

# Impaired disengagement of attention in young children with autism

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**Background:** The present study examined the disengage and shift operations of visual attention in young children with autism. **Methods:** For this purpose, we used a simple visual orienting task that is thought to engage attention automatically. Once attention was first engaged on a central fixation stimulus, a second stimulus was presented on either side, either simultaneously or successively. Latency to begin an eye movement to the peripheral stimulus served as the main dependent measure. The two stimulus conditions (simultaneous and successive) provided independent measures of disengaging and shifting attention, respectively. Performance of children with autism was compared to that of children with Down syndrome and a normal group. **Results:** The main finding was that relative to both comparison groups, children with autism had marked difficulty in disengaging attention. Indeed, on 20% of trials they remained fixated on the first of two competing stimuli for the entire 8-second trial duration. Evidence is also provided for a more subtle problem in executing rapid shifts of attention. **Conclusions:** Our findings on disengagement in autism parallel those reported in normal 2-month-olds, in whom attention has been described as 'obligatory'. Discussion focuses on the potential role of general versus domain-specific processes in producing some of the core features of autism. **Keywords:** Attention, autistic disorder, Down syndrome, pervasive developmental disorder, temperament, visuo-spatial functioning.

Early reports of autism emphasised the children's unusual gaze behaviour (Ornitz, 1976). This feature was considered cardinal to the disorder, and consistent with a more general pattern of atypical responsiveness to sensory stimulation. Parents retrospectively detailed an empty gaze, as well as a failure to use gaze to regulate behaviour and to engage in the social games of infancy. Early empirical findings indicated that, when presented with two spatially adjacent visual stimuli, children with autism show relatively few back and forth eye movements (Hermelin & O'Connor, 1967). Others described the children as having 'tunnel vision', based on evidence of overly focused attention on visual discrimination tasks (Rincover & Ducharme, 1987). Although controversial initially (Lovaas, Kogel, & Schreibman, 1979), what was shown to distinguish autism is the spatial distance between the stimulus features to be discriminated: with increased distance, children with autism respond selectively only to some stimulus features; they fail to respond to other features separated in visual space (Rincover & Ducharme, 1987).

With the trend toward conceptualising autism as a social learning disorder, atypical eye gaze has for some time now been viewed as an integral part of the social-communicative impairment (e.g., Phillips, Baron-Cohen, & Rutter, 1992). The question of whether autistic children's gaze abnormalities are unique to the social domain is, however, a subject of renewed debate (e.g., Bryson, Landry, & Wainwright,

1996). Consistent with earlier reports, recent work on visual-spatial orienting implicates more general (vs. domain-specific) processes in autism. Visual orienting is of particular interest because of its putative role not only in cognitive development, but also in the regulation of emotional states (Johnson, 1990; Rothbart, Posner, & Rosicky, 1994). In particular, disengagement or distraction is thought to be a basic mechanism by which we regulate emotional upset. By implication, deficits in early-developing, general processes of visual attention may well underlie the restricted temperamental styles and contribute to the atypical social-communicative development characteristic of autism.

Attention is currently conceived as a network of interrelated systems that are organised into distinct levels and instantiated in different neural areas (Posner, 1988; Posner & Dehaene, 1994). Posner and colleagues have delineated three such systems: the sub-cortical/vigilance system, which maintains alertness and sustained attention; the posterior/basic attentional system, which moves attention and selects locations for further processing ('spatial selectivity'); and the anterior/executive system, which exerts volitional control and recruits resources necessary for goal-directed behaviour.

Visual-spatial orienting forms an integral part of the posterior attentional system. Its component disengage, shift and engage operations are thought to sub-serve 'spatial selectivity' by responding quickly and automatically to modality-specific stimuli.

According to Posner's (1988) model, specific computations, each instantiated in a particular neural area, govern the movement of attention from one location in space to another. When visual attention is engaged, a particular spatial location has been selected in order to facilitate processing of visual information in that location. Once the environmental coordinates of a new target's location have been computed, attention must be disengaged from the current location, that is, focused processing of visual information in that location must be terminated. Once attention is disengaged, it must move to the new location in space, bringing with it the processing resources of the visual system. Attention is then engaged at this new spatial location.

