

Course Syllabus: THE ARTISTIC BRAIN: BIOLOGY AND COMPUTATION BEHIND MUSIC

Language of Instruction: English or Spanish
Professor: Fernando Giraldez (CEXS) and Perfecto Herrera (TIC)
Professor’s Contact and Office Hours: 9 to 17h
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Course Contact Hours: 15 hours
Recommended Credit: 2 ECTS credits
Weeks: 1: 4th -8th JULY
Course Prerequisites: There are no prerequisites for this course.
Language Requirements: English

Time module: 9:00-12:00

Course Description:

Science and art are rooted in our perception of the world. The course is aimed at exploring the biology perception and its implications on how we experience music. It is a discussion on beauty and the brain, a discussion on the history of breakthroughs and the irresistible attraction of music for humans.

The course starts with a general overview of how our senses build up a representation of the world, with particular reference to the auditory systems. We shall look at the biological and evolutionary roots of musical perception. This will lead us to a general discussion on beauty and art: the notion of artists as intuitive neuroscientists, the perceptual grammar of art, aesthetic universals and computational aesthetics (can a machine be “creative”?, can an algorithm decide on aesthetic properties?)

Learning Objectives:

- To learn the basis of the neuroscience of perception.
- To explore general concepts about music and biology.
- To better appreciate music from another perspective.
- To appreciate science as culture and art as a source of knowledge.

Course Workload

The course is based on discussion sessions and lectures. Typically, students will read 3-4 short papers (two-three pages), 5 fragments or book chapters and write 2-3 short papers/reports (one page) along the course. There will be two quiz tests and a final exam.

Methods of Instruction:

The course will blend short talks with reverse class and discussion seminars.

Method of Assessment

Final exam: 50%. The final exam will be held on the last day of the course (40 min). It will consist of short questions and problem-solving exercises.

Continuous evaluation: 50%. Intermediate evaluations will be based on assignments of one-page essays, cooperative (two-stage) exams and participation in the discussions.

Absence Policy

Attending class is mandatory and will be monitored daily by professors. The impact of absences on the final grade is as follows:

Absences	Penalization
Up to one (1) absence	2 points subtracted from final grade (on a 10 point scale).
Two (2) absences	The student receives an INCOMPLETE for the course

The BISS attendance policy does not distinguish between justified or unjustified absences. The student is deemed responsible to manage his/her absences.

Emergency situations (hospitalization, family emergency, etc.) will be analyzed on a case by case basis by the Academic Director of the UPF Barcelona International Summer School.

Classroom Norms:

No food or drink is permitted.

There will be a ten-minute break during the class.

Students must come to class fully prepared.

CONTENTS AND SCHEDULE:

Monday July 4th INTRODUCTION TO THE BRAIN AND PERCEPTION

Session 1. Introduction and “Brain history”. Basic concepts of brain organization for *neophytes*.

Session 2. The senses and the arts: how we see the world. The irresistible attraction of the senses. The organization of sensory systems. “Every animal lives in its own world”.

Session 3. Practical activities. Questions and problems on sensation and perception. Demos on perception.

Reading assignments:

Plato “The Allegory of the Cave : Plato “The Allegory of the Cave”

Robson, D. (2011) *A brief history of the brain*. New Scientist

<https://www.newscientist.com/article/mg21128311-800-a-brief-history-of-the-brain/?ignored=irrelevant#.VK--p96rPIM>

Tuesday July 5th THE BIOLOGY OF HEARING

Session 4. From waves to sound, from sound to music. From “hair cells” to ecstasy.

Session 5. Sound localization and categorization: what we learn from owls and bats.

Session 6. Practical activities. Sound Perception and Cognition. Practical activities: Auditory demonstrations of perceptual processes. **QUIZ-1**

Reading assignments:

Vilis L9 (2021) Hearing <http://www.tutis.ca/Senses/L9Auditory/L9Auditory.swf>

Wolfe et al. (2017) *Sensation and Perception* (5th Ed.) [Web activities](#)

Wednesday July 10th MUSIC IN THE BRAIN

Session 7. Auditory perception: basic sensations. Loudness. Periodicity, tonality and noisiness. Timbre sensations.

Session 8. Making sense of our sonic world. Auditory and musical illusions. Combining sounds: fusion. Disentangling polyphonies: fission.

Session 9. Practical activities. Auditory demonstrations. Musical illusions. Commented music listening.

Reading assignments:

[Deutsch, D. \(2010\). Hearing music in ensembles, *Physics Today* 63, 2, 40](#)

Thursday July 11th MUSIC, BRAIN AND COMPUTATION

Session 10. What is the game of music? Expectation, its fulfillment and its violation

Session 11. Music and emotions

Session 12. Practical activities. Auditory demonstrations. Musical illusions. Commented music listening. QUIZ-2

Reading assignments:

[Brattico, E., & Pearce, M. \(2013\). The neuroaesthetics of music. *Psychology of Aesthetics, Creativity, and the Arts*, 7\(1\), 48-61.](#)

Friday July 12th FINALE

Session 13. Beauty in the brain, beauty and the brain; rt, technologies and the brain. Music Universals.

Session 14. General discussion and pre-exam review

Session 15 Final exam

Recommended bibliography:

On neurobiology

Most neurophysiology necessary for the course can be found in:

BrainFacts.org *A primer on the brain and Nervous System.* Chapter 3, 18-24

<http://www.brainfacts.org/~media/Brainfacts/Article Multimedia/About Neuroscience/Brain Facts book.ashx>

UTHealth (2014) Neuroscience Online. An electronic textbook for the Neurosciences, University of Texas, Dept. Neurobiology and Anatomy

<http://nba.uth.tmc.edu/neuroscience/s2/index.htm>

Vilis, T. (2014) *The Physiology of the Senses*. Transformations for Perception and Action <http://www.tutis.ca/Senses/index.htm>

[Wolfe et al. \(2017\) *Sensation and Perception* \(5th Ed.\) Web activities](#)

On music:

Main readings:

Hudson, D. Is music an evolutionary adaptation?. *Ann N Y Acad Sci.* 2001,930: 43-61. 10.1111/j.1749-6632.2001.tb05724.x.

Brattico E., Brattico P. J., Vuust P. (2017). Global sensory qualities and aesthetic experience in music. *Front. Neurosci.* 11:159. 10.3389/fnins.2017.00159

Pressnitzer, D., Suied, C., Shamma, S. (2011). Auditory scene analysis: The sweet music of ambiguity, *Frontiers in Human Neuroscience*, 5, 1662-5161

Complementary readings

- Ball, P.** (2010). *The music instinct: how music works and why we can't do without it*. London: The Bodley Head
- Bowling, DL and Purves, D.** (2015) *A biological rationale for musical consonance*. [Proc. Natl. Acad. Sci. USA, 11:11155-60](#)
- Giraldez, F. (2016)** *Brain and music: looking for universal rules*, translation from Sonograma Magazine 032 Oct. 2016 "El cerebro y la música: buscando reglas universales" <http://sonograma.org/2016/10/cerebro-musica-reglas-universales/>
- Levitin D.J and Tirovolas A.K.** (2009) *Current advances in the cognitive neuroscience of music*. *Ann N Y Acad Sci.* 1156:211-31
- Manaris et al** Zipf's Law, Music Classification, and Aesthetics. *Computer Music Journal* Spring 2005, Vol. 29, No. 1, pp. 55–69
- Purves, D (2021)** *Purves Lab Sound and Music* <https://purveslab.net/sound-and-music-2>
- Wolfe et al.** (2017) *Sensation and Perception* (5th Ed.) Web activities