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## Curriculum Vitae

### André Moraes Bastos

Assistant Professor  
Department of Psychology  
Vanderbilt Brain Institute  
Vanderbilt University

### Contact Information

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### Date of Birth

27 June 1985, Campinas, São Paulo, Brazil

### Education

- 2013 PhD in Neuroscience, Thesis advisors: Pascal Fries, W. Martin Usrey, George Ron Mangun, University of California, Davis
- 2007 BA with Highest Honors in Cognitive Science, Thesis advisor: Eleanor Rosch, University of California, Berkeley

### Current Position

2021- Assistant Professor, Vanderbilt University

### Past Positions

- 2019-2021 Research Scientist, Massachusetts Institute of Technology
- 2017, 2020 Parental leave of absence (6 months in total, full-time)
- 2014-2019 Postdoctoral Associate, Massachusetts Institute of Technology
- 2007-2008 Post-baccalaureate researcher, Robert T. Knight Lab, UC Berkeley
- 2006-2007 Research Assistant, Lynn Robertson Lab, UC Berkeley

### Awards and Honors

- 2023 NARSAD Young Investigatory Award
- 2023 Vanderbilt Brain Institute Faculty Fellow
- 2022 Fellow at Scialog: Molecular Basis of Cognition
- 2022 OpenScope Program Awardee, Allen Institute
- 2020 Emmy Noether Programme, German Research Foundation (declined)
- 2018 NIMH K99/R00 Pathway to Independence Award
- 2017 Association for Psychological Science Rising Star
- 2016 Elected to chair postdoctoral association of the Brain and Cognitive Science department at MIT
- 2015 Best presentation award, Latin American School for Computational Neuroscience
- 2010 Graduate Research Fellowship Program, National Science Foundation

- 2009 Fulbright Scholar to The Netherlands, US Department of State
- 2009 Michael Posner Award in Cognitive Neuroimaging, UC Davis Center for Mind and Brain
- 2007, 2008 Research Fellow to the Mind and Life Summer Research Institute
- 2007 Glushko Prize for best honors thesis, UC Berkeley, Department of Cognitive Science
- 2007 Neufeld Award for scholar-athlete with the highest Grade Point Average at UC Berkeley

## Publications

1. Mendoza-Halliday D(\*), Major AJ, Lee N, Lichtenfeld M, Carlson B, Mitchell B, Meng PD, Xiong YS, Westerberg JA, Maier A, Desimone R, Miller EK, **Bastos AM**(\*). (2024). A ubiquitous spectrolaminar motif of local field potential power across the primate cortex. (\* Corresponding author). *Nature Neuroscience*. <https://doi.org/10.1038/s41593-023-01554-7>
2. YS, Donoghue JA, Lundqvist M, Mahnke M, Major AJ, Brown EN, Miller EK(\*), **Bastos AM**(\*). (2023). Propofol-induced loss-of-consciousness disrupts predictive routing and local field phase. (\*equal contribution). *BioRxiv*
3. Gabhart K, Xiong YS, **Bastos AM** (2023). How are Global oddballs encoded? *PsyArxiv*. <https://osf.io/preprints/psyarxiv/7sz3w>
4. Tovar DA, Westerberg JA, Cox MA, Dougherty K, Wallace M, Bastos AM, Maier A. (2022). Near-field potentials index local neural computations more accurately than population spiking. *BioRxiv*. <https://doi.org/10.1101/2023.05.11.540026>
5. Akella S, **Bastos AM**, Miller EH, Principe, JC. (2023) Measurable fields to spikes causality and its dependence on cortical layer and area. *BioRxiv*. <https://doi.org/10.1101/2023.01.17.524451>
6. Wollstadt P, Rathbun DL, Usrey WM, **Bastos AM**, Lindner M, Priesemann V, Wibral M. (2023). Information-theoretic analyses of neural data to minimize the effect of researchers' assumptions in predictive coding studies. *PLOS Computational Biology*. 19(11): e1011567. <https://doi.org/10.1371/journal.pcbi.1011567>
7. Katsanevaki C, **Bastos AM**, Cagnan H, Bosman CA, Friston KJ, Fries P. (2023) Attentional effects on local V1 microcircuits explain selective V1-V4 communication. *NeuroImage*. 281:120375. <https://doi.org/10.1016/j.neuroimage.2023.120375>
8. Sanchez-Todo R, **Bastos AM**, Lopez-Sola E, Mercadal B, Santarnecchi E, Miller EK, Deco G, Ruffini G. (2023). A physical neural mass model framework for the analysis of oscillatory generators from laminar electrophysiological recordings. *NeuroImage*. 270:119938. <https://doi.org/10.1016/j.neuroimage.2023.119938>
9. Vezoli J, Vinck MA, Bosman CA, **Bastos AM**, Lewis CM, Kennedy H, Fries, P. (2021) Brain rhythms define distinct interaction networks with differential dependence on anatomy. *Neuron*. 109 (23), 3862-3878 <https://doi.org/10.1016/j.neuron.2021.09.052>
10. **Bastos AM**\*, Donoghue JA\*, Brincat SL, Mahnke M, Yanar J, Correa J, Waite AS, Lundqvist M, Roy J, Brown EN, Miller EK. (2021) Neural effects of propofol-induced unconsciousness and its reversal using thalamic stimulation. (\*equal contribution). *Elife*. 10:e60824
11. **Bastos AM**, Lundqvist M, Waite AS, Kopell N, Miller EK. (2020) Layer and rhythm specificity for predictive routing. *Proceedings of the National Academy of Sciences of the United States of America*. 117(49): 31459–31469 <https://doi.org/10.1073/pnas.2014868117>

