Let's Face It!: New technologies to improve the social skills of children with autism

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Presentation Outline

1. The nature of face processing

2. The assessment of face processing

3. Technology-based interventions (Centre for Autism Research Technology & Education - CARTE)

   • Facial expression production

   • Can we build social networks through iPad apps?

Faces are special

Faces carry a wealth of information about who we are, what we are feeling and what we are thinking

Identity

Expression

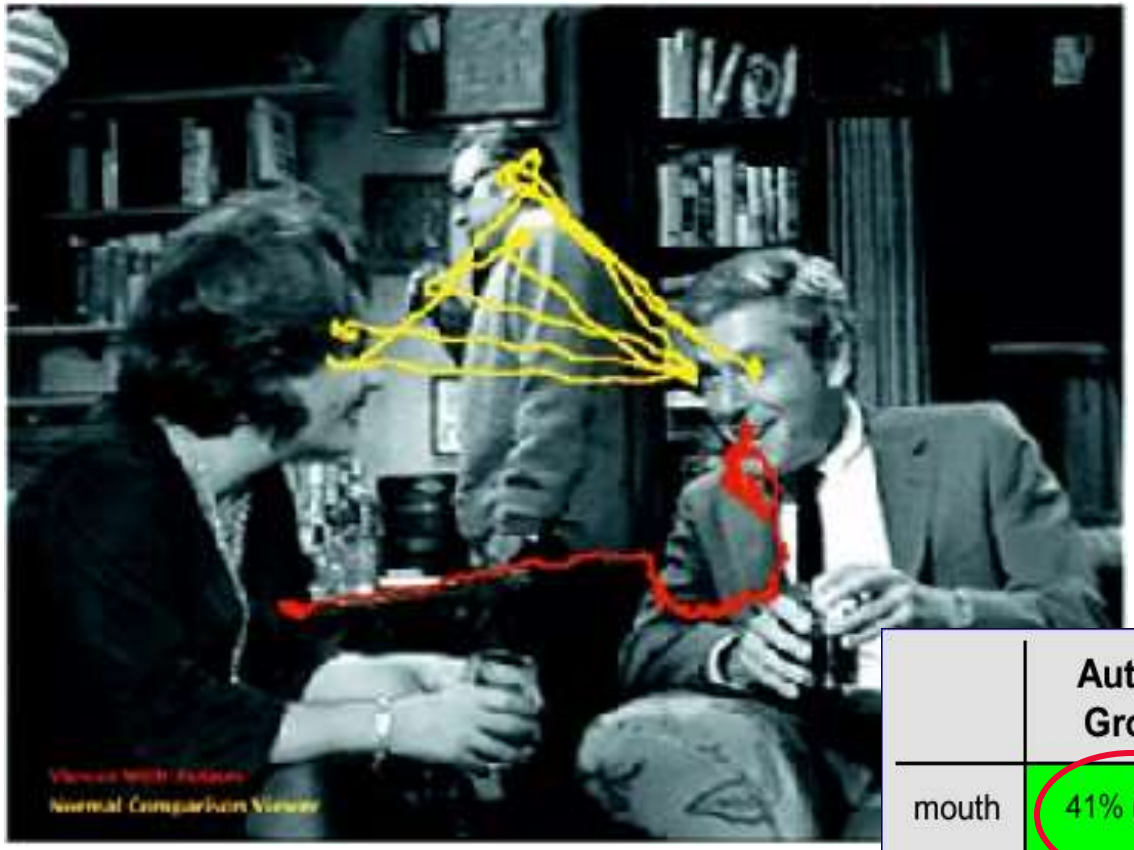
Eye Gaze

Most of us can perform these face processing skills so accurately and effortlessly that we can be referred to as “face experts”.

Children with autism are face “novic

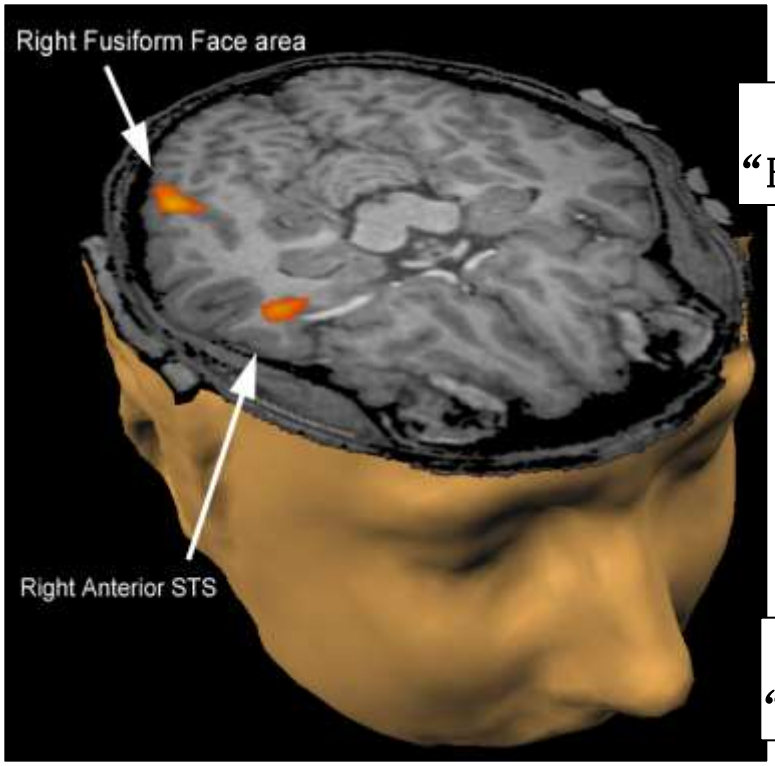
- Spend significantly less time looking at faces and eyes (Dalton *et al.* 2005; Klin et al., 2002, 2009)
- Difficulty recognizing facial identity (Weigelt, Koldewyn & Kanwisher, 2012, Wolf et al. 2009)
- Difficulty interpreting facial expressions (Harms et al., 2010; Tanaka et al., 2012)

Visual fixation patterns during viewing of naturalistic scenes (Klin et al., 2002)

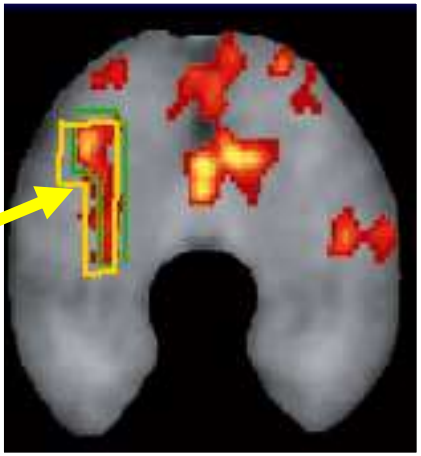


	Autism Group	Normal Controls	*t* values
mouth	41% (15)	21% (12)	4.03, $p < .001$
eyes	25% (8)	65% (13)	10.50, $p < .001$
body	25% (12)	10% (6)	4.23, $p < .001$
object	10% (6)	4% (2)	3.30, $p < .003$

Brain activation of fusiform “face” area in neuroimaging (Schultz, 2005)

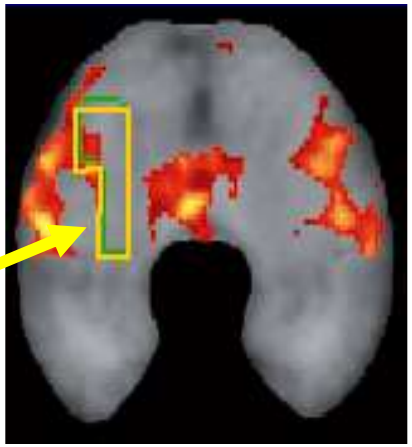


Fusiform “Face” Area



Control Group

Fusiform “Face” Area



Autism Group

Horizontal (Coronal) View

What face processes are impaired in autism?: *Let's Face It!* Test Batt

RESEARCH ARTICLE

Specific Impairment of Face-Processing Abilities in Children With Autism Spectrum Disorder Using the *Let's Face It!* Skills Battery

