



Social Attention Research Group

Social Attention in Autism Spectrum Disorders: Past, Present, and Future Research

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ENGAGING THE WORLD

Today

- What is social attention, and how is this affected in Autism Spectrum Disorders (ASD)?
- What methods are needed for understanding how these processes operate in the real world?
- How can this research inform intervention?

What is social attention?

What is social attention?



What is social attention?



- Intrinsic interest in other people, and where those people are attending

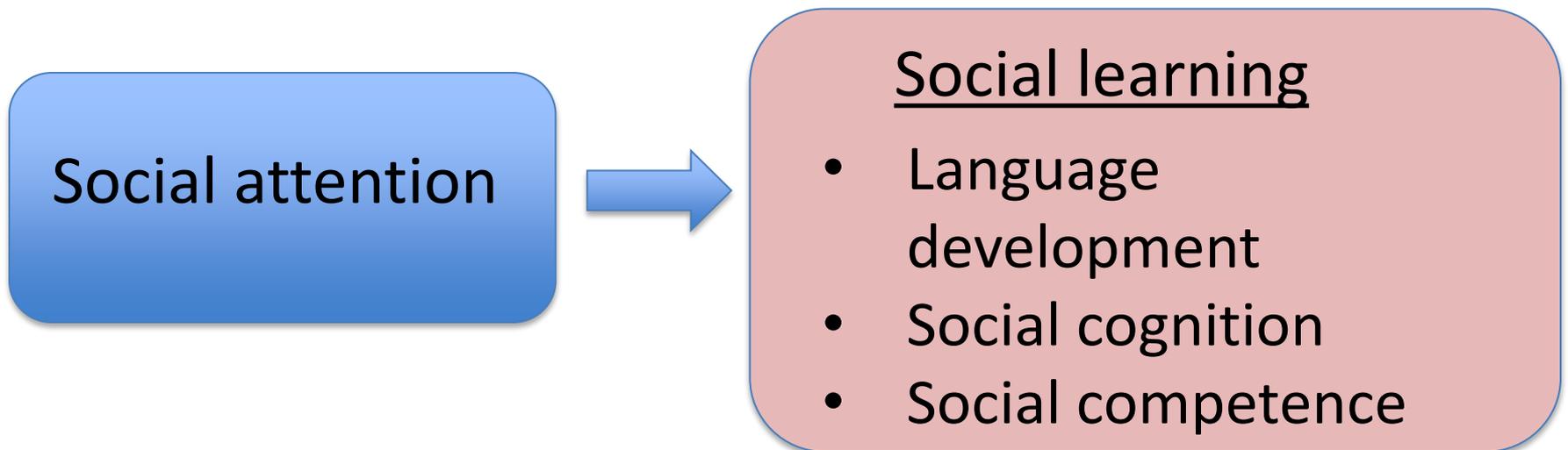
What's so special about social attention?

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What's so special about social attention?

- Early social attention in infants predicts later language development (Brooks & Meltzoff, 2005)
 - Creating a shared frame of reference for word learning



What's so special about social attention?

- Social attention contributes to social competence - by coordinating attention with others we are showing interest in what they are doing and learning about the world



Social Attention in ASD

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- Children with ASD are less likely than typically developing children to appropriately follow:
 - **the head turn of an adult** (e.g., Dawson et al., 1998; 2004; Leekem et al. 1997; 1997)
 - **the pointing gesture of an adult** (Baron-Cohen et al., 1996; Landry & Lovelamd, 1988)
 - **pointing combined with looking** (e.g., Dawson et al., 1998; 2004)

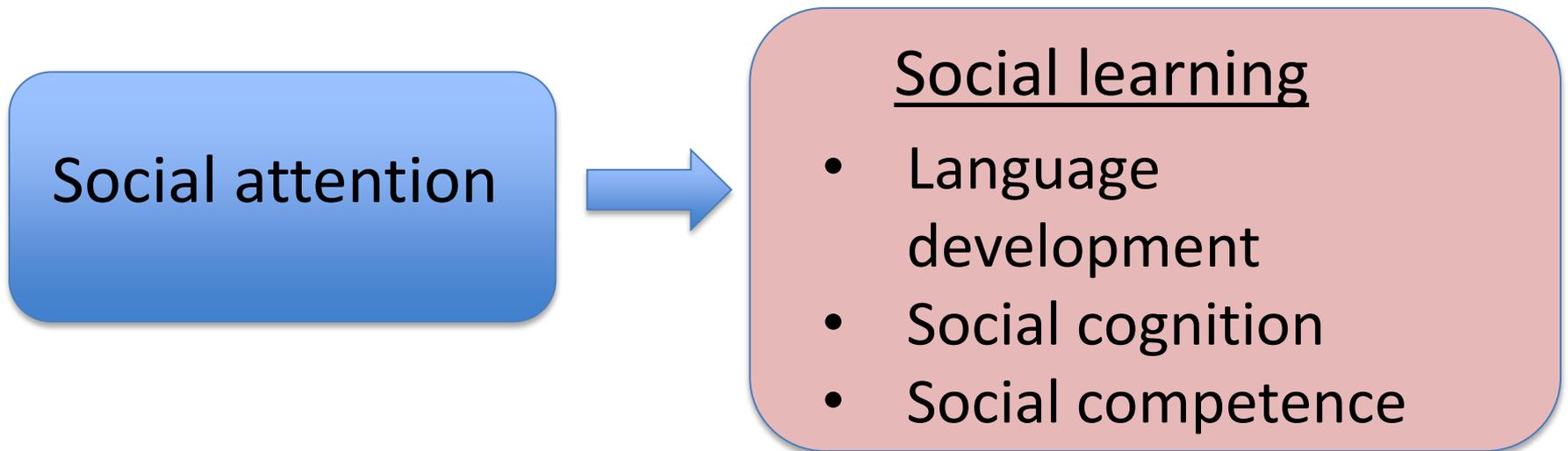
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Social Attention Theory of ASD

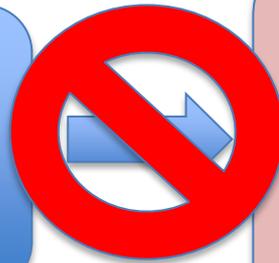
- Atypical developmental prioritization of attending to and processing information about other people impedes social learning and the development of language, social cognition, and social competence in affected individuals
 - Mundy, 1995, 2003; Mundy & Neal, 2000
 - Dawson et al., 1998; Dawson et al., 2004

Social Attention Theory of ASD



Social Attention Theory of ASD

Social attention



Social learning

- Language development
- Social cognition
- Social competence

Evidence

- Social attention impairment in ASD is a significant predictor of:
 - **delayed language development** (Mundy, Sigman, & Kasari, 1990)
 - **symptom severity** (Mundy, Sigman & Kasari , 1994)
 - **slow development of a theory of mind** (Charman et al., 2000)
 - **long-term social and communication deficits** (Sigman & Ruskin, 1999)

How do researchers measure social attention?

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- Naturalistic studies of gaze following with small children.



Experimenter establishes eye contact with child



Experimenter averts her gaze to look at an object to the left or the right

The child's response is noted

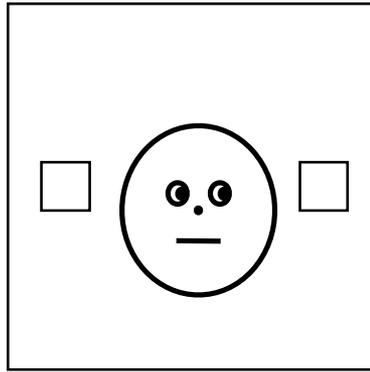
Limitations of naturalistic studies

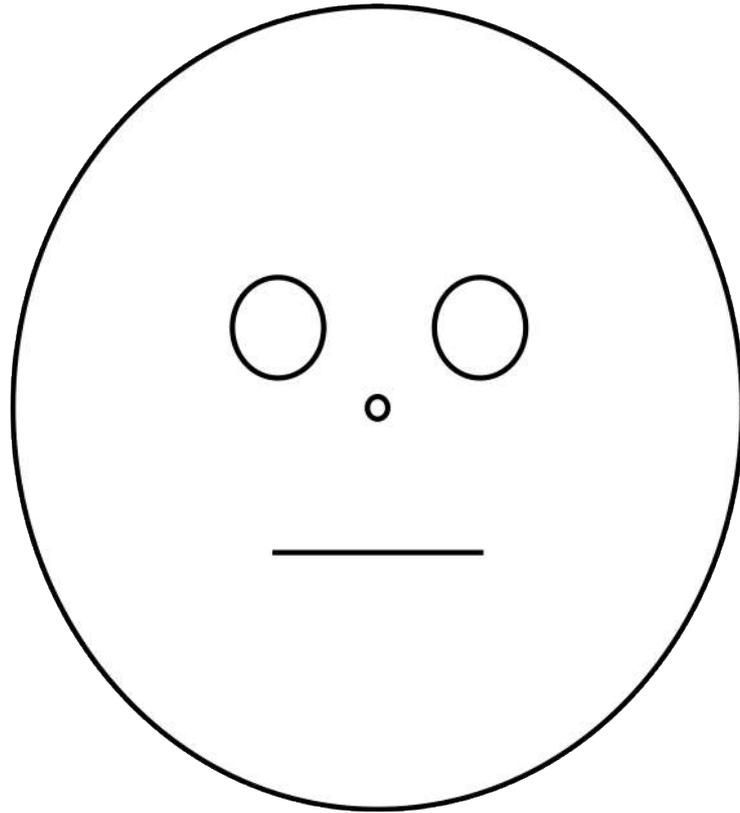
- Lack of precise control over timing of cues
- Not appropriate for older children (e.g., school-aged)
 - Most of what we know about social attention is from research on infants and toddlers
 - Little to no research on school-aged children
 - As a result, research-based interventions targeting social attention are lacking for school-aged children

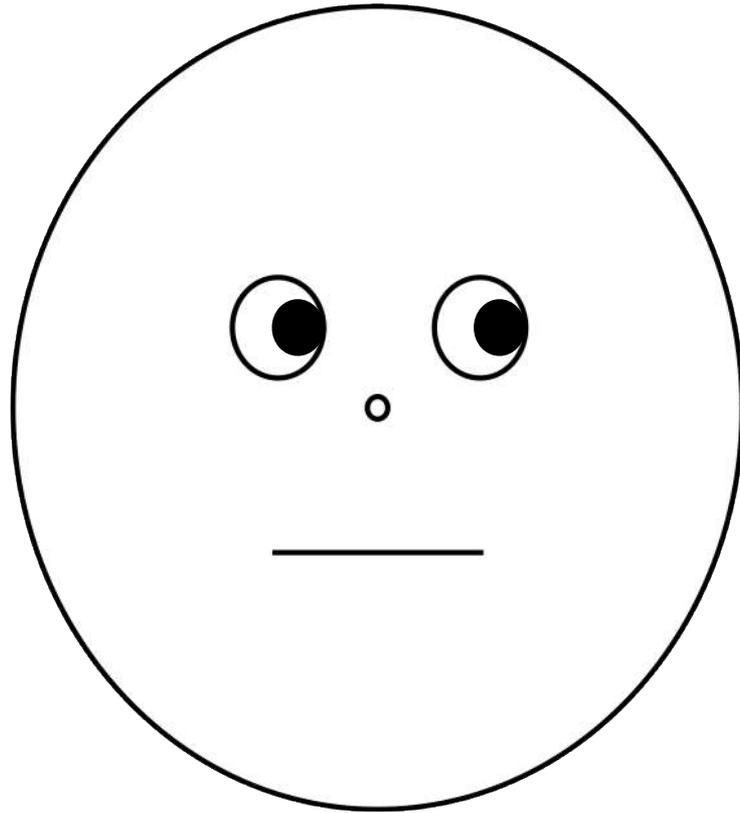
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 - As a result, research-based interventions targeting social attention are lacking for school-aged children
- **Need a paradigm that can be used across a variety of age groups**

