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Impaired Categorical Perception of Facial Expressions in High-Functioning Adolescents with Autism

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ABSTRACT

Categorical perception of facial expressions is studied in high-functioning adolescents with autism, using three continua of facial expressions obtained by morphing. In contrast to the results of normal adults, the performance on the identification task in autistic subjects did not predict performance on the discrimination task, an indication that autistic individuals do not perceive facial expressions categorically. Performance of autistic subjects with low social intelligence was more impaired than that of subjects with higher social IQ scores on the expression recognition of unmanipulated photographs. It is suggested that autistic subjects with higher social intelligence may use compensatory strategies that they have acquired in social training programs This may camouflage the deficits of this subgroup in the perception of facial expressions.

Research on the perception of facial expression in autistics over the last 10 years has suggested a face processing deficit in this population. The area that has received most attention is that of the autistics' ability to process facial expressions (e.g., Davies, Bishop, Manstead, & Tantam, 1994; Hobson, 1986a, b; Hobson, Ouston & lee, 1988; Langdell, 1978). This special interest in expression perception is not surprising, given Kanner's (1943) statement that autistic children ''have come into the world with the innate inability to form the usual biologically provided affective contact with people''. Normally, a facial expression is recognized easily. Not only is this the case across different cultures (Ekman, 1984, 1994), but infants recognize facial expressions very early on (Meltzoff & Moore, 1977; Markham & Adams, 1992). According to Hobson (1993), autistics are impaired in those 'primary representations' that are relevant for socio-emotional and especially affective interpersonal relations. Such a view on autism would fit a perspective that supposes a biologically endowed ability for expression recognition. Etcoff and Magee (1992) sum up several lines of evidence that support this suggestion. For example, animal studies have found neurons that are selectively sensitive to expressions (Hasselmo, Rolls, & Baylis, 1989; Perrett, Smith, Potter, Mistlin, Head, Milner, & Jeeves, 1984), patients with brain injuries can be selectively impaired on expression recognition (Bruyer, Laterre, Seron, Feyereisen, Strypstein, Pierrard, & Rectem, 1983; Etcoff, 1984; Campbell, Landis & Regard, 1986), and infants as young as 12 days old imitate facial expressions (Meltzoff & Moore, 1977).

The recognition of facial expressions is only one of the dimensions of face recognition (Bruce & Young, 1986). Facial speech analysis (lip reading), directed visual processing (for selective attention to certain aspects of the facial structure) and familiar face recognition are taken to be expression-independent processes within the face encoding system. While the data converge

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towards an expression recognition deficit, it is hard to evaluate the relation between an impairment in the perception of expressions, possibly caused by a deficit in emotion perception, and other helpful, more structural aspects of face encoding. A supplementary source of difficulty is that autistics may use different face processing strategies. A review of available studies for disentangling expression recognition from other aspects of face processing illustrates how several factors may have been masking these strategies. To begin with, some paradigms are not sensitive to bring out different styles of processing. An example of this is the matching task, a widely-used method in face recognition. In the simplest version of this task subjects are asked to match photographs of facial expressions to a set of target photographs. Target and test photographs are usually not exact copies, but differ on other dimensions than expression, for example, orientation or identity. Performance on expression matching is then compared to performance on identity matching, and in some experiments also to matching objects (Braverman, Fein, Lucci, & Waterhouse, 1989) or symbols (Davies et al., 1994). Braverman et al. (1989) found in such a task that autistics made more errors on expression matching than a control group that was matched on nonverbal IQ. On identity and object matching the autistics did not differ. In a similar experiment, however, Ozonoff, Pennington & Rogers (1990) found that autistics were not only worse on expression matching, but also on identity matching and matching a face to an affect-laden situation (such as two children fighting). Only on object matching were the autistics as good as their controls. In a sorting task used in the same study, autistics were only worse in sorting expressions and not in sorting identities, but this interaction was not significant. Davies et al. (1994) studied identity matching, expression matching and symbol pattern matching in high- and low-functioning autistics. They found that high-functioning autistics were worse on all tasks, while the low-functioning autistics did not differ from their controls. Teunisse and De Gelder (1994) did not find deficits in high-functioning autistics on an expression matching task that was part of a clinical test battery for face recognition.

