*CBCD 21st Anniversary Workshop*
*15-16 November 2019*

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

Atsushi Senju
*Birkbeck, University of London*

CBCD Centre for Brain and Cognitive Development

Birkbeck UNIVERSITY OF LONDON

MRC Medical Research Council

My CBCD “Farewell” Mug (2006)

ELSEVIER

Cognition 89 (2003) B43–B51

COGNITION

www.elsevier.com/locate/COGNIT

Brief article

# Eye contact does not facilitate detection in children with autism

Atsushi Senju[a,*], Kiyoshi Yaguchi[b], Yoshikuni Tojo[c], Toshikazu Hasegawa[a]

ELSEVIER

Cognition 89 (2003) B43–B51

COGNITION

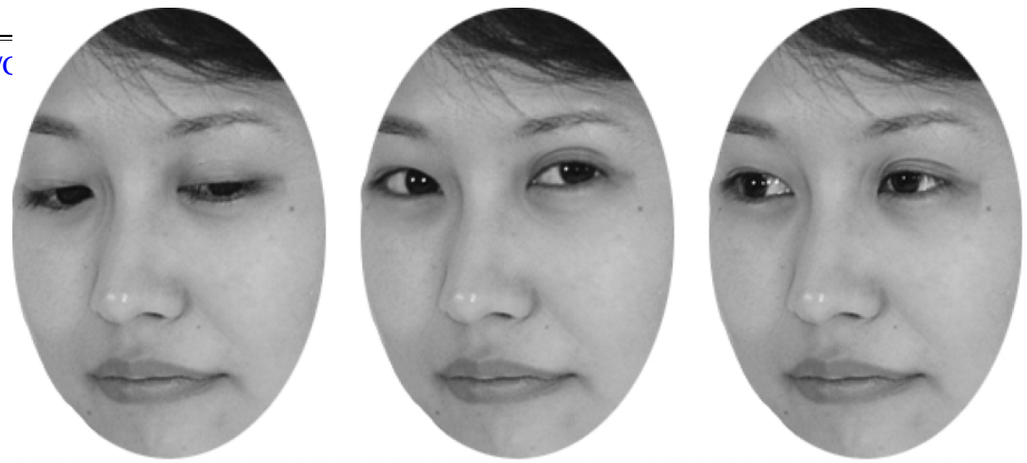
www.elsevier.com/locate/C

Brief article

# Eye contact does not facilitate detection in children with autism

Atsushi Senju[a,*], Kiyoshi Yaguchi[b], Yoshikuni Tojo[c], Toshikazu Hasegawa[a]

## 3-item visual oddball paradigm



frequent

rare 1 (direct)

rare 2 (averted)

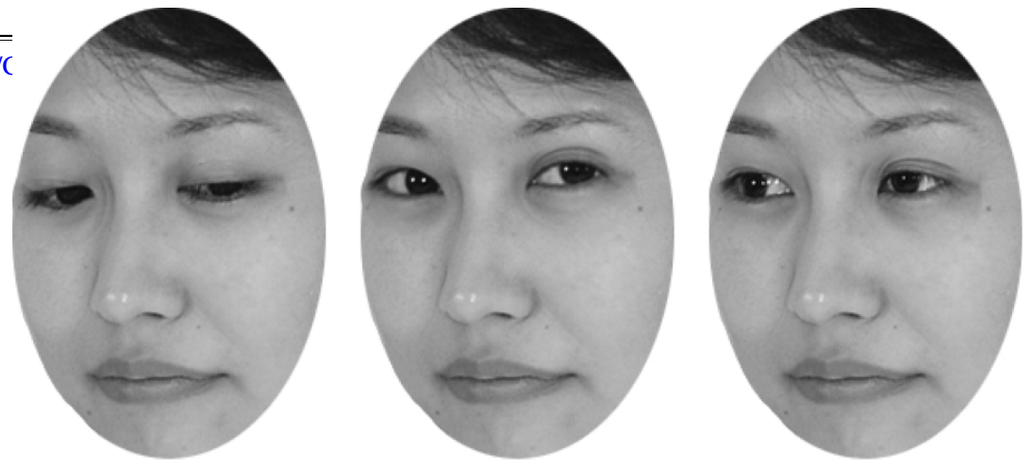
# 3-item visual oddball paradigm

ELSEVIER

COGNITION

Cognition 89 (2003) B43–B51

www.elsevier.com/locate/C



frequent rare 1 (direct) rare 2 (averted)

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

Brief article

## Eye contact does not facilitate detection in children with autism

Atsushi Senju[a,*], Kiyoshi Yaguchi[b], Yoshikuni Tojo[c], Toshikazu Hasegawa[a]