Research on autism has focused on deficits associated with the anterior or executive system (e.g., on failures to disengage and/or shift 'mental' or cognitive set; Ozonoff, 1995; Hughes & Russell, 1993). However, more basic, posterior attentional processes are implicated in recent studies using variants of Posner's (1988) visual cueing task. In its standard form, this task requires simple detection of stimuli projected to either side of central fixation, the location of which is pre-cued either validly or invalidly. Cue parameters are varied such that attention is oriented either automatically or via more controlled processes, and either overtly or covertly (with or without associated eye movements). Regardless, reaction times (RTs) are typically faster on validly than on invalidly cued trials (referred to as the 'validity effect'), presumably because of the increased time taken on invalid trials to disengage and shift attention from the side opposite to that on which the stimulus subsequently appears.

In studies of autism, the most striking finding is that validity effects are abnormally large, even when attention is oriented automatically in the absence of eye movements (Casey, Gordon, Mannheim, & Rumsey, 1993; Courchesne et al., 1994; Wainwright-Sharp & Bryson, 1993; also see Wainwright-Sharp & Bryson, 1996). As we (Bryson, Wainwright-Sharp, & Smith, 1990) predicted in autism, there is also evidence of particular difficulties disengaging and shifting attention from the right to the left side of space. These findings parallel those reported for patients with hemi-spatial neglect (Posner, Walker, Friedrich, & Rafal, 1984), which is typically associated with damage to the posterior, notably the right parietal, cortex (Heilman, Watson, & Valenstein, 1993). Using magnetic resonance imaging (MRI), Townsend, Courchesne, and Egaas (1996) argue for neuroanatomically distinct subgroups of autism, deficient in either disengaging and/or rapidly shifting attention. The entire group, all with MRI evidence of cerebellar abnormalities, had difficulty rapidly shifting attention (indexed by RTs to orient to validly cued stimuli); those with cerebellar *plus* parietal abnormalities (43%) had difficulty disengaging attention as well (indexed by invalid-valid RT differences).

Several outstanding questions remain. Among the most central is whether these putative deficits in disengaging and/or shifting attention are specific to autism. To date, studies of visual orienting in autism are restricted largely to comparisons with normal groups, matched on either chronological or mental age (but see Courchesne et al., 1994). Data on clinical comparison groups are required to determine whether impaired visual orienting distinguishes autism from other developmental disorders. Existing data also preclude firm conclusions about whether the problem in autism is one of disengaging and/or shifting attention. Posner's (1988) visual cueing task does not provide strictly independent measures of the two operations. In this task, participants first fixate a continuous central stimulus, and then orient to onset of a peripheral stimulus, the side of which is either validly or invalidly cued. It is thus possible, for example, that measures of shifting attention (i.e., orienting to either side on validly cued trials) are confounded by difficulties disengaging attention from central fixation.

The present study addressed these issues within the context of examining visual-spatial attention in young children with autism. For this purpose, we used a simplified version of a visual orienting task employed in studies of normal infants, which is thought to engage attention automatically (Hood & Atkinson, 1993; Johnson, Posner, & Rothbart, 1991, 1994). Briefly, three computer screens are positioned side by side, and once the child orients to a stimulus appearing in the central screen, eye movement latencies are monitored to a second stimulus presented in one of the two lateral screens. Unlike Posner's visual cueing task, the critical manipulation is whether, upon presentation of the lateral stimulus, the central stimulus remains on or not; this provides independent measures of disengaging (central stimulus 'on') and shifting attention (central stimulus 'off'). The disengage function is normally operative by 3-4 months of age; prior to then attention has been described as 'obligatory', that is, younger infants have difficulty disengaging and thus shifting attention from one of two competing stimuli (Hood & Atkinson, 1993; Johnson et al., 1991, 1994).