In a more complex version of the matching task, the ability to generalize the affective meaning of a face to another domain, e.g., the voice, gestures or emotional context, is studied. Macdonald, Rutter, Howlin, Rios, Le Conteur, Evered, & Foistein (1989) found that adult autistics made more errors than their controls in matching a facial expression to an emotional context. In addition, Bormann-Kischkel, Amorosa and von Benda (1992) found that both low- and high-functioning autistics were less able than their controls to match a vocal expression to the appropriate facial expression. However, in these experiments there was no non-emotional control task. Hobson (1986a, b), who used a cross-modal task with objects as a control, found that autistics were impaired in choosing the appropriate drawings and photographs of facial expressions that go with videotaped gestures, vocalizations and contexts. Normal performance on the non-emotional control task suggests that this impairment was not general, but specific for affective stimuli. In a replication of this experiment by Prior, Dahlstrom & Squires (1990) however, no impairments were found in autistics. On the other hand, Ozonoff et al. (1990) found that autistics were not only worse in a condition where photographs of facial expressions had to be matched to sounds with emotional intonation, but also in a non-emotional condition where sounds had to be matched with common objects, animals and actions. This would suggest a more global perceptive deficit that is not exclusively dependent on affective processing. Van Lancker, Cornelius and Kreiman (1985) presented neutral sentences which were spoken in different emotional intonations. They had to be matched to either line-drawings representing the meaning of the sentences, or to line-drawings of facial expressions that corresponded to the intonation. Older autistics made more errors than their controls on the emotional matching task, while the younger autistics were worse than their controls on the linguistic task.

A study of Hobson et al. (1988) makes clear that performance in a matching task can be the result of different face processing strategies. In the original matching task of expression and identity, no differences were found between autistics and mentally retarded controls. However, when parts of the face (first the mouth, then also the forehead) were blanked out, there was a greater decline in performance on expression matching for the autistics than for the controls, while this decline was the same for both groups in the identity matching task. Moreover, correlations between identity and expression matching were higher for autistics, suggesting that autistics might be processing facial expressions in a 'non-emotional' way.

A further indication that faces may be processed qualitatively different in autistics was found in a second experiment of Hobson et al. (1988) where full photographs were presented upside-down. Although both groups made more errors in this condition, the autistics performed better than the controls on both expression matching and identity matching. This relatively good performance on inverted faces in autistics was also found in two other studies. Langdell (1978) presented familiar faces upside-down and in several masking conditions. Subjects of two age levels (10 and 14-years-old, respectively) were asked to name the faces. In the inverted condition, young autistics were not different from their controls, whereas older autistics had a superior recognition ability in this presentation mode. The masking conditions revealed that all autistics paid more attention to the lower half of the face than their controls. Tantam, Monagham, Nicholson and Stirling (1989) found that autistics, relative to retarded controls, made more errors in a multiple choice task on labeling expressions, while they were not different in labeling objects. However, when the facial expressions were presented upside-down, autistics, in contrast to the controls, did not drop in level of performance.

Other studies suggest that autistics are not blind to expressions in a face, but that expressions are less salient to them. Weeks and Hobson (1987) found that, relative to mentally retarded controls, autistics prefer to sort photographs of faces by type of hat to sorting by facial expression. Many autistics did not sort by expression at all, even if this was the only discriminant feature of the stimuli or when they were explicitly asked to do so. In a similar experiment of Bormann-Kischkel et al. (1992), low- and high-functioning autistics had to select out of 3 cards 2 exemplars that go together. In every task there were two ways of selecting: snowflakes by color or form, faces by identity or type of wig, and faces by identity or expression. High-ability autistics preferred identity over expression, while the controls had the opposite preference. Low-ability autistics showed no preference. Autistics were not different from controls in preferring form over color and identity over type of wig. Tantam et al. (1989) asked autistics to select the odd picture out of four exemplars. In one condition a face was considered odd because it had a different expression, in the other condition a different identity was the criterium for oddness. The subjects were not told the criterion. Relative to retarded controls, autistics were worse on both tasks.

Although, these experiments show that there is clearly something special in the way autistics look at facial expressions, results are not consistent. Even when the same paradigm is used, conflicting results are found. Furthermore, there is important variability within the group autistics. Age, level of functioning, verbal and non-verbal intelligence influence task performance. Beyond such differences there is a different source of intra group differences that may at least indirectly affect performance. Most autistics get special education, which includes training to improve their communication skills in social situations. An important part of this education is learning to recognize facial expressions. As a result of such tutoring many autistics, especially the high-functioning autistics, may acquire compensation strategies for their deficit and as a consequence perform well in tasks of explicit expression recognition (De Gelder, 1987). The representations and processes sustaining compensatory recognition of facial expressions may be different from what is commonly envisaged in models of normal face recognition. One critical way in which compensation strategy-based expression perception would differ from its natural or primitive counter part might be that the latter but not the former would be based on prewired expression categories in the organism. This brings us to the paradigm used in the present study.

