What makes social signals special?
Or A long way back to autism research

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Challenges to the social cognition study

Eye contact does not facilitate detection in children with autism

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Abstract

Eye contact is crucial in achieving social communication. Deviant patterns of eye contact behavior are found in individuals with autism, who suffer from severe social and communicative deficits. This study used a visual oddball paradigm to investigate whether children with high functioning autism have difficulty in detecting mutual gaze under experimental conditions. The results revealed that children with autism were no better at detecting direct gaze than at detecting averted gaze, which is unlike normal children. This suggests that whereas typically developing children have the ability to detect direct gaze, children with autism do not. This might result in altered eye-contact behavior, which hampers subsequent development of social and communicative skills.

Keywords: Eye gaze; Direct gaze; Face; Autism; Oddball task

1. Introduction

Eye gaze direction conveys much information about the internal states of social partners. In particular, mutual gaze (eye contact) is an important signal of another's interest and intentions towards the perceiver (Gibson & Pick, 1963); it serves to establish a communicative context (Kleinke, 1986) and functions in the maternal-infant affective attachment (Harrington, 1984).
Eye contact does not facilitate detection in children with autism

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12:1 years, range 9:5–14:10 years; mean RCPM score 34.2, range 26–36) participated in this study. All of the children were Japanese, and all were students or graduates of a primary school that is attended by both autistic and typically developing children. Verbal informed consent was obtained from each child, his or her parents, and the school director. One child with autism refused to participate in the experiment and was excluded from the study. All of the children with autism met the DSM-IV criteria for autistic disorder (American Psychiatric Association, 1994), and all had been diagnosed with autistic disorder by at least one child psychiatrist when they entered the school. Japanese RCPMs (Raven, 1956; Sugishita & Yamazaki, 1993) were administered to all of the children to estimate their non-verbal cognitive ability, which might affect their performance in the task. All the children had normal or corrected to normal acuity. All the experiments were conducted with the children individually in a quiet room at the National Institute of Special Education, which is near their primary school.

2.2. Apparatus and stimuli

The experiment was run on a PC with a 17-inch color monitor using Neuroscan Stim software. The participants were seated approximately 130 cm from the monitor. The children's reaction time (RT) and accuracy were measured from their button-press responses.

A fixation point consisting of a central cross that subtended 0.5 8 appeared on the screen and the children were instructed to fixate on it before the experiment started. Color photographs of the laterally averted faces of three female models were cut into ovals (5 8 wide and 7 8 high) to produce one frequent and two rare stimuli for each model. Examples of each stimulus type are shown in Fig. 1. The frequent stimuli (Fig. 1, left) were faces glancing downward. The eyes of the rare stimuli were either in direct gaze (Fig. 1, center) or laterally averted (Fig. 1, right). Adobe Photoshop 7.0 software was used to produce each stimulus type.

Fig. 1. Examples of frequent and rare stimuli. Left: frequent stimulus. Center: rare stimulus (direct gaze). Right: rare stimulus (averted gaze).
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---3-item visual oddball paradigm

frequent  rare 1  rare 2  (direct)(averted)

Task: detect the target (rare 1/2), ignore the distractor (rare 2/1)
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3-item visual oddball paradigm

Brief article

Eye contact does not facilitate detection in children with autism

Frequent: TD\textsuperscript{a}

Rare 1: ASD\textsuperscript{a}, TD\textsuperscript{a}

Rare 2 (direct)(averted)

Task: detect the target (rare 1/2), ignore the distractor (rare 2/1)

△: TD

●: ASD
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**3-item visual oddball paradigm**

**Brief article**

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**Task:** detect the target (rare 1/2), ignore the distractor (rare 2/1)

**TD:** Direct > Averted

**ASD:** Direct = Averted

\[ \Delta: \text{TD} \quad \bullet: \text{ASD} \]
Next Questions (2004)

• Why are social signals not salient (or attention-grabbing) in children with ASD?
• What are the consequences of atypical social attention on social cognition / behaviour?
• Can we ‘normalise’ social attention in ASD?
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• Why are social signals not salient (or attention-grabbing) in children with ASD?
• What are the consequences of atypical social attention on social cognition / behaviour?
• Can we ‘normalise’ social attention in ASD?
To answer them, I first needed to answer…

- Why are social signals *salient* (or attention-grabbing) in *neurotypical* children?
- What are the consequences of *typical* social attention on social cognition / behaviour?
- What makes ‘*typical*’ social attention in *neurotypical* people?
Feedbacks I received:
Feedbacks I received:

Isn’t it obvious?
Feedbacks I received:

Isn’t it obvious?

