

# The Neural Mechanism of Social Emotion: A Research Framework

Naijia Chen

Key Laboratory of Modern Teaching Technology of Ministry of Education, Shanxi Normal University,  
Shanxi Xi'an, China

c\_n\_j@163.com

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**Abstract.** Chinese reform has entered a critical period and a deep-water area. Social emotions caused by various factors may continue to emerge. Based on the perspective of society and individuals, a study on the neural mechanism of social emotions will not only help human beings to understand the neural mechanism of social emotions, the relationship between social emotions and brain activities, and the neurophysiology of social emotions, but also help to find new ways to ease social emotions. This paper proposes a framework for the study of the neural mechanism of social emotions from the aspects of the neural mechanism of social emotions of interpersonal interaction, the quantitative relationship between social emotions and brain activity, and the neurophysiological basis of social emotions, which can provide a reference for relevant researchers.

## 1. Introduction

At present, the social emotion of Chinese people is generally positive and healthy. The value system of socialism with Chinese characteristics is increasingly popular in the new era. Insisting on reform and opening-up has increasingly become the consensus of the people. Endeavour, rational tolerance and mature opening-up are gradually becoming the mainstream of social emotion. However, it should be noted that with the deepening of social transformation and reform, people's interests demand and value orientation are becoming more and more diverse, leading to various social contradictions and conflicts of interests more complex. These situations are inevitably reflected in social emotions. Some negative, irrational and even extreme social emotions may appear, which will have adverse effects on economic development, social stability and people's psychology.

Social emotion refers to the subjective psychological experience and psychological feeling that accompanies the whole social psychological process of an individual. It is the emotion that an individual experiences and expresses in the long-term social interaction, such as guilt, gratitude, jealousy, admiration, and so on [1]. Social emotions are closely related to moral behavior, social cooperation and group decision-making, so social emotions have always been an important research field in social psychology, politics and sociology.

Researchers have done in-depth research including the nature of social Situations inducing social emotions, the response patterns of social emotional differentiation and the accompanying different emotional states, the particularity of different types of people in different stages of emotional activities, the suitability of social regulation for social emotional responses in specific situations, as well as the role of expression control. However, it is rather limited that people understand the neural mechanism of social emotions. With the development of cognitive neuroscience, it is possible to study the neural mechanism of social emotion based on cognitive neuroscience and technology. Social psychologists try to reveal the neurological basis of human advanced social psychological phenomena by using neuroscience research technology, and use social cognitive neuroscience to analyze the relationship among social emotion, cognition and neurological basis in social interaction [2]. Cognitive neuroscience and technology provide a solid technical foundation for the study of social emotions in social psychology.

## 2. Literature review

Many researchers are interested in the connotation of social emotion. Some researchers believe that social emotions are generated on the basis of individual emotions. After social generalization, individual emotions become a common psychological orientation and characteristics of group emotions because of externalization [3,4]. Obviously, this understanding of social emotions is based on group and individual emotions. Some researchers believe that social emotions are related to public needs and are the whole process of psychological activities with specific public experiences, explicit attitudes and behavioral manifestations [5]. Other researchers believe that social emotions are first expressed in people's perception of various situations in social life, and then through interaction among group members, a more complex and relatively stable attitude experience is formed [6,7]. This perception and experience has a directive and dynamic impact on the individual or the whole.

Researchers divide social emotions into positive social emotions and negative social emotions. They believe that positive society emotions are an internal driving force for people's healthy physical and mental development and make people positive and upward. Negative social emotions are generally expressed as depression, and then as passive and lack of creativity in work and life [8,9]. Researchers think that the mainstream of social emotions in China is positive and healthy, but some negative social emotions are increasing and sometimes tending to be serious [10]. Life and work pressure, income gap and class difference are considered to be the main factors inducing negative social emotions [11,12]. The stratification of social emotions is manifested not only in the general emotional indicators, but also in the differences of specific emotional types. The stratification of negative emotions is significantly correlated with the stratification of stress exposure and the stratification difference of stress susceptibility. Compared with the stratum with high social and economic status, the stratum with low social and economic status is more susceptible to adverse events, and the former is more susceptible to most stressful events [13]. Coordination of various interests, improvement of appeal expression mechanism and improvement of people's political participation level are effective ways to alleviate social emotions and dredge people's psychology [14,15,16].

Based on cognitive neuroscience, studying the neural mechanism of social emotion, such as examining the brain structure changes hidden in sympathy and caring, constitutes another important research field of social emotion. Lutz et al. [17] studied the social emotions of sympathetic groups with Buddhist monks as participants, and found that sympathy is not only related to the brain response, but also highly to physiological self-discipline activities. Buddhist monks who have practiced for several years are regarded as participants in this study. When empathy is aroused, Buddhist monks who have practiced for several years have greater activation than monks who have just begun to practice in the anterior and middle parts of the insular cortex and the anterior motor areas. In addition, Buddhist monks who have practiced for several years also show an increase in heart rate and a stronger coupling of hemodynamic responses in the central insular cortex. Immordino-Yang et al. [18] found that when sympathy and envy occur, the anterior insula, dorsal anterior cingulate and hypothalamus are activated. By comparing the time course of these different emotional reactions, it is found that the insular response induced by observing others' physical pain is slower than that stimulated by sympathy or envy for others' social pain. A study by Baumgartner et al. [19] focused on maternal love and Romantic love found that the activation effects of the two types of care overlap in the middle insula, the dorsal anterior cingulate cortex, the amygdala, the globus pallidus and the caudate nucleus. When a mother sees her baby's face or a girl (boy) sees her (his) loved one, the striatum is activated, which indicates that neuropeptide receptors play a key role in human attachment [20].

