

Jonathan Vacher

Address: Office 633, MAP5 (UMR 8145)

UFR de Mathématiques et Informatique, Université Paris Cité

45 Rue des St-Pères, 75006 Paris, France

E-mail: jonathan.vacher@u-paris.fr * *Website:* jonathanvacher.github.io

Research Experience

Associate Professor (Maître de Conférence) *Université Paris Cité, Paris, France*
MAP5, UFR de Mathématiques et Informatique *Sept. 2022*
Applied Mathematics

Postdoctorate Research Fellow *PSL Research University, Paris, France*
Laboratoire des Systèmes Perceptifs, École Normale Supérieure *Sept. 2020 - Aug. 2022*
Supervisors: Pascal Mamassian and Ruben Coen-Cagli

Postdoctorate Research Fellow *Albert Einstein College of Medicine, New-York, USA*
Department of Comp. Biology *Sept 2017 - Aug. 2020*
Supervisors: Ruben Coen-Cagli and Pascal Mamassian

PhD Student *PSL Research University, Paris, France*
Ceremade, Dauphine University *Oct. 2013 - Aug. 2017*
Unité Neurosciences, Information et Complexité (NeuroPsi)
Gif-sur-Yvette, France
Supervisors: Gabriel Peyré and Cyril Monier
Title: Dynamic Textures Synthesis for Probing Vision in Psychophysics and Electrophysiology

Academic Background

2013–2017 **PhD in Applied Mathematics.** *Dauphine University, PSL Research University.*
2011–2013 **Master's degree in mathematics.** *Mathematics, Vision and Learning. Graduated with honours. École Normale Supérieure de Cachan.*
2010–2011 **Bachelor's degree in mathematics.** *Applied Mathematics. Graduated with honours. École Normale Supérieure de Cachan.*

Research Supervision

Félix Watine (trainee) *Université Paris Cité, Paris, France*
MAP5 *Mar. – Sept. 2024*
Project: Geometry of Texture Images and Perception
Co-supervisor: Pascal Mamassian

Thomas Jeanmougin (trainee) *Université Paris Cité, Paris, France*
MAP5 *Mar. – Sept. 2024*
Project: Medical Image Segmentation of Invasive Devices
Co-supervisor: Antoine Chambaz

Matteo Dutertre (trainee) *PSL Research University, Paris, France*
Laboratoire des Systèmes Perceptifs, École Normale Supérieure *Jul. – Sept. 2021*
Project: Experimental Design of a Visual Task to Study the Aperture Problem
Co-supervisor: Pascal Mamassian

Elliot Kim (trainee) *Albert Einstein College of Medicine, New-York, USA*
Department of Comp. Biology *Jun. – Jul. 2020*

Project: Comparing mixture models trained on neural activity *vs* natural image stimuli
Co-supervisor: Ruben Coen-Cagli

Alexander Ferrena (trainee)

Albert Einstein College of Medicine, New-York, USA

Department of Comp. Biology

Mar. – Apr. 2020

Project: Studying the possibility to use Generative Adversarial Networks to generate image from neural activity and *vice-versa*

Co-supervisor: Ruben Coen-Cagli

List of Contributions

Pre-prints

until Nov. 2024

- None

Journal

until Nov. 2024

- **Vacher, J.**, Launay, C., Mamassian, P., Coen-Cagli, R., “Measuring uncertainty in human visual segmentation,” *PLOS Computational Biology*, vol. 19, no. 9, pp. 1–24, Sep. 2023
- **Vacher, J.**, Launay, C., Coen-Cagli, R., “Flexibly regularized mixture models and application to image segmentation,” *Neural Networks*, vol. 149, pp. 107–123, 2022
- **Vacher, J.**, Briand, T., “The Portilla-Simoncelli Texture Model: towards Understanding the Early Visual Cortex,” *Image Processing On Line*, vol. 11, pp. 170–211, 2021, <https://doi.org/10.5201/ipol.2021.324>
- Le Coënt, A., Fribourg, L., **Vacher, J.**, Wisniewski, R., “Probabilistic reachability and control synthesis for stochastic switched systems using the tamed euler method,” *Nonlinear Analysis: Hybrid Systems*, vol. 36, p. 100 860, 2020
- Roggerone, V., **Vacher, J.**, Tarlao, C., Guastavino, C., “Auditory motion perception emerges from successive sound localizations integrated over time,” *Scientific Reports*, vol. 9, p. 16 437, 2019
- **Vacher, J.**, Meso, A. I., Perrinet, L. U., Peyré, G., “Bayesian modeling of motion perception using dynamical stochastic textures,” *Neural computation*, vol. 30, no. 12, pp. 3355–3392, 2018
- Briand, T., **Vacher, J.**, “How to apply a filter defined in the frequency domain by a continuous function,” *Image Processing On Line*, vol. 6, pp. 2016–11, 2016
- Briand, T., **Vacher, J.**, Galerne, B., Rabin, J., “The heeger-bergen pyramid-based texture synthesis algorithm,” *Image Processing On Line*, vol. 4, pp. 2014–11, 2014