ELSEVIER

Cognition 89 (2003) B43–B51

COGNITION

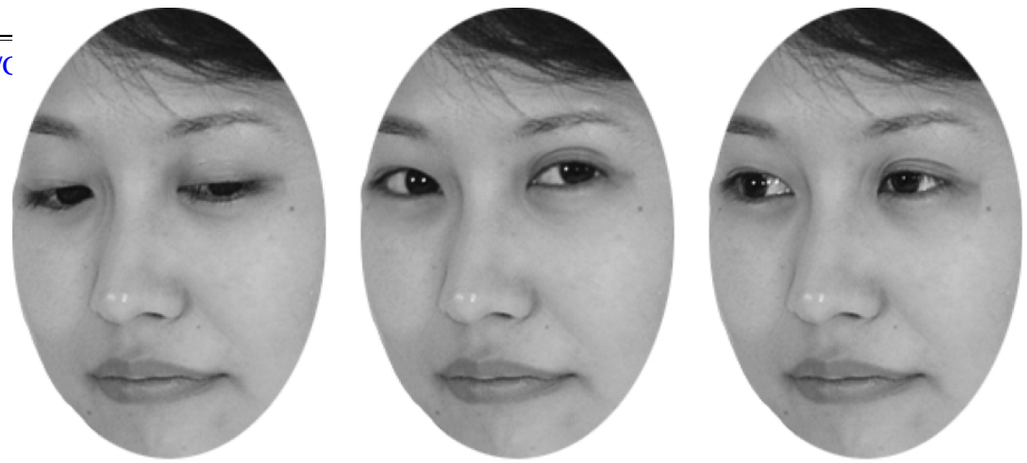
www.elsevier.com/locate/C

Brief article

# Eye contact does not facilitate detection in children with autism

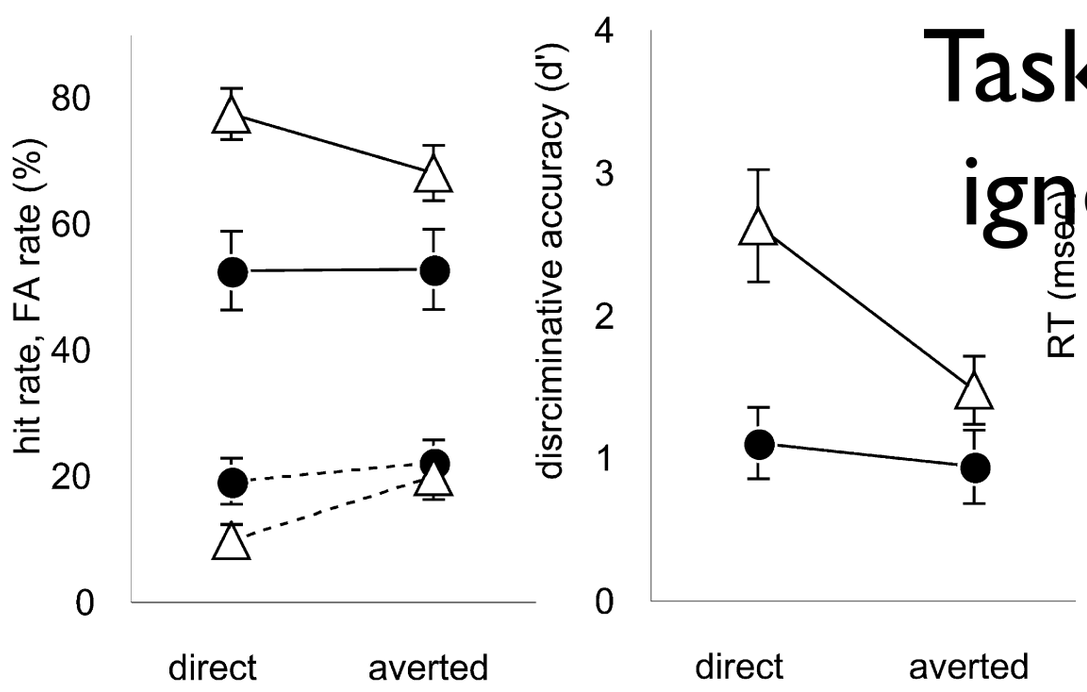
Atsushi Senju[a,*], Kiyoshi Yaguchi[b], Yoshikuni Tojo[c], Toshikazu Hasegawa[a]

## 3-item visual oddball paradigm



frequent　rare 1 (direct)　rare 2 (averted)

