

SHAKE THE FUTURE.



ENGINEERING PROGRAMME

PROFESSIONAL OPTION

SCIENCE AND MUSIC
AUTUMN SEMESTER

EXPERIMENTAL METHODOLOGY IN PSYCHOLOGY

SCIENCE AND MUSIC, ENGINEERING PROGRAMME PROFESSIONAL OPTION
AUTUMN SEMESTER

Professor: Jean-François PETIOT

Objectives

To present the experimental method for the study of human auditory perception with hearing tests.
To know how to set up a hearing perceptual experiment (choice of the experimental protocol, choice of the material, statistical analysis of data).

Course contents

1) The experimental method in psychometry
perceptual tests - protocols - sound quality

2) Organisation of hearing tests
Audio conformity - HRTF

3) Methods and tools for the analysis of psychometric data
Review of statistics. Descriptive statistics, modelling of data, statistical tests
Monovariate analysis (ANOVA, multivariate analysis (PCA - principal component analysis),
multidimensional scaling (MDS), linear models - Classification (HAC), subjective/objective analyses

Lab 1: analysis of hearing tests - ANOVA - PCA - tests

Lab 2: free sorting task - multidimensional scaling (MDS) - classification (HAC)

Course material

Lebart L., Morienau A., Piron M. Statistique exploratoire multidimensionnelle. DUNOD, Paris, 2002.
McAdams S., Bigand E. Penser les sons. Psychologie cognitive de l'audition. PUF, 1994, Paris.

Keywords

Perceptual evaluation, hearing tests, sound quality, statistical methods

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	9 hrs	0 hrs	8 hrs	0 hrs

DIGITAL MUSIC

SCIENCE AND MUSIC, ENGINEERING PROGRAMME PROFESSIONAL OPTION
AUTUMN SEMESTER

Professor: Mathieu LAGRANGE

Objectives

To present tools and methods for the management and the operation of musical databases.
To give the principles of the main audio coding formats.

Course contents

- MIR (Music Information Retrieval): automatic transcription, audio abstract.
- Indexation and compression of music: detection of musical genre, MP3 coding, AAC
- Distribution of music: fingerprinting (Shazam), micro services (the echo nest)
- Large scale musical recommendations (Big data): collaborative filtering (Last.fm), spark, hadoop
- New tools for browsing and creation - micro service based: <http://new.musichackday.org/>

Course material

Keywords

audio indexation, MIR, recommendation systems

Links with other programmes

Musicology - perception

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	16 hrs	0 hrs	12 hrs	0 hrs

ACOUSTICS, SIGNAL, PSYCHOACOUSTICS

SCIENCE AND MUSIC, ENGINEERING PROGRAMME PROFESSIONAL OPTION AUTUMN SEMESTER

Professor: Jean-François PETIOT

Objectives

To present the tools and methods to represent, analyse and synthesize audio signals.
Basics of acoustics and sound propagations
Introduction to psychoacoustics and the study of sounds as perceived by humans.

Course contents

a) Basic tools for audio signal processing

- Classification of sounds
- spectral analysis - time-frequency representation - spectrogram - audio filtering
- digital sound

b) Basic acoustics

- Sound sources - Propagation - wave equation
- dimensions (intensity, power, decibels)
- the audio chain - captors - transducers - peripherals

Lab 1 Matlab: sound analysis - example of additive synthesis - filtering - soustractive synthesis - sound effects;

Lab 2 Audacity - audio editing - effects

c) Introduction to Psychoacoustics

- auditory physiology
- sound perception
- Masking effect - critical bands - auditory scenes organisation - audio streams - cocktail effect
- Psychoacoustic metrics (dBA, loudness, sharpness, roughness)

Lab 3: masking effect - beats - perpetual scales

Course material

Philippe GUILLAUME. Musique et acoustique - de l'instrument à l'ordinateur, Hermès, Lavoisier, 2005.

Olivier CALVET. Acoustique appliquée aux techniques du son. Educavivre, Casteilla 2002

Keywords

audio signals, acoustic, perceptions, audio editing, digital sound

Links with other programmes

First Year Course - from Measurement to Control

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	8 hrs	10 hrs	0 hrs	0 hrs

MUSICAL ACOUSTICS

SCIENCE AND MUSIC, ENGINEERING PROGRAMME PROFESSIONAL OPTION
AUTUMN SEMESTER

Professor: Jean-François PETIOT

Objectives

To present the main principles governing how musical instruments work and their design:

- wind
- strings (violin - piano)
- percussion

To give the basics on room acoustics.

Course contents

Part 1 - Musical instruments – systemic and organological study – physical models

- specifications of a musical instrument

a) intervals - scales – temperaments

b) instrument manufacturing - perceived quality

- winds (reeds, flutes, singing voice)
- string (violin, piano)
- percussion

Labs (3 three-hour sessions)

Lab 1: programming different musical temperaments – sound synthesis of instruments - comparisons of instruments.

Lab 2: setting up of physical model simulations

Lab 3: exercise on a multitrack mixage

Part 2 - Room acoustics

- Objective characterization – processing - isolation
- Sound engineering - systems – sound mixing – peripherals - sound effects

Part 3 - Innovative and augmented instruments

- captors and interfaces for sound creation
- tangible interfaces – captors

Lab 4: creation of innovative instruments and interfaces with smartphones

Course material

Emile LEIPP. Acoustique et Musique. Masson, 1989.

Michèle CASTELLENGO. Ecoute musicale et acoustique. Eyrolles, 2015.

Philippe GUILLAUME. Musique et acoustique. Hermes, Lavoisier 2005.

Keywords

physics of musical instruments, sound simulations, instrument making

Links with other programmes

LANGUAGE	ECTS CREDITS	LECTURES	TUTORIALS	LABO	PROJECT
French	1	21 hrs	0 hrs	12 hrs	0 hrs