Language skills in children with autism: Implications for assessment and intervention

Molly Losh, PhD

Communication Sciences and Disorders
Northwestern University
Learning Objectives

• Explain clinically meaningful profiles of language impairment in autism
• Explain how different social cognitive factors can contribute to language impairments in autism
• Describe important targets for language-based intervention in autism
How does research inform assessment and treatment of autism?
Clinical Behaviors → Core Impairments → Underlying causes *gene, brain, environment → Intervention, Education
• **Social brain** (and encoding genes and geneXenv) supports social cognition

• Better **social cognition** (e.g., empathy, social perception) gives rise to more functional social and communicative behavior (e.g., narrative)

• More adept **social-communicative behavior** (conversation, expression of emotion, etc.) leads to better **social functioning** (e.g., peer acceptance, successful relationships)
Significance of autism research

• Inform treatment and policy – *evidence based practice*
Persistent challenges to research, assessment and treatment...
Illinois governor cuts autism funding on World Autism Day

by Laura Clawson

$1 million in state funding for autism services frozen

Additional $4 million anticipated cut in next budget

Imperils services for over 45,000 children, and up to 100,000 adults in Illinois
Yet still reasons for optimism...
*Awareness, activism at all time high*
Great Sphinx and Pyramids of Giza in Blue for Autism Awareness Day
Figure 1: Citations of Kanner (1943). The graph displays the number of times the seminal paper by Kanner (1943) was referenced in the peer-reviewed scientific press from the time of publication to the end of 2009. Various events in the evolution of autism advocacy are indicated on the chart and are described in the text.
Funding, impactful research, clinical translation

Improves detection, assessment, services

Awareness & Advocacy
Agenda

• Quick review of component features of autism

• The language profile in autism and potential causes
  – Pragmatics – universally impaired in autism
  – Social cognition – fundamentally linked with pragmatics

• Clinical significance
  – Significance for speech & language intervention
Acknowledgments

The Neurodevelopmental Disabilities Lab

http://ndl.northwestern.edu

Research supported by: R03 MH079998-01, NIMH; 1R01DC010191-01, NIDCD; 1R01MH091131-01A1, NIMH; National Science Foundation, Autism Speaks
Acknowledgments

Northwestern University
Christine Rothermel, MA, CCC-SLP
Christie Stiehl, BA
Michelle Lee, BA
Abby Hogan-Brown, BA
Nell Maltman, BA
Jamie Barstein, BA
Stephanie Crawford, BA
Lauren Bush, BA
Kritika Nayar, BS

UNC, Chapel Hill
Gary Martin, PhD, CCC-SLP
John Sideris, PhD
Peter C. Gordon, PhD
Patrick Sullivan, MD
Joseph Piven, MD

Rush University
Elizabeth Berry-Kravis, MD, PhD
Deborah Hall, MD, PhD
Lili Zhou, MD

University of Iowa
Dianne McBrien
Thomas Wassink, MD, PhD
Frank Fleming, BS

Research supported by: R03 MH079998-01, NIMH; 1R01DC010191-01, NIDCD; 1R01MH091131-01A1, NIMH; National Science Foundation, Autism Speaks
Acknowledgments

• The Organizing Committee
  – Drs. Pam Souza, Steve Zecker, & Megan Roberts

• CASL Clinic Director
  – Denise Boggs-Eisenhauer

• CSD Chair
  – Dr. Sumit Dhar

• SoC Dean
  – Dr. Barbara O’Keefe
Characterizing autism, beginning historically
Kanner’s criteria

1943, Reported 11 children
* autistic aloneness
* desire for sameness
* islets of ability

Autism $\rightarrow$ ‘autos’ ‘self’
“There is from the start an extreme autistic aloneness that, whenever possible, disregards, ignores, shuts out anything that comes to the child from the outside. . . People figure in about the same manner as the desk, the bookshelf, or the filing cabinet.”

**Autism --> ‘Autos’ ~ ‘Self’**

Clinical profile of autism

Impressions from NU undergraduates (responses to class questionnaire)

• trouble with eye contact
• social difficulties
• ticks and focus on routine, “very tactile”
• “made me a little uncomfortable”
• working with child with autism was “stressful, but also very rewarding”
• each person “so incredibly different”
• “really variable – some who could talk whereas others had very limited communication abilities”
• “talented, one really skilled at drawing and the other at piano”
• Autism/Autism Spectrum Disorder
  – Problems with social reciprocity, social communication
  – Restricted interests and repetitive behaviors

Social and language impairments inextricably related, and evident from very early in development…
Epidemiology

Prevalence

autism  $\sim 1/68$  $\sim 30\%$ w/ID (CDC, 2014)
Epidemiology

Prevalence

**autism**  \(~1/68\)  \(~30\%\) **w/ID** (CDC, 2014)

Gender Ratio

overall  4-5 males : 1 female

Onset

generally early (<3 years)

*Average age of diagnosis \(~5\) or 6 years*
Preference for human speech, and even native language from first days of life.

Communicative gesture ~6 mo. (imperative, declarative pointing); recognizes name (head turn).