In the domain of speech research the categorical perception paradigm has extensively been used to argue for basic perception categories

(Repp, 1984, for a historical overview). Etcoff and Magee (1992) adapted this paradigm to find evidence for the hypothesis that an innate mechanism for expression recognition is tuned to facial configurations presenting some basic expressions. These would be the expressions that are perceived categorically. They constructed several expression continua of line-drawings from one expression to another and found categorical perception for happiness, sadness, fear, anger and disgust. In a recent study, De Gelder, Teunisse and Benson (1997) applied the same methodology with photo-realistic stimuli instead of drawings. They found evidence for categorical perception of emotional expressions in both adults and children.

In this paper, the categorical perception in high-functioning autistics is studied using the same materials and methodology as De Gelder et al. (1997). Three continua are used: angry–sad, angry–afraid, and happy–sad. Performance of the autistic group is compared with the results of normal adults, but also variance between autistics will be discussed by considering sub-groups based on age, verbal IQ, non-verbal IQ and social IQ. The latter analysis can help understand what factors influence task performance on expression recognition in autistics.

METHOD

Subjects

A total of 17 autistic subjects (13 male and 4 female) participated in this experiment. A total of 24 normal adults (12 male and 12 female; mean age 21.3 years, range 18–29) completed the angry–sad continuum, and 24 other normal adults (12 male and 12 female; mean age 20.9 years, range 18–26) completed the other two continua.

Autistic subjects were drawn from an institute for non-retarded autistic adolescents. They satisfied the diagnostic criteria for the autistic disorder according to DSM-IIIR (1987). Raven's matrices (Raven, 1960) were administered as a measurement of visuospatial intelligence. Verbal abilities were tested with the sub-test 'woordenlijst' (wordlist) of the Groninger Intelligentie Test (Luteijn & van der Ploeg, 1983). Social intelligence was tested with the Social Interpretation List (Vijftigschild, Berger & van Spaendonck, 1969) and WAIS Picture Arrangement. Social IQ was positively correlated with GIT-wordlist ($r = .62$, $p < 0.01$). No other correlations were significant. Table 1 shows the details for the autistic group.

Table 1. Details of the Autistic Subjects ($N = 17$; 13 Male, 4 Female).

	M	(*S.D.*)	Range
Age	19y;5m	(2y;2m)	16y;1m-24y;8m
Raven raw score	40.65	(7.83)	25–55
GIT-wordlist raw score	8.70	(4.70)	1–17
Social IQ score	92.94	(17.05)	50–115

Influence of age, verbal IQ, non-verbal IQ and social IQ was studied by dividing the autistic sample in three sub-groups for each variable. As the population size is only small, only sub-group effects that are found in all three continua are considered to have a reliable mediating influence.

The sub-groups were formed as follows:

Age-groups: 6 younger (16;1–18;2), 5 middle (18;7–20;8) and 6 older (20;7–24;8) subjects;
Raven-groups: 6 low (25–37), 6 middle (38–43) and 5 high (45–55) scoring subjects;
GIT-groups: 6 low (1–5), 5 middle (7–11) and 6 high (12–17) scoring subjects;
Social IQ-groups: 6 low (50–85), 5 middle (90–100) and 6 high (105–115) scoring subjects.

One male autistic subject (20;8 years old; Raven score 38; GIT score 12; Social IQ score 100) was not available for testing on the angry–afraid and the happy–sad continua, and one other male autistic subject (24;8 years old; Raven score 36; GIT score 12; Social IQ score 85) was not available for testing on the happy–sad continuum.

A group of 4 of the 17 autistics on the angry–sad continuum had an 50% identification point that fell outside the 0–10 range, and were excluded from further analyses. One autistic on the angry–afraid continuum had a 50% point of 0.87. His data were used for analyses of the identification task, but as it was not possible to calculate a mean peak value, these data were not used for the discrimination analyses.

Materials

Stimuli were computer generated black and white photographs representing a continuum of facial expressions. The continuum was created by a morphing program (Benson & Perrett, 1991; Benson, 1994). The prototype expressions were taken from a standardized set (Ekman & Friesen, 1976) and digitized. The morphing program created gradual changes from one prototype expression to the other. The result of the morph sequence was a continuum of 11 faces (2 prototype expressions and 9 intermediate faces, see appendix A). The computer grey-scale pictures were 9.5 cm × 6.3 cm.

Procedure

The autistic subjects were tested individually in a quiet room in the institute. The Commodore 369SX color monitor was place at a distance of 1.5 m from the subject (stimuli subtended a visual angle of 3.6 × 2.5 degrees). The experimenter ensured that attention was paid to the task.

Three expression continua were tested: angry–sad, happy–sad and angry–afraid. After first analyzing the results of the angry–sad continuum, it was decided to adapt the step size of the ABX discrimination task from 3 to 2 steps for the happy–sad and angry–afraid continua, that were tested some months later.

The experiment consisted of successively the ABX discrimination task and the identification task.

