What does attention and perception have to do with the social development of children with ASD?

SFU

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Overview

- Theoretical perspective on ASD
- Where does attention and perception fit within the diagnostic triad of impairments?
- A developmental account of the development of expertise in faces and objects
- Current research on attention and perception in ASD and the link to social adaptation
- Promising research
- Research at ADDL
- Practical applications

Perspectives on autism

- Paul Collins (father and novelist) in his novel about his son's autism "Not Even Wrong: Adventures in autism" wrote
  - "To know autism is to know the mystery of what it means to be human"
  - "Children need people in order to become human beings"
    - Uri Bronfenbrenner

Perspectives on autism

- The book's title is based on a phrase used by Wolfgang Pauli (theoretical physicist), who would put down colleagues by calling them "not even wrong"—their answers were so off target as to be irrelevant
- Collins applies the phrase to people with autism, whose frame of reference is so far off from that of a typical person that their perceptions, ideas and answers can be described as neither right nor wrong, but something else entirely
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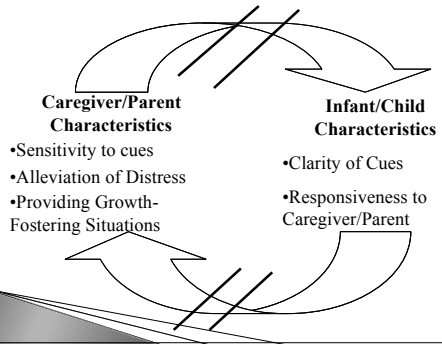
  - "Only a person working from the same shared set of expectations could give a wrong answer. The autist is working on a different problem with a different set of parameters; they are not even wrong."

A developmental systems perspective on ASD

- Genetic, biological, neurological processes that prime children for learning within their social context in children with ASD limits their ability to engage in the learning interactions to the same extent
  - Different attentional and perceptual attunement to the environment coupled with a lack of experience/skill development (compounded over time) in a variety of relational contexts
    - Parent-child, peer relations, teacher-child

The Barnard Model of parent child interaction



Parenting challenges as well as deficits contribute Lane Strathearn (2009)

- Genetically determined predispositions and the cumulative effects of exposure to adverse or atypical social environments
  - Quotes (Kanner, 1965) "the patient, endowed with an innate disability to relate to people, is further influenced adversely by the parents' emotional detachment"

Definition of terms

- Sensation: simple sensory experiences
- Attention: selection of sensory input to process further while ignoring others
- Perception: organized and constructed associations from sensory input- involves attending and learning
- Social perception: organized and constructed meaning from social stimuli

DSM-IV Criteria for autism

- Impairment in social interaction
- Impairments in communication
- Restricted, repetitive and stereotyped patterns of behaviour and interests
- Onset before the age of 3 years

Where does attention and perception fit?

- Could explain narrow and restricted interests
  - Enhanced perception
- Could explain poor social ability
  - Diminished attention to faces and social cues
- Potential to connect the triad

  attention and perception form the foundation for all other high-order cognitive operations

Early sensory experiences and attentional biases help infants orient to what's relevant

- Infant has some experience with sounds
  - Mother's voice and music in utero
- Relatively less visually experienced
  - Orient to light changes in utero

The experience provides some guidance about who to listen to but not who to look at

Attentional bias to face-like configurations present at birth

How do we know? Preferential looking paradigm

Human faces are attractive in a multi-modal sense

- Stimulus properties of faces
  - Face-like configurations (visually captivate)
  - Preference for human voice (auditorily captivate)
  - Preference for human animation (movement captivates)
  - Face can also be manipulated (tactile input)
- Experience with faces
  - Lots of exposure to faces
  - Interactive and responsive
  - Rewarding experiences

Bias and experience lead to skill development

- Infants show an innate perceptual bias for face-like shapes
- Yet experience is needed since the capacity to distinguish facial features develops during the first year of life (Cassia et al., 2006; Gliga and Csibra, 2007)

Face expertise in humans

Face expertise in humans

Why are faces not captivating for children with ASD?

- Are they attending to it or differently?
- Are they perceiving it or differently?
- Is it less rewarding or distressing?
- Do they have preference/bias for objects?

