

9.85 Cognition in Infancy and Early Childhood

Finish theory of mind
Autism

Today

- A -- Senju: Evidence for lack of spontaneous mentalizing B. Elsabbagh: What do you make of it?
- Apologia for studying autism

- Card A -- Senju: explain evidence for the lack of “spontaneous mentalizing” in Asperger’s patients; Card B -- Elsabbagh: what did you make of the article?

Autism spectrum disorder

1. Diagnosis
2. Causes
3. Interventions?
4. Domain-specificity and theory of mind

Autism spectrum disorder

1. **Diagnosis**
2. Causes
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Background

- Leo Kanner: 1943
- Hans Asperger: 1944
- Bruno Bettelheim: 1967

Diagnosis

- All children with autism have:
 - Abnormalities of social interaction
 - Communication disorders
 - Repetitive behaviors

Diagnosis

- A total of six (or more) items from (1), (2), and (3), with at least two from (1), and one each from (2) and (3)

(1) qualitative impairment in social interaction, as manifested by at least two of the following:

- a) marked impairments in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body posture, and gestures to regulate social interaction
- b) failure to develop peer relationships appropriate to developmental level
- c) a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people, (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people)
- d) lack of social or emotional reciprocity (not actively participating in simple social play or games, preferring solitary activities, or involving others in activities only as tools or "mechanical" aids)

Diagnosis

(2) qualitative impairments in communication as manifested by at least one of the following:

- a) delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)
- b) in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
- c) stereotyped and repetitive use of language or idiosyncratic language
- d) lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level

Diagnosis

- ***(3) restricted repetitive and stereotyped patterns of behavior, interests and activities, as manifested by at least one of the following:***
 - a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
 - b) apparently inflexible adherence to specific, nonfunctional routines or rituals
 - c) stereotyped and repetitive motor mannerisms (e.g hand or finger flapping or twisting, or complex whole body movements)
 - d) persistent preoccupation with parts of objects

Diagnosis

- Autistic **spectrum disorders (ASD)** include:
 - Autism
 - Aspergers syndrome
 - Pervasive developmental disorders, not otherwise specified (**PDD-NOS**) -- meet some but not all criteria for either of the other two diagnoses.

Proposal DSM - V

Autism Spectrum Disorder

Must meet criteria A, B, C, and D:

- A. Persistent deficits in social communication and social interaction across contexts, not accounted for by general developmental delays, and manifest by all 3 of the following:
 - 1. Deficits in social-emotional reciprocity ...
 - 2. Deficits in nonverbal communicative behaviors used for social interaction ...
 - 3. Deficits in developing and maintaining relationships, appropriate to developmental level (beyond those with caregivers) ...
- B. Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least two of the following:
 - 1. Stereotyped or repetitive speech, motor movements, or use of objects.
 - 2. Excessive adherence to routines ...
 - 3. Highly restricted, fixated interests that are abnormal in intensity or focus ...
 - 4. Hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of environment; ...
- C. Symptoms must be present in early childhood (but may not become fully manifest until social demands exceed limited capacities)
- D. Symptoms together limit and impair everyday functioning.

Diagnosis

- Many children with autism have:
 - Abnormal sensory experiences
 - Sound of rain, telephone, vacuum cleaner, waves may be painful
 - Touch of clothes, light brush painful
 - But may be oblivious to traumatic injury (broken arm; head bash) or extreme cold and heat
 - Mental retardation
 - 33%-50% insufficient language to communicate daily needs
 - 1:4 develop seizures
 - Other disorders -- Fragile X; tuberous sclerosis; PKU; allergies

Diagnosis

- Some babies appear to have early abnormalities -- lack of normal attachment, dislike of touch ...
- However, at least 20% of babies appear to experience “regression” -- normal development followed by loss of words, social contact around 18-months.
- 3-25% of children diagnosed with ASD before 3 recover; lose the diagnosis by 6.

Early diagnosis

- Modified CHAT -- Checklist for Autism in Toddlers (validated for use between 16-30 months)

M-CHAT Autism screening checklist removed due to copyright restrictions. <http://www.firstsigns.org/downloads/m-chat.PDF>
Source: Robins, Diana L., Deborah Fein, et al. "The Modified Checklist for Autism in Toddlers: An Initial Study Investigating the Early Detection of Autism." *Journal of Autism and Developmental Disorders* 31, no. 2 (2001): 131–44.

Early diagnosis

- Failing any 2 of 7 key questions, 2, 5, 7, 9, 13, 15, 23 or any 6 of the 23 questions indicates need for follow-up.

Good confirmatory power (proportion of children already diagnosed with ASD identified by the CHAT): 97%

Good specificity (proportion of children without ASD identified as normal): 95% (i.e., few false positives)

Low sensitivity (proportion of children who tested fine but were later diagnosed): 36% (many false negatives)

Autistic syndrome disorders

1. Diagnosis
2. Causes
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Causes of autism

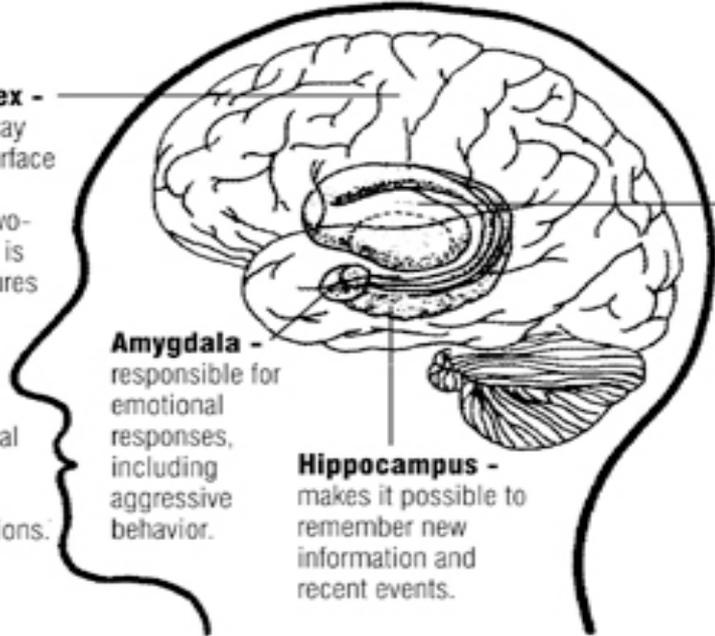
- “There is no known single cause for autism, but it is generally accepted that it is caused by abnormalities in brain structure or function.” (Autism Society of America)

Cerebral cortex - a thin layer of gray matter on the surface of the cerebral hemispheres. Two-thirds of its area is deep in the fissures or folds. Responsible for the higher mental functions, general movement, perception, and behavioral reactions.

Amygdala - responsible for emotional responses, including aggressive behavior.

Hippocampus - makes it possible to remember new information and recent events.

Basal ganglia - gray masses deep in the cerebral hemisphere that serves as a connection between the cerebrum and cerebellum. Helps to regulate automatic movement.

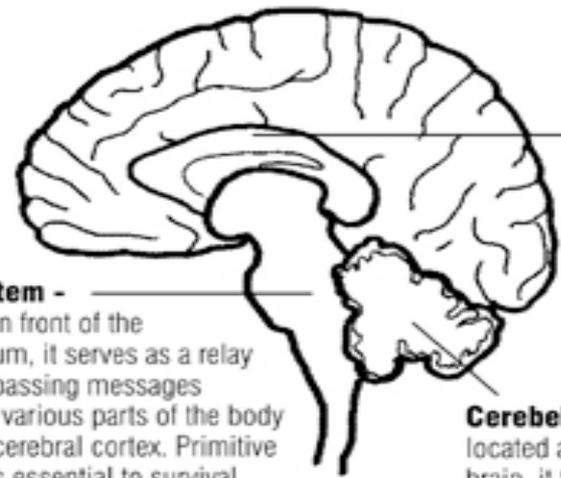


Major Brain Structures Implicated in Autism

Brain stem - located in front of the cerebellum, it serves as a relay station, passing messages between various parts of the body and the cerebral cortex. Primitive functions essential to survival (breathing and heart rate control) are located here.

Corpus callosum - consists primarily of closely packed bundles of fibers that connect the right and left hemisphere and allows for communication between the hemispheres.

Cerebellum - located at the back of the brain, it fine tunes our motor activity, regulates balance, body movements, coordination, and the muscles used in speaking.



National Institute of Mental Health

Causes of autism

- “Autism is not a disease, but rather a disorder in which there may be a number of different causal pathways. In the vast majority of cases, no specific underlying cause of autism can be identified. A variety of genetic, metabolic, infectious, and environmental factors may be important.”

National Institute
of Mental Health

Not “a disorder” at all?

- Low to modest correlations among three core areas of deficits
 - Social and communication, $r = .2 - .4$
 - Communication and stereotyped behavior, $r = .3 - .4$
 - Social and stereotyped behavior, $r = .1 - .3$
- 10% of children with ASD have deficits in only one of the three core areas (59% of those with social deficits have only social deficits)
- Suggests three independent domains of impairment -- not one “disorder”.

Causal mechanism

- Is unknown.
- Some research has pointed to disrupted formation of synapses and dendritic spines.
- Evidence of overconnectivity in early development. Failure of synaptic pruning?
- Disruptions in synaptic development also underlie epilepsy -- which may be why the two tend to co-occur.

