



A Review of the Facial Emotion Recognition in Children with Autism

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Abstract. The most striking feature of autistic children is their social cognitive deficits, with emotion recognition being the weakest aspect of social cognition. From reviewing the literature related to emotion recognition in children with autism, it is found that there are problems in this field, such as insufficient research sample size, relatively insufficient developmental research, inconsistency of research results, and difficulty in implementing empirical research. This is followed by a summary of the relevant research as well as an outlook to provide a reference for those involved in the research work.

Keywords: Children with Autism, Emotional Faces, Recognition, Emotion Recognition Intervention

1 Introduction

Autism Spectrum Disorders (ASD), or autism for short, is a neurodevelopmental disorder that develops in infancy and it is closely linked to abnormalities in the neurochemical mechanisms of the brain[1]. People with ASD have low cognitive ability in social situations, lack eye contact when interacting with others, do not understand the implicit content of social situations, lack appropriate social behavior and have difficulty establishing social relationships and adapting to social rules.

Facial expressions are the external manifestations of people's emotions and are known as "the most sensitive indicator of emotional response". Research has shown that various facial patterns are broadly consistent with the emotional experiences evoked. Accurate recognition of human facial expressions and accurate inference of other people's emotional states based on their facial expressions are critical to establishing effective social interactions. For the average child, emotion recognition is an early-developed social skill. 4-month-old infants can recognize basic expressions such as joy, sadness, fear, and surprise in familiar environments[2]; 7-month-old infants can respond habitually and directionally to familiar or unfamiliar emotional faces; 12 Month-old infants can use non-verbal communication to express basic requests and socially interact with others[3]. From the perspective of developmental psychology, with the growth of individual age, the accumulation of experience and the improvement of thinking quality, the ability to recognize emotions is also continuously improved,

and children with autism have qualitative defects in this regard. Children with autism often exhibit delays and deviations in their ability to recognize emotions in themselves and others. These delays have been demonstrated in emotion recognition tasks for facial emotion, tone of voice, and body language. Children with autism have hearing deficits, have difficulty recognizing emotions through sound stimuli, and have difficulty making emotional judgments through tone of voice[4].

In this study, literature search was mainly carried out by keyword search. First, the author performs keyword search, and searches the keywords such as autism, children, autism spectrum disorder, emotion recognition, simple emotion, complex emotion, etc. in databases such as Web of Science, Springer, Science Direct, etc. Afterward, the research object and research content irrelevant to emotion recognition, as well as duplicate literature, were removed by browsing the title of the literature.

2 Expression recognition characteristics and influencing factors of children with autism

2.1 Main characteristics of emotion recognition in children with autism

At present, research on ASD patients' ability to recognize facial expressions is not only carried out in children, but also involves adult patients. Most studies believe that ASD patients have low ability to recognize facial expressions. But there are also scholars who hold the opposite opinion. Their research found that children with autism have basically the same or similar ability to recognize some emotions, especially simple emotions, as ordinary children. For example, Yongning Song et al. used the Bubbles paradigm to study and found that children with autism had essentially the same performance as regular children in identifying happy and sad expressions[5].

However, after a more in-depth study, Baron-Cohen et al used a standard facial expression chart to examine the recognition of different emotional categories in adults with autism and found that they were better at recognising basic facial expressions triggered by external situations, such as happiness and sadness, but had difficulty recognising facial expressions triggered by beliefs and wishes, such as anger, surprise, fear and complex facial expressions such as embarrassment. It has also been shown that people with ASD are significantly less able to judge subtle, complex facial expressions such as arrogance and levity than normal controls.[6] Begeer et al found that children with high-functioning autism did not differ from normal controls in the recognition of 4 basic facial expressions (happy, sad, angry and afraid), but showed difficulty in recognizing complex emotions such as jealousy and embarrassment[7].

In addition to this, a noteworthy feature of face recognition in children with autism is their autonomic attention to the facial expressions of others. A socially important phenomenon in early childhood psychological development is the "face preference" in infancy, where the infant prefers to look at a person's face compared to other stimuli. Children with autism are less likely to pay autonomous attention to the facial expressions of others. A retrospective study of home videos of children with autism found that at 6 months of age, children with autism were still unable to orient their attention to eye

gaze and spent little time paying attention to faces compared to normal and mentally challenged infants of the same age[8]. Swettenham et al. found that children with autism at 20 months of age spent less time looking at faces and more time looking at objects than children of the same age with developmental delay and normal development[9].