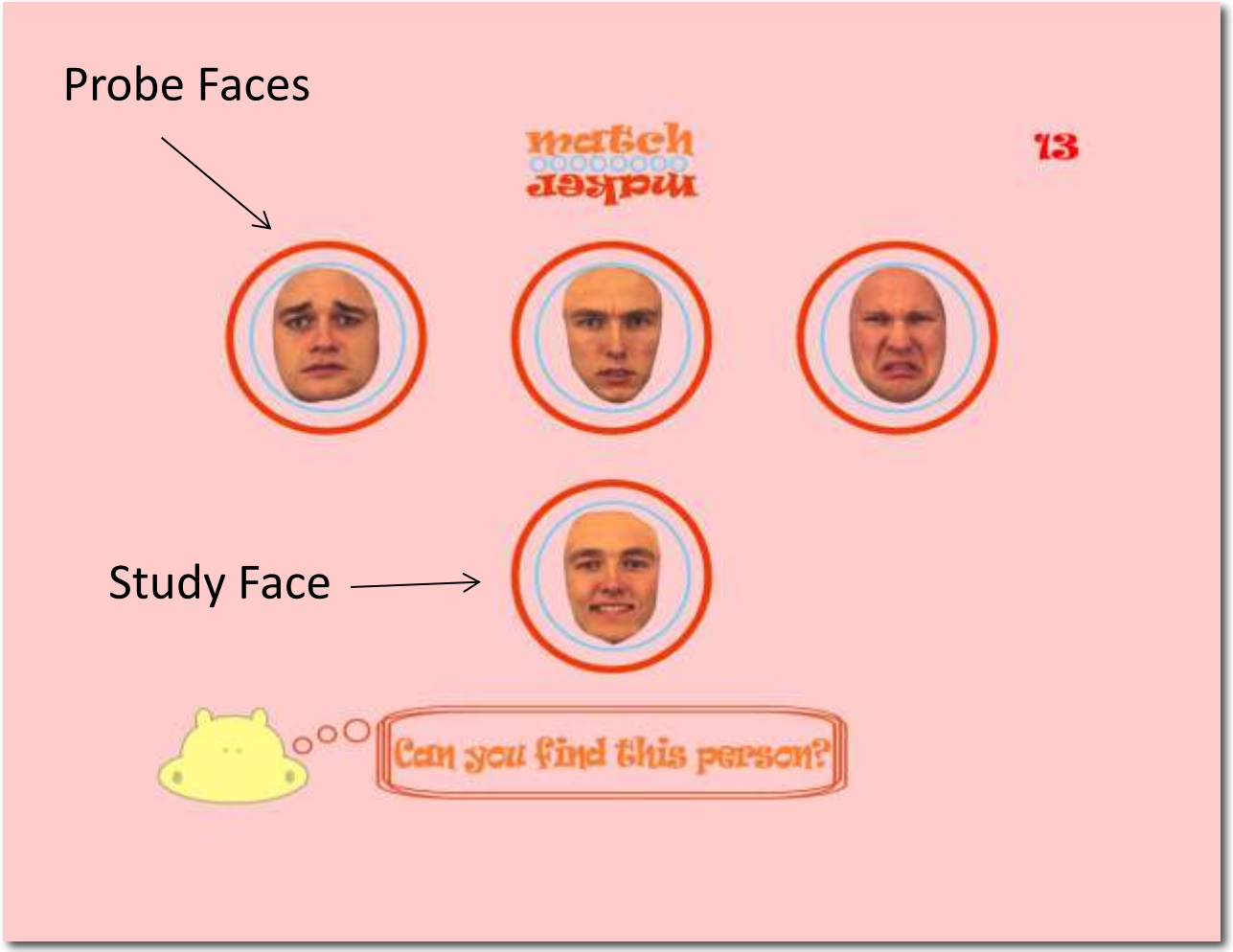
Julie M. Wolf, James W. Tanaka, Cheryl Klaiman, Jeff Cockburn, Lauren Herlihy, Carla Brown, Mikle South, James McPartland, Martha D. Kaiser, Rebecca Phillips, and Robert T. Schultz

Although it has been well established that individuals with autism exhibit difficulties in their face recognition abilities, it has been debated whether this deficit reflects a category-specific impairment of faces or a general perceptual bias toward the local-level information in a stimulus. In this study, the *Let's Face It!* Skills Battery [Tanaka & Schultz, 2008] of developmental face- and object-processing measures was administered to a large sample of children diagnosed with autism spectrum disorder (ASD) and typically developing children. The main finding was that when matched for age and IQ, individuals with ASD were selectively impaired in their ability to recognize faces across changes in orientation, expression and featural information. In a face discrimination task, ASD participants showed a preserved ability to discriminate featural and configural information in the mouth region of a face, but were compromised in their ability to discriminate featural and configural information in the eyes. On object-processing tasks, ASD participants demonstrated a normal ability to recognize automobiles across changes in orientation and a superior ability to discriminate featural and configural information in houses. These findings indicate that the face-processing deficits in ASD are not due to a local-processing bias, but reflect a category-specific impairment of faces characterized by a failure to form view-invariant face representations and discriminate information in the eye region of the face.

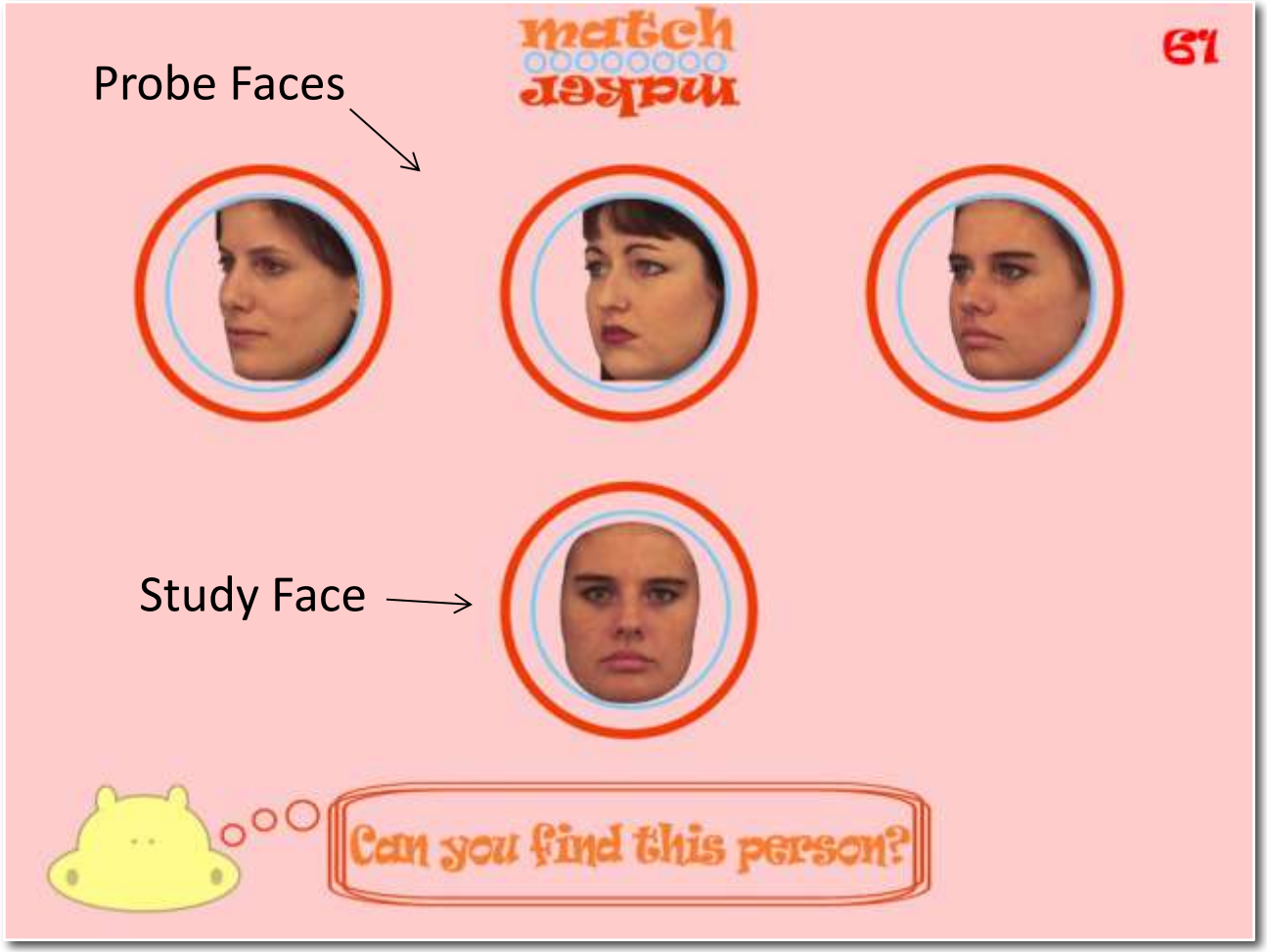
Wolf et al. 2009, *Autism Researc*

85 children and adolescents with ASD and 85 Full Scale IQ- and age-matched control participants were administered a battery of face processing measures.