In the present study, the disengage and shift operations were examined in young children with autism, and their performance was compared to that of both developmentally matched normal children and children with Down syndrome. We hypothesised that the children with autism would have particular difficulty disengaging visual attention. This hypothesis was derived from direct, clinical observation of children with autism, who appeared to have difficulty disengaging their gaze from an object or activity, and from evidence of left-sided neglect in the written work of a number of individuals with autism (Bryson et al., 1990).

## Method

### Participants

The participants included three groups of children: 15 children with autism/pervasive developmental disorder (PDD), 13 children with Down syndrome and 13 typically developing children. The children with autism/PDD were recruited through the Pervasive Developmental Disorders Program at Chedoke-McMaster Hospitals in Hamilton and through the Child Development Centre, a paediatric clinic, at the Hospital for Sick Children in Toronto. Of the 15 participants, 13 were diagnosed with autism and two with Asperger's syndrome. The children were diagnosed either by a child psychiatrist or by a developmental paediatrician, each with expertise and considerable experience in autism/pervasive developmental disorders. Each child met criteria for a diagnosis of autism on both the DSM-IV and the Autism Diagnostic Inventory-Revised (ADI-R; Lord, Rutter, & Le Couteur, 1994); the ADI-R was administered, as standardised, by diagnosticians with established research reliability.

The children with Down syndrome were recruited through a local Down syndrome association and through an early intervention programme for children with special needs. Typically developing children were recruited through a local day-care facility; none had any diagnosed disorder or obvious developmental delay. Attempts were made to match the two clinical groups on chronological age, and all three groups on both non-verbal and verbal mental age, as measured by the Leiter International Performance Scale (Leiter, 1948) and the Test of Auditory Comprehension of Language (TACL-R; Carrow-Woolfolk, 1985). Descriptive data on each group are provided in Table 1. One-way ANOVAs confirmed that all three groups did not differ on either nonverbal or verbal mental age; the typically developing children were younger than both the children with autism and those with Down syndrome, who did not differ in age. Written informed consent was obtained from the parents of each child prior to any testing.

### Procedure

Each child was assessed individually in a quiet room, either at one of the two local hospitals (the clinical groups) or at the day-care facility (the typically developing group). In order to maximise interest and compliance, the measures were administered in the following fixed order: nonverbal intelligence test (Leiter), Attention task, Play task and receptive language test

(TACL-R). The play task and accompanying results will be described in a subsequent paper.

*Attention task.* The children were seated approximately one metre in front of, and at eye level with, the centre of three computer monitors, positioned side by side, in a dimly lit room. Two different dynamic patterns served as stimuli, each composed of brightly coloured geometric shapes (red, green and yellow rectangles versus purple, brown and blue triangles) that quickly and continuously filled the screen, giving the impression that they were falling on each other. One pattern served as the central or fixation stimulus; the other served as the peripheral stimulus and thus appeared in either of the two lateral monitors. The position (central vs. peripheral) of the stimuli was counterbalanced within each group.

There were two kinds of trials, Shift and Disengage trials. On the Shift trials, a stimulus first appeared in the central monitor; once the Experimenter determined that the child was looking at the central stimulus, that stimulus was turned off, and after a 250-msec delay, the other stimulus appeared either to the left or right of centre in one of the peripheral monitors. The peripheral stimulus remained on the screen until the child made an eye movement or for a maximum of 8 seconds. The Disengage trials were identical except that the central stimulus remained on during the 250-msec interval and the presentation of the peripheral stimulus. There were 10 Shift and 10 Disengage trials, each equally distributed across the left and right monitors. The 20 trials were presented in a fixed pseudorandom order such that no trial type (Shift or Disengage) or side of presentation (left or right) occurred more than three times consecutively. Trials were replaced as necessary (i.e., if the child looked away before the peripheral stimulus appeared or otherwise moved).

