

# **Developmental changes in childrens processing of nonsymbolic ratio magnitudes: A cross-sectional fMRI study**

**Yunji Park**

University of Wisconsin - Madison, Madison, Wisconsin, United States

**John Binzak**

University of Wisconsin - Madison, Madison, Wisconsin, United States

**Elizabeth Toomarian**

University of Wisconsin-Madison, Madison, Wisconsin, United States

**Priya Kalra**

University of Wisconsin, Madison, Wisconsin, United States

**Percival Matthews**

University of Wisconsin - Madison, Madison, Wisconsin, United States

**Edward Hubbard**

University of Wisconsin-Madison, Madison, Wisconsin, United States

## **Abstract**

A growing number of studies has revealed that humans and nonhuman animals have the ability to process magnitudes of nonsymbolic ratios. Lewis, Mathews & Hubbard (2015) hypothesized that this ability may depend on a ratio processing system (RPS) that may help acquire symbolic fractions knowledge. The present study investigated ratio processing in 2nd and 5th graders using functional MRI. In the scanner, children decided which of two ratios was numerically larger. The stimuli were constructed as pairs of nonsymbolic line ratios, symbolic fractions, and mixed notations. Both 2nd and 5th graders showed the distance effect the behavioral performance and the neural activation were modulated by the numerical distance between two ratios. Notably, 5th graders showed greater neural distance effect and more overlaps in activation across notations when compared to 2nd graders. These results suggest that educational experience might promote recruitment of the RPS for processing symbolic fractions as well.