BACKGROUND
- Children naturally abstract typicality structures that represent how facial features vary across individuals in the population. They come to know which values of features are common or distinctive, and which values best represent categorical information such as age.
- This abstraction process of faces begins in infancy and develops through childhood.
- Previous research examining the face processing abilities of individuals with autism has indicated that both face processing and prototype formation abilities may be impaired; however, the relationship between these deficits has not been examined.

QUESTION
- Can children with autism abstract prototypical information from faces across various tasks in a manner analogous to that of typically-developing children?

PARTICIPANTS
Children with Autism who participated in this study were each previously diagnosed by a psychologist. All diagnoses were confirmed using the ADOS (Autism Diagnostic Observation Schedule).

DEMOGRAPHICS

<table>
<thead>
<tr>
<th></th>
<th>Group</th>
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<tbody>
<tr>
<td></td>
<td>Control</td>
<td>Autism</td>
<td></td>
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<td>Age (months)</td>
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<tr>
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<td>SD=9.3</td>
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<td>IQ</td>
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<td></td>
<td>SD=10.4</td>
<td>SD=15.3</td>
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STUDY 1: Gender Discrimination

STIMULI: Videos of 42 male and female faces
- Half rated as typical examples of each gender
- Half rated as less typical of each gender (can be categorized by control adults with 100% accuracy)
- Half showed the individuals with normal hair cues
- Half showed the individuals wearing backwards baseball caps that occluded hair cues

PROCEDURE
- Asked to press one of two labeled keys to indicate if the face was male or female

RESULTS
- Percent correct for control group was significantly higher than for autism group for typical stimuli and approached significance for less typical stimuli with hair cues.
- No differences were found for less typical stimuli without hair cues.
- NOTE: For comparison, data from a previous study conducted in our lab, which indicates that by age 8 control children are at nearly 100% accuracy, has been included.

STUDY 2: Recognition Memory

STIMULI: 12 color photographs of female faces
- Half rated as distinctive faces (memorable)
- Half rated as typical faces (less memorable)

PROCEDURE: Storybook Paradigm
1) Incidental familiarization with 12 faces (6 distinctive and 6 typical faces)
2) Delay period (no faces shown)
3) Surprise memory test with 24 faces (12 old faces & 12 new faces) in which children were asked to judge faces as old or new by pressing one of two labeled keys

RESULTS
- Scores were converted to d' to control for group response biases (i.e., false alarm rates).
- Control children showed a memory advantage for distinctive faces.
- Children with autism did not show a memory advantage for distinctive faces.

STUDY 3: Emotion Recognition

STIMULI: 4 expressions were presented dynamically with 4 levels of each emotion (from subtle to exaggerated). Each level of an emotion stimuli exhibited graded increases in the movement of appropriate facial muscles necessary to model the respective emotion.

PROCEDURE:
- Static Prototypes of each emotion were shown to establish baseline performance.
- If 100% baseline accuracy was reached, children were then shown each clip for 1000 msec before making a forced-choice response.

RESULTS:
- Overall, a trend was observed in how stimuli exhibited graded emotion stimuli exhibited graded.
- No differences were found for less typical expressions.
- This abstraction process of faces begins in infancy and develops through childhood.

CONCLUSIONS
- Individuals with autism do not appear to be abstracting and representing faces based on typicality information.
- Study 1 results indicated that individuals with autism have difficulty discriminating faces at the boundary of male/female categories. This difficulty may be due to an inability to discriminate subtle facial features and the failure to abstract prototypes for each category.
- Study 2 showed that individuals with autism do not have a notion of what makes a face distinctive, nor do they capitalize on distinctiveness to aid memory of faces.
- Study 3 results indicated that while children with autism were able to discriminate dynamic examples of emotional expressions, they generally required more exaggerated muscle movement in order to discern emotion. These results suggest a difficulty due to an inability to discriminate subtle expressions of emotion, perhaps due to the failure to form prototypical structures.

- Overall, these results suggest that individuals with autism do not develop an expertise with faces that are at the boundaries of categories. So even though they can perform these face processing tasks, their performance suffers when they are forced to discriminate subtle or difficult stimuli. One explanation for the inability to perform is that they are not representing faces within a typicality structure or abstracting specific and useful information about faces and how facial features and emotional expressions vary.

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