

PERSONAL INFORMATION

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RESEARCH PROFILE

The central theme of my research is to uncover the neural and computational mechanisms of human information sampling and their role in flexible decision-making. I combine cognitive modeling (low-dimensional algorithmic models and high-dimensional neural networks) with model-based neuroimaging (magnetoencephalography, MEG) to link latent computations to their neural representations. This approach allows me to characterize the computational strategies that govern how the brain samples, filters, and represents information to guide decisions under uncertainty ([Cao et al., 2019, *Neuron*](#); [Cao & Tsetsos, 2022, *eLife*](#); [Cao et al., 2020, *NeurIPS*](#)). My work focuses on answering how these strategies adapt to context and task structure ([Siems et al., accepted, *Nature Communications*](#)), and how they are shaped by internal optimization signals ([Cao et al., 2025, *bioRxiv*](#)).

ACADEMIC & PROFESSIONAL APPOINTMENTS

01/10/2024–present	Marie Skłodowska-Curie Fellow , École Normale Supérieure, Paris, France Host laboratory: Laboratoire de Neurosciences Cognitives et Computationnelles Advisor: Valentin Wyart Secondment advisor: Tobias H. Donner
01/08/2020–30/09/2024	Postdoctoral Researcher , Institute of Neurophysiology and Pathophysiology, University Medical Center Hamburg-Eppendorf, Hamburg, Germany Host laboratories: Decision Neuroscience Group (Tsetsos lab); Computational Cognitive Neuroscience Section (Donner lab) Advisors: Konstantinos Tsetsos, Tobias H. Donner
01/01/2020–30/07/2020	Research Specialist , University of Oxford, Oxford, United Kingdom Advisors: Christopher Summerfield, Andrew Saxe
01/10/2015–29/11/2019	PhD (Clarendon Scholar) in Experimental Psychology, University of Oxford, Oxford, United Kingdom Supervisors: Christopher Summerfield (primary), Christoph Kayser (co-supervisor)

EDUCATION

01/10/2015–29/11/2019	PhD, University of Oxford, Oxford, United Kingdom
01/09/2011–15/07/2014	MA, McGill University, Montréal, Canada Supervisor: Stephen McAdams
01/09/2007–15/07/2011	BEng, Tsinghua University, Beijing, China

RESEARCH TRAINING & VISITING POSITIONS (BEFORE PHD)

2014–2015	NSERC-CREATE Research Intern in Neuroimaging, International Laboratory for Brain, Music and Sound Research (BRAMS), Montréal, Canada
2013–2015	Visiting Researcher, Institute of Neuroscience and Psychology, University of Glasgow, Glasgow, United Kingdom

FELLOWSHIPS & COMPETITIVE FUNDING

- **Marie Skłodowska-Curie Fellowship** (€195,915), European Commission, 2024–present
- Clarendon Scholarship & Brasenose-Kwai Cheong Scholarship, University of Oxford (full doctoral funding, ~£44,331), 2015–2019
- NSERC-CREATE Auditory Cognitive Neuroscience Research Award (\$3,550) & Graduate Fellowship (\$17,300), Natural Sciences and Engineering Research Council of Canada, 2011–2015
- CIRMMT Research Exchange Award (\$3,000), McGill University, 2013
- GREAT Travel Awards (\$375), McGill University, 2013
- Graduate Excellence Fellowship (\$10,500), McGill University, 2011–2013

SCIENTIFIC OUTPUTS

Cao, Y., Summerfield, C., Park, H., Giordano, B. L., & Kayser, C. (2019). Causal inference in the multisensory brain. *Neuron*, 102(5), 1076–1087. doi: <https://doi.org/10.1016/j.neuron.2019.03.043>

Cao, Y. & Tsetsos, K. (2022). Clarifying the role of an unavailable distractor in human multi-attribute choice. *eLife*, 11, e83316. doi: <https://doi.org/10.7554/eLife.83316>

Siems, M., **Cao, Y.**, Tohidi-Moghaddam, M., Donner, T. H., & Tsetsos, K. (accepted). Rhythmic sampling of multiple decision alternatives in the human brain. *Nature Communications*. Preprint on *bioRxiv*, doi: <https://doi.org/10.1101/2023.12.08.570734>

Cao, Y., Summerfield, C., & Saxe, A. (2020). Characterizing emergent representations in a space of candidate learning rules for deep networks. *Advances in Neural Information Processing Systems (NeurIPS)*, 33, 8660–8670. [\[link to paper\]](#)

Cao, Y., Alméras, C., Lee, J. K., & Wyart, V. (2025). Humans use a dual information-seeking policy to improve noisy inferences outside the explore-exploit tradeoff. *bioRxiv*. doi: <https://doi.org/10.1101/2025.10.08.681186>

