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Department of Educational Psychology  
University of Wisconsin-Madison  
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## **EDUCATION**

2010 Ph.D., Psychology, Vanderbilt University, Nashville, TN  
2008 M.A., Psychology, Vanderbilt University, Nashville, TN  
2001 M.A., Political Science, University of Chicago, Chicago, IL  
1997 B.A., Physics, Harvard University, Cambridge, MA

## **ACADEMIC POSITIONS**

Fall 2012 – Assistant Professor  
Department of Educational Psychology  
University of Wisconsin-Madison

Summer 2010 – Fall 2012 Postdoctoral Researcher  
Moreau Postdoctoral Fellowship  
Department of Psychology  
University of Notre Dame

## **HONORS AND AWARDS**

Moreau Academic Diversity Postdoctoral Fellowship, one of ten competitive two-year postdoctoral appointments awarded by the Provost of The University of Notre Dame, 2010-2012

Hardy Culver Wilcoxon Award, presented by the Peabody College Department of Psychology and Human Development to the graduate student with the most distinguished doctoral dissertation in any area of Psychological Inquiry, 2010.

Julius Seeman Award, presented by the Peabody College Department of Psychology and Human Development to the graduate who exemplifies the department's ideals of scholastic, personal and professional achievement, 2009.

Student Travel Award, Society for Research in Child Development, April 2009.

Vanderbilt University Provost Fellowship, September 2005.

## **ARTICLES IN REFEREED JOURNALS**

Sidney, P. G., Thompson, C. A., Matthews, P. G. & Hubbard, E. M. (accepted). From continuous magnitudes to symbolic numbers: The centrality of ratio. *Behavioral and Brain Sciences*.

Matthews, P.G., & Hubbard, E. M. (2016). Making space for spatial proportions: Commentary for special issue. *Journal of Learning Disabilities*.

Matthews, P. G., & Lewis, M. R. (2016). Fractions we can't ignore: The ratio congruity effect. *Cognitive Science*. Advance online publication. doi: 10.1111/cogs.12419

Hubbard, E. M., Matthews, P.G., & Samek, A. S. (2016). Using online compound interest tools to improve financial literacy, *The Journal of Economic Education*, 47, 106-120.

Matthews, P. G., Lewis M. R., & Hubbard, E. M. (2016). Individual differences in nonsymbolic ratio processing predict symbolic math performance. *Psychological Science*, 27(2), 191-202.. doi: 10.1177/0956797615617799

+ Featured in Psychology Today: <https://www.psychologytoday.com/blog/finding-the-next-einstein/201601/do-humans-have-basic-capacity-understand-fractions>

- Matthews, P. G., & Chesney, D. L. (2015). Fractions as percepts? Exploring cross-format distance effects for fractional magnitudes. *Cognitive psychology*, 78, 28-56.
- Byrd, C. E., McNeil, N. M., Chesney, D. L., & Matthews, P. G. (2015). A specific misconception of the equal sign acts as a barrier to children's learning of early algebra. *Learning and Individual Differences*, 38, 61-67.
- Chesney, D. L., McNeil, N. M., Matthews, P. G., Byrd, C. E., Petersen, L. A., Wheeler, M. C., ... & Dunwiddie, A. E. (2014). Organization matters: Mental organization of addition knowledge relates to understanding math equivalence in symbolic form. *Cognitive Development*, 30, 30-46.
- Chesney, D. L., & Matthews, P. G. (2013). Knowledge on the line: Manipulating beliefs about the magnitudes of symbolic numbers affects the linearity of line estimation tasks. *Psychonomic Bulletin & Review*, 1-8.
- McNeil, N. M., Chesney, D. L., Matthews, P. G., Fyfe, E. R., Petersen, L. A., Dunwiddie, A. E., & Wheeler, M. C. (2012). It pays to be organized: Organizing arithmetic practice around equivalent values facilitates understanding of math equivalence. *Journal of Educational Psychology*, 104(4), 1109.
- Matthews, P.G., Rittle-Johnson, B., McEldoon, K., & Taylor, R. (2012). Measure for measure: What combining diverse measures reveals about children's understanding of the equal sign as an indicator of mathematical equality. *Journal for Research in Mathematics Education*, 43(3), 316-350.
- Rittle-Johnson, B., Matthews, P. G., Taylor, R. S., & McEldoon, K. L. (2011). Assessing knowledge of mathematical equivalence: A construct-modeling approach. *Journal of Educational Psychology*, 103(1), 85.
- Matthews, P.G., & Rittle-Johnson, B. (2009). In pursuit of knowledge: Comparing self-explanations, concepts, and procedures as pedagogical tools. *Journal of experimental child psychology*, 104(1), 1-21.