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




△: TD　　●: ASD

# 3-item visual oddball paradigm

ELSEVIER

COGNITION

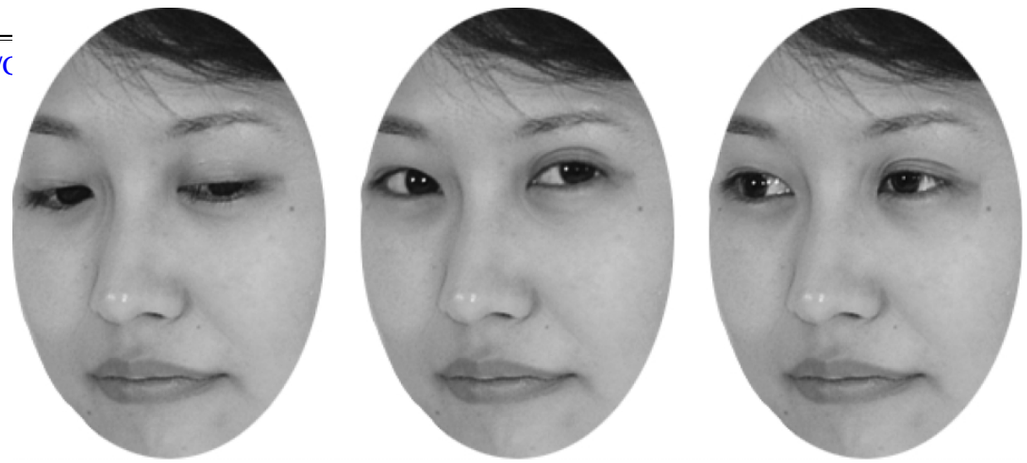
Cognition 89 (2003) B43–B51

www.elsevier.com/locate/C

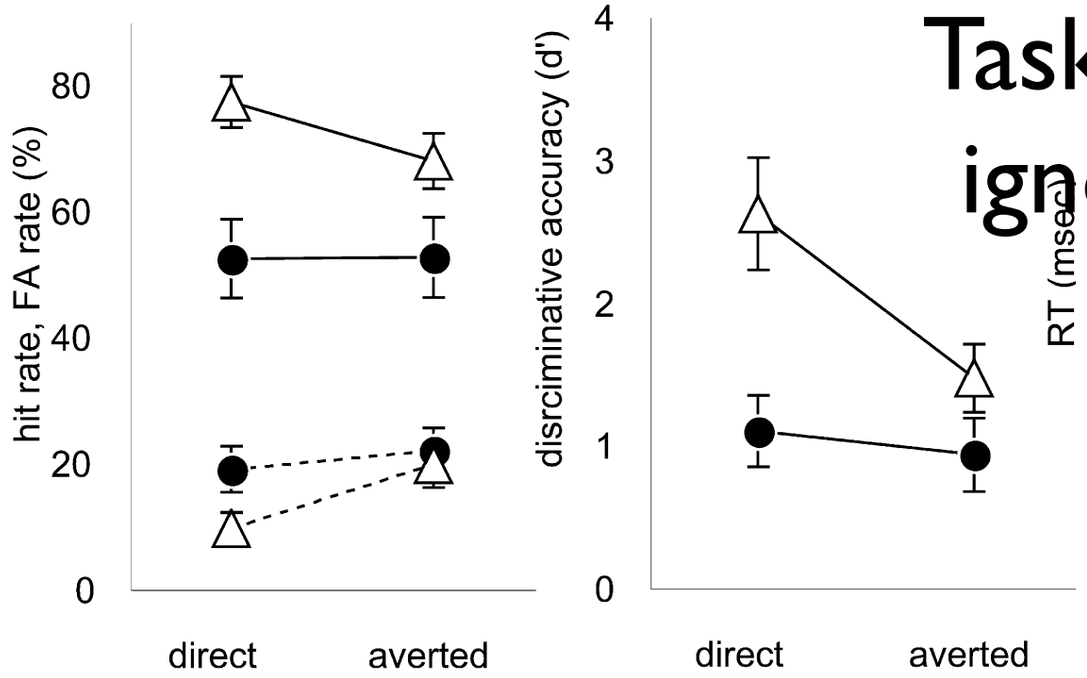
Brief article

## Eye contact does not facilitate detection in children with autism

Atsushi Senju[a,*], Kiyoshi Yaguchi[b], Yoshikuni Tojo[c], Toshikazu Hasegawa[a]



frequent　rare 1 (direct)　rare 2 (averted)




△: TD　　●: ASD

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

TD:　Direct > Averted

ASD: Direct = Averted

# 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?

# 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?

# 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.

All you have to do is neuroimaging.

