

## Melissa-Evelyn Libertus, PhD

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### Academic appointments

2013 – present: Assistant professor, Dept. of Psychology, University of Pittsburgh, USA  
2013 – present: Research scientist, Learning Research and Development Center  
University of Pittsburgh, USA  
2010 – 2013: Postdoctoral fellow, Dept. of Psychological and Brain Sciences  
Johns Hopkins University, USA  
Advisors: Lisa Feigenson & Justin Halberda

### Education

2006 – 2010: PhD in Psychology and Neuroscience, Duke University, USA  
Advisor: Elizabeth M. Brannon  
2004 – 2006: M.A. in Psychology and Neuroscience, Duke University, USA  
Advisor: Elizabeth M. Brannon  
2001 – 2004: B.Sc. in Cognitive Science (summa cum laude), University of Osnabrück,  
Germany

### Scholarships and Awards

2015: Association for Psychological Science (APS) Rising Star Award  
2015: Sofja Kovalevskaja Award, Alexander-von-Humboldt-Foundation (declined)  
2014: International Mind Brain and Education Society (IMBES) Early Career Award  
2011: Developmental Science Early Career Research Prize  
2011: Building Bridges Travel Award, German Scholars Organization  
2009 – 2010: Katherine Goodman Stern Fellowship, Duke University  
2009: Frances Degen Horowitz Millennium Scholar, Society for Research in Child  
Development  
2007 – 2009: Three Conference Travel Grants, Duke University  
2006 – 2007: George H. Hitchings New Investigator Award in Health Research and Training,  
Triangle Community Foundation  
2006 – 2009: Four Summer Vertical Integration Scholarships, Duke University  
2004 – 2005: Fulbright Scholarship (declined)  
2002 – 2006: German National Merit Foundation Scholarship (Studienstiftung des Deutschen  
Volkes)

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### GRANTS

#### External grants

“APA Summer Undergraduate Psychology Research Experience (SUPRE)”

APA

PI: Jana Iverson; Co-PIs: Julie Fiez, Melissa Libertus, Elizabeth Votruba-Drzal, Aidan Wright

Funded period: 05/2017 – 07/2017

Total costs: \$21,874

“Tell me about math: A longitudinal training study on the effects of parent-child interactions and parental cognition on children’s math abilities”

National Science Foundation (DUE1534830)  
PI: Melissa Libertus, Co-PIs: Klaus Libertus, Aidan Wright  
Funded period: 09/2015 – 08/2018  
Total costs: \$499,750

“Revealing the importance of math-related parent-child interactions via EEG hyperscanning”  
National Science Foundation (Supplement to DUE1534830)  
PI: Melissa Libertus, Co-PIs: Klaus Libertus, Aidan Wright  
Funded period: 09/2016 – 08/2018  
Total costs: \$ 99,194

### **Internal grants**

“How Low- and High-SES Parents Support Young Children’s Mathematical Thinking”  
Learning Research and Development Center Internal Award  
PI: Melissa Libertus, Co-PIs: Heather Bachman, Elizabeth Votruba-Drzal  
Funded period: 07/2017 – 06/2019  
Total costs: \$149,962

“The dangers of computation without quantitative meaning: Testing the case of symbolic estrangement”  
Learning Research and Development Center Internal Award  
PI: Melissa Libertus, Co-PIs: Julie Fiez, Christian Schunn  
Funded period: 05/2014 – 06/2016  
Total costs: \$87,955

“Tell me about math: A longitudinal training study on the effects of parent-child interactions and parental cognition on children’s math abilities”  
Learning Research and Development Center Internal Award  
PI: Melissa Libertus, Co-PI: Klaus Libertus  
Funded period: 05/2015 – 02/2016  
Total costs: \$149,873

### **Pending grants**

“Neurobehavioral Differences in Symbolic Integration and the Math Ability of Community College Students”  
NIH, R21  
PIs: Marc Coutanche, Julie Fiez, Melissa Libertus

“How parents support young children’s mathematical thinking across SES”  
NICHD, R01  
PI: Melissa Libertus; Co-Is: Heather Bachman, Elizabeth Votruba-Drzal

“NCS-FO: Neurobehavioral Integration of Visual and Semantic Number Knowledge and its Role for Individual Variation in the Math Ability of Children and Adults”  
National Science Foundation  
PIs: Marc Coutanche, Julie Fiez, Melissa Libertus

“Math cognitions in toddlers from low-SES Latino and white families: Contributions of home experiences with mothers and fathers”  
NICHD, R21  
PIs: Natasha Cabrera, Melissa Libertus, Catherine Tamis-LeMonda

## PUBLICATIONS

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### Publications in peer-reviewed journals