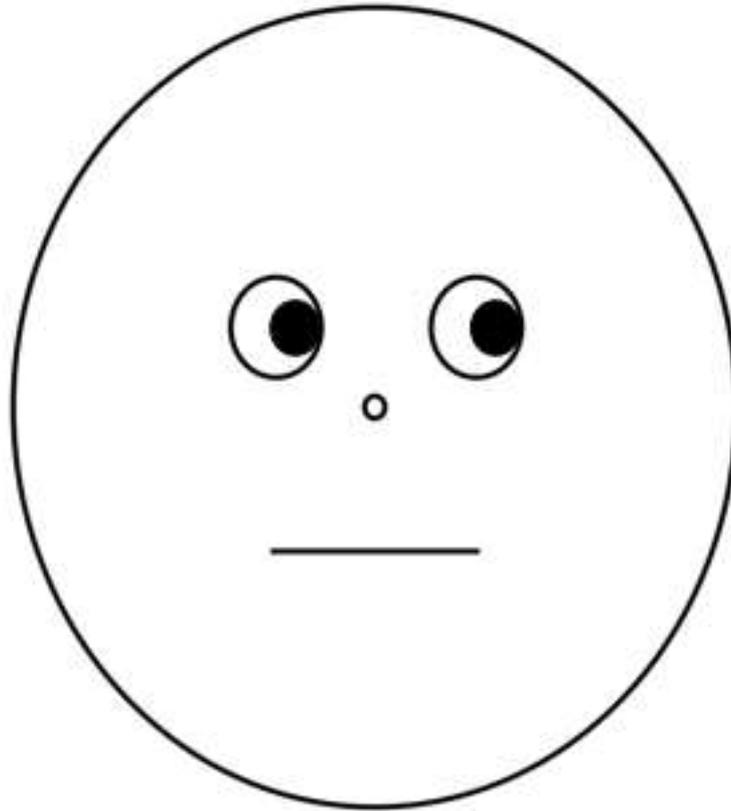
The Gaze Cueing Paradigm



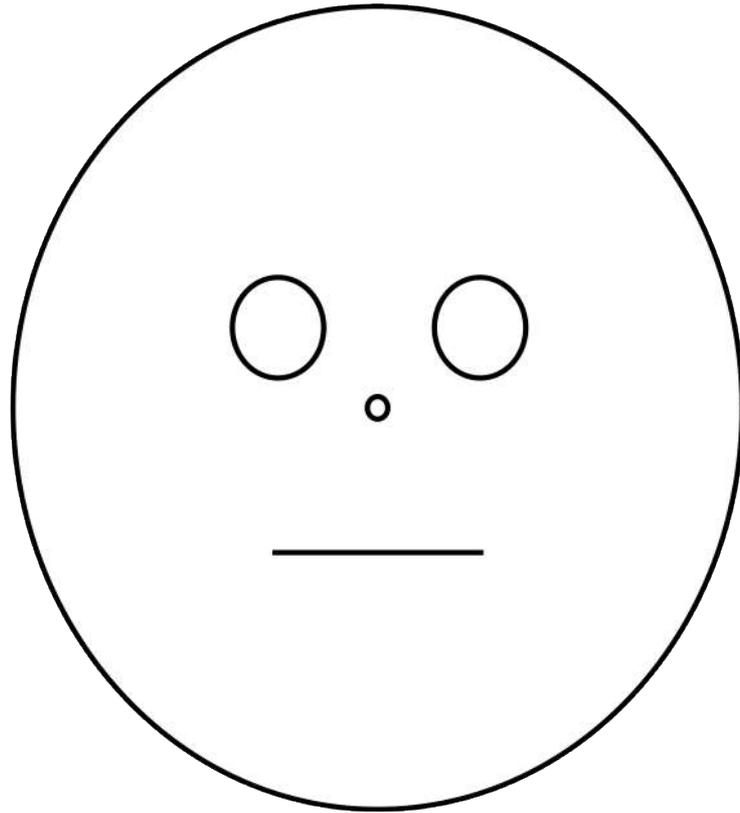


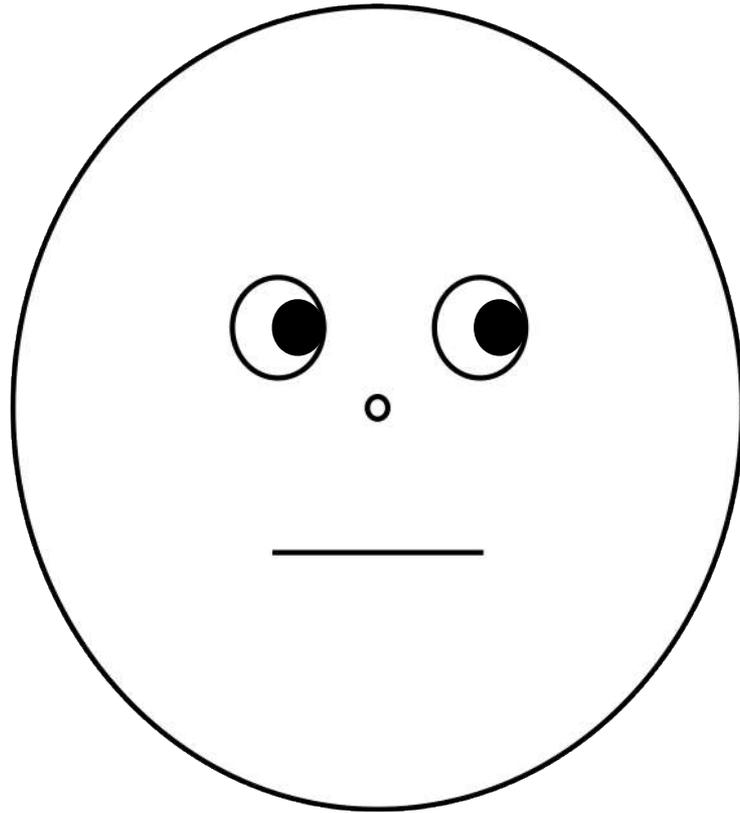


Cued target trial



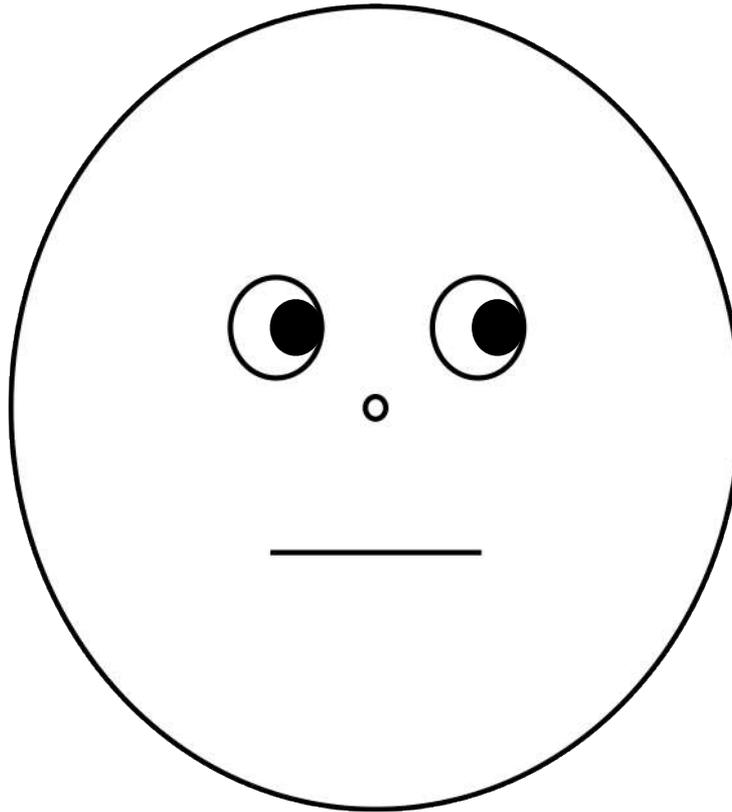
X





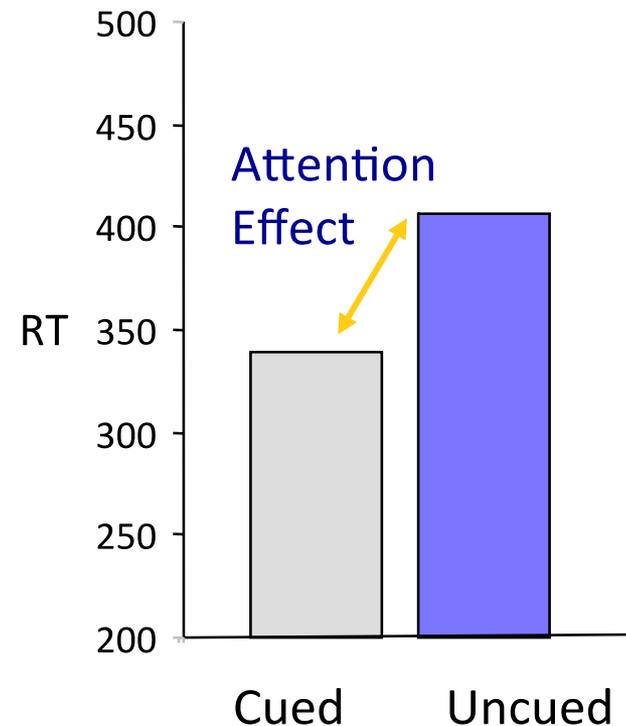
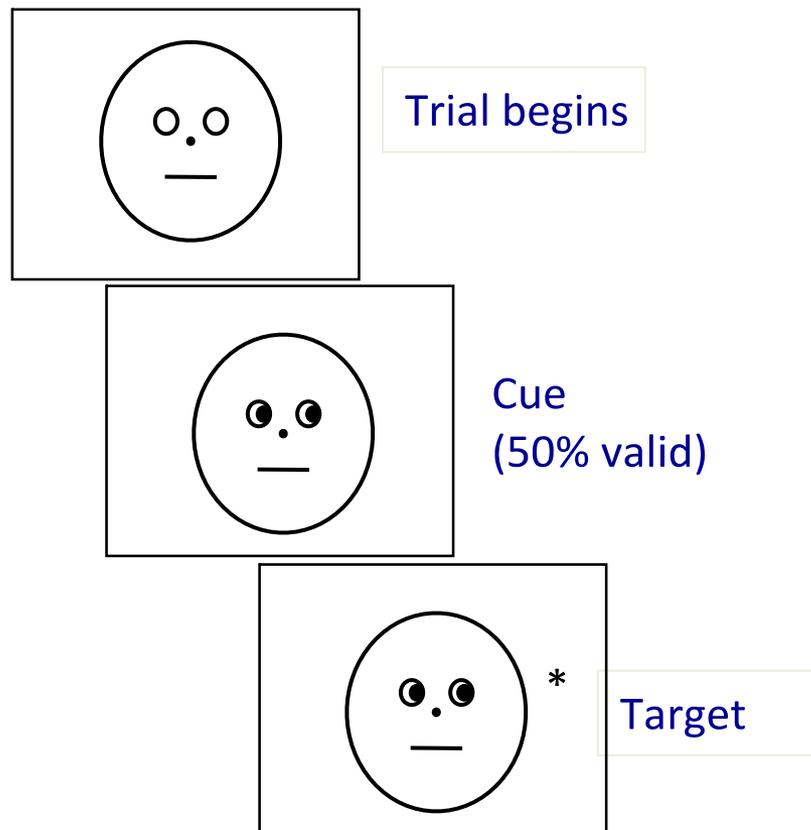
Uncued target trial

