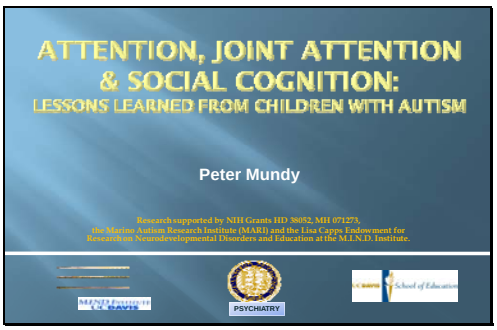
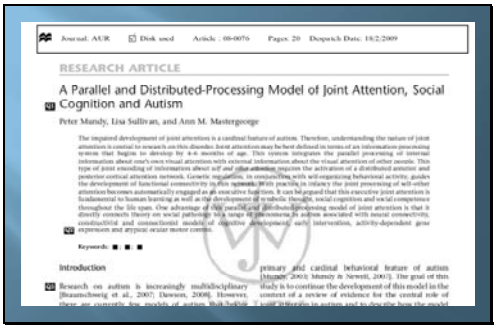
Slide 1



Slide 2

Slide 3



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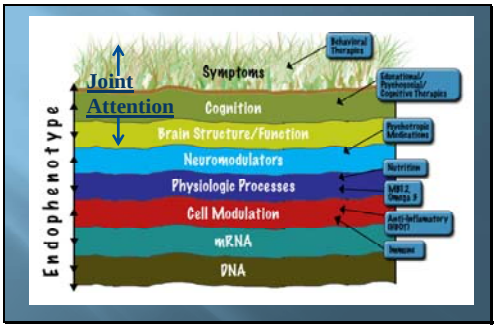

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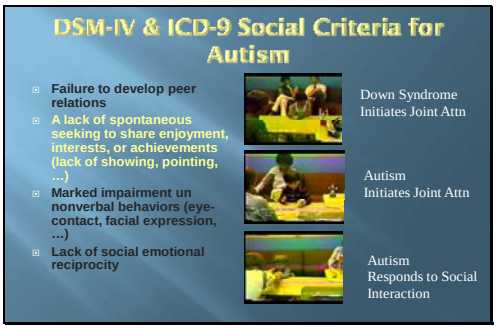

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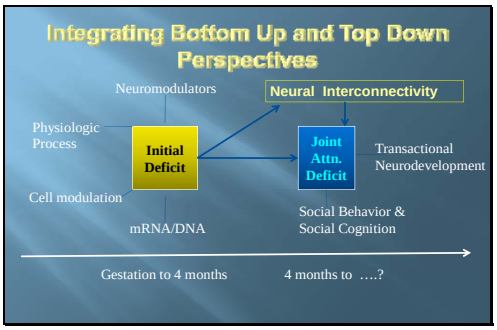


Slide 7

WHAT IS JOINT ATTENTION?

Slide 8

How Do People Learn?

- Paying attention to what other people *attend to* is fundamental to human learning
- Begins to Develop Very Early
  - JOIINT ATTENTION
- Impairment contributes to developmental vulnerability & autism

PAY ATTENTION TO WHAT OTHER PEOPLE ATTEND TO

GET OTHERS TO PAY ATTENTION WITH (TO) ME

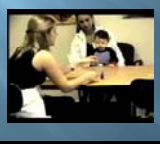
Slide 9

Responding to Joint Attention (RJA)

- Scaife & Bruner (1975)
- RJA–Social JA
  - # of trials out of 8
- Development
  - Onset: neonatal
  - Cog. shift 9-10 month

Slide 10

Initiating Joint Attention (IJA)



- Frequency of:
  - Eye contact while touching toy
  - **Alternating eye contact (toy active)**
  - Pointing to active toy or event
  - Shows toy
- Development
  - Onset ? (4 months – 8 mos.)
  - Stable differences by 9 mos.

