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**“Understanding the Nature of Autism:
Behavior and Brain Science”**

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Understanding the Nature of Autism: *Behavior and Brain Science*

Featuring

Dr. Travis Thompson

Dr. Anastasia Dimitropoulos

Moderator: Steve Peterson



The Fine Print

- All information in this webinar and related material is provided for informational purposes only
- Observations and recommendations represent the expert opinions of the presenters based on their knowledge, experience, and training, but are in no way meant to substitute for the advice of a medical practitioner or other professional
- You should consult with a health professional or other specialist if you are interested in more information

Today's Presentation

- Insights into why children with autism do the things they do
- An explanation of what the brain tells us about face recognition in children with autism
- A look at children's need for predictability and control of their environment and how you can use that knowledge to help build trust out of potentially stressful situations
- Answers to your questions about autism, behavior, and brain science

Today's Speakers



Dr. Travis
Thompson

Travis Thompson, Ph.D. is the author of the new book *Making Sense of Autism*. He is supervising psychologist at the Minnesota Early Autism Project and a professor in the Department of Pediatrics at the University of Minnesota School of Medicine. He has received The Arc USA Distinguished Research Award, the Academy on Mental Retardation Life Time Research Award, the Don Hake Award of the American Psychological Association, and the Edgar A. Doll Award for his contributions to facilitating the transfer of research on intellectual and developmental disabilities into practice. Dr. Thompson has a grandson with an autism spectrum disorder.



Dr. Anastasia
Dimitropoulos

Anastasia Dimitropoulos, Ph.D. is a neuroimaging specialist and an assistant professor in the Department of Psychology at Case Western Reserve University in Cleveland.

Understanding the Nature of Autism: Behavior and Brain Science

Travis Thompson, Ph.D.
Professor
Dept of Pediatrics
University of Minnesota
School of Medicine

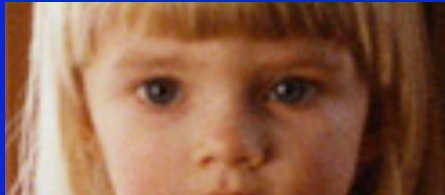


We Will Discuss:

- Why Children with ASDs Do the Things They Do
- Characteristics of Autism: The Core Deficits
- Lack of Understanding of, and Skill with Communication
- Brain Basis of Social Deficits
- Compulsivity: Brain Differences in ASDs

Why Do Children with ASDs Do the Things They Do?

- It helps to try to see the world through their eyes



- They are doing the best they can to make sense of a disorderly world that causes them frequent distress

Characteristics of Autism: The Core Deficits



- Communication Deficit
- Social Deficit
- Compulsive Disorder:
Fixed Interests &
Repetitive Behavior

Deficit in Communication as Problem Solving Tool

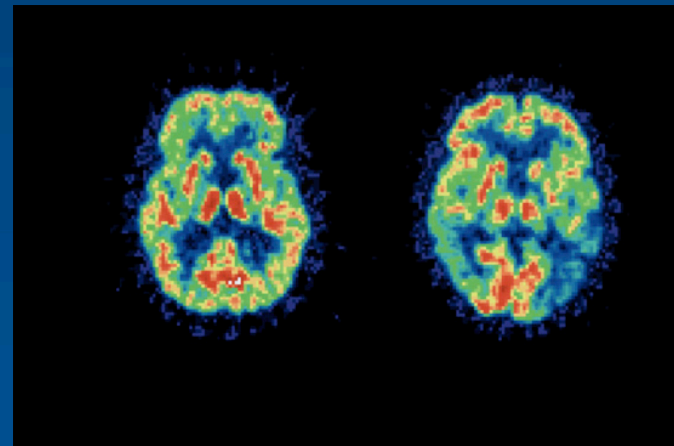
- Fail to grasp the idea that communication is a problem solving tool
- Slow language processing: Poor synchronization across brain's language areas
- Difficulty with pragmatics

Fail to Understand Social Cues

- Don't look at people's eyes, as early as 6 months of age
- Lack amygdala and prefrontal cortex activation to faces exhibiting emotions
- Little response of fusiform gyrus to faces
- Mirror neuron deficits - inability to understand gestures
- Unable to draw social inferences