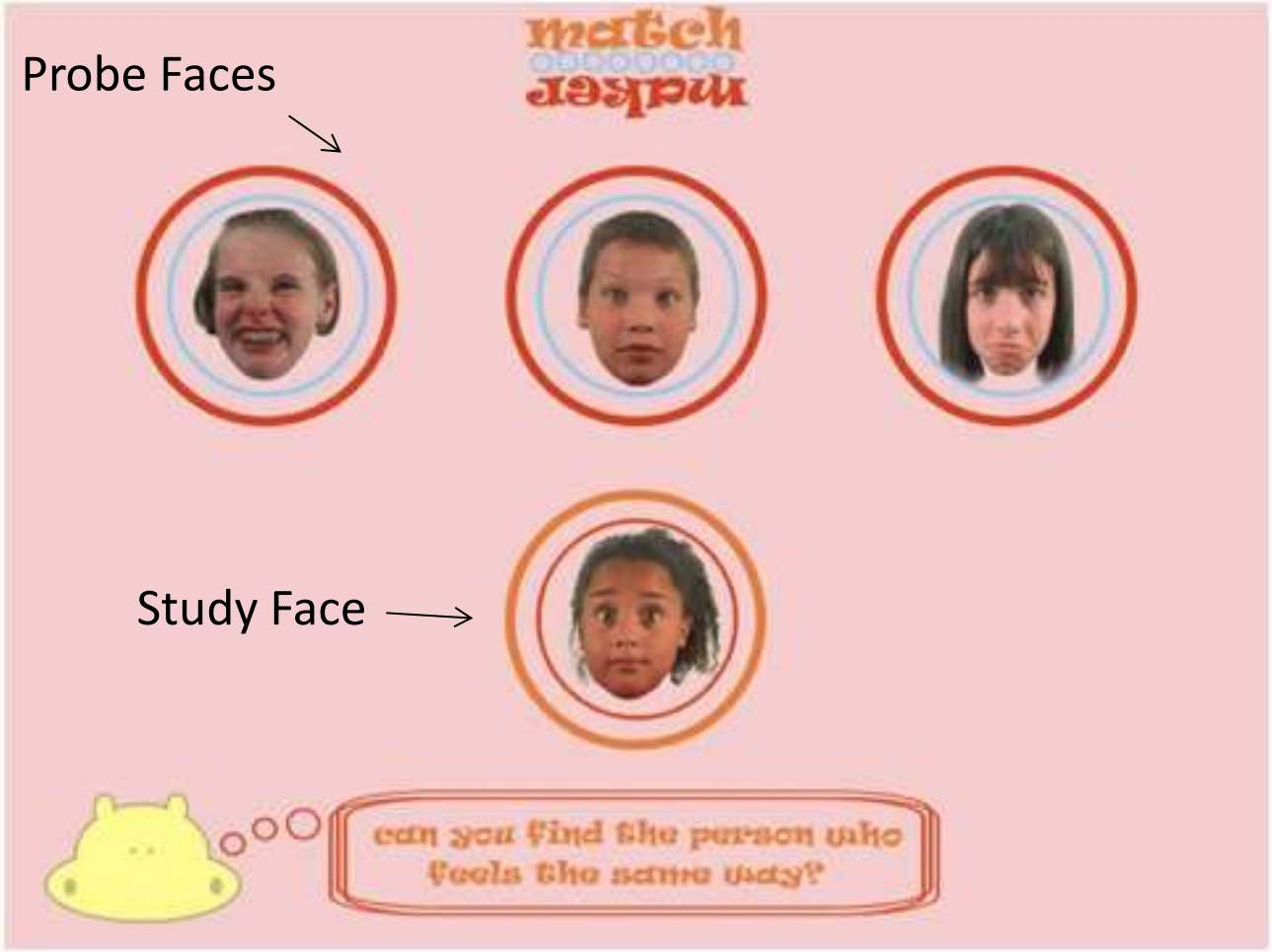
Recognition of identity across changes in expression