Clues from research on social and non-social attention in ASD

- Social attention
  - Less attending to eye region more to mouth
  - Conceptual understanding of eye gaze direction
    - Equating eyes and arrows
  - Less accurate at determining mental states from pictures of faces
    - When accurate use information from the eyes
- Non-social attention
  - Preference for local processing
  - Modulating attention–bottom up and top down
  - Enhanced visual search of conjunctive features

Clues from computer models of attention

- Computer models of learning designed to build and test hypotheses (Elman et al., 1998)
- Gustafsson and Paplinski (2004) compared the end states of four neural networks which had learned to distinguish between a set of stimuli
  - early attention-shifting impairment combined with familiarity preference could result in the commonly-found features of enhanced discrimination and restricted interests in ASD

Most advantageous conditions for typical face processing in ASD

- Static picture –no interference from other senses
- More time to process
- No distractors in periphery
  - Under these conditions they show more typical patterns of attending and brain activity
- Diversity within the ASD group
- Variability in social motivation and learning

Children with ASD are captivated by certain objects

- Obsessive and restricted interest in objects is a defining feature of ASD
  - An estimated 75% of children with ASD actively pursue, collect and engage with objects (Klin et al., 2007)
  - extent that it interferes with family life and social activities (Lord et al., 1994)
- Object perception/recognition is better than their face perception
  - Some are perceptual experts

Perceptual expertise: Name the dino

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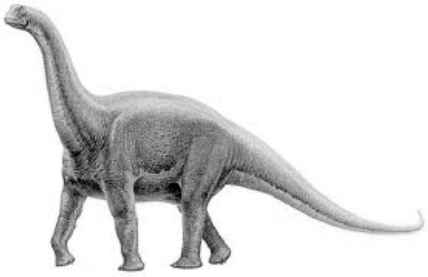
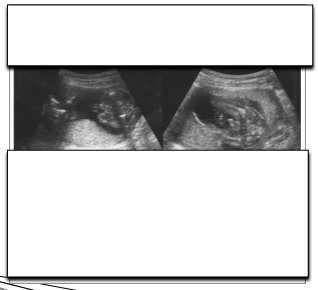
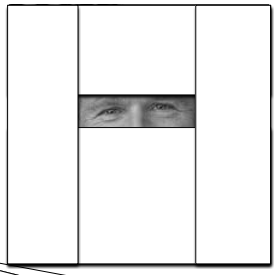


Perceptual expertise requires intense training : What is the sex of the fetuses?



Perceptual expertise: It's a boy!

Face expertise in humans: Configural not parts based like object perception



Face expertise in humans: Configural not parts based like object perception

Promising methodologies

- Genetic heritability of the disorder
  - infant siblings at high risk of a later diagnosis
-
  - unaffected siblings and parents
-
  - examination of autistic-like traits in the general population

Face and object perception is heritable (Kuusikko-Gauffin et al., 2011)

- Parents of children with ASD like their children
  - Poorer memory for faces
  - Better object recognition than face recognition

Baby sibs with ASD *develop* social-communicative difficulties

(Ozonoff et al., 2010)

- Lack of shared eye contact, smiling and communicative babbling not present at 6 months but gradually emerges during the latter part of the first year of life in infants later diagnosed with autism

Slowed habituation to face learning in toddlers with ASD (Webb et al., 2010)

- Toddlers (18-30 months) with ASD who were experiencing more severe social and communication symptoms showed slowing in face processing/learning that was not observed in toddlers with more general developmental delays
- The siblings of the children with ASD also take longer to habituate to faces
- Toddlers who had low SC symptoms of ASD did not differ in their time to habituate to faces or houses

Habituation to faces and houses

(Webb et al., 2010)

Figure 1 Examples of stimuli used in the habituation procedure.