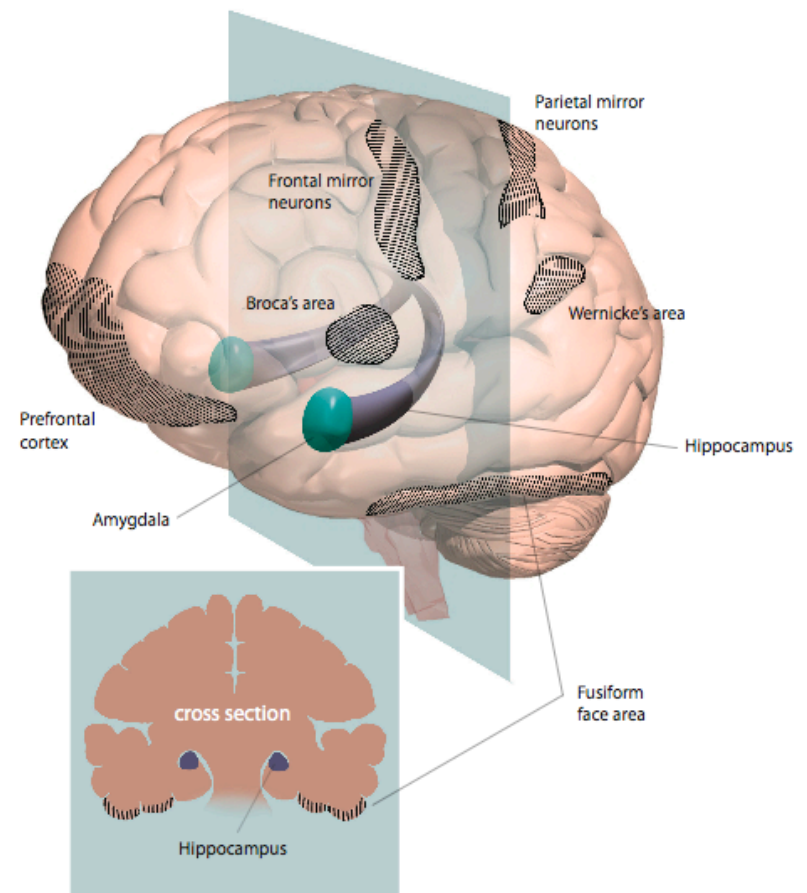
Function Versus Structure: fMRI Scanning

- **Functional Magnetic Resonance Imaging measures localized blood flow before and after a stimulus is presented as an estimate of brain activity in those regions**