Recognition of identity across changes in viewpoint



Recognition of expression across changes in identity



Tanaka et al., 2012. *J of Child Psych & Psychi*

Results: Children with autism have difficulty creating abstract face memories

Abstract Identity Representation

Angry Shaun | Scared Shaun | Happy Shaun

Shaun

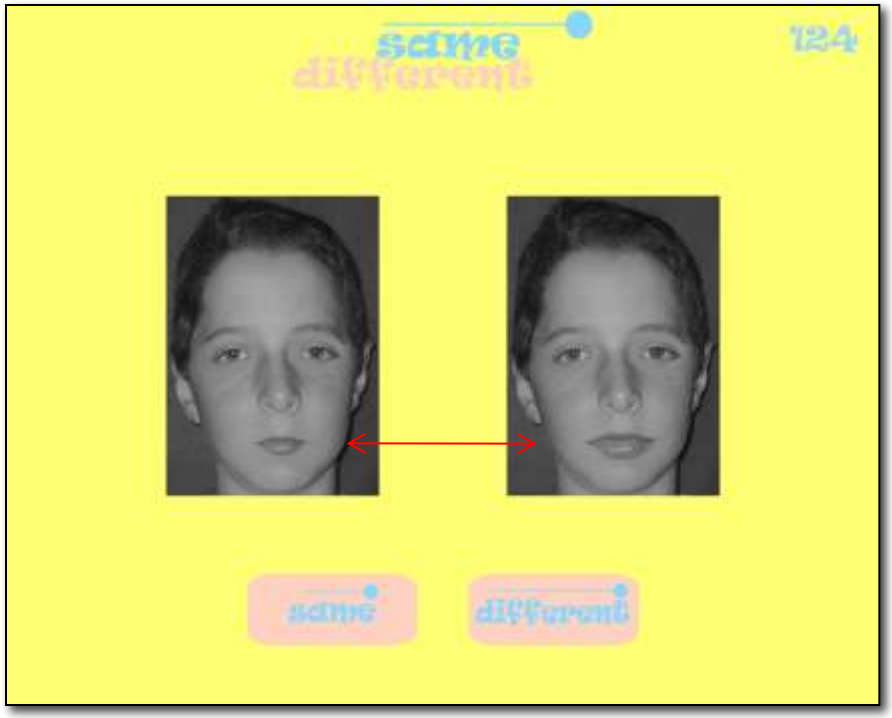
Abstract Expression Representation

Happy Julie | Happy Meg | Happy Billy

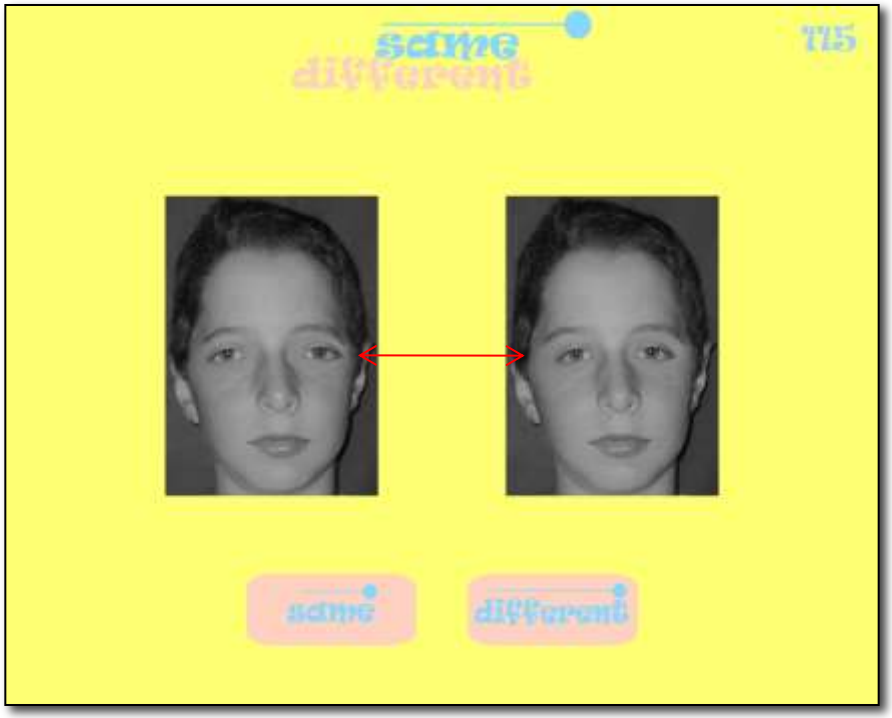
Happy

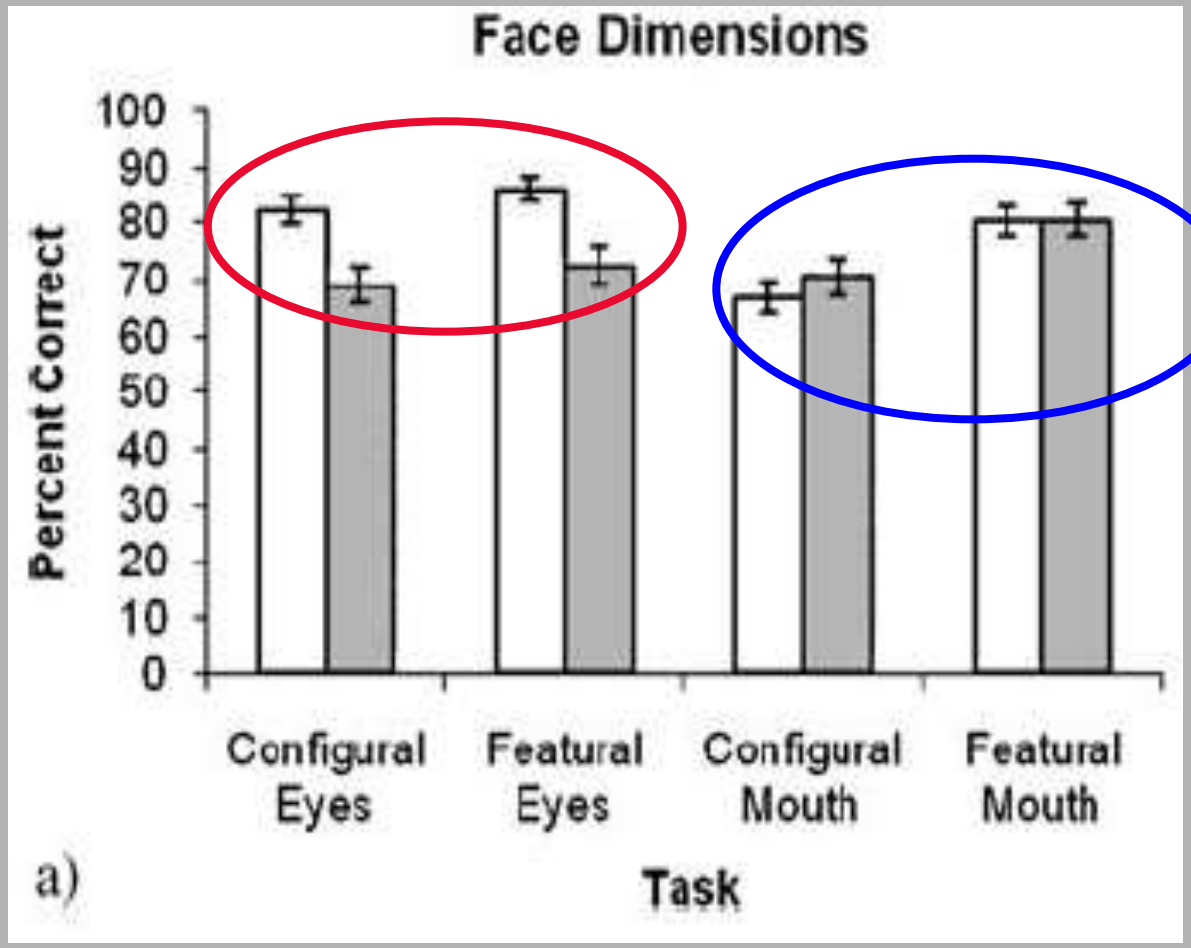
Same/Different Faces

Featural Mouth



Configural Eyes



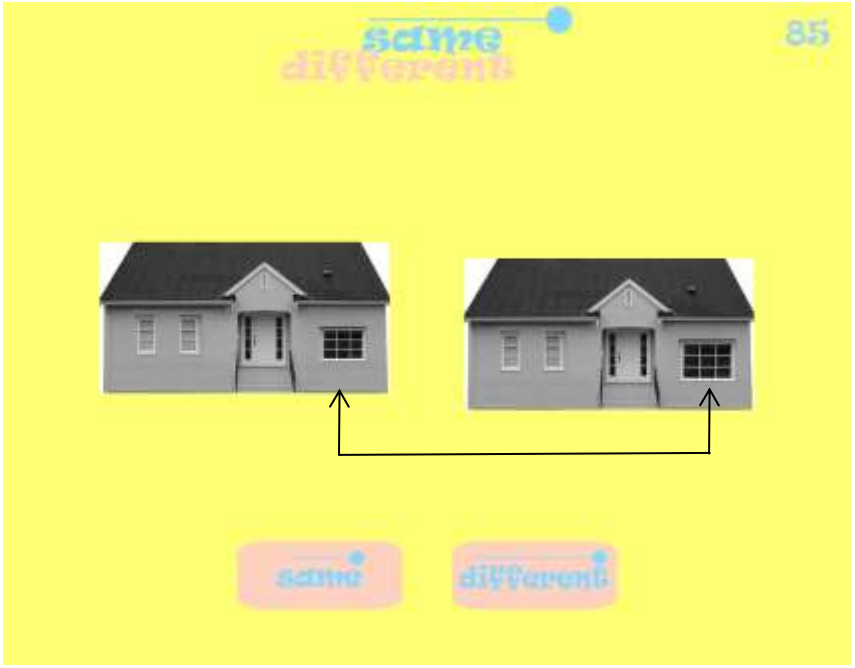


Typically Developing

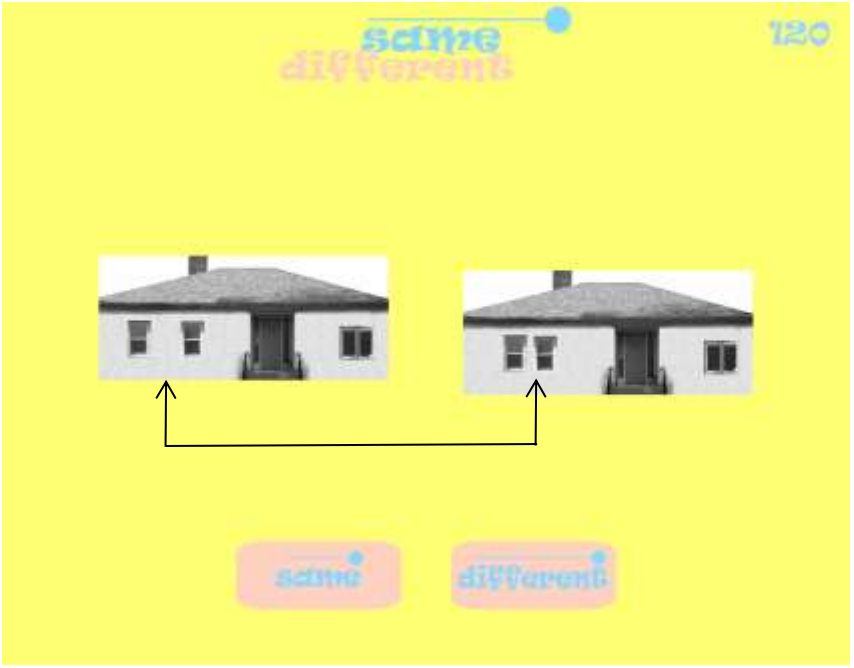
Autism Spectrum

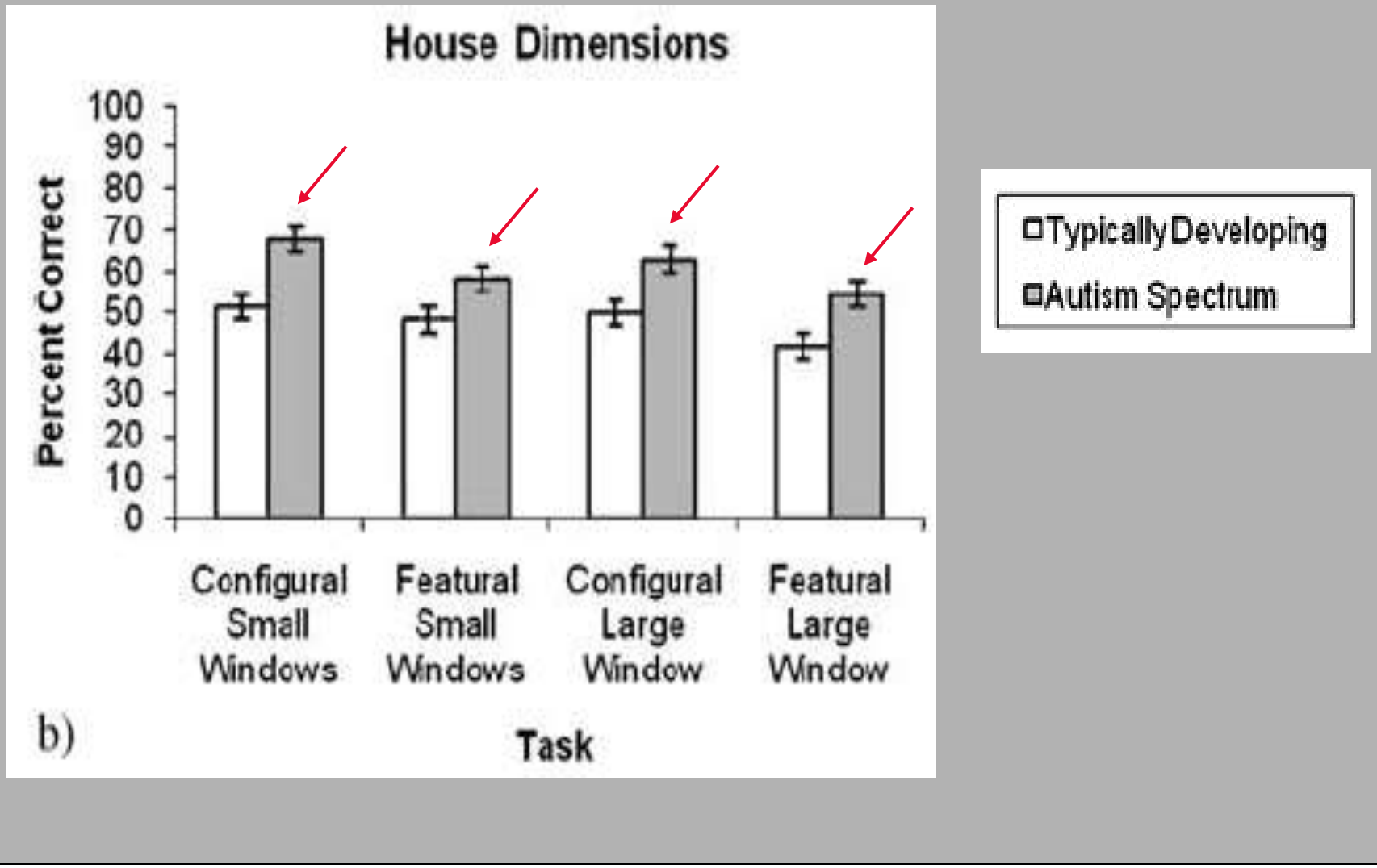
Same/Different Houses

Featural



Configural

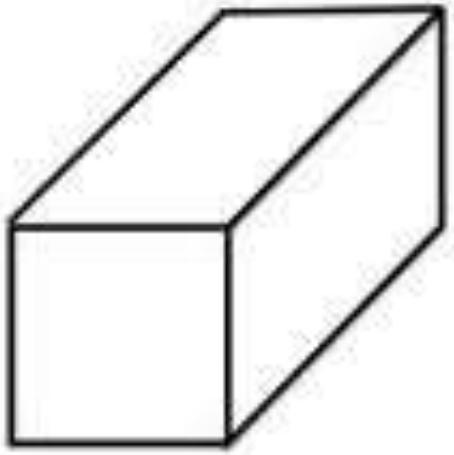


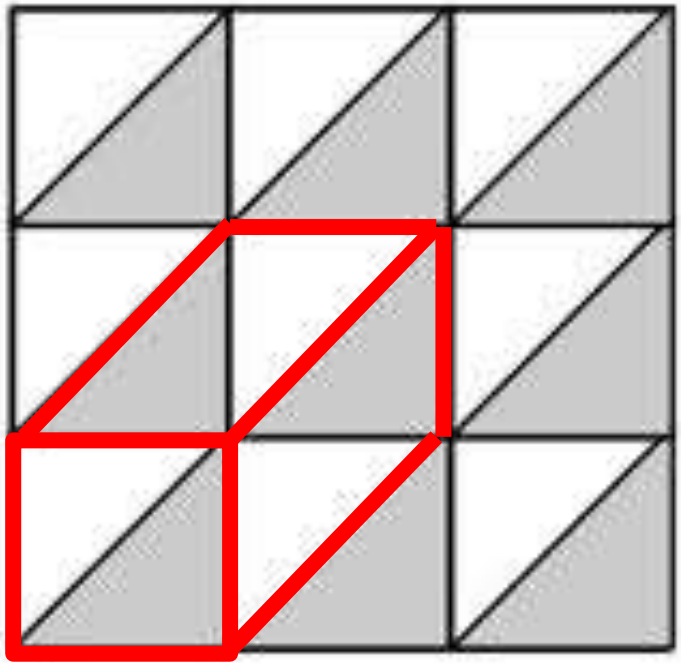

House Dimensions
Percent Correct
100
90
80
70
60
50
40
30
20
10
0
Configural Small Windows
Featural Small Windows
Configural Large Window