X



Social attention: typically developing

- People attend automatically to gaze direction

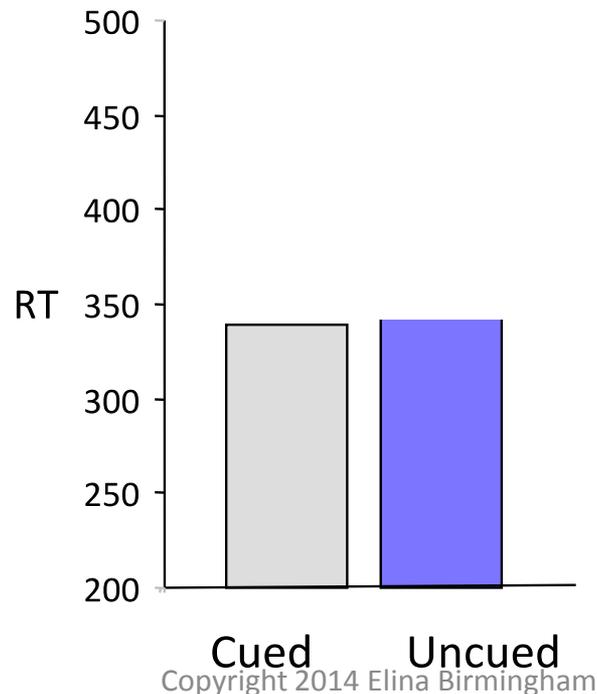


Social attention: typically developing

- People can't ignore these gaze cues, even though they are irrelevant to the task (e.g., Friesen & Kingstone, 1998)
- Suggests there is a “reflexive” tendency to attend to where others are looking

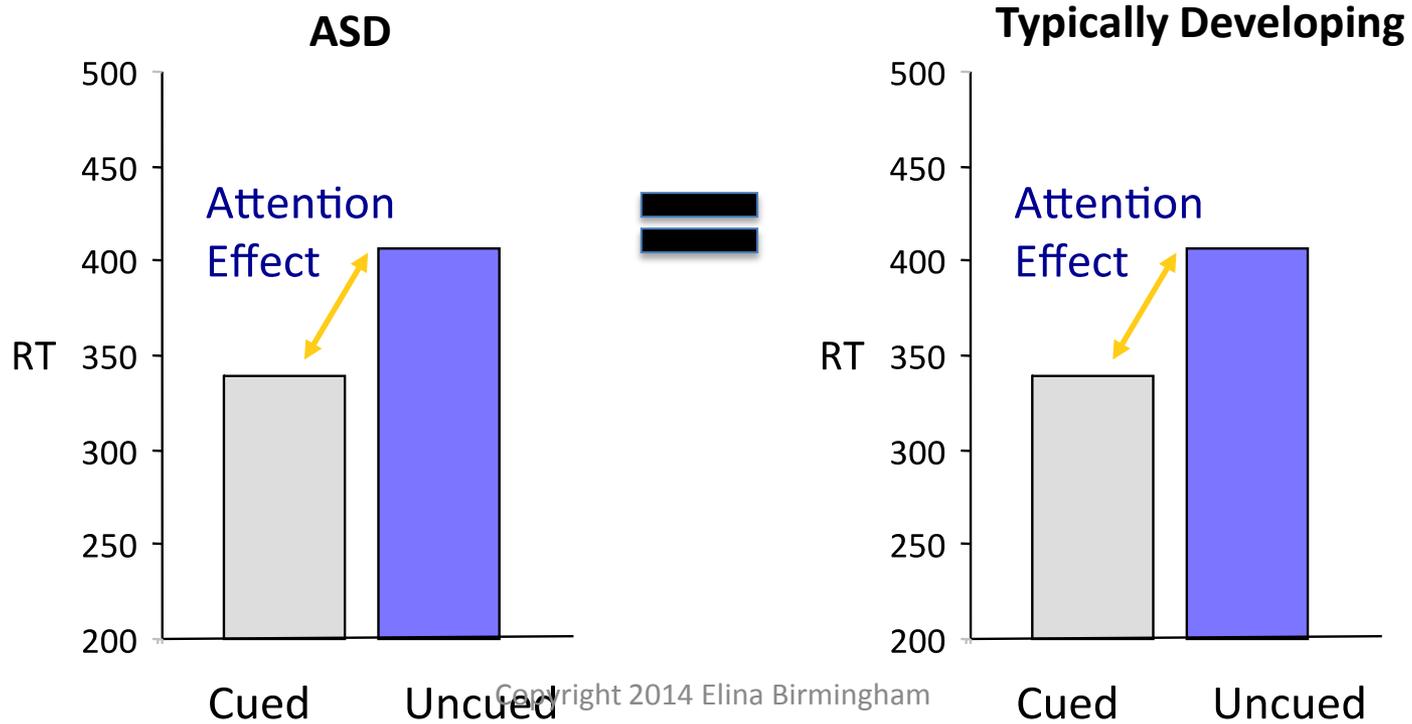
Social attention in ASD

- This paradigm was soon applied to the ASD population with the expectation of finding **reduced or absent gaze cueing effects**



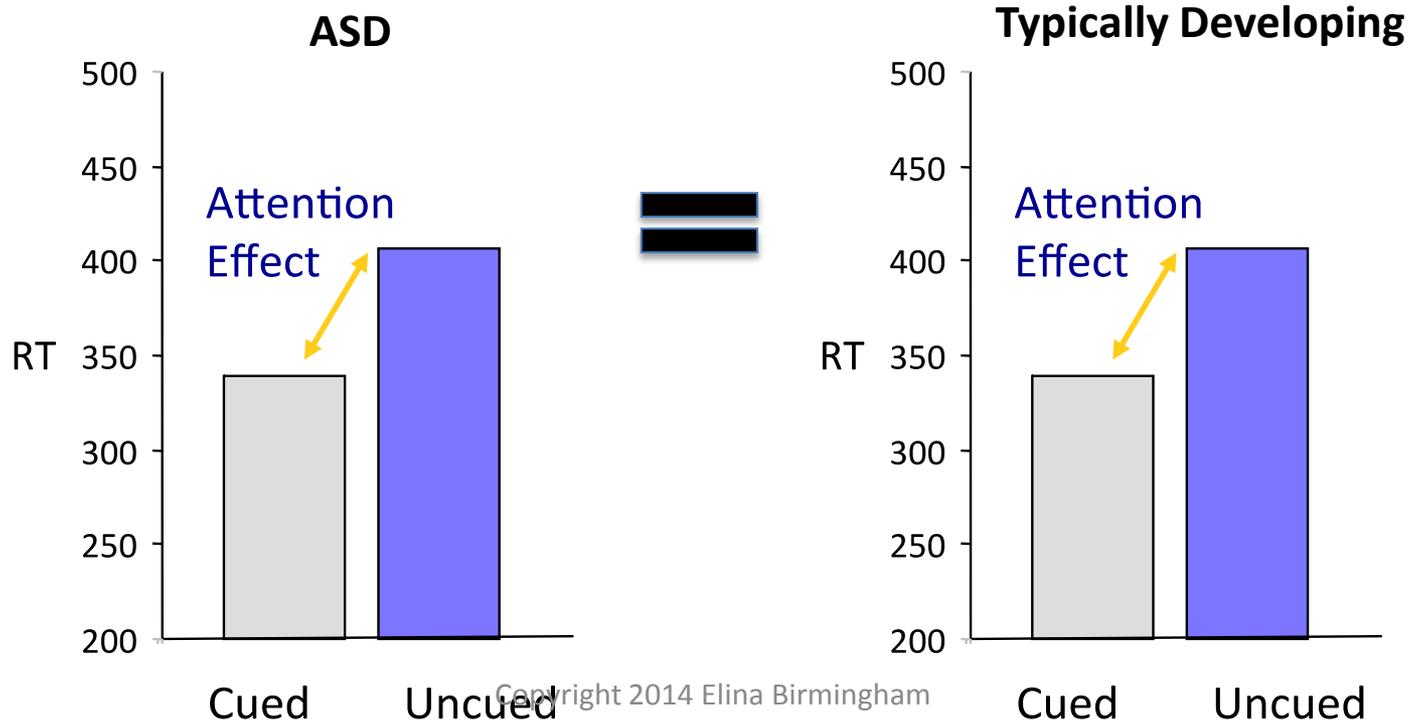
Social attention in ASD

- Instead, the vast majority of this research (13/17 studies) found that gaze cuing effects are similar in ASD and Typical Development



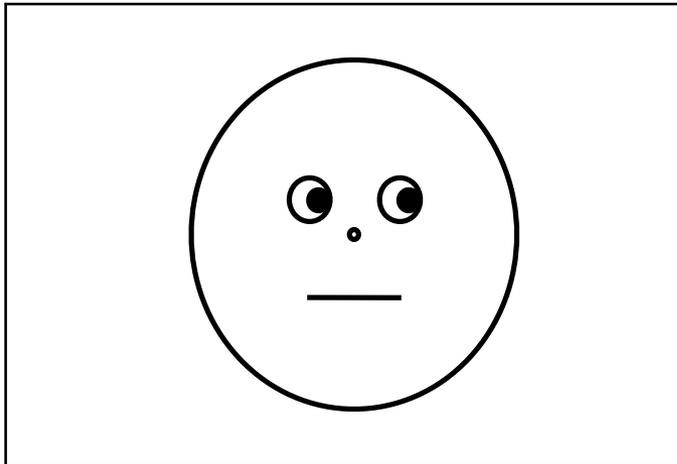
Social attention in ASD

- This is true even for young children who showed severe gaze following impairments in the real world (Chawarska et al., 2003)



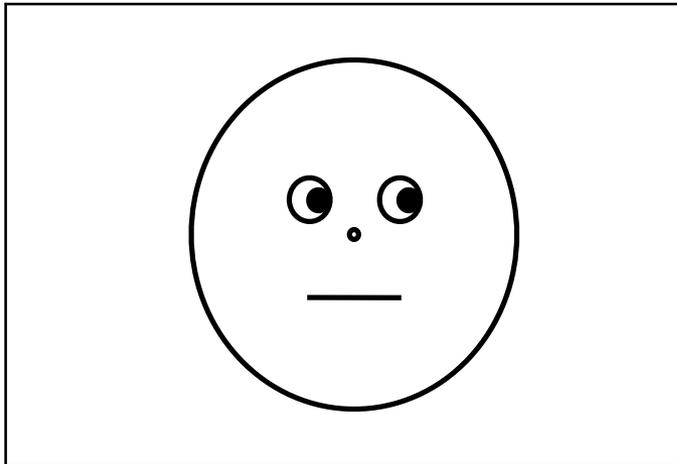
Conflicting findings?