Conferences

until Nov. 2024

- **Vacher, J.**, Mamassian, P., “Perceptual scales predicted by fisher information metrics,” in *The Twelfth International Conference on Learning Representations*, 2024
- Launay, C., **Vacher, J.**, Coen-Cagli, R., “Unsupervised video segmentation algorithms based on flexibly regularized mixture models,” in *2022 IEEE International Conference on Image Processing (ICIP)*, IEEE, 2022, pp. 4073–4077
- **Vacher, J.**, Davila, A., Kohn, A., Coen-Cagli, R., “Texture interpolation for probing visual perception,” 2020
- Le Coënt, A., Fribourg, L., **Vacher, J.**, “Control synthesis for stochastic switched systems using the tamed euler method,” in *6th IFAC Conference on Analysis and Design of Hybrid Systems ADHS 2018*, vol. 51, 2018, pp. 259–264

- **Vacher, J.**, Meso, A. I., Perrinet, L. U., Peyré, G., “Biologically inspired dynamic textures for probing motion perception,” in *Advances in Neural Information Processing Systems*, 2015

Unpublished Reports

until Nov. 2024

- **Vacher, J.**, Mamassian, P., Coen-Cagli, R., “Probabilistic model of visual segmentation,” *arXiv preprint arXiv:1806.00111*, 2019

Participation in Conferences and Seminars

Upcoming

Nov. 2024 *Séminaire LMBA, Université Bretagne Sud, [Link](#)*

Past

May 2024 *The Twelfth International Conference on Learning Representations, Wien, [Link](#)*
 May 2024 *INC Days, Université Paris Cité, [Link](#)*
 Feb. 2024 *Séminaire, Institut de la Vision, Paris [Link](#)*
 Oct. 2023 *Séminaire, Imaging in Paris, [Link](#)*
 Apr. 2023 *Journées ANR Mystic, Paris, [Link](#)*
 Jan. 2023 *GDR Vision, Toulouse, [Link](#)*
 Oct. 2022 *Séminaire, Imaging in Paris, [Link](#)*
 Mar. 2022 *Séminaire, Institut des Neurosciences de la Timone, Marseille, [Link](#)*
 Feb. 2022 *Séminaire de l'équipe Image, Centre Borelli, ENS Paris-Saclay, [Link](#)*
 Dec. 2021 *Séminaire de l'équipe MLMDA, Centre Borelli, ENS Paris-Saclay, [Link](#)*
 Nov. 2021 *Séminaire de l'équipe Parietal, INRIA Saclay, [Link](#)*
 Oct. 2021 *GDR Vision, Lille, [Link](#)*
 Oct. 2021 *NeuroSpin Conferences, Paris-Saclay, [Link](#)*
 Sep. 2021 *Séminaire IMAGES team, Telecom Paris, [Link](#)*
 Aug. 2021 *Modélisation Aléatoire et Statistique (SMAI): Statistique et Image, [Link](#)*
 Jun. 2021 *SMAI Congres: Transport Optimal pour l'Inférence Statistique, France, [Link](#)*
 Jun. 2021 *Séminaire de l'ANR Mystic, [Link](#)*
 May 2021 *Séminaire Images Optimisation et Probabilités de l'IMB, Bordeaux, [Link](#)*
 Dec. 2020 *Spotlight – Neural Information Processing Systems (NeurIPS), Online, [Link](#)*
 Dec. 2020 *Vision Team Seminar at INCC, Université Paris Cité, [Link](#)*
 Nov. 2020 *Image Team Seminar at MAP5, Université Paris Cité, [Link](#)*
 Nov. 2020 *GDR Vision, Online, [Link](#)*
 Jun. 2020 *Vision Science Society (VSS), Online, [Link](#)*
 Feb. 2020 *Computational and Systems Neuroscience (Cosyne), Denver, [Link](#)*
 Aug. 2019 *European Conference on Visual Perception (ECVP), [Link](#)*
 Jun. 2016 *International Conference on Mathematical NeuroScience (ICMNS), [Link](#)*
 Dec. 2015 *Spotlight – Neural Information Processing Systems (NeurIPS), Montréal, [Link](#)*
 Jun. 2015 *SMAI Congres, France, [Link](#)*
 Jun. 2015 *International Conference on Mathematical NeuroScience (ICMNS), Nice, [Link](#)*
 Oct. 2014 *Workshop on Geometrical Models in Vision, Paris, [Link](#)*