Cao, Y., Giordano, B. L., Avanzini, F., & McAdams, S. (2016). The dominance of haptics over audition in controlling wrist velocity during striking movements. *Experimental Brain Research*, 234(4), 1145–1158. doi: <https://doi.org/10.1007/s00221-015-4529-9>

Tsetsos, K. & **Cao, Y.** (2025). Perspectives on the mechanistic underpinnings of choice biases. In: Ettinger, U., Heinrichs, B., Murawski, C. (eds) *Decision Making. Studies in Neuroscience, Psychology and Behavioral Economics*. Springer, Cham. https://doi.org/10.1007/978-3-032-00880-0_5
Preprint: doi: <https://doi.org/10.31234/osf.io/2bjae>

Cao, Y. & Tsetsos, K. (2023). Decision bias and sampling asymmetry in reward-guided learning. *bioRxiv*. doi: <https://doi.org/10.1101/2023.09.10.557023>

Siems, M., **Cao, Y.**, Donner, T. H., Tsetsos, K., & Engel, A. K. (2025). Inter-areal coupling for cognition through coincident oscillatory transients. *bioRxiv*. doi: <https://doi.org/10.1101/2025.11.21.689181>

Cheng, Y., Yuan, X., Jiang, Y., & **Cao, Y.** (2025). Computational models and neural mechanisms of causal inference in multisensory integration. *SCIENTIA SINICA Vitae*, 55(7), 1395–1408. doi: <https://doi.org/10.1360/SSV-2024-0160>

SCIENTIFIC IMPACT & RECOGNITION

- Invited speaker at major international conferences and symposia, including the FENS Symposium.
- Regularly invited to present at international institutes and workshops spanning cognitive neuroscience, computational neuroscience, and decision science.
- Invited speaker at NeuroChat, a large international science dissemination platform reaching more than one thousand multidisciplinary attendees worldwide, including biologists, philosophers, and science journalists.

- Regular presenter at leading international conferences, including Society for Neuroscience (SfN) Annual Meeting, the Federation of European Neuroscience Societies (FENS) Forum, the Conference on Cognitive Computational Neuroscience (CCN), and The Bernstein Conference on Computational Neuroscience.
- Recipient of highly competitive fellowships, including the Marie Skłodowska-Curie Fellowship and the Clarendon Scholarship.

Invited Talks (selected):

- 2025 Workshop on Cognitive Modeling (WoCoMo), Marseille, France
Unpacking the black box: Building recurrent neural networks from scratch
- 2025 Institut de Neurosciences de la Timone (invited by Andrea Brovelli), Marseille, France
Flexible human information seeking in decisions under uncertainty
- 2023 École Normale Supérieure (invited by Valentin Wyart), Paris, France
Emergent bias in reward-guided learning
- 2023 NeuroChat (international public neuroscience forum, online)
Flexible information sampling in human decision-making
- 2021 Max Planck Institute for Human Development, Berlin, Germany
Emergent representations in a space of learning rules for deep networks
- 2020 The FENS Forum 2020—Symposium “The flexible use of multisensory information for behavior – models, neurons and neuroimaging” (Chairs: Uta Noppeney, Christoph Kayser)
Unfolding of multisensory inference in mind and behavior

Conference Presentations (selected):

- 2025 Multi-disciplinary Conference on Reinforcement Learning and Decision Making (RLDM), Dublin, Ireland
- 2024 Foraging and Information Seeking Conference, Lyon, France
- 2023 International Symposium on Biology of Decision Making (SBDM), Paris, France
- 2022 Society for Neuroscience Annual Meeting (SfN), San Diego, CA, USA
- 2022 Bernstein Conference on Computational Neuroscience, Berlin, Germany
- 2019 Conference on Cognitive Computational Neuroscience (CCN), Berlin, Germany
- 2019 Organization for Human Brain Mapping (OHBM) Annual Meeting, Rome, Italy

SUPERVISION & TEACHING

Supervised 1 MSc student (Inès Maye), École Normale Supérieure (2024–2025).
Supervised 2 BSc students (Fabian Otto, Xavier Roberts-Gaal), University of Oxford (2020).
Co-supervised 1 BSc student (Emily Wilson), McGill University (2013).
Teaching assistant, Cognitive Science (COGS 444, Honors Research, 6 credits), McGill University (2012).

SERVICE TO THE SCIENTIFIC COMMUNITY

Ad-hoc reviewer for journals: PNAS, Nature Communications, PLOS Computational Biology, Open Mind: Discoveries in Cognitive Science, Auditory Perception and Cognition, The Journal of the Acoustical Society of America (JASA), eLife etc.