

Children's Evaluations of Fraction Magnitudes in Strip Diagrams: Strip Lengths and Visible Segments Matter

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BACKGROUND & PURPOSE

Fractions

- Difficult for middle school students (Lortie-Forgues, Tian, & Siegler, 2015)
- Magnitude knowledge strongly associated with math achievement, even controlling for fraction arithmetic (Siegler et al., 2012)

Strip Diagrams

- Commonly used to teach fractions (Murata, 2008)
- Kindergarten to grade 4 students perform less well on magnitude comparison with discrete vs. continuous diagrams (Boyer et al., 2008)

Research Questions

Do children perform better at magnitude comparison with:

- *continuous* strips than with *discrete* ones?
- *same* length strips than with *different* length strips?

Can eye tracking data provide insights into the performance differences?

METHOD

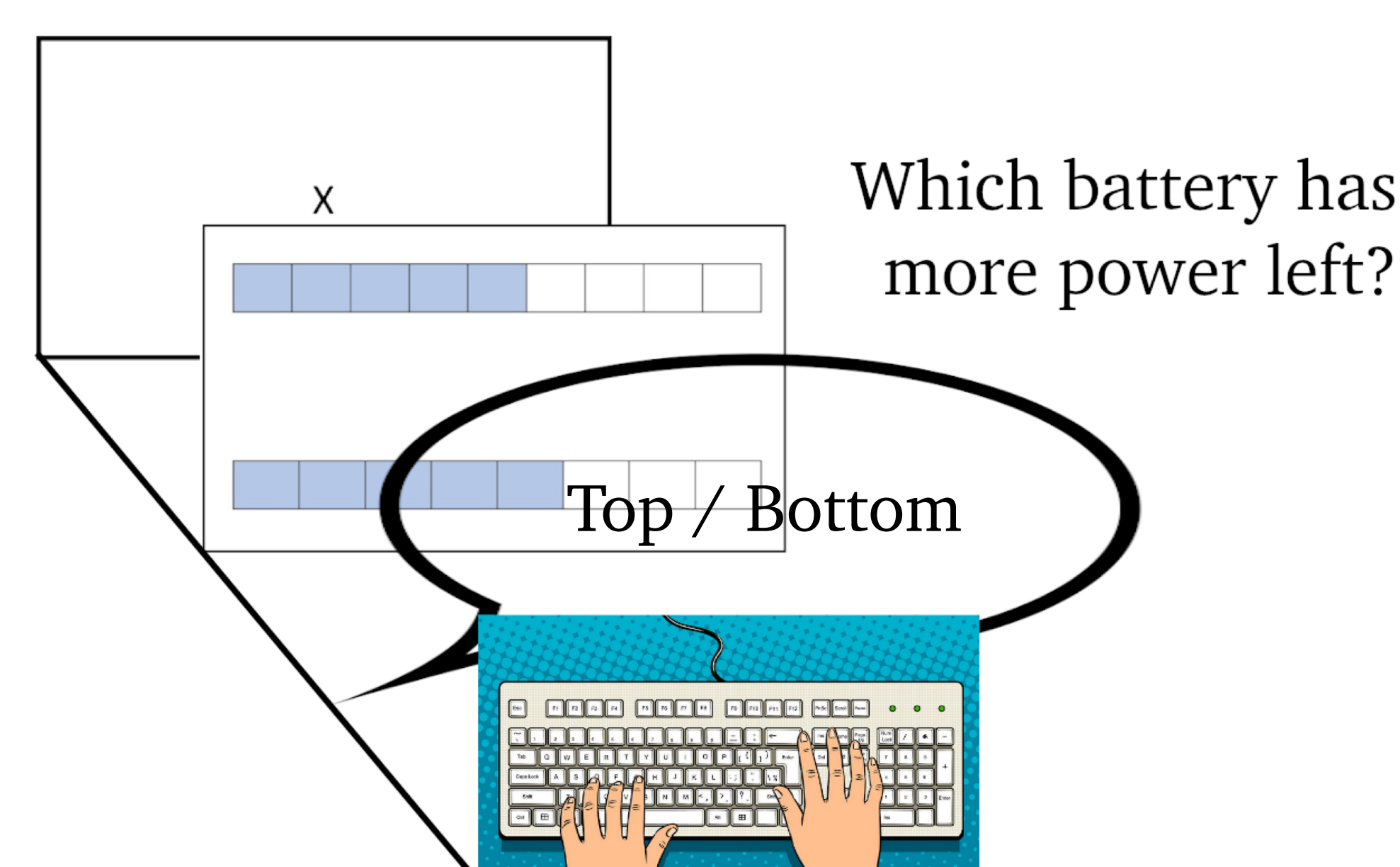
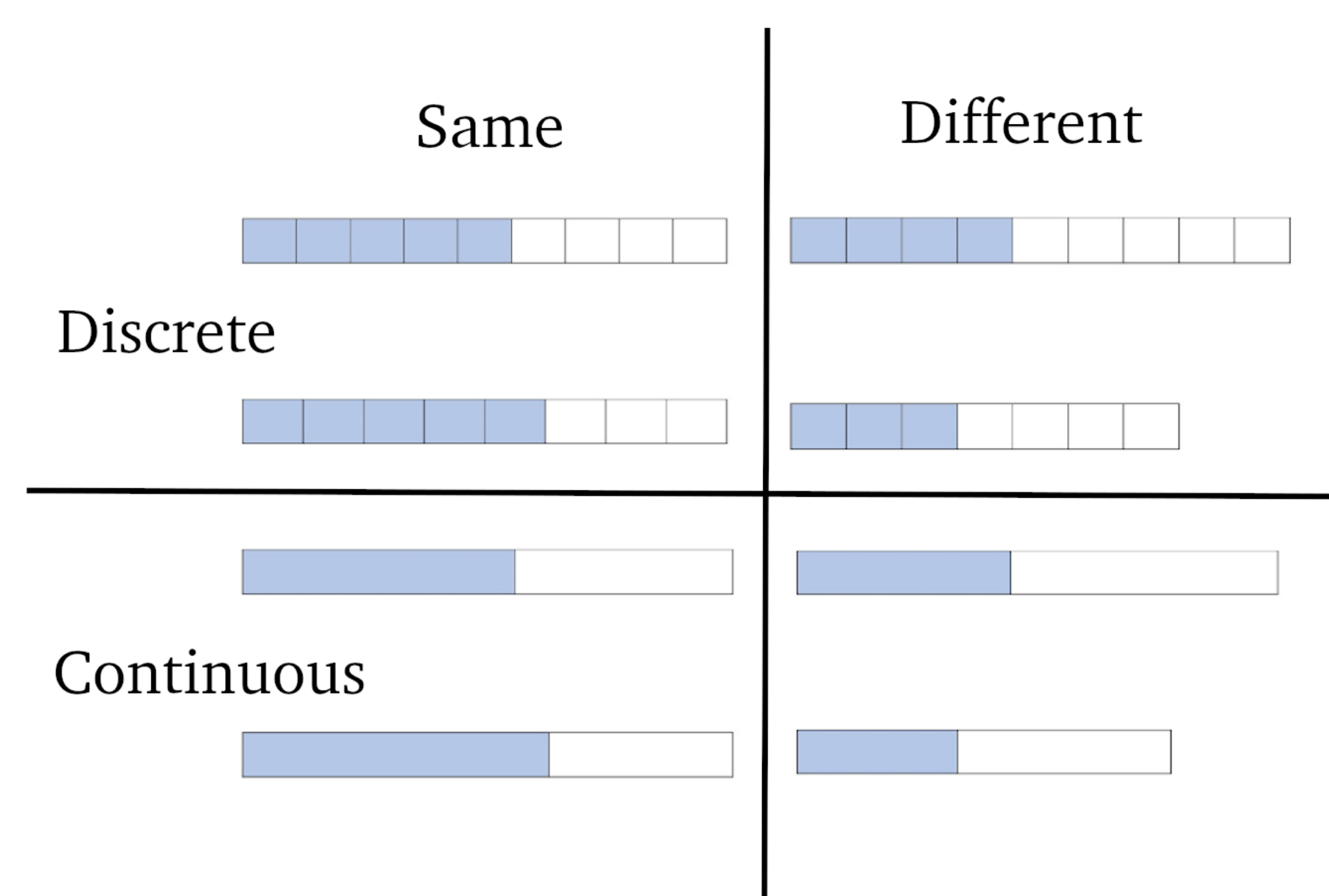
Participants: N= 22; grades 4-6; 12M, 10F