In the ABX discrimination task, 800 ms after an auditory warning signal three successive pictures were shown for 1 second, separated by 1 second intervals. The first 2 pictures (A and B) differed 3 steps along the angry–sad continuum, and 2 steps along the angry–afraid and happy–sad continua. The third picture (X) was identical to A or to B. Subjects indicated which picture (A or B) was identical to picture X by pressing one of two response keys labeled A and B. The time out period for reaction was 5 s for autistics, and 3 s for normal adults. Intertrial interval was 2 s. Since the AB points in the angry–sad continuum differed 3 steps, 8 comparisons could be made. In the angry–afraid and happy–sad continua 9 comparisons were made. Four combinations of every comparison were possible (ABA, ABB, BAA, BAB). Every combination was given 3 times, thus yielding a total of 96 randomized trials for angry–sad and 108 randomized trials for angry–afraid and happy–sad.

In the identification task, the same stimuli as in the ABX task were used, but they were presented one by one. Every photograph appeared for 1 s 800 ms after the auditory warning signal. The subject indicated by pressing one of two response keys what expression was shown on the photograph. Labels of the expressions 'kwaad' (angry), 'verdrietig' (sad), 'angst' (afraid) or 'vrolijk' (happy) were placed next to the buttons. Each of the 11 stimuli was shown 3 times in random order, giving a total of 33 trials. Time-out period was 5 s for autistics and 3 s for adults. Intertrial interval was 2 s.

The experiment started with verbal instructions of the ABX task and a practice session consisting of 10 trials. Once the task was understood the experimental task Started.

RESULTS

The total identification function (% responses) for each continuum appears in Figure 1a for the autistics and in Figure 1b for the adults. For each continuum, the identification responses of each subject were submitted to a logit transformation (Finney, 1964), which provided estimations of the 50% point and of the slope of the identification function at that point. The means of these two variables are given for each continuum in Table 2. To test if the identification curves have similar shapes for adults and autistics, for each continuum a repeated-measures ANOVA with Group (autist vs. adult) and Face (0 – 10) as experimental factors was carried out. A significant interaction Group × Face indicates a different shape for each group.

The ABX discrimination data were compared subject by subject to the prediction from the identification data. The most generally agreed manifestation of categorical perception is the occurrence of a peak in discrimination performance around the point on the continuum at which identification reaches 50%. To account for individual differences, the discrimination data of each subject were reduced to two values, one corresponding to the predicted peak and the other to regions of the continuum on either side of the peak. For angry–sad, where the AB points used in the ABX task were 2 steps apart, each subject's 50% identification point falls into two successive AB intervals, and the peak discrimination is supposed to fall in one of these. For instance for a subject whose 50% points is at 4.2, the peak must occur in one of the two intervals 3–5 and 4–6. We chose to consider the two intervals as containing the predicted peak. For happy–sad and angry–afraid, where 3-steps intervals were used in the ABX task, the predicted peak consisted of three AB intervals. Our test consisted in calculating for each subject two measures of discrimination performance: a 'peak performance' value which is the mean of the observed % correct