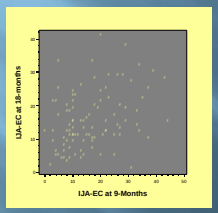
Slide 11

Initiating Behavior Requests (IBR)

- Frequency of:
  - Eye contact active toy ceases
  - Reach and Alternating eye contact
  - Pointing to toy out of reach
  - Giving toy
- Proto-imperative (Bates et al. 1975)
  - Comparable to IJA but less social
- Development
  - Onset ?

Slide 12

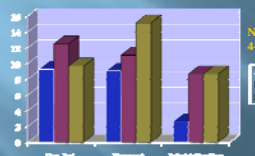
Individual Differences and JA



r (94) = .35, p < .005

Slide 13

Dissociation of Social Attention Coordination in Autism



N = 18/group
4-year-olds

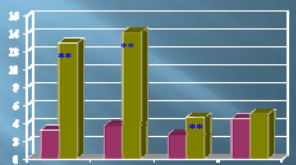
96% discrimination

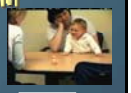
Deficit due to impaired
1) Attention regulation
2) Social-Cognition
3) Affective Contact

Curcio, 1978
Wetherby & Prutting, 1984
Loveland & Landry, 1986
Mundy, Sigman, Ungerer, & Sherman, 1986

Slide 14

Dissociation of Initiating and Responding in AUTISM





Lo MA = 8 to 22 months Hi MA = 23 to 39 months

Mundy, Sigman & Kasari (1994) also see Leekam (2000), Leekam & Moore (2000)
Little evidence of a chronic impairment in process the direction of gaze in (Kate & Penny, 2008),
but suggestion of early delay in sibling studies.

Slide 15

Sharlet Anderson, Diana Robins, Lauren Adamson (2009)

- For each additional M-CHAT critical item failed, participants were 25% more likely to be diagnosed with ASD.
- For each additional instance of IJA, participants were 47% less likely to be diagnosed with an ASD.

Table 4. Observed and Predicted Frequencies for M-CHAT critical items ALONE*

	Predicted		
Observed	DD	ASD	% Correct
DD	4	4	50.0
ASD	3	15	83.3
Overall % correct			73.1

*Logistic regression, controlling for cognitive development

Sensitivity = 15/(15+3)% = 83.33%.
Specificity = 4/(4+4)% = 50.00%.
Positive Predictive Value = 15/(15+4)% = 78.95%.
Negative Predictive Value = 4/(4+3) = 57.14%.

Table 5. Observed and Predicted Frequencies for M-CHAT critical items plus ESCS IJA*

	Predicted		
Observed	DD	ASD	% Correct
DD	7	1	87.5
ASD	1	17	94.4
Overall % correct			93.3

*Logistic regression, controlling for cognitive development

Sensitivity = 17/(17+1)% = 94.44%.
Specificity = 7/(7+1)% = 87.50%.
Positive Predictive Value = 17/(17+1)% = 94.44%.
Negative Predictive Value = 7/(7+1)% = 87.50%.

Slide 16

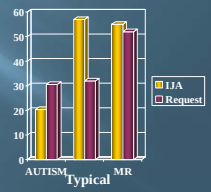
Dissociation of Joint Attention and Attachment

- Children with autism display attachment (Sigman & Mundy, 1989)
- Attachment and IJA not related in autism (Capps, Sigman & Mundy, 1994)
- Attachment related to IJA in infant- caregiver, **not infant-tester interactions** (Block et al. 2006)

Slide 17

Emotion, Motivation & Joint Attention

Kasari et al. 1990; Mundy et al. 1992; Venezia et al. 2002; Parlade et al. 2009



- What is the Motivation/Reward?
1. Pleasure in shared experience?
2. **Pleasure in attention to self?**
3. Does attention have value?

Slide 18

Joint Attention and Intervention

Slide 19

Constructivism and Social Learning

- Infants self-organize social information input via joint attention skills
- Self generated activity essential to learning in both structured and incidental social learning opportunities
- FREQUENCY IS IMPORTANT
  - Related to quality of learning opportunities

From Baldwin (1995)

Slide 20

Joint Attention & Depth of Processing

- Shared attention in Condition A elicits
  - Frontal brain activity at 300 to 700 msec related to depth of processing
  - Better novelty-response recognition memory in 9 month olds (Striano, 2005,2006).
- Also see Farronni et al. 2004, 2006, 2007.