\* denotes graduate student mentee

1. \*Braham, E., **Libertus, M.** (in press). Intergenerational Associations in Numerical Approximation and Mathematical Abilities. *Developmental Science*.
2. Möhring, W., \*Liu, R., **Libertus, M.** (in press). Infants' speed discrimination: Effects of different ratios and spatial orientations. *Infancy*.
3. **Libertus, M.**, \*Braham, E., \*Liu, R. (in press). Infants discriminate number: Evidence against the prerequisite of visual object individuation and the primacy of continuous magnitude. *Brain and Behavioral Sciences*.
4. Libertus, K., **Libertus, M.**, Einspieler, C., Marschik, P. (in press). "What" matters more than "Why" - Neonatal behaviors initiate social responses. *Behavioral and Brain Sciences*.
5. \*Elliott, L., \*Braham, E., **Libertus, M.** (2017). Understanding Sources of Individual Variability in Parents' Number Talk with Young Children. *Journal of Experimental Child Psychology*, 159, 1-15.
6. **Libertus, M.**, Odic, D., Feigenson, L., Halberda, J. (2016). The Precision of Mapping Between Number Words and the Approximate Number System Predicts Children's Formal Math Abilities. *Journal of Experimental Child Psychology*, 150, 207-226.
7. Pailian, H., **Libertus, M.**, Feigenson, L., Halberda, J. (2016). Developmental Changes in Visual Short-Term Memory (VSTM) Capacity Between Ages 3 and 8 Years. *Attention, Perception, & Psychophysics*, 78, 1556-1573.
8. Einspieler, C., Bos, A., **Libertus, M.**, Marschik, P. (2016). The general movement assessment helps us to identify preterm infants at risk for cognitive dysfunction. *Frontiers in Psychology*, 7.
9. **Libertus, M.**, Odic, D., Feigenson, L., Halberda, J. (2015). A Developmental Vocabulary Assessment for Parents (DVAP): Validating parental report of vocabulary size in 2-7-year-olds. *Journal of Cognition and Development*, 16(3), 442-454.
10. \*Keller, L. E., **Libertus, M.** (2015). Inhibitory control may not explain the link between approximation and math abilities in kindergarteners from middle class families. *Frontiers in Developmental Psychology*, 6, 685.
11. **Libertus, M.** (2015). The role of intuitive approximation skills for school math abilities. *Mind, Brain, and Education*, 9(2), 112-120.
12. **Libertus, M.**, Feigenson, L., Halberda, J., Landau, B. (2014). Understanding the mapping between numerical approximation and number words: Evidence from Williams syndrome and typical development. *Developmental Science*, 17(6), 905-919.
13. **Libertus, M.**, Marschik, P. B., Einspieler, C. (2014). Number word use in toddlerhood predicts number recall performance at seven years of age. *PLoS ONE* 9(6): e98573. doi:10.1371/journal.pone.0098573
14. **Libertus, M.**, Starr, A., Brannon, E. (2014). Number trumps area for 7-month-old infants. *Developmental Psychology*, 50(1), 108-112.

15. Starr, A., **Libertus, M.**, Brannon, E. (2013). Number sense in infancy predicts mathematical abilities in childhood. *Proceedings of the National Academy of Sciences*, 110(45), 18116-18120.

*Article was featured in Science, Nature, one of top 100 stories in 2013 in Discover, National Geographic, Washington Post, and on NSF Science 360*

16. **Libertus, M.**, Feigenson, L., Halberda, J. (2013). Numerical approximation abilities correlate with and predict informal but not formal mathematics abilities. *Journal of Experimental Child Psychology*, 116(4), 829-838.
17. Hellgren, K., Halberda, J., Forsman, L., Aden, U., **Libertus, M.** (2013). Compromised approximate number sense in extremely preterm school-aged children. *Developmental Medicine and Child Neurology*, 55(12), 1109-1114.
18. Starr, A., **Libertus, M.**, Brannon, E. (2013). Infants show ratio-dependent number discrimination regardless of set size. *Infancy*, 18(6), 927-941.
19. Feigenson, L., **Libertus, M.**, Halberda, J. (2013). Links between the intuitive sense of number and formal mathematics ability. *Child Development Perspectives*, 7(2), 74-79.
20. Odic, D., **Libertus, M.**, Feigenson, L., Halberda, J. (2013). Developmental change in the acuity of approximate number and area representations. *Developmental Psychology*, 49(6), 1103-1112.
21. **Libertus, M.**, Feigenson, L., Halberda, J. (2013). Is Approximate Number Precision a Stable Predictor of Math Ability? *Learning and Individual Differences*, 25, 126-133.
- One of the most highly cited papers in Learning and Individual Differences during 2014, 2015, and 2016*
22. **Libertus, M.**, Odic, D., Halberda, J. (2012). Intuitive sense of number correlates with math scores on college-entrance examination. *Acta Psychologica*, 141(3), 373-379.
23. Möhring, W., **Libertus, M.**, Bertin, E. (2012). Speed discrimination in 6- and 10-month-old infants follows Weber's Law. *Journal of Experimental Child Psychology*, 111, 405-418.
24. Wu, C.-T., **Libertus, M.**, Meyerhoff, K., Woldorff, M. (2011). The temporal dynamics of object in visual cortex during the transition from distributed to focused spatial attention. *Journal of Cognitive Neuroscience*, 23(12), 4094-4105.
25. Cantlon, J., Davis, S., **Libertus, M.**, Kahane, J., Brannon, E., Pelphrey, K. (2011). Intra-parietal white matter development predicts numerical performance in young children. *Learning and Individual Differences*, 21(6), 672-680.
26. **Libertus, M.**, Feigenson, L., Halberda, J. (2011). Preschool acuity of the approximate number system correlates with school math ability. *Developmental Science*, 14(6), 1292-1300.
- One of top 5 downloads for 2013, 2014, 2015; article was featured in New York Times, Science Daily, and on MSNBC*
27. **Libertus, M.**, Brannon, E., Woldorff, M. (2011). Parallels in stimulus-driven oscillatory brain responses to numerosity changes in adults and seven-month-old infants. *Developmental Neuropsychology*, 36(6), 651-667.
28. **Libertus, M.**, Brannon, E. (2010). Stable individual differences in number discrimination in infancy. *Developmental Science*, 13(6), 900-906.