First words ~1 yr

Joint attention ~9 mo.

Phrases, simple syntax ~2 yrs

Grammar of native language mastered ~ 5 yrs

Pragmatic language development through school age and beyond
Experiment

Klin et al. 1991

• Attention to child-directed speech
• Preferential listening
  – button on toy to play either child-directed speech or continuous stream of noise (“Babel”)
Attention to child directed speech vs. "Babel"

Fig. 1. Percentage of total time spent listening to mother's speech and to Babel.
Fig. 2. Box plot display for the listening time (in %) to mother's speech for the 3 experimental groups.
Communicative gesture ~6 mo. (imperative, declarative pointing); recognizes name (head turn)

Preference for human speech, and even native language from first days of life

First words ~1 yr

Phrases, simple syntax ~2 yrs

Grammar of native language mastered ~ 5 yrs

Joint attention ~9 mo.

Pragmatic language development through school age and beyond
Prelinguistic communication in autism: data from home-videos (Osterling et al., 2002)
Gaze-related impairments in autism: data from home-videos

<table>
<thead>
<tr>
<th>Social behavior</th>
<th>Autism spectrum disorder</th>
<th>Typical development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looks at people</td>
<td>32.3</td>
<td>34.9</td>
</tr>
<tr>
<td>Looks at face while smiling</td>
<td>1.5</td>
<td>4.3</td>
</tr>
<tr>
<td>Orient to name called</td>
<td>37.0</td>
<td>74.7</td>
</tr>
<tr>
<td><strong>Communication behavior</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 1 vocalization</td>
<td>1.6</td>
<td>2.1</td>
</tr>
<tr>
<td>Stage 2 vocalization</td>
<td>0.013</td>
<td>0.004</td>
</tr>
<tr>
<td>Contingent vocalizations</td>
<td>0.25</td>
<td>0.69</td>
</tr>
<tr>
<td><strong>Repetitive behavior</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inappropriate repetitive behavior</td>
<td>2.6</td>
<td>1.8</td>
</tr>
</tbody>
</table>

* Expressed as percentages of total amount of codable time for looking behavior and as percentages of instances of name called for orienting behavior.

* Expressed as frequency per minute.

*Primarily visual attention differences noted*
Preference for human speech, and even native language from first days of life.

Communicative gesture ~6 mo. (imperative, declarative pointing); recognizes name (head turn)

Social gaze, joint attention ~9 mo.

First words ~1 yr

Phrases, simple syntax ~2 yrs

Grammar of native language mastered ~ 5 yrs

Pragmatic language development through school age and beyond
Joint attention

• State in which 2 or more people are attending to the same object or event, and each other.

The importance of gaze...
Evolutionary importance of gaze

• Features of human eyes help to advertise presence and gaze direction
  – Human eyes are disproportionately large
  – Increased coloration, contrast
  – ⬆ gaze detection = ⬆ cooperation on tasks involving joint attention (e.g., cooperative hunting)
Unsettling effect of uncertainty in gaze direction
**To Fall in Love With Anyone, Do This**

Answer series of 37 increasingly personal Qs

**Stare into partner’s eyes for 4 minutes, nonstop**

“Two minutes is just enough to be terrified ... four really goes somewhere”

-Participant in experiment

Significance of gaze

• Index of attention
  – people vs. objects
    *Big dichotomy between world of people and world of “things”
Consequences of failure to use gaze, share emotions, etc. in joint attention
Gaze and language development

• “Oh how pretty that is look at the butterfly over the re what a beautiful orange color its wings are”

• How do prelinguistic children know what in world the adult is talking about?
Gaze and language development

‘Parents do not announce to children “look where I look when I utter a novel word” ..., nor do they teach their child to do this...’

-- Baron-Cohen et al. (1997)
Do Children with Autism Use the Speaker’s Direction of Gaze Strategy to Crack the Code of Language?

Simon Baron-Cohen, Dare A. Baldwin, and Mary Crowson
Consequences

• Autism group
  – Mapped novel words onto object of their **own attention**, rather than tracking speaker’s gaze to infer their intention during labeling
  – Inability to make sense of another’s actions (or disinclination to attend) related to problems with language learning
Long-term consequences

• Longitudinal study from preschool – adolescence (Sigman & Ruskin, 1999)
  – Synchronized gaze in joint attention predicts language gains 8 years later

• Other consequences of early joint attention impairment?
  – Pragmatic language
  – Social perception, interaction
Preference for human speech, and even native language from **first days of life**

Communicative gesture ~6 mo. (imperative, declarative pointing); recognizes name (head turn)

First words ~1 yr

Phrases, simple syntax ~2 yrs

Grammar of native language mastered ~ 5 yrs

Joint attention ~9 mo.

Pragmatic language development through school age and beyond
Pragmatics in autism

• Social uses of language
  – Conversation, narrative, politeness, humor, etc...