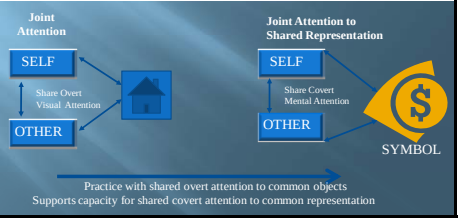
- A

- B

Slide 21

Symbol Development

Symbolic thinking emerges from primordial sharing situations – Werner & Kaplan, 1963



Practice with shared overt attention to common objects
Supports capacity for shared covert attention to common representation

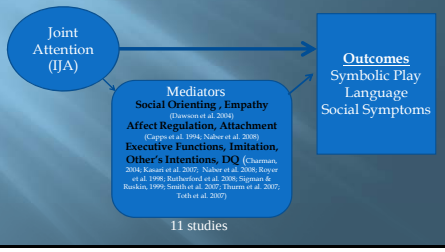
Slide 22

JA as a PIVOTAL MARKER

- Early joint attention is related to social symptom and language outcomes in autism
  - Dawson et al. 2004; Charman, 2004; Lord et al. 2003; Mundy et al. 1994; Sigman & Ruskin, 1999;
- Intervention with joint attention leads to collateral change in social and cognitive outcomes in autism
  - Kasari et al. 2007; Jones, Carr & Feely, 2006; Whalen & Schreibman, 2006
  - IJA intervention most effective with children with little to know language (Kasari et al. 2008)
- Initial joint attention status mediates responsiveness to intervention in autism
  - Bono et al. 2004; Yoder & Stone, 2006

Slide 23

Mediators of Joint Attention?



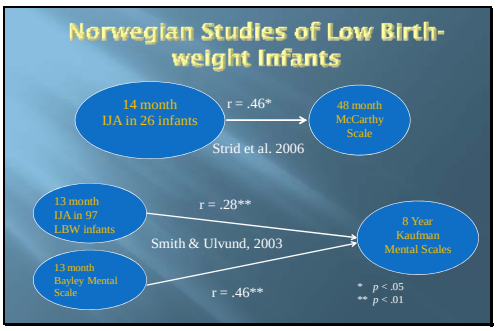
11 studies

Slide 24

Intervention Approaches

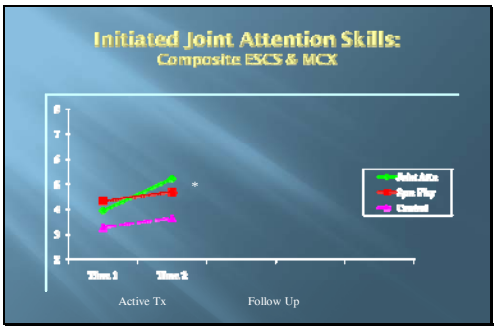
- STIMULUS RESPONSE LEARNING THEORY AND INTERVENTION
  - *operant discrete trial operant methods*
  - rebuild development one skill at a time.
- COGNITIVE LEARNING THEORY
  - Specific brain functions facilitate human learning.
  - One of these is the capacity to coordinate attention with other people.
  - *Developmental approaches : Teach children to actively learn*

Slide 25



Slide 26

Slide 27



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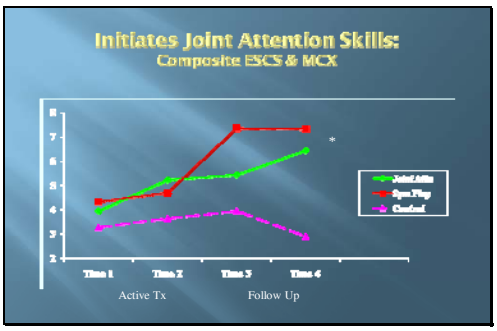