Mechanism

- Complex disorder -- core aspects of disease may have distinct causes that tend to co-occur.
- Unclear whether ASD is explained by rare mutations with major effects or rare multigene interactions of common genetic variants.
- No clearly established mechanism at molecular, cellular, or systems level.

Causes of autism

- For environmental factors claimed to contribute to or exacerbate autism, Wikipedia lists:
- Certain foods, infectious disease, heavy metals, diesel exhaust, PCB's phthalates and phenols used in plastics, pesticides, flame retardants, alcohol, smoking, illicit drugs, vaccines, and prenatal stress ...
- Also recent evidence that advanced paternal age is a risk factor.

“The Centers for Disease Control and Prevention estimates that 1 in 88 children in the United States has been identified as having an autism spectrum disorder (ASD), according to a new study released today that looked at data from 14 communities. Autism spectrum disorders are almost five times more common among boys than girls – with 1 in 54 boys identified.”

“Study results from the 2008 surveillance year show 11.3 per 1,000 8-year-old children have been identified as having an ASD. This marks a 23 percent increase since the last report in 2009. Some of this increase is due to the way children are identified, diagnosed and served in their communities, although exactly how much is due to these factors is unknown.”

Source: Centers for Disease Control and Prevention, Press Release.
http://www.cdc.gov/media/releases/2012/p0329_autism_disorder.html

Number of children ages 6-17, per 1,000 US residents served under Individuals with Disabilities Education Act because of ASD diagnosis

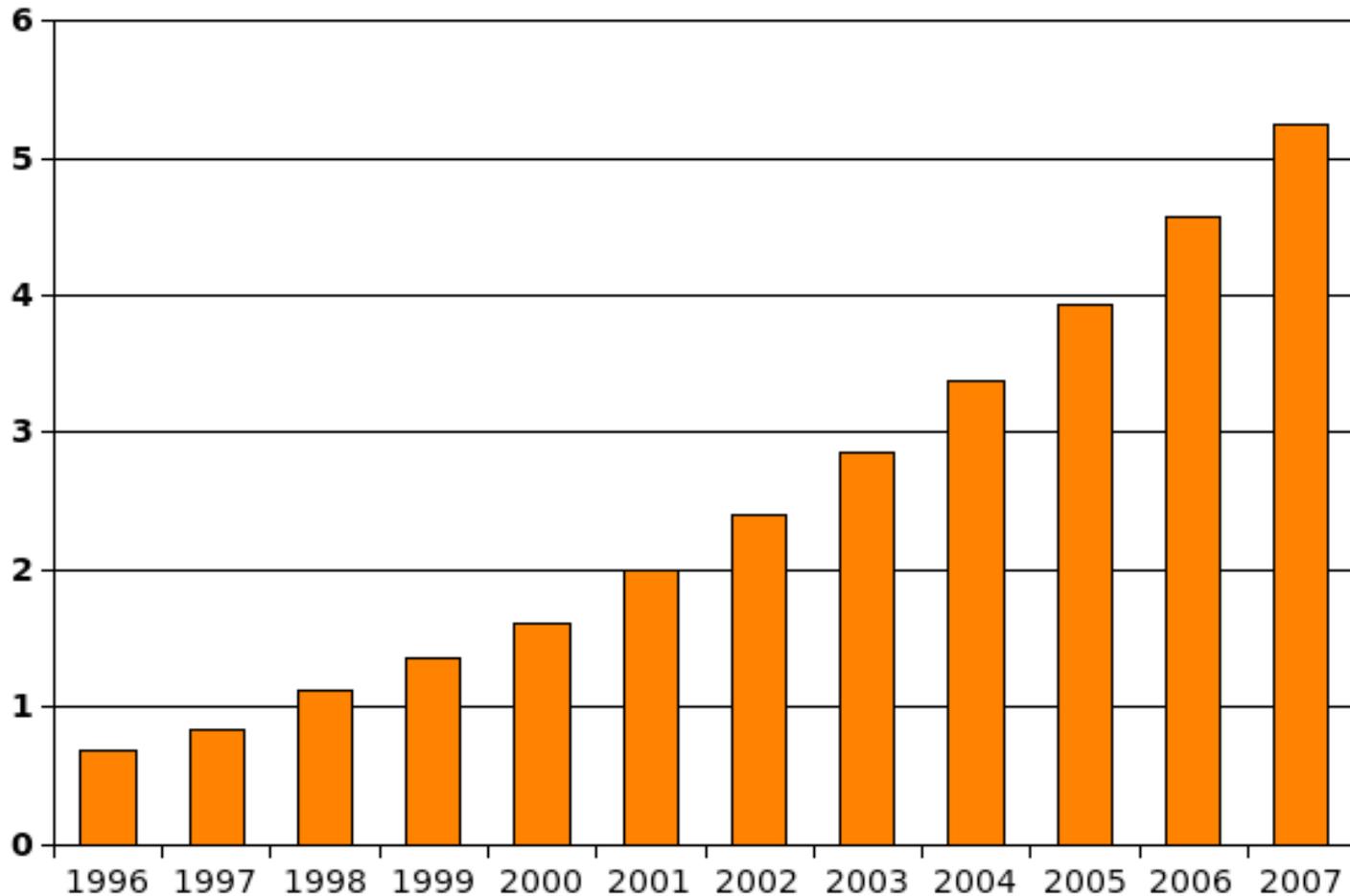


Image: Wikimedia. CC-BY-SA. Eubulides. This content is excluded from our Creative Commons license. For more information, see <http://ocw.mit.edu/fairuse>.

Autism increasing?

- “Unfortunately, we do not have a definitive answer to the question of what the true incidence of autism is ... Recent reports suggest that the incidence of autism may be substantially increasing. It is not clear that the reported increases can be accounted for by improved or expanded diagnosis, or by the increasing availability of educational and other support services, although these are surely factors.”
- NIH Testimony to US Department of Health and Human Services, April, 2000

Wikipedia

“Most recent [reviews](#) tend to estimate a prevalence of 1–2 per 1,000 for autism and close to 6 per 1,000 for ASD;[9] because of inadequate data, these numbers may underestimate ASD's true prevalence.[1] [PDD-NOS](#)'s prevalence has been estimated at 3.7 per 1,000, Asperger syndrome at roughly 0.6 per 1,000, and [childhood disintegrative disorder](#) at 0.02 per 1,000.[149] The number of reported cases of autism increased dramatically in the 1990s and early 2000s. This increase is largely attributable to changes in diagnostic practices, referral patterns, availability of services, age at diagnosis, and public awareness,[149][150] though unidentified environmental risk factors cannot be ruled out.”

Source: Wikipedia contributors, “Autism,” Wikipedia, The Free Encyclopedia, <http://en.wikipedia.org/wiki/Autism>.

Autism increasing?

- Possibilities
 - The increase is real and some environmental factor is causing it.
 - The increase is an artifact of better/changing diagnoses
 - Most of the increase is due to diagnoses of high IQ children with ASD.
 - In low IQ children, there has been a corresponding fall-off in diagnoses of mental retardation
 - More public awareness, more populations sampled, more reporting of ASD with comorbidity (Cerebral palsy, Tourettes, Downs, etc.)

Autism and vaccinations?

- Five large epidemiological studies conducted in the United States, the United Kingdom, Denmark, and Sweden since 2001 consistently provided evidence that there is no association between thimerosal-containing vaccines and autism. Similarly, 14 large epidemiological studies consistently showed no association between the MMR vaccine and autism.

Autism and genetics?

- Males four times more likely to be diagnosed with ASD than females
- Families with one autistic child have a 5% risk of having another child with autism.
- Concordance rate with identical twins = 70% (90% for broader phenotype)

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Continuum of Approaches in Communication Enhancement for Children with Autism

Discrete Trial

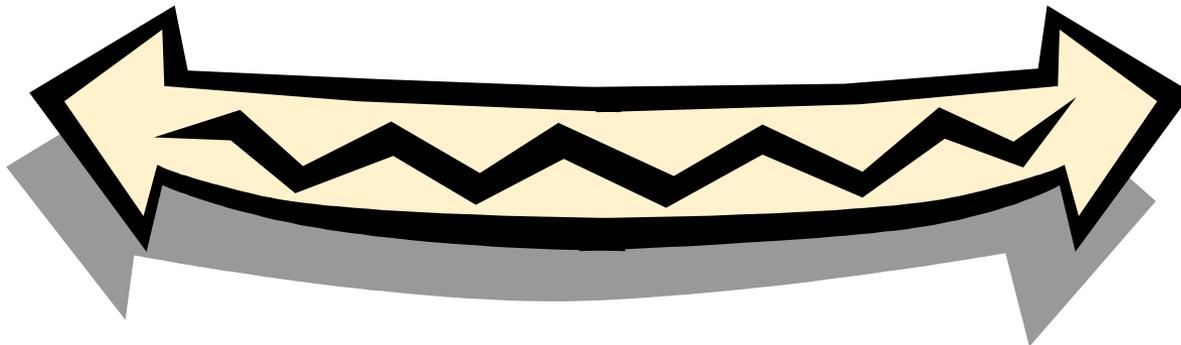
Traditional

Behavioural

Social

Pragmatic

Developmental



Peer-reviewed interventions have been tried on a wide variety of skills

Object imitation (Ingersoll & Schreibman, 2006)

Motor imitation (Stone & Yoder, 2001)

Verbal imitation (Sallows & Graupner, 2005; Smith, Zaidman-Zait, & Mirenda 2005)

Synchronized behavior with caregivers (Rollins & Snow, 1998; Siller & Sigman, 2002)

Early language and nonverbal skills (Szatmari, Bryson, Boyle, Streiner, & Duku, 2003)

Joint attention (Charman et al., 2003; Rollins & Snow, 1998; Travis, Sigman, & Ruskin, 2001; Sigman & McGovern, 2005; Smith et al., 2005)

Early gestures (Brady, Marquis, Fleming, & McLean, 2004)

Bopp, Smith, Mirenda, 2006

However, we don't know what 'works best'

- The best research has focused on intensive Discrete Trial Therapy (Applied Behavioral Analysis) and suggested that it can be effective for many children.
- However, there have been few controlled studies comparing one intervention to another.