The only instruction was 'to look at the screens'. The children were given verbal reinforcement (e.g., 'you're doing a good job') and in some cases edibles for cooperative behaviour. The main dependent measure was the time taken to initiate an eye movement toward the peripheral stimulus. A Panasonic video camera was used to record the children's eye movements. It was positioned directly behind the three computer monitors and hidden by a large black curtain, which served as backdrop. The video camera was connected to a Sony Trinitron television monitor, from which the Experimenter was able to observe the child's eyes and control the presentation of stimuli. A second Panasonic video camera recorded the presentation of the stimuli on the computer monitors. Except for the maximum 8-second

**Table 1** Descriptive data on participating groups

Group	Autism	Down syndrome	Typically developing
Chronological age (yrs)	5.6 (1.3) 3.8–7.6	5.5 (1.3) 3.5–8.0	3.6 (1.2) 2.1–6.2
Nonverbal IQ	70.2 (29.3) 34–150	65.5 (14.5) 43–92	109.5 (22.1) 81–143
Nonverbal mental age	4.0 (1.6) 1.8–6.2	3.4 (.8) 2.4–5.7	4.0 (1.9) 2.2–8.5
Verbal mental age	3.4 (1.1) 2.3–5.2	3.0 (.4) 2.3–3.7	3.8 (1.5) 2.5–7.7

presentation of peripheral stimuli, onset and offset of the stimuli were controlled by the Experimenter via an IBM computer using the OS2 software program.

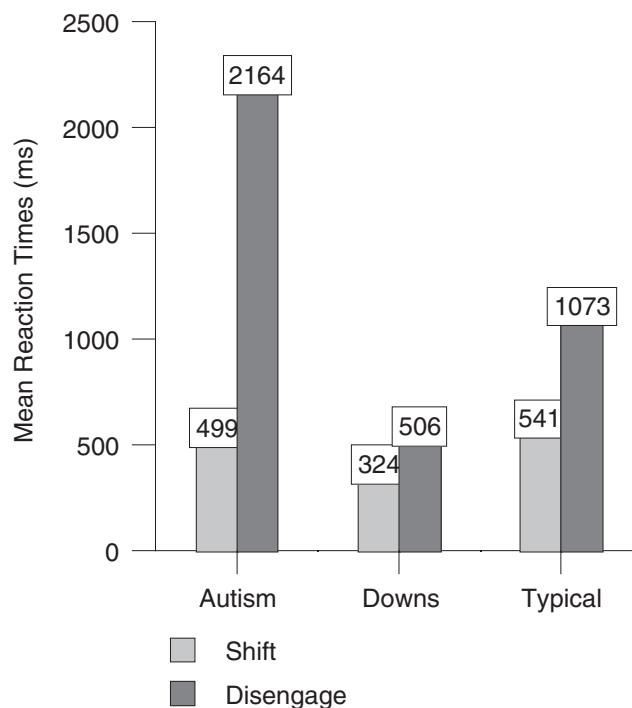
**Coding of data.** Latencies to initiate an eye movement toward the peripheral stimulus were calculated from the videotaped recordings of the children's eye movements. Using a Sony SLV-700HF Video cassette recorder, video recordings were played back frame by frame, with 30 frames for every second of real time, to establish the durations of interest. The number of frames taken to initiate an eye movement was divided by 30 to provide estimates of the latencies in milliseconds.

The children's eye movements were coded in detail from onset of the central stimulus, which reliably appeared as an image in their pupils, to offset of the peripheral stimulus. From the inventory of eye movements, the number of frames from onset of the central stimulus to the initial movement toward the peripheral stimulus was calculated first (D1). Then, duration of the central stimulus presentation and duration of the interval between the central and peripheral stimuli (for Shift trials only) were calculated (D2). Latency to begin an eye movement was calculated by subtracting D1 from D2, which yielded the main measure of interest, the number of frames from onset of the peripheral stimulus to the initiation of an eye movement toward it. We also calculated the frequency of failures to disengage, that is, the number of times the children did not disengage their attention from the central stimulus during the entire 8-second trial duration.

