Symbolic understanding of pictures in typical development and autism: divergent pathways?

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Ceci n'est pas une pipe.
Magritte

Early Actions on Pictures

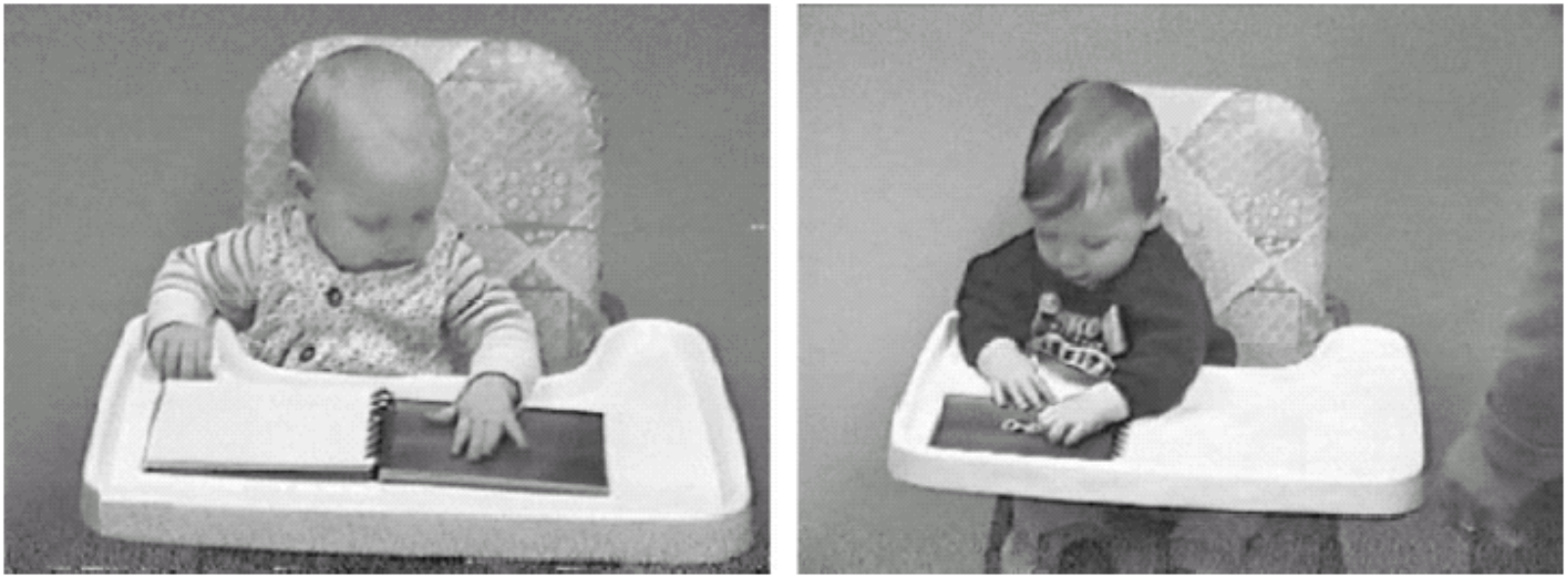
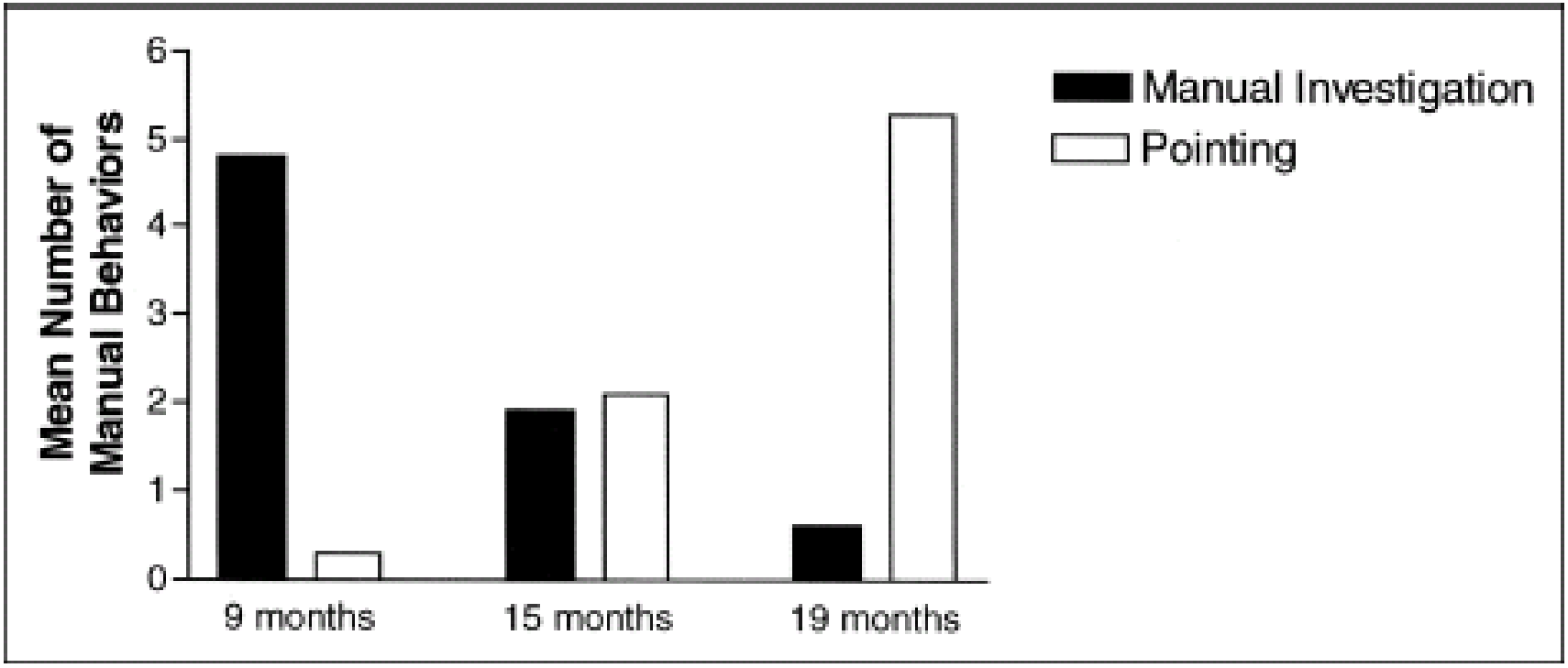


FIGURE 2 Manual exploration of depicted objects: The 9-month-old on the left is feeling the picture of a toy bear, and the infant on the right is grasping at a depicted rattle.

