

Neuroplasticity &  
Development Lab



## MARINA BEDNY

Assistant Professor

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### RESEARCH INTERESTS

How does developmental experience sculpt the human mind and brain? Our lab investigates this puzzle by comparing the minds and brains of people with different developmental experiences: sighted, congenitally blind and late-blind individuals. These studies allow us to disentangle the contributions of innate predispositions and experience to cortical function and cognition. A central line of work in our lab examines the acquisition of novel functions by visual cortices in blind individuals. We have known for over twenty years that the visual cortices of blind individuals respond to auditory and tactile stimuli. The cognitive role and mechanism of these "cross modal" responses remains debated. Some of the questions we study are: What new cognitive functions do visual cortices acquire in blindness and how similar are these new functions to the original visual functions of occipital cortices? How does non-visual information reach the visual system? Is plasticity during childhood different than plasticity in adulthood and if so in what way? A second line of work examines how vision contributes to concept formation. We use behavioral and neural measures to study concepts of events, objects and mental states in congenitally blind individuals. For example, are there differences between blind and sighted people's understanding of sight perception itself? What do blind individuals know about the meanings of sight verbs such as "stare" and "glance"? What about light events e.g. "sparkling" and "flashing?" Working with blind individuals enables us to understand the contribution of vision to concept acquisition.

### ACADEMIC POSITIONS

2013 to present – Assistant Professor, Department of Psychological and Brain Sciences, Johns Hopkins University

2013 to present – Joint Appointment in the Department of Cognitive Science, Johns Hopkins University

2008 to 2012 – Postdoctoral Fellow, Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology

2006 to 2008 – Postdoctoral Fellow, Berenson-Allen Center for Noninvasive Brain Stimulation, Beth Israel Deaconess Medical Center, Harvard Medical School

### EDUCATION

2006 – Ph.D. in Experimental Psychology, University of Pennsylvania

2002 – M.A. in Experimental Psychology, University of Pennsylvania

2001 – B.A. in Cognitive Science, Johns Hopkins University

### PUBLICATIONS

#### Publications, peer reviewed

1. Kanjlia, S., Feigenson, L., & **Bedny, M.** (in press) Numerical cognition is resilient to dramatic changes in early sensory experience. *Cognition*.

2. **Bedny, M.** & MacSweeney, M. (in press) Insights into the neurobiology of language from individuals born blind or deaf. To appear in: *Human Language: From Genes and Brains to Behavior*. Edited by P. Hagoort, MIT Press.
3. Kim, J. S., Kanjlia, S., Merabet, L. B., & **Bedny, M.** (2017). Development of the Visual Word Form Area Requires Visual Experience: Evidence from Blind Braille Readers. *Journal of Neuroscience*, *37*(47), 11495–11504.
4. **Bedny, M.** (2017) Evidence from blindness for a cognitively pluripotent cortex. *Trends in Cognitive Science*. *21*(9), 637-648.
5. Lapinskaya, N., Uzomah, U., **Bedny, M.**, & Lau, E. (2016). Electrophysiological signatures of event words\_ Dissociating syntactic and semantic category effects in lexical processing. *Neuropsychologia*, *93*(Part A), 151–157.
6. Lane, C., Kanjlia, S., Richardson, H., Fulton, A., Omaki, A., & **Bedny, M.** (2016). Reduced Left Lateralization of Language in Congenitally Blind Individuals. *Journal of Cognitive Neuroscience*, *6*, 1–14.
7. Kanjlia, S., Lane, C., Feigenson, L., & **Bedny, M.** (2016). Absence of visual experience modifies the neural basis of numerical thinking. *Proceedings of the National Academy of Sciences*, *113*(40), 11172–11177.
8. Lane, C., Kanjlia, S., Omaki, A., & **Bedny, M.** (2015). “Visual” cortex of congenitally blind adults responds to syntactic movement. *Journal of Neuroscience*. *35*(37): 12859-12868.
9. **Bedny, M.**, Richardson, H., & Saxe, R. (2015). “Visual” cortex responds to spoken language in blind children. *Journal of Neuroscience*. *35*(33): 11674-11681.
10. Deen, B., Saxe, R., **Bedny, M.** (2015). Occipital cortex of blind individuals is functionally coupled with executive control areas of frontal cortex. *Journal of Cognitive Neuroscience*. *27*(8): 1633-1647
11. Koster-Hale, J., **Bedny, M.**, Saxe, R. (2014). Thinking about seeing: Perceptual sources of knowledge are encoded in the theory of mind brain regions of sighted and blind adults. *Cognition*. *133*: 65-78
12. **Bedny, M.**, Dravida, S., & Saxe, R. (2014). Shindigs, brunches, and rodeos: The neural basis of event words. *Cognitive, Affective, & Behavioral Neuroscience*. *14*(3): 891-901
13. Dravida, S., Saxe, R., **Bedny, M.** (2013). People can understand visual motion without activating visual motion brain regions. *Frontiers in Psychology*.
14. Strnad L, Peelen MV, **Bedny M**, Caramazza A (2013). Multivoxel Pattern Analysis Reveals Auditory Motion Information in MT+ of Both Congenitally Blind and Sighted Individuals. *PLoS ONE*.
15. **Bedny, M.** & Saxe, R. (2012) Insights into the origins of knowledge from the cognitive neuroscience of blindness. *Cognitive Neuropsychology*. *29*(1-2): 56-84.
16. Gweon, H., Dodell-Feder, D., **Bedny, M.**, Saxe, R. (2012). Theory of Mind performance in children correlates with functional specialization of brain regions recruited for thinking about thoughts. *Child Development*. *83*(6): 1853-1868.
17. **Bedny, M.**, Caramazza, A., Pascual-Leone, A., Saxe, R. (2012). Typical neural representations of action verbs develop without vision. *Cerebral Cortex*. *22*(2): 286-193.
18. **Bedny, M.**, Pascual-Leone, A., Saxe, R. (2011). A sensitive period for language in the visual cortex: Distinct patterns of plasticity in congenitally versus late blind adults. *Brain and Language*. *122*(3): 162-170.
19. **Bedny, M.** & Caramazza, A. (2011). Perception, action, and word meanings in the human brain: the case from action verbs. *Annals of the New York Academy of Sciences*. *1224*: 81–95.
20. **Bedny, M.**, Pascual-Leone, A., D. Dodell-Feder, Fedorenko, E., Saxe, R. (2011). Language processing in the occipital cortices of congenitally blind adults. *Proceedings of the National Academy of Sciences*. *108*(11): 4429–4434.
21. Dodell-Feder, D., Koster-Hale, J., **Bedny, M.**, Saxe, R. fMRI item analysis in a theory of mind task. (2011). *Neuroimage*. *55*(2): 705-712.
22. **Bedny, M.**, Konkle, T., Pelphrey, K., Saxe, R., Pascual-Leone, A. (2010). Sensitive period for a multi-