12. Lundqvist M\*, **Bastos AM\***, Miller EK. (2020) Preservation and changes in oscillatory dynamics across the cortex. (\*equal contribution). *Journal of Cognitive Neuroscience*. 32(10):2024-2035.
13. Gong X, Mendoza-Halliday D, Ting JT, Kaiser T, Sun X, **Bastos AM**, Wimmer RD, Zhou Y, Wu C, Barak B, Deisseroth K, Miller EK, Halassa MM, Bi G, Desimone R, Feng G (2020) An ultra-sensitive step-function opsin for minimally invasive optogenetic stimulation in mice and macaques. *Neuron*. S0896-6273(20)30239-7.
14. Miller EK, Lundqvist M, and **Bastos, AM**. (2018) Working Memory 2.0. *Neuron*. 100(2):436-75
15. **Bastos AM\***, Loonis R\*, Kornblith S, Lundqvist M, Miller EK. (2018) Laminar recordings in frontal cortex suggest distinct layers for maintenance and control of working memory. (\*equal contribution). *Proceedings of the National Academy of Sciences of the United States of America*. 115(5):1117-1122.
16. Pinotsis DA, Loonis R, **Bastos AM**, Miller EK, Friston KJ. (2016) Bayesian Modelling of Induced Responses and Neuronal Rhythms. *Brain topography* DOI 10.1007/s10548-016-0526-y
17. **Bastos AM**, Schoffelen JM (2016) A Tutorial Review of Functional Connectivity Analysis Methods and Their Interpretational Pitfalls. *Frontiers in Systems Neuroscience*. 9:175
18. **Bastos AM\***, Vezoli\*, J, Bosman CA\*, Schoffelen JM, Oostenveld R, Dowdall JR, De Weerd P, Kennedy H, Fries P (2015) Visual areas exert feedforward and feedback influences through distinct frequency channels. (\*equal contribution). *Neuron*. 85(2):390-401
19. **Bastos AM**, Litvak V, Moran R, Bosman C, Fries P, Friston KJ (2015) A DCM study of spectral asymmetries in feedforward and feedback connections between visual areas V1 and V4 in the monkey. *Neuroimage*. 108:460-75
20. **Bastos AM**, Vezoli J, Fries P (2015) Communication through coherence with delays. *Current Opinion in Neurobiology*. 31:173-180
21. Friston KJ, **Bastos AM**, Pinotsis D, Litvak V (2014) LFP and oscillations – what do they tell us? *Current Opinion in Neurobiology*. 31C:1-6.
22. Friston KJ, **Bastos AM**, Litvak V, Richter C, Van Wijk B (2014) Granger causality revisited. *Neuroimage*. S1053-8119(14)00539-4
23. **Bastos AM**, Briggs F, Alitto HJ, Mangun GR, Usrey WM (2014) Simultaneous recordings from the primary visual cortex and lateral geniculate nucleus reveal rhythmic interactions and a cortical source for gamma-band oscillations. *Journal of Neuroscience* 34:7639-7644
24. Pinotsis DA, Brunet N, **Bastos AM**, Bosman CA, Litvak V, Fries P, Friston KJ (2014) Contrast gain control and horizontal interactions in V1: A DCM study. *Neuroimage* 92:143-55
25. **Bastos AM**, Usrey WM, Adams RA, Mangun GR, Fries P, Friston KJ (2012) Canonical microcircuits for predictive coding. *Neuron* 76:695-711
26. Bosman CA, Schoffelen JM, Brunet N, Oostenveld R, **Bastos AM**, Womelsdorf T, Rubehn B, Stieglitz T, De Weerd P, Fries P (2012) Attentional stimulus selection through selective synchronization between monkey visual areas. *Neuron* 75:875-88
27. Friston KJ, **Bastos AM**, Litvak V, Stephan KE, Fries P, Moran RJ (2012) DCM for complex-valued data: cross-spectra, coherence and phase-delays. *Neuroimage* 59:439-55