Wikipedia

“Studies of interventions have methodological problems that prevent definitive conclusions about efficacy ... Although many ... interventions have some positive evidence, suggesting that some form of treatment is preferable to no treatment, the methodological quality of systematic reviews of these studies has generally been poor, their clinical results are mostly tentative, and there is little evidence for the relative effectiveness of treatment options. ... claims that intervention by around age three years is crucial are not substantiated.”

Source: Wikipedia contributors, “Autism therapies,” Wikipedia, The Free Encyclopedia, http://en.wikipedia.org/wiki/Autism_therapies.

Early intervention effective but not overwhelming

“Recent reviews highlight limitations in the evidence base for early interventions for children with autism. We conducted a systematic review of controlled studies of early intensive behavioral interventions (EIBI) for young children with autism. Eleven studies met inclusion criteria (including two randomized controlled trials). At group level, EIBI resulted in improved outcomes (primarily measured by IQ) compared to comparison groups. At an individual level, however, there was considerable variability in outcome, with some evidence that initial IQ (but not age) was related to progress. This review provides evidence for the effectiveness of EIBI for some, but not all, preschool children with autism.”

Howlin, Patricia, Iliana Magiati, et al. "Systematic Review of Early Intensive Behavioral Interventions for Children With Autism." *American Journal on Intellectual and Developmental Disabilities*. 114, no. 1 (2009): 23-41.

Why? Parents try multiple interventions

Many “name-brand” programs have been developed to treat children with ASD (e.g. floor time, Relationship Development Intervention /RDI, Lovaas therapy, etc)

But, the presence or absence of research support does not appear to impact parents’ or service providers’ choice of treatments

Green et al. (2006) found in an internet survey that 108 treatments were currently being or had been used by at least one parent.

The average number of individual treatments currently used by parents was 7

So do providers

Stahmer et al. (2005) examined primary service providers for children with autism. They reported: using up to 30 different intervention models research base for the programs implemented was rarely considered when choosing an intervention practice when evidence-based practices were implemented, they were often modified significantly (e.g. program methodologies were combined to fit child characteristics or programs were adapted to fit teacher preferences). Finally, the majority of EI providers reported that they did not receive adequate training on any of the models they implemented.

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Autism and Theory of Mind

- Most of the following studies refer to children with autistic syndrome disorders and normal or close to normal IQ's ...
- Otherwise, they are IQ-matched (and age-mismatched) or IQ and age-matched to children with other developmental disorders.

Autism and TOM

- Abilities impaired in autism
 - Poor joint attention
 - Poor gaze monitoring
 - Poor at directing visual attention of others (point to get objects but rarely point “protodeclaratively”)
 - Little or no pretend or symbolic play
 - Poor at social nuance, irony, etc.

Autism and TOM

Figure removed due to copyright restrictions. Figure 2. Klin, Ami, Warren Jones, et al. "The Enactive Mind, or from Actions to Cognition: Lessons from Autism." *Philosophical Transactions of the Royal Society* 358, no. 1430 (2003): 345-60.

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Autism and TOM

- Evidence for “mind-blindness”.
- Failure to distinguish mental representations and reality
 - Jack is thinking about a dog.
 - Jill is holding a dog.
 - Who can pet the dog?

Autism and TOM

- Evidence for “mind-blindness”.
- Failure to understand mental properties of the brain.
 - Keeping you alive, helping you eat, helping you move
 - Thinking, wishing, dreaming

Autism and TOM

- Evidence for “mind-blindness”.
- Failure to understand where knowledge comes from.
- Alice looks in the box
 - Paul touches the top of the box.
 - Who knows what’s in the box?

Autism and TOM

- Evidence for “mind-blindness”.
- Failure to understand deception.
 - Hide the penny
 - Autistic children may hide the penny in one hand, but leave the other open.

Autism and TOM

- Evidence for “mind-blindness”.
- False beliefs
 - First order delays
 - Second order impairments and delays

Autism and TOM

- Pragmatics (Gricean implicatures)
 - Cooperative principle
 - Mom, there's a party at Joe's.
 - How about that research paper?
 - Maxim of quantity
 - Do you have 2 brothers?
 - Any more than 2?
 - Maxim of relevance
 - Is your mom there?
 - Yes
 - Maxim of manner

By contrast, ASD children typically have preserved math and spatial

- Domain-specific deficit?
- Fathers and grandfathers with children or grandchildren with ASD were twice as likely to be engineers as fathers of children with Tourettes, language delay, Downs syndrome or control.

Not all of TOM

- Attribute agency and goals to Heider and Simmel stimuli (although less accurate and less frequent use of mental state terms)
- Identify emotions accurately (some modest difficulties with social emotions like pride and shame)
- Experience emotion, including self-reported loneliness
- Secure attachment to primary caregivers
- Stereotype of social indifference is misleading, children can be affectionate,

Not just TOM ...

Deficit of central coherence (Frith)

Local rather than global processing

Y Y

Y Y

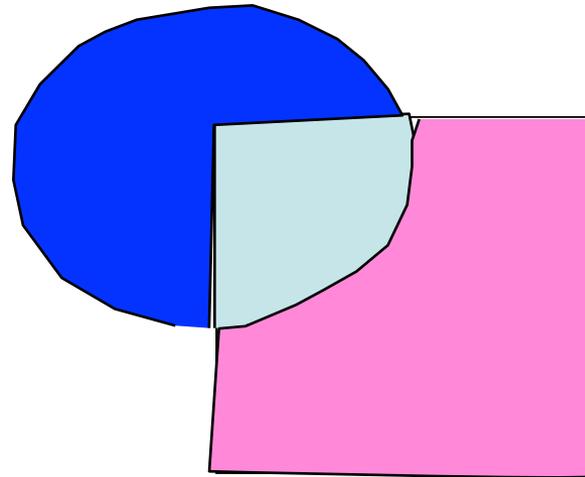
Y Y

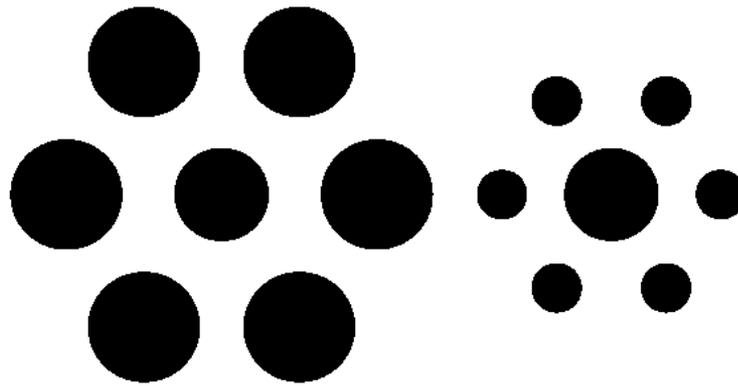
Y Y

Y Y

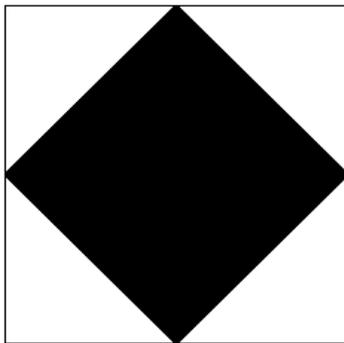
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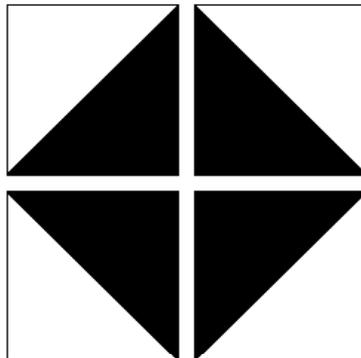




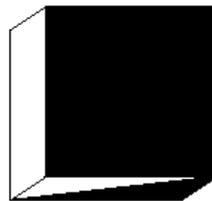
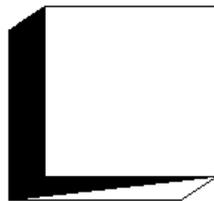
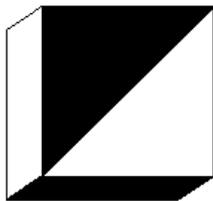
A



Original pattern

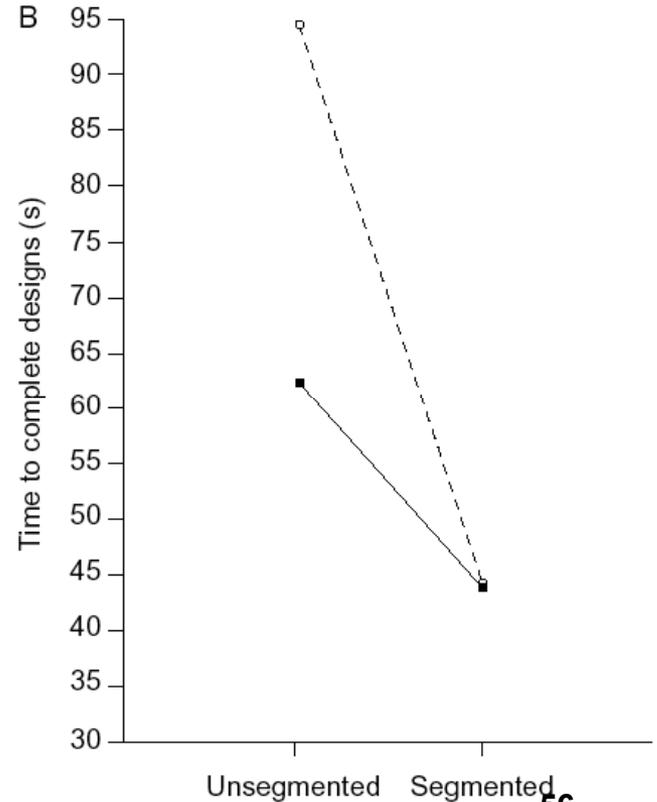


Segmented pattern



Types of blocks available for making the pattern

B



Not just TOM ...