- modal response in human visual motion area MT/MST. *Current Biology*. 20(21): 1900-1906.
23. **Bedny, M.**, Pascual-Leone, A., Saxe, R. (2009). Growing up blind does not change the neural bases of Theory of Mind. *Proceedings of the National Academy of Sciences*. 106(27): 11312-11317.
  24. **Bedny, M.**, Caramazza, A., Grossman, E., Pascual-Leone, A. and Saxe, R. (2008). Concepts are more than percepts: the case of action verbs. *Journal of Neuroscience*. 28(44): 11347-11353.
  25. **Bedny, M.**, McGill, M., Thompson-Schill, S.L. (2008). Semantic adaptation and competition during word comprehension. *Cerebral Cortex*. 18(11): 2574-2585.
  26. **Bedny, M.**, Aguirre, G. K., Thompson-Schill, S. L. (2007). Item analysis in functional magnetic resonance imaging. *Neuroimage*. 35: 1093-1102.
  27. **Bedny, M.**, Hulbert, J. C., Thompson-Schill, S. L. (2006). Understanding words in context: the role of Broca's area in word comprehension. *Brain Research*. 1146: 101-104.
  28. **Bedny, M.**, & Thompson-Schill, S. L. (2006). Neuroanatomically separable effects of imageability and grammatical class during single-word comprehension. *Brain and Language*. 98(2): 127-139.
  29. Thompson-Schill, S. L., **Bedny, M.**, & Goldberg, R. F. (2005). The frontal lobes and the regulation of mental activity. *Current Opinion Neurobiology*. 15(2): 219-224.
  30. Bedny, G., Karwowski, W. & **Bedny, M.** (2001). The principle of unity of cognition and behavior: Implications of activity theory for the study of human work. *International Journal of Cognitive Ergonomics*. 5(4): 401-420.