## Book Chapters

1. Xiong YS, Fries P, **Bastos AM** (2021) Intracranial EEG research in cognitive neuroscience. In: Axemacher, N. (ed) Which rhythms reflect bottom-up and top-down processing? DOI: [10.13140/RG.2.2.21306.52160](https://doi.org/10.13140/RG.2.2.21306.52160)
2. Adams RA, Friston KJ, **Bastos AM** (2015) Active Inference, Predictive Coding and Cortical Architecture. In: Casanova M., Opris I. (eds) Recent Advances on the Modular Organization of the Cortex. Springer, Dordrecht.

### **Selected Conference Abstracts (Since 2021)**

1. Nejat H, Sherfey J, Bastos AM. (2023). "Cortical gamma-beta rhythms perform predictive routing via stochastic reinforcement learning," Society for Neuroscience, 11/11/2023-11/15/2023, Washington, D.C., Poster Presentation.
2. Westerberg JA, Durand S, Bawany A, Cabasco H, Loeffler H, Belski H, Hardcastle B, Olsen S, Lecoq J, Maier A, Bastos AM. "Global and local oddball detection across the mouse visual cortical hierarchy," Society for Neuroscience, 11/11/2023-11/15/2023, Washington, D.C., Poster Presentation.
3. Xiong YS, Maier A, Westerberg JA, Nejat H, Gabhart K, Meng PD, Bastos AM. "Late Hierarchical Emergence of Global Prediction Error Encoding in the Macaque Cortex," Society for Neuroscience, 11/11/2023-11/15/2023, Washington, D.C., Poster Presentation.
4. Meng PD, Lichtenfeld MJ, Mulvey AG, Carlson BM, Mitchell BA, Maier A, Bastos AM. "Validation of light-sheet microscopy for identifying the laminar distribution of parvalbumin-, calbindin-, and calretinin-positive neurons in the macaque cortex," Society for Neuroscience, 11/11/2023-11/15/2023, Washington, D.C., Poster Presentation.
5. Lichtenfeld MJ, Mulvey AG, Carlson BM, Mitchell BA, Mendoza-Halliday D, Meng PD, Desimone R, Maier A, Kaas JH, Bastos, AM. "The laminar structure of inhibitory and excitatory cell types in macaque cortex and its implications for hierarchical information processing," Society for Neuroscience, 11/11/2023-11/15/2023, Washington, D.C., Poster Presentation.
6. Nejat H, Sherfey J, Bastos AM (2022). "Reinforcement learning reveals the contribution of distinct cell types and layers to predictive routing", Society for Neuroscience, 11/12/2022-11/16/2022, San Diego, CA, Poster Presentation
7. Bastos AM, Mendoza-Halliday DM, Major A, Lee N, Lichtenfeld M, Carlson B, Mitchell B, Meng PD, Xiong YS, Westerberg J, Kaas J, Maier A, Desimone R, Miller EK (2022). "A preserved spectro-laminar motif of local field potential power across cortical areas maps onto histologically-identified layers", Society for Neuroscience, 11/12/2022-11/16/2022, San Diego, CA, Poster Presentation