DeLoache, et al. (1998), *Psych Sci*

Developmental Trajectory



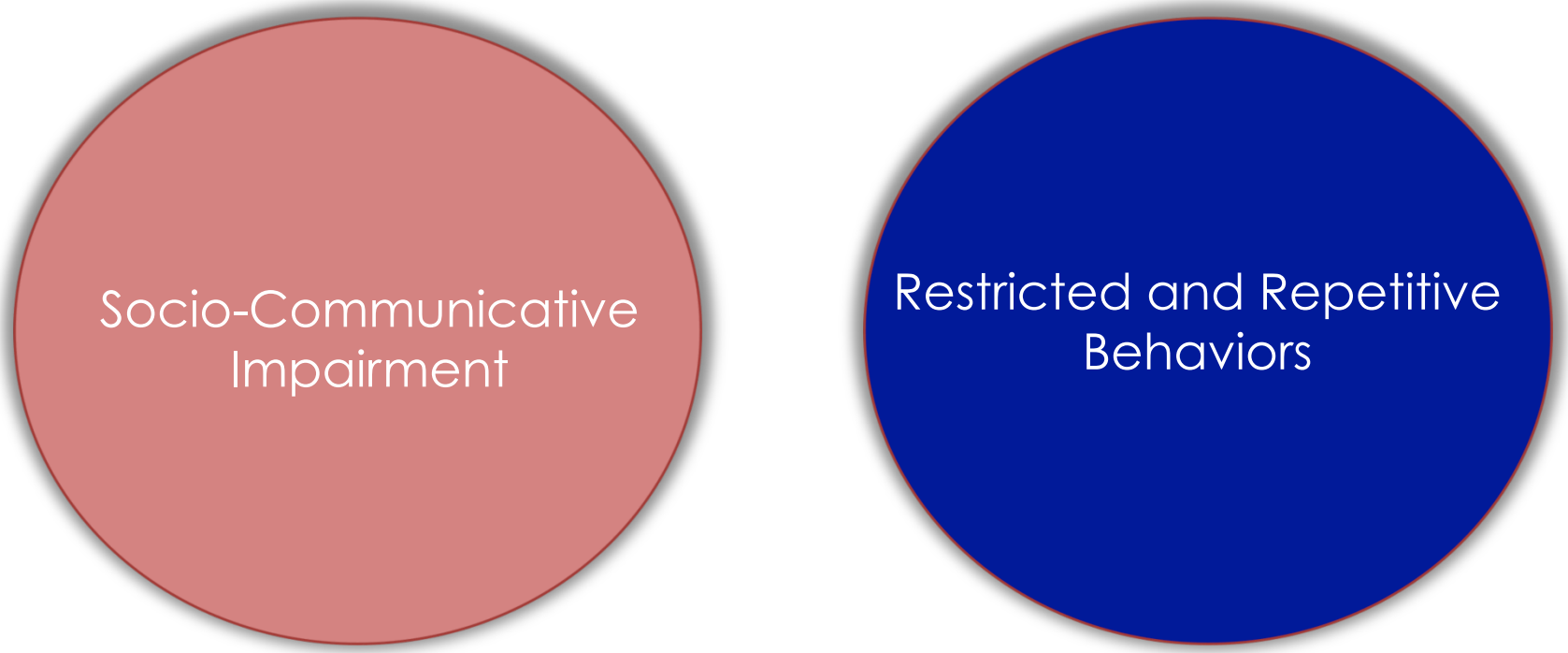
Picture Understanding in TD

- Children begin to appreciate the symbolic capacity of pictures by 18-24 months (Preissler & Carey, 2004; Ganea, et al., 2009)
- By 30 months, they can use pictures as a source of information about the world (DeLoache & Burns, 1994; Allen, Bloom, & Hodgson, 2010)
- Use intentional information and naming

Bloom & Markson (1998)

This is picture of a spider and a tree.

Autism Spectrum Disorder (ASD)



Social-emotional reciprocity

Deficits in non-verbal communicative behaviours

Difficulty understanding and maintaining relationships

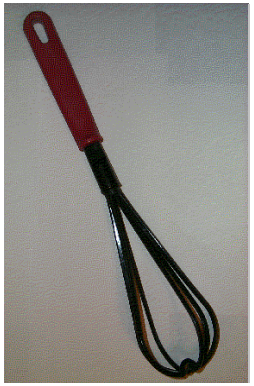
Noted Symbolic Difficulties

- Symbolic play & pretense

Picture Understanding in ASD

- Children with ASD learn picture-word-object relations associatively(Preissler, 2008; Preissler & Carey, 2004)

"whisk"



"whisk"

- Mediated by use of picture system

Research Questions

- Is symbolic understanding of pictures in ASD affected by iconicity?
- Is symbolic understanding of pictures in ASD directed by naming?
- Are children with ASD naïve realists when interpreting pictures?