#### INVITED TALKS & WORKSHOPS

1. Nature and nurture in neurocognitive development. Talk at Science of Learning Institute, Johns Hopkins University, December 2017. Baltimore MD
2. Higher-cognitive functions in the visual cortices of congenitally blind individuals: evidence for a pluripotent cortex. Talk at symposium: How Visual Experience Affects (or not) the Functional Organization of the "Visual" Cortex. Organization for Human Brain Mapping. June 2017, Vancouver, Canada.
3. Nature & nurture in neurocognitive development: insights from studies of plasticity in blindness. Invited Talk at Helen at Wills Neuroscience Institute and the Cognitive Neuroscience Group in the Department of Psychology University of California, Berkeley, September 2017, Berkeley, CA.
4. The Power of the Mind: Research Exploring the Capacity of the Blind. Invited Talk: National Federation of the Blind Annual Convention, July 2017, Orlando, Florida.
5. Influence of experience on concepts and brain development. Invited Talk at Social Cognitive Neuroscience of Thought Summer School, June 2017, Siena, Italy.
6. How sensory experience shapes the human mind and brain: insights from empirical investigations of cognition in blindness. Talk at American Philosophy Association Pacific Division meeting in Seattle, Session on Sensory Transformation and Disability, April 2017, Seattle, WA.
7. Invited participant to Ernst Struengmann on "Manifestations and Mechanisms of Dynamic Brain Coordination over Development at Frankfurt Institute for Advanced Studies, March 2017, Frankfurt, Germany.
8. Effects of experience on neurocognitive development: insights from studies of blindness. Colloquium at the UC-Davis Center for Mind & Brain, March 2017, Davis, CA.
9. Nature and Nurture in Human Brain Development: Insights from Studies with Blind Individuals. Distinguished Lectures in Educational Neuroscience 2016-2017, Gallaudet University, October 2016, Washington, DC.
10. Symposium on "Event Structure" Cognitive Science Society Annual Meeting, August 2016, Philadelphia, PA.

11. Language processing in the visual cortex of blind individuals. Neural Plasticity Workshop: Insights from Deafness and Language, University of College London, June 2016, London, UK.
12. Nature and Nurture in Neurocognitive Development. Villanova Psychology Department Colloquium, February, 2016, Villanova, PA.
13. Nature and Nurture in Neurocognitive Development. CDS preconference: "Early development, conceptual change, and continuity: Insights from cognitive neuroscience." October 2015, Columbus, OH.
14. Nature and Nurture in Neurocognitive Development. Beijing Normal University, School of Brain and Cognitive Sciences. June 2015, Beijing, China.
15. Nature and Nurture in Neurocognitive Development. Peking University, School of Brain and Cognitive Sciences. June 2015, Beijing, China.
16. Developmental experience drives functional specialization in human cortex. Rovereto Workshop on Concepts, Objects and Actions, May 2015, Rovereto, Italy
17. Nature and Nurture in Neurocognitive Development. Center for Brain Plasticity and Recovery, Georgetown University Medical Center, October 2015, Washington, DC.
18. Session Organizer, Session on Neuroplasticity and Development, German-American Kavli Frontiers of Science Symposium, April, 2014, Irvine, CA.
19. Nature & nurture in human cognition: evidence from studies of blindness, University of Pennsylvania Center for Cognitive Neuroscience Colloquium Series, January 2014, Philadelphia, PA.
20. Insights into the origins of language from studies of blindness. Johns Hopkins University, Department of Cognitive Science, Colloquium, September 2013, Baltimore, MD.
21. Visual cortex invaded by higher cognitive functions as a result of early blindness. Optical Society of America Annual Meeting, October 2013, Houston, TX.
22. Insights into abstract thought from studies of blindness, University of Maryland Neuroscience and Cognitive Science Seminar Series, October 2013, College Park, MD.
23. Insights into nature and nurture from studies of blindness, Blind Brain Workshop, University of Pisa, October 2013, Pisa, Italy.
24. Nature & nurture in human cognition: evidence from studies of blindness. University of Maryland Cognitive Science Colloquium, December 2013, College Park, MD.
25. Nature & nurture in neurocognitive development. May 2013, Royal Society Meeting on Blindness and Visual Development, Chicheley, UK.

## **HONORS/AWARDS**

2017 - Programme Committee Chair Society for the Neurobiology of Language

2017 – Reporteur Ernst Struengmann Forum

2013 – Kavli Frontiers Fellow of the National Academy of Sciences

2007 to 2011, Grant from Clinical Loan Repayment Program of the National Institute on Deafness and Other Communication Disorders at NIH

2005 – Fellow, Summer Institute in Cognitive Neuroscience, Dartmouth College, Hanover New Hampshire

2002 – Honorable Mention, National Science Foundation Graduate Fellowship

2001 – Bachelors of Arts with Honors in Cognitive Science, Johns Hopkins University

2001 – Phi Beta Kappa Honors Society, Johns Hopkins University

## **MEMBERSHIPS**

2016	Member, Cognitive Science Society Program Committee
2008 – present	Member, Society for Neuroscience
2008 – present	Member, Society for the Neurobiology of Language
2001 – present	Member, Cognitive Neuroscience Society
2011 – present	Member, Cognitive Development Society
2009 – present	Member, Cognitive Science Society

### **AD-HOC REVIEWER**

Brain and Language

Cerebral Cortex

Cognition

Cognitive Neuroscience

Current Biology

Journal of Cognitive Neuroscience

Journal of Experimental Psychology: Learning, Memory and Cognition

Journal of Experimental Psychology: General

Journal of Neuroscience

Language and Cognition

Neuron

Neuroimage

Proceedings of the National Academy of Sciences

Psychological Science

### **TEACHING & ADVISING**

#### **Advisees**

Shipra Kanjlia (graduate student)

Research: Experience based change in numerical cognition

Role: Co-advisor

Giulia Elli (graduate student)

Research: First person experience contribution to concepts.