8. Xiong YS, Donoghue J, Mahnke M, Lundqvist M, Brown EN, Miller EK, Bastos AM (2022). "Predictive processing without consciousness in the auditory cortex", Society for Neuroscience, 11/12/2022-11/16/2022, San Diego, CA, Poster Presentation
9. Bastos AM (2022). "A spectro-laminar framework for cortical computations", Society for Cognitive Neuroscience, 04/23/2022 – 04/26/2022, San Francisco, Symposium Talk
10. Xiong YS, Donoghue J, Mahnke M, Lundqvist M, Brown EN, Miller EK, Bastos AM (2022). "Predictive processing in auditory cortex without consciousness", Cognitive Neuroscience, 04/23/2022 – 04/26/2022, San Francisco, Poster Presentation
11. Katsanevaki C, Bastos AM, Cagnan H, Bosman CA, Friston KJ, Fries P (2022). "Selective V1-to-V4 communication of attended stimuli mediated by attentional effects in V1", Cosyne, 03/17/2022-03/20/2022, Lisbon, Portugal, Poster Presentation

12. Bastos AM, Mendoza-Halliday D, Lee N, Lichtenfeld M, Major A, Desimone R, Miller EK (2021). "A ubiquitous laminar motif of local field potential power across cortical areas, individual subjects and studies", Society for Neuroscience (virtual), 11/08/2021-11/11/2021
13. Xiong YS, Donoghue J, Mahnke M, Lundqvist M, Brown EN, Miller EK, Bastos AM (2021). "Predictive processing in auditory cortex without consciousness", Society for Neuroscience (virtual), 11/08/2021-11/11/2021
14. Major AJ, Bastos AM, Miller EK (2021). "Layer-specific deactivation of prefrontal cortex as a causal test of predictive coding", Society for Neuroscience (virtual), 11/08/2021-11/11/2021
15. Kozachkov L, Eisen A, Bastos AM, Donoghue JA, Mahnke M, Brincat SL, Brown EN, Miller EK (2021). "Propofol anesthesia changes dynamic stability in cortex", Society for Neuroscience (virtual), 11/08/2021-11/11/2021

### **Invited Lectures**

"Multi-Area, High-Density, Laminar Neurophysiology (MaDeLaNe) for discovering the neural mechanisms of predictive coding" 03/15/2024. University of Tuebingen, Tuebingen, Germany, invited by Prof. Markus Siegel

"Multi-Area, High-Density, Laminar Neurophysiology (MaDeLaNe) for discovering the neural mechanisms of predictive coding" 11/01/2023. Webinar organized by Diagnostic Biochips.

"Multi-laminar, multi-area recordings in the non-human primate brain suggest Predictive Coding is implemented via Predictive Routing" July 10-14, 2023, NSF-funded workshop 'Sensory Prediction: Engineered and Evolved', Santa Fe Institute, Santa Fe, New Mexico, invited by Profs. Jim Crutchfield and Sarah Marzen

"Canonical cortical circuits and dynamics for cognition" 11/03/2022. Georgia State University. Atlanta, GA, invited by Profs. Mukesh Dhamala and Yang-Ting Chien

"Canonical cortical circuits and dynamics for cognition" 03/23/2022. Leverhulme Seminar Series at the University of Sussex. Brighton, United Kingdom, invited by Anil Seth.