Why slowed habituation to face learning in ASD (Webb et al., 2010)

- A bias to attend to individual features of the face might slow learning in toddlers with ASD, relative to other groups of toddlers who tend to process the face in a more holistic fashion

Emotion processing and social adaptation in adults with ASD (Garcia-Villamiser et al., 2010)

- An association between facial processing accuracy and social adaptation in adults with intellectual disabilities with and without ASD?
  - ASD group scored significantly lower on both emotion and non-emotion facial processing tasks
  - Analyses showed that the association between facial emotion processing accuracy and the level of social adaptation was statistically significant for the ASD group

Social attention and adaptive functioning in ASD adults (Sheppard et al 2010)

- Perceiving driving hazards using social and non-social cues
  - Participants with ASD identified fewer **social hazards than the comparison but not non-social**
  - **Participants with ASD were also slower to respond than comparison participants**
- **Although people with ASD can perceive driving hazards they may have specific difficulty identifying them if they involve a person**

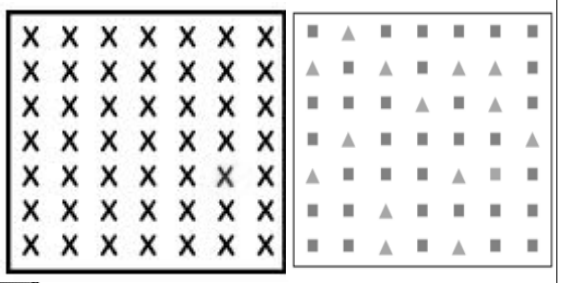
The research challenge to understand link between perception and social competence

- Social, and non-social information is presented in the real-world in multiple sensory modalities, moving, and loaded with social complexity
- Challenge for researchers
  - Experimentally investigate these components separately and then together to distinguish the effects of perceptual processing requirements from social attention atypicalities

Research at ADDL

- Examining the components of social competence
  - From basic to higher-order processes
    - Social attention, perception, cognition and competence
  - Basic attention, perception and the relation to SC
- Improving measurement of the construct of SC
- Exploring and improving methods to increase social competence
  - Individual instruction
  - Social conditions (sensitivity training and inclusion practices)
- Exploring the connection between SC and identity development and mental health

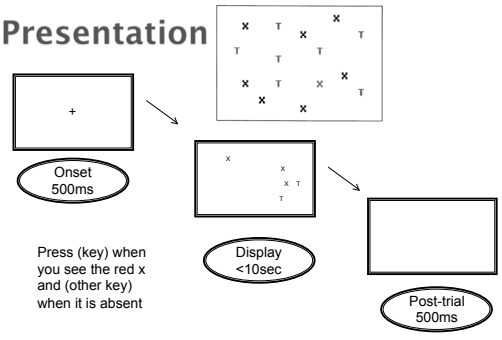
Clues from perceptual strengths in ASD



Kimberly Armstrong: Enhanced visual search and social functioning

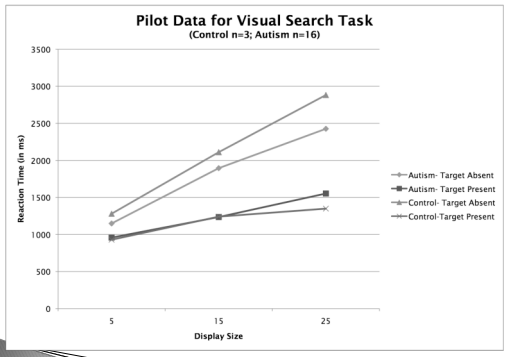
- Visual search tasks involve identifying a target stimulus amongst highly similar distracters
- People with autism are faster at this task than TD individuals, and the difference between the groups increases the more similar the target is to the distracters (e.g. O'Riordan at el., 2001)
- Is this ability specifically associated with particular symptoms or clusters of symptoms that occur in autism?

Presentation



Participants so far:

- 16 with ASD
- 13 males; 3 females
- Age: 14 (range 12-18)
- IQ: 104 (range 76-120)
- AQ: 34 (27-45)



Elina Birmingham: Emotion recognition and attentional strategies

- Faces were converted to grayscale and blurred with a Gaussian filter

Method

What are these people feeling?

