



BioAcoustics Winter School

3rd Ed.



January 6-17, 2020

BWS speakers

Université de Saint-Etienne (ENES Lab)

Nicolas Mathevon, Prof.
Frédéric Sèbe, Associate Prof.
Marilyn Beauchaud, Associate Prof.
Michael Greenfield, Prof, Research Associate
Florence Levréro, Associate Prof.
Vincent Médoc, Associate Prof.
David Reby, Prof
PhD students, post-docs

Exterieurs

Olivier Adam, Professeur Univ. Sorbonne
Thierry Aubin, Directeur de Recherches CNRS
Yves Bas, Museum National Histoire Naturelle
Elodie Briefer, University of Copenhagen
Isabelle Charrier, Directrice de Recherches CNRS
Sébastien Derégnacourt, Prof Univ Nanterre
Paulo Fonseca, Professeur, Univ. Lisbonne
Julien Meyer, Chargé de Recherches CNRS
Andrea Ravnani, post-doc Vrije Universiteit Brussel
Colleen Reichmuth, Senior Researcher Univ. Calif. Santa Cruz
Fanny Rybak, Maître de Conférences Univ. Paris-Sud
Jérôme Sueur, Maître de Conférences MNHN
Frédéric Theunissen, Professeur Univ. Calif. Berkeley

Students should bring the following material :

- laptop
- headphones
- softwares : PRAAT + Audacity + R with seewave package + Python + BioSound Python package

Please check that you're able to record your voice with your laptop.

Location:

**Faculté des Sciences & Techniques, 23 rue du Dr. Paul Michelon, 42100 Saint-Etienne
(on campus: Amphi F101)**

Students registered at BWS follow all courses and practicals listed below.

In bold: courses open to students from the master of Ethology UJM and not registered at BWS.

Day 1 (Monday, January 6th, 2020)

8h30-12h30 **What is a sound signal I? (N.Mathevon & F.Sebe)**

Acoustic waves, digital acquisition, amplitude and measuring dB

13h30-15h30 **What is a sound signal II? (N.Mathevon & F.Sebe)**

Time/frequency representations, acoustic parameters, sound propagation, filters

Short introduction to classical softwares (Goldwave, Praat, Avisoft, seewave)

16h-20h **Students' projects warm-up (D.Reby, N.Mathevon & F.Sebe)**

Groups of 5 students (material: their own phones and/or computers + free apps)

Examples of possible projects:

- *The campus soundscape. I- the noise. (objective: mapping the variation of intensity level on the La Métare Campus –in and out the classrooms; method: recording + measuring the dB level of the background noise with phone apps at different hours and locations on the campus + characterizing the entropy and biodiversity indexes*
- *The campus soundscape. II- Biodiversity. (objective: mapping the acoustic diversity on the La Métare Campus; method: recording the soundscape with phone apps at different hours and locations on the campus + characterizing the entropy and biodiversity indexes*
- *The circadian rhythm of voice pitch (objective: testing if the pitch of an individual's voice changes during the day; method: recording of students' voices at different moments during the day + psycho-acoustic tests to evaluate if we're sensitive to these changes in voice "Please tell when during the day this voice has been recorded")*
- *Voice features and individual size (objective: testing how voice pitch and spectrum depend on an individual's size ; method: recording students' voices + measuring their size & correlates + psycho-acoustic test to see if we're able to assess the size of an individual from her/his size –confounding effect = sex)*
- *Politicians' voices and election issues (objective: is it possible to predict the issue of an election from vocal features measured during a political debate?; method: analysis of recordings –political debates available on the net- + psychoacoustic tests of students?)*
- *Lombard effect (objective: do we modify the amplitude of our voice depending on the level of the background noise – methods : playback of noise of different levels through headphones + recording of speech + measure of amplitude)*
- *Characterizing a loudspeaker for a bioacoustics experiment (objective: determining which is the best loudspeaker for an experiment on woodpecker drumming – methods: playback of white noise + woodpecker drummings in the sound-proofed chamber + comparison with original signals)*
- ...

