

Michael D. Nunez, Ph.D.

Assistant Professor
Psychological Methods
University of Amsterdam

<https://scholar.google.com/citations?user=vta5mnwAAAAJ>

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EDUCATION

University of California, Irvine

2017 - Ph.D. in Psychology w/ Concentration in Cognitive Neuroscience

Cognitive Sciences Department

2017 - M.S. in Cognitive Neuroscience

University of California, Irvine

2015 - M.S. in Statistics

Statistics Department

Tulane University, New Orleans, LA

2010 - B.S. in Mathematics and Economics (Double Major, cum laude), Minor in Psychology

Mathematics Department

EMPLOYMENT HISTORY

Assistant Professor

July 2021 - Present

Psychological Methods Group

Department of Psychology

University of Amsterdam

I develop my own research program on neurocognitive modeling, decision-making and other topics. I also teach graduate and undergraduate courses, as well as mentor Masters and Bachelor students.

Assistant Project Scientist, Cognition and Individual Differences Lab, Human Neuroscience Lab

Aug 2020 - June 2021

PIs: Prof. Joachim Vandekerckhove, Prof. Ramesh Srinivasan

Department of Cognitive Sciences

University of California, Irvine

I developed and found parameter estimates of neurocognitive models using human EEG and behavioral data.

Assistant Project Scientist, Fuster Laboratory of Cognitive Neuroscience

Feb 2019 - July 2020

PI: Prof. Michele A. Basso

Department of Psychiatry and Biobehavioral Sciences

University of California, Los Angeles (UCLA)

I studied decision making from recordings of neurons, intracranial data, and behavioral data in Rhesus macaques.

Assistant Project Scientist, Cognition and Individual Differences Lab, Human Neuroscience Lab

May 2018 - Feb 2019

PIs: Prof. Joachim Vandekerckhove, Prof. Ramesh Srinivasan

Department of Cognitive Sciences

University of California, Irvine

I sought to estimate unidentified cognitive models of human decision making with experimental behavior and scalp-recorded EEG.

Associate Specialist, Laboratory of Computational and Translational Neuroscience

Sep 2017 - May 2018

PI: Prof. Beth A. Lopour

Department of Biomedical Engineering

University of California, Irvine

I classified and statistically modeled markers of epilepsy in human patients using electric potentials recorded directly from the cortex.

Graduate Student Researcher, Human Neuroscience Lab, Cognition and Individual Differences Lab Aug 2012 - Aug 2017
PIs: Prof. Ramesh Srinivasan, Prof. Joachim Vandekerckhove
Department of Cognitive Sciences
University of California, Irvine

I tested the veracity of combined electrocortical and cognitive models of human visual attention and decision-making. This was typically performed in a hierarchical Bayesian statistical framework with statistical models of EEG and human behavior.

Teaching Assistant, Cognitive Sciences Department Sep 2012 - Dec 2016
University of California, Irvine

I was responsible each academic quarter to fulfill the duties of a teaching assistant as needed by the instructor of the course. I held discussion courses for undergraduates each week as well as provided office hours and graded papers, homework, and exams.

Research Assistant, Psychology Department 2011 - 2012
PI: Prof. Edward Golob
Tulane University, New Orleans, LA

I sought to advance understanding of normal cognitive aging by exploring condition differences in auditory EEG Event Related Potentials obtained from Independent Component Analysis (ICA).