"Canonical cortical circuits and dynamics for cognition" 06/04/2021. Institute de Neurosciences de la Timone. Marseille, France, invited by Bjørn Kilavik.

"Canonical cortical circuits and dynamics for cognition" 04/20/2021. Virtual fMRI

"Dinner" Event. National Institute of Mental Health. Bethesda, MD, invited by Andrew Morgan.

"Canonical cortical circuits and dynamics for cognition" 12/18/2020. Brain Meeting, Wellcome Trust Centre for Cognitive Neuroimaging. London, UK, invited by Prof. Karl Friston.

"Laminar recordings in frontal cortex suggest distinct layers for maintenance and control of working memory" 11/10/2020. 7th International Conference on Non-Invasive Brain Stimulation. Baden-Baden, Germany, Chairs: Javier Márquez-Ruiz, Alexander Rotenberg

"Canonical properties of cortical circuits and dynamics for cognition and consciousness" 05/27/2020. University of Michigan. Invited by Professors Anthony Hudetz and George Mashour

"Canonical properties of cortical circuits and dynamics for cognition" 03/18/2020. University of Newcastle. Invited by Professor Alexander Thiele

“Canonical properties of cortical circuits and dynamics for cognition” 02/26/2020. Georgetown University. Invited by Professor Italo Mocchetti

“Canonical properties of cortical circuits and dynamics for cognition” 02/10/2020. Northwestern University. Invited by Professor Joel Voss

“Canonical properties of cortical circuits and dynamics for cognition” 01/20/2020. Vanderbilt University. Invited by Professor Frank Tong

“Canonical properties of cortical circuits and dynamics for cognition” 01/07/2020. European Neuroscience Institute, Göttingen, Germany. Invited by Professor Mathias Bähr.

“Theoretical and Neurophysiological Underpinnings for Predictive Coding,” 2019 ASU Cognitive Science Symposium: Whatever Next? Predictive Brains and the Future of Cognitive Science. 10/18/2019. Arizona State University, invited by Professor Arthur Glenberg

“Laminar recordings in frontal cortex suggest distinct layers for maintenance and control of working memory,” Lecture Series. 06/20/2018. German Primate Institute, Göttingen, Germany, invited by Prof. Hans Scherberger

“Spectral asymmetries in the cortex and predictive coding,” Latin American School of Computational Neuroscience. 01/27/2018. NeuroMat, Universidade de São Paulo, São Paulo, Brazil, invited by Prof. Antonio Roque

“Laminar specific working memory coding in frontal circuits,” Lecture series. 12/06/2016. University of Wisconsin, Madison, invited by Prof. Matthew Banks

“Laminar specific working memory coding in frontal circuits” 2016 CCN Workshop on predictive coding. 08/16/2016, Dartmouth University, invited by Prof. James Haxby. [Link to Full talk](#)

“Spectral asymmetries in feedforward and feedback connectivity: a basic motif in cortical processing?” NETT International Conference on System Level Approaches to Neural Engineering. 09/22/2015. Barcelona, Spain, invited by the Organizing Committee.

“Testing the canonical microcircuit model: is there a conserved laminar functional anatomy across cortex?” Cognitive Rhythms Collaboration Meeting. 09/08/2015. Cambridge, MA, USA, invited by Prof. Nancy Kopell

“Spectral asymmetries in feedforward and feedback connectivity: a basic motif in cortical processing?”. Brain Meeting, Wellcome Trust Centre for Cognitive Neuroimaging. 02/20/2015. London, UK, invited by Prof. Ray Dolan

“Dynamic coordination of neuronal circuits through inter-areal synchronization”, Bernstein Conference pre-conference workshop, 09/26/2013. Tuebingen, Germany, organized by Profs. Michael Wibral and Matthias Kaschube

“Canonical microcircuits for predictive coding” Free Energy Principle conference: at Berlin School of Mind and Brain. 07/17/2013. Berlin, Germany, invited by Ryszard Auksztulewicz

“Canonical microcircuits for predictive coding” Donders Theme 4 talk at Radboud University Nijmegen. 04/18/2013. Nijmegen, The Netherlands, invited by Prof. Ole Jensen.