Happy *Angry* *Grossed out* *Scared*

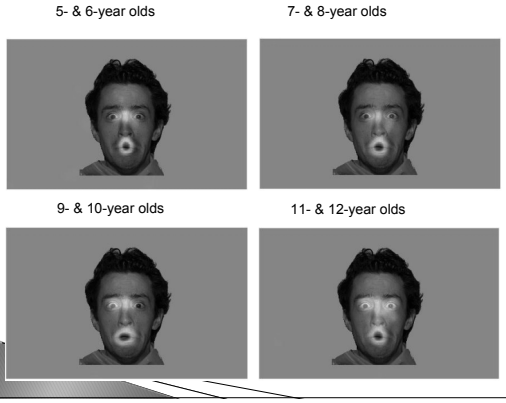
Method

Can you tell me what the face is feeling? A blurry face is going to appear on the screen, and you will be able to explore the face through a window on the screen.

You can reveal different parts of the face by moving the window around the screen with the mouse.

You`ll have 15 seconds to explore.

When you know the feeling, say it out loud! Can you tell me the feeling before the face disappears?



Jodi Yager: The development of a measure of SC

- Social impairment is particularly striking among individuals with “high functioning” ASD
- Variability in “quality of social impairment” observed even within the “HF” group
- Limitations in existing measures: do not permit a sufficiently detailed analysis of social competence; designed for use in other populations (e.g., TD, other DD)

Development of the Multidimensional Social Competence Scale (MSCS)

Format –
- Summated rating scale
- Informant = primary caregiver

Domains Assessed
- Social Motivation
- Social Inferencing
- Demonstrating Empathic Concern
- Social Knowledge
- Verbal Conversation Skills
- Nonverbal Sending Skills
- Emotion Regulation

K Johnston: What kind of instructional techniques improve processing of dynamic social scenes?

(Jacobs & Jacobs, 2005)

Practical applications

- Increase awareness of importance of social attention and perception
  - Example Face camp (Dr. Tanaka at Uvic)

Increase interest and excitement about faces: Uvic team

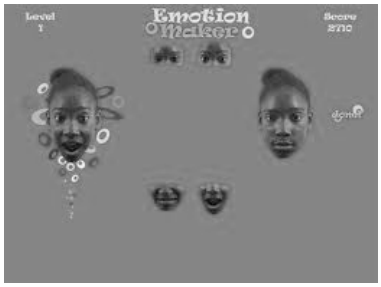
Practical applications

- Use research knowledge on the development of expertise to design computer games to improve face processing
  - Let's Face It! (Dr. Tanaka at Uvic)

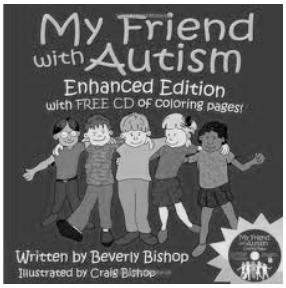
Use motivation for computer games

LFI!: Perceptual expertise training for face identity

LFI!: Perceptual expertise training for face emotion



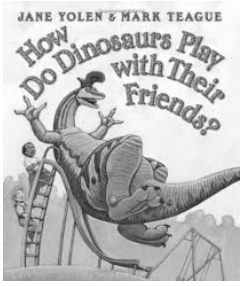
Increasing opportunities for peer interactions and social development



Facilitating social exchange among children with ASD and their peers

- Characteristic impairments of ASD prevent children from participating in critical social contexts (ie. *play*)
- PMI approach promotes social interaction through:
  - facilitating sensitivity towards peers with disabilities
  - fostering understanding of peer relationships and reciprocity
- Will measure how involvement impacts both preschoolers with ASD and TD peers (Developmental Systems Framework)
- Intervention will incorporate both *Sensitivity Training* and *Social Skills Program* components to answer key questions:
  - Do those peers who receive *Sensitivity Training* in addition to a *Social Skills Program* demonstrate increased knowledge of, and more positive attitudes toward ASD?
  - Do those who receive both components interact with their ASD peer more frequently and positively than those who receive *Social Skills Training* alone?

Use what we learn about perceptual interests/skills to teach social skills



- Paul Collins:
  - "Autists are the ultimate square pegs, and the problem with pounding a square peg into a round hole is not that the hammering is hard work. It's that you're destroying the peg."

How to find us

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