**Language of Instruction:** English or Spanish  
**Professor:** Fernando Giraldez (CEXS) and Perfecto Herrera (TIC)  
**Professor’s Contact and Office Hours:** 9 to 17h  
fernando.giraldez@upf.edu; perfecto.herrera@upf.edu  
**Course Contact Hours:** 15 hours  
**Recommended Credit:** 2 ECTS credits  
**Weeks:** 1: 16th -20th JULY  
**Course Prerequisites:** There are no prerequisites for this course.  
**Language Requirements:** English  
**Time modules:** 2h Mo-Fri. 9:00-11:00h + 1h Mo.-Fri, 13:00-14:00  

**Course Description:**  
Science and art are rooted in our perception of the world. The course is aimed at exploring the biology of perception and its implications on how we experience works of art. 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 painters’ achievement of the conquest of space and movement on a canvas. Then we do a parallel 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 universal and computational aesthetics.

**Keywords:** Neurosciences, computation, art, music, painting, creativity, aesthetics.

**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 will use flipper-classroom-inspired methodology, and combined with a set of short talks (20 min) and seminars. Seminars consist of problem solving, paper discussions and general discussions with invited speakers. Demonstrations include animations, data analysis, music listening and comments, and interactive materials. Materials, power point PDFs, handouts and readings will be available in advance.  
The course may be combined with a supervised project that will provide an additional 2-4 ECTs.

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

Class participation: 20%

**Absence Policy**
Attending class is mandatory and will be monitored daily by professors. The impact of absences on the final grade will be announced soon.

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 16th**

**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) LiThe eye http://www.tutis.ca/Senses/L1Eye/L1eye.swf

**Tuesday July 17th**


**Session 5. The conquest of reality in painting: from Fra Angelico to Velázquez.** Binocular cues and monocular spatial reconstruction. From Fra Angelico to Sorolla. The subversion of the rules: Picasso and Magritte.
**Session 6. Practical activities.** The neuroscientific eye on painting. 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](http://www.tutis.ca/Senses/L2VisualCortex/l2v1.swf)

**Wednesday July 18th**

**Session 7. From waves to sound, from sound to music.** From “hair cells” to ecstasy. The ear and the auditory brain.


**Reading assignments:**

**Thursday July 19th**


**Session 11. Music and emotions.**

**Session 12. Practical activities (Computer room). Musical Paradoxes. Quiz 2**

**Reading assignments:**

**Friday July 20th**

**Session 13. Music and computational aesthetics.**
**Session 14. 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:

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:
https://www.ted.com/talks/denis_dutton_a_darwinian_theory_of_beauty#t-22329

On painting:
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2813684/

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