Perception of Dynamic Changes in Facial Expressions of Emotion in Autism

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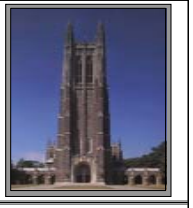
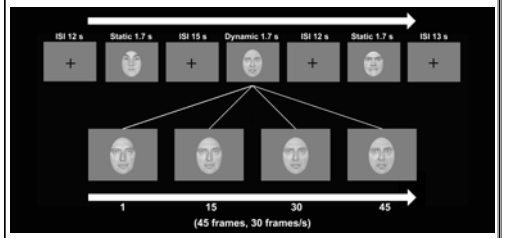


INTRODUCTION

Impairments in several aspects of face processing are striking features of autism (see Pelphrey et al., 2004, for a review). For example, studies of visual scanpaths indicate that people with autism spend less time looking at the eyes when viewing faces (Klin et al., 2002; Pelphrey et al., 2002). They also have difficulty identifying emotional characteristics of posed facial expressions (Adolphs et al., 2001; Pelphrey et al., 2002). Despite extensive behavioral descriptions of face processing abnormalities in autism, identification of the underlying biological mechanisms remains a critical and largely unmet challenge. Cognitive neuroscientists have started to explore the social brain in adults with autism. Functional neuroimaging studies have reported abnormal activity in components of the human face processing system, including the fusiform gyrus (FFG; e.g., Schultz et al., 2000), posterior superior temporal sulcus (STS; e.g., Pelphrey et al., 2005), and amygdala (AMY; e.g., Baron-Cohen et al., 1999). One limitation of the existing literature is the common use of static, posed snapshots of faces. These stimuli are relatively ineffective in eliciting physiological reactions and do not contain the dynamic facial information displayed in human social interaction. Here we sought to characterize the neural circuitry associated with the dynamic perception of facial affect and identity in individuals with and without autism. Building upon a prior study in neurologically normal adults (LaBar et al., 2003), we compared brain activity to dynamic and static facial expressions in adolescents and adults with and without high-functioning autism using an event-related functional magnetic resonance imaging (fMRI) design and three classes of face stimuli: emotion morphs, identity morphs, and static images.



METHODS

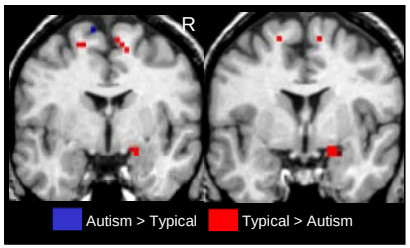
- Static images depicted prototypical fearful, angry, and neutral expressions.
- Identity morphs depicted shifts from one person to another, always with neutral expressions.
- Emotion morphs depicted expression changes from neutral to fear or anger, creating the illusion that the actor was 'getting scared' or 'getting angry' in real time.
- 8 right-handed subjects with high-functioning (full-scale IQ > 80) autism (2 females) were compared to 8 IQ- and age-matched neurologically normal subjects (2 females).
- Functional MRI at 1.5T: 34 axial slices were acquired using a gradient-recalled inverse spiral pulse sequence (Guo & Song, 2003) [TR: 1.5 s, TE: 30 ms, Flip Angle: 90°, voxel size: 3.75 × 3.75 × 4.0 mm, (64^2 matrix, 24 cm FOV)].

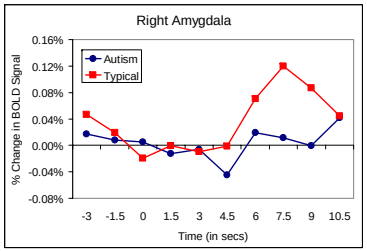
Subject Characteristics		
	Typically Developing	Autism
	n=8	n=8
Age, y	24.1 (5.6)	24.5 (11.5)
FSIQ Score	120 (9)	113 (11)
VIQ Score	118 (10)	114 (14)
PIQ Score	118 (9)	108 (15)
ADI-R Social Interaction		21(8)
ADI-R Communication-Verbal		15 (5)
ADI-R Communication-Nonverbal		10 (4)
ADI-R Rest-Rep-Stereo Behavior		6 (3)

