Postdoctoral Position – Educational Neuroscience and Cognitive Development of Mathematics

We are seeking a Postdoctoral Research Associate to work on the Longitudinal Analysis of Mathematical Brain Development and Abilities (LAMBDA) project – a longitudinal behavioral and fMRI study of fractions processing at the University of Wisconsin-Madison (PI Edward Hubbard; Co-PI Percival Matthews) currently in its third year. This is a 2-year appointment that will begin in the summer of 2019, with the possibility of extension for a third.

**Title:** Research Associate
**Salary:** $48,432 (minimum)
**Deadline Date:** Until filled; review of applications will begin April 15, 2019
**Start Date:** TB/d
**Contact:** Mia Prifti – prifti@wisc.edu

A PhD in Psychology, Cognitive Science, Neuroscience or a related field is required. Experience with neuroimaging analysis programs (e.g., AFNI, FSL, SPM, or other relevant programs), stimulus presentation programs (e.g., E-prime, Presentation, Cogent/Psychtoolbox [MATLAB]), and statistical analysis (e.g., MATLAB, R, SPSS) is required.

The ideal candidate will have a background in neuroimaging of numerical and mathematical cognition, and especially working with imaging in developmental populations. Excellent scientific writing skills and strong publication records are highly desired. Applicants should be able to work independently and with minimal supervision, but should also demonstrate interpersonal skills and an interest in working collaboratively.

To apply, please send a letter of interest describing graduate training and research interests, a CV, two representative publications and the names and contact information for three potential references, via email to Mia Prifti at prifti@wisc.edu. Please note "Postdoc Inquiry" in the subject line.

More information can be found at the following links:
EdNeuroLab (Hubbard): https://web.education.wisc.edu/edneurolab/
LAMBDA Website: https://web.education.wisc.edu/lambda/
MELD Lab (Matthews): http://website.education.wisc.edu/pmatthews/

**Project Summary:**
Mathematical competence is an important determinant of life chances in modern society, and knowledge of fractions is a foundational skill for establishing mathematical competence. Despite the importance of fraction knowledge, children and adults often encounter considerable difficulties understanding fractions. To explain these widespread difficulties, many researchers have argued for an innate constraints account. They propose that fractions are difficult because they do not correspond to any preexisting categories in our brain, unlike whole numbers, which correspond to sets of countable things. Thus, they argue fractions concepts are challenging because they do not benefit from existing cognitive abilities and instead must be learned through adapting children's whole number understanding.

The study team is investigating a competing hypothesis, the cognitive primitives account, which integrates findings from neuroscience, developmental psychology and education. We argue that a primitive cognitive architecture that we dub the ratio processing system (RPS) is tuned to the

processing of non-symbolic fractions—such as the relative length of two lines or the relative area of two figures—and is present even before formal instruction. On this view, children are equipped with cognitive mechanisms that support fractions concepts in the same way that the ability to process countable sets equips them to learn about whole numbers.

To test the predictions of these competing hypotheses, we have been following two cohorts of children longitudinally (2nd graders until 5th grade and 5th graders until 8th grade; currently in Year 3, so children are in $3^{rd}/4^{th}$ and $6^{th}/7^{th}$ grade) using behavioral and brain imaging methods to (a) trace the development of non-symbolic fraction processing abilities, (b) determine how symbolic fraction knowledge relates to these abilities and (c) investigate whether individual differences in the RPS predict later math achievement. To test whether the acuity or recruitment of these non-symbolic architectures plays a role in difficulties with fractions as well as general math learning difficulties, the study team will compare the behavioral performance and neural activity on a battery of cognitive tasks.

This research has important implications for our understanding of number processing and for designing educational practices that are optimal for fraction learning. Improving fractions understanding would help children to clear a critical hurdle in the acquisition of higher-order mathematical competencies that impact educational, employment, and even health outcomes. If cognitive primitives for non-symbolic fractions can provide a foundation for the acquisition of symbolic fraction ability, then instruction should attempt to recruit these primitives. If deficits in these primitives contribute to math learning difficulties, then screening should include measures of non-symbolic abilities and interventions should be designed to address these abilities.