## **BOOK CHAPTERS & CONFERENCE PROCEEDINGS**

- Matthews, P. G., Meng, R., Toomarian, E. Y. & Hubbard, E. M. (August, 2016). *The Relational SNARC: Spatial representation of nonsymbolic ratios?* In A. Papafragou, D. Grodner, D. Mirman & J. C. Trueswell (eds.), *Proceedings of the 38th Annual Conference of the Cognitive Science Society* (pp. 2651-2656). Philadelphia, PA: Cognitive Science Society.
- Lewis, M.R., Matthews, P. G., & Hubbard, E. M. (2015). The non-symbolic foundations of fraction understanding. In D. B. Berch, D. C. Geary, & K. Mann Koepke (Eds.), *Development of mathematical cognition: Neural substrates and genetic influences*. San Diego, CA: Academic Press.
- Ziols, R. & Matthews, P.G. (2015). Exploring a 'Not-So-Common' Common Fraction Representation. In T. G. Bartell, T. G., Bieda, K. N., Putnam, R. T., Bradfield, K., & Dominguez, H. (Eds.), *Proceedings of the 37th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. East Lansing, MI: Michigan State University.
- Matthews, P.G., Chesney, D.L., & McNeil, N.M. (2014). Are Fractions Natural Numbers Too? In P. Bello P., Guarini M., McShane M. & Scassellati B. (Eds.) *Proceedings of the 36th Annual Conference of the Cognitive Science Society* (pp. 982-987). Austin TX: Cognitive Science Society.
- Lewis, M.R., Matthews, P.G., & Hubbard, E. M. (2014). The neurocognitive roots of fraction knowledge. In P. Bello, M. Guarini, M. McShane, & B. Scassellati (Eds.), *Proceedings of the*

*36th Annual Conference of the Cognitive Science Society* (pp. 2549-2554) Austin, TX: Cognitive Science Society.

Matthews, P. G. & Chesney, D. L. (2011). Straightening Up: Number Line Estimates Shift from Log to Linear with Additional Information. In L. Carlson, C. Hölscher, & T. Shipley (Eds.), *Proceedings of the 33rd Annual Conference of the Cognitive Science Society* (pp. 1936-1941). Boston, MA: Cognitive Science Society.

Matthews, P. G. & Rittle-Johnson, B. (2007). To teach by concept or by procedure? Making the Most of Self-Explanations. In D. S. McNamara & J. G. Trafton (Eds.), *Proceedings of the 29th Annual Meeting of the Cognitive Sciences Society* (pp. 1283-1288). Nashville, TN: Cognitive Science Society.

## **MANUSCRIPTS UNDER REVIEW**

Binzak, J. V., Matthews, P. G., & Hubbard, E. M. (revisions invited). No Calculation Necessary: Accessing the Magnitude of Fractions and Decimals. *Cognition*.

Ziols, R. & Matthews, P. G. (under review). What's Perception got to do with it? Re-framing Foundations for Rational Numbers. *Journal for Research in Mathematics Education*.

Matthews, P. G. & Ellis, A. B. (under review). Natural Alternatives to Natural Number: The Case of Ratio. *Journal of Numerical Cognition*.

Fyfe, E. R., Matthews, P. G., Amsel, E., McEldoon, K. L., and McNeil, N. M. (revisions invited). Knowledge of math equivalence beyond elementary school. *Journal of Educational Psychology*.

Rau, M. A. & Matthews, P. G. (revisions invited). How to Make 'More' Better? Principles for Effective Use of Multiple Representations to Enhance Students' Learning about Fractions. *ZDM*

## **CONFERENCE PRESENTATIONS**

Ziols, R. & Matthews, P.G. (2016). Beyond comparison and counting: What A "sense of proportion" might mean for mathematics education. Talk presented at the 13<sup>th</sup> International Congress on Mathematical Education, Hamburg, Germany.

Meng, R., Matthews, P. G., Toomarian, E. Y., & Hubbard, E. M. (July 2016). *The relational SNARC: Spatial representation of nonsymbolic ratios?* Paper presented at the 4<sup>th</sup> Annual Midwest Meeting on Mathematical Thinking, Madison, WI.

