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# Getting answers from babies about autism

Wales 4<sup>th</sup> International Autism Conference  
Cardiff, 21<sup>st</sup> June 2011

Professor Tony Charman  
*Chair in Autism Education*  
*Institute of Education, London*

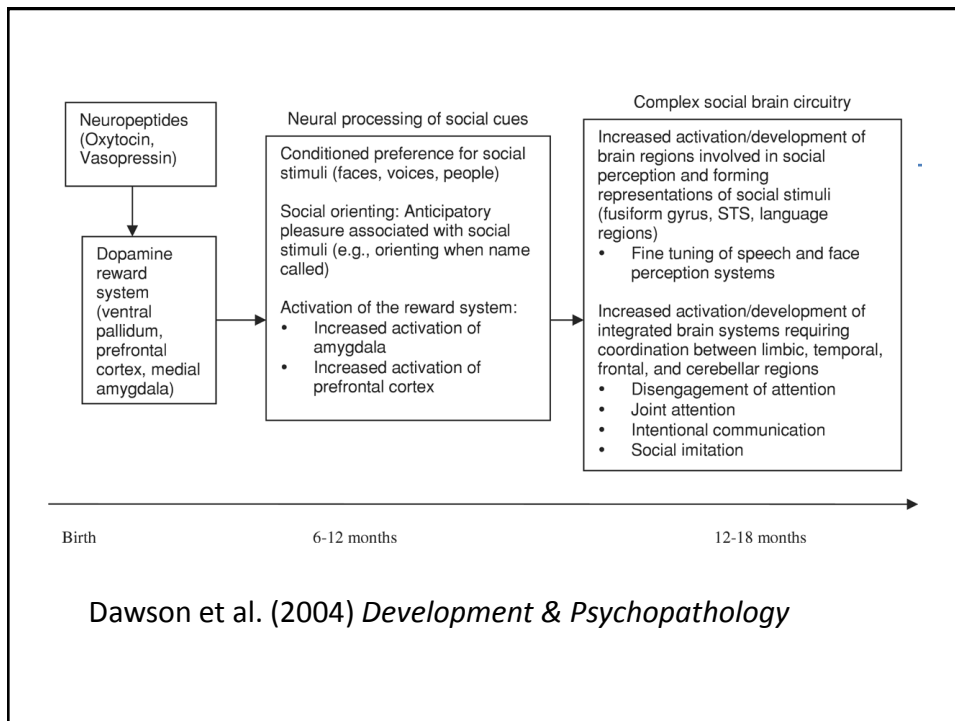
Centre for Research in Autism and Education  
<http://www.ioe.ac.uk/crae/>



## Overview

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- Autism in infants and toddlers
  - What we knew from home movies + screening studies
- Developmental models of autism
  - Informed by understanding of typical development
- The new science of autism in infancy
  - Studying at risk siblings
- Relevance for early intervention



## Earliest signs identified in home movies

- Advantages
  - ‘Blinded’ (as diagnosis is not yet know)
  - Naturalistic
- Limitations
  - Data not standardized
  - Parents may not film toddlers when showing behaviours most of interest (e.g. ‘odd behaviours’)
  - Do not know how specific the signs are to autism

## Earliest signs identified in home movies

Time period	Behaviour	Studies
~6 months	Dyadic and intersubjective behaviours Less attention to social stimuli Reduced affect	Maestro et al (2002, 2005) Clifford & Dissanayake (2008)
~12 months +	Reduced response to name Less joint attention Abnormal eye contact Reduced looking at people Motor abnormalities	Adrien et al (1991, 1993) Osterling & Dawson (1994); Werner & Dawson (2005) Baranek (1999) Ozonoff et al (2008) + others

*British Journal of Psychiatry* (1996), **168**, 158–163

### Psychological Markers in the Detection of Autism in Infancy in a Large Population

SIMON BARON-COHEN, ANTONY COX, GILLIAN BAIRD, JOHN SWETTENHAM,  
NATASHA NIGHTINGALE, KATE MORGAN, AURIOL DREW and TONY CHARMAN

J. AM. ACAD. CHILD ADOLESC. PSYCHIATRY, 39:6, JUNE 2000

### A Screening Instrument for Autism at 18 Months of Age: A 6-Year Follow-up Study

GILLIAN BAIRD, F.R.C.PAED., TONY CHARMAN, Ph.D., SIMON BARON-COHEN, Ph.D.,  
ANTONY COX, F.R.C.PSYCH., JOHN SWETTENHAM, Ph.D., SALLY WHEELWRIGHT, B.A.,  
AND AURIOL DREW, M.A.

