



Visual attention and sensory processing in ASD: research approaches and eyetracking methods

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Outline

Sensory processing continued

• Attention

• Training attention control





Outline

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- Attention

• Training attention control



Sensory processing continued



Research from the Wales Autism Research Centre... Multi-sensory environments



Katy Unwin, Georgie Powell & Catherine Jones (In progress)





Outline

Sensory processing continued

• Attention

• Training attention control





Clinical description of ASD (DSM V)



Attention

Ability to select or ignore information in environment



Not specific clinical feature of ASD But could contribute?



Attention in ASD – why are we interested?







Attention in ASD – eye tracking methods





- Non invasive
- Improving ease of use
- Relatively cheap
- Overcome barriers of communication and motor control





Attention in ASD – social attention





Bias away from eyes

But show same bias for social scenes



Sue Fletcher-Watson, Sue Leekam, Valerie Benson, Michael Frank and John Findlay (2009). Neuropsychologia

Klin et al., (2002). Archives Psychiatry.



Attention in ASD – Social attention



Typically developing (TD) children and children with ASD *both* show bias to look at eyes before mouth



Sarah Thompson, Sue Leekam, Georgie Powell and Catherine Jones (in prep)





Attention in ASD – Non-social attention

Disengagement – gap-overlap task

Difficulty ignoring distractors



Slower to

move eyes

Flanker task

Adams & Jarrold (2010) JADD

e.g. Landry and Bryson 2004, Kawakubo el al, 2007, Elsabbagh et al., 2009, 2013.

Faster to

move eyes





Attention in ASD – Non-social attention

Individuals with ASD can perform better on some tasks





Jolliffe & Baron-Cohen (1997)

O'Riordan et al., (2001)





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Attention in ASD – why are we interested?







Attention in ASD – can it be trained?





Evidence for implicit learning of context in a visual search paradigm

ASD group had longer fixation durations overall and slower to launch first eye movement

Anastasia Kourkoulou, John Findlay and Sue Leekam (2012), JADD

-NEW



Attention in ASD – can it be trained?



Sam Wass et al., 2012

Developed a set of attention training games that improved some areas of attention in 11 month old typically developing infants.





Training attention in ASD- areas to train



1. Sustained attention











Training attention in ASD- study design



Training games - Butterfly

Sustaining attention, ignoring distractors



Training games - Butterfly

Sustaining attention, ignoring distractors



Training games - Stars

Disengagement, ignoring distractors, memory



Game increases in difficulty level adaptively.

Visual rewards

Training games - Stars

Disengagement, ignoring distractors

Training games – Fly Me (to the moon)

Sustained attention, Ignoring distractors, peripheral monitoring, disengagement





Increase to two and three birds – switch gaze between them.





Training attention in ASD- study design







- All had a diagnosis of ASD
- Recruited and tested at local schools
- No exclusion criteria
- 19/27 children recruited engaged (70%)



Ν	9	8
Gender	1 F	1 F
Calendar age	6 yrs	7 yrs
	5 mon	2 mon
Mental age equivalent	6.37	6.39



Training attention in ASD- sustained attention



Improvement in sustained attention

- ANCOVA controlling for pre-test scores - significant difference in post-test first look duration to interesting images, F(1, 14) = 5.2, p < 0.05, d = 0.67).
- No difference in post-test first look duration for the boring images, F (1, 14) = 1.2, p > 0.05.





Training attention in ASD- sustained attention



Current study







Boring

Interesting



Training attention in ASD- results summary



- 1. Sustained attention: Significant improvement in first look duration.
- 2. Disengagement: Problems with data quality, potentially promising but need larger sample.
- **3.** Prediction/anticipation: Some participants seem to improve, but need more for it to reach significance.









Training attention in ASD- future directions



Tailor games to individual ability profiles and interests











Training attention in ASD- future directions



Portable technology – tablets with eye trackers built in.







Talk summary



- Social and non-social attention important for development
- Children with ASD may have difficulties in some aspects of attention
- Training attention early could aid development in other domains
- Attention control training is feasible in children with autism
- And it may lead to improvements in some areas of attention
- ...But more research needed

http://sites.cardiff.ac.uk/warc/



Training attention in ASD– Acknowledgements



Project collaborators



Professor Sue Leekam Chair in Autism School of Psychology Cardiff University

wellcometrust



Dr Sam Wass Research Fellow MRC Brain and Cognition Unit, Cambridge



Professor Jonathan Erichsen School of Optometry and Vision Sciences Cardiff University



Professor Angus Clarke School of Medical Genetics Cardiff University

- Participants and families
- Teachers and support staff



Training attention in ASD- sustained attention







Training attention in ASD- sustained attention



Boring

Interesting







Training attention in ASD- training data





Training attention in ASD- training data

All but two participants show a trend upwards over sessions.

This suggests that most participants improved on the training games.

Some participants are consistently better at games than others.











Difficulty tracking fast moving ball

1 st Throw	2 nd Throw	Fake Throw
··· · · · · · · · · · · · · · · · · ·		• • • 800
		700
		500 a
		400 pg
-in	No.	300 ÷
Y R	9.8	≥200 ○ 100
		0

- Individuals with ASD not more susceptible to illusion.
- But temporal delay in shifting gaze and following ball.
- Suggests, difficulty quickly allocating attention to people and objects.

Gustav Kuhn, Anastasia Kourkoulou and Sue Leekam (2010) Psych Sci.



Training attention in ASD- too easy?



Some games are too easy

This is what we see in our sample..



Georgie Powell, Sam Wass, Jon Erichsen & Sue Leekam (2016). Autism

This is what we see in infants..





Ideal sample



Trained group



Our sample

Control group



Attention in ASD – what causes problems?





Bottom up

Physiological Over-arousal Under-arousal Modulation

Top down

Integration of information, Memory, Narrow attentional lens