- The results from lab studies are very different from how we see children with ASD responding in more “real-world” studies



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- The results from lab studies are very different from how we see children with ASD responding in more “real-world” studies
- **What’s going on?**



Two stages of social attention



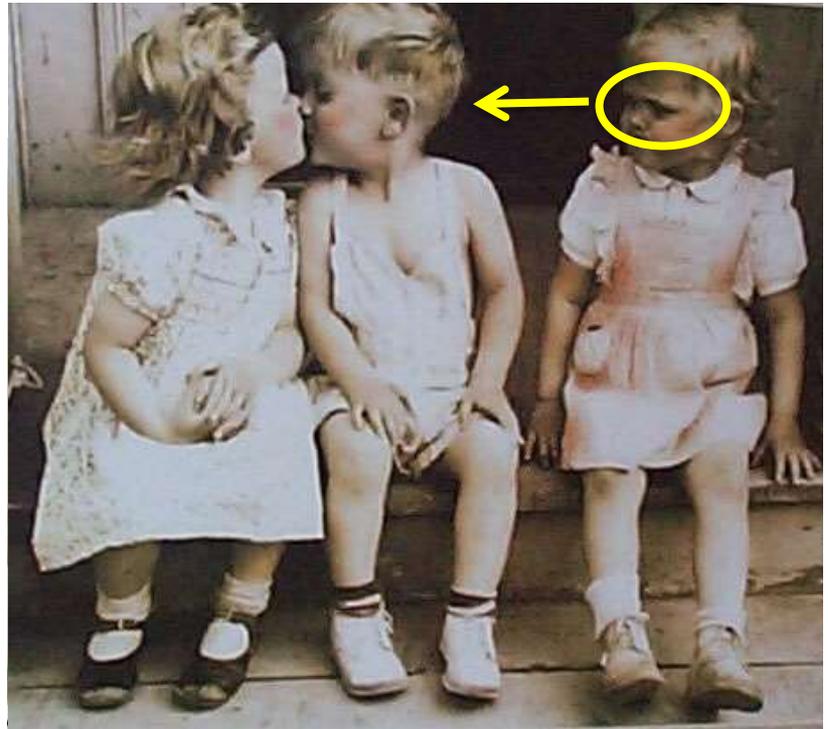
Two stages of social attention

(1) Select the eyes



Two stages of social attention

- (1) Select the eyes
- (2) Shift our attention from those eyes to where those eyes are looking



Preselecting the cue

- The cueing paradigm is designed to examine the 2nd stage only
- Cue is “preselected” for the observer
- The observer is forced to select the gaze cue and its direction



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Selecting the eyes

- Hypothesis: much can be learned about social attention and the special status of eyes by measuring the selection of eyes (**gaze selection**) from complex environments



Research on Stage 1: Gaze Selection

Eye tracking



00000000 ms



Using gaze selection to measure social attention

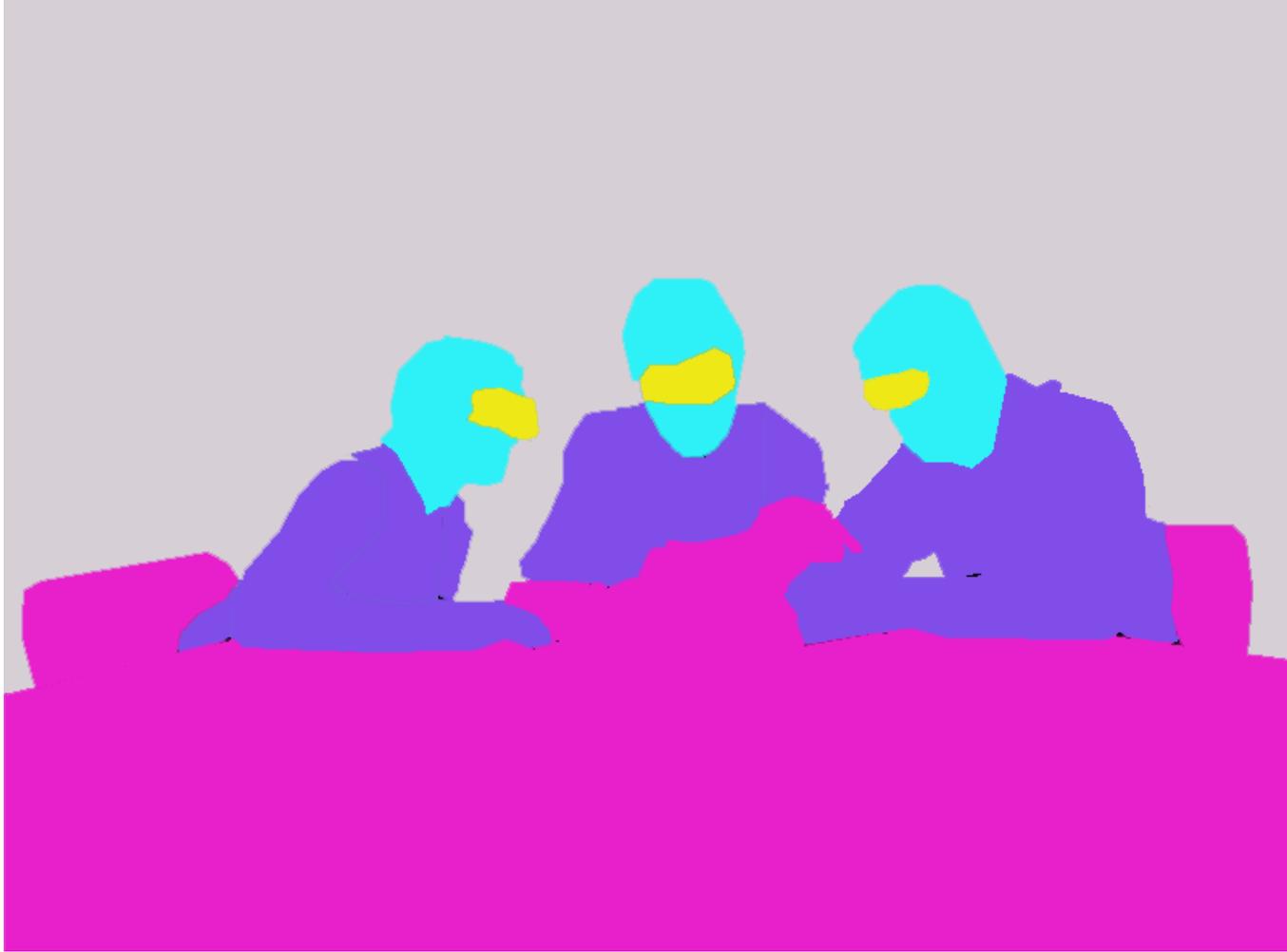
- Do typically developing observers preferentially select the eyes of others from complex scenes?
- Do typically developing observers select the eyes to determine people's attentional states?

Research on Typical Development

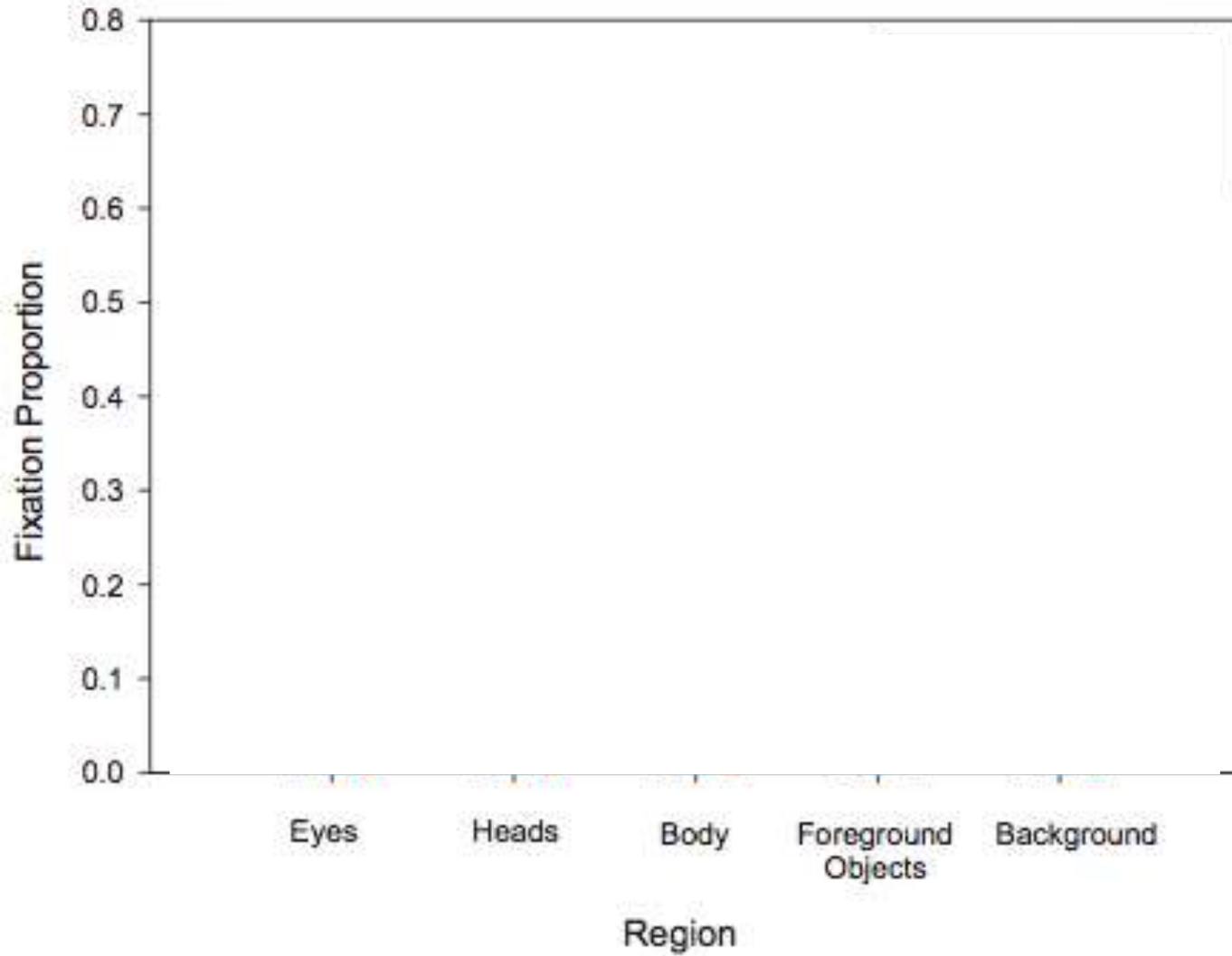
- **Look** at the picture
- **Describe** the picture
- **Social attention:** Where are people in the picture directing their attention?***

