Clément Gaultier

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Scientific Background & Interests

Hearing Research

Speech Perception in Noise.

- Cochlear implants, behavioural study design
- Speech intelligibility, adaptive procedures
- Adaptation to noise, stimuli calibration

Machine Learning

Speech Processing.

- Deep learning models for speech enhancement, noise and reverberation reduction
- Binaural sound source localization, HRTF
- Virtually supervised learning,

Signal Processing

Acoustic and Audio.

- Multichannel audio reconstruction, acoustic echo cancellation
- Time-frequency real-time algorithm design
- Sound propagation modeling, acoustic sensing
- Distributed audio systems

Others

Teaching and Committees.

- Student supervision, PhD examiner, jury member
- Scientific outreach
- Teaching wave propagation physics (optics, acoustics, electromagnetics)

Research Positions

Dec. 2021 – current — **Postdoctoral Research Fellow**, *MRC Cognition and Brain Sciences Unit*, Cambridge, UK, *Research.*

- Deep Hearing Lab: Dr. Tobias Goehring
- Project: Speech Enhancement for people with cochlear implants, Fondation Pour l'Audition Fellowship
  - cochlear implant research,
  - auditory science, speech perception,
  - study design, participant recruitment,
  - multi-microphone signal processing,
  - deep learning models, virtual acoustics,
  - student supervision.

Sept. 2019 – Feb. 2021 — **Postdoctoral researcher**, *Orange, Orange Labs*, Cesson-Sévigné, FRANCE, *Research & Development.*

- Project: Multichannel acoustic echo cancellation for ad-hoc distributed audio systems
  - low-latency Acoustic Echo Cancellation (AEC),
  - Room Impulse Responses measurements,
  - speaker localization through multilateration,
  - patent filed on real-time acoustic echo cancellation robust to acoustic path change and double-talk scenario.

Feb. 2019 – Aug. 2019 — **Research Engineer**, *Inria Rennes research center*, Rennes, FRANCE, *Research & Development.*

- Projects: audio restoration transfer of technology
  - pop noise removal,
  - multichannel declipping,
  - DSP algorithms code conversion,
  - listening tests.

Nov. 2015 – Jan. 2019 — **Ph.D. candidate specialized in acoustic & audio signal processing**, *Inria Rennes research center*, Rennes, FRANCE, *Research.*

- Early stage researcher
- Projects: acoustic & audio signal processing inverse problems
  - digital sound processing,
  - non-convex optimization algorithms,
  - machine learning for binaural sound source localization,
  - science popularization.
- Teaching, mentoring & evaluation
  - Teaching wave propagation physics tutorials - acoustics, electromagnetics, optics - for second year students (INSA Rennes public school of engineering delivering a postgraduate degree in engineering),
  - Mentoring undergrads students on a room acoustics project,
  - Jury member for final year students graduating as sound engineers from ESRA Bretagne school.

March 2015 – Sept. 2015 — **Postgraduate visiting student**, *Institute of Sound and Vibration Research*, Southampton, UK, University of Southampton.

Measuring the adaptation to noise for enhanced speech perception in individuals with normal hearing

- Under the supervision of Dr. Jessica J. M. Monaghan and Prof. Stefan Bleeck
- Research work on the auditory system, hearing in noise, speech intelligibility, signal processing
- Setting up listening experiments for people with normal hearing
  - noisy speech stimuli calibration,
  - ethical study / noise exposure validation,
  - statistical analysis,
  - participants recruitment.

Education

June 2022 **Training course on hearing**, *Institut de l'Audition & Institut Pasteur*, Paris, France.
- A 3-week intensive training course on auditory science
- "Hearing: From mechanisms to restoration technologies"
- In depth lectures with topics ranging from basic auditory science to gene therapy to hearing impairments,
- Practical sessions including phsycoacoustic testing, confocal microscopy…

Nov. 2015 – Jan. 2019 **Ph.D. specialized in acoustic & audio signal processing**, *Université de Rennes 1*, Rennes, FRANCE, *Research.*

Design and evaluation of sparse models and algorithms for audio inverse problems
- Under the supervision of Dr. Nancy Bertin & Prof. Rémi Gribonval
- Graduated in: January 2019
- Projects: acoustic & audio signal processing inverse problems
  - denoising, declipping, dereverberation,
  - structured (co)sparsity for time-frequency modeling,
  - non-convex optimization algorithms,
  - virtually supervised learning for binaural sound source localization,
  - multichannel real-time audio reconstruction.