29. **Libertus, M.**, Brannon, E. (2009). Behavioral and neural basis of number sense in infancy. *Current Directions in Psychological Science*, 18(6), 346-351.
30. **Libertus, M.**, Pruitt, L., Woldorff, M., Brannon, E. (2009). Induced alpha-band oscillations reflect ratio-dependent number discrimination in the infant brain. *Journal of Cognitive Neuroscience*, 21(12), 2398-2406.
31. Cantlon, J., **Libertus, M.**, Pinel, P., Dehaene, S., Brannon, E., Pelphrey, K. (2009). The Neural Development of an Abstract Concept of Number. *Journal of Cognitive Neuroscience*, 21(11), 2217-2229.
32. Cantlon, J., Cordes, S., **Libertus, M.**, Brannon, E. (2009). Numerical Abstraction: It ain't broke. *Behavioral and Brain Sciences*, 32, 331-332.
33. **Libertus, M.**, Brannon, E., Pelphrey, K. (2009). Developmental changes in category-specific brain responses to numbers and letters in a working memory task. *Neuroimage*, 44(4), 1404-1414.
34. Cantlon, J., Cordes, S., **Libertus, M.**, Brannon, E. (2009). Comment on Log or Linear? Distinct Intuitions of the Number Scale in Western and Amazonian Indigene Cultures. *Science*, 323, 38b.
35. Brannon, E., **Libertus, M.**, Meck, W., Woldorff, M. (2008). Electrophysiological measures of time processing in infant and adult brains: Weber's law holds. *Journal of Cognitive Neuroscience*, 20(2), 193-203.
36. **Libertus, M.**, Woldorff, M., Brannon, E. (2007). Electrophysiological evidence for notation independence in numerical processing. *Behavioral and Brain Functions*, 3(1).
37. Schwank, I., Armbrust, S., **Libertus, M.** (2003). Prädikative versus funktionale Denkvorgänge beim Konstruieren von Algorithmen [Predicative versus functional thinking processes while constructing algorithms]. *Zentralblatt für Didaktik der Mathematik* [ZDM The International Journal on Mathematics Education], 35 (3), pp.79-85.

### **Publications in preparation**

- \*Braham, E., **Libertus, M.** (under review). When Approximate Number Acuity Predicts Math Performance: The Moderating Role of Math Anxiety.
- \*Elliott, L., Feigenson, L., Halberda, J., **Libertus, M.** (under review). Bidirectional, longitudinal associations between math ability and approximate number system acuity in childhood.
- Libertus, M.**, Feigenson, L., Halberda, J. (under review). Infants extract frequency distributions from variable approximate numerical information.
- \*Liu, A., Schunn, C., Fiez, J., **Libertus, M.** (under review). Adjusting for adults' number estimation biases reveals symbolic integration of double-digit numbers.
- \*Navarro, M., \*Braham, E., **Libertus, M.** (under review). Intergenerational associations of the approximate number system in toddlers and their parents.
- Libertus, M.**, Forsman, L., Aden, U., Hellgren, K. (under review). Deficits in Approximate Number System Acuity and Mathematical Abilities in 6.5-year-old Children Born Extremely Preterm.

**Libertus, M.**, Liu, A., Pikul, O., Jacques, T., Cardoso-Leite, P., Halberda, J., Bavelier, D. (under review). The impact of action videogame training on mathematical abilities in adults.

Odic, D., **Libertus, M.**, Zhu, R., Feigenson, L., Halberda, J. (in prep). The development of verbal estimation is independent from the development of approximate number in five- to seven-year-old children.

**Libertus, M.**, Odic, D., Feigenson, L., Halberda, J. (in prep). Abstract numerical approximation abilities and their correlations with school mathematics performance in 4-7-year-old children.

\*Liu, R., Schunn, C., Fiez, J., **Libertus, M.** (in prep). The integration between non-symbolic and symbolic numbers: Evidence from an EEG study.

Wang, J., **Libertus, M.**, Feigenson, L. (in prep). Hysteresis-induced changes in preverbal infants' approximate number precision.

## PRESENTATIONS

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### Invited Talks and Colloquia

- 12/2016: Colloquium, Bucknell University, USA
- 10/2016: Developmental Brownbag, Carnegie Mellon University, USA
- 04/2016: Neuroscience and Education lab, New York University, USA
- 09/2013: Developmental Brownbag, Carnegie Mellon University, USA
- 09/2013: Developmental Brownbag, University of Pittsburgh, USA
- 09/2013: Cognitive Brownbag, University of Pittsburgh, USA
- 03/2013: JRG-Auswahlssymposia, University of Tübingen, Germany.
- 03/2013: Workshop on Early Childhood Development, University of Zurich, Switzerland.
- 02/2012: Colloquium, Stanford University, USA.
- 02/2012: Developmental Brownbag, Stanford University, USA.
- 01/2012: Colloquium, Peabody College, Vanderbilt University, USA.
- 01/2012: Colloquium, Dept. of Psychology and Learning Research and Development Center, University of Pittsburgh, USA.
- 11/2011: Regional ERP/EEG Research Meeting, Baltimore, USA.
- 06/2011: Colloquium, University of Tübingen, Germany.
- 05/2011: Colloquium, University of Gießen, Germany.
- 05/2011: Colloquium, Karolinska Institute, Sweden.
- 07/2009: Laboratory for Child Development, Johns Hopkins University.
- 05/2009: Internal seminar, Institute of Cognitive Neuroscience, University College London, UK.
- 05/2009: Colloquium, Centre for Brain and Cognitive Development, Birkbeck College, University of London, UK.
- 05/2009: Colloquium, Institute for Empirical Research in Economics, University of Zurich, Switzerland.
- 05/2009: Colloquium, Institute of Cognitive Science, University of Osnabrück, Germany.
- 09/2007: NeuroMath Workshop, University of Osnabrück, Germany.
- 02/2007: Cognitive, Affective and Social Neuroscience Series, Duke University.
- 11/2006: Cognitive Neuroscience Presentation Seminar Series, Duke University.
- 10/2005: Cognitive Neuroscience Presentation Seminar Series, Duke University.
- 04/2005: Duke University Lunchbox Series.