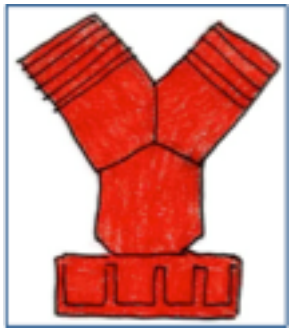
Study 1: Method

Within-subjects component (Iconicity):

Color photograph
Greyscale photograph
Color line drawing
Black and white line drawing

Group	N	CA	MA (BPVS)	CARS
ASD	20	9.7 (5.3-14)	3.7 (2.4-5.7)	43
TD	20	3.3 (2.5-5.3)	3.5 (2.6-5.7)	--

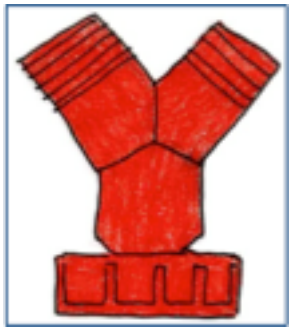
Hartley & Allen, 2015, *JADD*



(picture)

Training Phase

"this is a zepper"

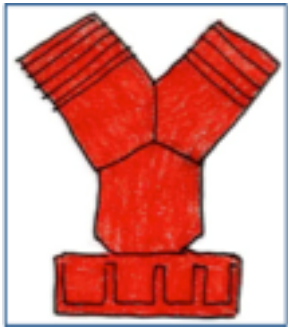


(picture)

(object)

Mapping Trial

"show me a zepper"



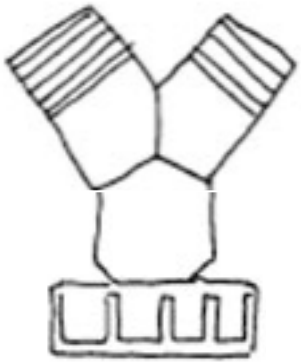
(picture)

(object)

Generalization Trial

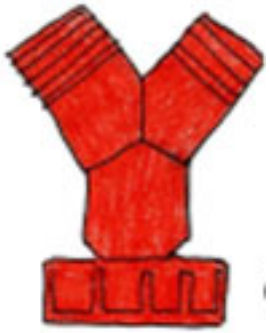
"show me a zepper"