2014 – 2015 **Master 2 Acoustics**, *Le Mans Université*, Le Mans, FRANCE, *Research, with Honours.*
- A University Master of Science under the authority of the French Ministry of Education and Research
- Graduated in: October 2015
- Specialized in: acoustics
- Project: Characterization of inhomogeneous membranes vibrations (psychoacoustic descriptors, spectrum analysis, vibration behaviour)

2012 – 2015 **Acoustics and vibrations graduate engineer**, *ENSIM - École Nationale d'Ingénieurs du Mans*, Le Mans, *Spécialité Acoustique - Vibration - Capteurs.*
- A selective Engineering School in three years under the authority of the French Ministry of Education and Research delivering a postgraduate degree in engineering
- Graduated in: October 2015
- Specialized in: vibration, acoustics, sensors
- Projects: With ONERA the French Aerospace Lab (acoustic measurements, signal processing, BEM modeling, correlation techniques)

Grants & Awards

June 09th, 2023 **GoB Travel Grant**, *Guarantors of Brain*, UK.
- Early Career Researcher Travel Grant,
- Award amount: £1000

May 15th, 2023 **2023 GFF Travel Grant**, *Graham Fraser Foundation*, UK.
- Travel grant awarded to non-clinical cochlear implant researchers to support attendance at scientific meetings,
- Award amount: £500

March 18th, 2021 **FPA Research Fellowship**, *Fondation pour L'Audition*, 13, rue Moreau, Paris.
- "RECOVER-CI: REverberation COmpensation using Virtual acoustics and multichannel speech Enhancement to Restore speech perception in noise with Cochlear Implants"
  - Research fellowship starting 08-12-2021 (24 months, University of Cambridge, UK),
  - Award amount: € 118 126

June 28th, 2019 **Best flash presentation and poster**, *JJCAAS, Journées Jeunes Chercheurs en Audition, Acoustique musicale et Signal Audio*, Le Mans, Laboratoire d'Acoustique de l'Université du Mans.
- "Désaturation audio multicanale : une approche par coparcimonie structurée"
  - Multichannel Audio Declipping : a structured cosparse approach,
  - French Young Researcher Days on Hearing, Musical Acoustics and Audio Signal Processing

March 2015 **Erasmus+ Grant**.
- European Union Mobility Grant accorded for a postgraduate visiting student stay at Institute of Sound and Vibration Research, Southampton, UK

March 2015 **Envoleo Grant**, *Région Pays de la Loire*, France.
- Regional Council Mobility Grant accorded for a postgraduate visiting student stay at Institute of Sound and Vibration Research, Southampton, UK

Other Scientific Activities

2017 – present **Occasional Reviewer**.

- International Journals
  - IEEE Journal of Selected Topics in Signal Processing,
  - IEEE Transactions on Audio, Speech, and Language Processing,
  - Elsevier Signal Processing,
- International Conferences
  - IEEE International Conference on Acoustics, Speech, and Signal Processing, ISCA Interspeech,
  - International Conference on Latent Variable Analysis and Signal Separation.

2016 – present **Scientific Outreach**.

- Ci-Fi experience (2022)
  - Science popularization wep page/app and demo about cochlear implants,
  - Cambridge Science Festival,
  - `https://deephearinglab.mrc-cbu.cam.ac.uk/ci-fi/`
- Journée Science et Musique
  - Member of the organizing committee (2016 – 2019),
  - Financial manager, communication manager,
  - JSM (Journée Science et Musique) is a science popularization open day about science and music organized every year by the PANAMA team (IRISA research center, Rennes (France)),
  - More than 650 attendees.

Teaching & Committees

2022 **PhD reviewer**, *University of Cambridge*, Cambridge, UK.

- Internal reviewer/examiner along with Prof. Olivier Macherey (external reviewer),
- PhD thesis: "The Panoramic ECAP Method: estimating patient-specific patterns of current spread and neural health in cochlear-implant users"
- Dr. Charlotte Garcia's work on characterization of the electrode-nerve interface with cochlear implants.