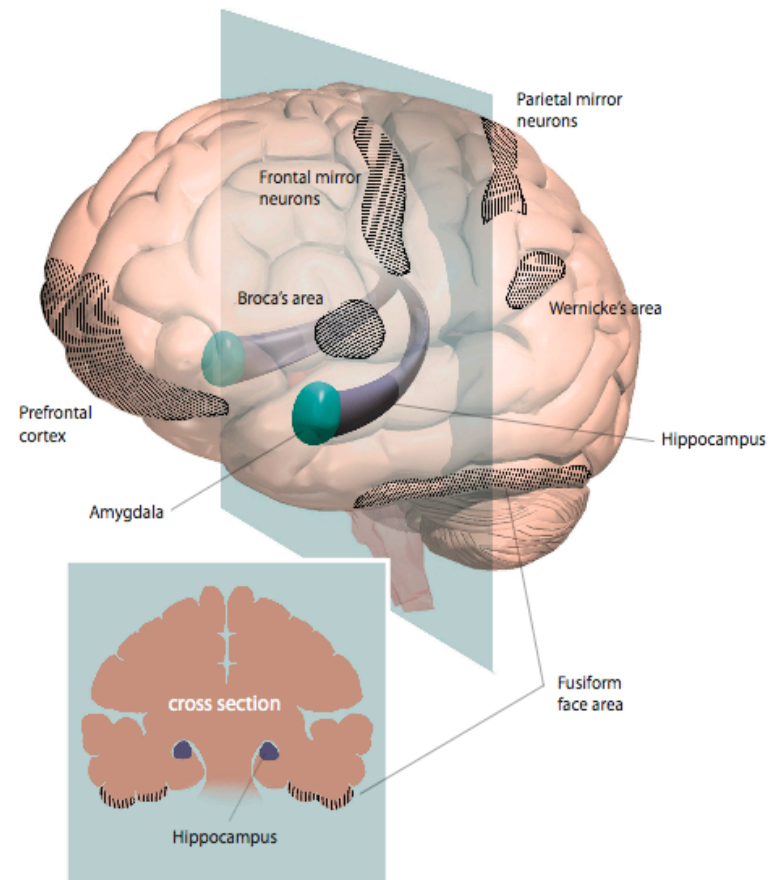
Eye and Facial Processing Deficits

- As early as 6 months, children who are later diagnosed with an ASD fail to look at eyes
- There is little or no amygdala (green spheres) and prefrontal cortex activation to eyes



Fusiform Gyrus and Mirror Neuron Dysfunction

- Fusiform “face area” under temporal lobe does not activate to faces
- Mirror neuron system required for understanding gestures is dysfunctional



Questions?

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- Don't worry about your typing—your questions will not be viewed by other attendees. We will monitor your questions throughout the presentation and address as many as we can during the Q&A session at the end.

Anastasia Dimitropoulos, Ph.D.

Dr. Dimitropoulos's primary research interests are in understanding



- why people who have the same genetic developmental disorder have many of the same behavioral characteristics
- why some characteristics vary within a population, and
- what neurobiological mechanisms account for these behaviors

Most of her work is directed at understanding behavioral characteristics of individuals with Prader-Willi syndrome (PWS). Evidence suggests that some people with PWS have repetitive behavior and social deficits reminiscent of autism spectrum disorders, so her recent work has included examination of similarities between PWS and ASD.

Understanding Face Recognition in Autism: Clues from the Fusiform Gyrus

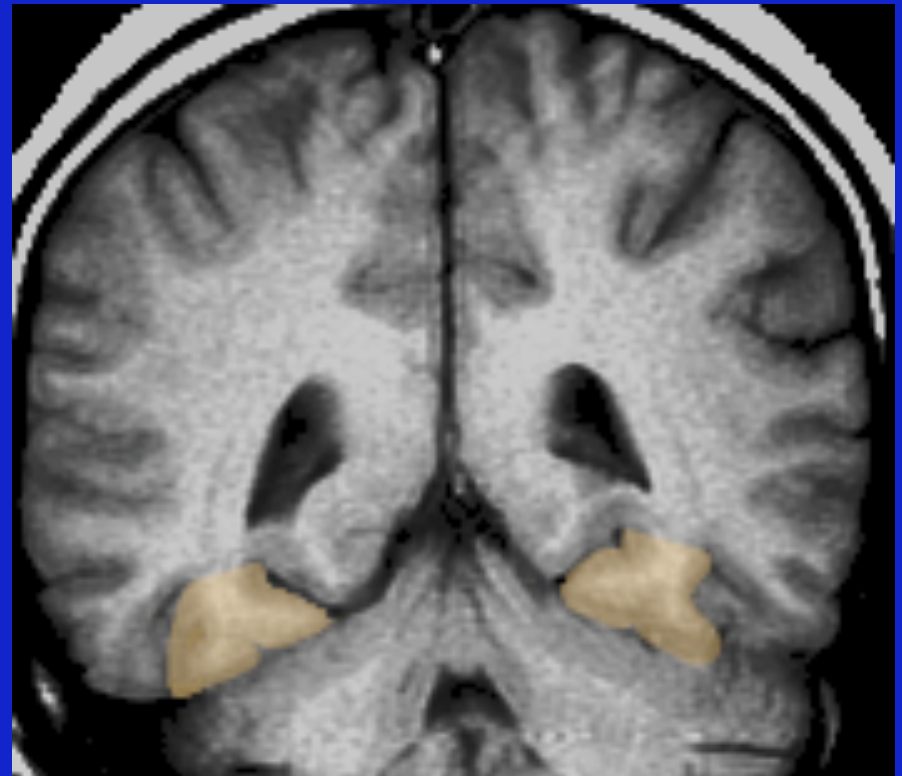
Anastasia Dimitropoulos, Ph.D.
Assistant Professor
Department of Psychology
Case Western Reserve University



Underside of Actual Brain

Face Recognition

- Face recognition is an important function in social animals
- In humans, face perception is uniquely associated with activity in the fusiform face area (FFA) located in the fusiform gyrus in the lower part of the temporal lobes.