## Conference Presentations - Oral

\* denotes graduate student mentee

1. **Libertus, M.**, \*Elliott, L., \*Braham, E. (04/2017). *Parents' Own Number Sense and Math Abilities Explain Variability in Informal Math Talk with Their Children*. Biennial Meeting of the Society for Research in Child Development (SRCD), Austin, TX, USA.
2. \*Elliott, L., **Libertus, M.** (04/2017). *Inhibitory Control and the Approximate Number System: Significant but Separate Predictors of Early Math Abilities*. Biennial Meeting of the Society for Research in Child Development (SRCD), Austin, TX, USA.
3. Shembel, A., Verdolini Abbott, K., Galera, R., **Libertus, M.** (06/2016). *Prospective Study of Voice Therapy in Children: Potential Cognitive Factors*. 45<sup>th</sup> Annual Symposium of The Voice Foundation, Philadelphia, PA, USA.
4. \*Liu, A., Schunn, C., Fiez, J., **Libertus, M.** (07/2015). *Symbolic Integration, Not Symbolic Estrangement, For Double-Digit Numbers*. 37<sup>th</sup> Annual Meeting of the Cognitive Science Society, Pasadena, CA, USA.
5. **Libertus, M.**, Hellgren, K., Forsman, L., Aden, U. (03/2015). *Deficits in Mathematical Abilities and Approximate Number System Acuity in Children Born Extremely Preterm*. Biennial Meeting of the Society for Research in Child Development (SRCD), Philadelphia, USA.
6. **Libertus, M.**, Odic, D., Feigenson, L., Halberda, J. (03/2015). *Verbal number estimation predicts math ability and mediates the relation between numerical approximation and math ability*. Biennial Meeting of the Society for Research in Child Development (SRCD), Philadelphia, USA.
7. Pailian, H., **Libertus, M.**, Feigenson, L., Halberda, J. (05/2014). *On the dynamic nature of VWM: Separate limits for the storage and manipulation of information*. Vision Sciences Society (VSS) 14<sup>th</sup> Annual Meeting, St. Pete Beach, USA.
8. Halberda, J., Bavelier, D., Landau, B., Hellgren, K., Forsman, L., Jacques, T., **Libertus, M.** (05/2013). *Training of Number Sense transfers broadly*. Vision Sciences Society (VSS) 13<sup>th</sup> Annual Meeting, Naples, USA.
9. **Libertus, M.**, Feigenson, L., Halberda, J. (04/2013). *The Relationship Between Informal and Formal School Math Ability and Children's Basic Numerical Approximation Skills*. Biennial Meeting of the Society for Research in Child Development (SRCD), Seattle, USA.
10. Starr, A., **Libertus, M.**, Brannon, E. (04/2013). *Infants show ratio-dependent discrimination regardless of set size*. Biennial Meeting of the Society for Research in Child Development (SRCD), Seattle, USA.
11. Halberda, J., **Libertus, M.**, Feigenson, L. (04/2013). *The Approximate Number System (ANS): What is it and how might it be affecting classroom performance*. Annual Meeting of The American Educational Research Association (AERA), San Francisco, USA.
12. **Libertus, M.**, Halberda, J., Feigenson, L. (04/2011). *Approximate Number Discrimination Correlates With Math Abilities in Preschoolers*. Biennial Meeting of the Society for Research in Child Development (SRCD), Montreal, Canada.
13. **Libertus, M.**, Wu, C., Harris, J., Woldorff, M. (11/2007). *Attention can be shifted to a color pop-out prior to face-specific visual processing at that location*. Annual Meeting of the Society for Neuroscience (SfN), San Diego, USA.

14. **Libertus, M.** (03/2007). *Neuronale Marker der Zahlenverarbeitung in Säuglingen und Kindern*. [Neural markers of number processing in infants and children]. Gemeinsame Jahrestagung der Deutschen Mathematiker-Vereinigung und der Gesellschaft der Didaktik für Mathematik [Joint annual meeting of the German Association for Mathematicians and the Society for Mathematical Education], Berlin, Germany.
15. Brannon, E., Cantlon, J., Cordes, S., Jordan, K., **Libertus, M.**, MacLean, E., & Suanda, U. (11/2006). *Comparative and developmental approach to studying nonverbal numerical cognition*. Annual meeting of the Psychonomic Society, Houston, TX.
16. **Libertus, M.** (06/2006). *Electrophysiological correlates of symbolic vs non-symbolic number magnitude*. Numeracy and brain development (Numbra) Summer School, Finland.
17. **Libertus, M.**, Armbrust, S. (09/2002). *Prädikative versus funktionale Denkvorgänge beim Konstruieren von Algorithmen* [Predicative versus functional thinking processes while constructing algorithms]. Young Scientists Session, 43<sup>rd</sup> Conference of the German Psychological Society (DGPs), Berlin, Germany.
18. Armbrust, S., Schwank, I., **Libertus, M.** (09/2002). *Augenblickbewegungen beim Lösen von Matrizenaufgaben (QuaDiPF)* [Eye-movements while solving matrices tasks (QuaDiPF)]. 43<sup>rd</sup> Conference of the German Psychological Society (DGPs), Berlin, Germany.

### **Conference Presentations - Posters**

\* denotes graduate student mentee

1. \*Elliott, L., Feigenson, L., Halberda, J., **Libertus, M.** (2017). Bidirectional, Longitudinal Associations between Math Ability and Approximate Number System Acuity in Childhood. *Math Cognition Conference, Nashville, TN, USA*.
2. \*Braham, E., \*Liu, R., **Libertus, M.** (2017). Variability in Math Talk During Parent-Child Interactions: The Role of Parents' Math Ability and Approximate Number System Acuity. *Biennial Meeting of the Society for Research in Child Development (SRCD), Austin, TX, USA*.
3. \*Braham, E., **Libertus, M.** (2016). Math anxiety moderates the relation between approximate number acuity and math performance. *International Mind Brain and Education Society Conference, Toronto, Canada*.
4. \*Liu, R., \*Liu, A., Schunn, C., Fiez, J., **Libertus, M.** (2016). The integration between non-symbolic and symbolic numbers and its relation to math ability. *International Mind Brain and Education Society Conference, Toronto, Canada*.
5. \*Braham, E., **Libertus, M.** (2016). Math talk variability in preschool classrooms: The role of teachers' abilities and beliefs. *International Mind Brain and Education Society Conference, Toronto, Canada*.
6. \*Liu, R., \*Liu, A., Schunn, C., Fiez, J., **Libertus, M.** (2016). Automatic integration between non-symbolic and symbolic numbers in adults. *Math Cognition Conference, Fort Worth, TX, USA*.
7. \*Liu, R., Schunn, C., Fiez, J., **Libertus, M.** (2016). Spontaneous integration between the representation of non-symbolic and symbolic numbers. *Annual Meeting of the Cognitive Neuroscience Society (CNS), New York, USA*.



