Impairment of Social Gestures in Individuals with Asperger’s Syndrome & High-Functioning Autism

University of Edinburgh, UK
American Speech & Hearing Association Convention
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Presentation Overview
- Autism and DSM-IV Criteria for Diagnosis
- Gestural Deficits in Autism
- Limb Apraxia
- Types of Gestures
- Gestural Processing Battery
- Patient Examples – patterns of praxis processing
- Conclusions

What is Autism?
- A ‘triad of impairments’
  Deficits in receptive or expressive language as used in social communication
  Impairment in development of reciprocal social interaction
  Impairments in Symbolic play – often with repetitive behaviors
- Asperger’s restricted interests and NO significant language delay

DSM-IV Criteria for Social Interaction and Communication
- Marked impairment in the use of multiple nonverbal behaviours such as eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction and
- Delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gestures or mime)

Autism and Communication
“Her expression was blank, though not unintelligent, and there was no communicative gestures”

Thank you to the Department of Neurology, Division of Neuropsychology at the Medical College of Wisconsin and to the families in the Milwaukee area for participating in the study.
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**Gestural Deficits in Autism**
- Imitation deficits well-documented since 1972 (DeMeyer)
- Documented deficits in communicative gestures
- Gestures in social communication

**Questions Driving Current Research**
- Do individuals with autism fail to imitate secondary to deficits in praxis or gestural processing?
- What might we learn about these patterns of gestural processing?
- Does this information provide us with clues to the underlying deficits in social cognition of this population?

**Underlying Causes of Gestural Impairments in Autism**
- Motor coordination
- Theory of Mind
- Self-Other Mapping
- Self-Identification
- **Dyspraxia**

**Definition of Limb Apraxia**
"Deficit in GESTURE processing resulting from neurological dysfunction which cannot be explained by elementary motor or sensory defects, by task-comprehension problems or inattention to command."

*De Renzi and Faglioni, 1999*

**Types of Gestures**

**Transitive Gestures = Object Use**
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Intransitive Gestures

The use of an object is constrained by its function, the intransitive gestures vary according to different sociocultural contexts (the same meaning may be expressed by different gestures, the same gesture may convey different meanings).

Cubelli et al. 2000

Lost In Translation

- Translated: “Shock greeting from Bush daughter.”

Pantomimes

Meaningless Gestures

Goldenberg, G. (1999). Matching and imitation of hand and finger postures with damage in the left or right hemisphere. Neuropsychologia, 37, pp. 559-566.

Need for a New Model

- Previous models could not account for the mounting evidence regarding dissociations within the praxis system – what if imitation is not spared?
- Could not account for differences in performance between meaningful and meaningless gestures.
- Could not account for deficits in discrimination or comprehension of gestures.
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Cognitive model of praxis processing (Cubelli et al., 2000)

Input/Conceptual Route

Output/Production Route

Lexical-Semantic Route

Non-lexical Route

Ideomotor Apraxia
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Meaningless Gestures in Autism

Brief Report: Imitation of Meaningless Gestures in Individuals with Asperger Syndrome and High-Functioning Autism

Meaningful Gestures Tasks Conceptual Level

- Transitive Gestures
  - Discrimination
- Pantomimes
  - Discrimination
  - Comprehension
- Intransitive Gestures
  - Discrimination
  - Comprehension

Important to test meaningless and meaningful gestures as well as different types of gestures (transitive, IG)

"Imitation behaviour cannot be localised to a single brain system, but rather different types of imitation involve different cognitive and neural systems."

Hamilton, Brindley, & Frith (2007)

"Imitation and action understanding in autistic spectrum disorders: how valid is the Mirror Neuron Hypothesis?"

Important to test meaningless and meaningful gestures as well as different types of gestures (transitive, IG)

"Broken Mirrors"
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Discrimination

Intransitive Gestures

<table>
<thead>
<tr>
<th>Symbolic Gestures</th>
<th>Iconic Gestures</th>
<th>Expressive Gestures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good job</td>
<td>Phone</td>
<td>Feeling cold</td>
</tr>
<tr>
<td>Finished</td>
<td>Eating</td>
<td>Angry</td>
</tr>
<tr>
<td>Sign of silence</td>
<td>Drinking</td>
<td>Hot, mopping one’s brow</td>
</tr>
<tr>
<td>In a minute</td>
<td>Walking</td>
<td>Feeling full</td>
</tr>
</tbody>
</table>

Comprehension of Intransitive Gestures

Production of Gestures

- Transitive Gestures
  - Object Use - ‘Use This Object’
  - Direct Imitation
- Pantomimes
  - Verbal Modality
  - Visual Modality
  - Tactile Modality
  - Direct Imitation
- Intransitive Gestures
  - Verbal Modality
  - Visual - Watch Video Clips of Social Scenarios
  - Direct Imitation

Production of Intransitive Gestures

- Verbal: Example: “A football player just made the winning touchdown, what gesture would he make?”
- Visual: Social Scenarios View Example Clip
- Direct Imitation