Binzak, J. V., Toomarian, E. Y., Matthews, P. G., & Hubbard, E. M. (July 2016). *New computer and tablet-based programs for exploring links between nonsymbolic ratio processing and symbolic fractions knowledge.* Poster presented at the 4<sup>th</sup> Annual Midwest Meeting on Mathematical Thinking, Madison, WI.

Leatham, K. R., Matthews, P. G., Cai, J. & Langrall, C. W. (April, 2016). *The Role of Theoretical Frameworks in Research Dissemination.* Talk presented at the Annual Research Conference of National Council of Teachers of Mathematics, San Francisco, CA.

Matthews, P. G. (August, 2015) *The ratio processing system: A developmental approach* . Paper presented at the 3<sup>rd</sup> annual Midwest Meeting on Mathematical Thinking, Minneapolis, MN.

Hopkins, R. C., & Matthews, P. G. (August, 2015). *Adult differences in fraction knowledge: Measuring reasoning with problem-solving strategies.* Poster presented at the 3<sup>rd</sup> annual Midwest Meeting on Mathematical Thinking, Minneapolis, MN.

Matthews, P. G. (March 2015). *Delimiting and Leveraging Children's Natural Sense of Proportion.* Poster presented at the Biennial Meeting of the Society for Research in Child Development (SRCD), Philadelphia, PA.

Matthews, P. G. (April 2015). An Alternative Route to Fractions Knowledge. In P.G. Matthews & C. Williams (Chairs), *Fractions Learning: One Subject, Multiple Perspectives.* Symposium conducted at the meeting of the American Educational Research Association, Chicago.

Hubbard, E. M., Matthews, P.G., & Samek, A. S. (January, 2015). Using Interactive Compound

- Interest Visualizations to Improve Financial Literacy. Paper presented at the annual Meeting of the American Economic Association, Boston, MA.
- Matthews, P. G. (July, 2014) *The perceptual roots of fraction knowledge: Foundations for understanding magnitude*. Paper presented at the 2<sup>nd</sup> Annual Midwest Meeting on Mathematical Thinking, Madison, WI.
- Lewis, M. R., Matthews, P. G., & Hubbard, E. M. (July, 2014). *The perceptual roots of fraction knowledge: A neurocognitive approach*. Paper presented at the 2<sup>nd</sup> annual Midwest Meeting on Mathematical Thinking, Madison, WI.
- Ziols, R., Matthews, P.G., <sup>P</sup> Lewis, M.R., <sup>S</sup>Toomarian, E.Y. & <sup>S</sup>Hubbard, E.M. (July, 2014). *Refining fraction constructs: An exploratory study of preference and generalization*. 2<sup>nd</sup> Annual Midwest Meeting on Mathematical Thinking. Madison, WI.
- Lewis, M.R., Matthews, P.G. & Hubbard, E.M. (May, 2014). *The "Rational Brain System" and fraction learning*. NICHD Mathematical Cognition Conference, Washington, DC.
- Matthews, P. G. (July, 2013). *Perhaps fractions are natural numbers too: A rational approach to number sense*. Paper presented at 1st annual Midwest Meeting on Mathematical Thinking, Minneapolis, MN.
- Lewis, M.R., Matthews, P. G., & Hubbard, E. M. (July, 2013). *Mappings between nonsymbolic ratios and arabic fractions*. Poster presented at the 1st annual Midwest Meeting on Mathematical Thinking, Minneapolis, MN.
- Matthews, P. G. (June, 2013). *Evaluating the interpretation of number line estimation tasks*. Paper presented at a symposium co-organized by P.G. Matthews and E. Amsel on Developmental and Instructional issues in mathematical reasoning, at the 2013 Annual Meeting of the Jean Piaget Society, Chicago, IL.
- Bryd, C. E., McNeil, N. M., Chesney, D. L., Matthews, P. G. (April, 2013). *Children's "arithmetic-specific" interpretation of the equal sign constitutes risk for poor learning of early algebra*. Poster presented at the Biennial Meeting of the Society for Research in Child Development (SRCD), Seattle, WA.
- Chesney, D. L., McNeil, N. M., Matthews, P. G., Bryd, C. E., Petersen, L. A., Wheeler, M. C., Fyfe, E. R., & Dunwiddie, A. E. (April, 2013). *Organization matters: Children's mental organization of arithmetic knowledge correlates with understanding of math equivalence*. In B. Rittle-Johnson (Chair), Representation, Concepts, and Problem-Solving: Mathematics. Paper symposium presented at the Biennial Meeting of the Society for Research in Child Development (SRCD), Seattle, WA.
- Chesney, D. L., Matthews, P. G., & McNeil, N. M. (May, 2013). *Fraction format affects adults' performance on magnitude comparison problems*. Poster presented at the annual convention for the Association for Psychological Sciences, Washington, D.C.
- Chesney, D. L. & Matthews, P. G. (May, 2012). *Proportions on the Line: Line Estimation Tasks Are Proportion Judgment Tasks*. Poster presented at the annual convention for the Association for Psychological Sciences, Chicago, Illinois.
- Matthews, P. G., Rittle-Johnson, B., Taylor, R. T., & McEldoon, K. L. (April, 2011). *Understanding the equals sign as a gateway to algebraic thinking*. Poster presented at the 2011 Biennial Meeting of the Society for Research in Child Development, Montreal.
- Matthews, P. G. (August, 2010). *Are Hindu-Arabic Numerals Concrete or Abstract Symbols?* Poster presented at the 32nd Annual Conference of the Cognitive Science Society. Portland, OR.