8. \*Braham, E., \*Navarro, M., **Libertus, M.** (2015). Intergenerational Transmission of Numerical Ability: Evidence from Toddlerhood and Middle Childhood. *Biennial Meeting of the Cognitive Development Society, Columbus, USA.*
9. \*Liu, R., Möhring, W., **Libertus, M.** (2015). The ratio and orientation effect in infants' and adults' speed discrimination. *Biennial Meeting of the Cognitive Development Society, Columbus, USA.*
10. Wang, J., **Libertus, M.**, Feigenson, L. (2015). Hysteresis-induced changes in infants' approximate number precision. *Biennial Meeting of the Cognitive Development Society, Columbus, USA.*
11. \*Braham, E., **Libertus, M.** (2015). Parental influences on children's numerical and mathematical abilities. *Annual Meeting of the Jean Piaget Society, Toronto, Canada.*
12. \*Keller, L., **Libertus, M.** (2015). Inhibitory control does not explain the link between approximation and math abilities in children. *Annual Meeting of the Jean Piaget Society, Toronto, Canada.*
13. \*Braham, E., **Libertus, M.** (2015). Intergenerational Associations in Approximate Number System Acuity and Mathematical Abilities. *Math Cognition Conference, St. Louis, MO, USA.*
14. \*Braham, E., **Libertus, M.** (2015). The Unique Contributions of Children's Numerical Approximation Skills for Various Math Abilities. *Biennial Meeting of the Society for Research in Child Development (SRCD), Philadelphia, USA.*
15. \*Braham, E., Libertus, K., **Libertus, M.** (2015). Information Processing Patterns During Approximate Number Comparisons in Preschoolers and Adults: An Eye-tracking Study. *Biennial Meeting of the Society for Research in Child Development (SRCD), Philadelphia, USA.*
16. \*Keller, L., **Libertus, M.** (2015). Examining the Importance of Child- and Parent-Level Cognitive Factors in Predicting Children's Early Math Abilities. *Biennial Meeting of the Society for Research in Child Development (SRCD), Philadelphia, USA.*
17. **Libertus, M.**, Halberda, J., Feigenson, L. (2014). Six-month-old Infants can Track Frequency Distributions of Numerosities. *19<sup>th</sup> Biennial International Conference on Infant Studies (ICIS), Berlin, Germany.*
18. **Libertus, M.**, Feigenson, L., Halberda, J. (2013). On the Stability of Individual Differences in Children's Numerical Approximation Skills. *Biennial Meeting of the Society for Research in Child Development (SRCD), Seattle, USA.*
19. Odic, D., **Libertus, M.**, Feigenson, L., Halberda, J. (2013). The quantity of quantity: are visual area and number represented by one system, or two? *Biennial Meeting of the Society for Research in Child Development (SRCD), Seattle, USA.*
20. Pailian, H., **Libertus, M.**, Feigenson, L., Halberda, J. (2013). Developmental Changes in Visual Short-Term Memory (VSTM) Capacity Between Ages 3 and 8 Years. *Biennial Meeting of the Society for Research in Child Development (SRCD), Seattle, USA.*
21. Pailian, H., **Libertus, M.**, Feigenson, L., Halberda, J. (2013). Measuring Individual Differences in Children's Visual Short-Term Memory Capacity using the Flicker Paradigm. *Biennial Meeting of the Society for Research in Child Development (SRCD), Seattle, USA.*

22. **Libertus, M.**, Starr, A., Brannon, E. (2012). Infants' sensitivity to changes in number versus surface area. *18<sup>th</sup> Biennial International Conference on Infant Studies (ICIS), Minneapolis, USA.*
23. Odic, D., **Libertus, M.**, Feigenson, L., Halberda, J. (2012). The development of number and area acuity in young children. *18<sup>th</sup> Biennial International Conference on Infant Studies (ICIS), Minneapolis, USA.*
24. Starr, A., **Libertus, M.**, Brannon, E. (2012). Small number discrimination in infancy: A case for approximate number representations. *18<sup>th</sup> Biennial International Conference on Infant Studies (ICIS), Minneapolis, USA.*
25. **Libertus, M.**, Feigenson, L., Halberda, J. (2011). Approximate Number Discrimination Predicts Later Math Ability in Preschoolers. *Seventh Biennial Meeting of the Cognitive Development Society, Philadelphia, USA.*
26. Libertus, K., **Libertus, M.** (2011). Similarities And Differences In Approximate Numerical Comparisons Between Children and Adults As Revealed By Eye Gaze. *Seventh Biennial Meeting of the Cognitive Development Society, Philadelphia, USA.*
27. **Libertus, M.**, Libertus, K. (2011). Differences in Strategies During Approximate Numerical Comparisons as Revealed by Eye-gaze Measures. *2011 Association for Psychological Science Annual Convention, Washington, DC, USA.*
28. **Libertus, M.**, Stevenson, A., Odic, D., Feigenson, L., Halberda, J. (2011). The Developmental Vocabulary Assessment for Parents (DVAP): A Novel Tool to Measure Vocabulary Size in 3- to 5-year-old Children. *Biennial Meeting of the Society for Research in Child Development (SRCD), Montreal, Canada.*
29. Möhring, W., **Libertus, M.**, Bertin, E. (2011). Speed Discrimination in 6- and 10-month-old Infant is Ratio-Dependent. *Biennial Meeting of the Society for Research in Child Development (SRCD), Montreal, Canada.*
30. **Libertus, M.**, Halberda, J., Feigenson, L. (2011). Approximate Number Discrimination Correlates With Math Abilities in Preschoolers. *Johns Hopkins 3<sup>rd</sup> Annual Postdoc Symposium, Baltimore, USA.*
31. **Libertus, M.**, Brannon, E. (2010). Behavioral Evidence for a Shared Mechanism of Number and Size Discrimination in Early but not Late Infancy. *1<sup>st</sup> Homewood Postdoctoral Poster Competition, Baltimore, USA.*
32. **Libertus, M.**, Brannon, E. (2010). Evidence for a shared system for number and area but not color discrimination in infancy. *24<sup>th</sup> Attention & Performance Meeting, Abbaye des Vaux de Cernay, France.*
33. Möhring, W., **Libertus, M.**, Bertin, E. (2010). Die Diskrimination von Geschwindigkeiten im Säuglingsalter. [Speed discrimination in infancy]. *8. LizentiandInnen- und DoktorandInnen-Kongress des Psychologischen Institutes der Universität Zürich (LiDoKo), Zürich, Schweiz. [8<sup>th</sup> Congress for Masters and PhD students at the Institute for Psychology of the University of Zurich, Switzerland].*
34. **Libertus, M.**, Brannon, E., Woldorff, M. (2010). Time course of stimulus-driven oscillatory synchronization and adaptation to numerical changes. *Annual Meeting of the Cognitive Neuroscience Society (CNS), Montreal, Canada.*