Example taken from Bartoli Apraxia Battery PhD thesis, 2002
Drawing by Italian artist Claudio Villa
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**Production of Intransitive Gestures in Visual Modality**

**Group Matching**

<table>
<thead>
<tr>
<th>Participant Group</th>
<th>CA</th>
<th>VIQ</th>
<th>PIQ</th>
<th>FIQ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AS</strong> (n=19)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>12.15</td>
<td>108.95</td>
<td>102.52</td>
<td>106.0</td>
</tr>
<tr>
<td>SD</td>
<td>2.35</td>
<td>18.95</td>
<td>22.73</td>
<td>21.97</td>
</tr>
<tr>
<td>Range</td>
<td>7.38-19</td>
<td>81-144</td>
<td>72-155</td>
<td>79-133</td>
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<tr>
<td><strong>Control</strong> (n=23)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>12.08</td>
<td>107.56</td>
<td>112.8</td>
<td>111.47</td>
</tr>
<tr>
<td>SD</td>
<td>2.12</td>
<td>12.9</td>
<td>18.86</td>
<td>16.49</td>
</tr>
<tr>
<td>Range</td>
<td>7.33-15.8</td>
<td>87-134</td>
<td>69-143</td>
<td>79-139</td>
</tr>
</tbody>
</table>

**Inclusion in the Study**

- Parent Interview – Social Communication Questionnaire
- Autism Diagnostic Observation Schedule (ADOS)
- Wechsler Abbreviated Scales of Intelligence
- Beery Visual Motor Integration Test
- Beery Visual Perceptual Test
- Working Memory Test Battery for Children – Digit Recall, Word List Matching, Listening Recall

Following Standardized Tests, administered the newly designed Apraxia Battery for Children

**Gestural Codes for Intransitives**

- Right Left Start – Mirror Image
- Execution of Other Gesture
- Hand Posture Error
- Arm Posture/Trajectory
- Amplitude
- Timing
- Verbal Response Only
- Don’t Know

**One Route for Processing all Meaningful Gestures?**

**A Selective Impairment of Intransitive Gestures in ASD**

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**JK Profile**
- No difficulty comprehending gestures
- IQ above normal limits including verbal IQ
- Visual perceptual skills, working memory, and visual motor integration all tested within normal limits
- Production of pantomimes across modalities as well as imitation of pantomimes and meaningless gestures were performed above cutoff.

**What’s Going on the Conceptual Level?**

<table>
<thead>
<tr>
<th>Discrimination</th>
<th>Comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obj Disc</td>
<td>Pan Disc</td>
</tr>
<tr>
<td>Cut-off</td>
<td>16</td>
</tr>
<tr>
<td>JK</td>
<td>18</td>
</tr>
</tbody>
</table>

**Production System on Command**

<table>
<thead>
<tr>
<th>IG Verbal</th>
<th>IG Visual</th>
<th>IG Imitation</th>
<th>Meaningless</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut Off</td>
<td>13</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>JK</td>
<td>9*</td>
<td>5*</td>
<td>18</td>
</tr>
</tbody>
</table>

**Other Types of Responses**
- Unrelated Gesture
- Nonspecific Gesture
- Verbal Response
- Spatiotemporal Errors
- Other
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### Video Clip of DS (verbal response)

### Video Clip of IF

### Video Clip of EJ

### What Does This Have to do with Social Communication?

- The results of the battery of praxis processing may shed light on the production of social gestures (intransitive gestures) both comprehension and production in individuals with autism.

- According to findings published by Dzuik, Larson, Apostu, Mahone, Denckla, & Mostofsky, 2007, motor signs may act as “markers for the parallel neural regions of social and communication skills.”

- Imitation/Mimicry part of gestural alignment in dialogue

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**Table: Conceptual Level**

<table>
<thead>
<tr>
<th>Level</th>
<th>DS</th>
<th>CA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Discrimination</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intransitive Gestures</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td><strong>Comprehension</strong></td>
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<td></td>
</tr>
<tr>
<td>Pantomimes</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Intransitive Gestures</td>
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<td>-</td>
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<tr>
<td><strong>Production Level</strong></td>
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</tr>
<tr>
<td>Verbal</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Visual</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tactile</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Imitation</td>
<td>-</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Imitation</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Diagram:**

- DS Deficit According to Model
- Motor Output
- Verbal Stimuli
- Visual Stimuli (Object)
- Visual Stimuli (Gesture)
- Phonological Input
- Lexicon
- Phonological Analysis
- Visual Analysis
- Structural Description System
- Sensory Gating
- Output Lexicon
- Visual-Motor Conversion Mechanism
- Gestural Buffer
- Action
- Semantic System
- Familiar
- Yes
- No
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Conclusions

- The model is a complete praxis processing model which allows us to make predictions at each level.
- Different types of gestures may be disordered for different reasons in individuals with autism.
- Even within the same gesture type, gestures may be impaired for different reasons.
- Imitation needs to be considered as part of an overall praxis processing system and not in isolation.