RESULTS

1 A random-effects contrast of **Emotion Morphs vs. Static Emotions** revealed group differences in the response of the R **AMY**:

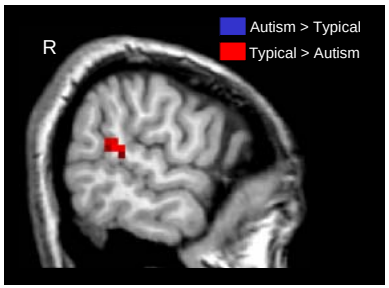
- Subjects with autism exhibited less R **AMY** activity to the Emotion Morphs.

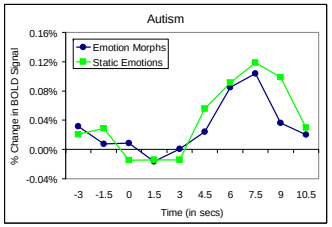


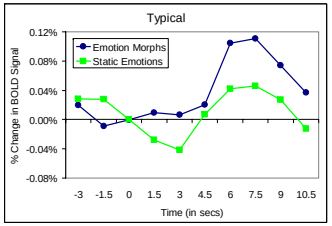


2 Comparison of **Emotion Morphs vs. Static Emotions** revealed a Group × Condition Interaction in the R **STS**:

- In individuals with autism, the R **STS** responded equally to emotion morphs and static emotions.

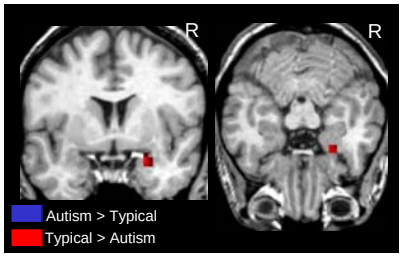


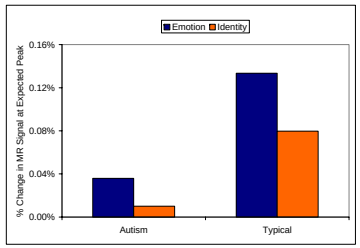




3 Comparison of **Emotion Morphs vs. Identity Morphs** revealed a Group × Condition Interaction in the R **AMY**:

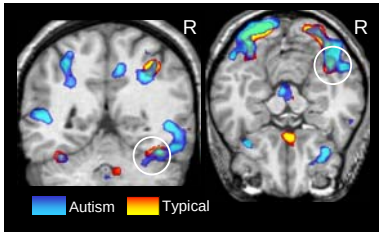
- Subjects with autism exhibited less R **AMY** activity and this activity did not differentiate identity and emotion morphs.

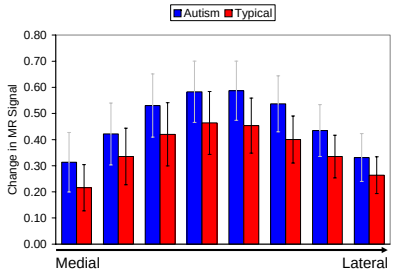




4 Examination of the responses in the R **FFG** revealed significant activity evoked by faces in each group across conditions.

- We examined the medial to lateral distribution of activity for faces in the R FFG and found no group differences, but note that we did not include non-face objects as a comparison condition.





CONCLUSIONS

- Subjects with autism exhibited three patterns of deficits relative to neurologically normal controls:
  - less activation to the emotion morphs compared to static emotions in frontolimbic areas including the R AMY,
  - lack of differential activation to emotion morphs and static emotions in the STS region, and
  - lack of differential activity to emotion and identity morphs in the R AMY.
- These findings further implicate two structures of the social brain, the R AMY and posterior STS region, in autism and thus advance our understanding of the neural basis of face processing deficits in this disorder.

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