Joint Attention Cues and Children with Autism Spectrum Disorders, Developmental Delay, and Typical Development

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Abstract

It has been established that children with autism have more difficulty responding to multi-modal cues to shift their visual attention than children without autism of equivalent language and developmental level. Deficits associated with autism in using a cue to direct attention may be affected by several different factors, including difficulties in interpreting social cues, rapid shifting of attention, and disengaging from a complex visual stimulus (i.e. Charman, 1998, Courchesne et al., 1994; Minshew et al. 1993). This poster reports a study of the automatic use of visual cues in quasi-naturalistic contexts and their relationship to other areas of development, including language and social communication. By studying young children in relatively natural circumstances, we address information processing and social sources of variance in orientation of gaze and shifting of attention.

Our sample consisted of 162 children, 110 male and 52 female, with a mean chronological age of 55 months (SD=22). Diagnostic groups included children with autism (N= 74), Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS: N=25), non-autism spectrum developmental delay (N=17), and typical development (N=46), matched on Verbal Mental Age. These groups were compared on 10 tasks that systematically varied methodological factors, such as timing and type of cue that might affect response to attempts to solicit joint attention.

Children with autism and children with PDD-NOS were less consistent in gaze establishment than both the developmentally delayed and typically developing children. Both children with autism and PDD-NOS had difficulty disengaging from the target toy after it was activated. Implications of findings for diagnosis and intervention will be discussed.

Introduction

- Autism is a developmental disorder defined deficits and abnormalities in reciprocal social interaction, communication and behaviors.
  - One still relatively unexplored source of variability is individual differences in basic cognitive processes, such as attention.
  - There is evidence that young children with autism do not generally use social cues to direct their visual attention as well as other children with equivalent language or nonverbal skills (Courchesne et al., 1994; Loveland & Landry, 1986; Mundy, Sigman & Kasari, 1993).
  - Mundy et al. (1994) found that on developmental aspects of joint attention, the responses of children with autism differed in relation to language level, though not in association with severity of autism specific behaviors.
- Deficits in attention are particularly important because they affect the information available to a person, and hence, the knowledge about social functioning and communication, upon which more sophisticated processes are built.
- In this study, we explore the question of whether children with autism differ from other developmentally matched non-ASD children in their use of gaze paired with sound as directional cues.
- We then ask what properties of the visual cue or task might account for these differences:
  1) the degree to which the child must disengage from the cue before attending to the target object (i.e., whether the cue continues to be actively available to the child as the target activates).
  2) the length of the cue.
- Other aspects of the cue are manipulated further, including
  1) whether the child must engage in reciprocal gaze or eye contact as part of the cue.
  2) the "level" of the cue in terms of its visual distinctiveness (i.e., pointing versus shift in gaze).

Table 1, Participant Characteristics

	TYP	OTH/DD	PDD	HAUT	LAUT
N (Male, Female)	46 (27,19)	17 (11,6)	25 (13,12)	46 (37,9)	27 (21,6)
Race Cauc., Other	38, 8	14, 3	24, 1	43, 3	22,5
Chronological Age	39.7 (17.2)	52.3 (17.9)	63.4 (18.7)	70.7 (17.7)	53.00 (22.32)
Verbal Mental Age	43.4 (19.9)	42.6 (17.4)	43.5 (15.9)	43.3 (18)	13.26 (3.87)
Non-Verbal Mental Age	42.7 (20.5)	43.6 (19.9)	52 (20)	57.6 (24.2)	28.37 (11.96)
Verbal IQ	109.4 (16.9)	83.1 (15.7)	69.3 (23)	62.8 (23.2)	27.74 (9.09)
Non-Verbal IQ	108 (15.7)	84.4 (20.6)	82.2 (22.4)	81.8 (27.3)	59.37 (25.56)