Deficit of central coherence (Frith)

Assemble puzzles without the picture

Remember strings of nonsense words almost as well as sentences

Can recite stories verbatim but may not be able to give you the “gist” of the story.

Deficit of executive function (Russell)

Poor planning

Perseverative

Also Savantism: ten times more common in people with autism than people with other mental handicaps.

Domain-specificity?

- Often contrasted with Williams syndrome
- 1:50,000
- $IQ < 70$
- Very social
- Large and unusual vocabulary
- Very poor spatial and math skills

Selective sparing of language

- List all the animals you can think of:
- Child with Down syndrome: “Dogs, cats, fish, bird, fish”
- Child with Williams syndrome (same age and IQ): “Brontosaurus, tyrannosaurus, brontosaurus rex, dinosaurs, elephant, dog, cat, lion, baby hippopotamus, ibex, whale, bull, yak, zebra, puppy, kitten, tiger, koala, dragon ...”

Grammatically sophisticated for IQ level as well

- “The horse is chased by the man”
- DNS fail; WS pass

- “I hope you to eat all your supper”
- DNS: “Chicken”
- WS” “I hope that you eat all your supper”

And pragmatics ...

- True also for prosody and paralinguistic devices to maintain audience interest:
- “And ah! He was amazed.” ... “And BOOM millions of bees came out and tried to sting him. And he goes ‘Ouch!’ oh uh get outta here bumblebees!”

Figure 2.6 removed due to copyright restrictions. Bellugi, Ursula, Paul P. Wang, and Terry L. Jernigan. "Williams Syndrome: An Unusual Neuropsychological Profile." In *Atypical Cognitive Deficits in Developmental Disorders: Implications for Brain Function*. Edited by Sarah H. Broman and Jordan Grafman. Lawrence Erlbaum Associates, 1994, p. 37.

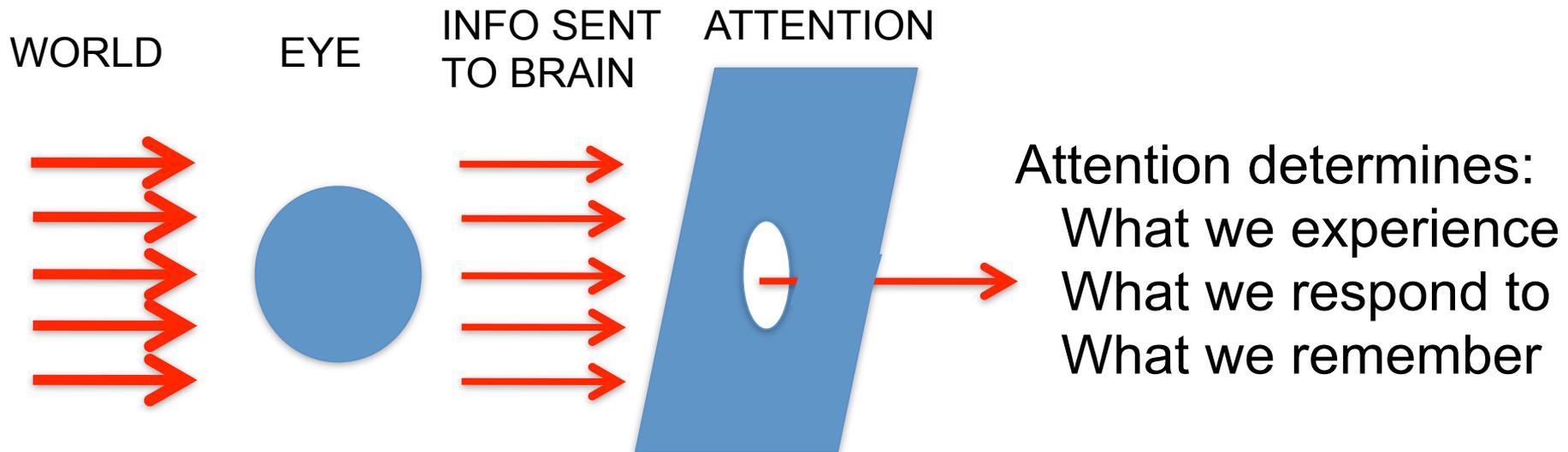
Domain-specific deficit

- However, contrast may be exaggerated.
- Many commonalities
- Language impairments even in Williams syndrome children.
- Retardation and sensory abnormalities common to both.
- TOM deficits too ... WS children use identical high prosody on fourth and fifth retelling ...
- Deficits in global processing also apparent in ASD.

What is Attention?

A Fundamental Filter of Experience

The key idea: We experience only a *small subset* of the information that comes in through our senses



Is attention affected in autism?

A Child with Autism

Image removed due to copyright restrictions. <http://www.autismspeaks.org/what-autism/video-glossary>

Three Main Claims about Attention in Cwkuo

- Impairment in global processing
 - Cannot see the “big picture”
 - Both perceptually and conceptually
 - “weak central coherence” (Frith, Happe)
- “Sticky attention”, i.e. impaired disengagement
 - Failure to respond to own name,
 - Restricted interests
- Reduced attention to faces

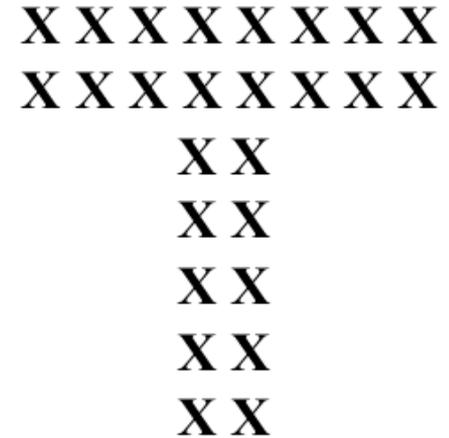


Image: Wikimedia. Public Domain.

Are these claims true?

Participants

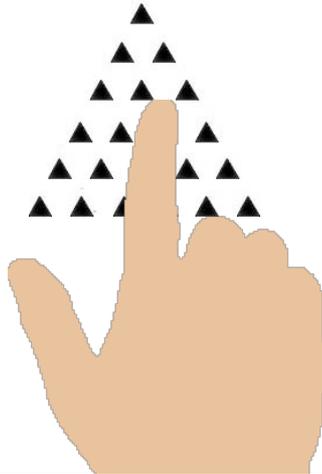
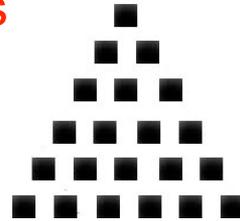
- 45 children with ASD (from SSC and AC)
 - Confirmed with ADOS
- 45 typically developing children
- Matched on
 - Age (5-12 years old)
 - Sex (9 female in each group)
 - Non-verbal IQ (KBIT), 80 or over
 - All participants: normal or corrected to normal vision.

Courtesy of Nancy Kanwisher. Used with permission.

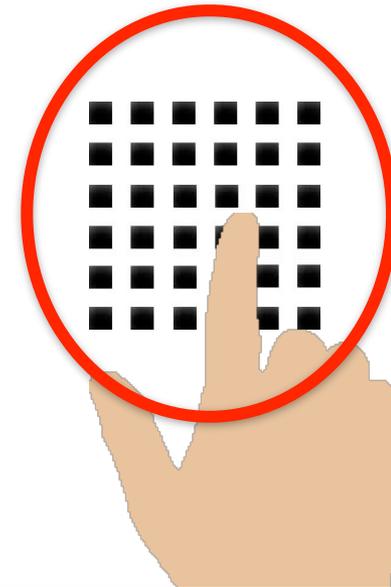
Expt 1: Default Global vs Local Attention

“Which one matches the top?”

Expectation from prior literature:
ASD group will show a local bias



Global Match



Local Match

68

Default Global vs Local Attention Task

“Which one matches the top?”