- *** “Gaze”/“looking”/“eyes” not mentioned in instruction

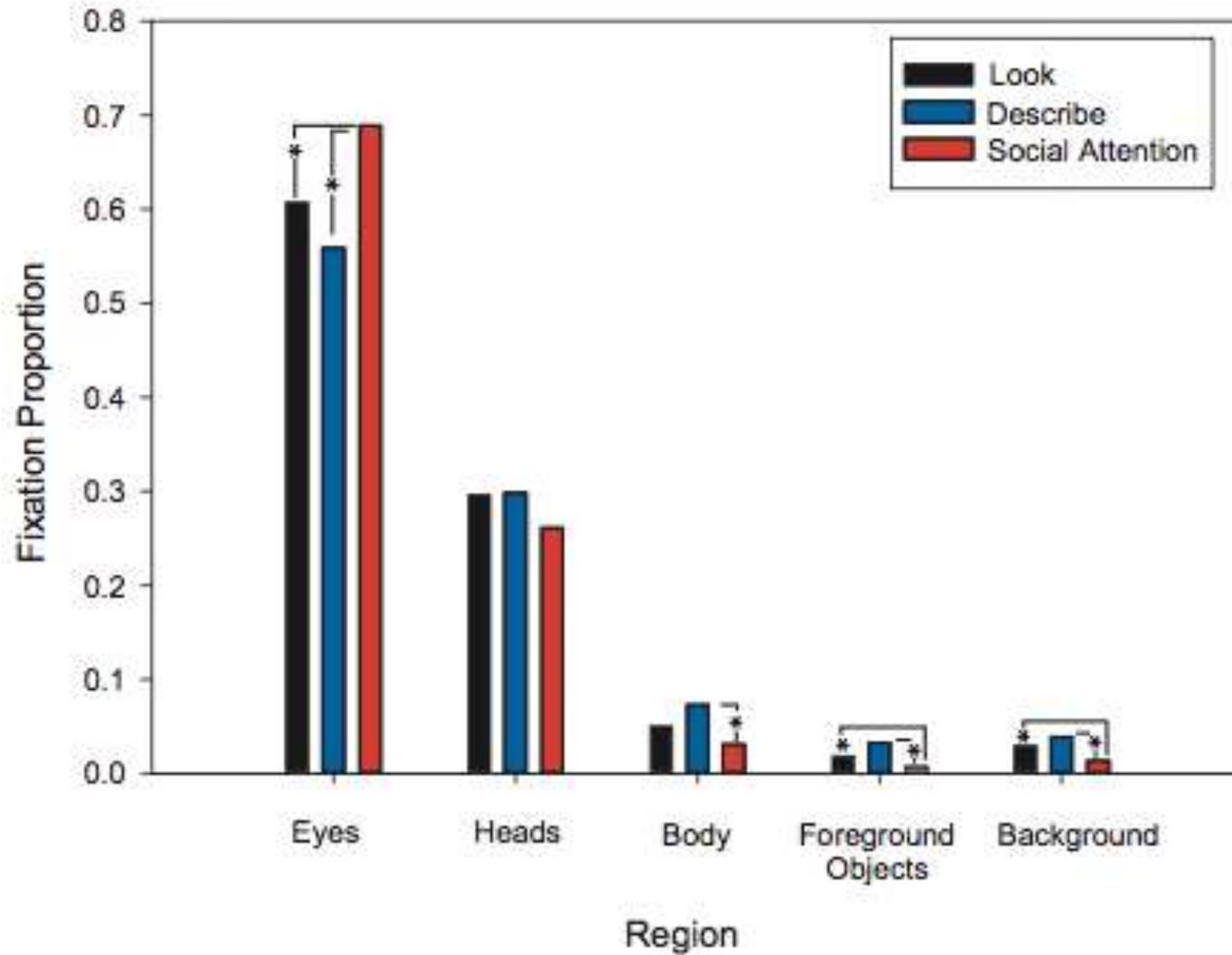
Regions of Interest



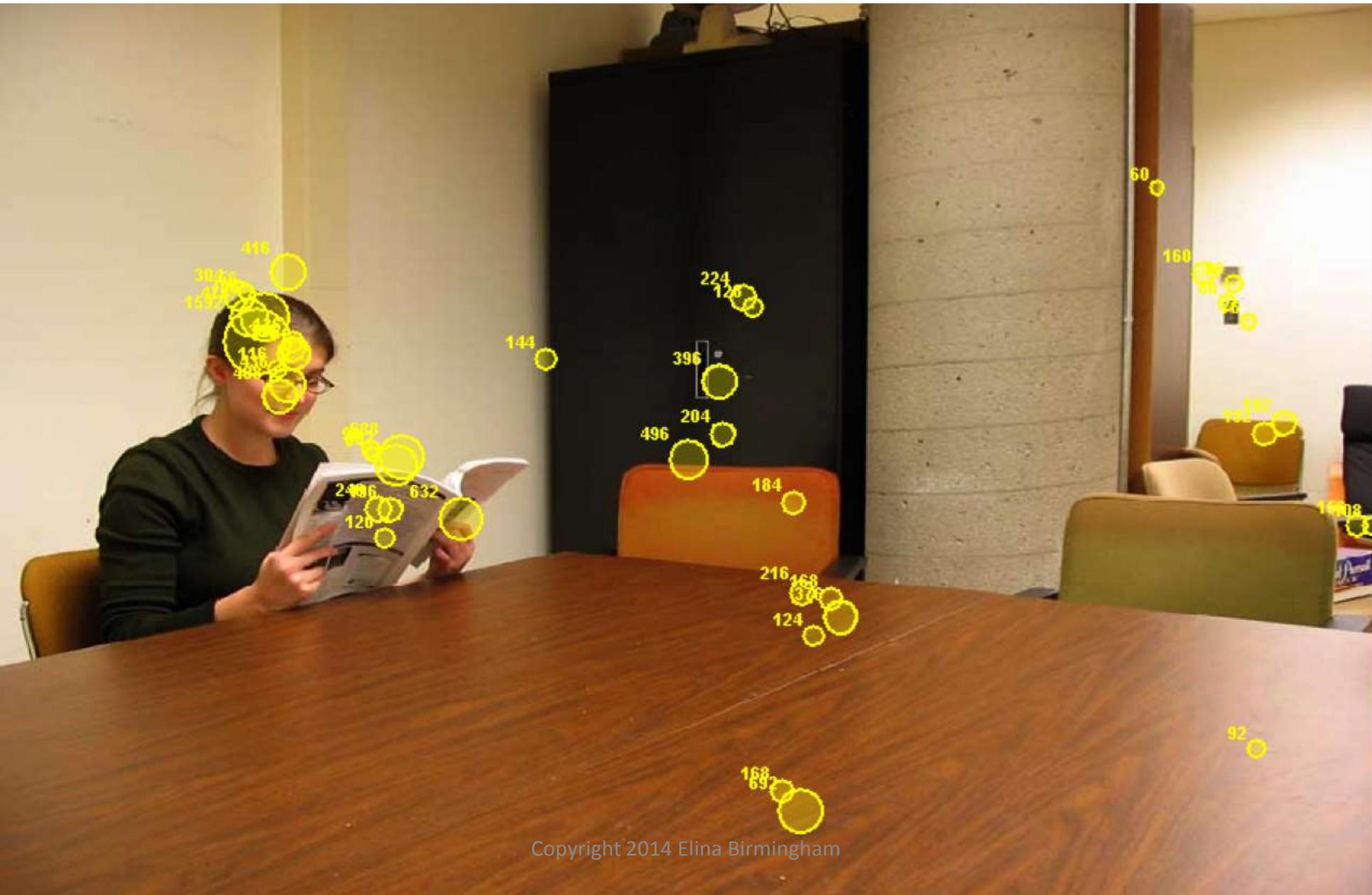
Task x Region



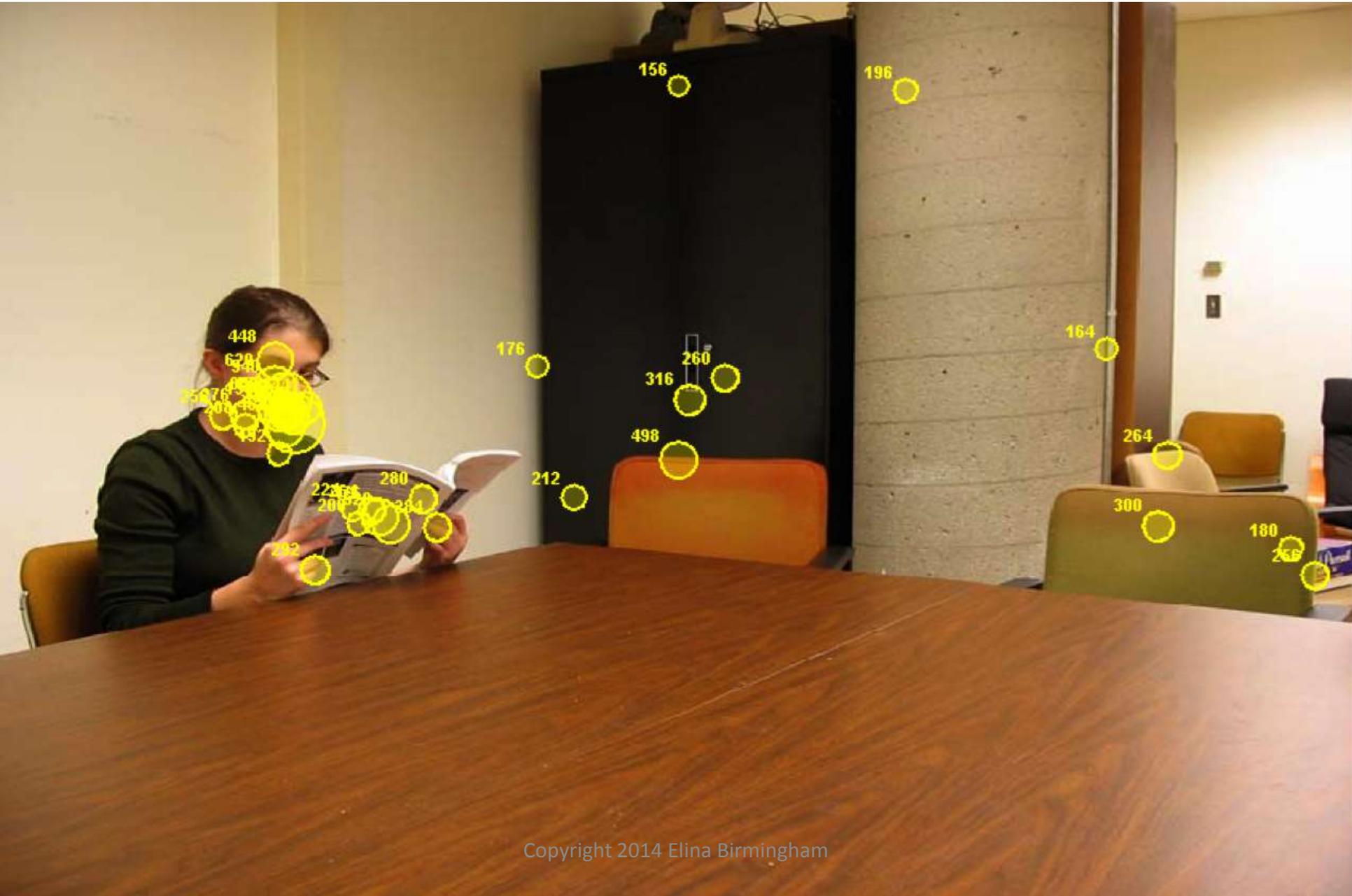
Task x Region



Task: Look



Task: Describe



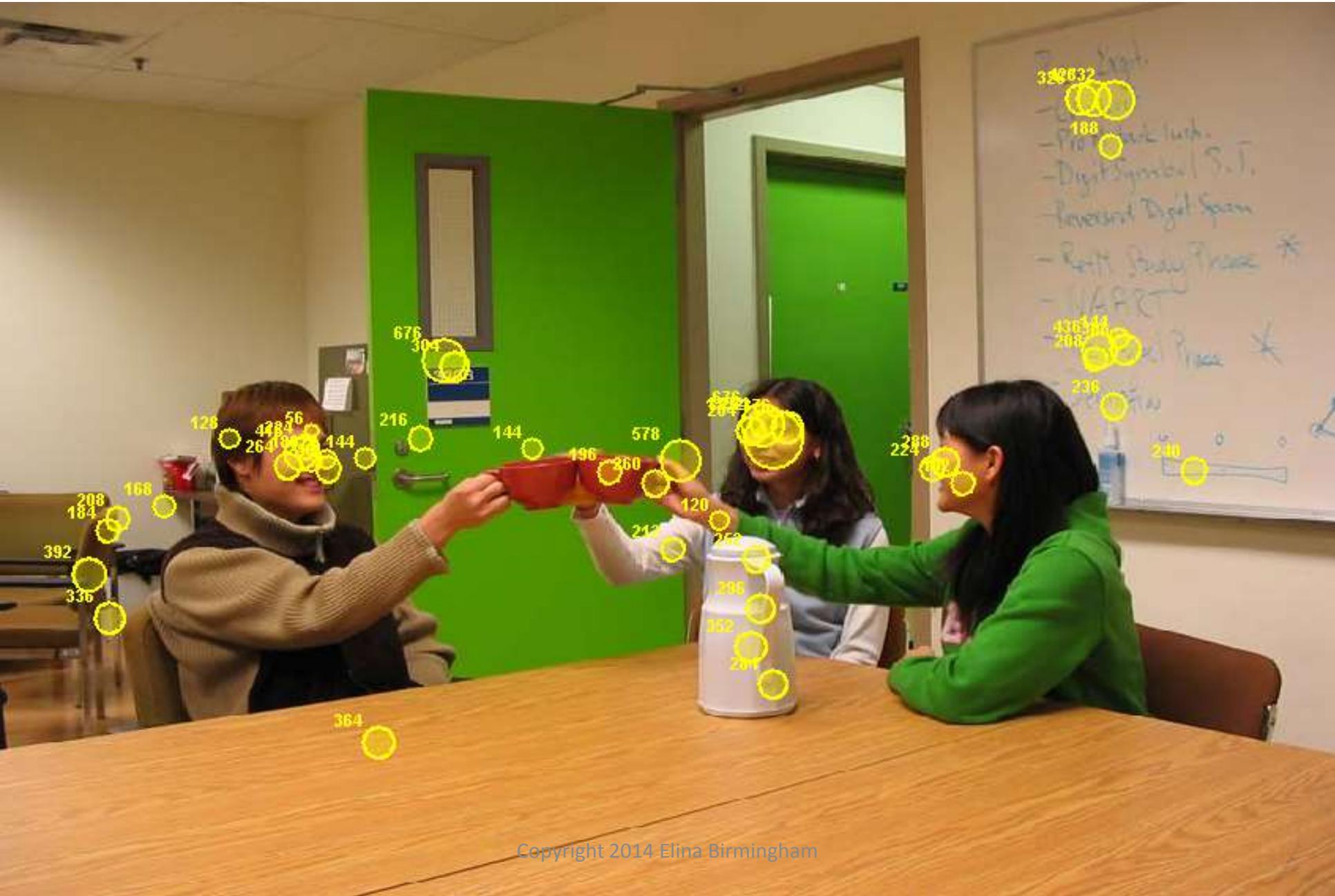
Task: Social attention



Task: Look



Task: Describe



Task: Social attention



Summary

- Preferential bias to select the eyes
- This bias is enhanced by the task to infer the attentional states of people in the picture
- Observers understand eye gaze to be important for determining where people are attending
- **Gaze selection is a key component of social attention**