- Rittle-Johnson, B., Matthews, P. G., Taylor, R. T., & McEldoon, K. L. (March, 2010). *Understanding the Equals Sign as a Gateway to Algebraic Thinking*. Paper presented at a symposium conducted at the 2010 Conference of the Society for Research in Educational Effectiveness. Washington, DC.
- Matthews, P. G. & Rittle-Johnson, B. (April, 2009). *Dual Dimensions for Concreteness?* Paper presented at a symposium chaired by P.G. Matthews on Unpacking concreteness – understanding how symbol choice affects learning and transfer, at the 2009 Biennial Meeting of the Society for Research in Child Development, Denver, CO.
- Rittle-Johnson, B., Matthews, P. G. & Saylor, M. M. (April, 2009). *Promoting explanations to support mathematics learning*. Paper presented at a symposium held at the 2009 Biennial Meeting of the Society for Research in Child Development, Denver, CO.
- Taylor, R. S., Rittle-Johnson, B., Matthews, P. G. & McEldoon, K. L. (March, 2009). *Mapping children's understanding of mathematical equivalence*. Paper presented at a symposium conducted at the 2009 Conference of the Society for Research in Educational Effectiveness. Crystal City, VA.
- Matthews, P. G. & Rittle-Johnson, B. (June, 2008). *In search of transfer: Concrete may lay a weak foundation*. Poster presented at the 2008 Institute of Education Sciences Research Conference. Washington, D.C.
- Go, S. C., Matthews, P. G., Rittle-Johnson, B., & Carr, T. H. (November, 2007). *When adults think like kids about equality: schema activation and time pressure in mathematical problem solving*. Paper presented at the 2007 Annual Meeting of the Psychonomic Society. Long Beach, CA.
- Matthews, P. G., & Rittle-Johnson, B. (June, 2007). *Concepts or procedures? Making the most of self-explanations*. Poster presented at the 2007 Institute of Education Sciences Research Conference. Washington, D.C.
- Matthews, P. G., & Rittle-Johnson, B. (April, 2007). *Concepts or procedures? Optimizing the use of self-explanations to Correct Misconceptions*. Paper presented at a symposium conducted at the 2007 Biennial Meeting of the Society for Research in Child Development, Boston, MA.
- Cordray, D. S., Hurley, S. M., & Matthews, P. G. (April, 2006). *The ExpERT Program*. Poster presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA.

## **CONFERENCE ORGANIZING RESPONSIBILITIES**

- Co-host with Sashank Varma and Edward Hubbard (July, 2016). 4<sup>th</sup> Annual Midwest Meeting on Mathematical Thinking, Madison, WI.
- Co-organizer with Sashank Varma and Edward Hubbard (August, 2015). 3<sup>rd</sup> Annual Midwest Meeting on Mathematical Thinking, Minneapolis, MN.
- Co-host with Sashank Varma and Edward Hubbard (July, 2014). 2<sup>nd</sup> Annual Midwest Meeting on Mathematical Thinking, Madison, WI.
- Co-organizer with Sashank Varma (July, 2013). 1<sup>st</sup> Annual Midwest Meeting on Mathematical Thinking, Minneapolis, MN.

