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REVIEW ARTICLE

# Research Progress on Emotion Understanding and Expression in Blind Children

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**Abstract**

The capacity to process emotion matters greatly to an individual's social adaptation, and earlier research has shown that blind children experience social difficulties in which emotion understanding and emotion expression are important contributing factors. This article reviews research on emotion understanding and on facial expression of emotion in the field of blind children's emotion processing. It examines the characteristics of emotion understanding and expression in blind children, analyses the influence of visual experience, early parent–child interaction and age on emotion processing, sets out the methods currently used to study emotion processing in blind children, and closes with concrete recommendations for intervention on blind children's emotion-processing ability.

***Keywords:*** blind children, emotion understanding, emotion expression, influencing factors, early intervention

## 1 Introduction

Emotion matters greatly to an individual's social adaptation. People who process emotion well have a certain advantage in perceiving and expressing emotion [1]. Because they lack visual experience, blind children's social-emotional competence tends to lag behind that of sighted children [2]. Earlier research on emotion in visually impaired groups has concentrated on two aspects — emotion understanding and facial expression of emotion [3, 4]. Within emotion understanding, emotional prosody occupies a central place and has been the focus of research [4]. People can learn what is being conveyed, and understand the emotion a speaker means to express, not only from the verbal content of speech but also from changes in acoustic cues such as pitch, duration, intensity and fundamental frequency; these acoustic cues are what is called emotional prosody [5]. Affected by their sensory impairment, blind children cannot observe others' facial expressions and bodily movements in order to gather how the other person feels, and the most convenient route open to them is to use intonation (emotional prosody) in order to recognise the other person's emotion [6]. Besides emotional prosody, blind children can also understand emotion through the semantic content of an utterance: semantic content is what the speaker has said, and an individual can judge the speaker's emotion from positive or negative content [7]. Emotion expression is likewise of great significance to survival in human society. Emotion may be displayed through many channels, including non-verbal vocalisation, posture, prosody, music and language, but it is chiefly conveyed through facial expression [8, 9].

Domestic research on the field of blind children's emotion is at present sparse and rather scattered, whereas research abroad is comparatively rich. Using 'emotion', 'emotion processing', 'emotion recognition', 'emotional prosody recognition', 'emotion expression' and 'emotional facial expressions' as keywords, the author ran combined searches in Web of Science, SAGE, Elsevier, EBSCO, Wiley Online Library, ProQuest and Google Scholar in order to establish the state of research on emotion processing in blind children. Specifically, this study discusses blind children's emotion-processing ability in terms of emotion understanding and facial expression of emotion, reviews the characteristics of, and factors influencing, emotion processing in blind children as reported in international journals and publications, and sets out several implications, in the hope of offering a reference for work on blind children's emotion-processing ability in China.

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## 2 Characteristics of Emotion Understanding and Expression in Blind Children

### 2.1 Emotion Understanding

A survey of the literature shows that research on emotion understanding in blind children has concentrated on two aspects: the recognition of emotional prosody and understanding based on semantic content.

#### *2.1.1 Recognition of Emotional Prosody*

Emotional prosody is an important cue for understanding a speaker's intention, meaning and emotional state [10, 11]. Researchers point out that visual experience is extremely important for acquiring social, cognitive and complex pragmatic skills. Children with blindness recognise emotional prosody less well than sighted children [12, 13], and blindness affects their access to the important emotional cues carried in conversation [14]. The reason is that sighted people perceive emotional cues jointly through facial expression, gesture and voice, whereas blind children lack the visual cues and therefore find it difficult to recognise another person's emotional state. Minter et al. selected congenitally blind and typically developing children aged 6 to 12 and had them listen to and discriminate emotional prosody audio with and without language content, then classify the emotional prosody. The results showed no significant difference between the two groups in recognising non-verbal emotional prosody, but the blind children were poorer at recognising emotional prosody that carried language content [14]. Dyck et al. tested blind children's recognition of the emotional prosody of eight emotions — anger, contempt, disgust, fear, happiness, sadness, surprise and neutrality — one item of which required the experimenter to say the sentence 'I can't believe it' with a variety of different emotional expressions and then asked the participant to judge the emotion the sentence expressed. The results agreed with those of Minter et al.: blind children showed a deficit in emotional prosody recognition and lagged behind sighted children of the same age [15].