Methods

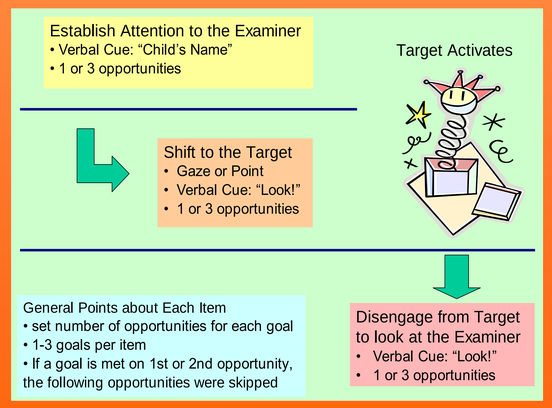
Participants

- Children with autism or PDD-NOS were recruited through the Developmental Disorders Clinic of the University of Chicago Hospitals. The children comprising the other developmental delay group and the typically developing children were recruited primarily through advertisements sent to local day care centers and preschools.
- Each child was assessed at the Developmental Disorders Clinic and was administered the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) in addition to a psychometric test, typically the Differential Ability Scale (DAS; Elliott, 1990) or the Mullen Scales of Early Learning (Mullen, 1989). As the final part of the assessment, each child completed the tasks comprising this study.
- Four diagnostic groups of children were included: children with autism, Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), other non-ASD developmental delays, and typical development.
  - Experimental groups were matched based on verbal mental age (VMA).
  - The sample of children with autism was divided into less and more advanced groups, defined by VMA (<21), and the higher VMA (>21) sample was matched to the other three diagnostic groups.
  - Table 1 for a breakdown, by diagnostic group, of race, gender, verbal and non-verbal mental ages (NVMA), verbal and nonverbal IQ, and chronological age in months.

Procedures

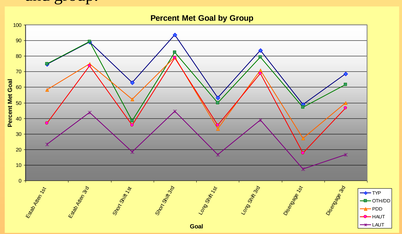
- All tasks took place in a small room that contained a table and chairs (for the child and his parent) and three cabinets directly across from the child.
  - Each cabinet had a shade attached that could be raised and lowered to reveal the target, an animated toy.
  - Also present in the room were the examiner, who interacted with the child, and two additional research staff who stood behind the cabinets, one who manipulated the shades and activated the toys, and the other who coded the child's responses to the tasks. In addition, all testing was videotaped.
- A series of 19 attention tasks, 10 social and 9 nonsocial, were devised to compare the attentional responses of each diagnostic group.
  - Only the social tasks are discussed here.
  - Each task included 1 to 3 goals (see Figure 1) and each goal had 1 or 3 opportunities to meet the goal.
  - For both sets of tasks, the child was seated while the examiner used defined strategies (i.e. shifting gaze for social tasks or pointing) to draw the child's attention to various targets.
- The tasks were either presented beginning with the nonsocial tasks or beginning with the social tasks.
  - The task orders were randomly assigned, and it took approximately 20 minutes to complete all tasks.
  - The child's responses to each of the presses in each task were recorded live and scored live.
  - Coders were trained to 80 percent exact agreement reliability, and reliability of coding was checked with videos of the tasks.