Procedure: Children performed fraction magnitude comparisons; eye movements were recorded

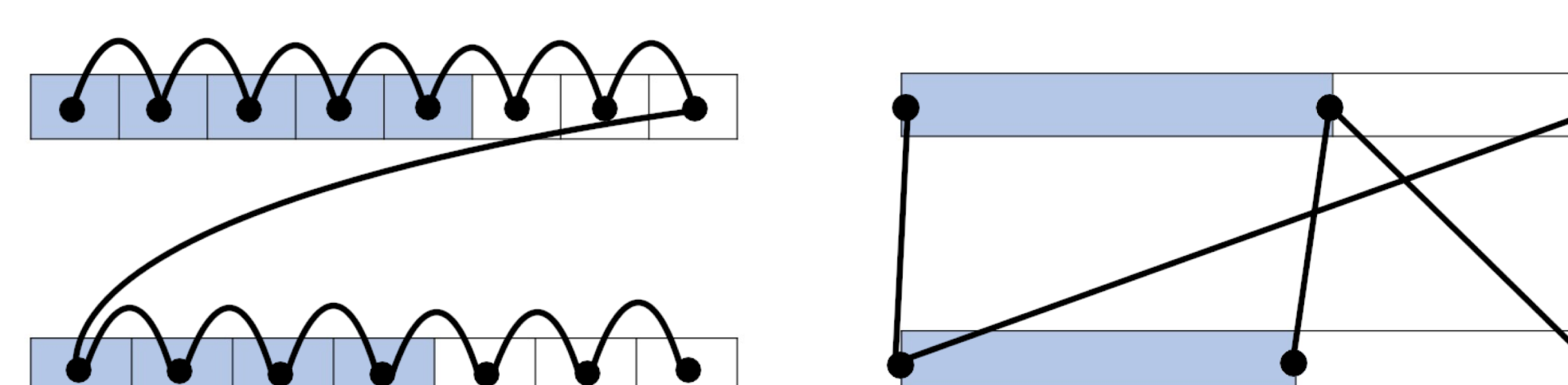
Stimuli: 48 trials, half with segments marked (discrete), half with same length strips

