Trail Making Task
Verbal Fluency

- Alternate saying beverages and football teams.
Design Fluency
Color-Word Interference

RED  BLUE  GREEN  BLUE
RED  BLUE  GREEN  BLUE
RED  RED  BLUE  RED  BLUE
GREEN  BLUE  RED  GREEN
BLUE  RED  GREEN  BLUE
A druxle makes a sound. What is a druxle?
A druxle is held by the hands.
A druxle has strings.
A druxle is used in music.
A druxle is used in rock music.
Tower
Proverbs

Common Proverbs
- Hit the nail on the head.
- One rotten apple spoils the barrel.
- All that glitters is not gold.

Uncommon Proverbs
- Still waters run deep.
- Better untaught than ill taught.
- Good and quickly seldom meet.
Results

- An initial exploratory factor analysis indicated that the verbal and nonverbal subtests clustered together.

Pattern and structure matrices from the EFA

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pattern Matrix</th>
<th>Structure Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Factor 1</td>
<td>Factor 2</td>
</tr>
<tr>
<td></td>
<td>Factor 2</td>
<td>Factor 2</td>
</tr>
<tr>
<td>TM4</td>
<td>0.693</td>
<td>-0.141</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VF3</td>
<td>0.200</td>
<td>0.344</td>
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<tr>
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<tr>
<td>DF3</td>
<td>0.729</td>
<td>0.150</td>
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<tr>
<td>CW3</td>
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<td>0.090</td>
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<tr>
<td>WC</td>
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<td>0.742</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>0.495</td>
<td>0.017</td>
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<tr>
<td>PFI</td>
<td>-0.125</td>
<td>0.566</td>
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</tbody>
</table>
Results

- Cluster analysis indicated a two-factor solution best fit the data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total Sample (n = 66)</th>
<th>Cluster 1 (n = 36)</th>
<th>Cluster 2 (n = 30)</th>
<th>Performance Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic (% AD)</td>
<td>50 %</td>
<td>72.7%</td>
<td>27.3%</td>
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<tr>
<td>Age</td>
<td>18.85 +/- 1.56</td>
<td>18.50 +/- 1.50</td>
<td>19.26 +/- 1.54</td>
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<tr>
<td>Gender (% male)</td>
<td>78.8</td>
<td>77.8</td>
<td>80.0</td>
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<tr>
<td>VIQ</td>
<td>111.56 +/- 11.64</td>
<td>108.42 +/- 11.20</td>
<td>115.33 +/- 11.18</td>
<td>6.91</td>
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<td>PIQ</td>
<td>108.80 +/- 9.85</td>
<td>104.81 +/- 7.57</td>
<td>113.60 +/- 10.23</td>
<td>8.79</td>
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<tr>
<td>FSIQ</td>
<td>111.62 +/- 9.78</td>
<td>107.72 +/- 8.06</td>
<td>116.30 +/- 9.73</td>
<td>8.58</td>
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<tr>
<td>TM4</td>
<td>9.88 +/- 3.26</td>
<td>8.11 +/- 3.40</td>
<td>12.00 +/- 1.15</td>
<td>3.89</td>
</tr>
<tr>
<td>VF3</td>
<td>10.74 +/- 3.11</td>
<td>9.58 +/- 2.89</td>
<td>12.13 +/- 2.81</td>
<td>2.55</td>
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<tr>
<td>DF3</td>
<td>12.33 +/- 3.49</td>
<td>10.00 +/- 2.45</td>
<td>15.13 +/- 2.29</td>
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<td>CW3</td>
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<td>7.58 +/- 3.76</td>
<td>12.40 +/- 1.99</td>
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<td>WC</td>
<td>11.00 +/- 2.13</td>
<td>10.11 +/- 2.10</td>
<td>12.07 +/- 1.66</td>
<td>1.96</td>
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<tr>
<td>T</td>
<td>11.08 +/- 2.84</td>
<td>9.81 +/- 2.14</td>
<td>12.60 +/- 2.57</td>
<td>2.79</td>
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<td>PFI</td>
<td>9.44 +/- 3.46</td>
<td>8.89 +/- 3.55</td>
<td>10.10 +/- 3.28</td>
<td>1.21</td>
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</table>
Results

- Receiver Operating Characteristics analysis indicated no subtests with significant sensitivity
  - Only 2 nonverbal subtests were indicated as possessing significant specificity
ROC Curve

Source of the Curve
- DKEFS Trail Making 4
- DKEFS Verbal Fluency 3
- DKEFS Design Fluency 3
- DKEFS Colour Word 3
- DKEFS Word Context
- DKEFS Tower
- DKEFS Proverb
- Reference Line

Sensitivity

1 - Specificity

Diagonal segments are produced by ties.
Interesting Findings

- 9 participants with AS were classified into cluster 2
  - Their VIQ, PIQ, FSIQ, and performance on all EF tasks was poorer than the 24 AS individuals in cluster 1
  - These 9 participants were termed “low performers”
- Similarly, 12 control participants were classified into cluster 1
  - Termed “high performers”
Interesting Findings

- Performance differential between clusters 1 and 2 was lowest on the Proverbs task
  - Surprising given the consistent finding that individuals with AD typically struggle with interpreting and understanding non-literal language\(^8, 9, 10, 11\).
Results

- What does this mean?
- There is no overall “EF deficit”
- There are some aspects of EF that individuals with AS struggle with
  - Visual EF tasks
  - But there was a lot of variability in performance
  - So even saying that there is a “nonverbal deficit” is incorrect
Back to the original question

- What do we “know” about individuals with AS?
- They have an EF deficit
  - Not really
So what does this mean?

- Individuals with AS demonstrate intact verbal EF abilities
  - These skills can be very well-developed in this population.
- This ability should be utilized in the classroom environment
  - They will likely be better able to think fluidly when information is presented verbally
So what does this mean?

- The most often noted challenge for this population is social interaction.
- Often this challenge arises due to lack of awareness of nonverbal cues in social interaction.
  - This is the one aspect of EF that AS individuals struggle with.
Social skills programs often teach specific patterns of prosocial behaviour

- But do not typically focus on identification of specific nonverbal behaviour
- Or what that behaviour means when presented by a social partner
So what does this mean?

- It will be important to link/pair verbal cues with nonverbal cues
  - E.g., specific words with tone of voice and body language
Future Directions

- Extend findings to other populations
  - HFA – examine differences in verbal/nonverbal EF performance between AS and HFA
  - Younger individuals with AS – developmental perspective
  - ADHD – individuals also struggle with EF tasks
- Investigate the relationship between EF and social skills
  - Particularly nonverbal EF ability
Thank-you

- I graciously thank all of our participants and their families as well as our community partners
  - Autism Calgary Association
  - Asperger Manitoba Inc.
  - The Sinneave Foundation

- Kind acknowledgement to research team members: Janine Montgomery, Danielle Brady, Keoma Thorne, Jo-Anne Burt, Yvonne Hindes, & Candace Kosack
References