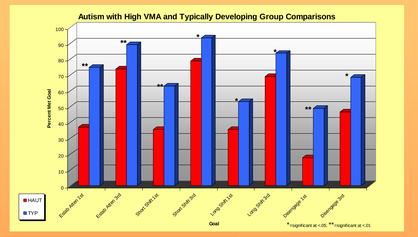
Figure 1, Item and Goal Hierarchy

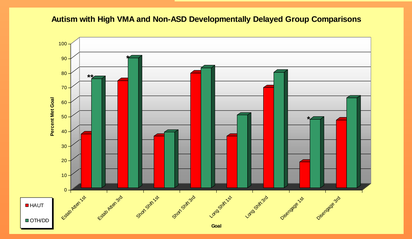


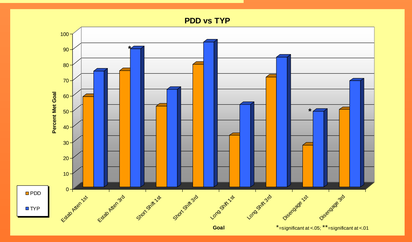
Results

- In order to test the effect of order on each type of goal, data were divided into groups based on the order the tasks were administered.
  - Percent of participants who met the goal was tested using Fisher's Exact Test, and no significant effects were established for the order of task administration.
  - Data were also divided into tasks administered during the 1st or 2nd half, and there were no significant differences between the 1st half and the 2nd half.
- ANOVAs were conducted to test for between group differences on each type of goal.
  - Differences were found on: establishing attention to examiner on the first trial ($F(4, 156)=15.038$, $p<.001$); establishing attention to the examiner collapsed across 3 opportunities ($F(4, 156)=16.348$, $p<.001$); Short shift to the target on the first trial after up to 3 attempts to establish attention ($F(4, 156)=7.861$, $p<.001$); Short shift to the target collapsed across 3 opportunities ($F(4, 156)=12.475$, $p<.001$); Long shift to target on first trial ($F(4, 156)=5.433$, $p<.001$), Long shift to target collapsed across 3 opportunities ($F(4, 156)=7.765$, $p<.001$); Disengage from target on first trial ($F(4, 156)=8.621$, $p<.001$); Disengage from target collapsed across 3 opportunities ($F(4, 156)=8.027$, $p<.001$).
  - Only shifts with 3 attempts to establish attention prior to the shift were analyzed here.
  - Table 2 for a complete breakdown of means, standard deviations, and ranges, by goal and group.









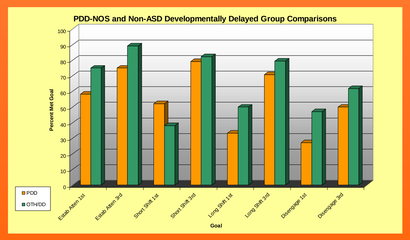


Table 2, Descriptives by Goal and Group

	TYP	OTH/DD	PDD	H-AUT	L-AUT
Estab Atten 1st 8 trials	74.73 abe [.00-100] (33.59)	75.00 ae [.00-100] (38.27)	58.50 ae [.00-100] (32.62)	36.94 bcd [.00-100] (32.96)	22.32 bcd [.00-100] (33.57)
Estab Atten 3rd 6 trials	89.13 abe [16.67-100] (21.15)	89.22 ae [33.33-100] (22.00)	75.00 ae [16.67-100] (26.84)	73.70 cde [16.67-100] (24.49)	42.26 abcd [.00-100] (33.48)
Short Shift 1st 2 trials	63.04 ace [.00-100] (40.05)	38.24 de [.00-100] (37.62)	54.00 ae [.00-100] (37.96)	35.55 bde [.00-100] (36.34)	17.86 abd [.00-100] (27.94)
Short Shift 3rd 2 trials	93.48 ae [50-100] (17.03)	82.35 e [.00-100] (30.32)	80.00 e [.00-100] (32.27)	78.88 de [.00-100] (32.84)	42.86 abcd [.00-100] (40.17)
Long Shift 1st 2 trials	53.26 ae [.00-100] (37.12)	50.00 [.00-100] (39.53)	36.00 e [.00-100] (33.91)	35.55 de [.00-100] (36.34)	16.07 cd [.00-100] (27.39)
Long Shift 3rd 2 trials	83.70 ae [.00-100] (28.00)	79.41 e [.00-100] (30.92)	72.00 e [.00-100] (29.15)	68.88 de [.00-100] (38.86)	39.29 abcd [.00-100] (41.63)
Disengage 1st 2 trials	48.91 ae [.00-100] (44.08)	47.06 ae [.00-100] (48.32)	26.00 de [.00-100] (32.66)	17.77 cd [.00-100] (26.45)	7.41 bcd [.00-100] (22.42)
Disengage 3rd 2 trials	68.48 ae [.00-100] (41.31)	61.76 e [.00-100] (41.57)	50.00 e [.00-100] (43.30)	46.66 de [.00-100] (40.45)	16.07 abcd [.00-100] (30.59)
EA=Establish Attention	same as TYP	same as TYP and HAUT	same as HAUT		

a=significantly different from autism group
b=significantly different from PDD group
c=significantly different from other developmental delay group
d=significantly different from typical group
e= significantly different from autism and low VMA group

Discussion

- These findings suggest that children with ASDs have significant difficulties establishing attention initially when compared to children who do not have an ASD.
  - Establishing attention seems to be the clearest difference between ASD and non-ASD groups.
  - Supports the validity of establishing attention as a diagnostic feature of ASD.
- Children with an ASD and a high VMA will shift their attention at similar rates to children with other non-ASD developmental delays.
- The finding that children with PDD-NOS shifted at similar rates to children without an ASD, but had more difficulty establishing attention and disengaging from the target than children without an ASD may inform diagnostic categories.
- When examining disengagement as a diagnostic factor, it is important to note that on the 1st trial, only about half of the non-ASD children successfully disengaged from a toy that was moving and making noise.
- Analysis of the aspects of joint attention tasks that seem to affect the performance of children with ASDs can inform the development of diagnostic measures as well as intervention and program planning.
- Furthering understanding of joint attention as a phenomenon can inform research on early language development.

Selected References

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