, Matthews also established a model to connect the three levels. He attributed different levels of interpretation to a cycle, in which three bridges connected different levels of interpretation in pairs. The associationist model connects the neural level, and the cognitive building level, which can describe how the neural elements in the network encode stimulus values, and shows the support of the neural level structure for the cognitive building level; what connects the cognitive building level and the knowledge level is arithmetic and learning strategies, and personality and self-regulation models try to find out how individuals' subjective choices of coping strategies and evaluation strategies are transformed into algorithms; finally, evolutionary biology connects the level of knowledge, and the neural level, which states that the brain that has evolved through natural selection supports and limits human motivation. Figure 2 shows the structure of the model.

3, Three Active Areas of Cognitive Scientific Research on The Relationship Between Personality and Emotion

In recent years, the cognitive scientific research on the relationship between

personality and emotion have mainly focused on three fields: cognitive neuroscience, connectedness, and the interaction process of stress. Personality psychologists have studied the relationship between personality and emotion based on the new advances in research in these three cognitive fields.

3.1 Cognitive Neuroscience

Cognitive neuroscience refers to the use of neurological evidence to identify the components of cognitive architecture. It uses physiological and pathological methods such as brain imaging, research on brain-injured people, homework research, and spatial orientation to collect evidence, to identify and find the positioning of cognitive functions in the brain. The purpose of personality research is to determine individual differences in cognitive function, then control individual responses to emotional stimuli.

In recent years, personality psychologists have explored the relationship between personality and attention with reference to the new developments in attention research. People usually regard attention as an important overall processing, but the model recently proposed in neuroscience believes that attention comes from different nervous systems, which perform different operations. By connecting these multiple attention systems, a model that links emotions, personality, and cognition can be developed. For example, Posner (1994) put forward the point of view of pre- and post- attention system. Posner pointed out that the post-attention system is a relatively active network, which involves the pointing and transfer of attention. The pre-attention system is a more autonomous system, and its main function is to adjust the more passive post-attention system, so that individuals can deviate, divert, and concentrate their attention autonomously. In this way, the pre- and post- attention systems separate autonomous and involuntary systems.

Personality psychologists have studied the relationship between personality and the pre- and post- attention system. Matthews *et al.* (1997) used spatial pointing tasks to investigate the relationship between anxiety traits and the post-attention system. It was found that individuals with high anxiety, such as neurotic and introverted individuals, were more likely to pay attention to threatening signals, and it was more difficult to deviate from the threat point.

In addition, Derryberry and Reed (1998) used hierarchical image tasks to assess personality differences in attention span and found that people with high anxiety monitored local goals faster than people with low anxiety, and this

anxiety-related attention narrowing phenomenon only appeared in threatening situations. Fredrikson *et al.* used positron tomography (PET) to study the effects of anxiety on the anterior attention system. The study showed that disgusting scenes activate the left anterior banding cortex. Similarly, Rehman (1997) reviewed 6 PET studies and concluded that the banding cortex is involved in the formation of normal and pathological anxiety. Derryberry and Reed (1998) also compiled a scale to assess individual differences in autonomic attention control. This scale with a scale that measures anxiety traits and response-time tasks that point to specific functions of the anterior banding cortex were used to evaluate individual differences in autonomous attention control and add irrelevant information that interferes with the target in the experiment. It was found that good attention control enables some anxious subjects to be unaffected by irrelevant information.

3.2 Unionism

The associationist model connects many neuron-like units into a network, through which the interaction between emotions, cognition, and personality can be described. In the network, individual differences are regarded as variables in the parameters that control the function of the network. Therefore, personality psychologists use the network to simulate different interpretations of personality and use it to verify many research data.

First, the associationist model can characterize the processing of emotional and semantic information as the activation of different styles of nodes in the network when facing stimuli. For example, the associationist model is used to explain depression. Ingram (1984) sees depression as excessive feedback between nodes that characterize negative information and nodes that characterize negative emotions in an associative network. Ledoux (1996) also proposed that an associative model can be used to simulate the feedback system between the processing structure of negative emotions (amygdala) and the semantic processing structure (hippocampal gyrus) in the brain. However, none of their views can explain why some individuals whose semantic representations and emotional representations have been linked are depressed and some are not. Siegle and colleagues (1999) integrated some of the distinctive features of the first two models and constructed a neural network model for emotional processing.