35. **Libertus, M.**, Brannon, E. (2010). Developmental trajectory of the relationship between numerical discrimination and other cognitive abilities in infancy. *17<sup>th</sup> Biennial International Conference on Infant Studies (ICIS), Baltimore, USA.*
36. **Libertus, M.**, Brannon, E. (2009). Evidence for Weber's Law in Infants' Numerical Discriminations From A New Change Detection Paradigm. *Biennial Meeting of the Society for Research in Child Development (SRCD), Denver, USA.*
37. **Libertus, M.**, Brannon, E., Woldorff, M. (2009). Stimulus-driven oscillatory responses to numerical changes: a novel frequency-tagging EEG paradigm. *Annual Meeting of the Cognitive Neuroscience Society (CNS), San Francisco, USA.*
38. **Libertus, M.**, Brannon, E., Pelphrey, K. (2008). Working memory for numbers, letters, and faces in 8-year-old children and adults. *Annual Meeting of the Cognitive Neuroscience Society (CNS), San Francisco, USA.*
39. **Libertus, M.**, Pruitt, L., Woldorff, M., Brannon, E. (2007). Electrophysiological markers of number processing in 7-month-old infants. *Numeracy and Brain Development (Numbra) Summer School, Greece.*
40. Cantlon, J., Davis, S., **Libertus, M.**, Brannon, E., Pelphrey, K. (2007). The Integrity of White Matter Pathways and Numerical Cognition in Adults and Young Children. *Annual Meeting of the Organization of Human Brain Mapping, Chicago, USA.*
41. Cantlon, J., **Libertus, M.**, Brannon, E., Pelphrey, K. (2007). The development of abstract numerical processing in parietal cortex. *Annual Meeting of the Vision Sciences Society, Sarasota, USA.*
42. **Libertus, M.**, Pruitt, L., Woldorff, M., Brannon, E. (2007). Electrophysiological markers of number processing in 7-month-old infants. *Annual Meeting of the Cognitive Neuroscience Society (CNS), New York, USA.*
43. Cantlon, J., **Libertus, M.**, Brannon, E., Pelphrey, K. (2007). Symbolic & Non-symbolic Number in the Developing Brain. *Annual Meeting of the Cognitive Neuroscience Society (CNS), New York, USA.*
44. **Libertus, M.**, Libertus, K., Suanda, S., Woldorff, M., Meck, W., Brannon, E. (2007). Behavioral and Neurophysiological Correlates of Interval Timing in Human Infants Follow Weber's Law. *Biennial Meeting of the Society for Research in Child Development (SRCD), Boston, USA.*
45. **Libertus, M.**, Woldorff, M., Brannon, E. (2006a). Electrophysiological Correlates of the Numerical Distance Effect. *5<sup>th</sup> Forum of European Neuroscience, Vienna, Austria.*
46. **Libertus, M.**, Woldorff, M., Brannon, E. (2006b). Electrophysiological correlates of number comparisons. *Annual Meeting of the Cognitive Neuroscience Society, San Francisco, USA.*
47. Libertus, K., **Libertus, M.**, Woldorff, M., Meck, W., Brannon, E. (2005). Behavioral and neurophysiological correlates of time processing in human infants. *Annual Meeting of the Society for Neuroscience, Washington, D.C., USA.*
48. Brannon, E., **Libertus, M.**, Meck, W., Woldorff, M. (2005). Neurophysiological correlates of time processing are modulated by interval differences in human infants and adults. *Annual Meeting of the Cognitive Neuroscience Society, New York, USA.*
49. **Libertus, M.** (2004). Unterschiede in Eigenschaftspräferenzen bei prädikativem versus funktionalem Problemlösen. [Differences in preferences for object features in the context of