Research on social emotions related to social decision-making, such as fairness, trust and happiness, is related to neuroeconomics. Researchers usually use the research paradigm adopted in game theory and behavioral economics to study social interaction and social choice [21,22]. Rilling et al. [23] and Qi et al. [24] use functional magnetic resonance imaging (fMRI) technology to measure the nervous response of social exchange and sense of fairness based on models of prisoner's dilemma game, ultimatum game or mutual trust game, and to examine the nervous mechanism of

decision-making process. It is found that, compared with rewarded cooperation, unrewarded cooperation induces significant bilateral forebrain insula activity and functional connectivity of forebrain insula and lateral prefrontal cortex, which indicates that forebrain insula is closely related to social decision-making. In recent years, the application of hyper-scanning technology has involved many aspects of social emotional research, such as trust and equity, cooperation and competition, imitation and action coordination, expression, gesture and speech communication, and so on [25,26]. Hyper-scanning technology mainly relies on fMRI, electroencephalogram, near infrared spectroscopy imaging and other equipment to scan, record and analyze the brain nerve mechanism of two or more people in social interaction at the same time. Therefore, hyper-scanning technology has a high ecological validity, which provides a more powerful technical support for the study of the neural mechanism of social emotion.

### **3. Research framework**

#### **3.1 Research on the neural mechanism of social emotions based on interpersonal interaction**

As the sum of social relations, people begin to experience emotions from birth, and continue to acquire expression and experience emotions from their interaction with the people around them in the process of growing up. Social emotions with the characteristics of social interaction drive specific social behavior, and then cause specific social consequences. Social situations, such as social environment, cultural norms and moral beliefs, have become important factors affecting the expression and understanding of social emotions.

The study about the neural mechanism of social emotions should be based on social situations in social interaction. Researches may use a variety of interactive games to simulate real social interaction, observe and measure the induced social emotions, and examine the direct emotional experience of people in interpersonal interaction. Functional brain imaging (fMRI, EEG, ERP, MEG, PET) can be used to study the neurological mechanism of social emotions and reveal the differences of brain structural of individual which causes different social emotions.

#### **3.2 Quantitative study on the interrelationship between social emotion and brain activity**

Social emotion is a remarkable characteristic that distinguishes human beings from other species. The generation and development of social emotion are later than basic emotion. Social emotions depend on social situations, moreover, individuals are required to have a broader representation of their social situations and states. The emotional state of an individual affects the higher cognitive processes of moral judgment, reasoning and decision-making. Quantitative research on social emotions and corresponding brain activities will help us to understand social emotions and their neurological mechanisms more deeply.

On the basis of the study of social emotional nervous mechanism of interpersonal interaction, the quantitative research firstly chooses appropriate methods to measure and calculate the activities produced by specific brain regions and neural networks, and then quantifies some components of social emotional processing as parameters by means of mathematical models. Next, the relationship between these parameters and brain activity is investigated, and the neurocomputational function of specific brain structures is revealed. Finally, the causal relationship between social information processing and brain regions is explained.

#### **3.3 Research on neurophysiological basis of social emotion**

Social situation and self-adaptation make people experience the change of their emotions all the time. When an individual is stimulated by emotional information or the body is in a certain emotional state, a series of physiological changes will occur in the autonomic nervous system. The level of physiological arousal and the degree of organ activation will be significantly different from the normal physiological rhythm. Research on the neurophysiological basis of social emotions is helpful to understand the biological nature of social emotions.

Future research can be based on molecular genetics, neuroimaging and electrophysiology technology. By comparing the behavioral and brain imaging data of different social emotional groups and different genotypes, we can get a deeper understanding of the biochemical and neurophysiological basis of social emotions.

#### 4. Conclusion

Social emotion is a complex psychological reaction of individuals to the real society. It is not only closely related to the interests and needs of individuals, but also deeply influenced by the individual's ideology, values and behavior patterns. Meanwhile, it is also related to the individual's brain structure. With the continuous development of society, social emotions will become more complex. The study of the neural mechanism of social emotion can provide decision-making reference for the guidance and alleviation of social emotion.

The research on the neural mechanism of social emotion involves a wide range of fields, and the research framework provided here is relatively extensive [27]. In fact, some researchers have formed more detailed research results. For example, researchers adopt continuous risk decision-making tasks and resting-state functional magnetic resonance imaging to explore the impact of other people's decision-making behavior on individual emotions and risk decision-making [28].

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