Each small dot in Figure 3 represents a node. The large ellipse characterizes

a group of nodes that realize the conceptual function of the same meaning. The pointing of the arrow indicates that the former activates the latter, the dotted line indicates that the connection is suppressed only in certain cases, and the wide arrow indicates feedback. In this model, the degree of matching between network output and known information causes the network to form a specific output or a series of semantic or emotional characteristics, and personality and individual differences are also included in the network as fixed component variables. In this model, the non-emotional nodes are consistent with the processing of Ledoux's hippocampal gyrus system, while the emotional nodes are consistent with the processing of the amygdala system. The feedback in the meantime is consistent with Ledoux's view of feedback between related brain regions. Siegle pointed out that through this model, we can obtain information about the attention process of emotional stimuli and understand the role of the emotional and non-emotional components of the resulting information before and after the stimulus is recognized. In addition, by adjusting the network through external output, we can also investigate the influence of different individual encounters on the processing of emotional information.

Siegle and his colleagues also conducted many simulation experiments. In these experiments, they artificially manipulated the model characteristics corresponding to different aspects of personality to study the interrelationship between personality and emotions. For example, Siegle and others simulated the personality variable of reflection by increasing the feedback between emotional and semantic units in the model and explored the relationship between reflection and depression. They proved experimentally that the higher the level of reflection, the slower the recovery from depression. They explained that reflective people produce less cognitive activity when facing emotional information, but when they connect the input information to the personality system, they maintain this cognitive activity and increase the cognitive load.⁽⁷⁾ As can be seen from the above, cognitive models can help researchers better understand personality traits, especially variables such as reflection that are difficult to manipulate.

3.3 Interacting pressure processes

Many traditional schools of personality psychology only understand personality at the intellectual level. For example, Freud assumes personality as a description of unconscious motivation, and Rogers sees personality as a description

of the effort to reach agreement between the actual self and the ideal self. However, as they lack a clear form of cognition, they cannot be proved empirically. Recently, personality research has used the structure extracted from current cognitive theory to re-explore the research on the level of knowledge of personality. The research on the level of personality knowledge includes many aspects, such as the study of the operationalization of self-related traits, the study of the relationship between traits and the process of self-regulation, and the study of individual differences in personality's self-information processing, etc. Recent research on personality, emotions, and self-knowledge can be integrated into Lazarus' stress interaction model.

The interaction model of stress describes how an individual's emotions are generated when facing a demanding macro-and micro-environment. At the macro level, the model regards emotions as part of the dynamic interaction between people and situational factors. For example, a longitudinal study by Bolger and Schilling (1991) showed that since most neurotic people experience more anxiety and tension in life, neuroticism can predict the degree to which individuals will be exposed to negative sexual events and stress in the future. At the micro level, the model describes the cognitive processes that affect stress response and emotional evaluation and coping. Therefore, personality research can use this model to identify these evaluation and coping tendencies and individual differences. At present, micro-level research mainly focuses on the relationship between neuroticism and extroversion and coping style. Overall research shows that extroversion is related to strategies such as problem center, active thinking, and seeking social support, while neuroticism is related to emotional center strategies, avoidance, and hostility.

Matthews *et al.* (1999) also studied individual differences in stress response. They examined the predictive potential of neuroticism on stress response and found that the influence of neuroticism on stress response is partly regulated by coping and evaluation, which means that individual differences in self-regulation regulate the influence of personality on negative emotions and stress response. Similarly, the influence of extroversion on positive emotions is also regulated by cognitive factors such as self-efficacy and coping skills. It can be seen from the above that personality and cognitive stress processing are closely related. In order to integrate relevant research results, Matthews *et al.* (2000) proposed a self-regulation model of personality traits, which explains the

correlation between personality traits and cognition. They pointed out that the stability of traits shows that the representations of knowledge in different people's long-term memory are different, and the process of self-regulation can be described by combining knowledge representations and situational cues.

4, Summary

The above reviews some applications of cognitive science in the study of the relationship between personality and emotion in recent years, including three main research areas, cognitive neuroscience, connectionism, and interactive stress processes. From this, we can see the advantages of the cognitive science framework over many simple personality and emotion models. The cognitive science framework can not only distinguish between different levels of description, but also integrate different levels of description; the cognitive science framework also emphasizes computational models, linking the emotional characteristics of personality with individual differences in action and control response; the cognitive model also brings us closer to the modern phase (turn to page 449) (then page 452) interactionism. In addition, cognitive science integrates the autonomous and involuntary regulation of emotional responses, which allows us to surpass the biological model, because in the biological model, people always express emotions passively. Therefore, cognitive science has great application value in the study of the relationship between emotions and personality and even the entire field of personality. The research reviewed here is only a small part of its application. There are still many topics that need to be explored, such as the relationship between attention and anxiety and other personality traits and various cognitive processes, the relationship between more personality traits and emotions, etc. I believe that the application of cognitive science in personality research will show us a new and vast world.

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