Stimuli



B&W line drawing

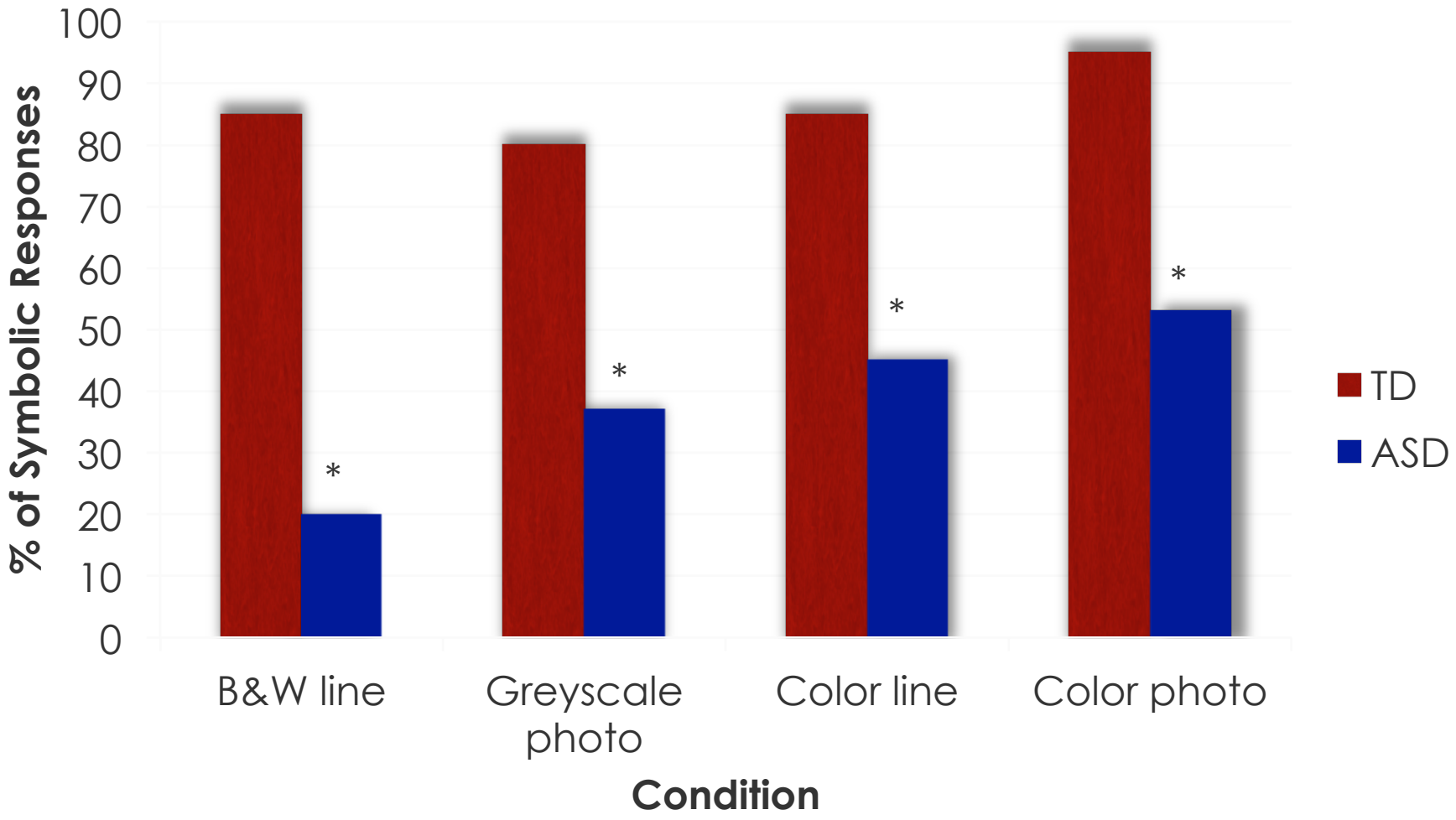
Greyscale photo



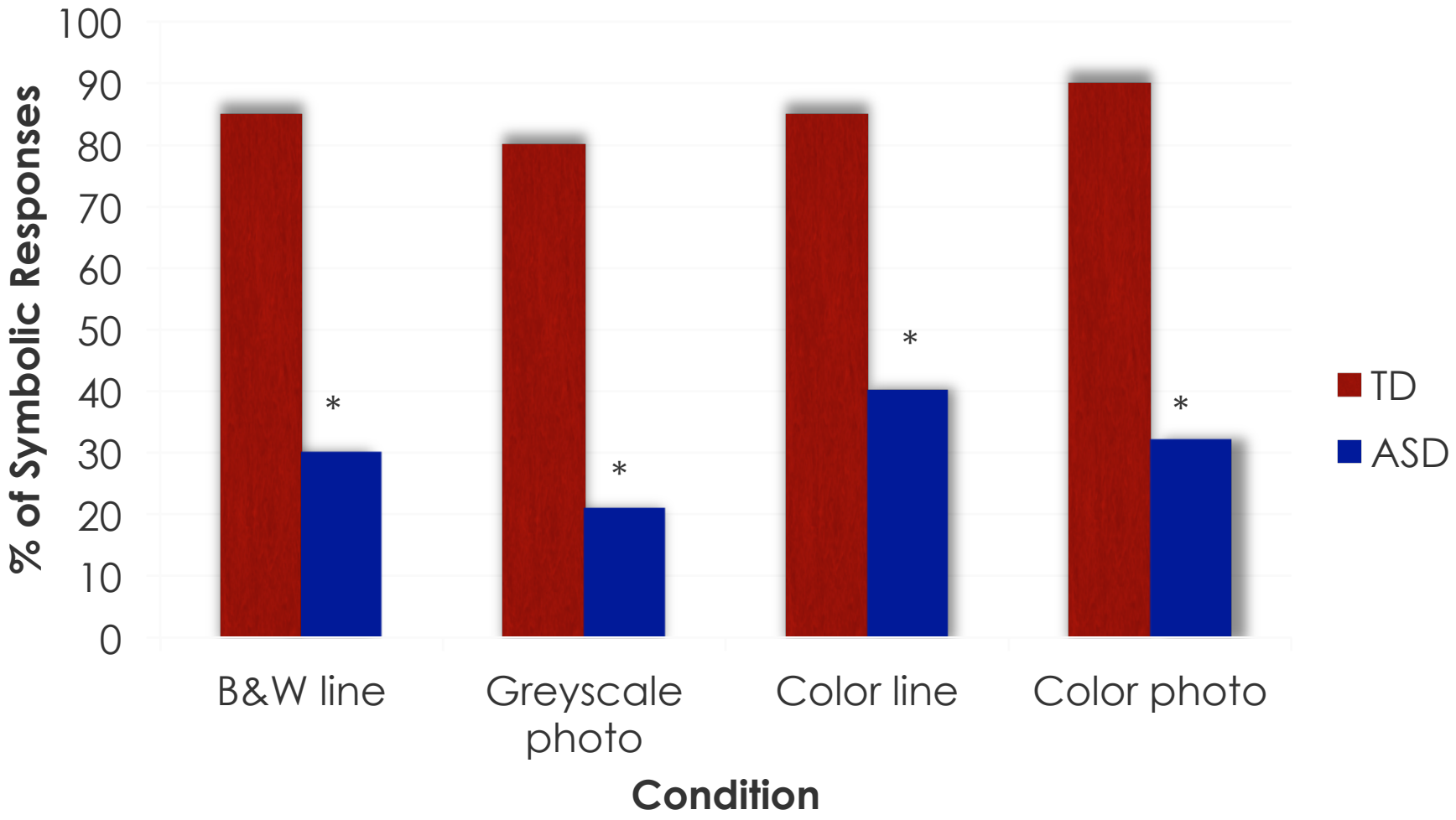
Color line drawing

Color photo

Mapping trials: Symbolic Responses



Generalization trials: Symbolic Responses



Study 1: Discussion

- Typically developing children generalize labels learned via pictures to real referents, regardless of iconicity
- Children with ASD are more likely to form associative relations
- However, they are more likely to map words to objects when the pictures are colored (50% vs 25%)
- Importance of perceptual similarity between picture and referent

Study 2: Naming

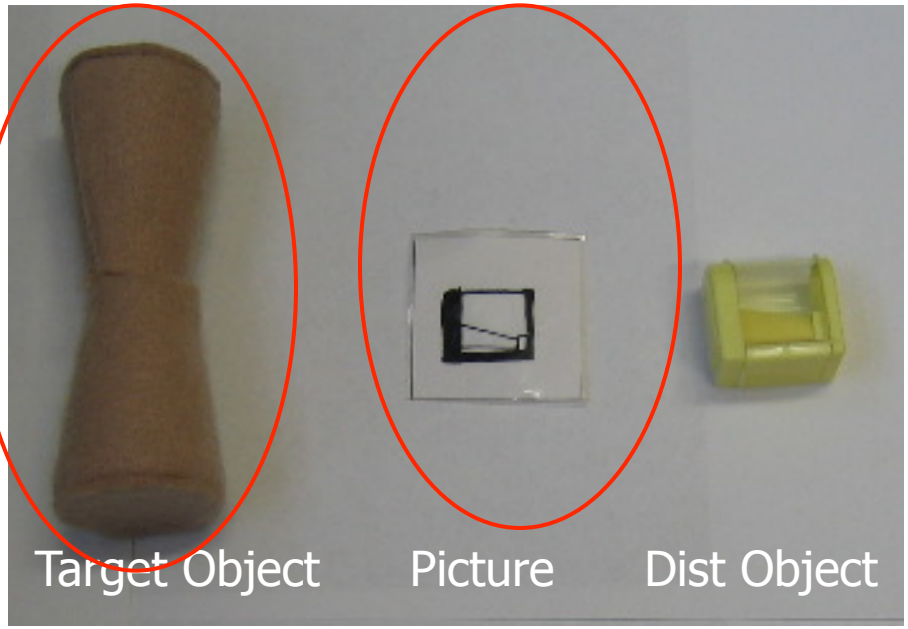
Do children with ASD use labels as a cue for a symbolic interpretation of pictures?