Measures: Accuracy, reaction time, eye tracking data

STIMULI & PROCEDURE



Hypothesized saccade patterns



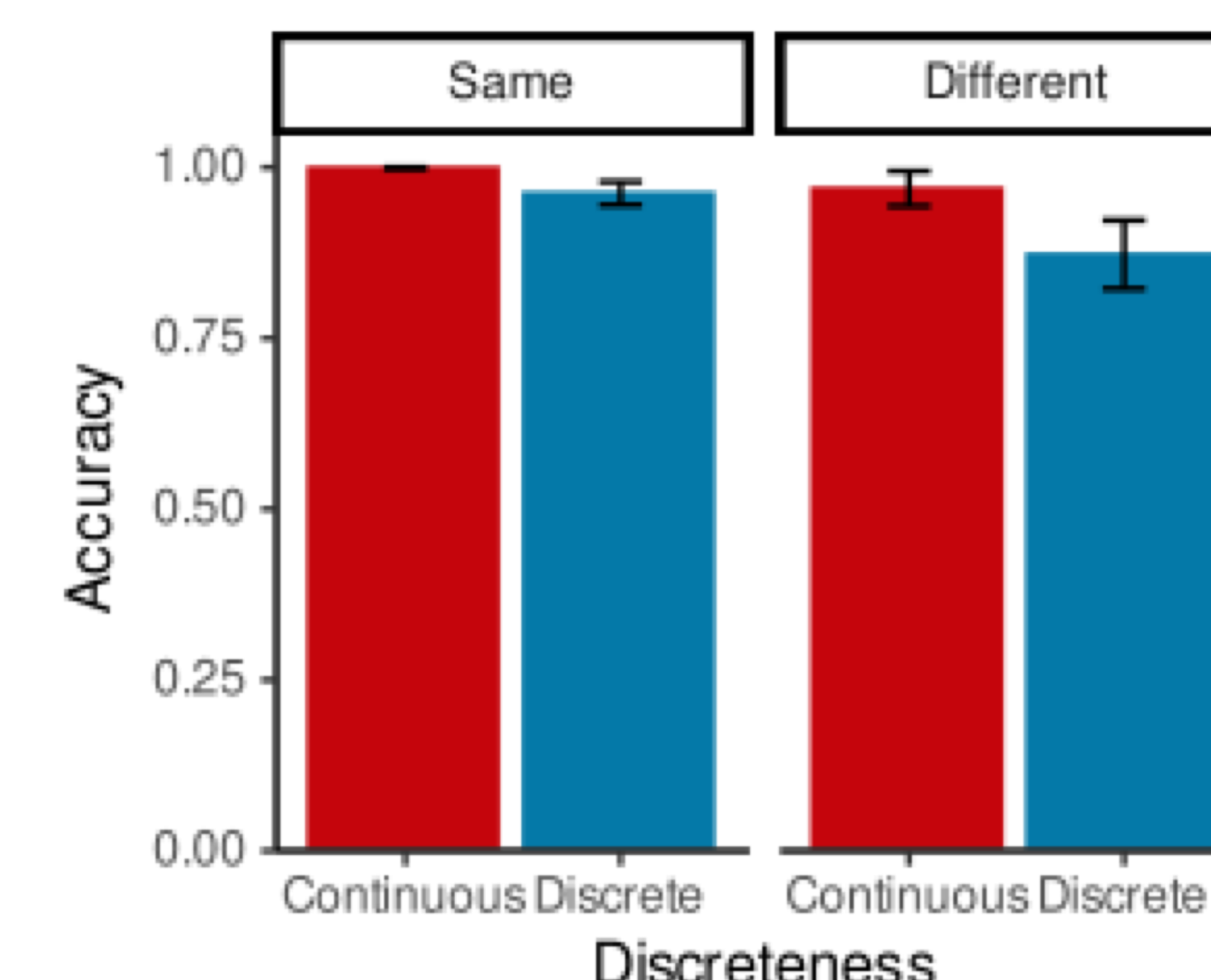
Analysis: Linear Mixed Effects Model

Fixed Effects:

