

**Course Syllabus- THE ARTISTIC BRAIN: BIOLOGY AND COMPUTATION
BEHIND PAINTING AND 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: 8th -12th 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 artwork. It is a discussion on beauty and the brain, a discussion on the history of breakthroughs in painting and on the nature of 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 visual and auditory systems. We shall discuss the biology underlying great painter's achievement of the impossible: the conquest of space and movement on a canvas. Then we do a similar exercise with music, looking 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 appreciate painting and music, and to look at art from a scientific perspective.
- To explore general concepts about art, music and biology.
- 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 4-5 short papers (two-three pages), 5 fragments or book chapters and write 2-4 short papers/reports (one page) along the course. There will be several quiz tests and a final exam.

Methods of Instruction:

The course is based on discussion sessions and lectures. Typically, students will read 4-5 short papers and fragments or book chapters and will have to listen to some selected music excerpts, in order to prepare and wrap-up the sessions. There will be several quiz tests and a final exam.

Method of Assessment

Rev. 14/6/19

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: 30%. Intermediate evaluations will be based on cooperative (two-stage) quiz and problem-solving exams.

Class participation: 20%: This includes active participation in discussions and the little artwork project.

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 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.

Course Contents:

Monday July 8th

Session 1. The senses and the arts: how we see the world. Introductory notes. The irresistible attraction of the senses. The organization of sensory systems. “Every animal lives in its own world”.

Session 2. What happens with lines?. Rods and cones. The smile of Mona Lisa. Retinal processing and contrast. Why we like line drawings.

Session 3. Practical activities. Questions and problems on sensation. Demos on retinal neurons.

Reading assignments:

Vilis, T. (2014) L1The eye <http://www.tutis.ca/Senses/L1Eye/L1eye.swf>
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>

Tuesday July 9th

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Session 4. The visual brain. From lines to objects. The brain is kantian: brain categorisation, shape and objects. Bosch and Pollock. What is colour. Colour and movement in Monet.

Session 5. The conquest of reality: from Fra Angelico to Velázquez. Binocular cues and monocular spatial reconstruction. The subversion of the rules: Picasso and Magritte.

Session 6. Practical activities. The eye of the beholder. Are there general rules for beauty? Is there a limit for the art forms? Quiz 1

Reading assignments:

Vilis, T L2 The visual cortex <http://www.tutis.ca/Senses/L2VisualCortex/l2v1.swf>
Zeki, S. (1997) The Wodhull Lecture: visual art and the visual brain. Proc. Royal Institution of Great Britain 29-63 <http://www.vislab.ucl.ac.uk/pdf/Woodhull.pdf>

Wednesday July 10th

Session 7. From waves to sound, from sound to music. From “hair cells” to ecstasy. The musical brain. Searching for “music universals”

Session 8. Music Perception and Cognition. Practical activities: Auditory demonstrations of perceptual processes.

Session 9. Practical activities. Auditory demonstrations. Musical illusions. “Little Art Project” discussion

Reading assignments:

Vilis (2014) L9 Hearing <http://www.tutis.ca/Senses/L9Auditory/L9Auditory.swf>
[Bowling, DL and Purves, D. \(2015\) A biological rationale for musical consonance. Proc. Natl. Acad. Sci. USA, 11:11155-60 URL](#)
[Deutsch, D. \(2010\). Hearing music in ensembles, Physics Today 63, 2, 40](#)

Thursday July 11th

Session 10. Music Perception and Cognition. Making sense of auditory information

Session 11. The game of music. Music cognition. Periodicity, consonance, contrast, and expectation. Music and emotions.

Session 12. Practical activities. Musical Paradoxes. Quiz2

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

Session 13. Music and computational aesthetics.

Session 14. Bring“ your little music”. General discussion: beauty, art, technologies and the brain (review).

Session 15 Final exam

Recommended bibliography:

Most neurophysiology necessary for the course can be found in:

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

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>

PURVES, D. et al *Neuroscience*, 2nd ed. Chapters 11-13 <https://www.ncbi.nlm.nih.gov/books/NBK10799/>

Some references on Aesthetics:

STANFORD Encyclopedia of Philosophy <http://plato.stanford.edu/> A reference for philosophy and Aesthetics:

DUTTON, D. (2010) A Darwinian theory of beauty TED talk https://www.ted.com/talks/denis_dutton_a_darwinian_theory_of_beauty#t-22329

On painting:

LIVINGSTONE, M. (2014) *Vision and Art: The Biology of Seeing*, Harry N. Abrams Pub. See also: (2009) What art can tell us about the brain. Lecture at the University of Michigan <http://www.youtube.com/watch?v=338GgSbZUYU>

KANDEL, E. (2013) *The New Science of Mind and the Future of Knowledge*. Neuron 80: 553-558 <http://dx.doi.org/10.1016/j.neuron.2013.10.039>

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](https://doi.org/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](https://doi.org/10.3389/fnins.2017.00159)

Additional readings

BALL, P. (2010). *The music instinct: how music works and why we can't do without it*. London: The Bodley Head

MANARIS, B., ROMERO, J., MACHADO, P., KREHBIEL, D., HIRZEL, T., PHARR, W., AND DAVIS, R.B. Zipf's Law, Music Classification, and Aesthetics. *Computer Music Journal* Spring 2005, Vol. 29, No. 1, pp. 55–69