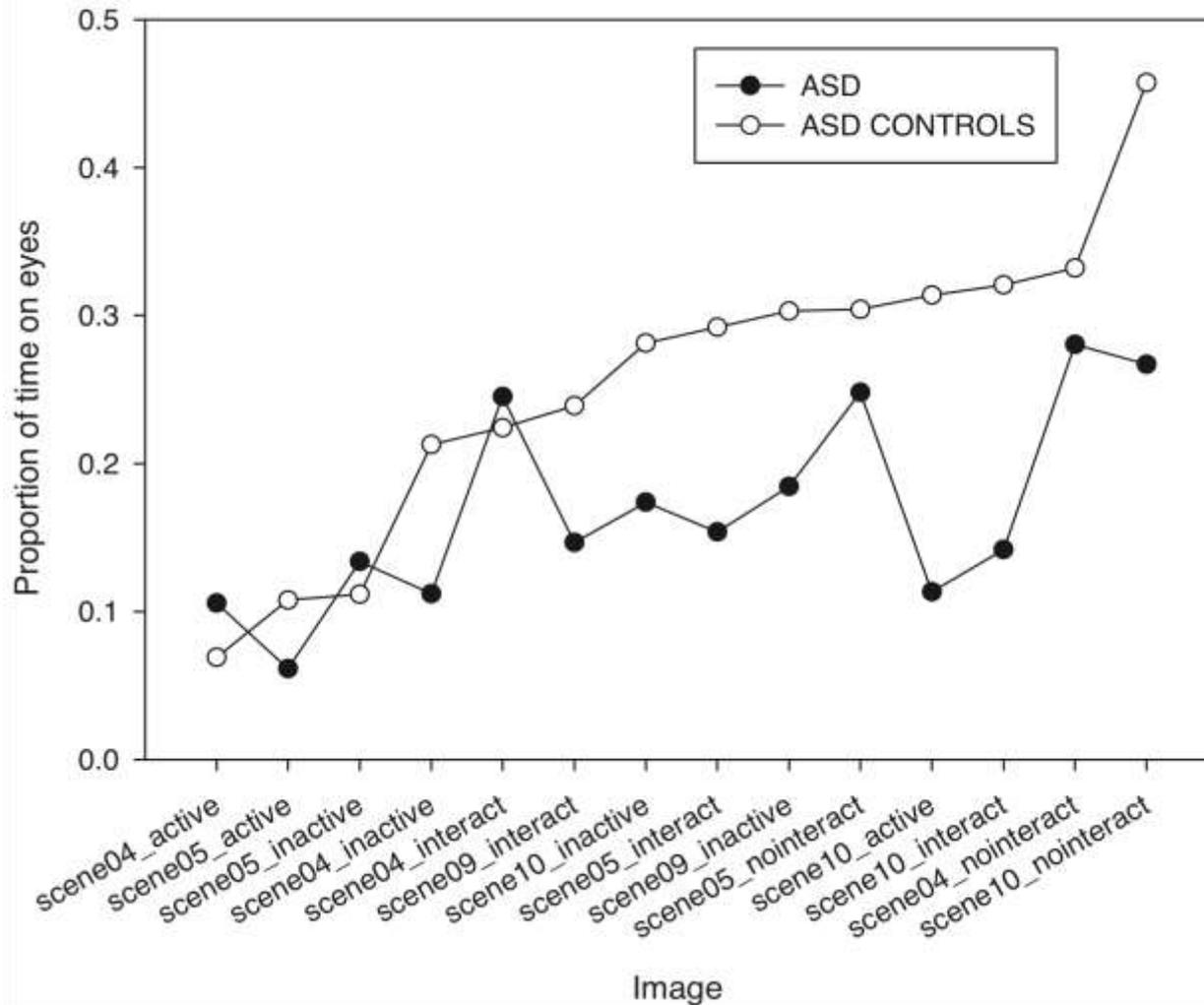
Examining gaze selection for social attention in ASD



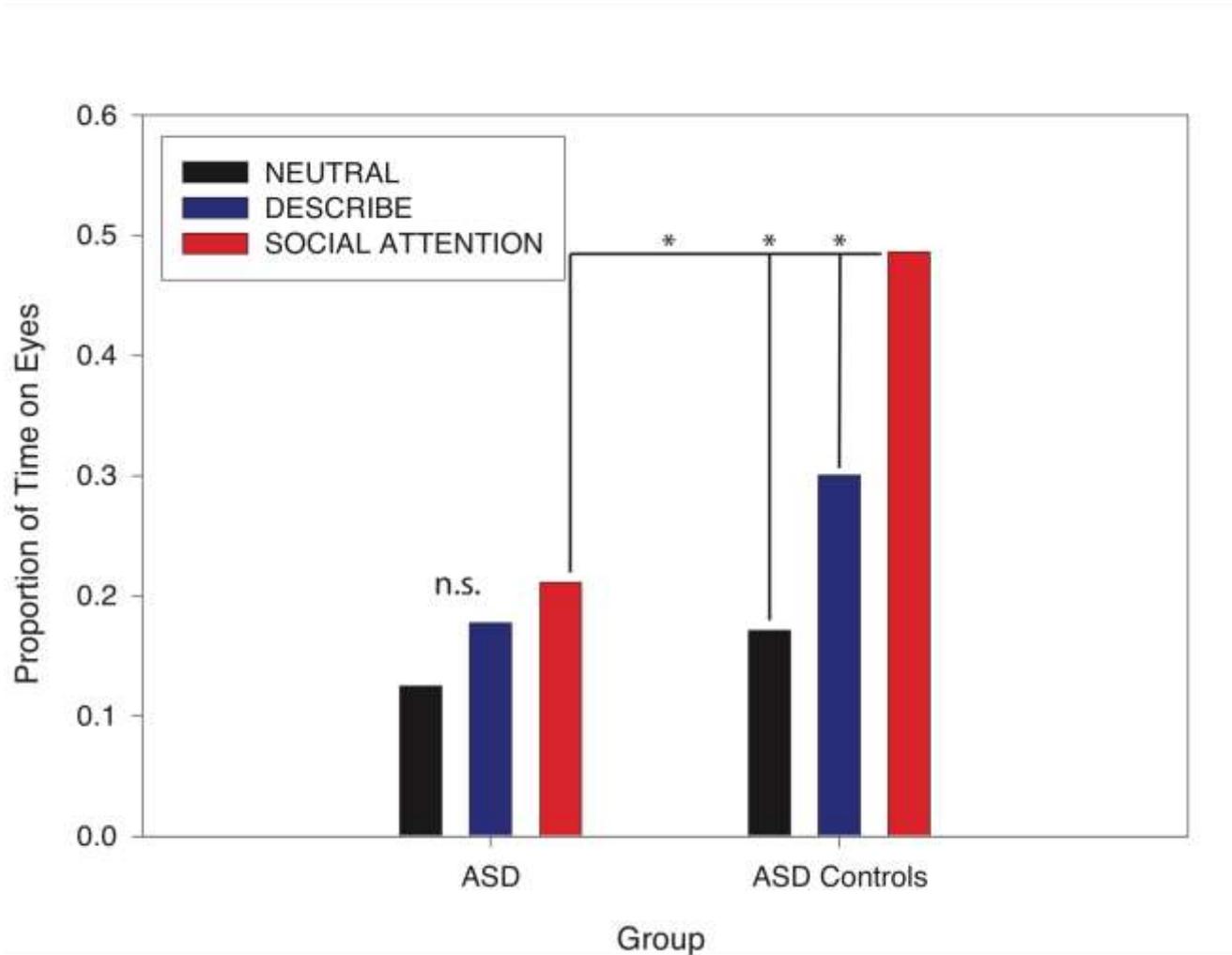
Examining gaze selection for social attention in ASD

- Is the bias for eyes reduced in ASD? (Consistent with early clinical profile)
- Do adults with ASD understand the eyes to be informative about where someone is attending?
- **Neutral** – what kind of room is this?
- **Describe** – describe the picture.
- **Social Attention** – where are people directing their attention?

Context: Image



Context: Task



Heat Maps

Typical



ASD



Summary

- Reduced attention to the eyes in the ASD group was present, but only for a subset of scenes
- For this subset of scenes, individuals with ASD did not increase their examination of the eyes to infer the attentional states of other people

The role of gaze selection in ASD

- These findings suggest that the most striking aspect of the social attention abnormality in ASD is **not** how individuals process social cues (gaze) that have already been selected for them (e.g., by an experimenter).
- Rather, the difference lies in the likelihood or way in which they seek out and select such information in the first place

Real World Social Attention Study

- Can we examine these two processes, gaze selection and gaze following, in more ecologically valid settings?

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Real World Social Attention Study

- Goal: observe social attention in an interactive task designed to measure spontaneous shifts of attention
- How do children with ASD select and follow social attention cues?
- What is the nature of atypical social attention in ASD?