Car?

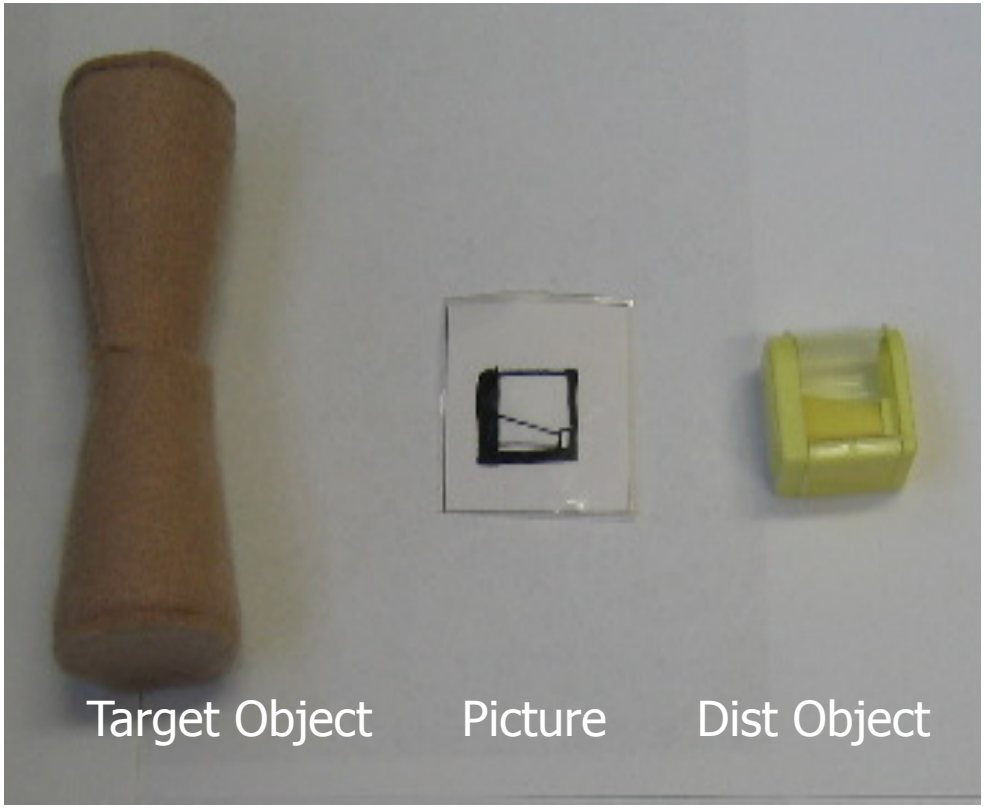
Preissler & Bloom (2007), *Psych Science*
Hartley & Allen (2015), *JADD*

Label Condition: This is a wug!

Non-Label Condition: Look at this!



TEST Q: Can you show me another one?



TD (ASD)		
Label	92.5 (82.5)	2.5 (15)
Non-label	22.5 (57.5)	77.5 (37.5)

Study 2: Discussion

- Typically developing children use names as a cue to interpret pictures symbolically
- Children with ASD are not using labels in the same way
- Reliance on perceptual information?

Study 3

Do young children follow an intentional or realism route to picture interpretation?

Group (ASD vs. TD)
Picture Type (Abstract & Realistic Conditions)

Group	N	CA	MA (BPVS)	SCQ
ASD	15	9.7 yrs	3.7 yrs	42.7
TD	15	3.3 yrs	3.7 yrs	-

Bloom & Markson (1997), *Psych Science*
Hartley & Allen (2014), *Cognition*

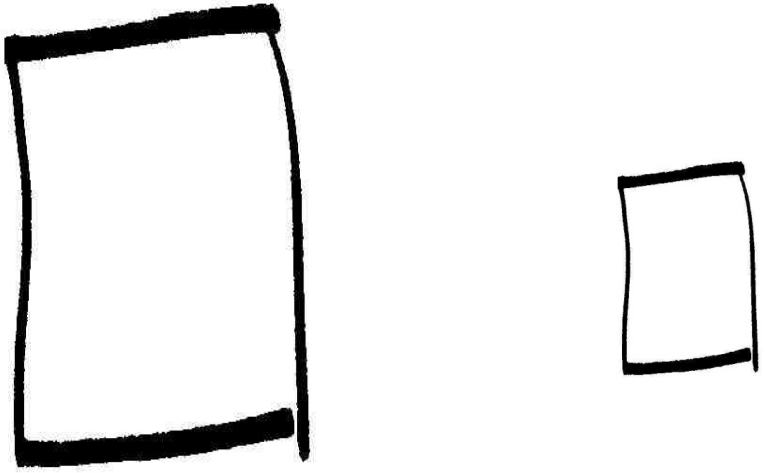
Abstract Condition

"I'm going to show you some pictures now. These pictures have been drawn by a little boy called Joe. Sadly, Joe has a broken arm and can not draw very well. Because of his broken arm, Joe's pictures did not always look how he wanted them to look."

Abstract Condition

"Joe has drawn pictures of an elephant and a mouse. I'm going to show you his pictures of a mouse and an elephant. Remember, Joe has a broken arm so his pictures might not look quite right."