To investigate the mechanisms underlying the processing of facial expressions in children with autism, several researchers have studied the visual scanning characteristics of facial expressions in children with autism using infrared eye-tracking techniques. Thomas found that children with autism focused more on the lower part of the face when viewing it, i.e. recognising facial emotions through information from the lower part of the face[10]. Other eye-tracking studies have also confirmed the view that when autistic individuals look at human faces, they focus less on the core areas of faces (such as eyes, nose and mouth), especially less on the eyes, and more on non-human faces. The core area, and when recognizing emotions, use less information from the eye area, which can help explain the difficulty of emotional face recognition to some extent. Humphreys et al also concluded that children with autism have significant difficulties in recognising fear expressions[11]. Studies have shown that children with autism who frequently avoid angry faces have more severe social difficulties. Therefore, when faced with complex information such as social input and facial feedback in the real environment, the different processing methods of autistic children and their ability to autonomously pay attention to the facial expressions of others may be the main reasons for the facial expression recognition disorder.

2.2 Influencing Factors

It is difficult to say about the influencing factors of the identification of children with autism, because the factors mentioned by many scholars have limitations and are not of general significance. More research in this area is needed to expand and verify. The factors can be summarized as the following:

Genetic. Neves et al. compared the facial expression recognition ability of the parents of autistic children and the parents of ordinary children, and found that the former showed difficulty in facial expression recognition[12].

Function of the brain's amygdala. Children with autism have difficulties recognizing facial expressions due to abnormalities in the amygdalar, according to cognitive neuroscientists. The study by Munson et al. demonstrated the impact of early amygdala abnormalities on emotional understanding and social adaptation in children with autism later in life[13].

Age. Studies have confirmed that older children with autism have significantly better levels of facial recognition than younger children[14].

Scenarios where facial expression recognition occurs. When asked to make socially relevant decisions, autistic children were able to recognize facial expressions just as well as normal children. This also means that there is a certain correlation between the autism group's recognition of other people's expressions and the authenticity of the test.

Familiarity with the person making the expression. Some researchers have found that children with autism can accurately identify their mother's face and emotional voice, but have difficulty recognizing test material played by others[14].

Gender. The reality of the ASD population is that women have fewer and more severe conditions than men. Many scholars have proposed whether the ability of autistic children to recognize emotions is related to gender. Numerous studies on normal subjects have shown that female subjects perform better than male subjects in recognizing male or female faces. However, some scholars' studies found that there was no significant difference in emotion recognition scores between male and female subjects with ASD[15]. Further research is still needed on gender-differentiated emotion recognition in autistic groups.

3 The research angle of emotion recognition ability of autistic children

In addition to the facial expression recognition features of autistic children mentioned in 1.1 above, there are three research perspectives on emotion recognition of autistic children.

3.1 Neurophysiological Mechanism Research

Emotion recognition involves multiple brain regions such as the fusiform gyrus, superior temporal gyrus, amygdala, and frontal lobe, and their activities all have insufficient activation or abnormal activation. Munson et al. believed that the attentional specificity caused by the abnormal amygdala was the reason why children with autism could not pay attention to and recognize facial expressions according to the conventional way in real social interaction[13].

The activation of brain regions during facial expression recognition in autistic children differs significantly from those in ordinary children, according to fMRI studies. The main manifestation is that the activation level of the face region of the fusiform gyrus is lower, while the activation level of the infratemporal brain region is higher. The former area is directly related to emotional cognition, and the activation of the latter area is mainly related to object cognition, which indicates that the shortened time of gaze at the eye area of the face in children with autism is related to the abnormal development of the fusiform gyrus and amygdala, resulting in difficulty to accurately process unfamiliar faces.

Bal believes that the difficulty in recognizing emotions in children with autism is caused by atypical characteristics of the sympathetic nervous system. That is, when viewing facial expressions, their pupils enlarge, their heart rate increases, their electrical skin level increases, and their breathing rate increases [16]. A series of physiological signals have changed. In-depth research has found that excessive local brain association and insufficient long-distance association in autistic children are the reasons for their difficulties in the coordination of expression recognition tasks.

Due to different research angles, methods and heterogeneity of children with autism, the results of some facial expression recognition researches are divergent, which also shows the complexity of the etiology of children with autism. With the development of research methods and the wide application of new technologies, the research on facial expression recognition of children with autism has become more and more in-depth. Eye tracking, ERP, fMRI, etc. are widely used in autism research, and it is also better to study the facial expression recognition of autistic children from the perspective of neurophysiology, which will certainly help to reveal the inner nature of facial expression recognition of autistic children's mechanism.