## TEACHING & MENTORING

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### Teaching

#### University of Pittsburgh

Spring 2017:	Cognitive Development (PSY 1330, advanced undergraduate level)
Fall 2016:	Cognitive Development (PSY 2330, graduate level, overall teaching effectiveness: 3.78 out of 5)
Spring 2016:	Cognitive Development (PSY 1330, advanced undergraduate level, overall teaching effectiveness: 4.73 out of 5)
Fall 2015:	Mind, Brain & Education (PSY 1054, advanced undergraduate level, overall teaching effectiveness: 4.86 out of 5) Human Developmental Neuroscience (PSY 2376, graduate level, overall teaching effectiveness: 4.7 out of 5)
Spring 2015:	Cognitive Development (PSY 1330, advanced undergraduate level, overall teaching effectiveness: 4.47 out of 5)
Fall 2014:	Cognitive Development (PSY 2330, graduate level, overall teaching effectiveness: 4.85 out of 5)
Fall 2013:	Cognitive Development (PSY 1330, advanced undergraduate level, overall teaching effectiveness: 4.63 out of 5)

#### Duke University

Summer 2007:	Developmental Psychology (PSY 97, undergraduate level)
Spring 2007:	Teaching and Research Ethics (graduate student seminar)

### Graduate student mentoring

#### Primary advisor

Ruizhe Liu	Cognitive Psychology	2014 - present
Emily Braham	Cognitive Psychology	2013 - present

#### Milestone committee member

Dana Rosen	Clinical-Developmental Psychology, Masters & Specialty exam	2015 - present
Bart Larsen	Cognitive Psychology, Specialty exam	2016
Leanne Elliott	Developmental Psychology, Specialty exam	2016

#### Mentoring committee member

Nabila Jamal Orozco	Cognitive and Developmental Psychology	2016 - present
Kevin Soo	Cognitive Psychology	2014 - present
Regina Calloway	Cognitive Psychology	2014 - present
Laura Betancur	Developmental Psychology	2014 - present
Joshua Tremel	Cognitive Psychology	2014 - 2016
Brendan Barstow	Cognitive Psychology	2014 - 2105
Xiaoping Fang	Cognitive Psychology	2013 - present

## Post-baccalaureate student mentoring

Monica Navarro	Hot Metal Bridge Program (now PhD student at the University of Pittsburgh)	2014 – 2015
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## Undergraduate student mentoring

### Bachelor of Philosophy students – University of Pittsburgh

Abigail Dillaha	Neuroscience & Psychology major Chancellor's Undergraduate Research Fellowship, Fall 2017 Brackenridge Research Fellowship, Spring 2016	2018
Peter Zheng	Business, Economics, Political Science & Psychology major PsychDRIVE Undergraduate Research Fellowship, Summer 2017 Chancellor's Undergraduate Research Fellowship, Spring 2017 Chancellor's Undergraduate Teaching Fellowship, Spring 2017 Humanities, Arts, and Social Sciences Research Fellowship, Fall 2016	2018
Erinn Hanner	Psychology & Studio Arts major Chancellor's Undergraduate Research Fellowship, Fall 2017	2017

### Honors thesis students – University of Pittsburgh

Ashley Whited	Neuroscience	2018
Joy Cui	Neuroscience Chancellor's Undergraduate Research Fellowship, Spring 2017 Brackenridge Research Fellowship, Summer 2016	2017
Sierra Struble	Neuroscience	2017
Jyothirmayi Thippana	Neuroscience	2017
Melanie Matyi	Neuroscience Chancellor's Undergraduate Research Fellowship, Fall 2016 Brackenridge Research Fellowship, Summer 2016	2016

### Directed Research in Psychology or Neuroscience – University of Pittsburgh

1. Adwoa Imbeah 2017 - present
2. Elias Rappaport 2017 - present
3. Kelly Staples 2017 - present
4. Michelle Gamburg 2016 - present
5. Erinn Hanner 2016 - present
6. Wyatt Macejka 2016 - present  
Chancellor's Undergraduate Research Fellowship, Fall 2017  
Brackenridge Research Fellowship, Summer 2017  
PsychDRIVE Undergraduate Research Fellowship, Summer 2017
7. Sonya Naik 2016 - 2017
8. Jamie Patronick 2016 - present
9. Emily Pullman 2016 - 2017
10. Mahima Rajan 2016 - present
11. Xiaoyun Xu 2016 - 2017
12. Peter Zheng 2016 - present
13. Kayla Banner 2015 - 2016
14. Dana Cohen 2015
15. Abigail Dillaha 2015 - present
16. Lydia Grubic 2015 - 2016

17. Ashley Johnson		2015 - present
18. Sejla Jukic		2015 - present
	PsychDRIVE Undergraduate Research Fellowship, Summer 2017	
19. Shreya Kolar		2015 - present
20. Carolyn Kotkiewicz		2015
21. Alexandra Lawall		2015 - 2016
22. Sarah Lazarro		2015 - 2016
23. Jenny Ly		2015 - 2016
24. Melanie Matyi		2015 - 2017
25. Paige McLaughlin		2015 - 2017
26. Gabrielle Simon		2015 - 2016
27. Sierra Struble		2015 - 2017
28. Jyothirmayi Thippana		2015 - present
29. Dominic Violi		2015 - 2016
30. Charles Yang		2015 - 2017
31. Laxmikausthubha Yaratha		2015 - 2016
32. Trevor Zwaan		2015 - 2016
	DeVito-Lipner Family Student Fund, Spring 2016	
33. Joy Cui		2014 - 2017
34. Eva Dice		2014 - 2015
	DeVito-Lipner Family Student Fund, Spring 2015	
35. Amanda Hopcroft		2014
36. Rebecca Laher		2014 - 2015
37. Permveer Longia		2014 - 2015
38. Eliana Munro		2014 - 2015
	DeVito-Lipner Family Student Fund, Spring 2015	
	Spring Undergraduate Research Award, Spring 2015	
39. Megan Raymond		2014
40. Deborah Scialabba		2014
41. Leah Siegel		2014
42. Amy Veasey		2014 - 2016
43. Serena Virgi		2014 - 2015