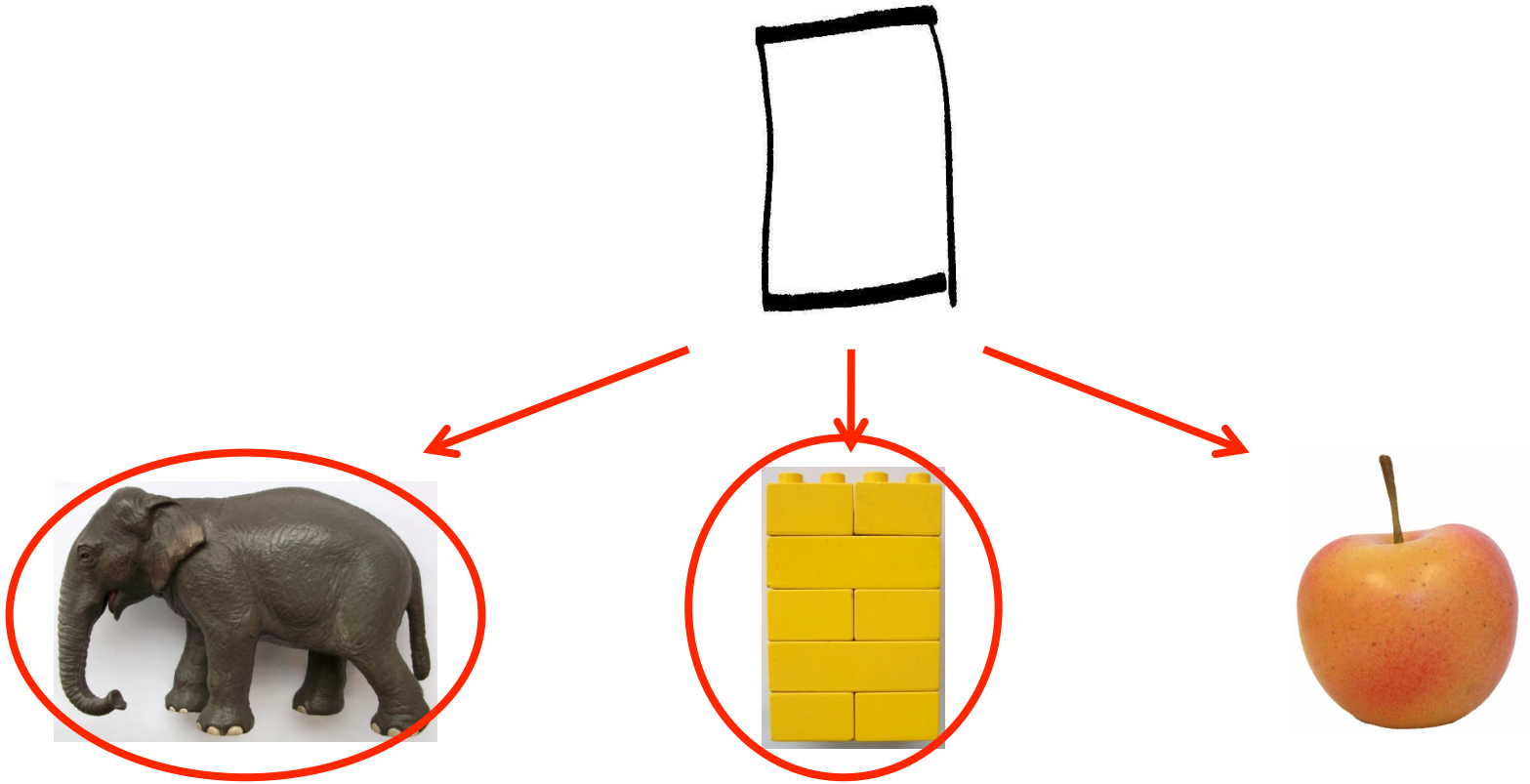
Abstract Condition
Picture Selection



"Look! Joe has drawn an elephant and a mouse. These are drawings of a mouse and an elephant."

"*Can you show me the elephant?*"

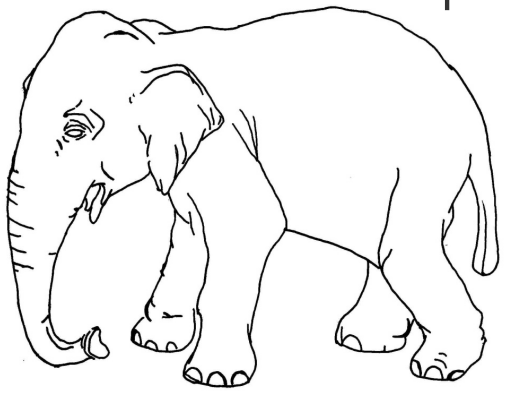
Abstract Condition
Object Selection

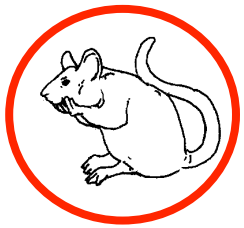


"What was Joe trying to draw?"

Realistic Condition
Picture Selection

"Ben has drawn pictures of an elephant and a mouse. I'm going to show you his pictures of a mouse and an elephant.