Cross Section MRI Slice of Fusiform Gyrus

Activating the Fusiform Face Area

Are these the SAME or a DIFFERENT person?

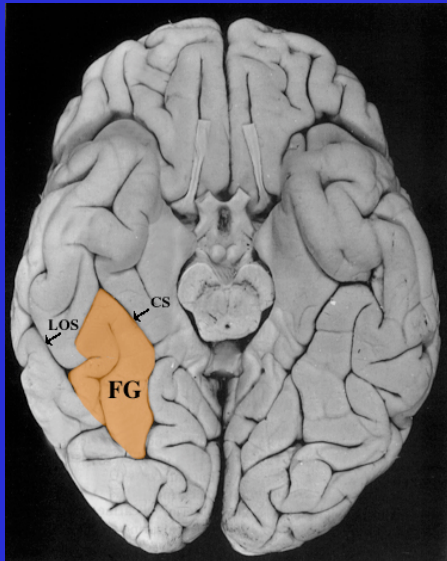


Are these the SAME or a DIFFERENT object?

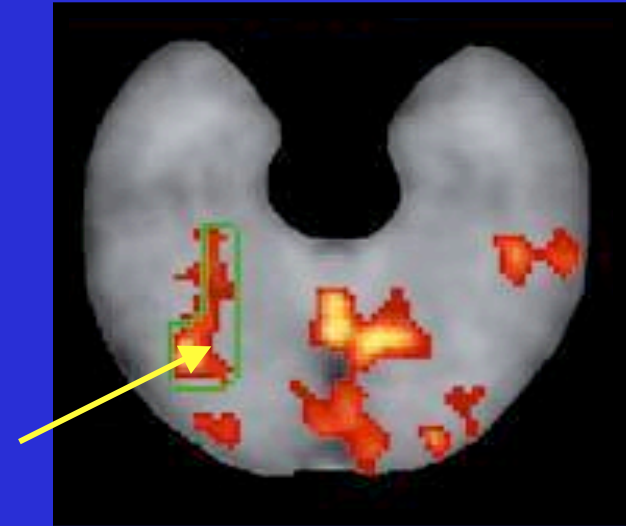


The Fusiform Face Area

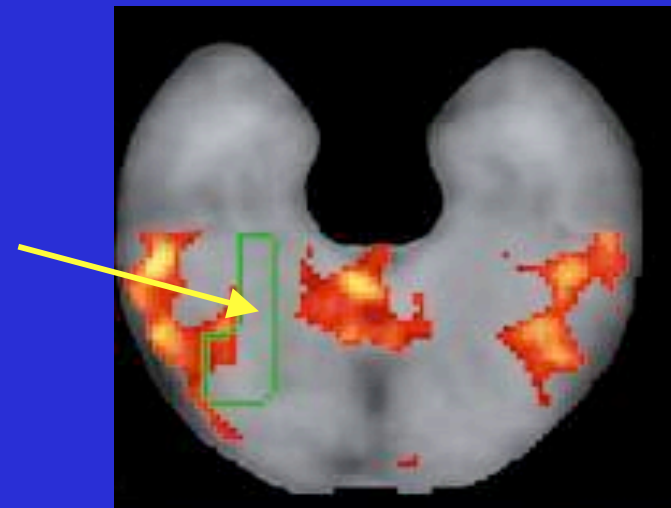
When comparing faces to objects, individuals with autism show less brain activation in the FFA than those without autism (area inside **green** rectangle).



Typically Developing



Autism



Reduced Activation of the “Fusiform Face Area”

- Schultz et al. (2000)
- Critchley et al (2000)
- Bookheimer et al (2000)
- Pierce et al (2001)
- Dierks et al (2001)
- Schultz et al (2004)

This has become the most widely reproduced neuroimaging finding in autism research.

Expertise Model of Fusiform Face Area Effects in Autism Spectrum Disorders

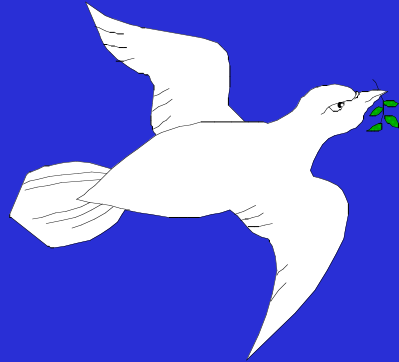
Are faces special?