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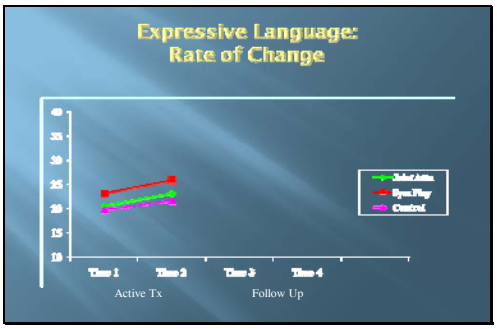

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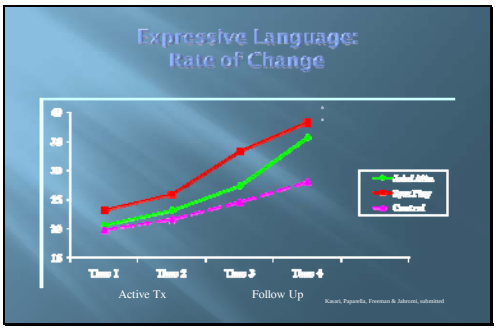


Slide 31

Predictors of Outcome

Connie Kasari, Stephanny Freeman & Tanya Paparella (2007)

- Only *Initiating Joint Attention improvement* predicts to cognitive and language outcomes at 4-year follow -up
- Initiating Joint Attention improvement also predicts symptom improvement on the Autism Diagnostic Observation Scales

Slide 32

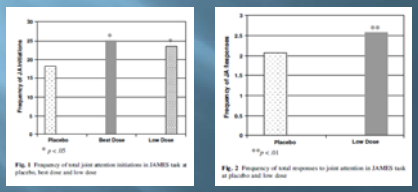
Caregiver-Child Joint Attention and Development in Autism

- Siller & Sigman (2002)
  - Caregiver of children with autism show 'typical' levels of following attention
  - Synchronized/"following" in predicts language gains over , 1, 10 & 16 years
    - "Following in" with "undemanding vocalizations" best predictor

Slide 33

Positive Effects of Methylphenidate on Social Communication and Self-Regulation in Children with Pervasive Developmental Disorders and Hyperactivity

Loudan B. Jahromi · Connie L. Kasari · James T. McCracken · Lisa S-Y. Lee · Michael G. Aman · Christopher J. McDougle · Lawrence Scahill · Elaine Tierney · L. Eugene Arnold · Benedetto Vitiello · Louise Ritz · Andrea Witwer · Erin Kustan · Jaswinder Ghuman · David J. Posey JADD 2009



Thirty-three 5 to 13 year olds

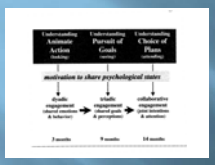
Slide 34

Why is Joint Attention Important?

Learning and Neurodevelopment in Autism

Slide 35

Joint Attention as Social Cognition:



Tomasello, Carpenter, Call, Behne, & Moll, (2005). Understanding sharing intentions: The origins of cultural cognition. *Brain and Behavior Sciences, 28*, 675–690

- ***Intentionality Detector* (ID)**, a dedicated cognitive facility that attributes goal directed behavior to objects or people.
- ***Eye Direction Detector (EDD)***, that senses and processes information about eyes.
- ***Shared Attention Mechanism* (SAM)**, a cognitive module that represents self and other as attending to the same referent *and* attributes volitional states (intentionality) to direction of gaze of *other* people.
- ***Theory of Mind Mechanism*** replaces SAM and enables representation of the full range of mental states of others and enables us to make sense of others behavior.

Baron-Cohen, S. (1995). *Mindblindness*. Cambridge, MA: MIT Press.