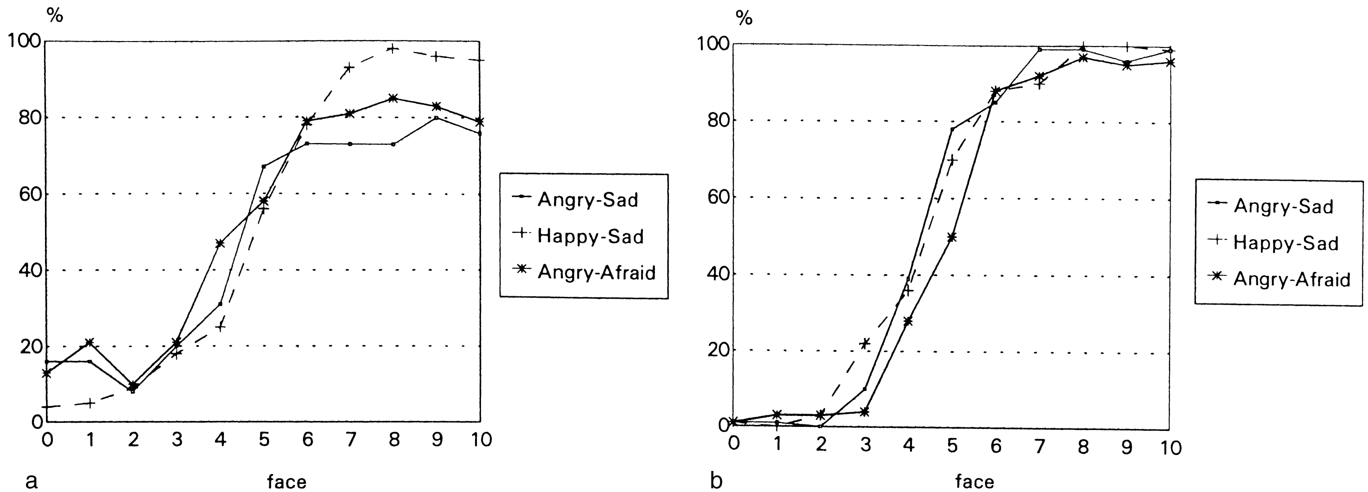

Fig. 1. Mean response percentages for the three continua in the identification task (percent 'sad' responses in the angry–sad and happy–sad continua, percent 'afraid' responses in the angry–afraid continuum). A. Autistics; B. Adults.

Table 2. Identification and Discrimination Results.

	Angry–sad	Happy–sad	Angry–afraid
A. Autistics			
Identification			
50% point	4.69	4.59	4.20
Slope	35.46	55.55	46.85
Discrimination			
Peak	67.4	57.8	68.7
Non-peak	66.9	61.0	66.1
t	.29	−1.07	.94
df	14	14	14
2-tailed *p*	.779	.301	.364
B. Adults			
Identification			
50% point	4.42	4.42	4.94
Slope	63.56	62.24	57.12
Discrimination			
Peak	81.1	73.5	81.7
Non-peak	74.6	68.0	76.0
t	3.16	2.28	3.27
df	23	23	23
2-tailed *p*	.004	.032	.003

responses over the peak intervals, and a 'non-peak performance' value, which is the mean of the same % correct over the remaining intervals. Significance was assessed using the *t*-test.

Table 2 shows that adults, as predicted by the categorical perception theory, show higher peak performance in each continuum whereas autistics do not show higher scores on the predicted peaks on any continuum.

The shape of the identification curve is different for adults than for autistics on angry–sad (interaction Group × Face: $F(10, 390) = 4.98, p < 0.001$) and angry–afraid ($F(10, 380) = 3.26$, $p < 0.001$). Not only the slope on the 50% identification point was less steep for autistics, but also the scores on the endpoints of these continua were less extreme (Fig. 1). The identification curve of happy–sad was not different for both groups.

RTs in both the identification and the ABX task were submitted to subject by subject analysis following the same principle as the correct discrimination data. For identification, the prediction for categorical perception was slower RT for the two photographs on either side of the 50% point (the 'peak RTs') than for the other items. Figure 2 shows the RT identification functions. The results which appear in Table 3 support the prediction for both groups on all three continua.

For the ABX task, the prediction was shorter mean RTs for the two 'peak intervals' than for 'non-peak' ones. For both autistics and adults, it was supported for none of the three continua.

There were important differences within the autistic group as the identification curves for angry–sad and angry–afraid were deviant for some autistics but not for all. Subgroup analyses revealed that only autistic subjects with a low social IQ score showed the deviant pattern (Fig. 3). The Social sub-group × Face interaction was significant for both angry–sad ($F(20, 140) = 2.54$, $p < 0.001$) and angry–afraid ($F(20, 130) = 2.14$, $p < 0.01$).

No sub-group effects were found on the happy–sad continuum, but even there the slope of the function is correlated most with social IQ (Table 4). These results seem to indicate that social IQ is an important mediating factor in the performance on the identification task.

Some other sub-group effects were also found, but these were not replicated in other continua. On