It is a DEVELOPMENTAL question!
- *Johnson MH (2004)*

# What I do in the CBCD

**The eye contact effect**

# What I do in the CBCD

Typical adults

**The eye contact effect**

# What I do in the CBCD

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

**The eye contact effect**

Acquired brain damage

# What I do in the CBCD

Infant development

Typical adults

Cultural differences

**The eye contact effect**

Acquired brain damage

Infants of blind parents

# What I do in the CBCD

Infant development

Typical adults

Cultural differences

**The eye contact effect**

Acquired brain damage

Autism

Infants of blind parents

# What I do in the CBCD

Infant development

Typical adults

Cultural differences

**The eye contact effect**

Acquired brain damage

Autism

Infants of blind parents

# The effect of socio-cultural experience on the development of face/gaze processing

# The effect of socio-cultural experience on the development of face/gaze processing

- It is obvious that human eyes are salient because:

# 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

# 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

# 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

# Case 1: Sighted infants of blind parents

- Sighted infants of blind parents experience qualitatively different visual communication with their parents

# Case 1: Sighted infants of blind parents

- 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

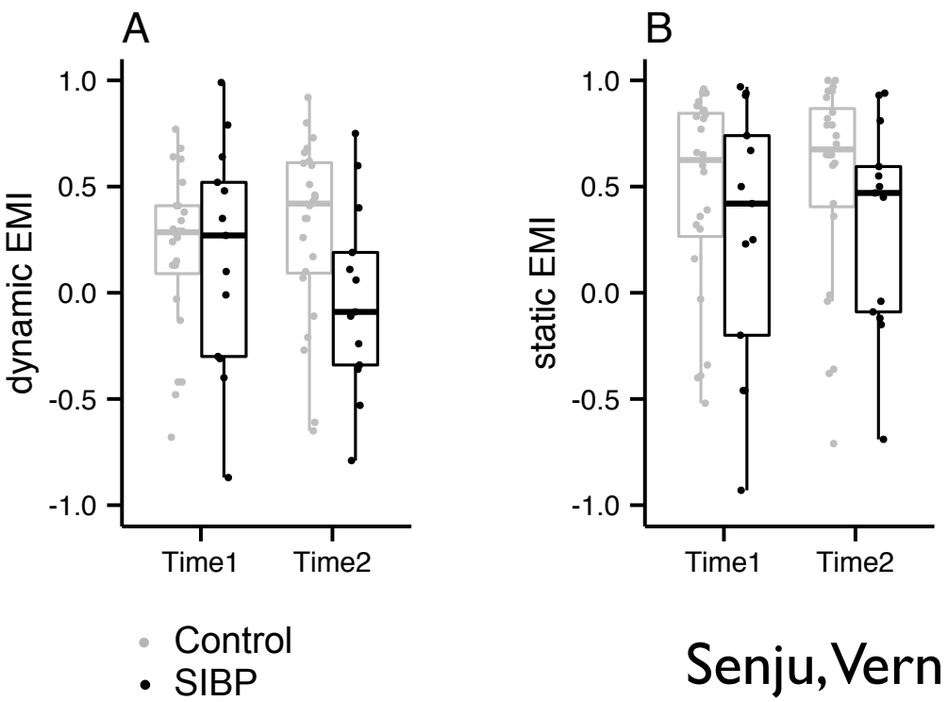
# Sighted infants of blind parents: eye-tracking