PROFESSIONAL SKILLS

- **Modeling:**
 - Neurocognitive models / Model-based Cognitive Neuroscience (mathematical cognitive models of brain and behavior)
 - Mathematical Psychology (mathematical cognitive models of human and Rhesus macaque behavior)
 - Computational Neuroscience (statistical models of scalp and intracranial EEG, LFPs and population activity)
- **Statistics:**
 - Bayesian model fitting (MCMC, Amortized Bayesian Inference, Bayesian model comparison, Bayes Factor calculations)
 - Hierarchical Bayesian models and Bayesian structural equation modeling
 - Classical (Frequentist) statistical methods
 - Machine Learning, Artificial Neural Networks, Time Series, etc.
- **Neuroimaging:**
 - EEG (recording with EGI and ANT hardware and software, OpenVibe, ICA artifact correction, ERPs, SSVEPs, source analysis, Brain-Computer Interfaces, custom Python and MATLAB functions, EEGLAB, etc.)
 - ECoG / iEEG (analysis of intracranial recordings from epileptic patients using custom Python and MATLAB functions)
 - Single unit electrophysiology (implantation of depth electrodes, finding of receptive fields, electrical noise reduction)
 - fMRI (operating the MRI machine, nibabel, Nilearn, SPM, analyzing structural MRI images, BrainSight)
 - Brain-Computer Interfaces / Adaptive Neurotechnologies (OpenVibe, Visual Evoked Potentials, SSVEPs, familiarity with BCI hardware, BCI start-up company involvement)
 - Eye tracking (infrared eye tracking of pupil and infrared reflection, eye tracking in monkeys using implanted eye coils)
- **Additional Mathematics:** Signal Processing, Linear Algebra, Multivariate Calculus, etc.
- **Programming:**
 - Python (advanced knowledge: Numpy, Scipy, Tensorflow, etc. public Github scripts)
 - R (advanced knowledge: base, dplyr, etc., built MCMC samplers, public Github scripts)
 - MATLAB (advanced knowledge: public Github repositories, experimental designs)
 - C++ (working knowledge: building experimental stimuli)
 - Stan, JAGS, Github, git, Linux Bash, html (lab website maintenance), Julia (learning), REX/VEX
- **Experimental design:** Design and implementation for human participants and Rhesus macaques
- **Teaching:** Teaching of undergraduate and graduate students in statistics, programming, experimental design, scientific writing, etc. Netherlands University Teaching Qualification (BKO).
- **Mentorship:** Mentoring of undergraduate, graduate students, and laboratory assistants from diverse backgrounds
- **Data analysis:** Preparing and organizing large data sets, dimension reduction, statistical modeling, etc.
- **Open science:** Sharing of code and data with github.com and osf.io, preregistration of scientific experiments, sharing of open-access papers, conference posters, etc. on preprint and postprint websites
- **Animal lab / Veterinary care:** Hands-on experience caring for, cleaning implants of, training, and building experiments for Rhesus macaques. Preparing and recording neural data from the cortex and midbrain in Rhesus macaques using depth electrodes.