It’s a trivial question. You should ask something more important.
Feedbacks I received:

Isn’t it obvious?

It’s a trivial question. You should ask something more important.

All you have to do is neuroimaging.
Feedbacks I received:

Isn’t it obvious?

It’s a trivial question. You should ask something more important.

All you have to do is neuroimaging.

It is a DEVELOPMENTAL question!
Feedbacks I received:

Isn’t it obvious?

It’s a trivial question. You should ask something more important.

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It is a DEVELOPMENTAL question!

What I do in the CBCD

The eye contact effect
What I do in the CBCCD

Typical adults

The eye contact effect
What I do in the CB CD

Typical adults

The eye contact effect

Acquired brain damage
What I do in the CBCD

- Infant development
- Typical adults
- The eye contact effect
- Acquired brain damage
What I do in the CBCD

- Infant development
- Typical adults
- Cultural differences
- Acquired brain damage

The eye contact effect
What I do in the CBCD

- Infant development
- Typical adults
- Cultural differences
- Acquired brain damage
- Infants of blind parents

The eye contact effect
What I do in the CBCD

Infant development

Typical adults

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Cultural differences

Acquired brain damage

Autism

Infants of blind parents
What I do in the CBCD

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- Infant development
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The effect of socio-cultural experience on the development of face/gaze processing
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- It is obvious that human eyes are salient because:
The effect of socio-cultural experience on the development of face/gaze processing

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  - Humans are equipped with (evolutionary) innate mechanism to respond to it
The effect of socio-cultural experience on the development of face/gaze processing

- It is obvious that human eyes are salient because:
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  - It is a primary ‘affective’ signal given by caregivers and hence reinforced
The effect of socio-cultural experience on the development of face/gaze processing

- It is obvious that human eyes are salient because:
  - Humans are equipped with (evolutionary) innate mechanism to respond to it
  - It is a primary ‘affective’ signal given by caregivers and hence reinforced
  - Is ‘saliency’ of the eyes dependent on early social experience?
Case 1: Sighted infants of blind parents
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- Sighted infants of blind parents experience qualitatively different visual communication with their parents
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- Sighted infants of blind parents experience qualitatively different visual communication with their parents.
- Measured their face scanning pattern at 7- and 14-months of age.
Sighted infants of blind parents: eye-tracking

Face scanning task

Sighted infants of blind parents: eye-tracking

Face scanning task

Sighted infants of blind parents: eye-tracking

Face scanning task

- Sighted infants of blind parents scanned eyes less, compared to controls
- But they did not show atypical development of social communication or autistic traits

Case 2: Cultural differences

- Canadian participants maintain longer eye fixation than Japanese participants (McCarthy et al., 2006, 2008)

- Western European and Eastern Asian participants have different cultural norms to direct and averted gaze (Argyle et al., 1986)

- Compared face scanning patterns between British and Japanese 10- and 16-months old infants, as well as adults
Cross-cultural study: eye-tracking

static

dynamic (speaking)

dynamic (expressive)

Haensel, Ishikawa, Itakura, Smith & Senju (under review)
Cross-cultural study: eye-tracking

Haensel, Ishikawa, Itakura, Smith & Senju (under review)
Cross-cultural study: eye-tracking

- More mouth look in British, more eye look in Japanese
- Pattern consistent across age range

Haensel, Ishikawa, Itakura, Smith & Senju (under review)
The effect of socio-cultural experience on the development of face/gaze processing
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- Development of social attention is plastic and adaptive to the individual social experience (familial, cultural)
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- The developmental adaptation to sociocultural experience seem to emerge from within the first year of life
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- Development of social attention is plastic and adaptive to the individual social experience (familial, cultural)
- The developmental adaptation to sociocultural experience seem to emerge from within the first year of life
- Would individuals with ASD adapt to sociocultural environment in their own ways? (e.g. Johnson 2017)
Cross-cultural Autism Research Consortium

UK-Japan Symposium for Autism Research
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