Expectation from prior literature:
ASD group will show a local bias

CONFIRMED

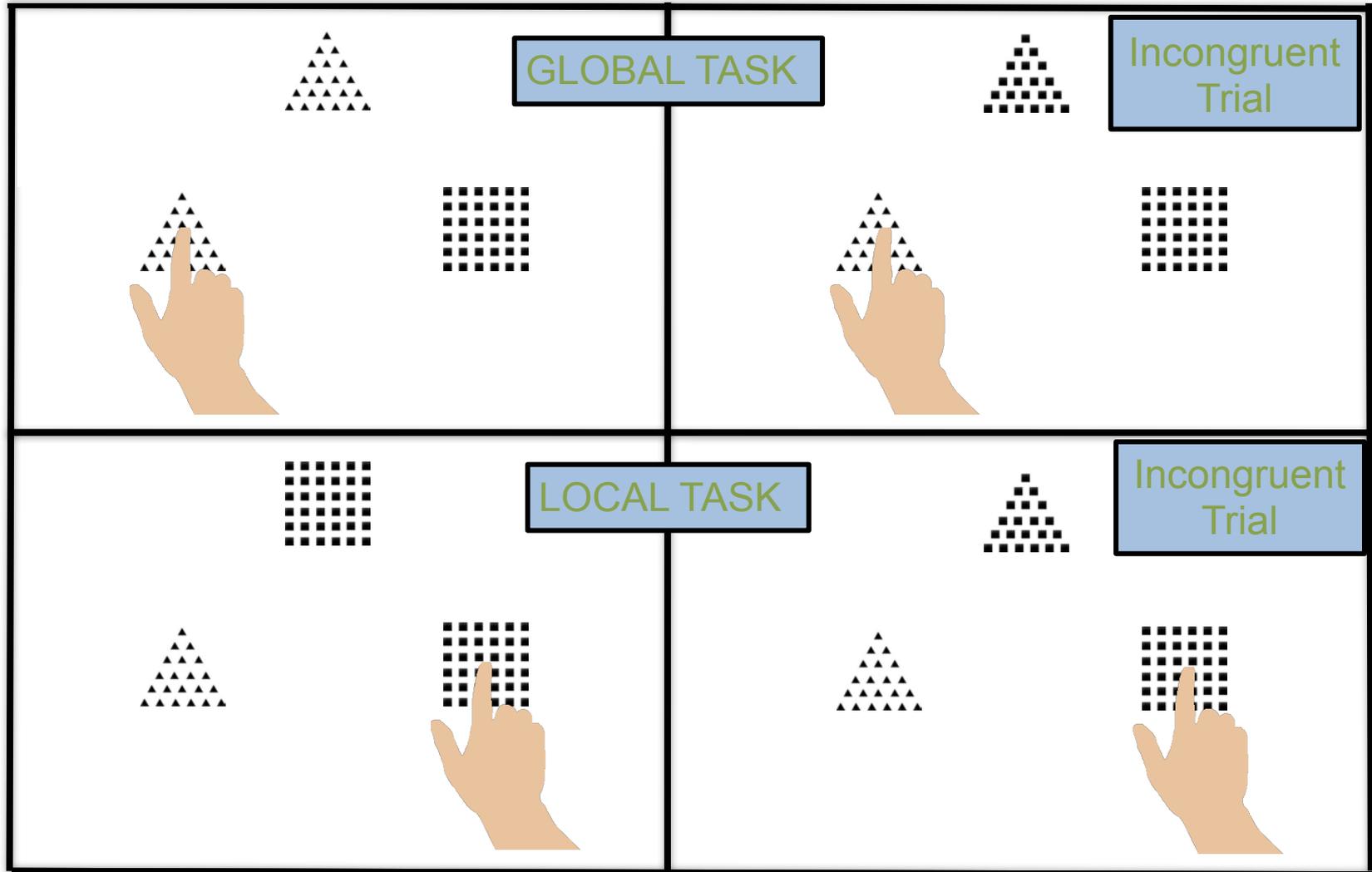
Figure 3 removed due to copyright restrictions. Russell-Smith S. N., Maybery M. T., et al. "Are the Autism and Positive Schizotypy Spectrally Opposed in Local versus Global Processing." *Journal of Autism and Developmental Disorder* 40, no. 8 (2010) : 968-77. DOI: 10.1007/s10803-010-0945-7.

Local preference is
correlated with
autism severity (both
ADOS score and
SRS).

BUT:

What if you *ask* them to attend global?

Expt 2: *Instructed* Global and Local Attention



Finding: Accuracy > 97% on both tasks for both ASDs and TDs.
Kids with ASD can do both tasks do as well as typical kids.
A subtler measure.....

Instructed Global vs Local Attention Task

Just as much global interference on local task,
As local interference on global task,
in ASD!

Figure 4 removed due to copyright restrictions. Russell-Smith S. N., Maybery M. T., et al. "Are the Autism and Positive Schizotypy Spectrally Opposed in Local versus Global Processing." *Journal of Autism and Developmental Disorder* 40, no. 8 (2010) : 968-77. DOI: 10.1007/s10803-010-0945-7.

BUT: What if you *ask* them to attend global?

ANSWER: they can process global just as well as local!

Testing Hypotheses

- Part I. Impairment in global attention?

ASDs: a lower *preference* to attend/report global,
not a lower *ability* to attend global

- Part II. Sticky attention: Do people with ASD have a Disengage Deficit?



- Part III. Reduced Interest in/Attention to Faces?

II. Sticky attention

- Delay in disengaging attention



Figure removed due to copyright restrictions. Landry, Reginald, and Susan E. Bryson. "Impaired Disengagement of Attention in Young Children with Autism." *Journal of Child Psychology and Psychiatry* 45, no. 6 (2004): 1115-22.

“Shift” condition

“Disengage” condition

Landry & Bryson, 2004

Questions:

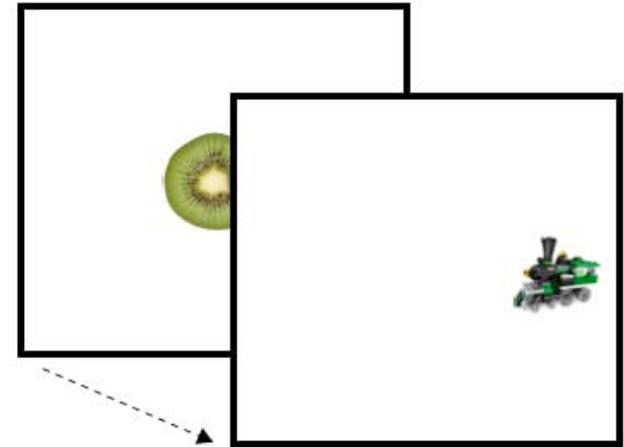
1. Is this disengagement deficit for real?
2. Does it depend on the nature of the stimuli?

Slide adapted from Yuhong Jiang

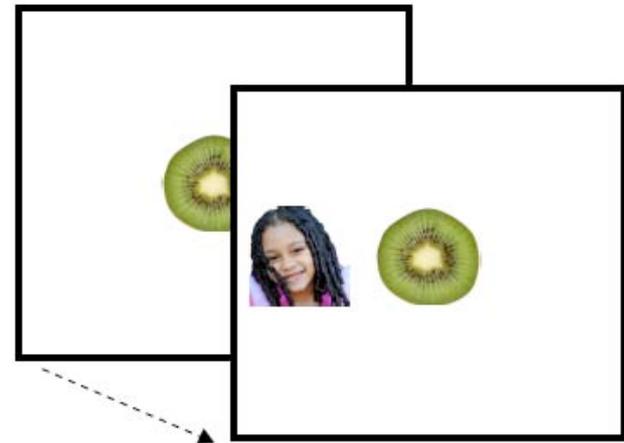
Disengagement

- Eye tracking
- No specific task instructions
- Design
 - Group: 51 ASD children, 70 TD children
 - Temporal condition: Shift vs Disengage
 - Nature of stimuli:
 - Central item: Social vs Nonsocial
 - Peripheral item: Social vs Nonsocial

Shift



Disengage



Slide adapted from Yuhong Jiang

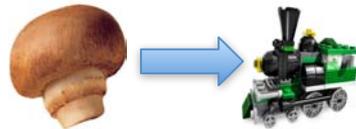
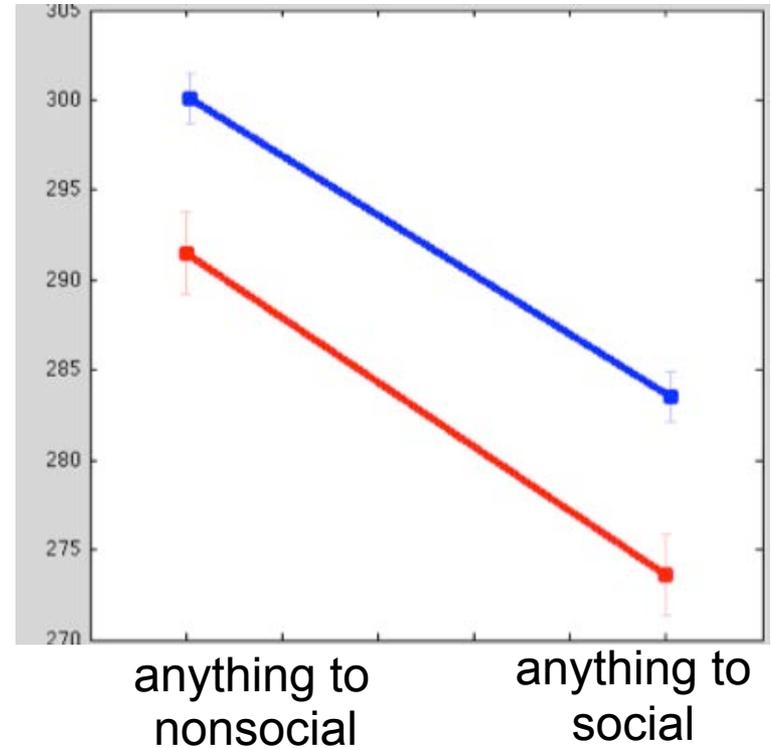
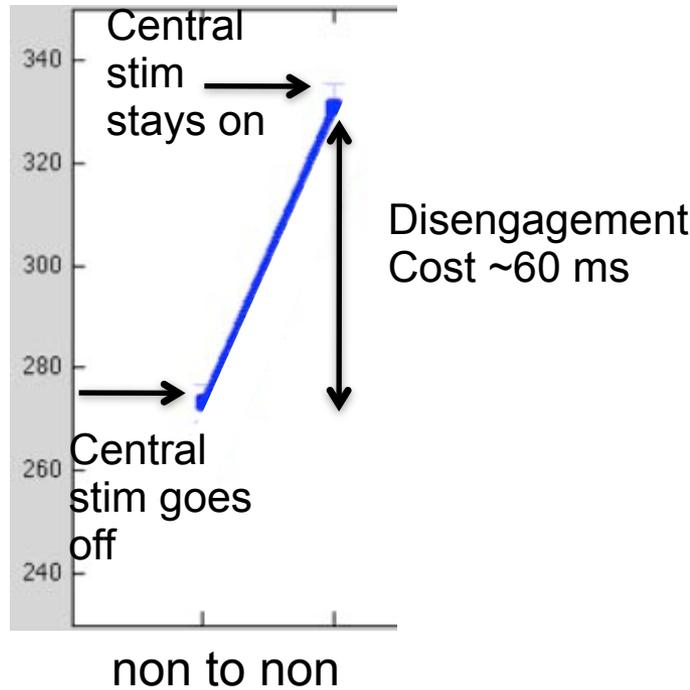
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Disengagement Costs