J Autism Dev Disord (2006) 36:713–722  
DOI 10.1007/s10803-006-0114-1

ORIGINAL PAPER

### Screening for Autistic Spectrum Disorder in Children Aged 14–15 Months. II: Population Screening with the Early Screening of Autistic Traits Questionnaire (ESAT). Design and General Findings

Claudine Dietz · Sophie Swinkels · Emma van Daalen ·  
Herman van Engeland · Jan K. Buitelaar

## Earliest signs that predict diagnosis (in population screening studies)

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- Lack of joint attention behaviours
  - Gaze monitoring, pointing for interest
- Reduced response to name
- Lack of early pretend play
- Reduced range of early play behaviours
- Impoverished range of facial expressiveness
- Reduced interest in people

## The new science of autism in infancy

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### REVIEW ARTICLE

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What are Infant Siblings Teaching Us About Autism in Infancy?

Sally J. Rogers

INSAR

Autism Research 1: 1-13, 2009

1

### EDITORIAL |

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**Autism Research Comes of (a Young) Age**

Tony Charman, Ph.D.

JOURNAL OF THE AMERICAN ACADEMY OF CHILD & ADOLESCENT PSYCHIATRY  
VOLUME 49 NUMBER 3 MARCH 2010

### Review

**Getting answers from babies about autism**

Mayada Elsabbagh and Mark H. Johnson

*Trends in Cognitive Sciences* Vol.14 No.2

## Allows us to study autism as it emerges

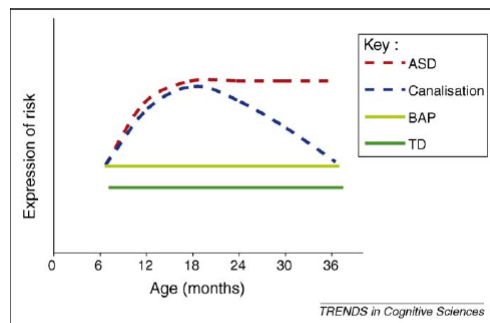
- 5% to 10% of younger siblings will go on to have ASD
  - May be higher in self-selecting research samples
- One goal is to identify the earliest signs of the disorder
  - Behavioural signs
  - Neural responses in addition to behaviour
- Allows us to study the 'broader autism phenotype'
  - Some features might characterise the 'at risk' group but not predict autism outcomes
  - This 'recovery' pattern might inform genetic and environmental influences on brain development

Review

### Getting answers from babies about autism

Mayada Elsabbagh and Mark H. Johnson

*Trends in Cognitive Sciences* Vol.14 No.2



**Figure 4.** Hypothetical trajectories for expression of risk in infant siblings at both neural and behavioural levels. The ASD trajectory is characterised by a high-dose of mediating risk factors, the impact of which becomes compounded and amplified over time. The BAP characterises infants with a low-dose of risk factors leading to sub-clinical expression of the condition. Canalisation involves similar initial expression of risk but eventual restoration of the typical developmental trajectory.

## The prodrome of autism: early behavioral and biological signs, regression, peri- and post-natal development and genetics

Nurit Yirmiya<sup>1</sup> and Tony Charman<sup>2</sup>

<sup>1</sup>Department of Psychology and School of Education, The Hebrew University of Jerusalem, Israel; <sup>2</sup>Centre for Research in Autism and Education, Institute of Education, London, UK

### Table 1. Characteristics of ASD emerging between 12 and 24 months. Early signs are variable and initially have low predictive value that then increases with age