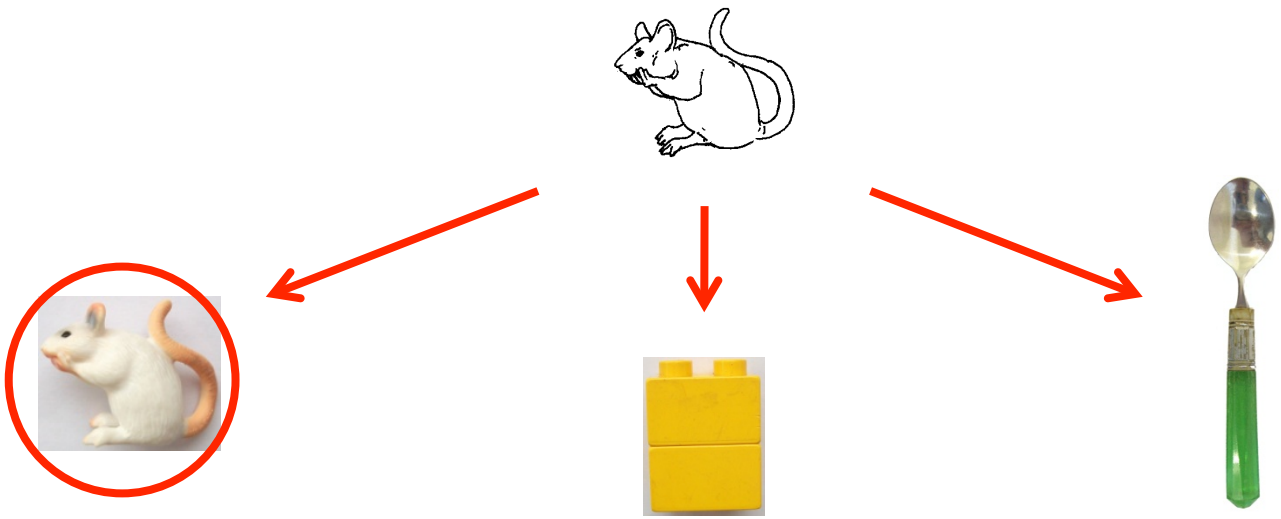




"Look! Ben has drawn an elephant and a mouse. These are drawings of a mouse and an elephant."

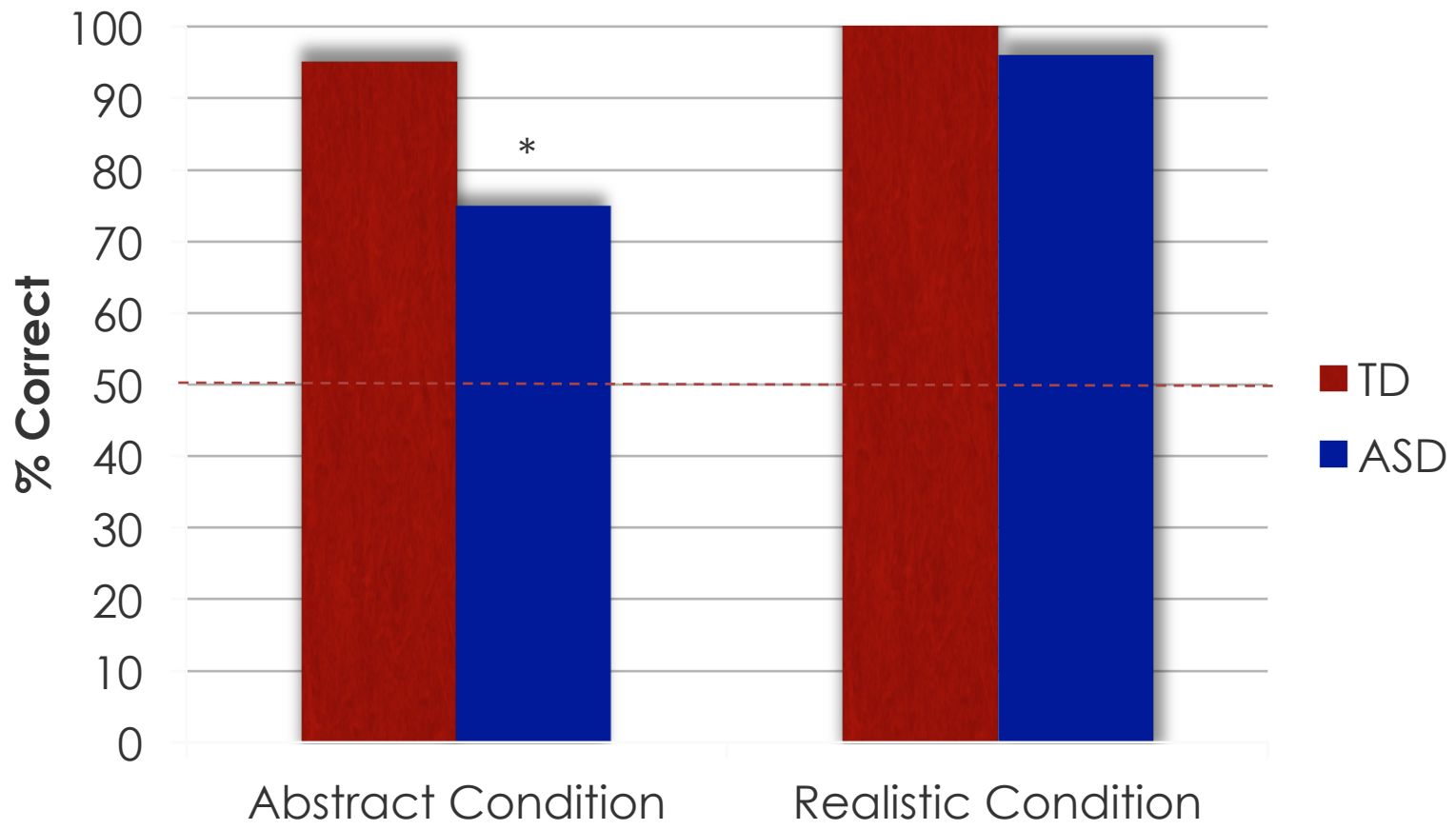
"*Can you show me the mouse?*"