- People can often recognize objects regardless of orientation, but upside-down faces are much more difficult to recognize
- People with expert knowledge of non-face objects (e.g. dogs) are good at recognizing upright items but not upside-down ones
- Recent research has examined what exactly drives this area's activation
 - This research suggests that not just face processing but rather people's **expertise** (i.e. experience) with faces underlies this activation

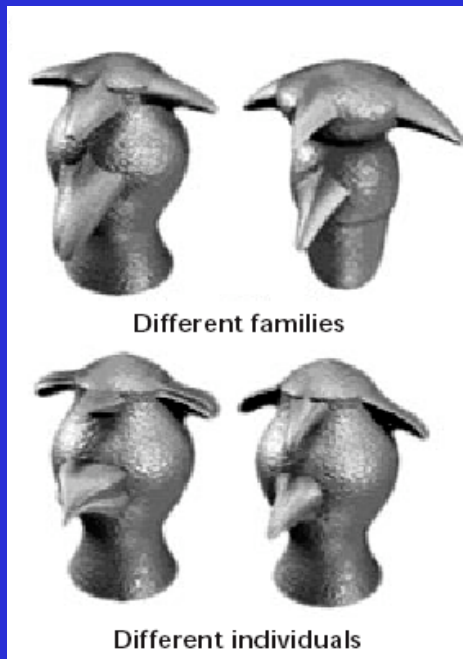
The Role of Perceptual Expertise in FG Engagement



Greebles



Car & bird experts showed > FFA activation
FFA correlated with degree of expertise

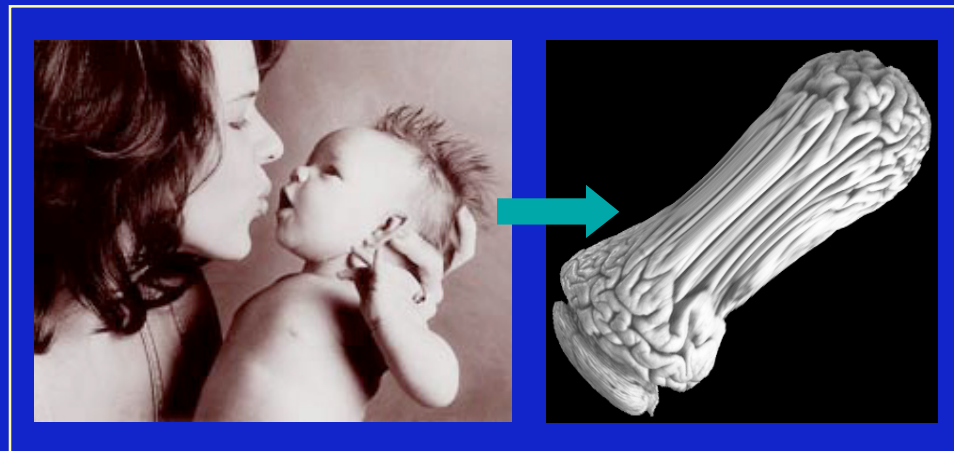


Greebles - Novel objects that have common elements but are individually distinct.
Novices were trained to be expert at recognizing Greebles

Experience discriminating Greebles > FFA
FFA is correlated with degree of expertise

Developmental Hypothesis of Autism

- Early experience with faces shapes visual cortex
- Diminished social interest in children with autism:
 - leads to lessened attention to people (faces) during critical early developmental periods
 - failure to develop *expertise* for faces