## **EXTRAMURAL RESEARCH SUPPORT**

### Current

- NIH R01 Grant HD088585: Perceptual and Cognitive Mechanisms of Developing Fractions Knowledge: A Cross-Sequential Approach, PI (Multi-PI model with Edward Hubbard, \$1,878,053, 2016-2021)
- NSF REAL Grant #1420211: Using Nonsymbolic Ratios to Promote Fraction Knowledge: A Neurocognitive Approach, co-PI (\$499,997, 2014 - 2017).

NIH R03 Grant HD081087: Delimiting and Leveraging Children's Natural Sense of Proportion, PI (\$150,500, 2014 - 2016).

NSF DGE Grant # 1545481: LUCID: A project-focused cross-disciplinary graduate training program for data-enabled research in human and machine learning and teaching, co-I (\$2,999,767, 2015 – 2020).

## **TEACHING**

Ed Psych 331, Development – Childhood through Adolescence, University of Wisconsin-Madison

Ed Psych 506, Exploring the Number Sense, University of Wisconsin-Madison

Ed Psych 925, The Development of Mathematical Thinking, University of Wisconsin-Madison

Psy 301, Experimental Psychology I: Statistics, University of Notre Dame

Social Sciences 151, Classics of Social and Political Thought, University of Chicago

Social Sciences 152, Classics of Social and Political Thought, University of Chicago

## **MENTORING**

UW Undergraduate Research Scholar advisees

Brian Brito (2012), Catherine Finedore (2012), Kimberley Lense (2015), Sai Xiong (2016)

Mentor for 20 University of Wisconsin Undergraduate Research Assistants

Doctoral Advisor for Ronald Hopkins (Fall 2014 – Present), Rui Meng (Fall 2015 – Present), Yunji Park (Fall 2016 – Present), and Sarah Lord (Fall 2016 – Present, C&I Student)

Mentor for Chancellor's Scholar Denzel Bibbs (Fall 2014 – Present)

Masters and Prelim Committee Member for Hsun-yu Chan (2012), Jichan Kim (2014), Andrea Donovan (2014), Ryan Ziols (2015), Yorel Lashley (2016) Hannah Kang (2016) Elizabeth Toomarian (2016), John Binzak (2016), and Sarah Brown (2016).

Dissertation Committee Member for Noelle Crooks (Psychology, 2014), Pooja Sidney (Psychology, 2016), Jichan Kim (Educational Psychology), Sonia Ibarra (Curriculum and Instruction, 2015), Fatih Dogan (Curriculum and instruction, 2015), and Natalia Bailey (Curriculum and Instruction).

## **PROFESSIONAL SERVICE**

Editorial Board Member for Journal of Research in Mathematics Education (Spring 2014 – Present)

Ad hoc reviewer for Acta Psychologica; American Educational Research Association; AERA Open; British Journal of Developmental Psychology; Canadian Journal of Experimental Psychology; Child Development; Cognitive Science Society; Cognitive Science; Cognitive Development; Developmental Psychology; Developmental Science; Frontiers in Psychology; IES ad-hoc panel reviewer; Instructional Science; Journal of Cognition and Development; Journal of Cognition and Instruction; Journal of Educational Psychology; Journal of Experimental Child Psychology; Journal of Experimental Psychology: Applied; Journal of Experimental Psychology, Learning Memory and Cognition; Journal of Learning and Individual Differences; Journal of Learning and Instruction; Journal of Numerical Cognition; Journal of Research on Educational Effectiveness; Journal for Research in Mathematics Education; Journal of Urban Mathematics Education; Memory & Cognition; NIH ad-hoc panel reviewer; NSF ad-hoc panel reviewer; Research in Mathematics Education; Science; SRCD

## **DEPARTMENTAL AND UNIVERSITY SERVICE**

Departmental Recruitment, Admissions, Fellowships, and Awards Committee (Fall 2014 - Present)

Departmental Delegate to the University Senate (Fall 2014 - Present)

Coordinating Committee Member for Wisconsin Ideas in Education Series (Spring 2014 – Fall 2015)

Departmental Faculty and Staff Honors Committee (Fall 2013 – Spring 2014)

Departmental Student Affairs Committee (Fall 2012 – Spring 2013)

**SPECIAL INVITATIONS**

White House Office of Science and Technology Policy (OSTP) Workshop: Bridging Neuroscience and Learning (January, 2015)

NICHHD Third Annual Math Cognition Conference: Typical and Atypical Learning of Complex Arithmetic Skills and Higher-Order Math Concepts (May 2015)

SESAME Workshop, UC Berkeley (March 7, 2016). An Eye for Ratio Processing: A Perceptual Route to Relational Thinking?