Realistic Condition
Object Selection



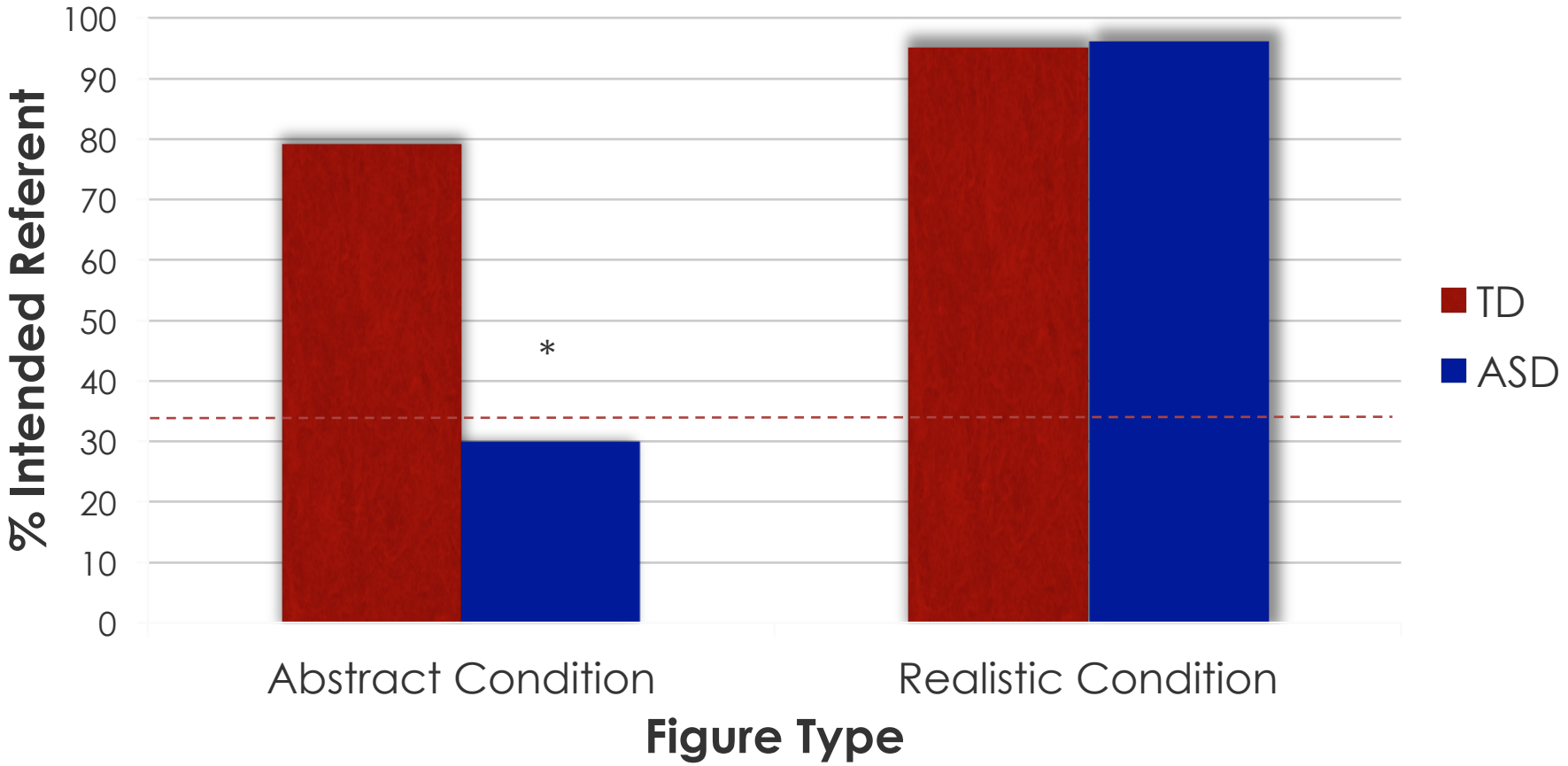
"What was Ben trying to draw?"

Results
Picture Selection



A significant group difference was obtained in Abstract Condition ($t(26) = 2.24$, $p < .05$)
Both groups performed above chance.

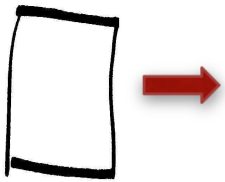
Results
Object Selection



Significant group difference in Abstract Condition:
Group x Response Type interaction, $F(1, 26) = 23.33$, $MSE = 2.15$, $p < .001$, $p^2 = .47$.
Only TD above chance, but both groups at ceiling in Realistic Condition

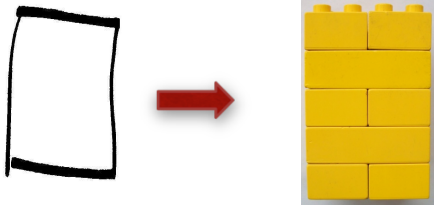
Study 3: Discussion

- In the Abstract condition, children with ASD used relative size to infer picture-referent relations in the absence of perceptual resemblance



"elephant"

- However, they linked the abstract picture to a perceptually related distractor rather than intended referent



Study 3: Discussion

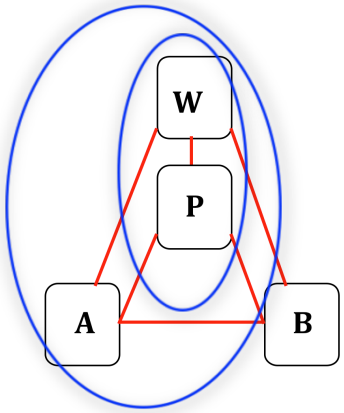
- In contrast, typically developing children can use relative size to infer representational status, ***and*** link this to the correct real world referent
- One piece of evidence that children with ASD follow a realist route while typically developing children follow an intentional one

General Discussion

- Typically developing children understand the symbolic relation between pictures, words and the objects they refer to
- Use naming and intentional information to help form these links
- Children with ASD instead form associative relations between pictures, words and objects
- They focus on perceptual resemblance (color, shape) when interpreting pictures

Naïve realists?

- Children with ASD are failing to use intent to reason about depictions
- They may be 'naïve realists' – evaluating pictures at face value
  - A viewer analyzes the world as it stands before him, making sense of his environment through perceptual analysis
  - Literal interpretation



Future Directions

- Medium of learning (traditional picture books vs. iPads) for symbolic understanding, word learning, and engagement
- What dimensions children with ASD use to generalize words (shape, color, size)?
- Creation of pictures – artistic style, meaning, intent

Acknowledgements

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