Slide 36

Different Views of Attention

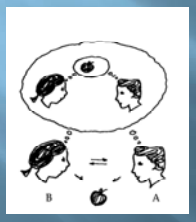
Slide 37

Alternative Perspectives

- Cognitive development need not *only* be construed in terms of discontinuous changes in knowledge. It can also be modeled in terms of continuous changes in the speed, efficiency and combinations of information processing that give rise to knowledge Hunt, E. (1999). Intelligence and human resources: Past, present and future. In P. Ackerman, P. Kyllonen, & R. Roberts (Eds.), *Learning and individual differences: Process, trait and content determinants* (pp. 3-30) Washington, DC: APA Books.
- The functional segregation of cognitive systems implicit to modular theory is *one point of view*. Another is that aspects of cognition are cortically mulit-determined because of the massively parallel nature of human brain networks and the fact that function also emerges from the flow of information between brain areas Ramnani, N., Behrens, T., Penny, W., & Matthews, P. (2004) New approaches for exploring anatomical and functional connectivity in the human brain. *Biological Psychiatry, 56*, 613-619.

Slide 38

Joint Attention, Triadic Processing and Self Awareness



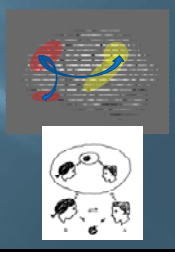
- Joint Attention involves:
  - Self-Referenced Information Processing
  - Other-Referenced Information Processing
  - Object or Event Information Processing
- Self-Awareness
  - A cognitive function that emerges from the flow of information across self-other brain processing areas

Slide 39

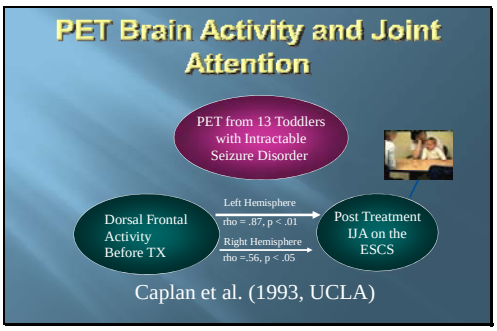
Joint Attention and Interconnectivity

Attention, Joint Attention, & Social Cognition : *Current Directions in Psychological Science Volume 16—Number 5*, 269-274

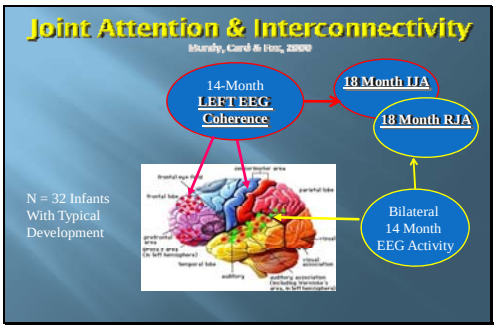
- **RJA & Posterior Attention**
  - Social Brain – "Other" Monitoring
    - Reflexive Attention disengagement & Spatial orienting
- **IJA & Anterior Attention**
  - Goal-related Attention
  - Switching attention
    - Integrated self and other-monitoring (Social executive function)
      - Frith and Frith (1999), Mundy (2003)
- *Development puts early demand on distal interconnectivity*



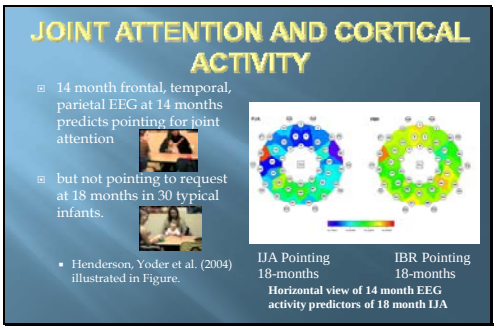
Slide 40



Slide 41



Slide 42



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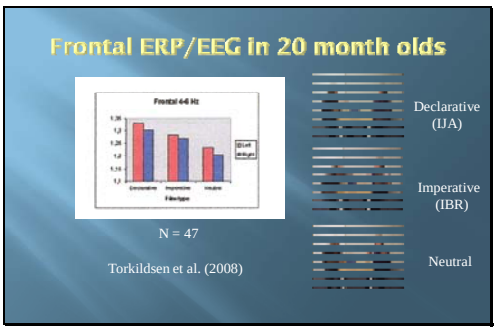