Typical N = 70; ASD N=51

No greater disengagement deficit in ASD!

RT to arrive at peripheral stimulus after its onset



Disengagement costs very similar for social stimuli. But.....

Are we faster overall to look at social stimuli?

*~20 ms faster cascading to a social stimulus
For both ASDs and TDs!*

Testing Hypotheses

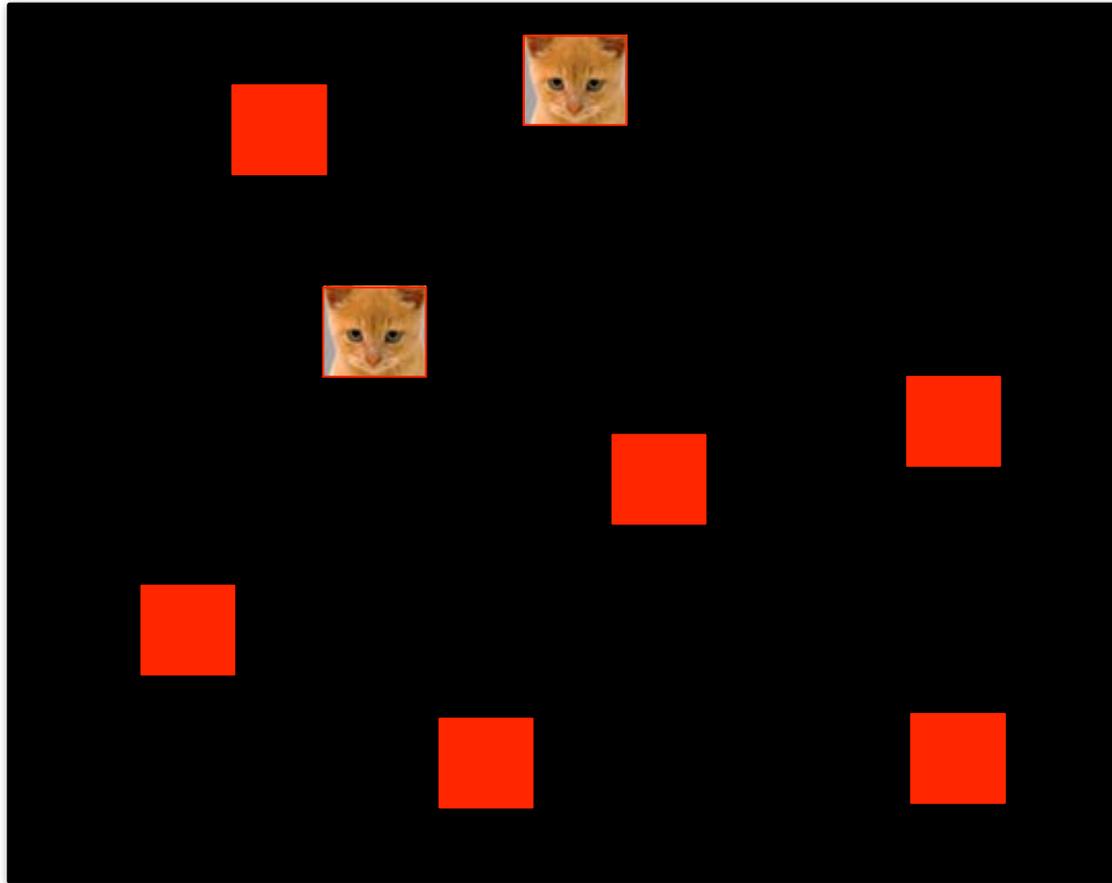
- Part I. Impairment in global attention?
No deficit in global processing, just a preference for local
- Part II. Sticky attention (Disengage Deficit)?
No general deficit in disengagement
- Part III. Reduced Attention to Faces?
No!
Faster eye movements to faces *for both* ASDs and TDs

Caveats, boundary conditions, further questions.....

1. Heterogeneity of ASD > Subgroups?
2. Disconnect between lab and real world?
Dynamic stimuli, real people
2. *Something* may be going on with attention in ASD.
width of attentional focus (Robertson & Baker)
attentional selection?

Multiple Object Tracking Task

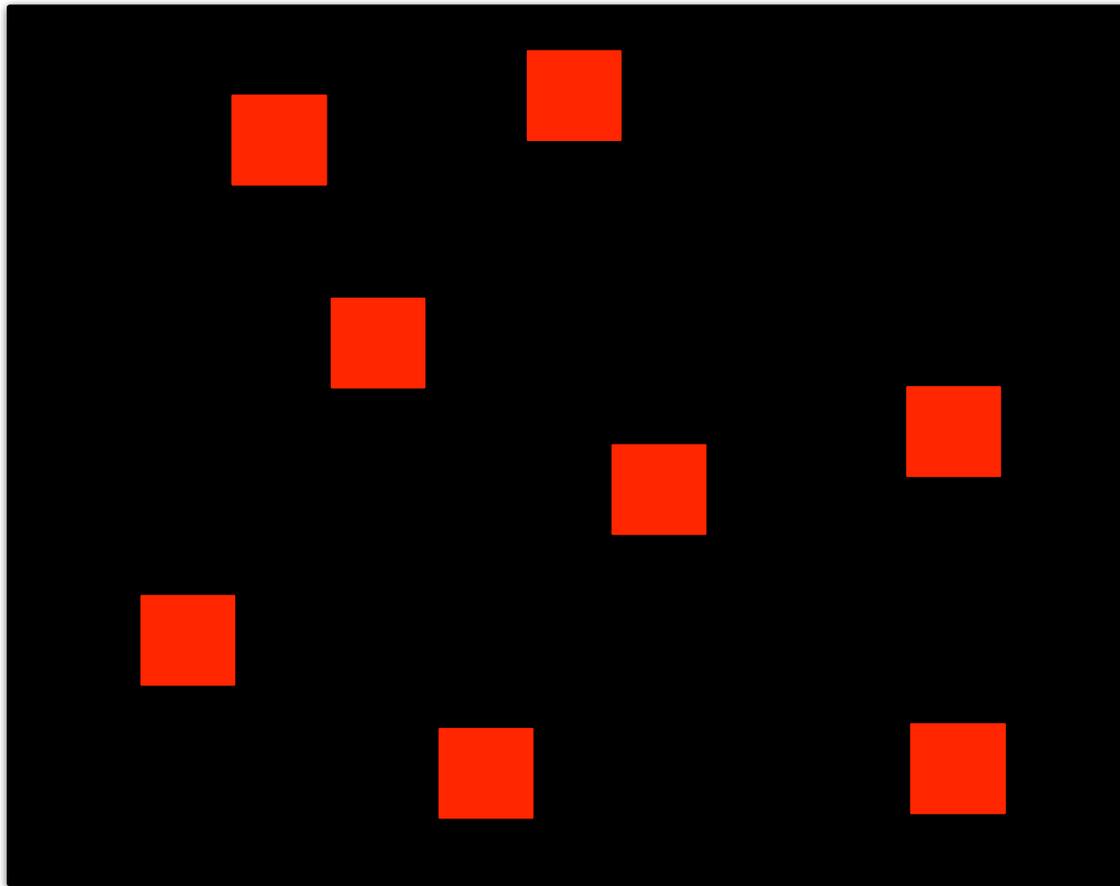
Track Those Kitties!



Kitten photo © Unknown. All rights reserved. This content is excluded from our Creative Commons license. For more information, see <http://ocw.mit.edu/fairuse>.