Face scanning task

Senju, Vernetti, Ganea, Hudry, Tucker, Charman & Johnson (2015) *Curr Biol*

# Sighted infants of blind parents: eye-tracking

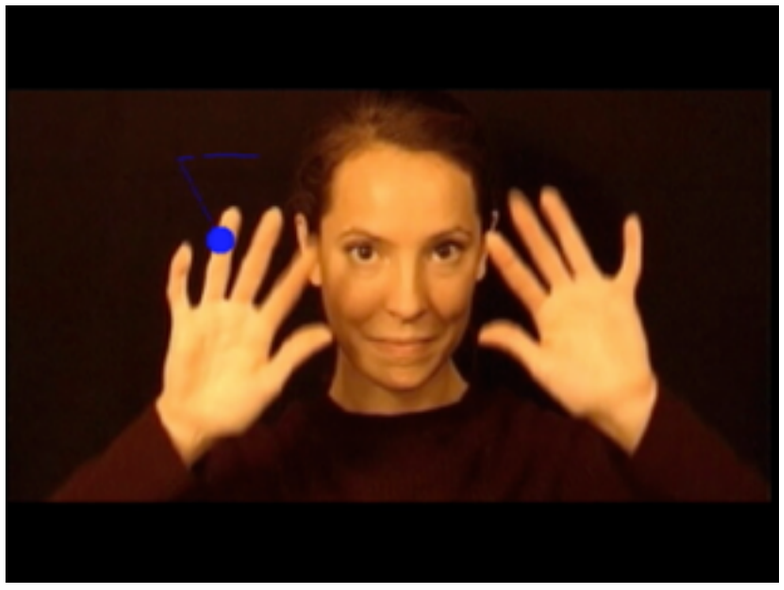
Face scanning task

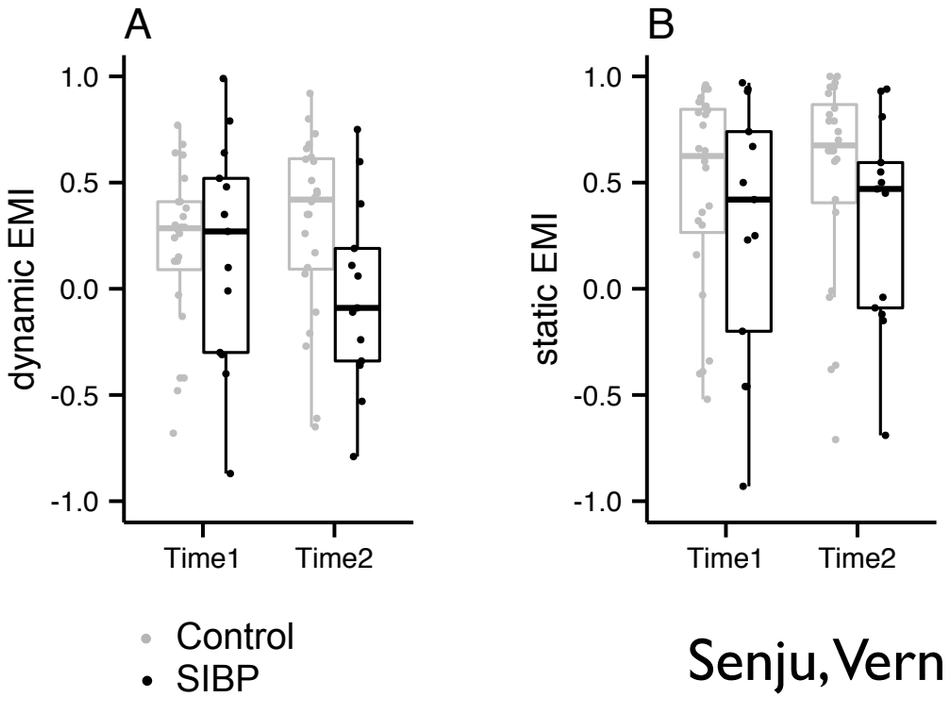



Senju, Vernetti, Ganea, Hudry, Tucker, Charman & Johnson (2015) *Curr Biol*

# Sighted infants of blind parents: eye-tracking

Face scanning task





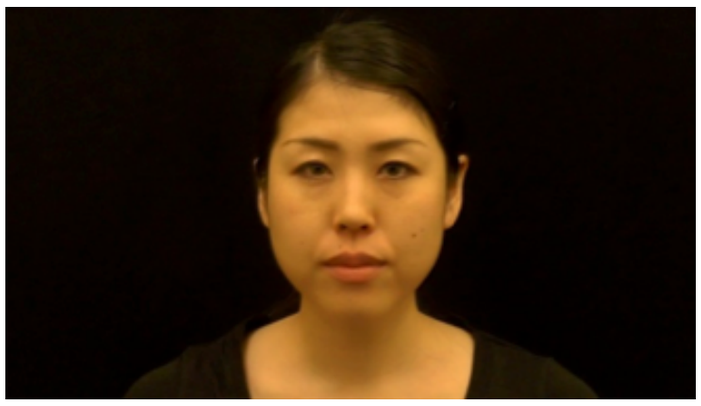

- Sighted infants of blind parents scanned eyes less, compared to controls
- But they did not show atypical development of social communication or autistic traits