PUBLICATIONS

- **Nunez, M. D.**, Fernandez, K., Srinivasan, R., & Vandekerckhove, J. (2024). [A tutorial on fitting joint models of M/EEG and behavior to understand cognition](#). *Behavior Research Methods*. doi: 10.3758/s13428-023-02331-x
- Vo, K., Sun, Q. J., **Nunez, M. D.**, Vandekerckhove, J., & Srinivasan, R. (2024). [Deep latent variable joint cognitive modeling of neural signals and human behavior](#). *NeuroImage*. doi: 10.1016/j.neuroimage.2024.120559
- **Nunez, M. D.**, Schubert, A.-L., Frischkorn, G. T., Oberauer, K. (2023). [Cognitive models of decision-making with identifiable parameters: Diffusion Decision Models with within-trial noise](#). *PsyArXiv*. doi: 10.31234/osf.io/h4fde
- Alanis, J. C. G., **Nunez, M. D.**, Wehrheim, M. H., Fiebach, C., Löffler, C., & Schubert, A. L. (2023). [The Devil's in the Variability: A Multidimensional Analysis of EEG Signal Dynamics and Their Relation to Behaviour](#). *PsyArXiv*. doi: 10.31234/osf.io/4ug3y
- Ghaderi-Kangavari, A., Rad, J. A., **Nunez, M. D.** (2023). [A general integrative neurocognitive modeling framework to jointly describe EEG and decision-making on single trials](#). *Computational Brain & Behavior*, 6, 317–376. doi: 10.1007/s42113-023-00167-4
- Ghaderi-Kangavari, A., Parand, K., Ebrahimpour, R., **Nunez, M. D.**, Rad, J. A. (2023). [How spatial attention affects the decision process: looking through the lens of Bayesian hierarchical diffusion model & EEG analysis](#). *Journal of Cognitive Psychology*, 35:4, 456-479. doi: 10.1080/20445911.2023.2187714
- Ghaderi-Kangavari, A., Rad, J. A., Parand, K., **Nunez, M. D.** (2022). [Neuro-cognitive models of single-trial EEG measures describe latent effects of spatial attention during perceptual decision making](#). *Journal of Mathematical Psychology*, 111, 102725. doi: 10.1016/j.jmp.2022.102725
- **Nunez, M. D.**, Charupanit, K., Sen-Gupta, I., Lopour, B. A., Lin, J. J. (2022). [Beyond rates: Time-varying dynamics of high frequency oscillations as a biomarker of the seizure onset zone](#). *Journal of Neural Engineering*. 19, 016034. doi: 10.1088/1741-2552/ac520f
- Jun, E. J.*, Bautista, A. R. *, **Nunez, M. D.***, Allen, D. C., Tak, J. H., Alvarez, E., Basso, M. A. (2021). [Causal role for the primate superior colliculus in the computation of evidence for perceptual decisions](#). *Nature Neuroscience*, 24, 1121–1131. doi: 10.1038/s41593-021-00878-6 *Contributed Equally
- Lui, K. K., **Nunez, M. D.**, Cassidy, J. M., Vandekerckhove, J., Cramer, S. C., & Srinivasan, R. (2021). [Timing of readiness potentials reflect a decision-making process in the human brain](#). *Computational Brain & Behavior*, 4, 264–283 (2021). doi: 10.1007/s42113-020-00097-5
- **Nunez, M. D.**, Gosai, A., Vandekerckhove, J., & Srinivasan, R. (2019). [The latency of a visual evoked potential tracks the onset of decision making](#). *NeuroImage*, doi: 10.1016/j.neuroimage.2019.04.052.
- Nunez, P. L., **Nunez, M. D.**, & Srinivasan, R. (2019). [Multi-Scale Neural Sources of EEG: Genuine, Equivalent, and Representative. A Tutorial Review](#). *Brain Topography*, 32, 193–214. doi: 10.1007/s10548-019-00701-3
- Schubert, A. L., **Nunez, M. D.**, Hagemann, D., & Vandekerckhove, J. (2019). [Individual differences in cortical processing speed predict cognitive abilities: A model-based cognitive neuroscience account](#). *Computational Brain & Behavior*, 2, 64–84. doi: 10.1007/s42113-018-0021-5
- Bridwell, D. A., Cavanagh, J. F., Collins, A. G., **Nunez, M. D.**, Srinivasan, R., Stober, S., & Calhoun, V. D. (2018). [Moving Beyond ERP Components: A Selective Review of Approaches to Integrate EEG and Behavior](#). *Frontiers in Human Neuroscience*, 12, 106. doi: 10.3389/fnhum.2018.00106
- **Nunez, M. D.**, Vandekerckhove, J., & Srinivasan, R. (2017). [How attention influences perceptual decision making: Single-trial EEG correlates of drift-diffusion model parameters](#). *Journal of Mathematical Psychology*. 76:B, (pp. 117-130), doi: 10.1016/j.jmp.2016.03.003
- **Nunez, M. D.** (2017). [Refining understanding of human decision making by testing integrated neurocognitive models of EEG, choice and reaction time](#) (Doctoral dissertation, UC Irvine).
- **Nunez, M. D.**, Nunez, P. L., & Srinivasan, R. (2016) [Electroencephalography \(EEG\), neurophysics, experimental methods, and signal processing](#). In Ombao, H., Linquist, M., Thompson, W. & Aston, J. (Eds.) *Handbook of Neuroimaging Data Analysis* (pp. 175-197), Chapman & Hall/CRC. Advance online publication. doi: 10.13140/rg.2.2.12706.63687
- **Nunez, M. D.**, Srinivasan, R. & Vandekerckhove, J. (2015). [Individual differences in attention influence perceptual decision making](#). *Frontiers in Psychology*. 8:18. doi: 10.3389/fpsyg.2015.00018

CONFERENCE PUBLICATIONS

- Sun, Q. J., Vo, K., Lui, K., **Nunez, M. D.**, Vandekerckhove, J., & Srinivasan, R. (2022) [Decision SincNet: Neurocognitive models of decision making that predict cognitive processes from neural signals](#). International Joint Conference on Neural Networks (IJCNN) Proceedings 2022. doi: 10.48550/arXiv.2208.02845
- **Nunez, M. D.**, Gosai, A., Vandekerckhove, J. & Srinivasan, R. (2017). [EEG measures of neural processing speed reflect human visual encoding time](#). Conference on Cognitive Computational Neuroscience. New York, New York. September 2017.
- Charupanit, K., **Nunez, M. D.**, Bernardo, D., Bebin, E. M., Krueger, D. Northrup, H., Sahin, M., Wu, J. Y., & Lopour, B. A. (2018). [Automated Detection of High Frequency Oscillations in Human Scalp Electroencephalogram](#). International