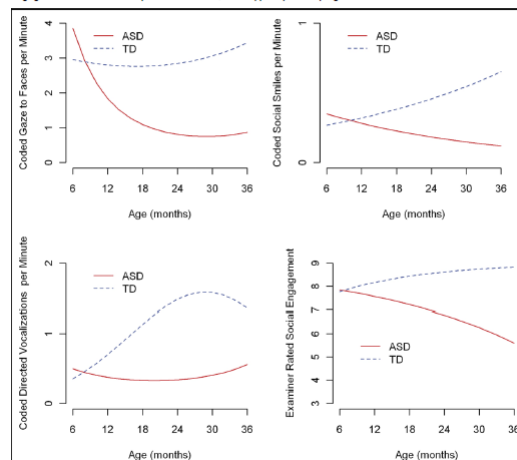
Deficits and delays in emerging joint attention [17,18]  
 Decreased response to name [19]  
 Decreased imitation [15]  
 Delays in verbal and non-verbal communication [20]  
 Motor delay [17]  
 Elevated frequency of repetitive behaviours, e.g. hand waving [21]  
 Atypical visuo-motor exploration of objects [22]  
 Extremes of temperament [23]  
 Decreased flexibility in disengaging visual attention [15]

### A Prospective Study of the Emergence of Early Behavioral Signs of Autism

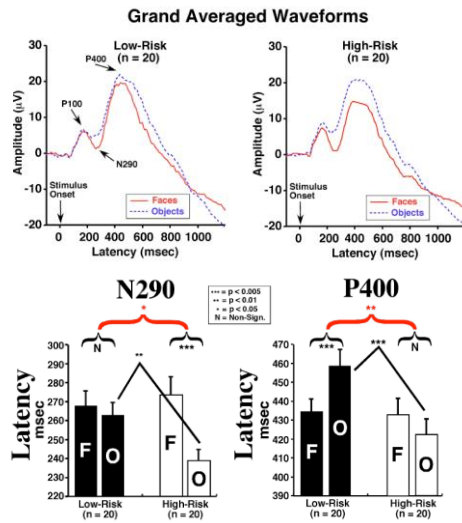
Sally Ozonoff, Ph.D., Ana-Maria Iosif, Ph.D., Fam Baguio, B.S., Ian C. Cook, Ph.D.,  
 Monique Moore Hill, M.S., Ted Hutman, Ph.D., Sally J. Rogers, Ph.D., Agata Rozga, Ph.D.,  
 Sarabjoti Sangha, B.S., Marian Sigman, Ph.D., Mary Beth Steinfield, M.D.,  
 Gregory S. Young, Ph.D.

J. Am. Acad. Child Adolesc. Psychiatry, 2010;49(3):258-268.

**FIGURE 1** Estimated Trajectories for Coded Social Communication Behaviors and Examiner Ratings of Social Engagement. ASD = autism spectrum disorders; TD = typically developing children.



# McCleery et al (2009) – Faces vs. Objects



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## PAPER

## Gaze behavior and affect at 6 months: predicting clinical outcomes and language development in typically developing infants and infants at risk for autism

Gregory S. Young,<sup>1</sup> Noah Merin,<sup>2</sup> Sally J. Rogers<sup>1</sup> and Sally Ozonoff<sup>1</sup>**Table 3** *Clinical outcome by risk group and eye-mouth index cluster*

Risk group	Outcome classification			
	No Concerns	Other Concerns <sup>a</sup>	Speech-Lang. Delay	Autism/ASD
High risk	15	4	5	2
Low risk	19	3	0	1
Eye-mouth cluster				
HHH <sup>b</sup>	19	3	3	2
LHL	9	3	2	1
LLL	6	1	0	0

<sup>a</sup>Other = global developmental delays; anxiety; oppositional behavior.<sup>b</sup>HHH = high eye-mouth index scores throughout all still-face conditions (i.e. preferential looking toward the eyes); LHL = high eye-mouth index scores only during unresponsive still-face condition; LLL = low eye-mouth index scores (i.e. preferential looking toward the mouth).

## PAPER

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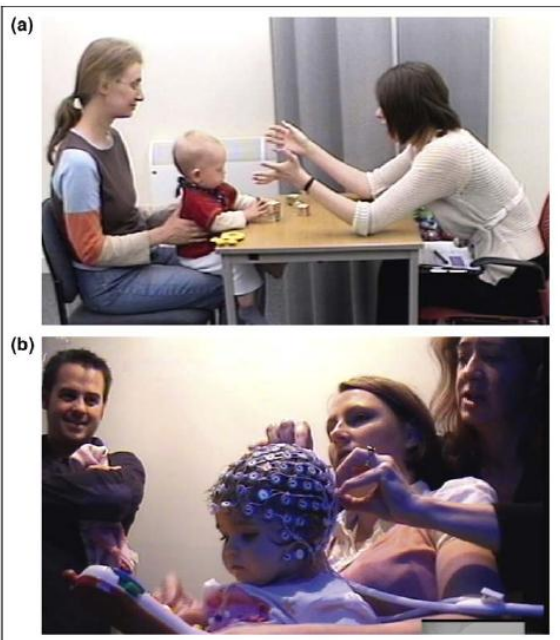