Featural Large Window
Task
b)
Typically Developing
Autism Spectrum

A “difference” model rather than a “deficit” model of autism

Children on the autism spectrum have perceptual strengths as well as weakness.

Autism Strength: Attention to detail



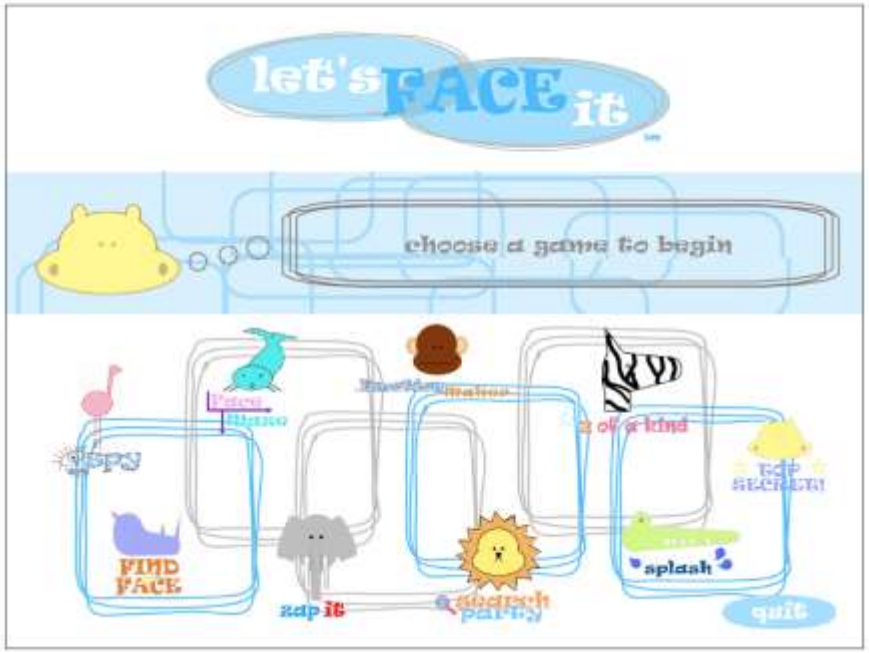


?

Can you find this object hidden in the geometric pattern?

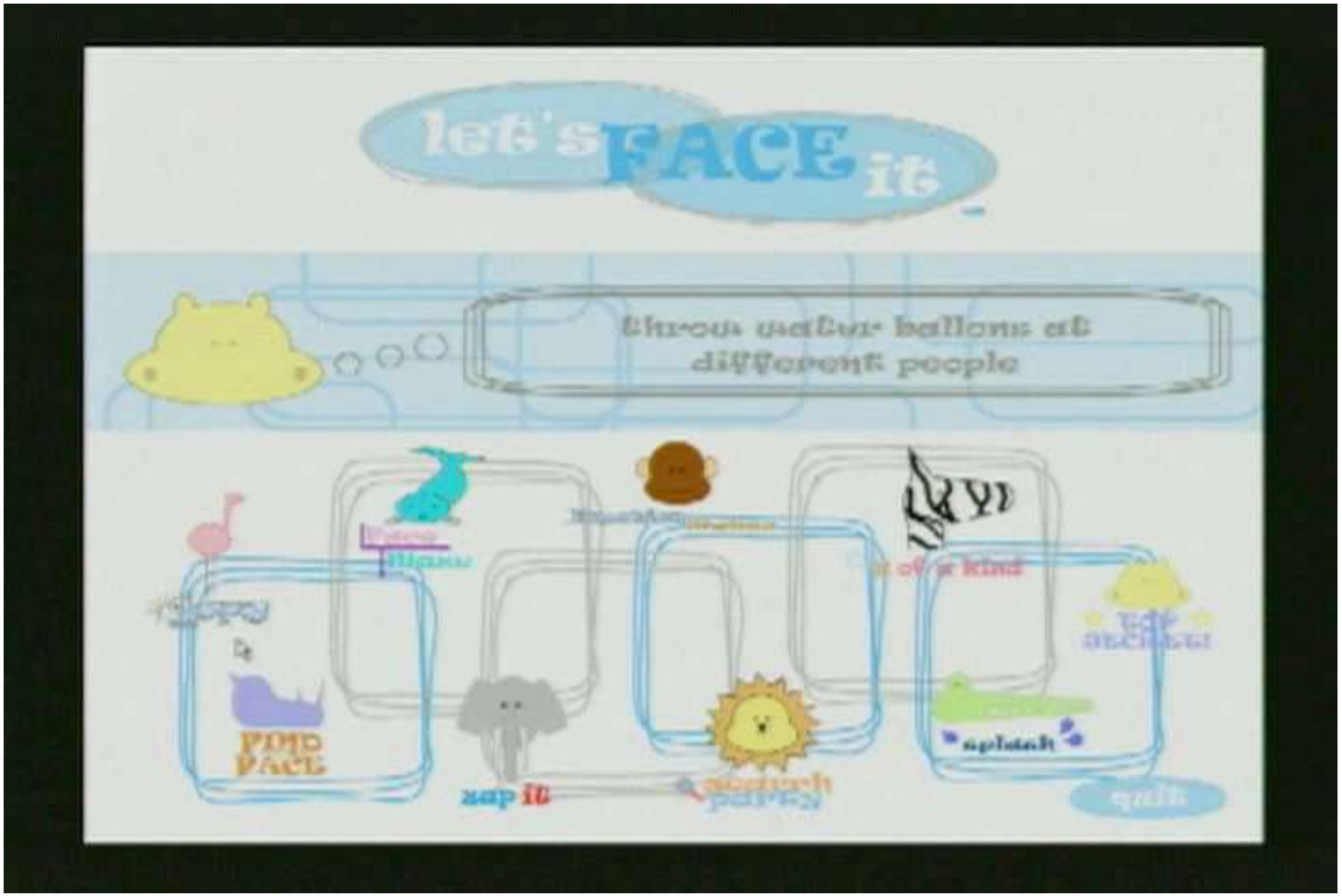
Can we train up face expertise
(like other forms of perceptual
expertise)
in children with autism?

The *Let's Face It!* Program



- Computer-based intervention in face perception and recognition
- A science- and evidence-based approach
- Seven different game activities emphasizing face processing skills in eye gaze, recognition of identity and expression

A sample of the *Let's Face It!* computer activi



LFI! Intervention Study

- Children diagnosed with autism spectrum disorder were pre-screened with a battery of subtests (the *Let's Face It!* Skills battery) examining face and object processing abilities.

