Learning to Interact: Developmental Trajectories of Linguistic Alignment in ASD

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A conversational phenomenon

Did you put your baby to sleep?



She's sleeping

Looks like she fell off her bed

> Don't fall off the bed

What to call this phenomenon?

- "Linguistic recycling" (Perkins, 2004)
- "Interactive alignment" (Pickering & Garrod, 2004)
- Priming

Interactive Alignment



Linguistic recycling



Alignment in systems

- Combination of:
 - External forces
 - Internal mechanisms
- "Why is conversation so easy?" (Garrod & Pickering, 2004)



A horse is pulling a woman

- Branigan & McLean (2016)
- TD children (N = 32, ages 3.5 - 4) are influenced by syntactic priming



The pirate shows the clown a gun

- Slocombe et al (2013)
- Adults with Asperger's syndrome (N = 17, ages 18-51) are influenced by syntactic priming



The witch was dragged by the bear

Allen et al (2011)

 Children with ASD (N = 12, ages 8-12) are influenced by syntactic priming just like TD controls



The sheep kissed the queen

Hopkins et al (2016)

 Children with ASD (N = 17, ages 8 - 14) are influenced by syntactic priming just like TD controls



Conversation is hard for kids with ASD

Hopkins et al (2016)

• What about natural conversation?



What pet is the best?

Hopkins et al (2016)

Example turn from real conversation:

Child A: My favorite two, three are kittens, bunnies, bearded dragons, and budgies.

Child B: Oh. Dogs, cats, and horses.

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Reuse of bigrams (as marked by V) by Child B = 0.52 (cosine) Example turn from "fake" control conversation: Child A: My favorite two, three are kittens, bunnies, bearded dragons, and budgies. Child C: Pick your letters up for you? Reuse of bigrams by Child C = 0 (cosine)

1. Does the degree of interactive alignment change as children age?

- 1. Does the degree of interactive alignment change as children age?
- 2. Is the degree of interactive alignment different in children with autism?

Conversational alignment in autism

- Previous studies have found no difference in conversational alignment between individuals with ASD and controls in task-oriented conversations
 - Allen et al, 2011; Hopkins et al, 2014; Slocombe et al 2014; Branigan et al 2016.
- But studies of non –verbal alignment found decreased alignment in postural sway and other non-task related movements

Study details

- 32 children with ASD
- 35 TD children
- Starting at approx 1 year
- Initially language-matched 6 visits over 3 years (ca. 400 videos)
- 30 minutes of play
- Full transcription at word-level



How did we define alignment?

- Lexical: probability of repeating caregiver's words in the following speech turn controlling for utterance length (cosine similarity).
- Syntactic: probability of re-using caregiver's parts of speech in the following speech turn controlling for utterance length (cosine similarity) and removing lexical alignment.
- N.B. we exclude lack of engagement (no answer).

How did we model alignment?

- Mixed-effects growth curve models
- Fixed factors:
 - ASD diagnosis (0, 1)
 - Visit
 - Gender
 - Mullen score
 - ADOS score (only for ASD)
- Random effects:
 - Visit (linear and quadratic) over Child

Results: Lexical alignment



Results: Syntactic alignment



- Does the degree of interactive alignment change as children age?
- Is the degree of interactive alignment different in children with autism?

• Does the degree of interactive alignment change as children age?

– Yes

Linear and quadratic components to alignment development

- Lexical linear: β=0.76, SE=0.2, t- stat=3.88, p=0.0001
- Lexical quadratic: β=-0.56, SE=0.18, t-stat=-3.07, p=0.002
- Syntactic linear: β=1.12, SE=0.44, t-stat=2.53, p=0.011
- Syntactic quadratic: β=-0.95, SE= 0.45, t-stat=-2.12, p=0.034

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Lower degree of alignment in children with ASD (+ ADOS)

- Lexical: β=-0.01, SE=0.01, t-stat=-1.96, p=0.05
- Syntactic: ASD: β=-0.07, SE=0.04, t-stat=-2, p=0.045
- Higher ADOS is related to lower lexical (β=-0.13, SE=0.05, t-stat=-2.6, p= 0.01)
- Higher ADOS is related to lower syntactic alignment (β=-0.09, SE= 0.04, t-stat=-2.47 p=0.013)

Other factors

- Higher Mullen is related to higher lexical (β=0.01, SE=0.01, t-stat=1.94, p=0.05) and lower syntactic alignment (β=-1.16, SE=0.33, tstat=-3.48, p<0.0001)
- No effects of gender
- No interaction with time

Why do we see a difference in alignment?

- Possible factors
 - Free conversation*
 - Younger children
 - Greater range of symptom severity

• * but see Hopkins et al (2016)

Questions for the future

- What do different levels of alignment reflect?
- Is it always "good" to align?
- Do caregivers align differently to ASD and TD children?
- What about "conceptual alignment" which is not captured by our analysis?

Thank you

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