- Dr. Grace Iarocci



Method

- N=26
 - ASD n=17 (high functioning: i.e., IQ >80)
 - TD n=11 (matched for group IQ and age)
- Age range: 8-15 years
- Mean age
 - ASD, M=11.7 years
 - TD, M=11.8 years

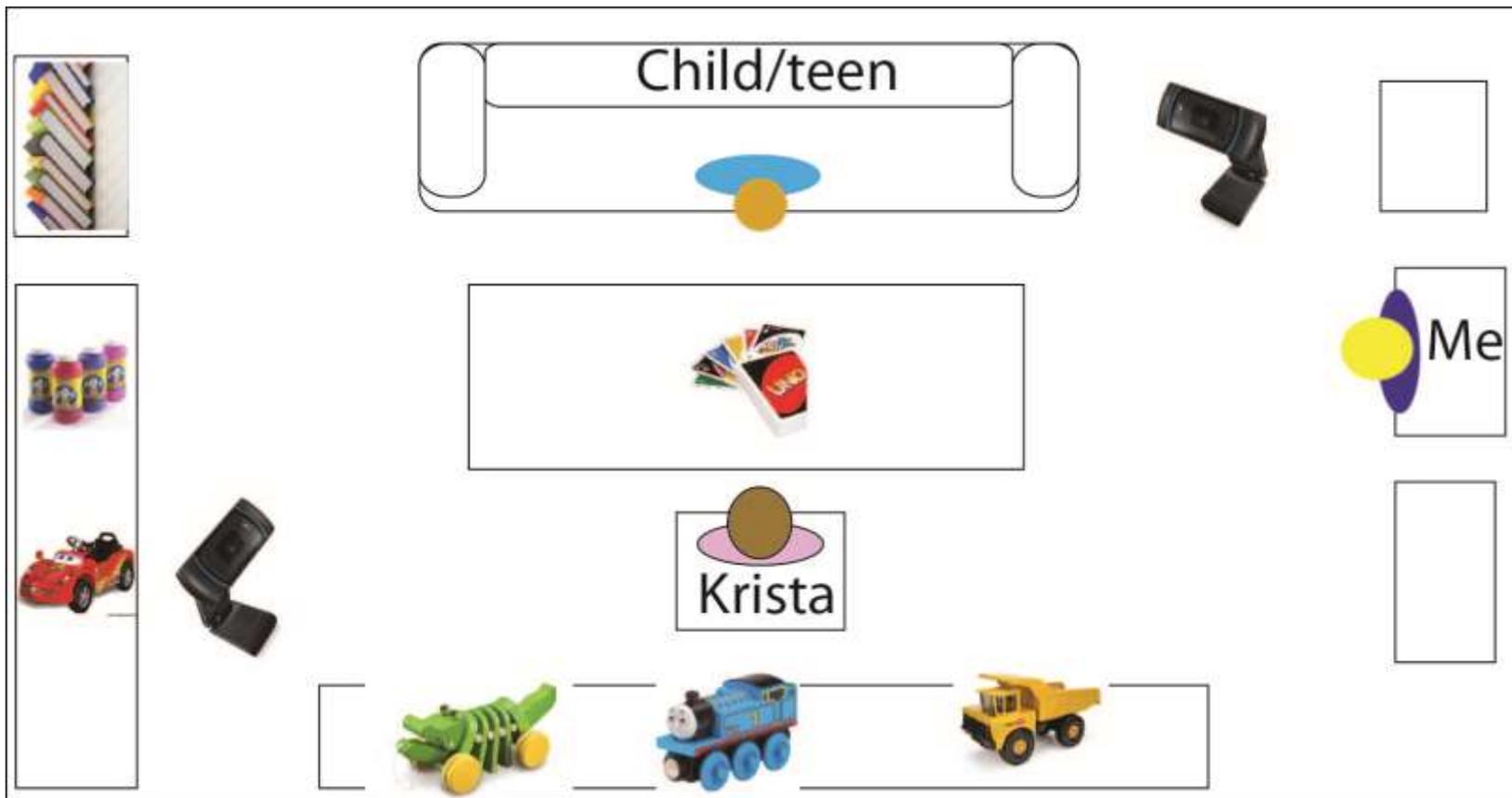


Method

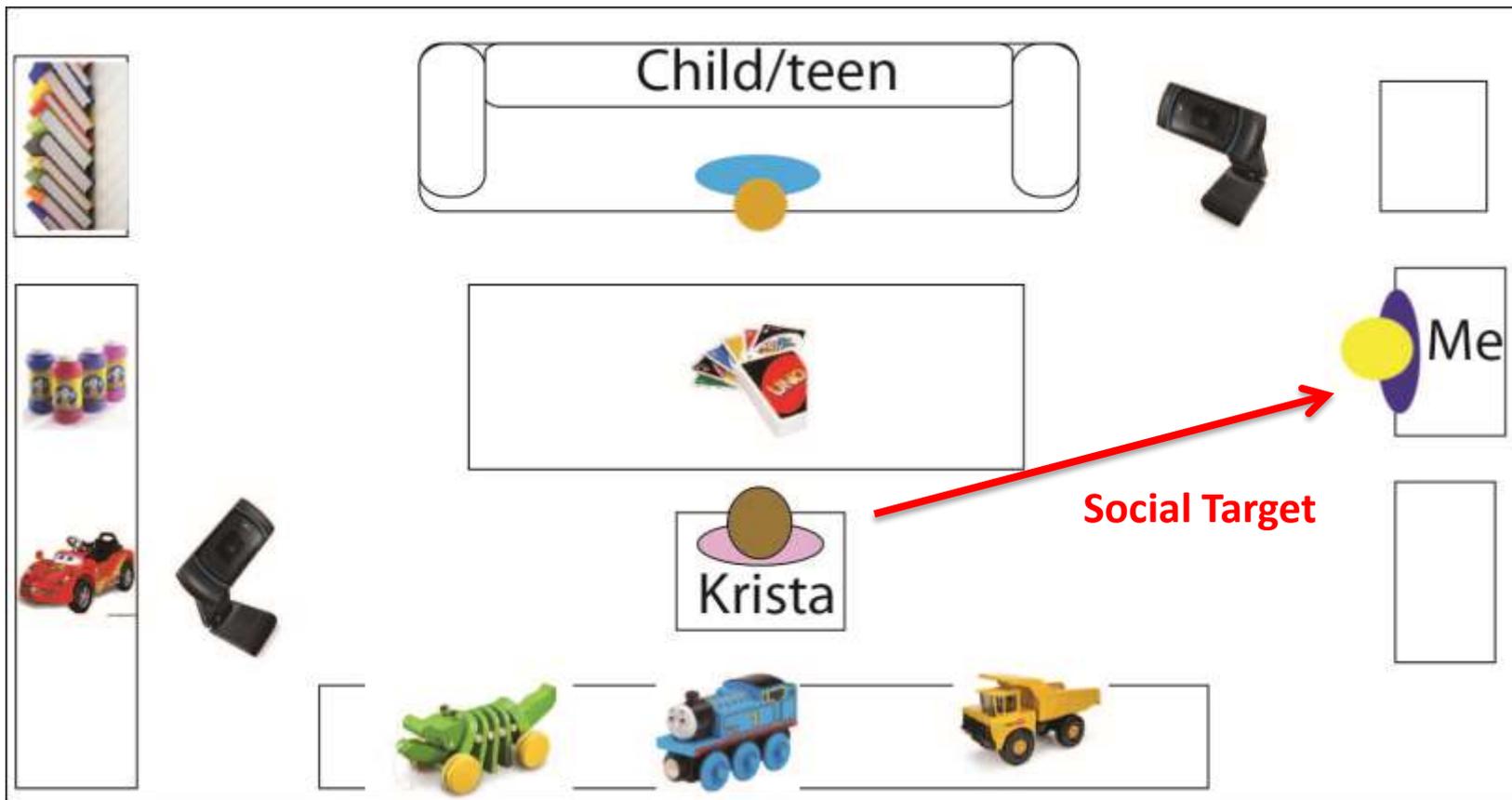


- Child wore an eye tracker and played a card game (UNO, Go Fish) with an experimenter (Krista Johnston)
- Krista pseudo-randomly averted her gaze (head turn)
 - Cue lasted for 10s or until response
- This was a very natural cue – happened seamlessly within the social interaction
- Designed to measure child's spontaneous monitoring of play partner's attentional state

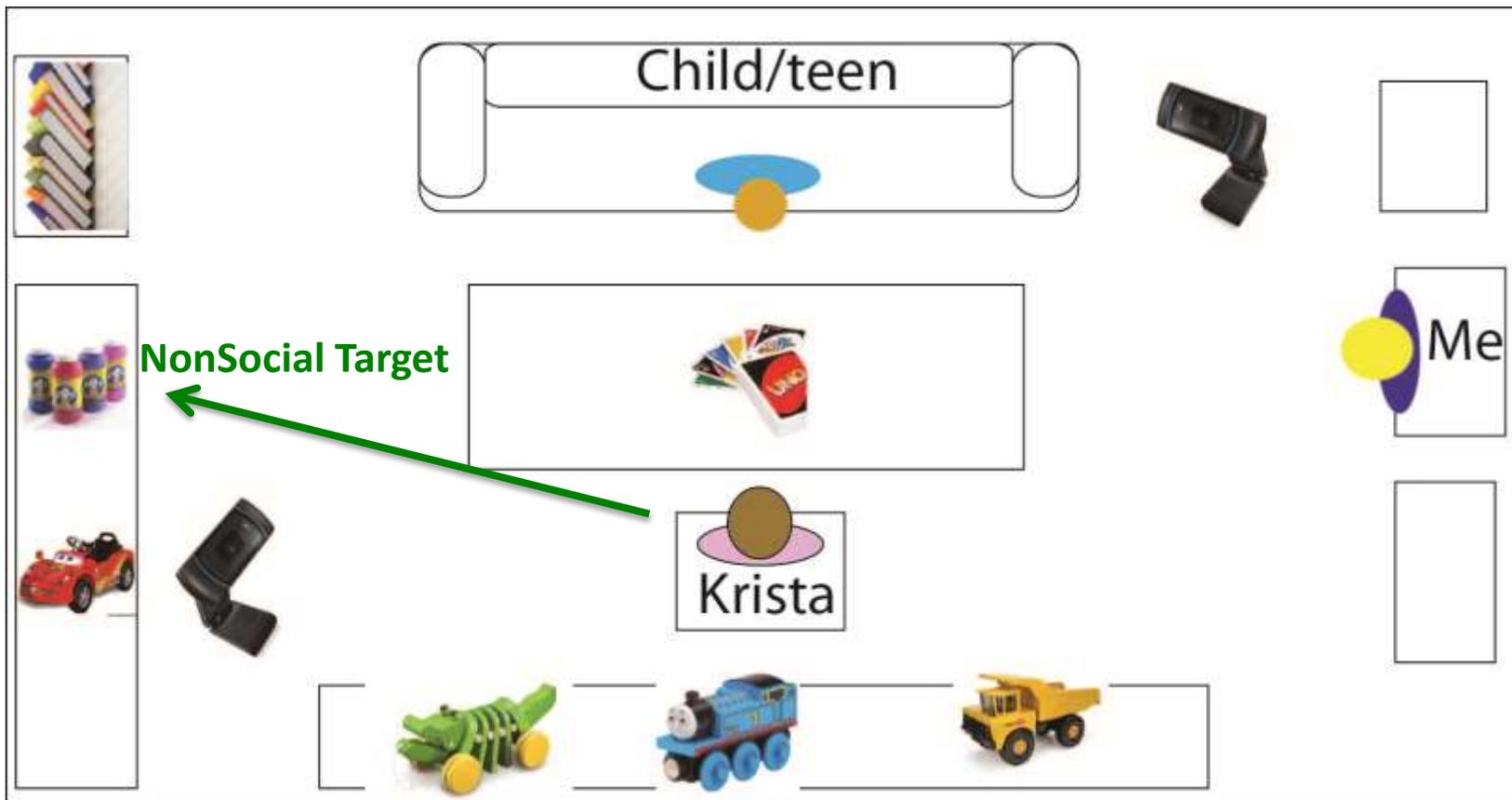
Method



Method



Method



Video: child with ASD playing “go fish”

Video: child with ASD playing “go fish”