### Research advisor – Johns Hopkins University

2010 – 2013: Internship advisor at Johns Hopkins University (Rebecca Zhu, Cambria Litsey, Samantha Tuepker, Michelle Pargament, Geena Frumkin, Matthew Pulaski, Stephanie Caronna, Misti Jeffers, Brent Rappaport, Ruxue Shao, Lina Montoya, Karen Ho, Sean Ostro)

### Research advisor – Duke University

2009: Frances Degen Horowitz Millennium Scholars mentor, Society for Research in Child Development

2008 – 2009: Independent study mentor at Duke University (Melissa Mang, Priya Patel)

2006 – 2010: Honors theses advisor at Duke University (Diana Hancock, Priya Patel, Tina Liang, Laura Pruitt)

2006 – 2008: Vertical Integration Program mentor at Duke University (Priya Patel, Melissa Mang, Stacey Blase, Lauren Marx, Laura Pruitt)

2005: NSF Mechanisms of Behavior Program mentor at Duke University (Anna Nehring)

## SERVICE

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### Ad hoc journal reviewing

Acta Psychologica	Journal of Experimental Child Psychology
Behavioral and Brain Sciences	Journal of Experimental Psychology: General
Biological Psychology	Journal of Experimental Psychology: Human Perception and Performance
British Journal of Developmental Psychology	Journal of Pediatric Neurology
Child Development, Cognition	Learning and Individual Differences
Cognitive Neuropsychology	Memory & Cognition
Developmental Cognitive Neuroscience	NeuroImage
Developmental Psychobiology	Neuroscience Letters
Developmental Science	Perception
Early Childhood Research Quarterly	Philosophical Transactions B
Educational Psychology	PLoS One
European Journal of Neuroscience	Prospects (UNESCO's quarterly review of comparative education)
European Journal of Psychology of Education	Psychological Research
Experimental Brain Research	Psychological Science
Frontiers in Developmental Psychology	Psychonomic Bulletin & Review,
Human Brain Mapping	Psychophysiology
International Journal of Psychophysiology	Quarterly Journal of Experimental Psychology
Journal of Behavioral Decision Making	Zeitschrift für Psychologie (Journal of Psychology)
Journal of Cognition and Development	
Journal of Cognitive Neuroscience	
Journal of Cognitive Psychology	

### Grant reviewing

Institut D'Etudes Avancees de Paris (Paris Institute for Advanced Study), France  
Israel Science Foundation (ISF), Israel  
National Science Foundation: College of Reviewers, USA  
Nuffield Foundation, United Kingdom  
Research Foundation Flanders (FWO), Belgium  
Swiss National Science Foundation, Switzerland

### Conference reviewing

2016: 38<sup>th</sup> Annual Meeting of the Cognitive Science Society  
2015: 20<sup>th</sup> Biennial International Conference on Infant Studies  
2015: 37<sup>th</sup> Annual Meeting of the Cognitive Science Society  
2011: 22<sup>nd</sup> Biennial Meeting of the International Society for the Study of Behavioural Development

### Professional Memberships

Cognitive Development Society (CDS), Cognitive Neuroscience Society (CNS), International Mind Brain & Education Society (IMBES), International Society on Infant Studies (ICIS), Society for Research in Child Development (SRCD)

### Departmental and University Service

2016 – present: Faculty Grants Committee, Dietrich School of Arts and Sciences, University of Pittsburgh

2016 – present: Co-chair, Communications Committee, Learning Research and Development Center, University of Pittsburgh  
 2016 – 2017: Faculty organizer, Cognitive Brownbag Seminar, University of Pittsburgh  
 2014 & 2015: Faculty search committee, Learning Research and Development Center, University of Pittsburgh  
 2014 – 2015: Colloquium committee, Dept. of Psychology, University of Pittsburgh  
 2013: Faculty search committee, Dept. of Psychology, University of Pittsburgh  
 2007 – 2010: Co-organizer Developmental Brownbag Series  
 Department of Psychology and Neuroscience, Duke University  
 2005 – 2007: International House Orientation Peer for international graduate students

## OTHER INFORMATION

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### Collaborators

2010 – present:	Ulrika Aden	Karolinska Institute, Sweden
2016 – present:	Heather Bachman	University of Pittsburgh, USA
2010 – present:	Daphne Bavelier	University of Geneva, Switzerland
2013 – present:	Mariagrazia Benassi	University of Bologna, Italy
2016 – present:	Clancy Blair	New York University, USA
2013 – present:	Roberto Bolzani	University of Bologna, Italy
2016 – present:	Natasha Cabrera	University of Maryland, College Park, USA
2009 – present:	Jessica Cantlon	University of Rochester, USA
2016 – present:	Marc Coutanche	University of Pittsburgh, USA
2012 – present:	Christa Einspieler	Medical University of Graz, Austria
2013 – present:	Julie Fiez	University of Pittsburgh, USA
2010 – present:	Lea Forsman	Karolinska Institute, Sweden
2010 – present:	Kerstin Hellgren	Karolinska Institute, Sweden
2011 – 2013:	Barbara Landau	Johns Hopkins University, USA
2012 – present:	Peter Marschik	Medical University of Graz, Austria
2016 – present:	Koleen McCrink	Barnard College, Columbia University, USA
2010 – present:	Wenke Möhring	University of Fribourg, Switzerland
2010 – present:	Darko Odic	University of British Columbia, Canada
2011 – present:	Hrag Pailian	Harvard University, USA
2016 – present:	Manuela Piazza	University of Trento, Italy
2016 – present:	Lauren Resnick	University of Pittsburgh, USA
2013 – present:	Christian Schunn	University of Pittsburgh, USA
2010 – 2013:	Ariel Starr	Duke University, USA
2016 – present:	Catherine Tamis-LeMonda	New York University, USA
2013 – present:	Katherine Verdolini Abbott	University of Pittsburgh, USA
2016 – present:	Elizabeth Votruba-Drzal	University of Pittsburgh, USA
2015 – present:	Aidan Wright	University of Pittsburgh, USA