THINKING IN PICTURES:
A fresh look at cognition in autism

Maithilee Kunda and Ashok K. Goel
School of Interactive Computing, Georgia Tech
mkunda@cc.gatech.edu  goel@cc.gatech.edu

Etiology\(^1\) of Autism


Temple Grandin

Thinking in Pictures — autobiographical account

“I think in pictures. Words are like a second language to me.”


Thinking in Pictures— What does it mean?

<table>
<thead>
<tr>
<th>Pictorial</th>
<th>Verbal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance— “what” and “where”</td>
<td>Arbitrary— driven by inferential needs</td>
</tr>
<tr>
<td>Analogical— structural correspondence</td>
<td>Propositional— no correspondence</td>
</tr>
</tbody>
</table>

Content

Encoding
THINKING IN PICTURES—
WHAT DOES IT MEAN?

Individuals with autism

Pictorial

Appearance—
“what” and
“where”

Content

Encoding

Analogical—
structural correspondence

Verbal

Arbitrary—
driven by inferential needs

Typically developing individuals

Propositional—
no correspondence

STUDY 1: WORD-LENGTH EFFECT DURING A PICTURE RECALL TASK

STUDY 2: TWO PARADIGMS FOR MEASURING “GENERAL INTELLIGENCE”

Wechsler Intelligence Scale

Raven’s Progressive Matrices

Verbal questions and responses

Pictorial questions and responses—minimal instructions


STUDY 2: TWO PARADIGMS FOR MEASURING “GENERAL INTELLIGENCE”

STUDY 3: SENTENCE COMPREHENSION USING (OR NOT USING) MENTAL IMAGERY

<table>
<thead>
<tr>
<th>High imagery:</th>
<th>Control</th>
<th>Autism</th>
</tr>
</thead>
<tbody>
<tr>
<td>“The number eight when rotated ninety degrees looks like a pair of eyeglasses.”</td>
<td>Active</td>
<td>Active</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low imagery:</th>
<th>Control</th>
<th>Autism</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Addition, subtraction, and multiplication are all math skills.”</td>
<td>Not so much</td>
<td>Still active</td>
</tr>
</tbody>
</table>


CONCLUSION

- **Thinking in Pictures has significant potential as a cognitive theory of autism.**
  - See paper for a discussion of relationships with other cognitive theories.

- **Next steps:**
  - Computational experiments → Testable predictions → Clinical trials
  - Implications for communication & education

ACKNOWLEDGMENTS

- This work was partially supported by the Office of Naval Research through an NDSEG fellowship and by an NSF IIS Grant (#0534622) on Multimodal Case-Based Reasoning in Modeling and Design.