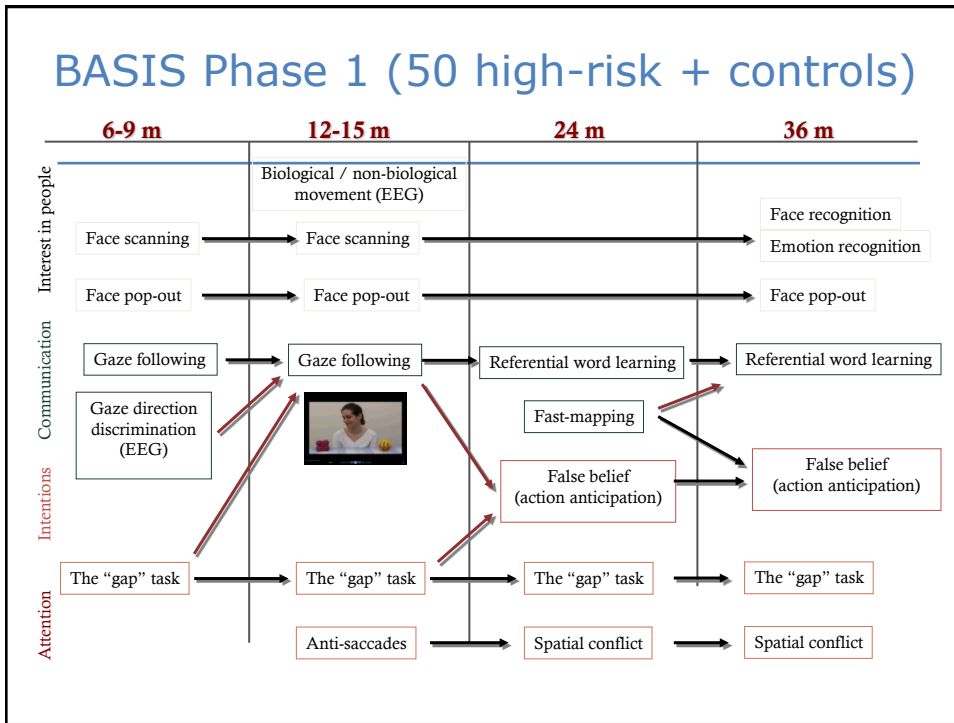
## BASIS (British Autism Study of Infant Siblings)

- Led by Mark Johnson and Mayada Elsabbagh (CBCD BABYLAB, Birkbeck College, London)
- Collaborators
  - Tony Charman (IOE), Patrick Bolton (IOP), Simon Baron-Cohen (Cambridge), Jonathan Green (Manchester), Declan Murphy (IOP)
- Funding
  - MRC, Autistica, Autism Speaks (USA)
- [www.basisnetwork.org.uk](http://www.basisnetwork.org.uk)



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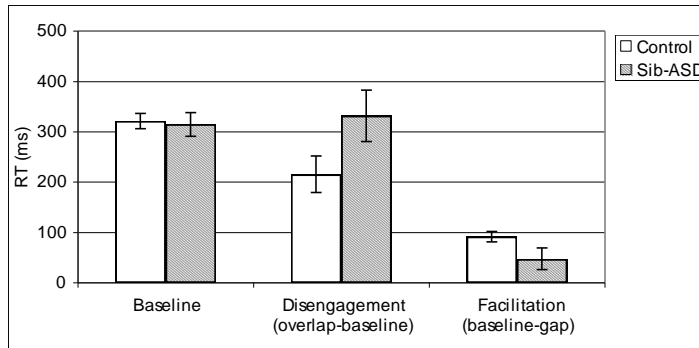