The Baby's Early Visual Environment

Window

Light

Mobile

Picture of Family

Lamp

Light Switch

BOOKS

DOOR

Wall
Paper



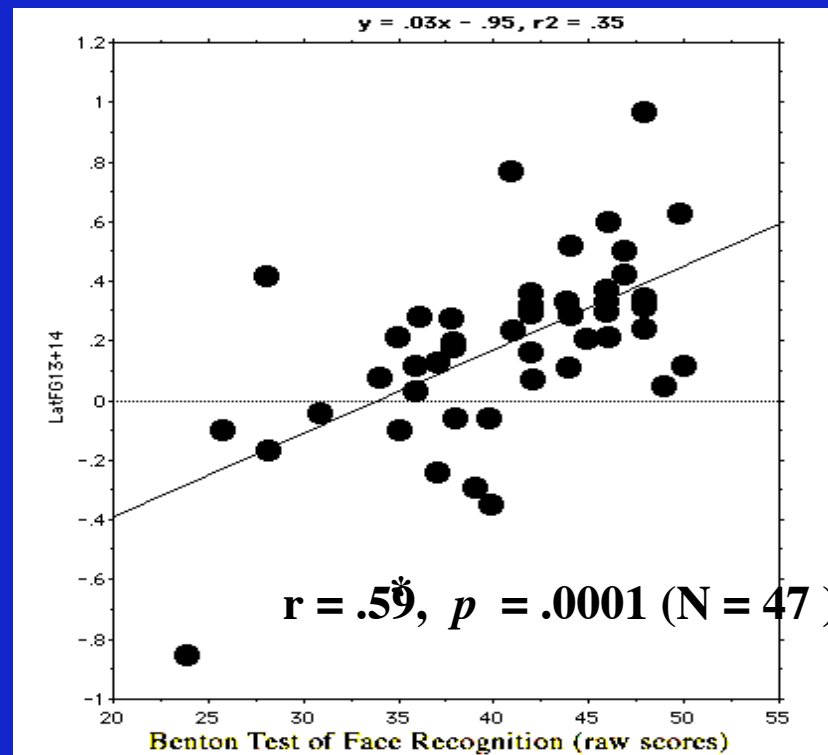
Toys

What the Baby Normally Sees



Predicting Severity of Social Deficit from Amount of FFA Activation during Face Perception Tasks

Fusiform Face Area Activity to Faces Predicts Actual Face Recognition



* $r = .50$, $p = .0005$ w/o outlier

The more the fusiform face area activates when looking at faces, the better at actually recognizing people's faces

Fusiform Face Area Activity to Faces Predicts Severity of Social Disability Across Diagnoses

- Research also indicates that the more social deficits individuals with an autism spectrum disorder have, the less the Fusiform Face Area will activate

Implications

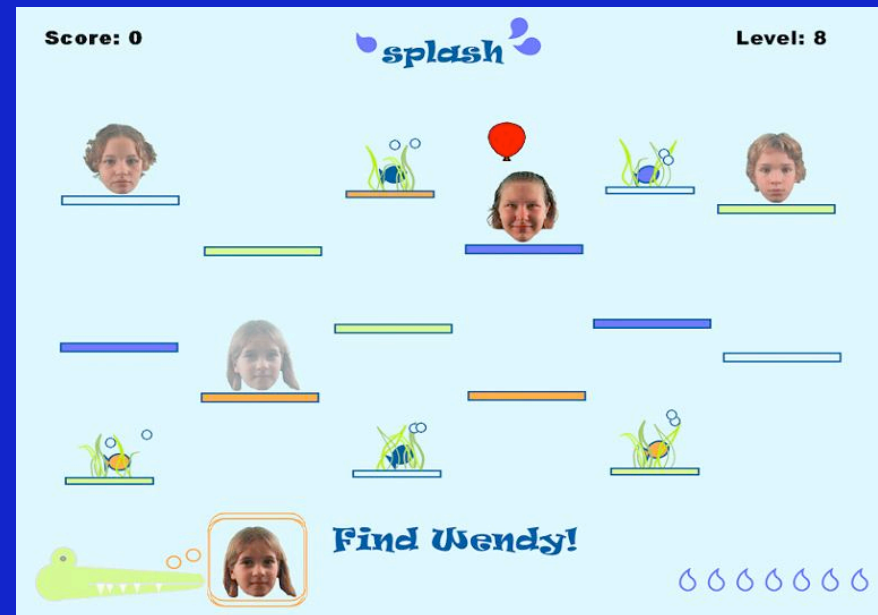
Lack of Fusiform Face Area activation is directly proportional to degree of impairment and therefore:

- Fusiform gyrus function is a good target outcome variable for a treatment study

Moreover, fMRI studies so far are merely correlational

- Early intervention studies focusing on facial recognition training studies may provide an experimental manipulation of behavior skills, to test the causal relationships between face perceptual skills, social skills and FFA activity

Let's FACE it! Research Program at the Yale Child Study Center



http://info.med.yale.edu/chldstdy/neuroimg/current_projects.htm

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Fixed Interests & Repetitive Behavior

“The child’s behavior is governed by an anxiously obsessive desire for sameness that nobody but the child himself may disrupt on rare occasions. Changes in routine, of furniture arrangement, of a pattern, or the order in which everyday acts are carried out, can drive him to despair.”