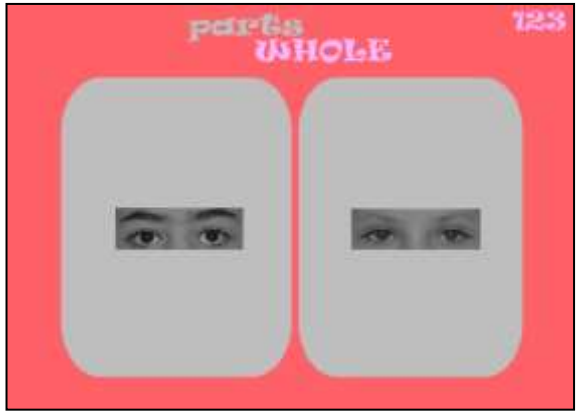
- In a randomized clinical trial (RCT), participants who were significantly impaired in their face processing abilities were assigned to either a treatment (N = 42) or waitlist (N =37) group.

- Children in the treatment group received 20 hours of face training with the *Let's Face It!* (*LFI!*) computer-based intervention over 3 to 4 month period and were then retested. Performance was compared to Time 1 and Time 2 waitlist group.

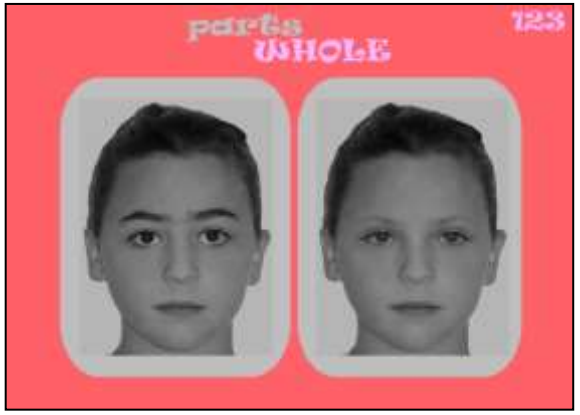
Tanaka, Wolf, Schultz et al., 2010, *Journal of Child Psychology & Psychiat*

Part/Whole Task: Holistic face recognition

Study Face



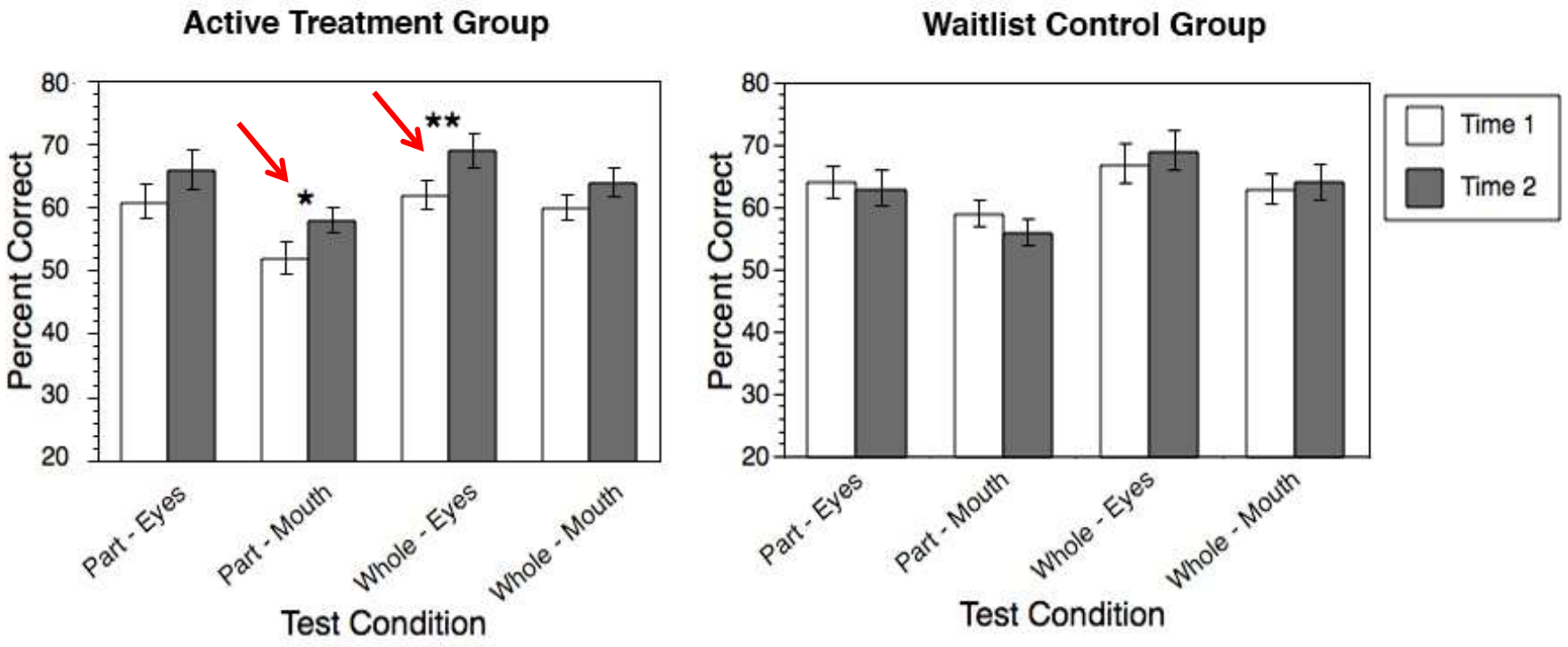
Part Test Item



Whole Face Test Item

Results

In the randomized clinical trial, children who played the *Let's Face It!* games for 20 hours outperformed children from the ASD control group on measures of holistic perception.



The *Let's Face It!* Home Page

Download software at no-charge from: web.uvic.ca/~letsface/letsfaceit

Approximately, 1500 downloads to date from over 90 countries

A promising start but . . . we are still confronted with the "Small Screen to Big World" problem of transfer and generalization.

Facial expressions by persons on the autism spectrum

Individuals on the AS are “flat” produce “flat” facial expressions

Their facial expressions are often disorganized or inappropriate to the social context

People on the AS can mimic other’s expressions, but have difficulty posing expressions (e.g., “smile for the camera”) in the absence of a model

The role of facial expressions for regulating social interactions

Big Bang Theory's Sheldon receives a smiling lesson from Leonard & Howard.

Can we train facial expression production in children with autism?

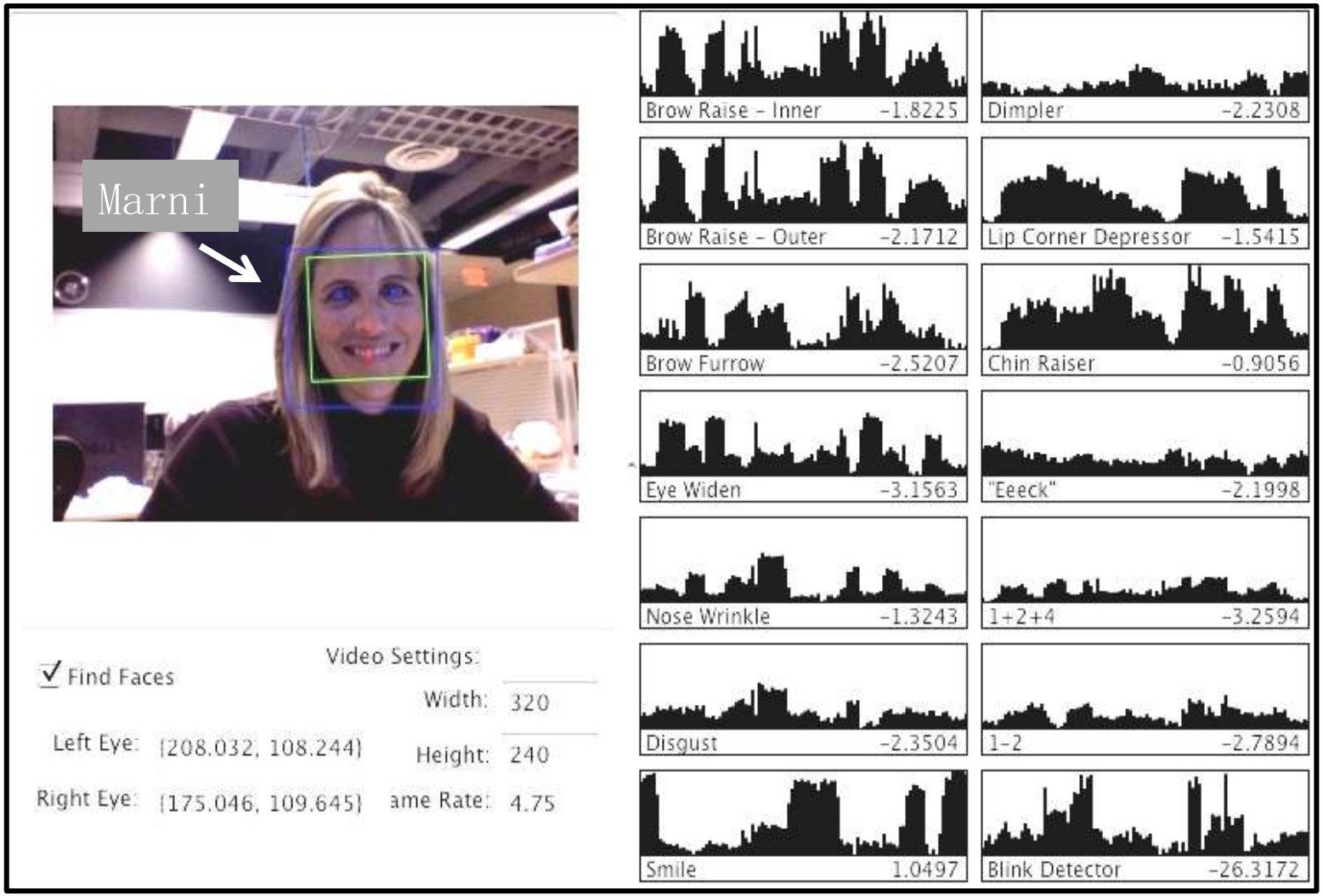
Centre for Autism Research, Technology and Education (CARTE)