Role: Advisor

Judy Kim (graduate student)

Research: Neurobiological basis of language

Role: Advisor

Rita Loiotile (graduate student)

Research: Neuroplasticity and working memory

Role: Co-Advisor

#### **Undergraduate Courses Taught**

Mind, Brain & Experience, Undergraduate

Neurobiology of Human Cognition, Undergraduate

Cognitive Neuroscience of Development (Graduate Courses, Co-Taught)

Psychological & Brain Sciences Core Topics A (Graduate Courses, Co-Taught)

Psychological & Brain Sciences Core Topics B (Graduate Courses, Co-Taught)

Fundamentals of Psychological and Brain Sciences (Graduate Courses, Co-Taught)

#### **Graduate Student Committees Service**

Graduate Thesis Committee Member, Psychosocial and Brain Sciences Department, student: Kitty Xu, Advisor: Susan Courtney, Defense to be scheduled

Graduate Board Oral Examination Committee Member, Cognitive Science Department, student: David Rothlein, Advisor Brenda Rapp, Defense September 2015

Advanced Exam Committee Member, Psychosocial and Brain Sciences Department, student: Tammy Tran, Advisor: Michela Gallagher, Defense September 2015

Advanced Exam Committee Member, Psychosocial and Brain Sciences Department, student: Shipra Kanjlia, Advisor: Marina Bedny, September 2015

Graduate Board Oral Examination Alternate Committee Member, Cognitive Science Department, student: Katrina Ferrara, Advisors Barbara Landau & Soojin Park, Defense January 2014

Graduate Board Oral Examination Committee Member, Cognitive Science Department, student: Teresa Schubert, Advisor Michael McCloskey, Defense January 2014

Graduate Board Oral Examination Committee Member, Psychological and Brain Sciences Department, student: Gi Yeul, Advisor: Jonathan Flombaum, Defense February 2014

Graduate Board Oral Examination Committee Member, Psychosocial and Brain Sciences Department, student: Aimee Stahl, Advisor: Lisa Feigenson, Defense April 2014

Advanced Exam Committee Member, Psychosocial and Brain Sciences Department, student: Jenny Wang, Advisor: Lisa Feigenson, June 2014

Advanced Exam Committee Member, Psychosocial and Brain Sciences Department, student: Mark Schurgin, Advisor: Jonathan Flombaum, June 2014

## **UNIVERSITY COMMITTEES AND SERVICES**

Member of Faculty Search Committee for Bloomberg Distinguished Professorship of Computational Neuroscience of the Human Brain, Department of Psychological Sciences and Department of Biomedical Engineering, 2013-2014.

Member of Faculty Search Committee for Bloomberg Distinguished Professorship of Neurodevelopment, School of Education and School of Public Health, 2014.

Member of Faculty Search Committee, Tenure-track or tenured Professor of Human Cognitive Neuroscience/Cognitive Psychology, Department of Psychological and Brain Sciences, 2014.

## **FUNDING**

“Visual cortex plasticity in blindness: a window into flexibility of human cortex” 1R01EY027352-01A1  
National Institute of Health, National Eye Institute R01  
Funding Period 9/2017-6/2022  
PI: Marina Bedny  
Total award: \$2,457,837

“Insights into human brain plasticity from studies of blindness.”  
Johns Hopkins University, Catalyst Award  
Funding Period 7/2017- 7/2018  
PI: Marina Bedny  
Total award: \$70,000

“Insights into Human Learning and Development from Visual Cortex Plasticity in Blindness”  
Science of Learning Institute Grant  
Funding Period 2014-2016  
PI: Marina Bedny  
Co-PIs Akira Omaki, Pablo Celnik  
Total award: \$150,000

“The role of visual experience in numerical processing.”  
NSF Graduate Research Fellowship  
Awarded to Shipra Kanjlia  
Funding Period: 2014-2017  
Total award: \$135,000

“The neural bases of word meanings: Insights from combined fMRI & TMS studies.”  
Source: Loan Repayment Program, National Eye Institute, National Institute of Health  
Funding Period 2007-2011  
PI: Marina Bedny  
Sponsor: Alvaro Pascual-Leone