### Network Protocol

	Measure	Visit 1 (6-9 m)	Visit 2 (12-15 m)	Visit 3 (24 m)	Visit 4 (36 m)
<b>Parent report</b>	Vineland Adaptive Behavior Questionnaire	✓	✓	✓	✓
	MacArthur Communicative Development Inventory (CDI)	✓	✓	✓	✓
	Infant Behaviour Questionnaire (IBQ)/ Early Childhood Behavior Questionnaire (ECBQ)	✓	✓	✓	✓
	Toddler Early Development Inventory Q-CHAT		✓	✓	
	Social Responsiveness Scale (SRS)				✓
	Feedback from parents on project	✓	✓	✓	✓
<b>Lab (or home visit)</b>	Demographics	✓	✓(updates)	✓(updates)	✓(updates)
	Medical history	✓	✓(updates)	✓(updates)	✓(updates)
	Mullen Scales of Early Learning	✓	✓	✓	✓
	Head circumference	✓	✓	✓	✓
	Autism Observation Scale for Infants (AOSI)	✓	✓		
	Autism Diagnostic Observation Schedule (ADOS)			✓	✓
	Autism Diagnostic Interview (ADI)				✓
	Parent Child Interaction (PCI)	✓	✓	✓	✓
<b>Proband</b>	Development and Wellbeing Assessment (DAWBA)	✓			
	Social Communication Questionnaire (SCQ)	✓			

## Gap task – Testing ‘sticky attention’



### Visual orienting in the early broader autism phenotype: disengagement and facilitation

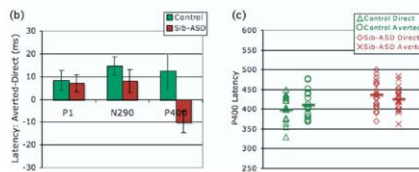
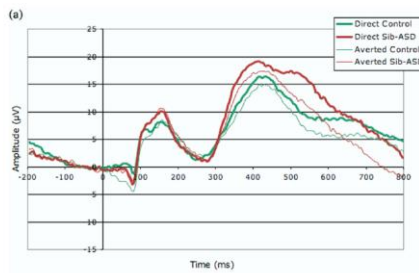
Mayada Elsabbagh,<sup>1</sup> Agnes Volein,<sup>1</sup> Karla Holmboe,<sup>1</sup> Leslie Tucker,<sup>1</sup> Gergely Csibra,<sup>1</sup> Simon Baron-Cohen,<sup>2</sup> Patrick Bolton,<sup>3</sup> Tony Charman,<sup>4</sup> Gillian Baird,<sup>5</sup> and Mark H. Johnson<sup>1</sup>

*Journal of Child Psychology and Psychiatry* 50:5 (2009), pp 637–642

## Neural Correlates of Eye Gaze Processing in the Infant Broader Autism Phenotype

Mayada Elsabbagh, Agnes Volein, Gergely Csibra, Karla Holmboe, Holly Garwood, Leslie Tucker, Sanya Krljes, Simon Baron-Cohen, Patrick Bolton, Tony Charman, Gillian Baird, and Mark H. Johnson

BIOL PSYCHIATRY 2009;65:31–38  
© 2009 Society of Biological Psychiatry



## Gaze Following Task: Eye-tracking.

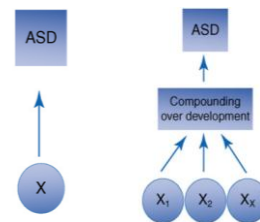
- Experimental measure of gaze following.
- High ecological validity.
- Precursor to joint attention.



- Two measures of gaze following: **first look & looking time** to the congruent object on correct first look trials.

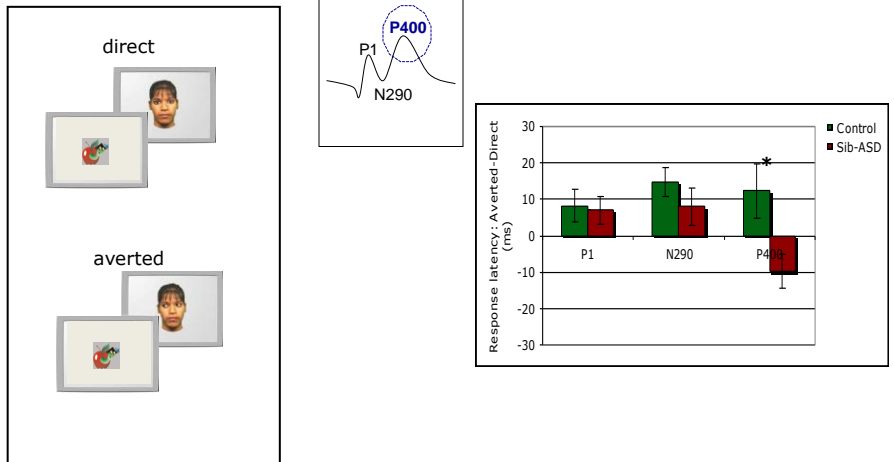
## Modeling interactions in the developing brain

