Seeing the world differently: The systemizing trait and perceptual biases

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• **Weak Central Coherence** (Frith, 1989)
  - Individuals with Autism Spectrum Disorders (ASD) have difficulties using and integrating contextual information.

• **Enhanced Perceptual Functioning** (Mottron et al., 2006)
  - Individuals with ASD have a detail-oriented processing style due to superior low-level visual processing.
Inconsistent findings due to variability in unmatched traits.

Traditional Group Comparison Approach

Individual Differences Approach

Illusion Susceptibility
The Systemizing Trait of Autism

- **Systemizing**: The tendency to prefer and analyze mechanical systems in the world, where the rules and operations in the system can be understood and predicted.

- **Numerical**: preoccupation with numbers, calendars, and timetables

- **Spatial**: fascination with routes

- **Environmental**: insisting on environmental order and consistent positioning of objects

- **Collectible**: organizing collections, making lists and catalogues

Baron-Cohen, et al., 2009
The Systemizing Trait of Autism

• **The Systemizing Quotient-Revised (SQ-R)**

  “In math, I am intrigued by the rules and patterns governing numbers.”

  “When I learn about a new category, I like to go into detail to understand the small differences between different members of that category.”

  “I find it distressing if people who live with me upset my routines.”

Wheelwright et al., 2006
Experiment 1

The Rod-and-Frame Illusion (RFI): A central line appears tilted in the direction opposite the tilt of a surrounding frame.
Experiment 1

• **The Rod-and-Frame Illusion (RFI):**
  A central line appears tilted in the direction opposite the tilt of a surrounding frame.
**Global Effect**  
(Visuovestibular distortion)

**Saccade to Vertical**  
(True vertical - perceived vertical)

**Perceived Vertical**

**True Vertical**

**True Rod Orientation**

**Perceived Rod Orientation**

**Local Effect**  
(Local orientation contrast effect)

**Saccade to Rod**  
(True rod orientation - perceived rod orientation)

**Perception Task**  
(Combined global and local effects)
Global Effect
(Visuovestibular distortion)

Saccade to Vertical
(True vertical - perceived vertical)

Local Effect
(Local orientation contrast effect)

Saccade to Rod
(True rod orientation - perceived rod orientation)
Systemizing and Perceptual Biases

Global visuovestibular effects

| Global Effect (Saccade-to-Vertical) | SQ-R | -0.40 ($p < .01$) |

Local orientation contrast effects

| Local Effect (Saccade-to-Rod) | SQ-R | 0.31 ($p < .03$) |
Types of Systemizing

**Factor 1**

*‘Analytical Tendencies’*

– When I look at a building, I am curious about the precise way it was constructed.

– When I listen to a piece of music, I always notice the way it’s structured.

– I am fascinated by how machines work.

**Factor 2**

*‘Insistence on Sameness’*

– If I had a collection (e.g. CDs, coins, stamps), it would be highly organized.

– It bothers me if things in the house are not in their proper place.

– I find it distressing if people who live with me upset my routines.
Types of Systemizing

Global visuovestibular effect

<table>
<thead>
<tr>
<th>Analytical Tendencies</th>
<th>Local Effect</th>
<th>Global Effect</th>
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<tr>
<td></td>
<td>.12 (NS)</td>
<td>-.44 (.004)</td>
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Local orientation contrast effect

<table>
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<th>Insistence on Sameness</th>
<th>Local Effect</th>
<th>Global Effect</th>
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<td>.36 (.019)</td>
<td>-.10 (NS)</td>
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</table>
Types of Systemizing

- **Baron-Cohen Data Set** (from Wheelwright et al., 2006)
  - 1761 neurotypical (NT) individuals (41% male)
  - 125 individuals with ASD (55% male)
    - 110 with Asperger diagnosis, 15 with high-functioning ASD diagnosis

- **Graphs**
  - **Analytical Tendencies**
  - **Insistence on Sameness**
Experiment 2

- Results suggest that there is a reduced tendency for high systemizers to use global contextual information.

- Does this reflect an *impairment* in using contextual information, or just a *disinclination* to use this information (i.e., in favor of more detail-oriented information)?
Perception Task

[Diagram of perceptual task]

Psychometric Function

Percentage of "Clockwise" Responses

Rod Orientation

$r(76) = -.08, p = NS$
Summary and Conclusions

- The Systemizing Quotient-Revised is measuring two distinct forms of systemizing: Analytical tendencies and insistence on sameness.

- In high functioning individuals with ASD, both of these types of systemizing are strongly expressed.

- Strong analytical tendencies are associated with decreased use of visual context, while a strong insistence on sameness is associated with an increased sensitivity to the visual details in a scene.

- Individuals with strong systemizing tendencies can use visual context when it is helpful, or when explicitly asked to do so.
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