## Results

Reaction times (RTs; in msec) to initiate an eye movement toward the peripheral stimulus were computed for each child. RTs were from correct (i.e., unspoiled) trials, including those in which the children failed to disengage. Only three trials were replaced due to children looking away prematurely. To achieve homogeneity of variance, the data were transformed into natural logarithms. Mean logarithmic latencies were calculated for each child both for the disengage and shift trials and for each field. These data were analysed using a three-way mixed design ANOVA, with Group (autism, Down syndrome, typical) as the between-subjects factor, and Trial Type (disengage, shift) and Field (left, right) as the within-subjects factors. Significant main effects were found for Group,  $F(2,38) = 13.93$ ,  $p = .000$ , and Trial Type,  $F(1,38) = 29.94$ ,  $p = .000$ , and the interaction between the two was also significant,  $F(2,38) = 9.98$ ,  $p = .000$ . The main effect of Field of stimulation did not approach significance, nor did any interactions with Field (all  $ps > .05$ ). The mean raw latencies are provided in Figure 1, analysis of which yielded the same findings.

Newman-Keuls post hoc tests of the main effect of Group indicated that the overall mean latency to orient to the peripheral stimulus was longer for the



**Figure 1** Mean reaction times as a function of Group and Condition

children with autism ( $M = 1330$  msec) than either the children with Down syndrome ( $M = 415$  msec;  $p = .001$ ) or the typically developing children ( $M = 808$  msec;  $p = .01$ ), who did not differ. The main effect of Trial Type indicated that, as a group, the children oriented more quickly during the shift than the disengage trials, although both main effects are qualified by the significant Group by Trial Type interaction. Post hoc analysis of the interaction included tests of both within-group ( $t$ -tests) and between-group (Newman Keuls) differences in disengaging and shifting attention.

Within-group comparisons indicated that both the children with autism and the typically developing children took longer to disengage than to shift visual attention ( $p = .000$  and  $.03$ , respectively); in contrast, no disengage–shift difference was found for the children with Down syndrome. No group differences were found for the shift trials. However, the speed of disengaging attention did differ across groups: the children with autism took significantly longer to disengage ( $M = 2164$  msec) than both the children with Down syndrome ( $M = 506$  msec;  $p = .000$ ) and the typically developing children ( $M = 1073$  msec;  $p = .01$ ), who also differed ( $p = .01$ ). Indeed, with two exceptions (both of whom pointed during the task), the individual mean *disengage* latencies for the children with autism all exceeded those of children in the other two groups by at least one standard deviation. Moreover, failures to disengage within the 8-second trial duration were particularly frequent among the group with autism (18.0% of trials vs. 7.7% for typical children and .8% for children with

Down syndrome); all but three (80%) of the children with autism failed to disengage on at least one trial. Note also that neither the latencies to disengage nor to shift attention were related to any of the developmental measures examined, including age, nonverbal intelligence or language level (all  $ps > .05$ ).

Robust group effects emerged for the disengage but not the shift trials. Our use of mean RTs may have obscured selective difficulties with rapid shifts of attention, as previously documented in adults with autism (e.g., Townsend et al., 1996). To explore this possibility, the distribution of individual RTs for the shift trials was analysed as well. Following Johnson et al. (1991), the latencies were categorised according to speed of orienting (Fast = 100–300 msec, Intermediate 1 = 301–600 msec, Intermediate 2 = 601–1000 msec, Slow = 1001–7000 msec and Failure = 7001–8000), and the frequency with which individual *shift* RTs fell into the five categories was computed for each group. Frequency data were divided by the total number of shift RTs to yield percentages for each RT category (see Table 2). Due to low or zero frequencies in some cells, these data were analysed via separate one-way ANOVAs, with Group as the between-subjects factor. Despite our failure to show a group effect for the mean shift RTs, the groups did differ in the frequency of Fast RTs,  $F(2,38) = 7.87$ ,  $p = .001$ , and Intermediate 1 RTs,  $F(2,38) = 6.32$ ,  $p = .002$ : the children with autism had significantly fewer shift RTs in the fast category and significantly more shift RTs in the Intermediate 1 category than either the children with Down syndrome ( $p = .000$ ) or the typical children ( $p = .000$ ), who did not differ. A marginal but non-significant positive relationship ( $r = .46$ ,  $p < .083$ ) was found between speed of shifting and disengaging attention in the children with autism; no such relationship ( $r = .01$ ) was found for the children with Down syndrome, and the two were negatively ( $r = -.55$ ,  $p < .05$ ) but, given the small sample size, perhaps spuriously correlated in the normal group.