Senju, Vernetti, Ganea, Hudry, Tucker, Charman & Johnson (2015) *Curr Biol*

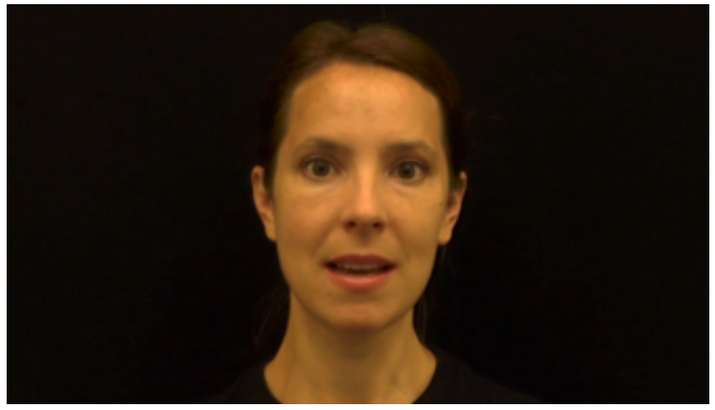
# Case 2: Cultural differences

- 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

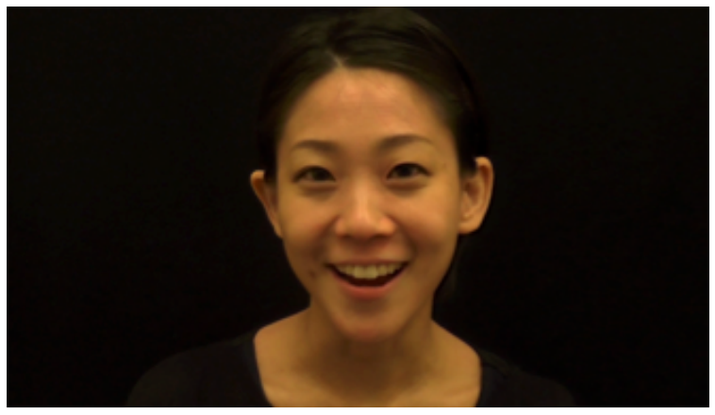
# Cross-cultural study: eye-tracking



static



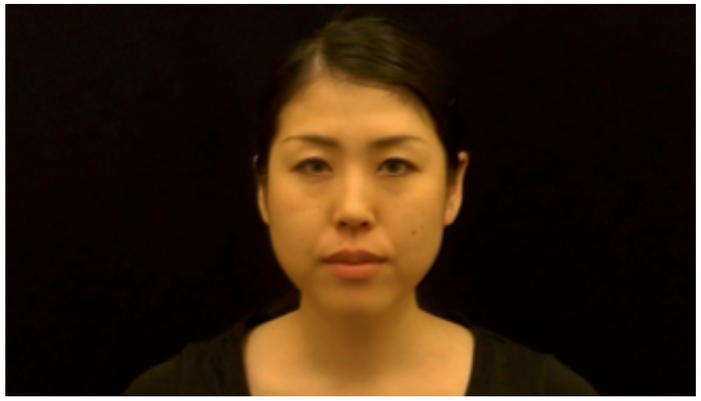
dynamic
(speaking)



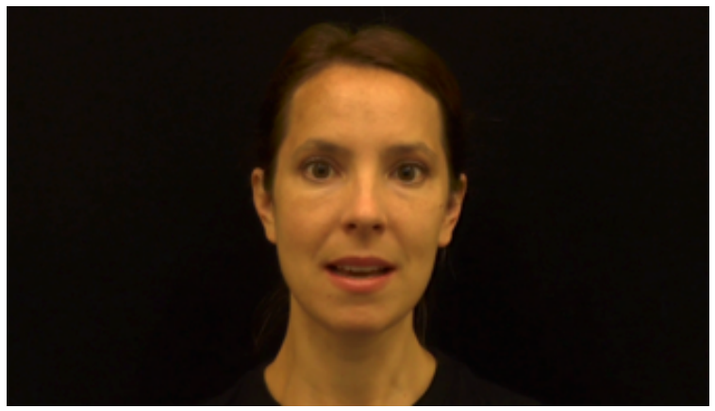
dynamic
(expressive)

Haensel, Ishikawa, Itakura, Smith & Senju (*under review*)