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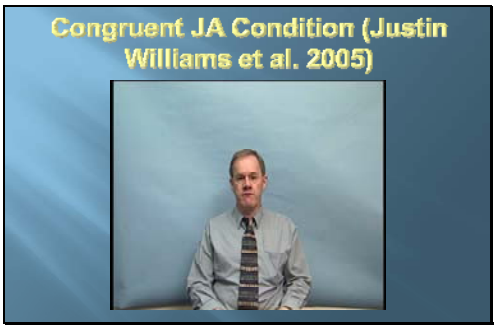
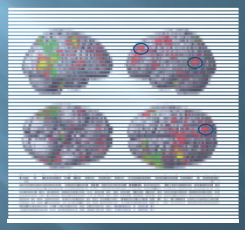


Slide 45

Slide 46

An fMRI study of the Experience of Joint Attention (Justin Williams et al. 2005)



Slide 47

Learning and Distributed Neural Systems

- Learning occurs best in the context of the simultaneous activation of multiple neural networks (Otten et al. 2001).
- "Hebbian learning algorithms (Oja, 1982) whereby units that fire together wire together, are one of the most common forms of self-organizing learning … and [may be] applied to understanding several developmental phenomena." (p. 152-153; Johnson & Munakata, 2005).

Slide 48

PDP and Depth of Information Processing

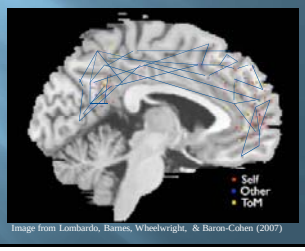
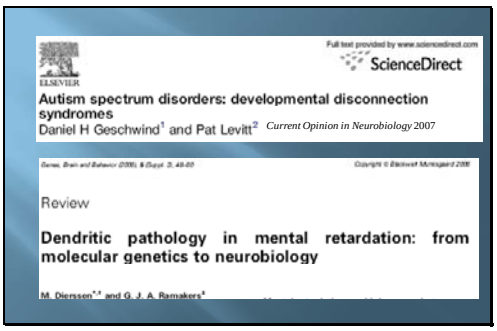


Image from Lombardo, Barnes, Wheelwright, & Baron-Cohen (2007)

Slide 49



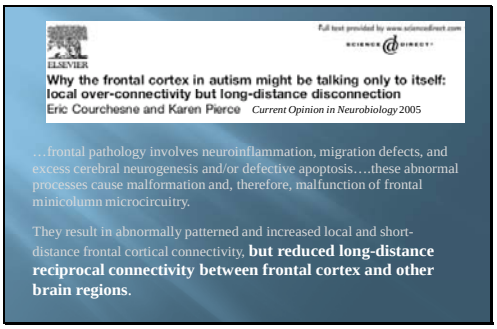
Autism spectrum disorders: developmental disconnection syndromes

Daniel H Geschwind[1] and Pat Levitt[2] *Current Opinion in Neurobiology* 2007

Review

Dendritic pathology in mental retardation: from molecular genetics to neurobiology

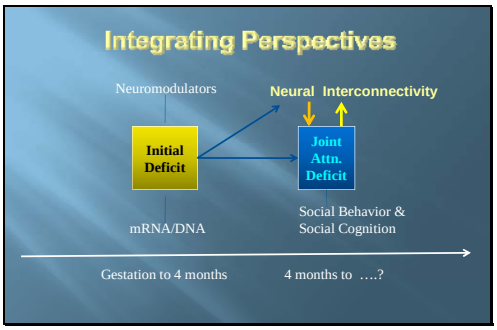
Slide 50



Why the frontal cortex in autism might be talking only to itself: local over-connectivity but long-distance disconnection

Eric Courchesne and Karen Pierce *Current Opinion in Neurobiology* 2005

…frontal pathology involves neuroinflammation, migration defects, and excess cerebral neurogenesis and/or defective apoptosis….these abnormal processes cause malformation and, therefore, malfunction of frontal minicolumn microcircuitry.

They result in abnormally patterned and increased local and short-distance frontal cortical connectivity, **but reduced long-distance reciprocal connectivity between frontal cortex and other brain regions**.

Slide 51