## Discussion

The present study was designed to test the hypothesis that young children with autism have difficulty disengaging their attention when it is engaged on a particular stimulus/location in space. For this purpose, we used a simple visual orienting task in which eye movement latency was monitored to onset of a peripheral stimulus, which either overlapped with, or did not overlap, a pre-existing central (fixation) stimulus. These conditions provided independent measures of the ability to disengage and shift attention, respectively. Performance of young children with autism was compared to that of children with Down syndrome and to a normal group. As predicted, the main finding was that children with autism had marked difficulty disengaging from one of two competing stimuli. Evidence is also provided for a more subtle problem in executing rapid shifts of attention to a stimulus in either side of space.

Analyses of the mean eye movement latencies yielded group differences for the disengage but not the shift trials. Relative to both comparison groups, children with autism were impaired in disengaging visual attention. Indeed, there was essentially no overlap between groups: with two exceptions (both of whom pointed during the task), the individual mean *disengage* latencies for the children with autism all exceeded those of the typical children and the children with Down syndrome. In addition, failures to disengage were restricted largely to the children with autism. On 20% of trials, they remained stuck on the first of two competing stimuli for the entire 8-second trial duration.

These findings are remarkably similar to those reported for normal 2-month-olds, in whom attention has been described as 'obligatory' or 'sticky' (Hood & Atkinson, 1993; Johnson et al., 1991, 1994). By 4 months of age, infants typically disengage with relative ease, thus underscoring the significance of our findings for 3–7-year-olds with autism. As might be expected with such an

**Table 2** Frequency of RTs in five latency classes as a function of Group

Intervals	Autism	Normal	Downs	F-Ratios
<b>Shift</b>				
1 (100–300 ms)	45.8	72.2	61.8	(2,79) = 7.8681 (a)
2 (333–600 ms)	41.1	19.8	34.8	(2,79) = 6.3200 (b)
3 (633–1000 ms)	5	3	.8	(2,79) = 2.0408
4 (1033–7000 ms)	8.2	2.8	2.5	(2,79) = .2187
5 (7033–8000 ms)	0	2.1	0	(2,79) = 2.0954
<b>Disengage</b>				
1 (100–300 ms)	32.7	30.3	38.9	(2,79) = .8613
2 (333–600 ms)	29.5	51.6	48.7	(2,79) = 7.2171 (a)
3 (633–1000 ms)	6	4.8	6.5	(2,79) = .8546
4 (1033–7000 ms)	13.4	5.2	5	(2,79) = 3.7155 (a)
5 (7033–8000 ms)	18.5	8.1	.8	(2,79) = 11.6039 (a)

(a) Significant differences between the children with autism and the two other groups, who did not differ.

(b) Significant differences between the typically developing children and the two other groups, who did not differ.

early-developing function, we found no relationship between the ability to disengage and either nonverbal intelligence or language level. Disengage problems were evident to varying degrees in all of the children with autism, even in those with average or above average intelligence. Our findings are limited by the size and relative homogeneity of the sample tested. Future research with larger and more heterogeneous samples might address the question of whether impaired disengagement is more related to severity of autism than to level of development.