“Brain-wide oscillatory networks at gamma and beta frequencies and their putative functional roles” Systems and Computational Neuroscience Series. 10/22/2012. Toronto, C.A., invited by Prof. Thilo Womelsdorf



“A proposal for the function of canonical microcircuits” Free Energy Workshop, 7/5/2012. London, U.K., invited by Prof. Karl Friston.

### **Teaching (Vanderbilt)**

- The Predictive Brain (PSY3892-02), Vanderbilt University, Fall 2022, Fall 2023, undergraduate course on the anatomy, physiology, and computations of predictive processing in neural circuits
- Experimental Methods in Behavioral Neuroscience (PSY 4720), Vanderbilt University, Spring 2022, Spring 2023, Spring 2023, undergraduate laboratory course on fundamental neurophysiology
- Guest Lecture in Prof. Thilo Womelsdorf’s graduate course Fundamentals of Neuroscience II (NURO 8340), Vanderbilt University, Fall 2022, Fall 2023
- Guest Lecture in Prof. Christine Konradi’s graduate course Principles of Pharmacology in Neurobiological Research (NURO 8338), Vanderbilt University, Spring 2024

### **Leadership, Mentoring and Outreach**

Advisees, Vanderbilt: Yihan (Sophy) Xiong (PhD student), Hamed Nejat (PhD student), Jacob Westerberg (postdoc), Eli Sennesh (postdoc), Patrick Meng (Research Assistant), Kaitlyn Gabhart (Research Assistant and Lab Manager), Max Lichtenfeld (Undergraduate student), Ali Hussain (Undergraduate student), Aidan Mulvey (Undergraduate student), Thomas Gonzales (Undergraduate student), John Alvord (Undergraduate student), Mazyar Azmi (Undergraduate student).

Advising on PhD Committees, Vanderbilt: Kianoush Banaie Boroujeni (graduated 2021), Jacob Westerberg (graduated 2022), Saman Abbaspoor (graduated 2023), Brock Carlson, Loïc Daumail, Justin Flanagan

Mentoring, MIT (2014-2020): I mentored junior members of the Earl Miller laboratory, including MD/PhD students Jacob Donoghue and Roman Loonis, post-baccalaureate students Jorge Yanar and Charles Svartsman, and postdoctoral associate Omar Costilla-Reyes.

Brain and Cognitive Sciences Department Postdoctoral Association (2015-2016):

Served as co-chair of the MIT BCS PDA. My responsibilities included acting as a liaison between postdocs and the directors of the BCS department, engaging in advocacy for enhancing the postdoctoral experience at MIT, and planning career, networking and social events.

Guest Editor at Frontiers in Systems Neuroscience (2016): Organized and co-edited 8 manuscripts for a Frontiers Research Topic titled “From theory to method to understanding: connectivity analysis of electrophysiological data to understand the function of the dynamic brain.”

Reviewer: Invited to review at Neuron, Current Biology, eLife, Journal of Neuroscience, NeuroImage, Cell Reports, Communications Biology, Cerebral Cortex, Frontiers, PLOS Biology, PLOS Computational Biology, Scientific Reports, Trends in Cognitive Sciences, Journal of Computational Neuroscience, eNeuro, and abstracts for CoSYNE and the Conference on Cognitive Computational Neuroscience.

Public Outreach: Participated in Brain Awareness week by presenting a booth at BrainBlast 2022 organized by the VBI, where we recorded EEG activity from the brains of kids in grades K-8. I have also led public tours at the MIT Museum, which exhibited original works from Santiago Ramon y Cajal. I have presented public lectures during the

Cambridge Science Festival (Cambridge, MA), local public elementary schools, and have delivered lectures to middle school students in rural parts of Brazil. My goal is always to inspire young people about the exciting new discoveries happening in neuroscience, as well as deliver the message that with enough curiosity and drive, anyone can contribute to scientific progress, if that is their calling.