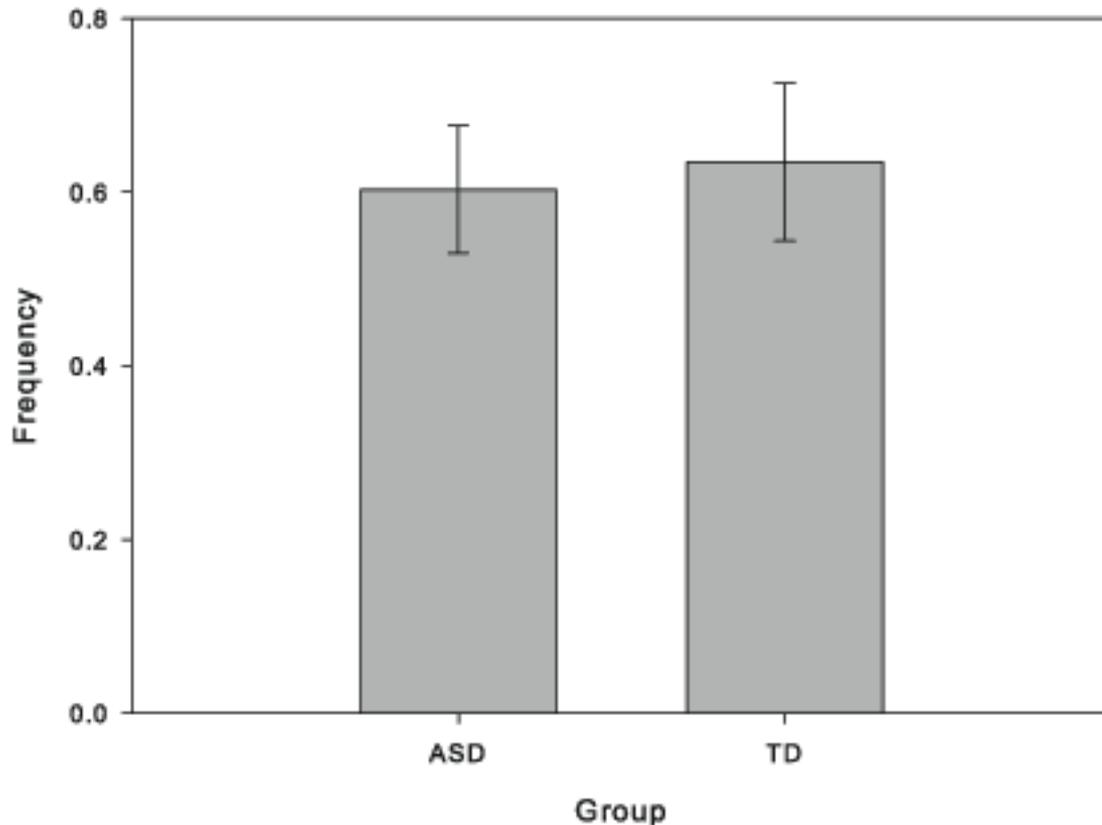
Measures of interest

- How likely are children with ASD to follow Krista's head turn?
- Frequency measure:

$$\frac{\text{\# times followed}}{\text{total \# trials}}$$

Results: Frequency of Gaze Following

ASD = TD



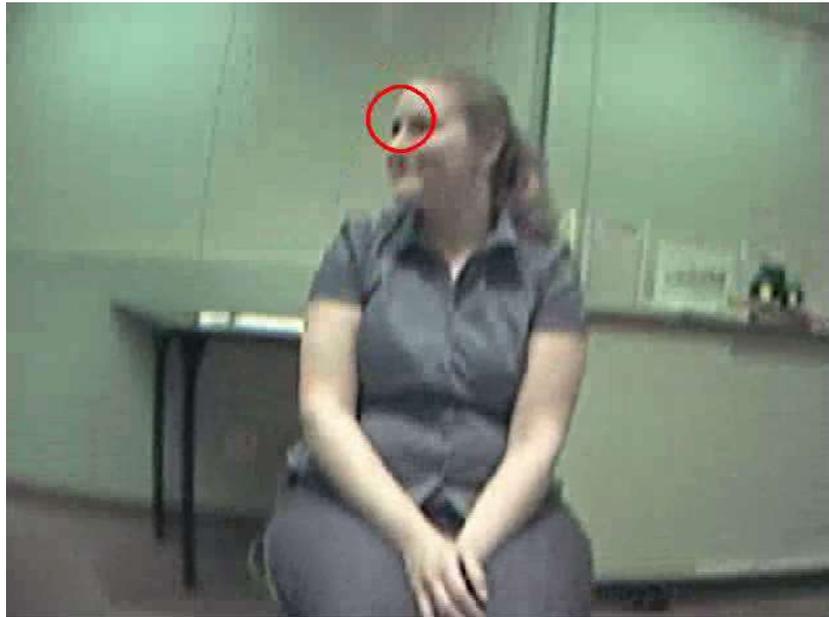
The groups were equally likely to follow Krista's head turn cue

Contrasts with the notion that kids with ASD are uninterested in where people are attending

What about when gaze selection is considered?

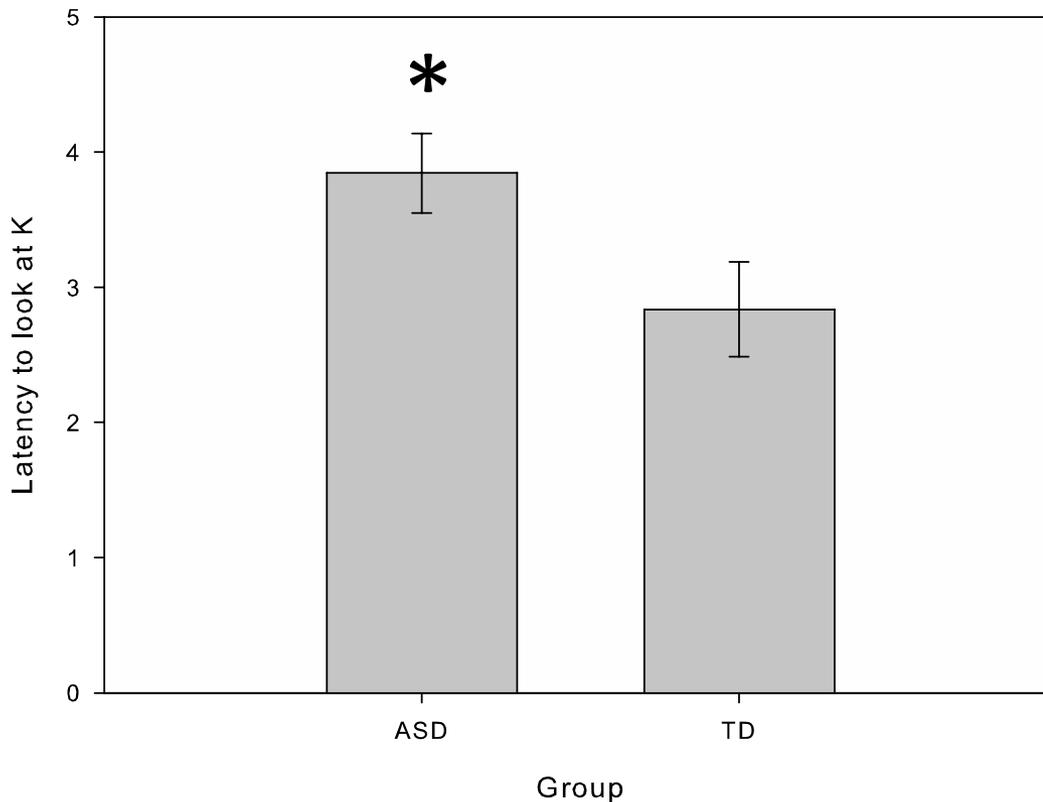
What about when gaze selection is considered?

- Measured the latency to look at Krista (relative to the onset of the cue)



Results: Latency to Look at Krista

ASD > TD

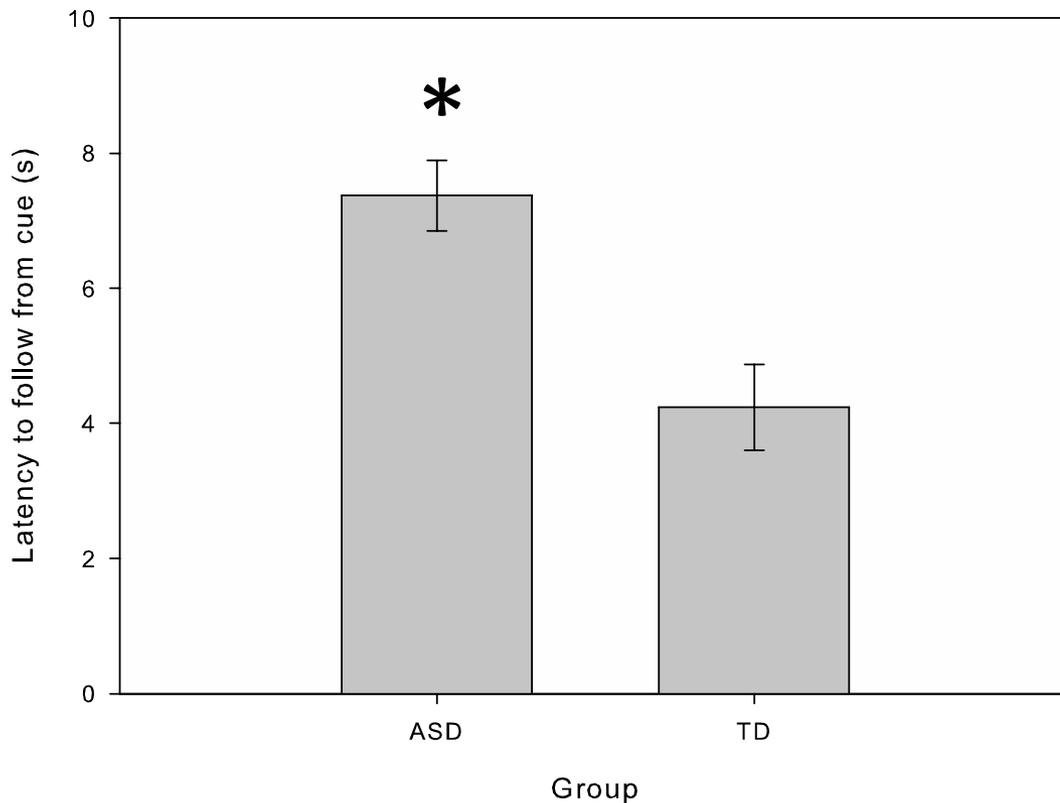


The ASD group was slower overall than the TD group to initially look at Krista

$F(1,25)=4.9, p<0.04$

Results: Latency to Follow Gaze Cue

ASD > TD



This also meant that the ASD group was overall slower to notice and follow Krista's gaze cue.

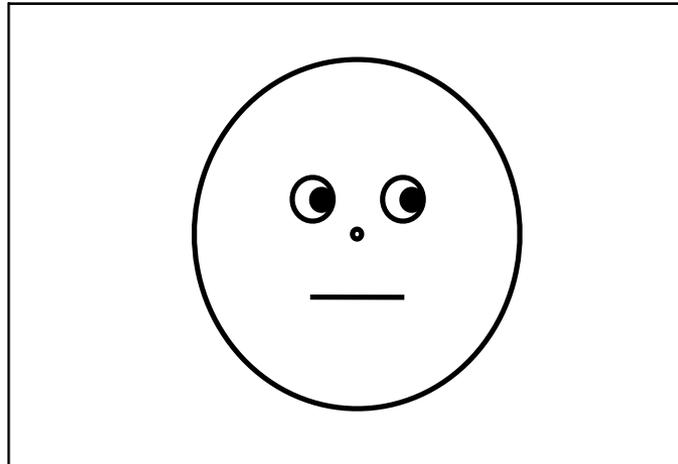
$F(1,25)=14.07,$
 $p<0.001$

Summary

- School-aged children with ASD were just as likely as TD children to follow the gaze cue
- Children with ASD were slower to notice and respond to the cue
- Not a case of “is it there, or isn’t it?”
 - Timing of the behavior is key to understanding ASD-related abnormalities in older children

Implications

- Measuring gaze selection reveals important ways in which social attention is affected in ASD
- This is lost in studies measuring gaze following in isolation



Slower to select → slower to follow

- May miss out on important social cues in rapidly changing, dynamic social environments



- Significant negative repercussions for social communication

Implications

- Jarrold et al. (2013): social attention (avatar selection) within a virtual reality environment



- The extent to which children selected the avatars predicted parent reports and objective measures of learning in the classroom

Interventions

- Target social cue selection as a key mechanism that contributes to social attention in ASD
 - The speed, in particular, with which social cues are selected and processed
- Future research should determine the impacts of
 - contextual variables, e.g., Mirenda et al. (1983): monologues vs. dialogues
 - Individual differences



Thank you



**University
of Victoria**