SELECTED CONFERENCE PRESENTATIONS

- **Nunez, M.D.** Pinier, C., Ghaderi-Kangavari, A. [When does evidence accumulation begin after a visual stimulus? Evidence from neurocognitive modeling of EEG and behavior](#), July 2023. Presented at the Society for Mathematical Psychology. University of Amsterdam, Netherlands.
- Ghaderi-Kangavari, A., Rad, J. A., **Nunez, M. D.** [Integrative neurocognitive approaches to understanding cognition through simultaneous analysis of EEG and behavioral data on single trials](#). Presented at the Society for Mathematical Psychology. University of Amsterdam, Netherlands July 2023.
- Ghaderi-Kangavari, A., Rad, J. A., **Nunez, M. D.** [Novel neuro-cognitive models can explore spatial attention's effect on perceptual decision making](#). Presented at the Virtual Meeting of the Society for Mathematical Psychology, July 2022.
- **Nunez, M.D.** [Developing neurocognitive models of joint EEG and behavioural data during perceptual decision-making](#). Presented at the Virtual Neuromatch 4.0 Conference, November 2021.
- **Nunez, M. D.**, Srinivasan, R., Vandekerckhove, J. [Recovering parameters of joint models of human EEG and behavior during decision making](#). Presented at the Virtual Meeting of the Society for Mathematical Psychology, July 2021.

SELECTED CONFERENCE POSTERS

- Özsezer, P., van der Maas, H., **Nunez, M. D.** [Cascading transitions in multistable perception and cognition](#). Presented at the Society for Mathematical Psychology. University of Amsterdam, Netherlands July 2023.
- Volz, L., Matzke, D., **Nunez, M. D.**, Heathcote, A. [Comparing Amortized to MCMC-based Bayesian Inference for Cognitive Models of the Stop-Signal Paradigm](#). Presented at the Society for Mathematical Psychology. University of Amsterdam, Netherlands July 2023.
- Pinier, C., **Nunez, M. D.** [Exploration of a potential relationship between the N200 peak-latency and visual encoding time](#). Presented at the Meeting of the European Mathematical Psychology Group 2022 in Trento, Italy.
- **Nunez, M. D.**, Tisby, M. K., Lui, K. K., Vandekerckhove, J., Srinivasan, R. [A macro-level perspective on evidence accumulation during decision making](#). Presented at the Society for Neuroscience Global Connectome Virtual Event, January 2021.
- Sun, Q. J., **Nunez, M. D.**, Vandekerckhove, J., & Srinivasan, R. [Using interpretable convolutional neural network on EEG to predict trial-level response time in perceptual decision making](#). Presented at the Virtual Society for Neuroscience 2021 meeting.
- **Nunez, M. D.**, Kapre, K., Grimaldi, P., Hakwan, L., Basso, M. A. Prefrontal cortex neuronal ensemble activity encodes confidence. Presented at the Summer School for Primate Cognitive Neuroscience. Bad Bevensen, Germany, August 2019.
- **Nunez, M. D.**, Charupanit, K., Lin, J. J., Lopour, B. A. [Temporal dynamics of high frequency oscillations at slow and fast time scales in patients with epilepsy](#). Presented at the American Epilepsy Society. New Orleans, LA, December 2018.
- **Nunez, M. D.**, Scambray, K. A., Lui, K. K., Vandekerckhove, J., Srinivasan, R. [The time course of brain signals reflect different cognitive processes during human decision making](#). Presented at the Society for Neuroscience. San Diego, CA, November 2018.
- **Nunez, M. D.**, Vandekerckhove, J., Srinivasan, R. [The cognitive chronometry of rapid human decision making](#). Presented at the Society for Neuroscience. Washington, DC, November 2017.