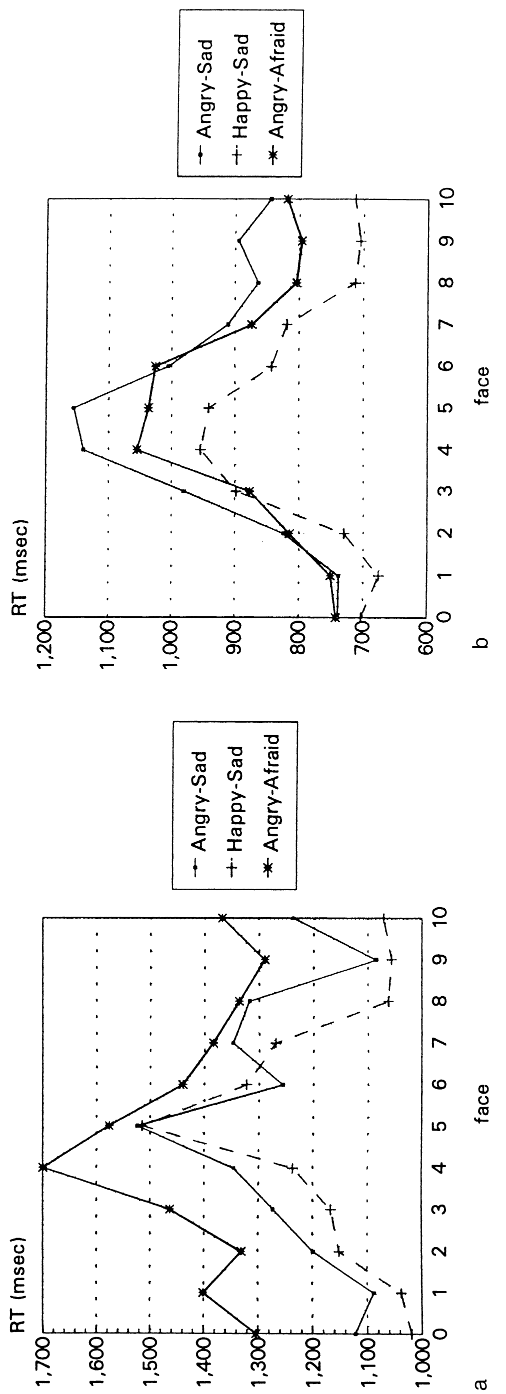

Fig. 2. Mean reaction times for the three continua in the identification task. (a) autistics; (b) adults.

Table 3. Mean Identification Reaction Times for 2 Photographs Around the 50% Identification Point and All Other Points Together.

	Angry–sad	Happy–sad	Angry–afraid
A. Autistics			
50%	1404	1443	1664
Rest	1221	1114	1363
t	2.19	5.31	3.38
df	16	14	15
2-tailed *p*	.044	.000	.004
B. Adults			
50%	1164	982	1043
Rest	866	748	837
t	5.91	7.31	6.57
df	23	23	23
2-tailed *p*	.000	.000	.000

Table 4. Correlations Between Slope of the Identification Function and Autistic Sub-Groups (*$p < 0.05$).

	Angry–sad	Angry–afraid	Happy–sad
Age groups	−.05	−.05	.00
Nonverbal score groups	.25	.50*	.19
Verbal score groups	.50*	.32	.34
Social IQ groups	.55*	.50*	.44

the angry–sad continuum there was a small effect of age ($F(2, 10) = 4.09$, $p < 0.05$) on performance in the discrimination task, with best performance for the oldest sub-group. A GIT-group × ABX Peak-performance interaction ($F(2, 12) = 5.54$, $p < 0.020$) on the angry–sad continuum suggests that only autistics with a low verbal IQ score show a higher peak performance in the discrimination task. These findings are not replicated in the other continua and will therefore not be considered here as reliable effects.

DISCUSSION

The main goal of this study was to investigate whether autistics perceive facial expressions categorically as do normal children and adults. An ABX discrimination task and an identification task were administered to the subjects, using photo-realistic stimuli of three expression continua. The finding that discrimination performance in high-ability autistic adolescents was not predicted by identification performance suggests that they do not perceive facial expressions categorically. The RT results in the identification task seem to contradict this conclusion: on each continuum autistics had slower RTs for photographs around the category boundary. However, De Gelder et al. (in press) have shown that this RT effect is probably not related to categorical perception but instead to a dichotomy artefact or some other general-type mechanism. In a control condition they presented the same photographs upside-down to normal adult subjects, a manipulation that is known to distort the perception of facial expressions (Rock, 1988; Thompson, 1980). The results were similar to the present autistic data: no significant peak in the discrimination task and a slower RT around the category boundary in the identification task. The fact that the discrimination peak was found with photographs in the normal rightway-up orientation but not in the inverted mode rules out the dichotomy artefact hypothesis, which predicts that a peak will occur on any continuum. Furthermore, the fact that in the identification task a slower RT around the 50% point is found even when the photographs are presented upside-down makes it very unlikely that this peak is specific of categorical processing of emotions. These findings support the conclusion that the autistics in the present experiment did not process the facial expressions categorically.

It is interesting that the present results of the autistic subjects parallel the results of the normal subjects on inverted photographs in the study of De Gelder et al. (in press), i.e., no peak in the discrimination task and a slower RT around the 50% identification point. This parallel might indicate that in autistics there is no qualitative difference in the processing of normal rightway-up faces and of inverted faces. Experiments with autistics on inverted faces support this suggestion; while controls show a serious decrease in recognition performance when photographs are pre-

