Jonathan Vacher

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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 Neuroscience, 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 Mistic, Paris, Link*
Jan. 2023	*GDR Vision, Toulouse, Link*
Oct. 2022	*Séminaire, Imaging in Paris, Link*
Mar. 2022	*Séminaire, Institut des Neuroscience 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 Mistic, 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	*Internation 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 Fundation,* ***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	*dehavioral data*
Neurosciences	*extracellular recordings, brain optical imaging, EEGs, ...*

Open Source Code

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

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	*Native*
English	*Fluent*
Spanish	*Basic*

Interests and Other Activities

Sports	*rock climbing/bouldering, biking, hiking, tennis, table tennis, handball*
Video Games	*Teamfight Tactics (league of legends), FPS, RTS, RPG*
Board Games	*Dune, Terraforming Mars, Megawatt, Smallworld, 7 wonders, Terra Mystica, King Domino, ...*
Miscellaneous	*Music, cinéema, all sciences, politics, ...*
Volunteering	*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).*