

2-YEAR-OLD TODDLERS WITH ASD ARE MORE SUCCESSFUL AT VISUAL SEARCH THAN TYPICALLY DEVELOPING TODDLERS

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BACKGROUND

- Classic visual search paradigms distinguish between 'feature search' tasks, in which a target item is distinguished from distractors by a unique feature and 'pops-out' (Treisman & Gelade, 1980), and 'conjunction search' tasks, in which the target is distinguished only by a combination of features.
- Studies have shown that older children and adults with Autism Spectrum Disorder (ASD) are faster at finding targets in feature conjunction search displays (Plaisted et al., 1998; O' Riordan et al., 2001; Joseph et al., 2009).
- Currently, there is very little known about the visual search skills of very young children (1-3 years olds), both typically developing or with ASD (but see Gerhardstein & Rovee-Collier, 2003).

Objectives: Our goal was to test if very young children with ASD show superior performance in visual search compared to typically developing toddlers. We used an eye-tracker and adapted a classic visual search paradigm to be suitable for toddlers: **the paradigm required no verbal instructions and was based on minimal verbal feedback** (Kaldy et al., 2009).

METHODS

Participants: 17 toddlers with ASD (mean = 29 m) and 17 typically developing age-matched toddlers (mean = 29 m). [10 typically developing toddlers matched on the Visual Reception (VR) scale of the Mullen Scales of Early Learning (mean = 23 m) were also tested. They performed at the same level or worse than the age-matched group across all measures.]

Materials: A Tobii T120 eye-tracker to display stimuli and measure fixation patterns.

Stimuli: One target (a red apple) among 'color' distractors (blue apples) and 'shape' distractors (red, elongated rectangular apples) (see Fig. 2).

Procedure: All participants saw one, two or three blocks of trials depending on their mood and motivation. Each block consisted of 4 familiarization trials and 13 test trials (a random mix of 4 single feature trials (4 or 8 distractors) and 9 feature conjunction trials (4, 8, or 12 distractors)). Each test display was presented for 4 seconds. At the end of each trial, the target started spinning back and forth: we hoped that this event is interesting enough for toddlers to look for the target even before the spinning has started.



Figure 1.
Experimental setup

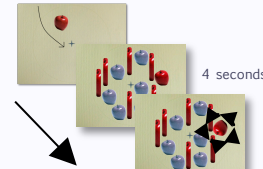


Figure 2.
Trial sequence

RESULTS

Familiarization trials:

- The ASD group looked longer at the target than the other two distractors, for the typical group $FL(\text{target}) > FL(\text{color dist.})$ (all p -values $< .05$);

Search trials:

- Toddlers in both groups looked longer at the target item across all trials.
- Search times and success rates for single feature displays (pop-out) did not differ among the groups.
- The ASD group was significantly more successful at finding the target in conjunction search displays (overall, as well as in set sizes of 8 and 12) than age-matched controls.

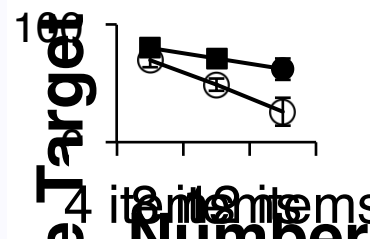


Figure 3. Success rate in feature conjunction trials by group

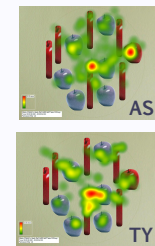


Figure 4. Heat maps by group

- Toddlers with ASD in our study were not significantly faster at finding the target. They also did not search more items than typical children. Their search paths were less random than controls', as if the target had guided their search more effectively

DISCUSSION

- We found that children with ASD were more successful at finding the target than age-matched typically developing children in feature conjunction trials.
- This finding suggests that the developmental trajectories of visual attentional processes start to diverge as early as 1-3 years of age in typically developing children vs. children with ASD.
- Our results support the 'perceptual enhancement' hypothesis of Joseph et al (2009). The target stood out more for ASD children, which led to more successes during the time period while the display was presented.
- This paradigm was unique in that it did not require participants to follow any verbal instructions, making it particularly suited for children with poor or no verbal skills.

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