University of Victoria

"New tools for different minds"

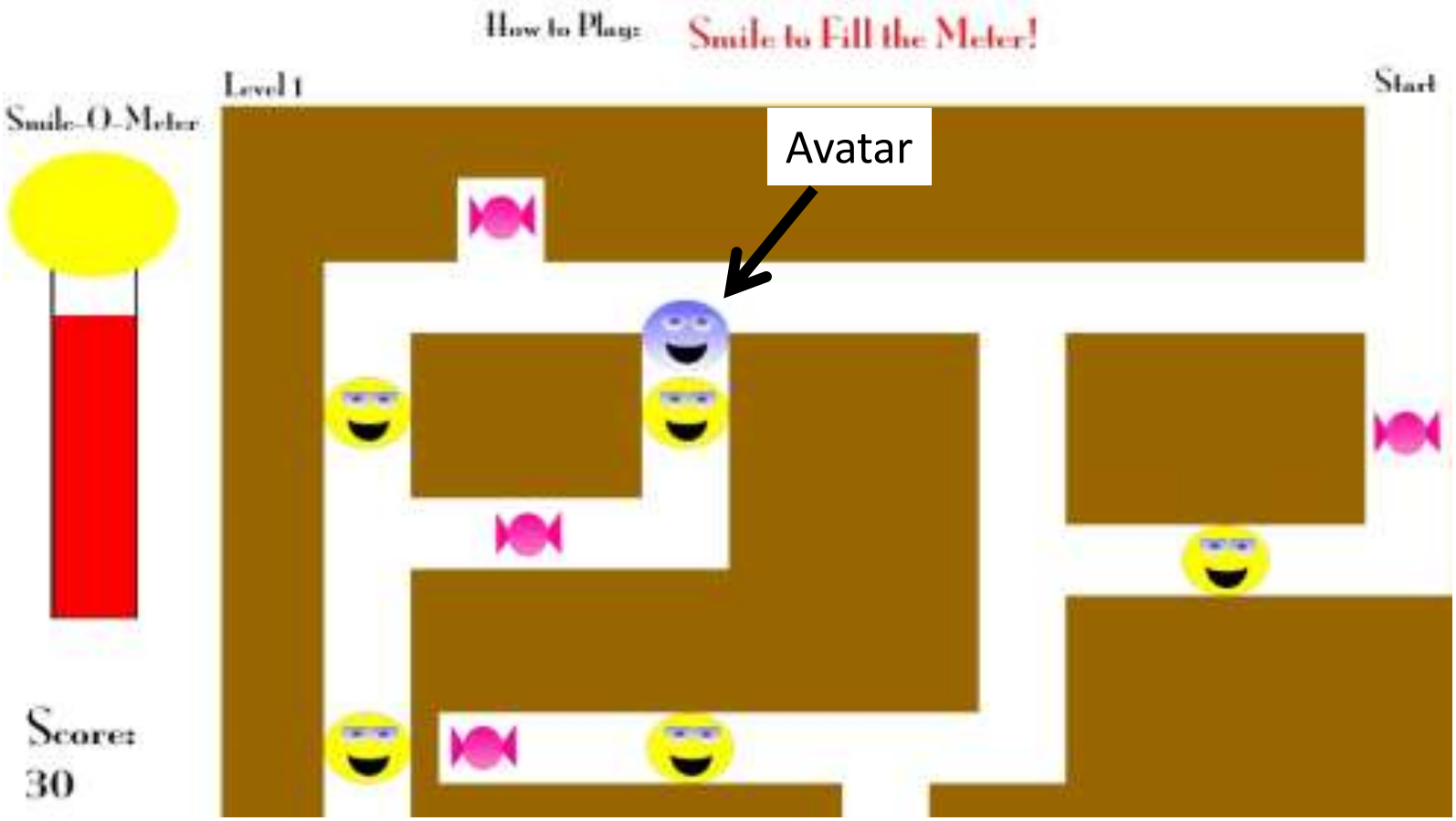
Our mission: To produce accessible, low-cost or free technologies for children with ASD that are empirically and theoretically grounded in the cognitive and brain sciences.

The Computer Expression Recognition Toolbox (CERT)



Marni Bartlett, Machine Perception Lab, University California, San Di

SmileMaze


How to Play:
Smile to Fill the Meter!
Level 1
Start
Smile-O-Meter
Avatar
Score:
30

< Insert CERT Demo Here >

1.) Does playing FaceMaze improve the quality of facial expressions?

Participants

20 children with Autism Spectrum Disorder (7 - 16 years of age)

(Gordon et al., under revie

The posed expression reveals the participant's motoric representation of emotion

Show us your "happy" face

Show us your "angry" face

Does playing *FaceMaze* improve the quality of facial expressions?

Pre-Training Expression Pose	5 minutes of Smile Maze or Angry Maze	Post-Training Expression Pose

Happy
Angry
Surprise (control)

Pre-Training

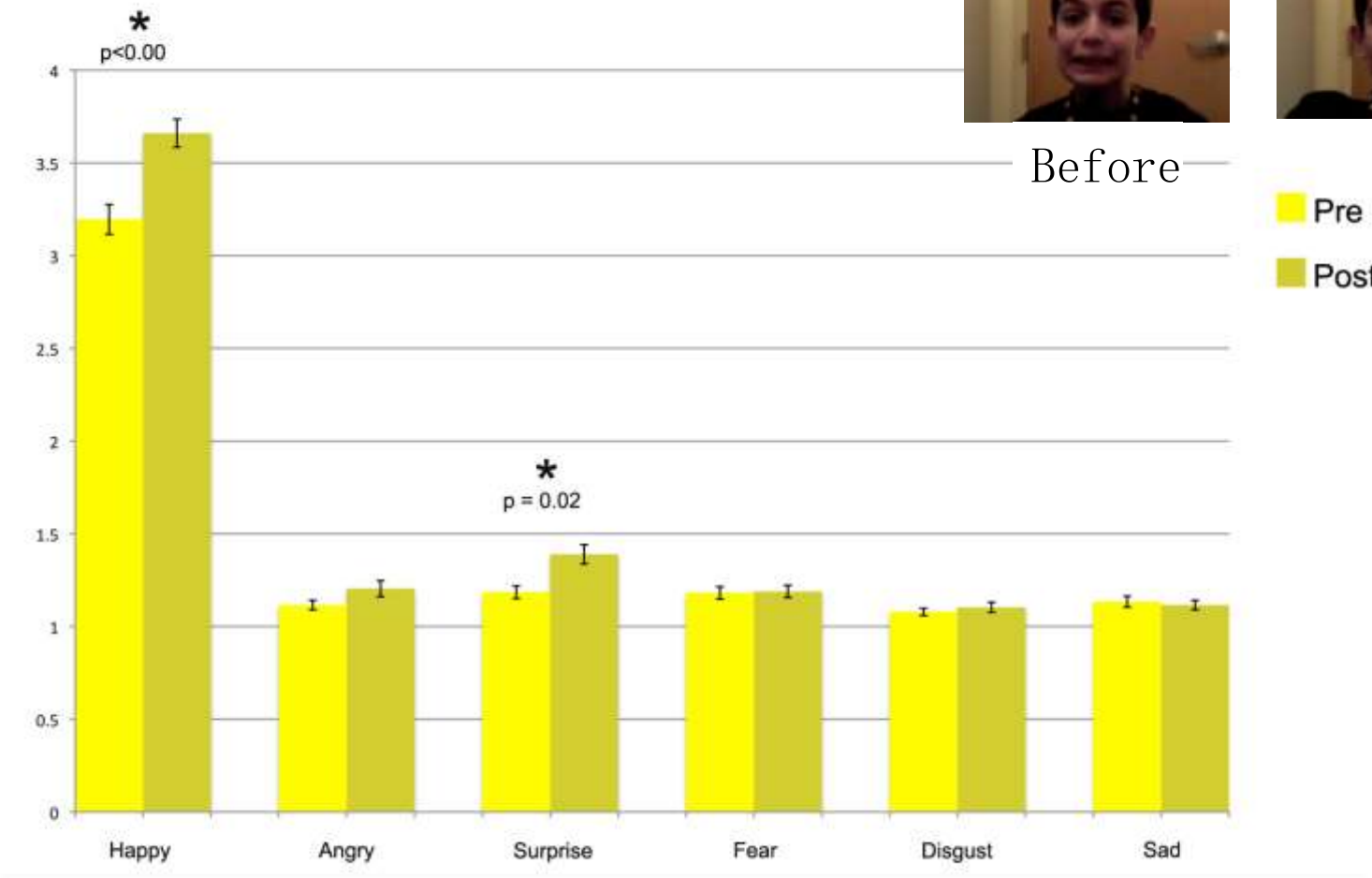
Happy
Angry
Surprise (control)

