Face Recognition in Children*

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Summary. The human face provides important cues for recognition of both individuals and emotions. A card-sorting test was devised for assessing which aspects of a face are attended to primarily. The subjects were 21 5-year-old children and 18 psychology students. The task required a choice between (a) person identity and an irrelevant aspect (hairstyle); (b) person identity and facial expression (emotions); and (c) as a control condition, complex visual stimuli without social meaning (form and colour). No group differences emerged with the non-social stimuli, ruling out differences between children and adults in general sorting strategies. The two groups processed non-emotional facial stimuli differently, with the children showing "mixed" sorting behaviour, and the students usually making choices based on person identity. This can be explained by different processing strategies. However, when person identity and facial expressions were the competing dimensions in the card-sorting task, both groups showed a preference for the facial expression. It is argued that this reflects the great importance of emotional signals for both children and adults. The relevance of this finding for disturbed development is discussed.

Key words: Face recognition – Emotion recognition – Children

Introduction

Over the past several decades there has been a tendency to attribute children's behavioural problems to the parents' pedagogical incompetence or to a disturbance in the emotional attachment between parents and children (Bettelheim 1967; Tinbergen and Tinbergen 1983). This has been the case even with regard to children who have multiple handicaps. There is no doubt that a stable emotional relationship with a caregiver is of primary importance to a young human being. But this should not lead one to overlook the fact that the development of such a relationship also presupposes certain basic capabilities on the child's part, one of these being the correct perception and interpretation of social cues. An important means of conveying socially relevant information is the human face. Among other things mood, and of course a person's identity, can be read from the face. The aim of the present study was to investigate the way in which normal children and young adults recognize people and emotions as displayed in the face.

Face Recognition

Memory for faces as compared with memory for non-facial stimuli is remarkable in quantity (i.e. number of faces that can be stored) and duration (i.e. time interval until a face is forgotten). Bahrick et al. (1975) found that up to 80% of a person's high school classmates were correctly identified from their yearbook pictures even after 35 years.

From a thorough survey of the literature, Carey (1981) concluded that by the age of 7 months babies possess the basic requirements to recognize faces correctly. They perceive the difference between faces and non-facial stimuli and they can discriminate between different individuals, persons of different sex and persons of different ages. In addition, they recognize a given individual in differing poses. Yet it is only at the age of 10 years that children approach or attain an adult's level of performance on face recognition tasks. This is not just due to an enhanced memory capacity in older children; it reflects the fact that younger children use a different strategy. When photographs of two different persons matched in paraphernalia (e.g. hats, scarves) were presented, 6- and 8-year-olds judged them to be the same person (Diamond and Carey 1977). The authors refer to this strategy as "piecemeal" processing, as opposed to a more successful configurational strategy applied by adults.

Emotion Recognition

The extensive work of Ekman and co-workers has shown that different emotional expressions are correctly identified inter-individually. Furthermore, what they call "primary emotions" (e.g. anger, joy, fear) are consistently recognized by people across different cultures (Ekman and Friesen 1975).

Numerous authors have reported that by the age of 30 weeks (or 7 to 8 months) young infants have the equipment necessary to read a person's mood from his or her face. At this age they can recognize the same emotion in different persons, and they can also discriminate between different expressions on the basis of their emotional meaning (Bühler and Hetzer 1928; Caron et al. 1982; Caron RF, Caron AJ, Myers RS (1986) Do infants see emotional expressions in static faces? (submitted for publication); Oster 1981).

From the age of 2 or 3 on children can match the picture of an expression with its verbal label. As in face recognition, the

error rates are high but decrease with age. However, the pattern of errors is surprisingly systematic across different age groups (Bullock and Russel 1984). These authors therefore claim that what changes during development is the child's conceptional organization of facial expressions. At any rate, children from age 3 on know more about facial expressions than their error rates in matching words to pictures would indicate.

The thesis of the present study is that during the early years of childhood the ability to discriminate between unknown persons is of less importance for a child than the ability to recognize an expressed emotion. Conventional child care practice is to have one main caregiver, usually the mother. The number of social encounters tends to be limited to a rather small group of individuals.