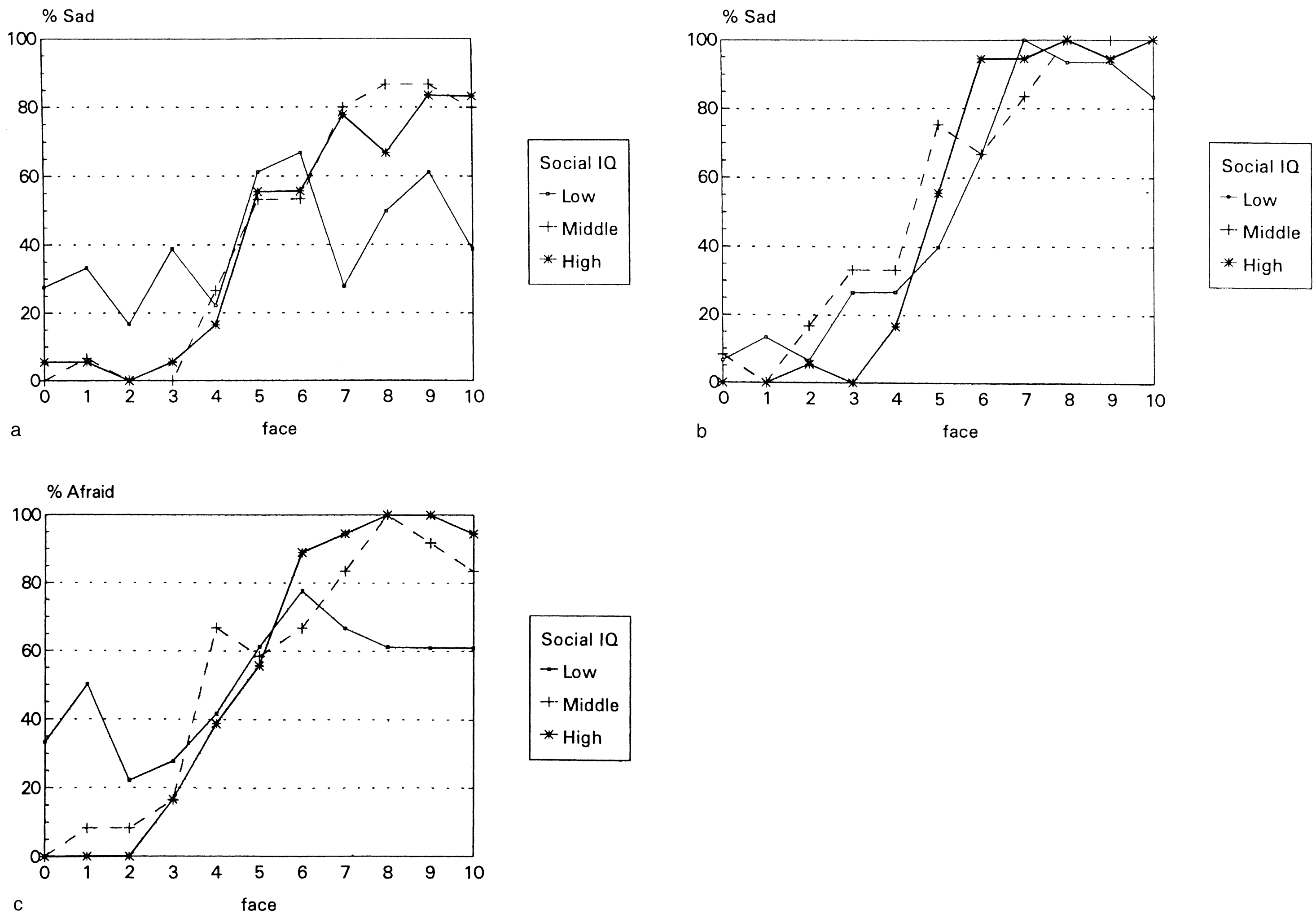

Fig. 3. Results of the Social IQ sub-groups on the Identification tasks; (a) angry–sad; (b) happy–sad; (c) angry–afraid.

sented upside-down, many autistics are influenced to a much lesser extend by inversion (Hobson et al., 1988; Langdell, 1978; Tantam et al., 1989; Teunisse & De Gelder, submitted for publication). In normal subjects, the processing style of inverted faces is qualitatively different from that of normal faces (Diamond & Carey, 1986). Recognition of facial identity and probably also of facial expression depends heavily on the configural information of the face. This configural information is less accessible when a face is presented upside-down. The finding that many autistics, particularly those with low social IQ scores (Teunisse & De Gelder, submitted for publication), do not show the usual drop in recognition performance suggests that they might use the configural information of a face to a much lesser extend. This might also explain the present findings, since it is very likely that categorical perception of expressions depends on configural information as well (De Gelder, Vroomen, & Popelier, 1996).

The robustness of the finding that emotional disorders in general and facial expression recognition in particular are impaired in autistic individuals contrasts with the increasing complexity of the behavioral and neurobiological findings. Clearly, single-factor approaches like the so called theory of mind explanations may appear ill suited to respond to this situation. Moreover, to the complexity arising from the multiple facets of the autistic impairments, another dimension must be added related to the ability of high-functioning individuals to benefit from behavioral adjustment training and from living in adaptive environments (Schreibman, in Lewin, 1995). Based on this ability compensation strategies are acquired.