3.2 Speech Information Recognition

In daily social interactions, people draw clues from different angles to understand the meaning of others. Like facial expressions, verbal information also provides rich information for people to recognize other people's emotions. In one sense, speech conveys relevant information about an individual's emotional state and background events, and in another sense, the tone of speech itself carries the individual's emotional cues.

Some studies suggest that compared with ordinary children, autistic children have no significant difference in the meaning recognition of nouns and neutral adjectives, but their understanding of emotional adjectives lags behind that of ordinary children. It is necessary to understand the complex psychology of others. Relevant studies on brain function have also confirmed that autistic children activate more fusiform gyrus for emotional words than ordinary children, but the activation of expression recognition is not as good as that of ordinary children.[17] It can be seen that autistic children do pay more attention to the processing of emotional words. Perhaps because children with autism suffer from memory impairments in retrieving semantic features, when faced with novel standard tasks, more information such as emotions and feelings is needed to facilitate episodic memory retrieval.

3.3 Other Emotional Cues

When researching emotional cues in context, it was found that children with autism can use cues in external contexts to infer the emotional state of others prompted by structural problems. The study found that music affects the emotional recognition of autistic children, especially the recognition of sad expressions is more likely to be affected by music situations that are consistent with emotions, it takes a longer time to recognize. In a study of physical cue recognition, it was found that children with autism had deficits in the ability to infer the emotions of others based on body movements. For example, when autistic children observe social situations, their eye movements are scattered, and they pay more attention to the background in the situation, ignoring the body posture and key movements of the characters.[18]

However, due to the limitation of daily life conditions, autistic children cannot immediately and actively absorb and utilize these emotional cues, so they do not perform well in emotional recognition. Even if they can understand the positive and

negative emotions of others, it is difficult for them to understand and distinguish the cognitive emotions of others based on false beliefs.

4 Intervention training of emotion recognition in children with autism

A large number of studies have shown that children with autism have deficits in the ability to understand and interpret other people's emotions, and further research has confirmed that emotional understanding deficits can lead to children with autism unable to communicate smoothly. Therefore, it is particularly important to intervene and train autistic children in their ability to understand emotions

Baron-Cohen, Golan and Ashwin used animation to train autistic children for four weeks and found that the experimental group was significantly better than the control group in emotional understanding, but only in a short period of time to the angry expressions of autistic children. The identification of the intervention is helpful, but the intervention effect is not lasting and stable[19].

A study conducted one-on-one interventions on autistic children using emotional video and audio to learn happiness, sadness, anger, and fear. Each session was conducted for 15-20 minutes, with a total of 40 interventions. After their 8-week intervention, the emotion recognition ability of the ASD children's intervention group has been significantly improved, indicating that the intervention of emotional video and audio has achieved good immediate effects. The data of the follow-up test after 6 weeks showed that there was no significant difference between the scores of the post-test and the post-test, indicating that the intervention had a good maintenance effect. It also further proves that the emotion recognition ability of children with ASD can be improved through intervention[20].

5 Conclusion

The severity of symptoms in children with autism can affect their development of emotional understanding and, to varying degrees, their social adjustment. However, there are still many problems in this area of research that need to be further developed. Firstly, in terms of subjects, due to the specificity of the research subjects, the selection of the subjects is difficult and the attrition of the subjects is serious. Secondly, the findings vary from study to study due to inconsistencies in research tools and methods, the use of different emotion scenarios, different criteria for selecting emotion pictures, and the influence of cultural factors on subjects' performance. Thirdly, there is a dearth of effective educational interventions and developmental research on emotion recognition in children with autism.

This is why there is a need for a deeper analysis of the emotional understanding of children with autism, to break away from the limitations of previous research methods and to find new ways of training. The research tools should be unified and new training methods should be found. Future research should also increase the sample size of

children with ASD as much as possible, extend the duration of interventions, and maintain the follow-up of the subjects.

In future research, we need to focus on building a standardised protocol for emotion recognition in children with autism, especially for early childhood, selecting appropriate assessment tools and educational content to further improve intervention strategies, combining qualitative analysis and quantitative research to form a complete intervention system, promoting early intervention and teaching practices for children with autism, and opening up new pathways for the treatment of the disorder.

6 References

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