Leo Kanner, 1943



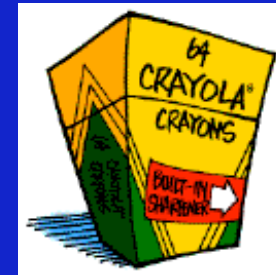
Preference for Things

- Preference for objects that are constant...predictable
- People are continually changing, producing ambivalence
- Adults' predictability and willingness to intervene to reduce distressful situations translate into trust

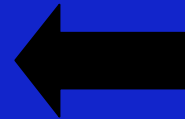
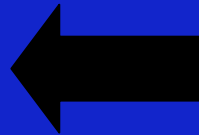
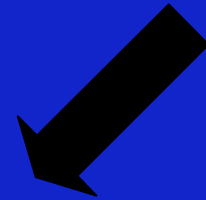
Making the World More Predictable

- Use visual schedules
- Give a warning before there will be a change in routine
- If possible, give the child a say in which things are done in what order

Visual Schedule



2 + 1 = 3



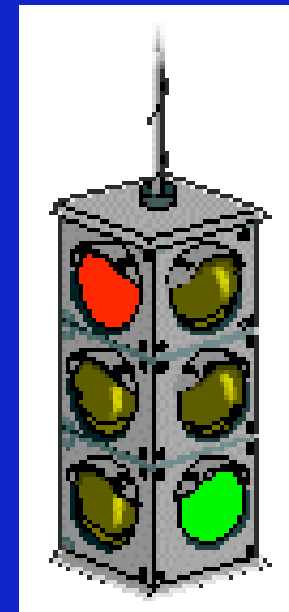
Need for Control: #1 Dilemma of Children with ASDs



- Most children with ASDs suffer from Obsessive Compulsive Disorder to some degree
- They're doing the best they can to make their world understandable, predictable, and tolerable
- Our job is to help them make their world more manageable

Gain Control by Relinquishing Control

- Teach legitimate means of requesting control over things important to the child but not very important to caregivers
- **Choices** - **Mother**: “Would like like apple sauce or pudding for dessert?”
- **Child**: “No! I don’t want to do spelling!” **Teacher**: “OK, let’s finish coloring, then we’ll do your spelling.”

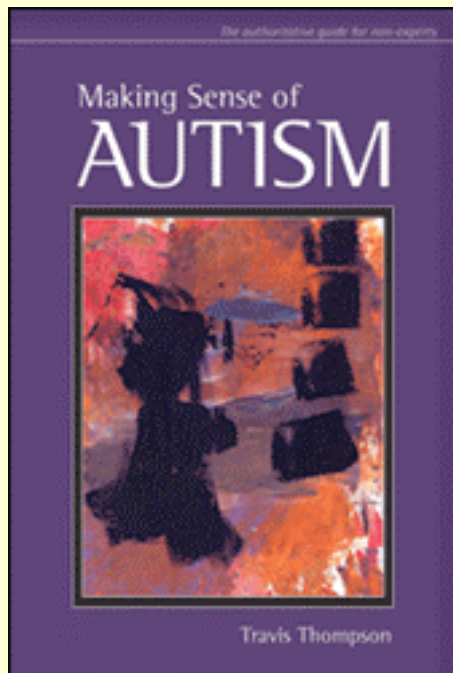


Epilogue: The Little Stranger in Our Midst



- Teachers and parents look at a child with autism and see a little stranger in their midst. What makes him so different?
- A child with an ASD is doing their best to make their world understandable and tolerable.
- It's up to us to help them. We usually can do so if we see the world from their vantage point and apply sound basic intervention practices.

Making Sense of Autism



Learn much more about the topics discussed in today's webinar in Dr. Thompson's new book *Making Sense of Autism*—the authoritative guide for non-experts.

For more information, go to www.brookespublishing.com.

Thank You for Attending!

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