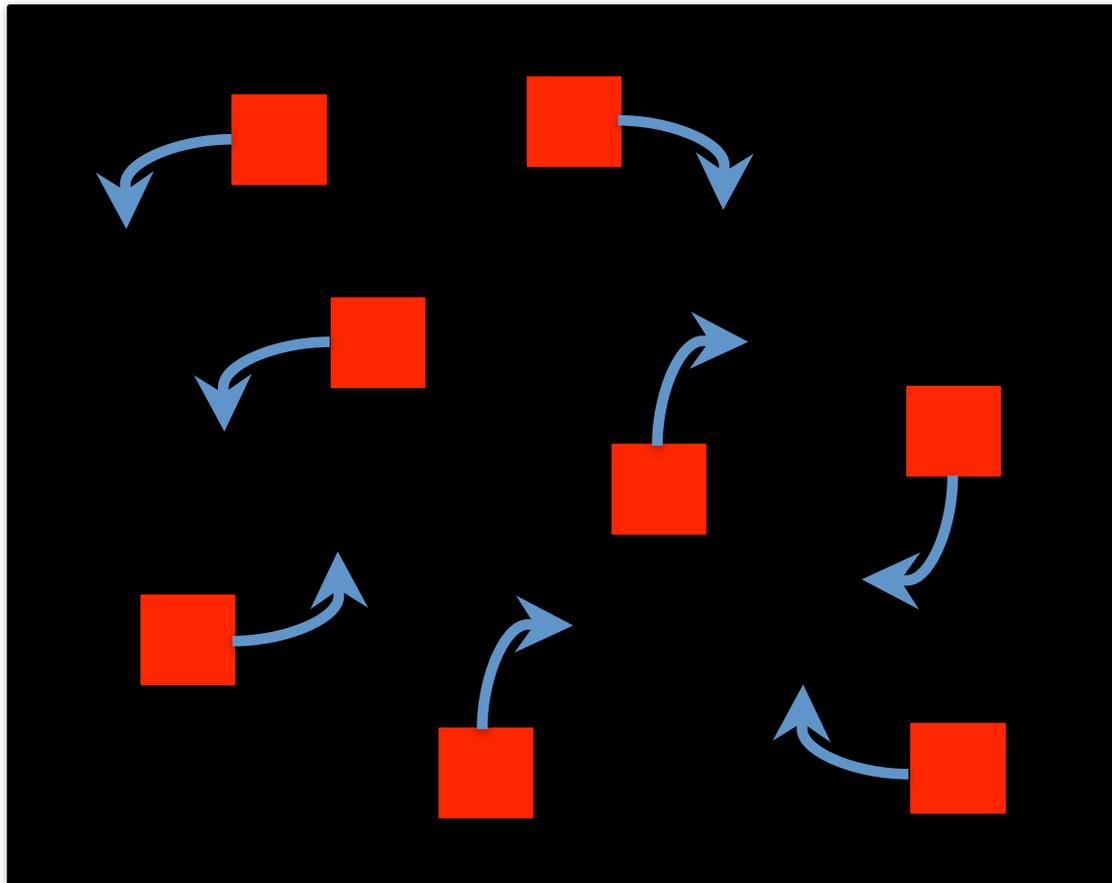
Multiple Object Tracking Task

Track Those Kitties!



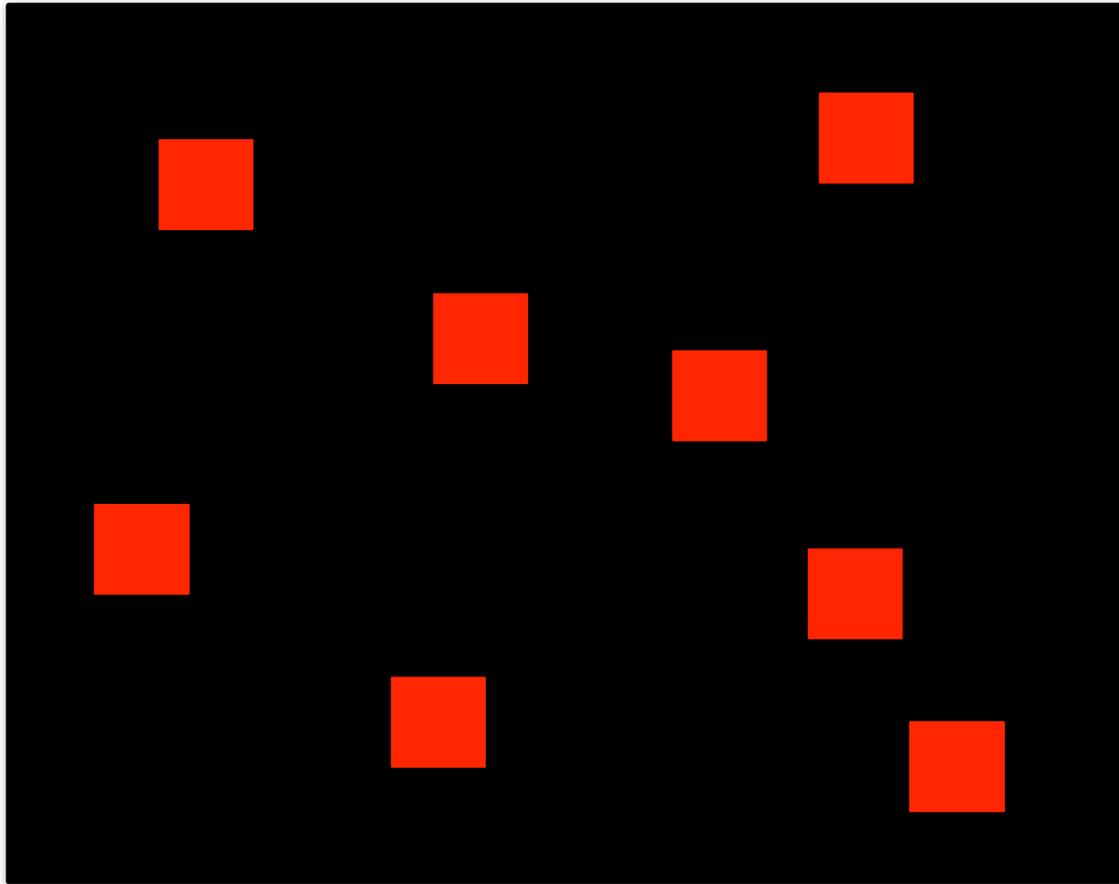
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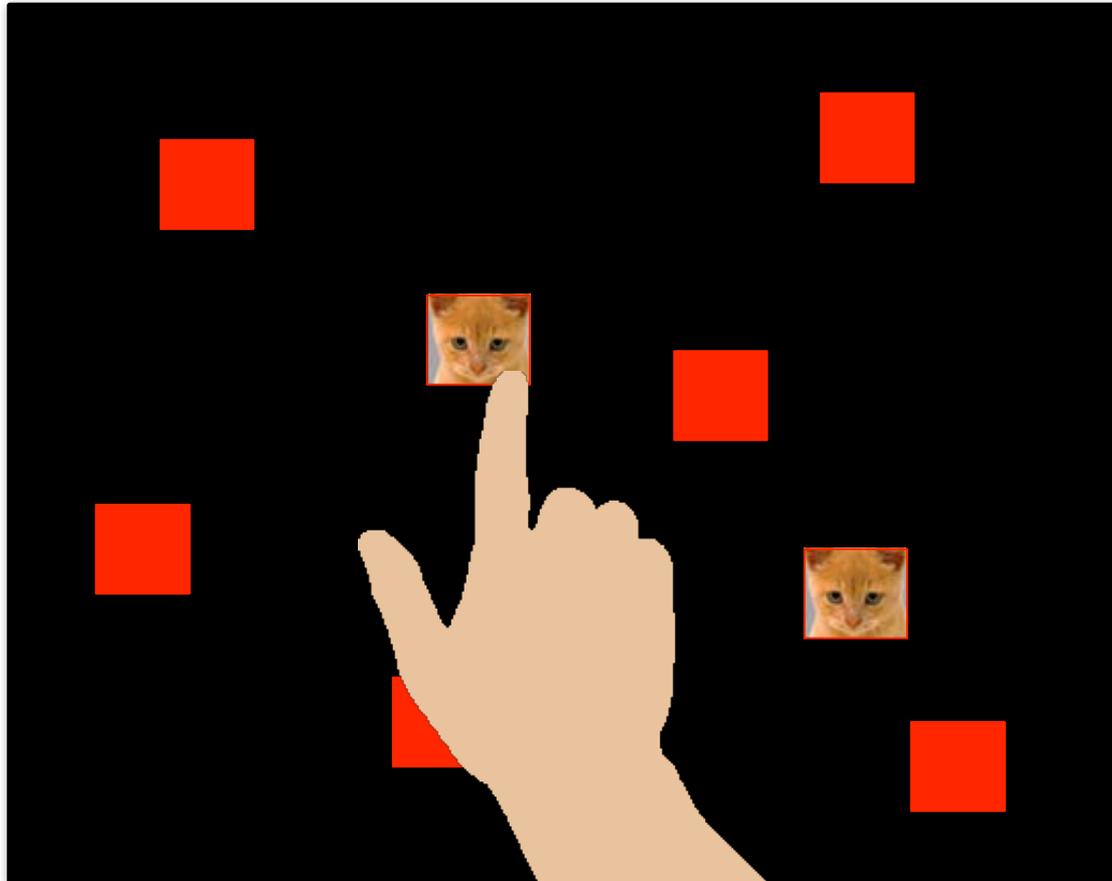
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Multiple Object Tracking Task

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Multiple Object Tracking (MOT) Task