• Structure vs. function
Conversational Contributions
(Tager-Flusberg & Anderson, 1991)
Conversation in older children
(Capps et al., 1998)
Conversation in older children

• Control example

Examiner: What do you and your friend do?
Child: We ride bikes, but it’s hard.
I ride, I ride on the middle.
Examiner: He rides you on his bike?
Child: (nods ‘yes’)
I was in the middle. I fell down and he just ran over my fingers.
Examiner: Ouch!
Child: (shaking head, ‘no’)  
It hurt my fingers, but it doesn’t hurt too much now.  
It really doesn’t.
Conversation in older children

- Autism example -- Verbatim repetition common

<table>
<thead>
<tr>
<th>Examiner:</th>
<th>Do you like cracker jacks?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(3 second pause)</td>
</tr>
<tr>
<td></td>
<td>I like cracker jacks.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Child:</th>
<th>Child: I like cracker jacks.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Do you like cracker jacks?</td>
</tr>
<tr>
<td></td>
<td>What’s your name?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Examiner:</th>
<th>Cindy.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child:</td>
<td>I like cracker jacks.</td>
</tr>
<tr>
<td></td>
<td>What’s your name?</td>
</tr>
</tbody>
</table>
Narrating from emotionally evocative scenes

- Thematic Apperception Test (White et al., 1941)

“Tell me a story with a beginning, middle, and end. Tell me what the character is thinking or feeling.” –Paul et al., 2003, 2006
Lee et al., in prep
Expressions of anxiety

“I don’t like thinking of that, what somebody’s thinking and why things happen…”

*ASD participant, VIQ=128

Lee et al., in prep
Expressions of anxiety
“this isn’t going to be easy...”

*ASD participant, VIQ=132
Complex syntax

“I guess when Michael came home he thought it'd be funny to scare his wife so he walked in quietly into the house and saw his wife reading a book on the couch.”

*Varied complex syntactic clauses to express temporal and causal relationships (TD, VIQ=98)*
Complex syntax, limited use

“So a woman was resting on the couch and then a guy came up to her and threatened her.”

*Simple grammatical structure (coordinate clause) (ASD, VIQ=125)
Latent Semantic Analyses

• Modeled after technology used in computer search engines
• Based on “learning” of a large body of text, uses statistical methods to select four “core” narratives and provide a numerical measure of the conceptual similarity of meanings of passages to the four core narratives
• Reflects coherence, or the flow/connection of information within discourse
• Previously applied in research of narratives of individuals with schizophrenia and first degree relatives
“Uh so this story is about a little boy who intends to become a doctor and his dad is a surgeon so he's performing surgery on or this body. And the boy is very interested. And so he's observing because he wants to be just like his father. And the father is feeling very um anxious because he has to perform the surgery and very um concentrated on his work and the story ends with the boy becoming a famous doctor.”

*High narrative quality TD; VIQ=122 semantic similarity= .40
“Like basically um the doctor was cutting open someone and then like that person's brother or dad or someone was turned away, and yeah.”

*Low narrative quality ASD; VIQ=106, semantic similarity= .22*
Social-communicative deficits due to gaze differences?

• What information gleaned from the scene?
• Aberrant narratives due to different processing of social and non-social stimuli?
Gaze and social perception in autism

• Less attention to eye region
• Idiosyncratic scan paths
• Differences in autism and more common in unaffected relatives

-Pelphrey et al., 2002
Gaze and narration in autism
Pupillary response in autism
(Tottenham, 2002)

Scrambled face (1sec)
Luminance-matched face (3 sec)
Repeated in random order
Pupillary response in autism

- TD - Calm
- TD - Happy
- TD - Fearful
- ASD - Calm
- ASD - Happy
- ASD - Fearful

Pupillary response (mm)

Time (ms)
Gaze tasks rely on the “social brain”

- Amygdala & fusiform gyrus
- **Social brain** (and encoding genes) supports social perception

- Better **social perception** gives rise to more functional social-communicative behavior

- More adept **social-communicative behavior** (conversation, social negotiations, etc.) leads to better **social functioning** (e.g., peer acceptance, successful relationships)
Summary

- Key brain regions implicated in autism
- Links to a core impairment (limited attention to eyes, associated problems in social communication)
- Associations with genetic risk to autism (shared neural signature in autism and relatives)
Clinical & Educational Implications

• Clinicians and educators are on the front lines
  – Highly trusted, influential guides to parents and policy makers

• Role in diagnostic and treatment teams
  – Knowledge of research can help guide decision making, selection of evidence-based intervention approaches.
Summary

• Language profile of autism
• Strong evidence of underlying social-perceptual differences
• Associated brain regions, genetic basis
  – Strong biological basis for autism
• Implications
  – Clinical intervention, educational policy and practice key for supporting families, individuals affected by autism
• Additional resources
Autism Resources

Simons Foundation for Autism Research Initiative (SFARI) [http://sfari.org/](http://sfari.org/)

-Focus is research dissemination & funding

Resources link:

Papers of the week, SFARI Wiki, Q&A

News and opinion link:

Classic Paper Reviews, Autism in the Arts
Autism Resources


Research link: reviews of high profile papers, scientific presentations, legislation, etc.

Resources link: many clinical resources (e.g., *Apps for Autism; Tool Kits...*)

Advocacy link: local and federal initiatives, links for getting involved