2022 **Student supervision**, *University of Cambridge*, Cambridge, UK.

- Project: "Speech enhancement for hearing devices: learned sound representations versus deterministic transforms"
- Student research project supervision, (Mr. Zephyr Verwimp)
- Cambridge Centre For Mathematical Sciences, math placement program.

Oct. 2018 – June 2020 **Teaching wave propagation physics**, *INSA Rennes*, Rennes, France.

- Teaching wave propagation physics tutorials - acoustics, electromagnetics, optics - for second year students (INSA Rennes public school of engineering delivering a postgraduate degree in engineering)

June 2019 **Jury Member**, *ESRA Bretagne*, Rennes, France.

- Jury member for final year students graduating as sound engineers from ESRA Bretagne school,
- Report reviewer and defence jury.

Jan. 2016 – July 2016 **Mentoring undergraduate students**, *Lycée Joliot-Curie*, Rennes, France.

- Room acoustics project, modal theory modeling, reverberation, practical validation and measurements,
- Undergraduate students in preparatory class studying intensive math, physics and engineering before French schools of Engineering competitive exams

Publications & Scientific Communications

International Peer Reviewed Articles

C. Gaultier and T. Goehring, "Joint compensation of multi-talker noise and reverberation for speech enhancement with cochlear implants using one or more microphones," in *INTERSPEECH 2023, ISCA*, 2023.

I. Thoidis, **C. Gaultier**, and T. Goehring, "Perceptual analysis of speaker embeddings for voice discrimination between machine and human listening," in *2023 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. IEEE, 2023.

C. Gaultier, A. Guérin, G. Pallone, and M. Emerit, "Double-talk robust acoustic echo cancellation using partition block frequency-domain adaptive filtering," in *29th European Signal Processing Conference (EUSIPCO)*. IEEE, 2021, pp. 171–175.

C. Gaultier, S. Kitić, R. Gribonval, and N. Bertin, "Sparsity-based audio declipping methods: selected overview, new algorithms, and large-scale evaluation," *IEEE/ACM Transactions on Audio, Speech, and Language Processing*, vol. 29, pp. 1174–1187, 2021.

S. Kitić, **C. Gaultier**, and G. Pallone, "A comparative study of multilateration methods for single-source localization in distributed audio," in *Conference of Open Innovations Association, FRUCT*, no. 27. FRUCT Oy, 2020, pp. 328–336.

R. Lebarbenchon, E. Camberlein, D. Di Carlo, **C. Gaultier**, A. Deleforge, and N. Bertin, "Evaluation of an open-source implementation of the SRP-PHAT algorithm within the 2018 locata challenge," in *2018 16th International Workshop on Acoustic Signal Enhancement (IWAENC), LOCATA Challenge*. IEEE, 2018.

C. Gaultier, N. Bertin, and R. Gribonval, "CASCADE: Channel-Aware Structured Cosparse Audio DEclipper," in *2018 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. IEEE, 2018, pp. 571–575.

C. Gaultier, S. Kitić, N. Bertin, and R. Gribonval, "AUDASCITY: AUdio Denoising by Adaptive Social CosparsITY," in *2017 25th European Signal Processing Conference (EUSIPCO)*. IEEE, 2017, pp. 1265–1269.

C. Gaultier, S. Kataria, and A. Deleforge, "VAST: The Virtual Acoustic Space Traveler dataset," in *International Conference on Latent Variable Analysis and Signal Separation*. Springer, 2017, pp. 68–79.

S. Kataria, **C. Gaultier**, and A. Deleforge, "Hearing in a shoe-box: binaural source position and wall absorption estimation using virtually supervised learning," in *2017 IEEE International Conference on Acoustics, Speech and Signal Processing*. IEEE, 2017, pp. 226–230.

Workshops with Selecting Committee

C. Gaultier and T. Goehring, "Recovering speech intelligibility for cochlear implants in noisy and reverberant situations using multi-microphone deep learning algorithms," in *4th Virtual Conference on Computational Audiology*, 2023.