The relevance of the recognition of emotional signals for an infant has been documented in numerous studies by the Papoušeks (Papoušek H and Papoušek M 1983). These authors found, for instance, that when parents interact with their babies they show quite consistent facial and vocal patterns (e.g. raising the eyebrows upon eye contact, high-pitched babytalk voice). It can be assumed that this behaviour is extremely well adapted to the infants' information processing capacities. Parents thus provide ideal "didactic conditions" for young children. Beyond the affective value, then, the ability to recognize facial expressions has an impact on a child's further social and cognitive development.

It is suggested that emotional signals as expressed in a person's face are more relevant and consequently will be attended to more than a person's identity or other aspects such as hairstyle.

The present study was conducted to investigate the extent to which normal children of about age 5 and young adults pay attention to these aspects in a card-sorting task. The cards used in a control condition for sorting strategies showed complex visual stimuli without any social meaning.

Materials and Methods

1. Subjects

Two groups of subjects were studied. One group consisted of 12 girls and 9 boys between the ages of 4 years 11 months and 6 years 9 months. Since age and sex did not influence the results, they will not be dealt with separately in this report. The other group consisted of 18 psychology students (9 male, 9 female).

The three experiments (see Procedures section) were conducted on different days. Due to sickness or absence from kindergarten not all subjects could be tested under all conditions. The total number of subjects for each condition and each group is given in Tables 1 to 3.

2. Procedure

In each of the three experimental conditions, Snowflakes, Wigs and Emotion, the subjects were presented with sets of three cards each. The added instructions were to "select two cards that go together".

(a) Snowflakes. In the snowflake condition, two of the cards showed snowflakes with the same form but different colours (e.g. light blue/dark blue) and the third card showed a differently shaped snowflake in one of the two colours (e.g. dark blue). Two choice strategies were appropriate here: the subject selected either the two cards showing the same form or the two with the same colour.

(b) Wigs. The subject was presented with three photographs of human faces. Two showed the same individual wearing different wigs. The third showed a different person wearing one of the wigs also worn by the first person. Thus, two pictures "went together" because they showed the same person and two went together because the wigs were the same.

(c) Emotions. Here two of the three photographs showed the same person with two different expressions (e.g. smiling and angry). The third was of a different person but showing one of the emotions seen in the first individual. All models wore white bathing caps to avoid attention to unspecific stimuli.

In conditions (b) and (c) dress, size of face, lighting, contrast and background were the same in all photographs.

For each condition, subjects were made familiar with the material and the relevant dimensions in pretraining trials. This served to ensure that they understood the task and attended to the relevant aspects. For testing, 14 sets of cards were presented in each condition.

Results

The results were analysed for each subject individually to determine whether (according to the binominal distribution) there was a significant preference for one of the two dimensions or "mixed" sorting behaviour.

Snowflakes. In the snowflakes condition the subjects in both groups prefered form choices. There was no significant difference between the groups (Table 1).

Wigs. In the wig condition a clear difference between groups emerged (Table 2). The majority of the psychology students preferred photographs with the same person but most of the children had no apparent preference. Among those few children who did sort unidimensionally, there was a slight preference for the same person (Table 2).

Emotions. In the emotion condition there were more subjects in both groups preferring the same facial expression. This was

Table 1. Snowflakes. Number of subjects preferring form, colour or neither dimension

	Form	Colour	Mixed
Children ($n = 20$)	14	5	1
Psychology students ($n = 18$)	13	1	4

$\chi^2 = 5.17$; $df = 2$; NS

Table 2. Wigs. Number of subjects preferring person, wig or neither dimension

	Person	Wig	Mixed
Children ($n = 21$)	5	2	14
Students ($n = 16$)	13	0	3

$\chi^2 = 12.33$; $df = 2$; $P < 0.005$

Table 3. Emotions. Numbers of subjects preferring person, emotion or neither dimension

	Person	Emotion	Mixed
Children ($n = 19$)	4	8	7
Students ($n = 16$)	2	8	6

$\chi^2 = 0.68$; $df = 2$; NS

slightly more pronounced for the students than for the children but the difference between groups was not significant (Table 3).

Discussion

(a) Snowflakes. In agreement with the literature on form vs colour preference (Suchman and Trabasso 1966), we found a clear dominance of form over colour in both groups on the Snowflake task. Since our children were beyond the age of 4 years 7 months, at which transition from colour to form occurs, this was to be expected.

The snowflakes were included to detect possible differences in general sorting behaviour between groups. No difference was found. The remaining differences between groups can therefore be attributed to the content of the social stimuli.

