

# Music is Patterns!: Measuring Preschoolers' Pattern Knowledge through Both Auditory and Visual Approaches

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## INTRODUCTION

• Music is recommended as a beneficial experience for young children, as some consider it supportive of mathematical understanding (Geist, Geist, & Kuznik, 2012; Williams et al., 2015).

• One reason music may promote early math learning is because it exposes children in informal and applied ways to complex mathematical concepts, such as patterning in both visual and auditory formats.

• Visual pattern knowledge is increasingly being shown to be a critical component of mathematical cognition (Rittle-Johnson, Fyfe, Loehr, & Miller, 2015); however, in the domain of music and elsewhere, patterns can exist in audible formats as well. Young children's abilities to detect patterns in sound, and the extent to which this is associated with and compares to their abilities to understand visual patterns is unknown.

• Further, while early childhood teachers do patterning activities in their classrooms in the form of worksheets, it is unclear whether they can be used on their own to reliably assess children's knowledge of visual patterns.

• Knowing how children think about patterns may help us understand how they process and experience music, and make meaning of the world around them.

## RESEARCH AIMS

1. To more broadly measure early pattern knowledge in both visual and auditory formats.
2. Examine the association between children's success with visual and auditory patterns.
3. Determine if teacher-developed and utilized visual patterning activities can be used to reliably assess early pattern knowledge.

## METHODS

### Procedure

• Children's auditory and visual patterning skills were assessed in a single 30-minute one-on-one session with a trained research assistant.

### Participants

• Twenty-six 3- and 4-year old children (Mean age = 4 years, 8 months)

• 62% female

• Majority English-speaking and White

• Recruited from 3 private preschool centers and one university preschool in a mid-Atlantic city.

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## MEASURES

| Pattern Tasks |          |            |   |  |  |  |
|---------------|----------|------------|---|--|--|--|
| Task Type     | Item     | # of Items | Description   | Example  |  |  |
| Visual        | Extend   | 5          | Add to the end of the pattern sequence  |  |  |  |
|               | Complete | 3          | Provide missing items within the pattern                                      |  |  |  |
|               | Abstract | 2          | Create the same kind of pattern with completely different pictures            |  |  |  |
| Auditory      | Copy     | 2          | Repeat sound pattern from beginning   | "I'm going to make a pattern with these animal sounds. After I stop, can you keep my pattern going the same way I would? Moo – moo – baa – baa – moo – moo – baa – baa – moo."   |  |  |
|               | Extend   | 3          | Repeat sound pattern from the stopping point                                  | "I'm going to make a pattern with these animal sounds [Gesture to visual cue card]. After I stop, can you keep my pattern going the same way I would? Neigh – neigh – meow – neigh – neigh – meow – neigh."  |  |  |
|               | Abstract | 4          | Recreate the sound pattern using completely different sounds                  | "I'm going to use these animal sounds to make a pattern [Gesture to visual cue card.] Buzz and oink. After I stop, you're going to use these animal sounds. Baa and meow."   |  |  |
|               | Memory   | 2          | Recreate the sound pattern exactly as it was presented (same number of units) | "Now we're going to play a memory game and just use animal sounds, so try to remember my animal sound pattern exactly like you hear it, with the same number of sounds as mine. You'll use these animal sounds. [Place the visual cue card in front of the child.] I'm going to sing you my animal sound pattern now, and I want you to listen really carefully and then say the same pattern that I said, with the same number of animal sounds. Baa – oink – baa – oink – baa – oink." |  |  |

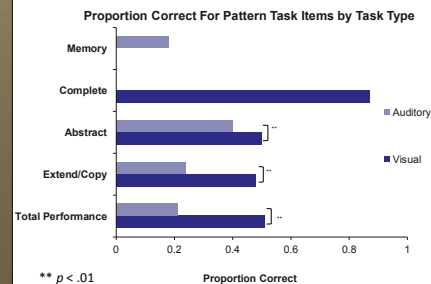
Visual pattern task response options were separate laminated cutouts of images relevant to each pattern item, as well as distractors.

Auditory pattern task items included images of animals on cards to prompt children to remember the animal sounds they were to use, as shown below.

All items were worth 1 point each.

## RESULTS

Reliability (Cronbach's Alpha)  
Sound pattern-  $\alpha = .70$   
Visual pattern-  $\alpha = .85$



| Correlations Among Pattern Measures and Item Types |       |                |             |          |
|--|-------|----------------|-------------|----------|
| Sound Pattern                                      |       | Visual Pattern |             |          |
|  |       | Total          | Extend/Copy | Abstract |
| Total  | .45*  | .42*           | .32         | .42*     |
| Extend/copy  | .55** | .51**          | .37         | .56**    |
| Abstract   | .32   | .32            | .32         | .26      |
| Memory   | .30   | .30            | .44*        | .29      |

\*\*  $p < .01$ , \*  $p < .05$

## RESULTS

- Children performed better on visual than auditory pattern tasks.
- However, both visual and auditory pattern measures proved to be reliable measures of children's pattern knowledge.
- Teacher worksheets were found to reliably assess children's visual pattern knowledge
- Children's visual and auditory pattern knowledge are moderately but significantly associated, with extend, copy items being the most strongly associated across task types.

## FUTURE DIRECTIONS

- Examine possible reasons for lower performance on sound pattern assessment (e.g., working memory demands or lack of visual aids).
- Combine teacher-made visual pattern measure with pre-existing research constructed visual pattern assessment.
- Examine how early music experiences predict children's pattern knowledge, and how children's pattern knowledge impacts the nature of their early experiences with music.

## KEY REFERENCES

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