FUNDED GRANT PROPOSALS

- *University of Amsterdam Starting Grant 2023* “*Extending AI models of abstract reasoning to jointly understand human brain, cognition, and behavior*” (€ 300 EUR). I wrote this grant with Claire E. Stevenson and Dora Matzke
- *NWO SGW Open Competitie 2021* “*Cascading transitions in multistable perception and cognition*” (€ 285 EUR). I wrote this grant proposal with Han van der Maas (project lead), Raoul Grasman, and Simon van Gaal.
- *NSF Methodology, Measurement, and Statistics Proposal 2021* “*Exploratory and confirmatory neurocognitive modeling with latent variables*” (~\$345K USD) I wrote this grant proposal along with Joachim Vandekerckhove and Ramesh Srinivasan based on a new modeling framework and preliminary results.
- [NSF Cognitive Neuroscience Proposal 1850849](#) “*Critical tests of neurocognitive relationships*” (\$675K USD) I wrote this grant proposal along with Joachim Vandekerckhove and Ramesh Srinivasan based on my work on the previous grant.
- [NSF Cognitive Neuroscience Proposal 1658303](#) “*Estimation of unidentified cognitive models with physiological data*” (\$337K USD) I wrote this grant along with Joachim Vandekerckhove and Ramesh Srinivasan based on my PhD materials.

SELECTED SOFTWARE

- <https://github.com/mdnunez/pyhddmjags> - Python repository for example Hierarchical Drift Diffusion Model (HDDM) code using JAGS and Stan
- <https://github.com/mdnunez/artscreenEEG> - MATLAB repository to perform basic artifact correction on electroencephalographic (EEG) data

TEACHING / PEDAGOGY

Teaching Certification: Netherlands University Teaching Qualification (BKO)

- **Programming in Psychological Science (UvA), Jan-Feb 2022-2024:** I teach Psychology Research Masters students introductory programming in both R and Python. Course materials are available here: https://github.com/mdnunez/PIPS_course
- **Research Design & Statistics (UvA), Nov-Dec 2021-2023:** I teach Brain & Cognition Masters students to conduct statistical inference and analyze data in R and JASP.
- **Behavioural Research Toolbox / Simulation Models, Methods & Statistics (UvA), Sep-Oct 2021-2023:** I teach students in this undergraduate course to simulate from statistical distributions and models in Python and R, as well as conduct statistical analysis and build experiments
- **Model-based Neuroscience Summer School, July 2022/2023:** I taught sessions to mainly PhD students / Postdocs on the topic of joint models of EEG and behavior.
- **Sixth European Summer School on Computational and Mathematical Modeling of Cognition, July 2022:** I mentored PhD students on their own computational modeling projects. I also taught sessions on Python programming, Bayesian statistics, and joint models of EEG and behavior.
- **Bayesian Statistics (UvA), June 2022:** I co-taught a theoretical basis and principles of Bayesian Statistical analysis to approximately 70 undergraduates.
- **Neuromatch Academy Project Mentor, Summer 2021:** I advised 5 PhD students from various backgrounds on a project to use High Frequency Oscillations (HFOs) in the Fusiform Face Area using ECoG/iEEG data to predict face perception.
- **History of Neuroscience (UCI), Fall 2016:** I answered student questions, graded quizzes and exams.
- **Probability and Statistics III in MATLAB (UCI), Spring 2015:** I held discussion sections and office hours and taught students statistical algorithms and topics such as bootstrapping.
- **Introductory Statistics (UCI), Falls of 2012 and 2014:** I taught lab and discussion sections as well as met with students individually and in group review sessions.
- **Experimental Methods (UCI), Winter 2012, Spring 2013, Winter 2013:** I was responsible for lab and discussion sections as well as helping students with their writing and research projects.

WORKSHOPS

- Bayesian cognitive modeling using the R-package brms - Given for the European Society for Cognitive Psychology 2022

COMMITTEE MEMBERSHIPS & ORGANIZATION ROLES

- UvA Psychology Scientific Advisory Board (active)
- UvA Psychology Diversity and Inclusivity Committee (active)
- Society for Mathematical Psychology 2023 Conference Chair

PROFESSIONAL MEMBERSHIPS

- [Society for Mathematical Psychology](#) (active)
- [The Cognitive Science Society](#) (active)
- [IOPS: InterUniversity Graduate School of Psychometrics and Sociometrics](#) (active)
- European Society of Cognitive Psychology (inactive)
- Society for Neuroscience (inactive)
- American Epilepsy Society (inactive)

GROUP MEMBERSHIPS

- Mathematical Cognitive Neuroscience Laboratory (active)
- [Amsterdam Mathematical Psychology Laboratory](#) (active)
- Amsterdam Brain and Cognition (active)