This is the other aspect brought out in the present data. An interesting finding in the present experiment is that autistics with a low social IQ score showed a deviant pattern in the identification task on at least two expression continua; they had a poor recognition score for the prototypical expressions on the extremes of the expression continuum. In contrast, the autistics with higher social intelligence were very well able to recognize emotional expressions, even though their recognition was not based on categorical perception. This is a strong support for the suggestion that they use compensatory strategies, which might explain the sometimes confusing results in studies of expression recognition in autistics. The present findings show that one should not conclude too easily on basis of good test results that autistics have no impairments in the perception of facial expressions (see also, De Gelder, 1987). Compensatory strategies may have been camouflaging the perception deficit. Most autistics nowadays get explicit training in understanding social situations and facial expressions and this may not only improve their social IQ scores (Berger, van Spaendonck, Horstink, Buytenhuijs, Lammers, & Cools, 1993), but may also help them in developing compensatory strategies to handle their handicap. The fact that these trainings lead to a better intellectual understanding of social situations in some autistics does not automatically mean that they can successfully apply this knowledge when they find themselves in a daily life situation (De Gelder, 1987). Even autistics with a high cognitive level show maladaptive behavior in social situations in the real world (Freeman, Rahbar, Ritvo, Bice, Yokota, & Ritvo, 1991; Rumsey, 1985). Theoretical understanding of social situations does not guarantee empathical understanding. According to Hobson (1993), it is this inability for empathic understanding of the thoughts and feelings of other people that is the essence of autism. The present finding that autistics show an absence of categorical perception of facial expressions may very well be related to this deficit in empathic perception. Faces are perceived as affectively neutral stimuli, and only by the use of compensatory strategies autistic subjects may manage to understand, although only theoretically, the significance and meaning of an emotional expression.

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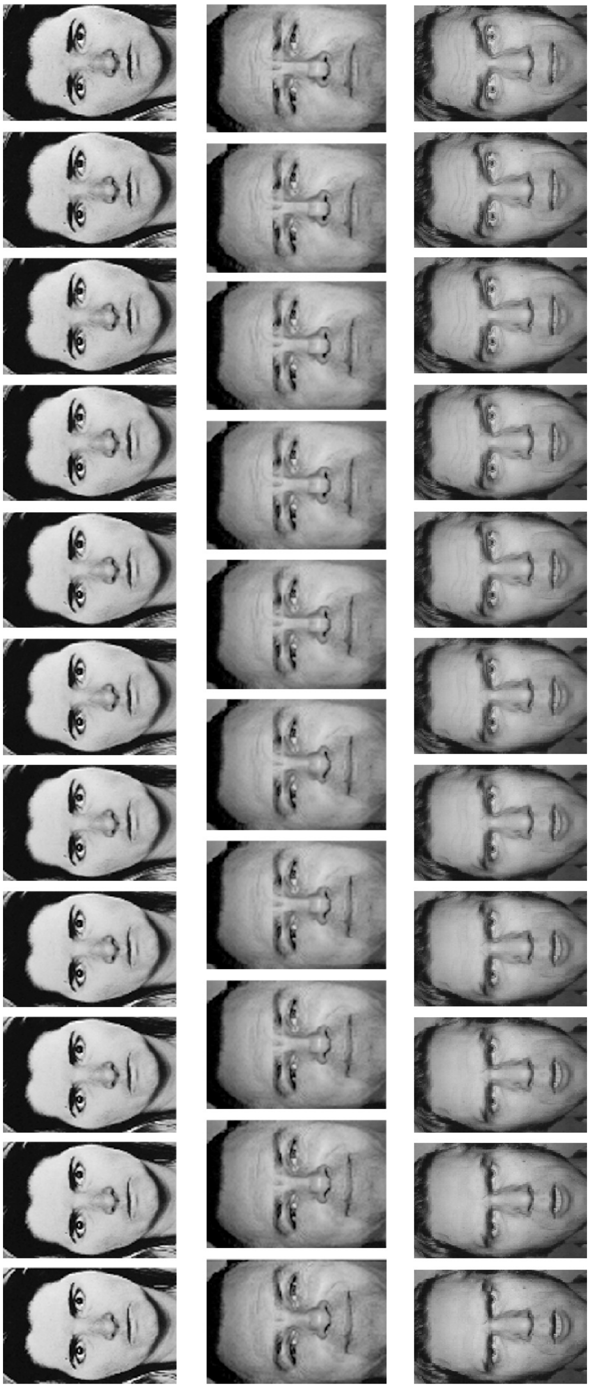

Appendix A Stimuli.