- Well studied and modeled (visual psychophysicist love this task), provide good quantitative measures of performance
- Measure *dynamic* visual attention, which might be implicated in AS (e.g., deficit in biological motion perception)
- Requires *selecting* targets, maintaining and updating them, and keeping them distinguished from nontargets
- Fun, engaging, and intuitive for kids

Multiple Object Tracking Task

Tested

41 children age 5-12 with HFA

41 typical children matched in age & IQ (≥ 80)

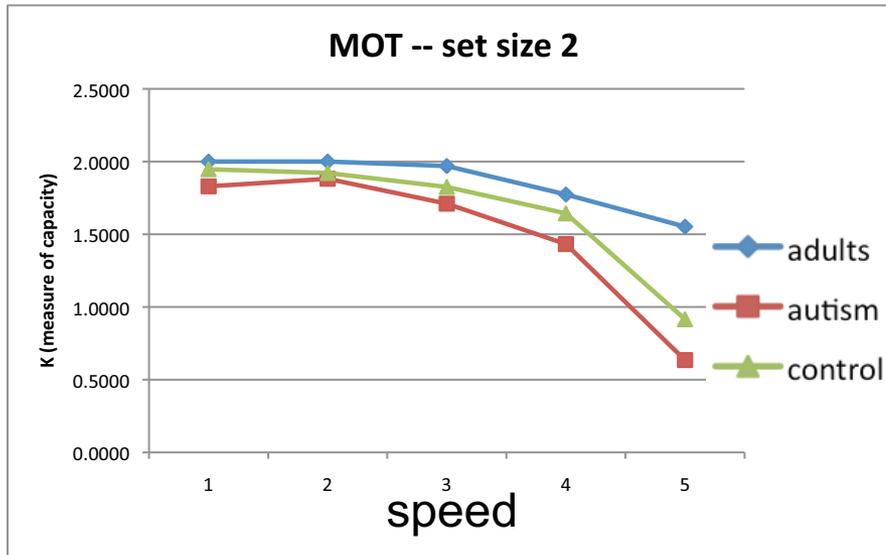
17 adults

Variables:

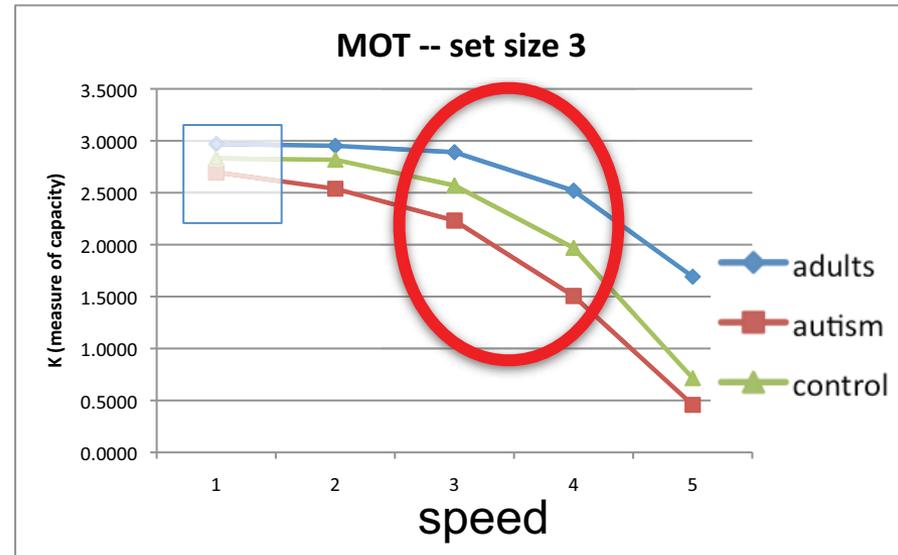
1. Number of Cats (2 vs. 3)
2. Speed (5 speeds)

Performance on MOT Task

Track two kitties



Track three kitties



- ASDs: lower capacity than TDs
 - but effect size is small
- Effect does not depend on speed, so
 - This deficit is not about the dynamic nature of the task
 - Instead, a difficulty with attentional selection

Testing Hypotheses

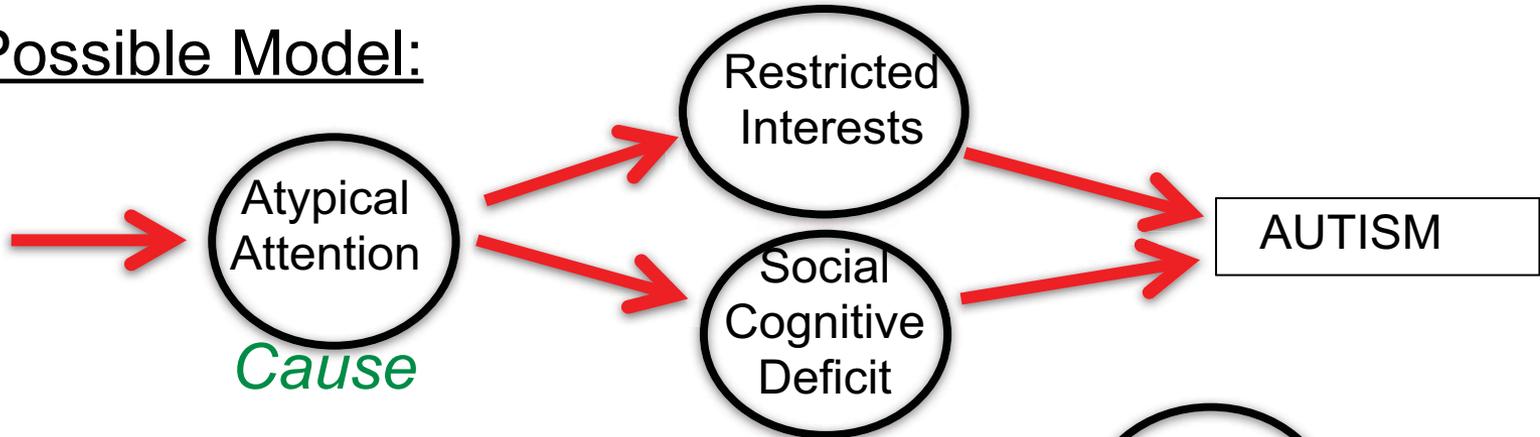
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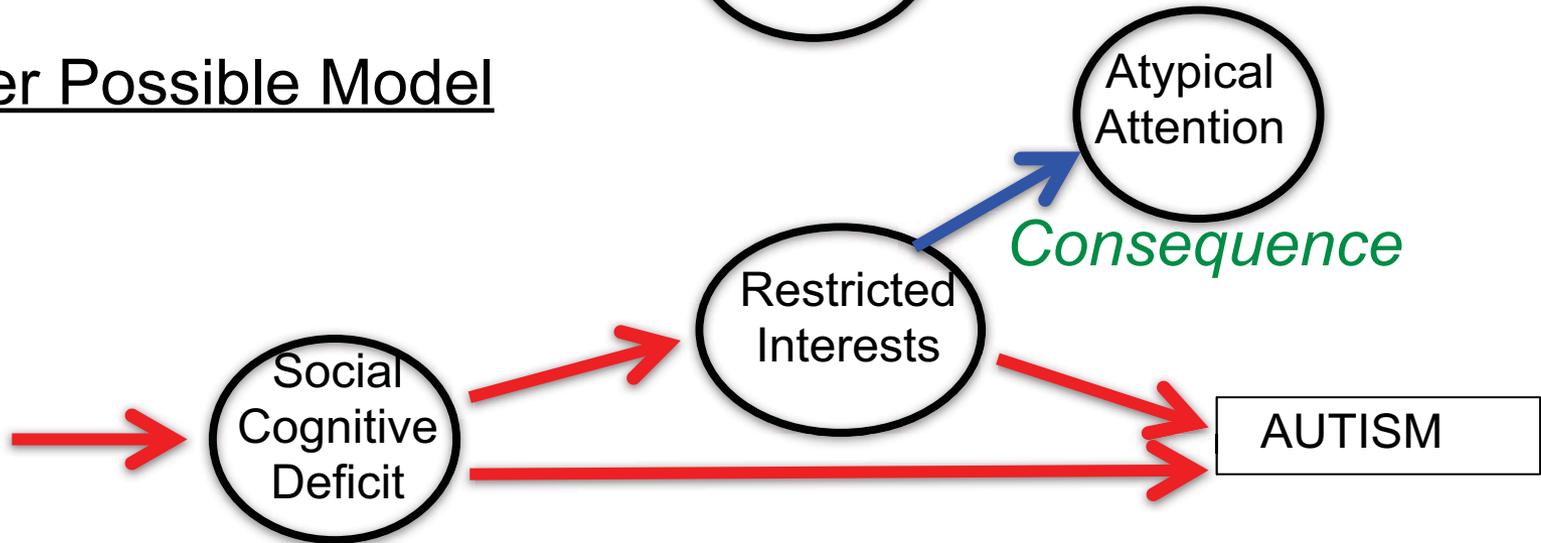
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width of attentional focus (Robertson & Baker)
attentional *selection?* **MAYBE** *Implications?*

Do Attentional Differences Play a *Causal* Role in the Development of Autism?

One Possible Model:



Another Possible Model



- *Very different implications for remediation*
- *Developmental studies are key here.....*

Summary

- ASD selectively impairs social functioning and communication
- Other impairments (in executive functioning, in central coherence, in sensory processing) are also present.
- But they may be differences in how children choose the foci of their attention, not impairments in their ability to do so.

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9.85 Infant and Early Childhood Cognition
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