C. Gaultier and T. Goehring, "Deep learning for speech enhancement with cochlear implants: joint compensation of noise and reverberation with one or more microphones," in *British Cochlear Implant Group Annual Meeting*, April, 13 2023.

C. Gaultier and T. Goehring, "Deep learning strategies for compensation of noise and reverberation: single- vs multi-microphone approaches and applications to cochlear implants," in *Hearing, Audio and Audiology Sciences Meeting*, Spetember, 12 2022.

C. Gaultier, N. Bertin, and R. Gribonval, "Désaturation audio multicanale : une approche par coparcimonie structurée," in *JJCAAS, Journées Jeunes Chercheurs en Audition, Acoustique musicale et Signal audio*, 2019.

C. Gaultier, N. Bertin, and R. Gribonval, "Multichannel cosparse declipping: Stucture helps," in *GDR MIA, Journée Thématique "Parcimonie et Applications"*, 2018.

C. Gaultier, S. Kitić, N. Bertin, and R. Gribonval, "Cosparse denoising: The importance of being social," in *The Signal Processing with Adaptive Sparse Structured Representations (SPARS) workshop*, 2017.

R. Gokula, **C. Gaultier**, J. J. M. Monaghan, and S. Bleeck, "Acclimatization to different english accents for enhanced speech intelligibility in noise in individuals with normal hearing," in *Basic Auditory Science Meeting*. British Society of Audiology, 2015.

Research Reports

C. Gaultier, N. Bertin, S. Kitić, and R. Gribonval, "A modeling and algorithmic framework for (non) social (co) sparse audio restoration," 2017.

Thesis

C. Gaultier, "Design and evaluation of sparse models and algorithms for audio inverse problems," Ph.D. dissertation, Université de Rennes 1, Jan. 2019.

Patents

C. Gaultier, A. Guérin, M. Emerit, and G. Pallone, "Method and device for variable stepsize echo cancellation," in *filed*, 2021.

Talks

C. Gaultier, "Recovering speech intelligibility for cochlear implants in noisy and reverberant situations using multi-microphone deep learning algorithms," in *4th Virtual Conference on Computational Audiology*, June, 28 2023.

C. Gaultier, "Deep learning for speech enhancement with cochlear implants: joint compensation of noise and reverberation with one or more microphones." in *Cambridge Hearing Group Seminars*, February, 17 2023.

C. Gaultier, "Introduction to git and git hosting platforms - useful tools for any researcher," in *MRC CBU, Method Seminar*, January, 09 2023.

C. Gaultier, "Double-talk robust acoustic echo cancellation using partition block frequency-domain adaptive filtering," in *29th European Signal Processing Conference (EUSIPCO)*, August, 26 2021.

C. Gaultier, "A double-talk robust frequency-domain acoustic echo cancellation algorithm," in *Orange Labs Seminar, Rennes*, February, 9 2021.

C. Gaultier, "Design and evaluation of sparse models and algorithms for audio inverse problems," in *Orange Labs Seminar, Rennes*, October, 10 2019.

C. Gaultier, "Désaturation audio multicanale : une approche par coparcimonie structurée," in *JJCAAS, Journées Jeunes Chercheurs en Audition, Acoustique musicale et Signal audio*, June, 27 2019.

C. Gaultier, "Multichannel cosparse declipping: Stucture helps," in *GDR MIA, Journée Thématique "Parcimonie et Applications"*, May, 03 2018.

C. Gaultier, "Cosparse denoising: The importance of being social," in *The Signal Processing with Adaptive Sparse Structured Representations (SPARS) workshop*, June, 05 2017.

C. Gaultier, "VAST: The Virtual Acoustic Space Traveler dataset," in *International Conference on Latent Variable Analysis and Signal Separation*, February, 21 2017.

Computing skills

Programming	python, C++, bash, distributed computing (OAR, Slurm), Docker, PyTorch, Git, CI/CD
Operating Systems	macOS, Linux, Windows
Computer Assisted Design	SolidWorks, Catia
Scientific softwares	MatLab, Labview, COMSOL, LMS VirtualLab, LMS TestLab
Office softwares	Microsoft Suite, LibreOffice Suite, LaTeX
Web	Html, CSS, WordPress, Jekyll