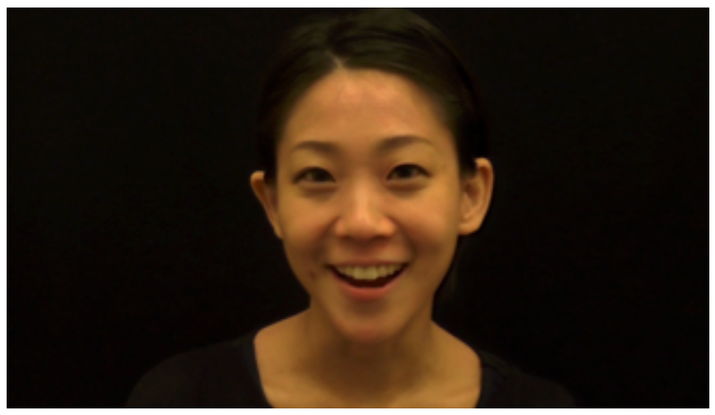
# Cross-cultural study: eye-tracking



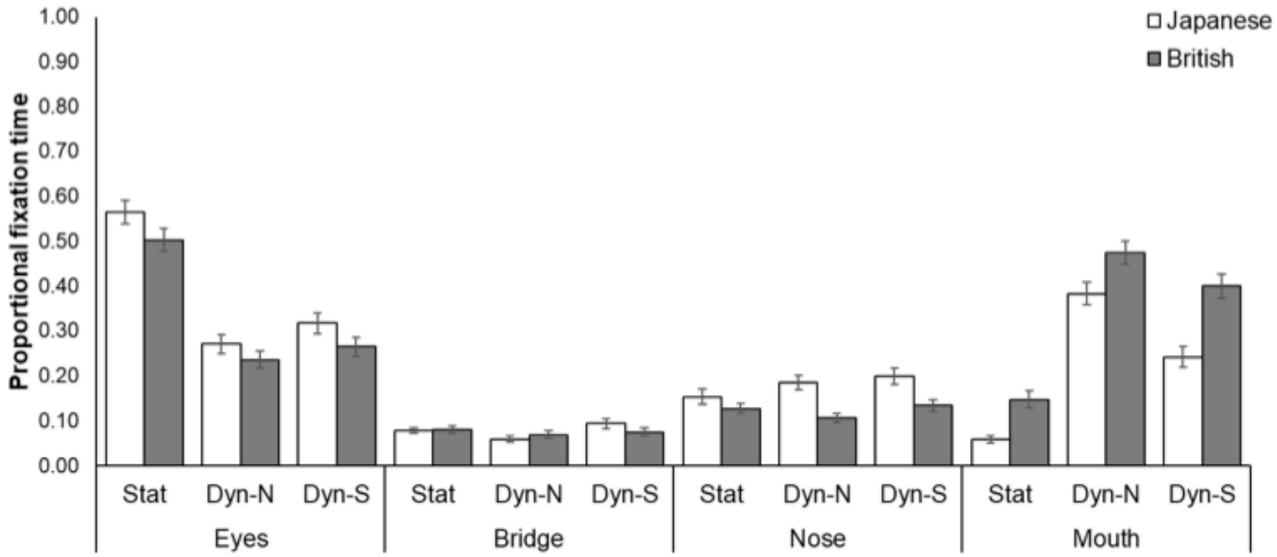
static



dynamic
(speaking)

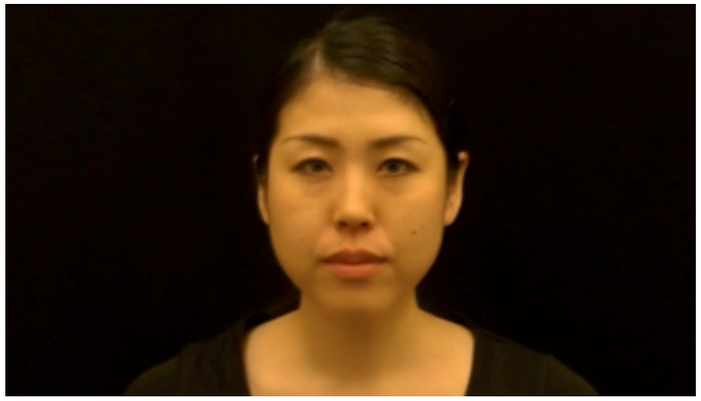


dynamic
(expressive)

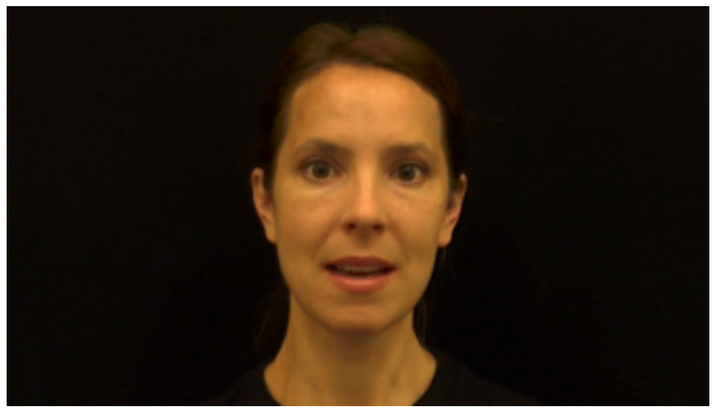



Haensel, Ishikawa, Itakura, Smith & Senju (*under review*)