Students' expected production:

**Poster (1 page) : Scientific context, problematic, hypothesis, method, results, discussion*

**Powerpoint (15 minutes max).*

Day 2 (Tuesday, January 7th, 2020)

8h-12h **Signal processing 1 (with a focus on PRAAT -D.Reby)**

- Practicals 1: Introduction to PRAAT (signal manipulation –editing, resampling...) + analysis of mammal vocalizations (Frequency analysis -spectrogram, spectrum, formants...; Time analysis)

14h-18h **Signal processing 2 (with a focus on PRAAT -D.Reby)**

- Practicals 2: Analysis and re-synthesis of human voice with PRAAT

Day 3 (Wednesday, January 8th, 2020)

8h-12h
& 14h30-18h30 **The recording and emission chains - Problems and solution**
(microphones, loudspeakers, recorders) – Practicals
(M.Greenfield, N.Mathevon & F. Sèbe)

Aquatic bioacoustics: from sound to silico – Practicals
(P.Fonseca)

13h-14h Technical support for students' project (*D.Reby, N.Mathevon & F.Sebe*)

19h-22h **Evening event (to be defined)**
(open to the public)
Maison de l'université, 10 rue Tréfilerie, Saint-Etienne

Day 4 (Thursday, January 9th, 2020)

9h-12h & 14-17h *Field experiment - Practicals I* (Human bioacoustics -Propagation of human voice - Field experiment – (*J.Meyer*))

9h-12h & 14-17h How to analyse vocal signatures (with a practical with PRAAT & seewave)
(*N.Mathevon & F.Sebe*)

12h-13h Technical support for students' project (*D.Reby, N.Mathevon & F.Sebe*)

16h30 – 18h The vocal expression of emotions (*E.Briefer*)

18h30-19h30 Fish bioacoustics (*M.Beauchaud*)

Day 5 (Friday, January 10th, 2020)

8h30-12h30 Introduction to ecoacoustics – (*J.Sueur*)

14h-17h Signal processing with the seewave R package (*J.Sueur*)
practicals 3: time frequency analysis and visualization, ecoacoustic analysis

17h-19h Technical support for students' project (*D.Reby, N.Mathevon & F.Sebe*)

Day 6 (Monday, January 13th, 2020)

8h - 11h Rhythmic patterns (*A.Ravignani*)

11h30-13h30 Bioacoustics as a tool for social network studies (monkeys and apes) (*F.Levréro*)

14h-17h Birdsong studies in the laboratory: technical advances in tracking vocal changes (*S.Derégnaucourt*)

16h-18h Signal processing 3 – *Practicals* (*F.Sebe*)
Graphical synthesis, automatical research of templates

18h-20h Signal processing 5 – BioSound Python package
(*F.Theunissen – VIDEO CONFERENCE*)

Day 7 (Tuesday, January 14th, 2020)

8h-9h30 Information theory (*T.Aubin*)

9h30-10h30 The noise (*T.Aubin*)

11h-12h Coding strategies in song of songbirds (*T.Aubin*)

14h30-18h30 Field experimentations in bioacoustics: problems and solutions
(*I.Charrier*)

18h30- 21h Field bioacoustics in movies
(*N.Mathevon & F.Sèbe*)

“Bonjour les morses” <http://videotheque.cnrs.fr/doc=2019>

“Capitaine de la forêt” <http://videotheque.cnrs.fr/doc=2846>

“Crocodile melody” <http://videotheque.cnrs.fr/doc=4168>

“Les chants de la mer” <http://www.universcience.tv/video-les-chants-de-la-mer-11660.html>

Day 8 (Wednesday, January 15th, 2020)

8h – 12 h Whales’ bioacoustics (*O.Adam*)

14h – 15h30 Acoustic survey of animal populations: Detection and automatic classification of bats’ echolocation calls (*Yves Bas*)

15h30 – 17h Classification of bat’s echolocation calls – *Practicals* (*Yves Bas*)

18h-20h Psychoacoustics of Marine mammals: behavioral conditioning, auditory curves and impact of subaquatic noise
(*C.Reichmuth – VIDEO CONFERENCE*)

Day 9 (Thursday, January 16th, 2020)

8h-10h & 10h-12h *Field experiment - Practicals II (Triangulation)* (*N.Mathevon & F.Sebe*)

8h-10h & 10h-12h The use of sound libraries for conservation and scientific studies
(*N.Mathevon*)

12h-14h Technical support for students’ project (*D.Reby, N.Mathevon & F.Sebe*)

14h – 16h Bioacoustics as a monitoring tool for fresh waters (*F.Rybak*)

16h – 18h Acoustic studies in Arthropods (*F.Rybak*)

Day 10 (Friday, January 17th, 2020)

8h – 8h45 **The International Bioacoustic Council, other structures, scientific journals and potential fundings opportunities in bioacoustics**
(N.Mathevon)

9h-13h **Current research topics at the ENES lab**
(ENES lab PhD students & post-docs)

14h-18h **Final exam**
1. **multiple choice test (45 minutes)**
2. oral presentation by students *(each group of students will present its project in 15 minutes)*