On this basis, blind children perform poorly at emotional prosody recognition in situations that are rich in verbal information and that call for integrated judgement. Research comparing blind children with sighted groups on emotional prosody recognition is not, however, plentiful at present, and sample sizes are small; the field needs further investigation.

#### *2.1.2 Emotion Understanding Based on Semantic Content*

Within emotion understanding, some research has focused on understanding based on semantic content. Recognition of emotional prosody differs from understanding based on semantic content: the former judges the emotional state expressed by an utterance by recognising intonation such as happy or sad, whereas the latter examines, on the basis of a situation, the emotion expressed by words and sentences. Research has consistently found that, relative to emotional prosody recognition, blind children perform better at emotion understanding based on semantic content, and that their performance does not differ from that of sighted groups. Their poor emotional prosody recognition occurs because recognising emotion usually also requires people to integrate various communicative cues (body language, facial expression and so on) beyond the cues in the sentence in order to reach a judgement.

Dyck et al. investigated blind children's emotion understanding based on semantic content [15]. The study used a Comprehension Test to measure participants' judgement of emotions arising from semantic content (for example, 'Susan is given a new bicycle on her birthday — how will she feel?'). It also used an Emotion Vocabulary Test to examine participants' understanding of emotion words (for example, 'What does the word angry mean?'). The performance of blind and sighted children did not differ significantly. Roch-Levecq examined participants' identification and understanding of four basic emotions — fear, happiness, sadness and anger — with items such as 'How do you feel when you hear or see a fierce big dog coming towards you?' (answer: afraid) and 'How do you feel when you receive a new present?' (answer: happy), and found no significant difference between blind and sighted children either [16]. In addition, Jiao Qing et al. had blind children listen to a story about a situation and then identify the emotion shown by its protagonist; most participants understood both the protagonist's positive emotions and their negative emotions [17].

### 2.2 Emotion Expression

For blind children, research on emotion expression has concentrated on the field of facial expression. Within facial expression of emotion, work has chiefly addressed voluntary facial expression of emotion and spontaneous facial expression of emotion. Voluntary emotion is produced at the experimenter's request and need not reflect inner feeling, whereas spontaneous facial expression is caused by genuine emotional experience and reflects what is truly felt [18]; the former is learned and the latter is inborn and arises naturally [15]. Existing research generally finds that blind children show a deficit in voluntary emotion expression but perform comparatively well at spontaneous emotion expression, with no difference from sighted groups. Valente et al. reviewed 21 studies of facial expression in visually impaired groups published between 1932 and 2015 [3]. Seventeen of them showed that visually impaired and sighted people can spontaneously produce the same patterns of facial expression, and that these patterns arise spontaneously in genuine

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affective contexts. Conversely, eight studies showed that visually impaired people have difficulty producing voluntary emotional expression.

Galati et al. compared the spontaneous facial expressions of blind and sighted children aged 8–10 in order to examine their ability to regulate and control facial expression in complex emotional situations [18]. The researchers filmed the blind children's facial expressions in the classroom as they heard conversations in different situations — for example, 'the biscuit you love has suddenly been taken away', or 'the teacher has rewarded you with a present' — and then coded and analysed the expressions. The two groups behaved very similarly, though there were some differences: sighted children masked negative emotion more easily than blind children, and blind children showed more head movement, eye closure, mouth opening and other task-irrelevant actions. The authors held that the two groups' spontaneous expressions have features in common, but that blind children do not know in which situations they should express or mask which emotion, and that their regulation of emotional intensity is not good enough; because these emotional skills are acquired through observational learning, they perform poorly.

In short, research shows that blind children, like sighted children, spontaneously produce the basic inborn emotions such as happiness, sadness and fear, but that they do less well when they must deliberately produce a voluntary expression to meet the demands of an experimental task. Rinn holds that the expression of spontaneous emotion depends on innate development in subcortical regions, whereas voluntary facial expression of emotion is bound up with a specific control process arising from the cortical motor strip, and that this voluntary control appears to depend on visual observation and motor feedback [19].

## 3 Factors Influencing Emotion Understanding and Expression in Blind Children

Many factors influence blind children's emotion understanding and expression — the family environment, parenting style and provoking events among them. Having analysed several decades of research on emotion processing in blind children, researchers find that visual experience, early parent–child interaction and age are the factors chiefly discussed internationally. This article therefore concentrates on these, in the hope of further clarifying the characteristics of emotion understanding and expression in blind children.