The present findings differ from those of Townsend et al. (1996; also see Townsend & Courchesne, 1994), who report that disengagement was a problem in only 45% of their adult sample with autism. In our study this was the case for most if not all of the children tested (9/11, the other two of whom pointed to the stimuli, which may have enhanced their ability to disengage). This discrepancy in findings may reflect any one or some combination of the following factors. First, our sample was much younger, and it is possible that disengage problems in autism are more prevalent earlier in life and improve with age. Note also that our task measures overt attention (i.e., attention associated with eye movements), whereas the task employed by Townsend et al. measures covert attention (i.e., movements of attention in the absence of eye movements). Abnormal eye movements have been implicated in autism (Scharre & Creedon, 1992; also see Stromland, Nordin, Miller, Akerstrom, & Gillberg, 1994), and may contribute to difficulties disengaging and shifting attention, particularly under conditions requiring overt (versus covert) movements of attention. Finally, recall that standard visual orienting tasks, as employed by Townsend et al., may confound measures of disengaging and shifting attention. It is thus possible that data from their task underestimate the frequency and severity of the disengage problem in autism. This possibility is currently being addressed in studies of adults with autism using methodologies that more closely parallel those employed here.

In addition to the striking impairment in disengagement, our findings on autism implicate a more subtle problem in shifting visual attention. While the mean latency to shift attention did not differ across groups, the frequency of 'fast' shifts did: relative to both normal children and children with Down syndrome, children with autism were less likely to *rapidly* shift attention to a peripheral stimulus. These findings are consistent with those reported by Courchesne and colleagues (1994; Townsend et al., 1996) on related tasks. One outstanding question is whether in autism visual orienting impairments reflect, at least in part, a problem with the programming and/or execution of eye movements (cf., Scharre & Creedon, 1992). We are currently addressing this question in studies of children with Moebius syndrome, in whom cranial nerve dysfunction results

in an inability to make lateral eye movements. The coexistence of autism and Moebius syndrome (Rodier, Ingram, Tisdale, Nelson, & Romano, 1996) provides a natural assay for such research.

The present findings indicate that children with Down syndrome disengage and shift attention with remarkable ease. They not only failed to show an advantage for shift (vs. disengage) trials, but also disengaged more quickly than both the normal children and the group with autism. Taken together, these findings raise questions about the extent to which the children with Down syndrome were engaged in the first place (cf., Miranda & Fantz, 1973). We suggest that in them attention may be less focused and more distributed in space. Conversely, in autism difficulties disengaging and shifting attention are consistent with claims that attention is overly focused and characterised by a narrow 'beam' or 'spotlight' (Bryson et al., 1990; Rincover & Ducharme, 1987). In a subsequent paper, we pursue the possibility that these two groups represent opposite poles on at least some dimensions of temperament (Rothbart et al., 1994). That paper details differences in behavioural reactivity (i.e., approach and distress/withdrawal behaviours) during the visual orienting task employed here.

Finally, while we recognise that firm conclusions are precluded by our small sample size, we do emphasise that the disengage problem in autism was striking. Note further that our findings implicate general rather than domain-specific (i.e., uniquely social) processes: children with autism had difficulty orienting to non-social visual events. Clearly, however, the integrity of visual orienting is basic to various aspects of social as well as cognitive development, not the least of which is the ability to orient to the presence of others or to one's name when called. Thus, dysfunction in general, basic processes may well underlie some of the core deficits in autism. We have proposed elsewhere that the lack of spatial awareness so characteristic of autism is suggestive of a developmental spatial neglect syndrome (Bryson et al., 1990). Assuming that our findings are replicable with larger and more diverse samples of children with autism, future research might establish whether impairments in disengagement are autism-specific, or whether they exist in other disorders of development as well. It may also be important to examine whether motor movements such as pointing facilitate disengagement in autism. In the present study, the two children with autism who performed relatively well pointed to the stimuli throughout the task. Finally, future research might identify the mechanisms that underlie the *development* of visual disengagement and its dysfunction. To date, research has focused largely on the neural structures that mediate the operations of visual orienting in adults (Posner, 1988; but see Johnson, 1990). Research addressing these and related issues promises to advance current understanding of

autism and of the mechanisms sub-serving normal development as well.

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