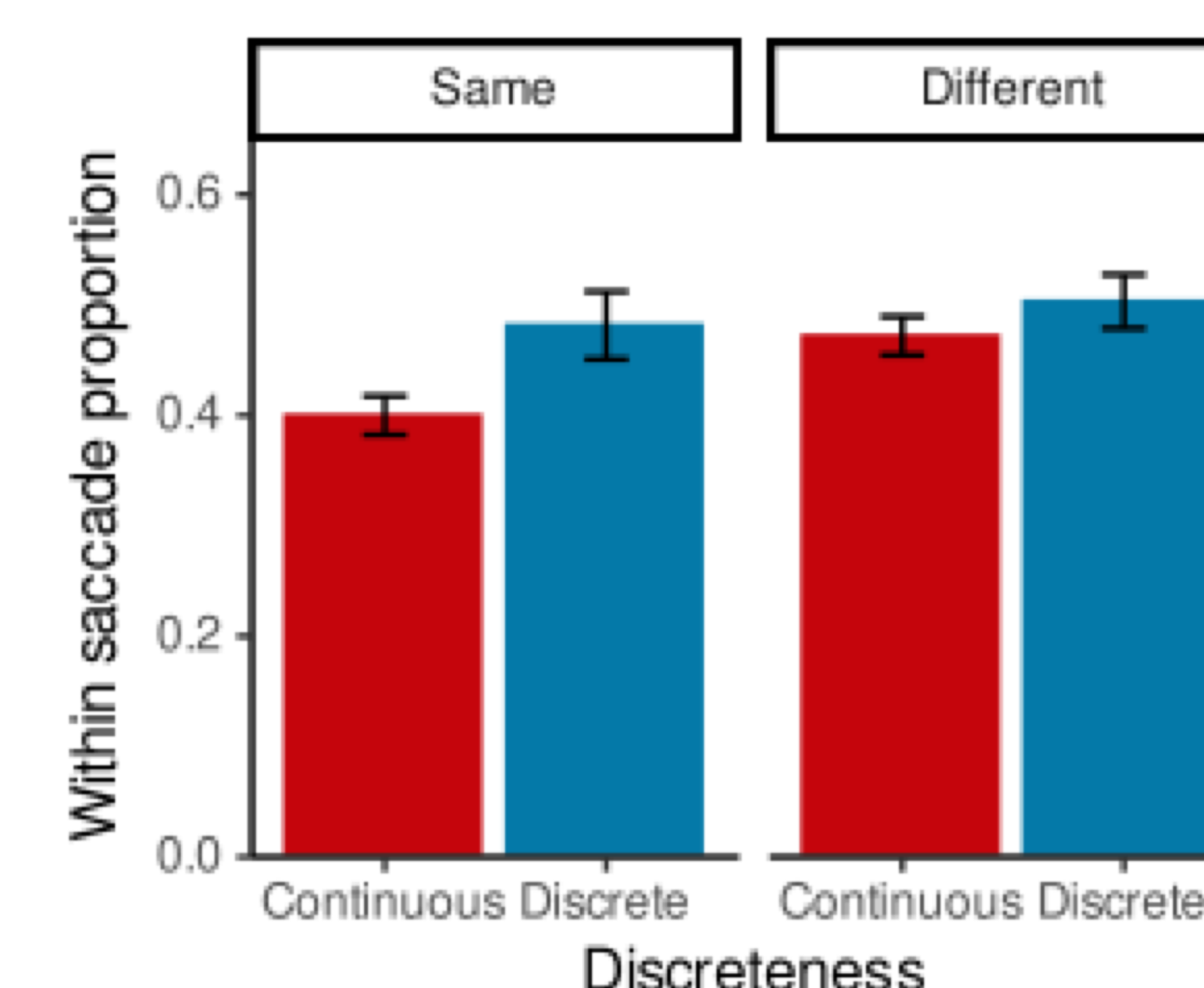
- Discreteness (continuous, discrete)
- Length (same, different)
- Length congruency (is longer bar larger fraction? yes, no)
- Magnitude difference
- Grade level
- Interactions of discreteness * length and discreteness * magnitude difference

Random Effects: Participant, Item

RESULTS



- Significant interaction of discreteness * length, $p = .03$
- Main effect of discreteness, $p = .004$, interaction with magnitude difference, $p = .02$
- Main effect of length, $p < .001$



- Significant interaction of discreteness * length, $p = .04$
- Main effect of discreteness *not signif.*, $p = .051$
- Main effect of length, $p = .002$

DISCUSSION

- Same-length trials allow comparison of shaded portions; different-length trials require mental stretching/squishing or computation with segments
- Discrete trials may have fostered counting strategies