- Autism emerges over the first three years from subtle and variable differences emerging in the first year
- Infants at-risk who do not go on to a diagnosis share some of the early *brain* functioning but do not go on to a diagnosis
- Variable pathways reflect multiple gene x environment interactions unfolding over time



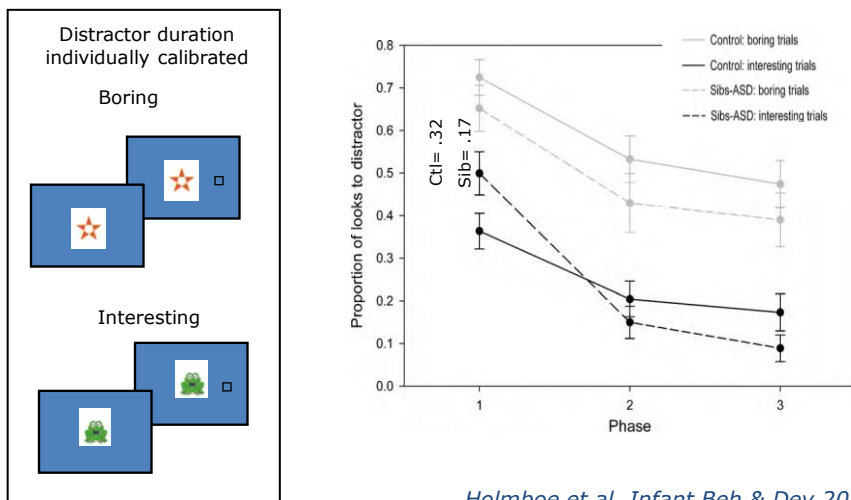
*Elsabbagh & Johnson, TICS 2010;  
Elsabbagh et al. Prog Brain Res, 2011*

## Response to eye gaze in infants at-risk



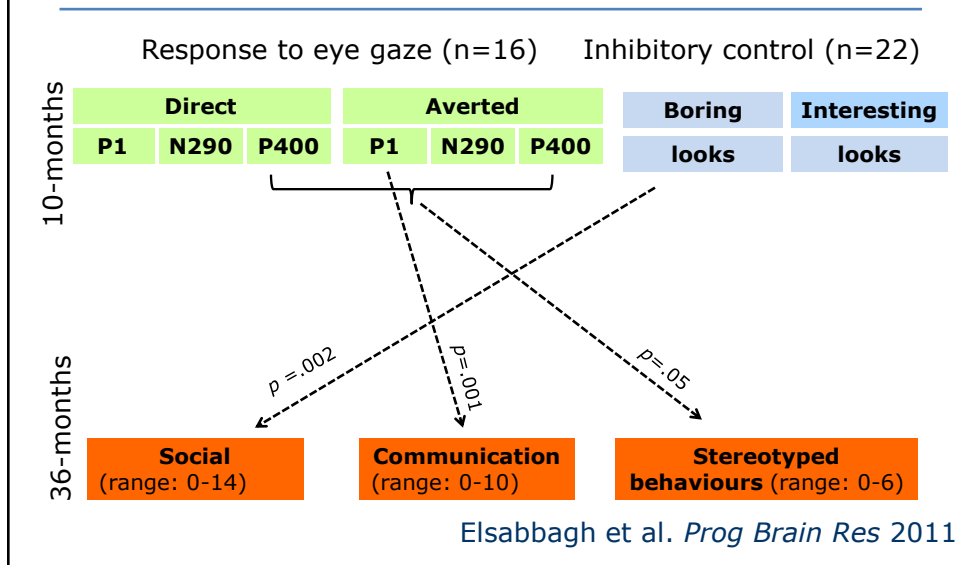
*Elsabbagh et al., 2009, Bio Psych*

## Inhibitory control in infants at-risk: The Freeze-Frame task



*Holmboe et al. Infant Beh & Dev 2010*

## Social and attention predictors of autism related characteristics



## Infants at risk for autism as a model for studying developmental interactions

- Variability in development of infants at risk is likely to be the result of dynamic and probabilistic interactions over development
- Autism-related characteristics in infant siblings who do not have a diagnosis map dimensionally onto brain function predictors in infancy across multiples social and non-social domains
- Systematic study of these variations can offer important clues toward understanding the emergent nature of autism