### 3.1 Visual Experience

A number of studies hold that visual experience has an important influence on emotion processing. Dyck et al. and Peterson et al. hold that blindness affects the acquisition of cues in emotional social interaction — blind children cannot, for instance, observe other people's facial expressions and bodily movements — and that the lack of these cues leads to delayed acquisition of theory of mind and also affects their emotion understanding and expression [20]. In daily life, sighted children communicate with others through several channels — facial expression, gesture and voice — and these channels interact in shaping people's emotion understanding and expression. Although congenitally blind children can communicate through the auditory channel, their understanding of causal relations remains limited compared with that of sighted children [16]. A recent study of facial emotion recognition emphasised the role of context in affective perception, finding that when contextual cues are presented to blind children in an isolated form, they have difficulty discriminating the emotional tone of a voice and difficulty expressing their own emotions appropriately [21]. In addition, Geldart et al. tested early-blind individuals whose sight had been restored, and this too reveals the importance of visual experience for emotion recognition. These participants had all had congenital cataracts and had regained their sight after treatment; aged between 10 and 38, they were given a series of facial expression tasks, and their facial expression processing was found to be impaired. The study holds that visual input in early infancy plays an important part in the processing of facial expression [22].

### 3.2 Early Parent–Child Interaction

Many scholars have analysed blind children's emotion understanding and expression from the standpoint of early parent–child interaction. This research shows that communication between a blind child and their main caregiver may have a profound influence on later development, shaping not only early attachment patterns but also cognitive development [23, 24]. Sandler and Hobson point out that the parents of blind children are often unable in the early period to perceive keenly the emotional signals their child emits, so that parent and child often cannot understand the emotional state in speech [13]. To study the effect of blindness on children's social and emotional development within the first year of life, Tröster and Brambring compared the social and emotional development of congenitally blind and sighted infants at 9 and at 12 months [25], assessing it with three subscales: emotionality, social interaction and impulse control. Compared with sighted infants, blind infants displayed fewer facial expressions, less often attempted to initiate contact with their parents, and less often complied with simple requests and instructions. The dynamic and interactional theories of emotion likewise stress the importance of visual interaction: they hold that the starting point of affective learning is to be traced to the face-to-face

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interaction between parent and infant, that this interaction is especially important in the first years of life, and that its quality has a profound influence on the child's later emotional development [26].

Sighted children can coordinate their behaviour with cues in the social environment and so continually strengthen their affective relationship with their parents. Blind children, when they express their needs, are more easily overlooked than sighted children, and may therefore give up behaviour that displays positive affect. This being 'overlooked' is unfavourable to the formation of the parent–child relationship: parents are insensitive to the child's needs and the child does not know what to do, which obstructs blind children's emotion understanding and expression [25].

### 3.3 Age

Many studies find that, unlike sighted groups, blind children's ability to express emotion facially declines as they grow older. Thompson studied the facial expressions — smiling, crying, anger, fear and so on — of 26 blind and 29 sighted children. The results showed that at one year of age the two groups' facial expressions were very similar, but that after the age of 2–3 the blind children's smiling facial activity gradually decreased, while sighted children's facial expression activity gradually became richer [27]. According to Galati et al., this may be because facial expression activity is not necessary for blind children in social interaction and they use facial expression less; through 'use it or lose it', the quality of their facial expression activity gradually declines [28]. Mistschenka also proposed that, with increasing age, blind children's control over facial activity gradually weakens, ultimately leading to a progressive deterioration in the quality of facial expression [29]. Galati et al. found that blind children's facial expression, though it did not deteriorate with age, remained stagnant [30]. Similarly, Fan Jialu et al. tested the intonation emotion recognition ability of 104 Chinese students with visual impairments and found that students in the primary and junior secondary divisions recognised angry intonation significantly better than students in the senior secondary division [6].

## 4 Methods for Studying Emotion Understanding and Expression in Blind Children

To generalise, earlier research on blind children's emotion understanding and expression has chiefly used naturalistic observation, emotion scale assessment and cognitive experimentation.