Participation in Review Committees

Conferences

- 2020/2023 *International Conference on Machine Learning (Link)*
2020–2024 *International Conference on Learning Representation (Link)*
2019–2024 *Neural Information Processing Systems (Area Chair since 2024, Link)*

Journals

- 2019–2023 *Vision Research (Link)*
2019–2023 *Computer Vision and Image Understanding (Link)*
2019–2023 *IEEE Transactions on Visualization and Computer Graphics (Link)*

Professional Society Membership

- 2015–2023 *Société de Mathématiques Appliquées et Industrielles (Link)*
2019–2023 *Vision Science Society (Link)*

Grants, Awards and Scholarships

- 2024–2025 ***KCL/UPCité Joint Call** Université Paris Cité / King’s College London, **10K€** (Link)*
2024–2026 ***Emergence** Université Paris Cité **15K€** (Link)*
2024 ***Bourse M2 – INC** Université Paris Cité, **3K€** (Link)*
Mar. 2023 ***Seal of Excellence** for the project “Decompose the hierarchical process of human visual segmentation” Certificate delivered by the **European Commission**, as the institution managing Horizon 2020, the EU Framework Programme for Research and Innovation 2014-2020 (Link)*
2012–2013 ***Master Scholarship** from Jacques Hadarmard Foundation, **10K€** (Link)*

Technical Skills

Operating Systems

- Linux *Regular user and admin*
Windows *Regular user*

Languages

- Python *numpy, scipy, matplotlib, scikit-learn, pytorch*
Matlab *+psychtoolbox*
JavaScript *basic knowledge (jspsych for online psychophysics)*
C/C++ *basic knowledge*

Data Knowledge

- Big data *natural images, natural textures*
Psychophysics *behavioral data*
Neurosciences *extracellular recordings, brain optical imaging, EEGs, ...*

Open Source Code

vseg Package	<i>Reconstruction of probabilistic image segmentation maps from psychophysical measurements in human participants (Link)</i>
Dynamic Textures	<i>Motion Clouds, Drifting Gratings (Link)</i>
Texture Interpolation	<i>Optimal transport of Deep Neural Network activation distributions (Link)</i>
Portilla-Simoncelli	<i>Online demo (see publications) and code: Link</i>
Heeger-Bergen	<i>Online demo (see publications) and code: Link</i>
Miscellaneous	<i>Link</i>

Teaching Activities

Since 2022	Associate professor (undergrad maths, CogMaster, Master MMA. Tot: 192h/y)
Since 2021	Examiner in mathematics. Oral exam training (2h/w). High level students. Classes Préparatoires aux Grandes Écoles, Louis-le-Grand high school, Paris.
2013-2015	Lecturer in Analysis, Linear Algebra, Differential Calculus (64h/y). Mid to high level students. Dauphine University, Paris.
July 2013	Highest French competitive exam in mathematics for academic teaching. Agrégation de mathématiques .
2011–2013	Examiner in mathematics. Oral exam training (2h/w). High level students. Classes Préparatoires aux Grandes Écoles, Janson de Sailly high school, Paris.

Language proficiencies

French	<i>Native</i>
English	<i>Fluent</i>
Spanish	<i>Basic</i>

Interests and Other Activities

Sports	<i>rock climbing/bouldering, biking, hiking, tennis, table tennis, handball</i>
Video Games	<i>Teamfight Tactics (league of legends), FPS, RTS, RPG</i>
Board Games	<i>Dune, Terraforming Mars, Megawatt, Smallworld, 7 wonders, Terra Mystica, King Domino, ...</i>
Miscellaneous	<i>Music, cinéma, all sciences, politics, ...</i>
Volunteering	<i>President of the association "Les sENS de l'Art" in 2012: in charge of the organization of the annual art and music festival of ENS Cachan (budget: 40 000 euros).</i>