## BASIS Phase 2

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- 75 high-risk sibs + controls
- Babies seen at 4m, 8m, 14m, 24m and 36m of age 14 experimental tasks, including eye-tracking, ERP, EEG and behavioural tasks
- Subgroup: Structural + functional imaging + NIRS at 4 months
- Including a pilot, 'proof of concept' RCT of parent early intervention at 8 months of age
  - i-BASIS

## i-BASIS team

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*University of Manchester*

Jonathan Green, Ming Wai Wan, Samina Holsgrove, Janet McNally, Clare Holt, Janine Lamb

*Birkbeck College, London*

Mark Johnson, Mayada Elsabbagh, Lesley Tucker, Helen Ribeiro, Jeanne Guiraud, Janice Fernandes

*Institute of Education, London*

Tony Charman

*Guys Hospital, London*

Vicky Slonims, Rhonda Booth

*Institute of Psychiatry, London*

Andrew Pickles, Patrick Bolton

## Technique

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- Core intervention based on Video Interaction to Promote Positive Parenting (VIPP, Juffer et al 2004)
- Additional techniques to adapt to early atypicalities
- Parent-mediated video-aided, home based
- Manualised
- 12 sessions over 5 months
- Procedures to
  - Enhance sensitivity of response
  - Increase shared enjoyment, joint attention, communicative synchrony
  - Specifically address details of early atypicality
  - Aid generalisation (written material, feedback, videos)

## Procedure

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- Video of free play/naturalistic meal time/face to face interaction – watch and discuss with parent
- Sequential themes
  - Infant watching
  - Speaking for the baby – *inferring intentionality*
  - Sensitivity chains – *synchronous responding*
  - Generalising to mealtime and other activities
  - Sharing feelings – *affect matching*
  - Sharing talk – *promoting communication*
- Adapting to ‘atypicality’
  - Inflexible attentional style, Face preference and visual face processing, Affect Matching and Reciprocity, Reactivity, Atypical Sensory Behaviours, Social Babble/early communication



## RCT design

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### *Design*

- 2 site 2 arm parallel group RCT of intervention/no intervention; N=50 (following a pilot case series N=8)

### *Sampling*

- Infant siblings in BASIS - not selected for atypicality

### *Assessment*

- 'Vertical integration' including
  - Contextual – BASIS protocol
  - Behavioural – AOSI
  - Brain function – EEG, ERP, Attention, Eye Tracking
  - Genetics – Buccal DNA
- Baseline 7-9 months; endpoint 14-15 months; follow up 2 and 3 years

## At-risk sibling studies - summary

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- Early behavioural indicators identified
  - Mostly early (non-verbal) social communication behaviours
  - Some motor and stereotyped behaviours
- Some surprising findings
  - Differences have not emerged before 12m
  - Early 'engagement' at 6m not atypical
- Neural responses vs. behavioural manifestations
- Different clinical vs. scientific approaches
  - BAP vs. identifying cases (outcome) approaches

# Thank you!

Thanks to: My collaborators and the families in all our studies!



**Birkbeck**  
UNIVERSITY OF LONDON

**Infant Scientists Wanted!**

Are you pregnant or do you have a baby between the ages of 1-3 months who has no other health or vision problems?

The BASIS Autism Study at Birkbeck (BASIS) is a UK wide network of researchers who study the early development of children with autism. We are looking for healthy babies and their families to take part in our research. We have a baby monitor that can be used to monitor your baby's behaviour and we can also use a special camera to monitor your baby's eye movements. We can also use a special camera to monitor your baby's eye movements. We can also use a special camera to monitor your baby's eye movements.

**BASIS: The BASIS Network Centre for Brain and Cognitive Research**, Tel: 020 7075 9762, Email: [autism@basis.ac.uk](mailto:autism@basis.ac.uk) or [www.basis.ac.uk](http://www.basis.ac.uk), [www.basisnetwork.org](http://www.basisnetwork.org)



[www.basisnetwork.org.uk](http://www.basisnetwork.org.uk)

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