### 4.1 Naturalistic Observation

Naturalistic observation is a traditional method of studying emotion. It has comparatively high ecological validity: it observes children's emotional expression directly in a variety of situations and can reflect children's true expressive state under different task demands. The earlier scholar to carry out naturalistic observation was Thompson, who in 1941 analysed the facial expressions of blind and sighted children by observation and photography and found that the facial expression activity of blind children aged 2–3 was gradually decreasing [27]. These early observational studies were of course rather subjective: they usually photographed participants' expressions in various situations and then asked trained judges to assess the emotional state in the photographs, and the judges often mixed in their own subjective experience — a judge who thought blind children's lives were miserable would, for instance, judge too many negative emotional states in them. Later research added objective facial expression coding systems for analysing expression and so became more scientific. Galati et al., for example, carried out an observational coding study of the facial expressions of 10 sighted and 10 blind children. The researchers worked with the children's guardians to elicit anger, joy, disgust, surprise, sadness and fear (for example, giving the children a biscuit they liked and then suddenly taking it away, prompting an angry expression), recorded the children's facial expressions on video, and then coded and analysed them using the Maximally Discriminative Facial Movement Coding System from Izard's theory of emotion [23].

### 4.2 Emotion Scale Assessment

Emotion scale assessment is the evaluation of children by a researcher according to the items of a scale, and these items have strict scoring criteria and assessment procedures. Tröster and Brambring used the Bielefeld developmental test for young visually impaired children to assess the social-emotional development of blind and sighted children at 9 and at 12 months; the scale includes both direct observation and caregiver report [25]. In direct observation the assessor observes the child's emotional expression in different interactive situations and scores it according to a coding scheme. In the caregiver report the assessor asks about the child's emotional expression in a series of situations, such as 'When … , how did your baby react?'. Compared with sighted infants, blind infants displayed limited facial expression and less emotional interaction, less often attempted to initiate contact with their mothers, and less often complied with simple requests and instructions. Roch-Levecq assessed blind children's emotion understanding based on semantic content, examining their identification and understanding of several basic emotions with items that presented different life situations and asked participants to give the specific emotional response according to the situation; blind children's performance was found not to lag behind [16].

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### 4.3 Cognitive Experimentation

Cognitive experimentation uses computerised psychological experiments or neuroscience experiments to study emotion processing in blind children. Geldart et al. studied the facial expression processing ability of individuals whose sight had been restored by cataract surgery, using a computerised facial expression processing task; compared with an age-matched control group, the restored individuals' facial expression recognition was impaired [22]. Fan Jialu et al. used the four basic emotional intonations of happiness, anger, sadness and fear to test experimentally the intonation emotion recognition ability of 104 students with visual impairments. The experimenter played 32 intonation emotion test sentences at random through a computer and professional loudspeakers, ensuring that participants could hear the sentence content clearly; as soon as each sentence had been played, the experimenter clearly spoke the four emotion category options and asked the participant to choose [6].

Besides these behavioural experiments, many studies have used physiological experiments such as brain imaging and ERP to examine the brain mechanisms of emotion processing in blind children. Klinge et al. used functional magnetic resonance imaging (fMRI) to examine the mechanism by which the amygdala takes part in auditory emotion processing, with sighted and blind children as participants. The results showed that, even in the absence of visual emotional experience, the amygdala can be activated when an auditory emotional stimulus is perceived [31]. Topalidis et al. used EEG to examine whether spatial selective attention affects the processing of emotional prosody in congenitally blind people. The researchers spoke a series of pseudowords with happy, neutral, fearful or threatening prosodic intonation while EEG recorded participants' responses. It was found that congenitally blind participants show potential reorganisation in the brain during emotional prosody processing [32].

## 5 Implications

The review above has examined the present characteristics of emotion processing in blind children, the factors that influence it and the methods used to study it. What follows are several implications drawn from that material, focusing on emotional intervention for blind children.

### 5.1 Strengthening Early Intervention on Emotion Processing in Blind Children

First, early parent–child interaction should be valued. Blind children's visual impairment often has an adverse effect on parent–child interaction within the family: parents are often insufficiently sensitive to the blind child's facial expression, the child may become angry because of this, and this in turn affects their willingness to communicate actively. Conversely, the affect revealed in a parent's face or bodily movements may go unanswered by the blind child, which also reduces the parent's initiative in emotional communication. From both sides, therefore, mutual adjustment is needed to raise the quality of parent–child interaction. Parents in particular need to take an active interest in the blind child's feelings: the child's feelings are often not easy to see from outward appearance, so parents need to enter the child's inner world to learn their true state, to strengthen mutual trust and to promote social-emotional development.