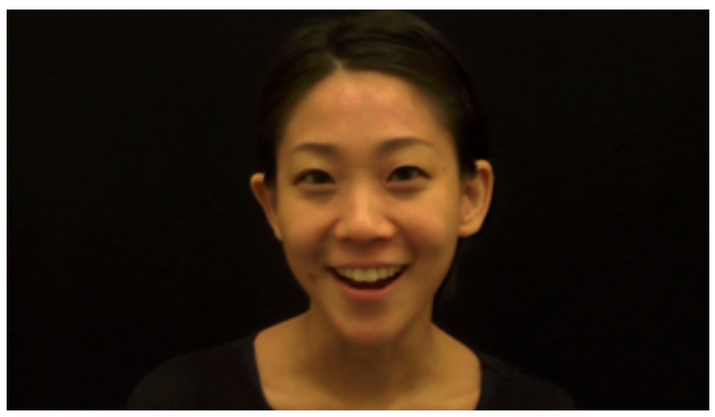
# Cross-cultural study: eye-tracking



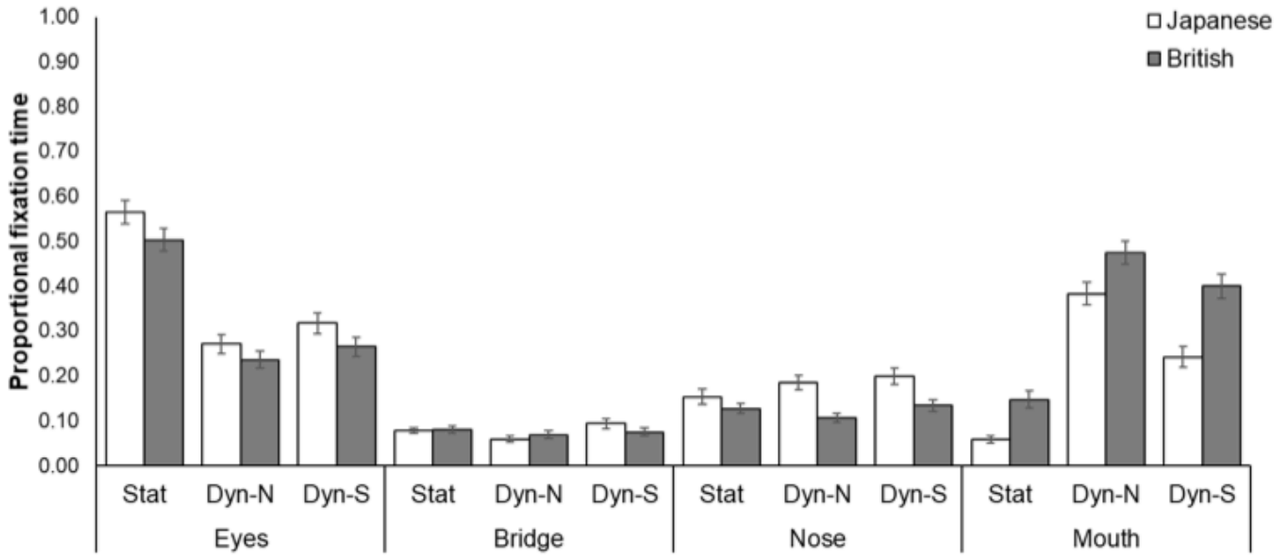
static



dynamic (speaking)



dynamic (expressive)




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

Haensel, Ishikawa, Itakura, Smith & Senju (*under review*)

# The effect of socio-cultural experience on the development of face/gaze processing

# The effect of socio-cultural experience on the development of face/gaze processing

- Development of social attention is plastic and adaptive to the individual social experience (familial, cultural)

# The effect of socio-cultural experience on the development of face/gaze processing

- 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

# The effect of socio-cultural experience on the development of face/gaze processing

- 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

# Acknowledgments


- Ines Mares
- Angélina Vernetti
- Nanami Harada
- Jen Haensel
- Natasa Ganea
- Nadia Neesgaard
- Giulia Ghillia
- Matt Denvers
- Marie Smith
- Tim Smith
- Liz Pellicano
- Mark Johnson
- Tony Charman
- Toshi Hasegawa
- Yukio Kikuchi
- Hiro Akechi
- Shoji Itakura
- Mitsu Ishikawa

## *Funding bodies*

MRC Career Development Award
Royal Society Daiwa International Exchange Award
Daiwa Foundation Small Grant
Great Britain Sasakawa Foundation
Birkbeck/Wellcome ISSF Conference Grant