Post-Training

Ratings of happy expressions before and after playing Smile Maze

Before

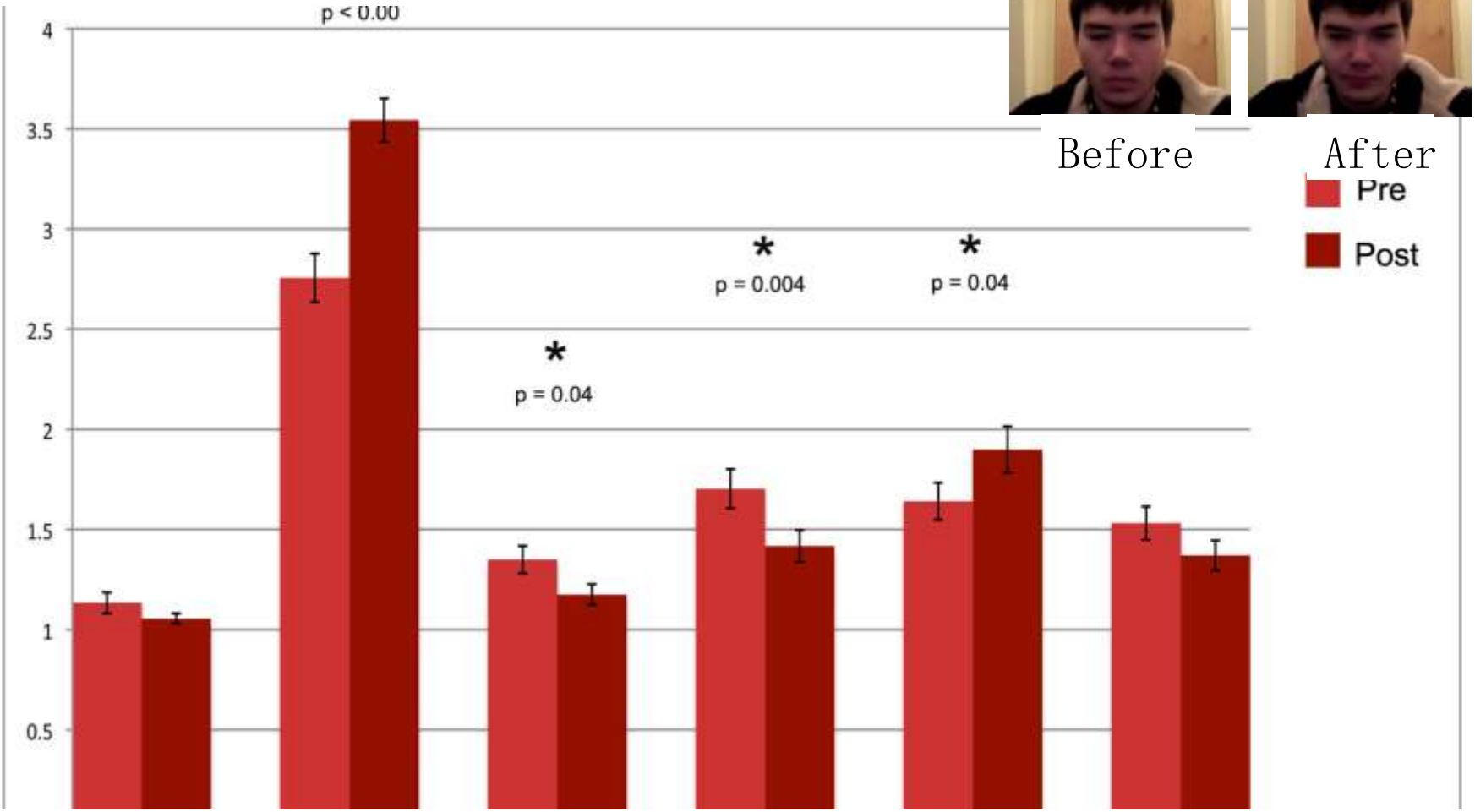
After



Ratings of angry expressions before and after playing Angry Maze

Before

After



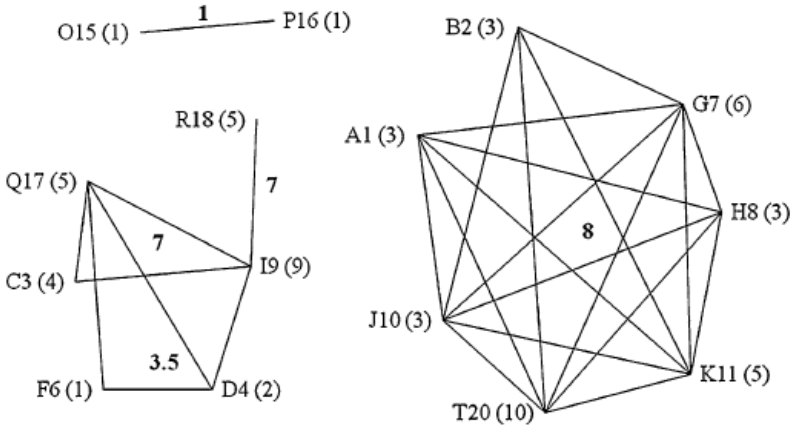
2.) Friendship and loneliness in children with A

Friendship is defined as an intimate relationship providing ‘ ‘companionship, mutual support, and affection’ ’ (Freeman & Kasari, 1998, p. 341)

Loneliness is an undesirable feeling associated with negative affect, heavily dependent on peer influences (Margalit, 1994). Social-cognitive loneliness gives rise to feelings of exclusion, meaningless, marginality and boredom (Weiss, 1973).

Children with autism report being lonelier and having fewer friendships than their TD counterparts (Bauminger & Kasari, 2000).

Social networks of children with ASD



Isolates: L12, M13, N14, S19, E5 (3)***

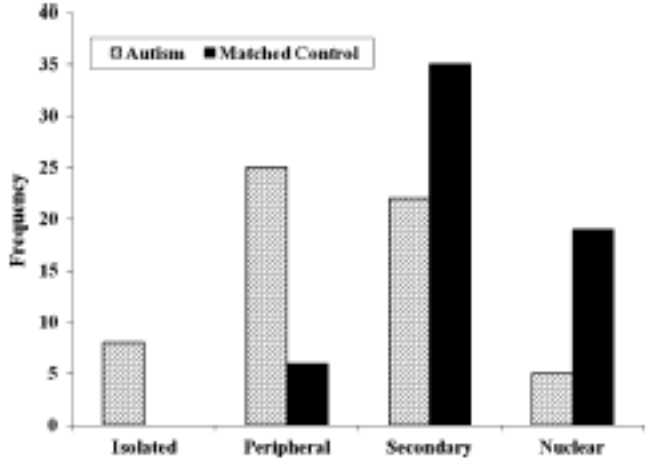


Fig. 2 Bar graph of the frequency of social network centrality status for children with ASD and their typically developing matched peers

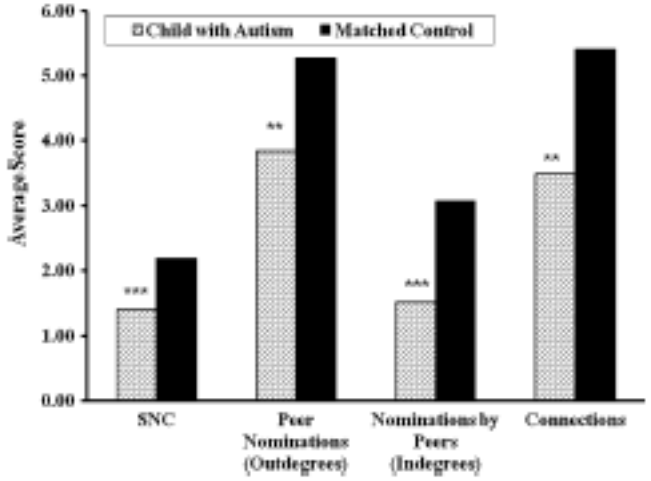


Fig. 3 Bar graph of children's social network variables between children with ASD and their typically developing matched peers (*** $p < .001$; ** $p < .01$)

Can we enhance the real-world social networks of children with AS through mobile apps?

Introducing *Let's Face It!* 2.0 and the iScrapbook

Acknowledgements

Collaborators

- **Bob Schultz** (Children's Hospital of Philadelphia)
- **Julie Wolf** (Yale Child Study Centre)
- **Marni Bartlett** (UCSD)
- **Iris Gordon, members of VizCogLab & CARTE**, University of Victoria

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Autism Speaks