Second, blind children's emotional and social communication with others should be valued. The research above finds that emotion understanding and expression in blind groups gradually decline with age. In the early period, therefore, blind children should be encouraged more to take part in the social life of children of the same age and to express their feelings, and should also be actively guided to understand other people's emotions and so improve their theory of mind. A series of studies has found that blind children's theory of mind is comparatively weak, which leaves their emotional understanding comparatively low [33]. Roch-Levecq holds that if blind children do not express emotion and their feelings are continually suppressed, they may have difficulty understanding other people's emotions, and vice versa. It is therefore recommended that opportunities be created as far as possible for blind children to express emotion [16]. Dale et al. hold that visual impairment has an adverse effect on almost every area of children's early development, and that without appropriate intervention their social-emotional problems become prominent: between the ages of 2 and 3 development in many respects stalls or regresses, accompanied by behavioural withdrawal, social avoidance and self-stimulation [34].

### 5.2 Valuing the Introduction of Social-Emotional Curricula in Schools

Beyond early parent–child interaction, this study recommends that schools for the blind add courses on the understanding and expression of emotional prosody to their social adaptation classes. Because, in the research set out above, blind children perform comparatively well at emotion understanding based on semantic content, schools should make greater use of semantic content to improve blind children's emotion-processing ability. Schools may adopt situational teaching and role play to teach emotion processing, both of which involve a good deal of semantic content. Situational teaching usually posits a social problem and asks the blind child to find a way of solving it, and it is often combined with role play. Role play is of great benefit to blind children in understanding others' emotions and expressing their own. Sighted children in early

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development can express their own emotions by imitating the emotion in adults' faces, prosody and posture, and in doing so learn to recognise others' emotions [35]. Imitative learning can likewise increase blind children's emotional sensitivity and raise their level of recognising others' emotional prosody. In the course of imitation a blind child must necessarily ponder and interpret the psychological and emotional state of the role being imitated, and in this process understanding of others' emotions and knowledge of emotional prosody are naturally improved. Teachers should also take care to make use of blind children's strength in emotion understanding based on semantic content, using verbal or social stories to improve their emotion understanding and expression, since these are highly engaging, rich in semantic content and readily attract blind children.

### 5.3 Accelerating Longitudinal Intervention Research on Emotion Processing in Blind Children

Although early intervention is a focus of research in special education, research on early intervention for blind children is comparatively scarce. At present research in China on blind children's emotion understanding and expression concentrates mainly on the basic characteristics of emotion processing, and longitudinal intervention research is lacking. Fan Jialu et al., for instance, studied emotional intonation recognition in blind and low-vision students [6], and Sun Shengtao and Liu Haiyan conducted an experimental study of visually impaired and typically developing children's understanding and use of emotion display rules [36]. Intervention research on social-emotional development helps to reveal effective strategies for emotional intervention with blind children and so to raise the efficiency of intervention. Internationally, Dale et al. carried out a study of home-based early intervention with 54 blind children using a longitudinal comparative design, and found that blind children who underwent structured home-based early intervention fared better than infants and young children receiving other forms of intervention, the benefits appearing in progress in cognition, language and behaviour. A randomised controlled trial was also carried out in New Orleans: 35 blind children (mean age 13 months) were divided into two groups, one receiving 'high-intensity' home-based early intervention for one hour a week and the other a 'low-intensity' control intervention monthly. The high-intensity condition included a developmental curriculum for the blind child's family and the resolution of vision-related problems in daily life and in activities using familiar toys and household objects. The experiment ran for two years, and the high-intensity group showed a significant positive effect on developmental and behavioural problems, though these effects were not maintained in the longer term [37].

In short, blind children's emotional prosody recognition and voluntary emotion expression lag behind those of sighted children of the same age. Researchers have concentrated more on establishing the current state of blind children's emotion processing — using observation, scale assessment and cognitive experimentation to examine the characteristics of their emotion understanding and expression — whereas at the practical level the intervention strategies that would promote blind children's emotion processing still need to be explored. Single-case research could therefore be undertaken to examine in depth the influence of different teaching and intervention approaches on emotion processing, with the dependent variable measured by naturalistic observation and scale assessment. Longitudinal research could also be undertaken, tracking the effects of social-emotional intervention over the long term and examining the development of blind children's social-emotional competence in greater depth.

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