Learning to Interact: Developmental Trajectories of Linguistic Alignment in ASD

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A conversational phenomenon

Did you put your baby to sleep?

Yeah

Looks like she fell off her bed

She’s sleeping

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

*RES: and can you **tell me** Gary in what direction does the sun **set**.

*GAR: that way.

*GAR: what's the sunset **do**.

*RES: that was when the sun goes down,, isn't it?

*GAR: **tell me**, is it the sunset **do**?

Figure 2. Recycling in autism.
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
Conversa4on 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.  

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)
Research questions

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

- 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
Research questions

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• Is the degree of interactive alignment different in children with autism?
Research questions

• Does the degree of interactive alignment change as children age?
  – Yes
Linear and quadratic components to alignment development

- Lexical linear: $\beta=0.76$, $SE=0.2$, $t\text{-}stat=3.88$, $p=0.0001$
- Lexical quadratic: $\beta=-0.56$, $SE=0.18$, $t\text{-}stat=-3.07$, $p=0.002$
- Syntactic linear: $\beta=1.12$, $SE=0.44$, $t\text{-}stat=2.53$, $p=0.011$
- Syntactic quadratic: $\beta=-0.95$, $SE=0.45$, $t\text{-}stat=-2.12$, $p=0.034$
Research questions

• Does the degree of interactive alignment change as children age?
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  – Yes
Lower degree of alignment in children with ASD (+ ADOS)

- Lexical: $\beta=-0.01$, SE=0.01, t-stat=-1.96, p=0.05
- Syntactic: ASD: $\beta=-0.07$, SE=0.04, t-stat=-2, p=0.045

- Higher ADOS is related to lower lexical ($\beta=-0.13$, SE=0.05, t-stat=-2.6, p= 0.01)
- Higher ADOS is related to lower syntactic alignment ($\beta=-0.09$, 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, t-stat=-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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