(b) Wigs. On the wig task, the results for the students were quite clear-cut: an almost exclusive preference for "same person" with no subject preferring "same wig". All of these students were in their early twenties. At that age they have had vast opportunities to encode and store unknown faces. The configurational strategy for face recognition is well developed. Therefore, it is not surprising that they rely on person identity in this task.

The children behaved quite differently. The wig condition was the only one where the majority of the subjects (two-thirds) showed mixed behaviour, i.e. no preference. This finding is consistent with the literature on the "piecemeal" strategy to encode unfamiliar faces. In agreement with Diamond and Carey (1977), we found that this strategy is not only used for memory tasks, but it also guides a child's attention in matching tasks. Despite substantial procedural differences between the Diamond and Carey study and our own (garments vs wigs; instructions to identify the same person vs sorting by preference, and hence error rates vs preferred choices), our results are quite similar.

(c) Emotions. In the third condition, there was no difference between the children and the students. Most subjects in both groups sorted by emotion. Admittedly, the number of "mixed" preferences was rather large, and several subjects in both groups preferred person identity to expression. Note, however, that the number of subjects with person preference was lowest in both groups.

Comparing the wig and the emotion conditions, we found quite different response patterns. If person identity and an irrelevant aspect such as hairstyle compete, adults prefer person identity and children have no preference at all. However, if the competing dimension is an emotional expression this is attended to by both adults and children, and both groups prefer the same emotions over the same persons. Although 5-year-old children do not discriminate between individual faces and hairstyles, they do show the same preference for emotions as adults.

The results of Savitsky and Izard (1970) support this finding and add further information about the comparison between paraphernalia and facial expression. In a preference task where person identity was held constant, they found with children from age 5 onwards a preference for expression that increased with age, whereas the paraphernalia choices decreased.

What is the reason for this shift in preference from wigs or persons to expressions? It could be argued that emotion preference – in analogy to wig preference – is due to the "piecemeal" strategy. There are two reasons why this is unlikely: (1) the students in our study were far beyond the age at which this strategy is generally observed. Furthermore, they showed no evidence of such a strategy in the wig condition. There is no reason then why they should apply this strategy here. (2) Since emotional expressions extend to the entire configuration of a face (e.g. corners of mouth up, lips retracted, eyes narrowed, eyebrows rounded for a full smile), it is difficult to imagine how a "piecemeal" mode of encoding would deal with this.

In conclusion, faces are perceived and attended to in quite different ways, depending upon the context. If a person's identity is a critical dimension, children will rely on different features and strategies than adults. However, if the expression of emotional signals is involved, both adults and children will attend more to this dimension than to features of a person's identity. Even in a sorting task with picture cards, emotional expressions tend to dominate over other social cues, underlining how much normal children rely on this kind of information. This probably reflects the greater relevance of emotional signals from early on. A final example shall help to illustrate the importance of facial expressions.

The term "social referencing" is used to describe the phenomenon that individuals confronted with an event with which they have had no prior experience tend to seek information from another person's face, voice or gestures to reduce ambiguity. Klinnert et al. (1983) demonstrated this phenomenon with 12-month-old toddlers. The child was seated at one end of a table with a visual cliff (i.e. a sharp drop covered with a thick sheet of glass) in the middle. The toddler's mother stood at the other end of the table. Half of the mothers were instructed to show a happy face (thus inviting the child to cross the table), and the other half a frightened expression. Almost all of the children with "happy" mothers went across the visual cliff to the other end of the table, whereas none of those with "frightened" mothers did. It is conceivable that children who are unable to pay attention to their mothers' facial expression or who cannot understand it will probably be heavily impaired not only in their affective relationship with their parents but in their exploratory and cognitive development as well.

There is one group of children with severe behavioural disorders, namely autistic children, where both social and cognitive/language development are heavily impaired. Many of these children have been reported by their parents to show abnormal reactions towards social stimuli (e.g. lack of eye contact, no smiling at or greeting of parents) even during the very first months of life. The importance of social stimuli for a child's development has already been indicated; however, the significance of these cues is not automatically correlated with a child's attention towards them. Apparently there is a group of children who fail to perceive or to attend to social

stimuli from early on. It would therefore seem necessary to investigate the ability of autistic children to perceive such stimuli before accusing the parents of educational and affectional failure.

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