Point to Those! Grouping Gestures Predict Children's Early Patterning Skills

Alicia L. Macchione, Nicholas A. Vest, & Emily R. Fyfe
Department of Psychological and Brain Sciences, Indiana University

Focus

We focused on individual differences in children's gestures on a pattern abstraction task and how they relate to patterning performance.

Background

Early patterning skills have been shown to relate to formal math and reading achievement (see Burgoyne et al., 2017).

Research is now needed to identify factors that relate to early patterning skills.

Previous research has found that gestures can have a powerful effect on thinking, and children's spontaneous gestures often influence their problem-solving strategies (e.g., Goldin-Meadow & Beilock, 2010).

We hypothesized that children's gestures that highlighted the pattern structure would positively relate to task performance.

Pattern Abstraction

We focused on pattern abstraction: the ability to recreate the structure of a pattern using novel materials (e.g., given "square-circle-circle" one could recreate the structure using different shapes such as "star-heart-heart").

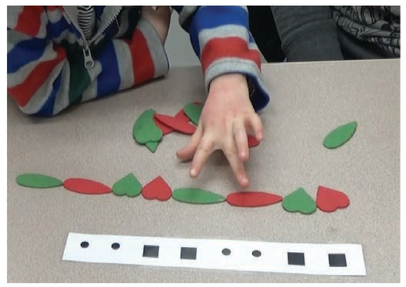
Method

Participants: 40 children (*M* age = 5.5 years; 58% female) participated in a one-on-one session in the lab.

Task: Children were first asked to solve and explain a single pattern abstraction item to assess their initial understanding. Children were then shown several examples of pattern abstraction tasks and asked to solve and explain 9 different items. We coded children's gestures during their explanation of each of these 9 items. (Explanation Prompt: "How is your pattern like my pattern?")

Gesture Types

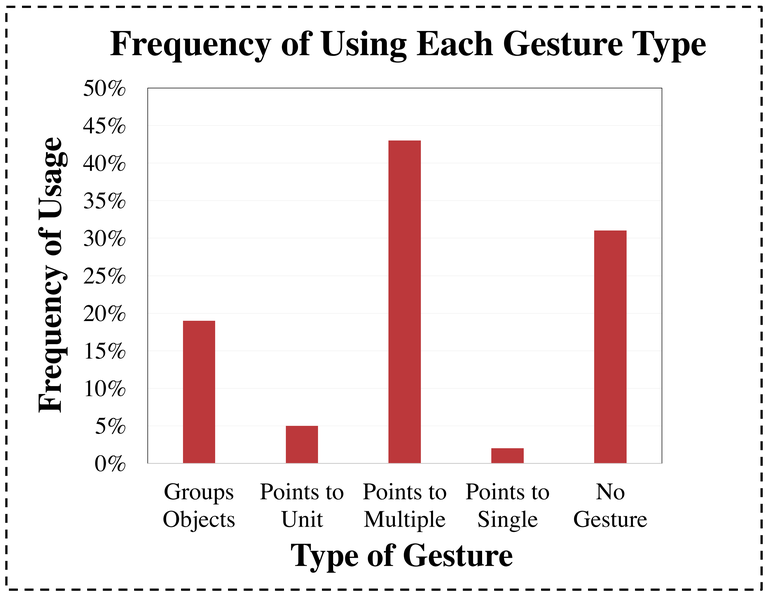
Groups Objects	Uses a single gesture to reference two objects simultaneously that share a feature
Points to Unit	Uses a gesture to explicitly reference a single unit (the part that repeats) within the pattern
Points to Multiple Objects	Points to every object in the pattern one at a time
Points to a Single Object	Points to a single object in the pattern
No Gesture	Does not gesture to any pattern object



Results

Baseline: Only 35% of children solved the baseline item correctly, and 48% did not gesture during explanation.

Target Problems: Across 9 items, average score was 53% (SD = 35%) and gestures used during ~70% explanations.



Correlations Between Frequency of Gesture Type and Percent Correct (controlling for age and baseline performance)

Gesture	*r*	*p*
Groups Objects	**.42**	**.007**
Points to Unit	.16	.329
Points to Multiple	-.28	.083
Points to Single	-.07	.677
No Gesture	-.04	.810

Conclusions

Five-year-old children exhibited moderate abilities to abstract a repeating pattern.

They varied in how they gestured toward their repeating patterns. The frequency of using a grouping gesture was positively related to performance. Grouping gestures may be an indicator of children's attention to structure.

Implications

The results in this study suggest that gesture indeed plays a profound role in thinking and learning about patterns.

Grouping gestures may align with cognitive representations that facilitate the recognition of structure in patterns. Future research should examine whether teaching children to gesture in this way facilitates their patterning performance.

References

- Burgoyne, K., Witteveen, K., Tolan, A., Malone, S., & Hulme, C. (2017). Pattern understanding: Relationships with arithmetic and reading development. *Child Development Perspectives, 11*(4), 239-244.
- Goldin-Meadow, S., & Beilock, S. L. (2010). Action's Influence on Thought: The Case of Gesture. *Perspectives on Psychological Science, 5(6)*, 664-74.