



Introduction to the course

The aim of this course is to provide a perspective on some “hot topics” in Neurosciences by examining specific areas in which they have made enormous progress in recent years. The course starts with a general overview of how the sensory systems build up a representation of the world, with particular reference to the visual and auditory systems. Then it analyses examples of the constructive character of perception and the mechanisms of brain categorization in vision, audition and the chemical senses. The neural basis of painting and music are discussed in this context, reviewing the works of art masters. From here, it goes into how neuroscience brings back and sheds new light on classical philosophical questions, like what is knowledge, aesthetic universals, the question of “nature and nurture”, and the implications of Neurosciences in Law.

Syllabus

WEEK 1-5 APRIL

1. Introduction to the course

2. The representation of the world: the sensory systems. The organization of sensory systems: parallel processing sensory receptors, brain localization, distortion, top-down and bottom-up processing.

3. The visual world: from the retina to the brain. Why we like line drawings?. Rods and cones. Retinal processing and contrast. The smile of the Mona Lisa.

WEEK 8-12 APRIL

4. The visual areas in the brain. How do we identify objects? From neurons to ideas: feature extraction. The brain is kantian: brain categorisation, shape and objects. The case of “face cells”.

5. The construction of space. Binocular and monocular cues for spatial reconstruction. From Fra Angélico to Sorolla: looking at the history of painting. Why they were so great. Baroque painting, Velázquez and the aerial perspective.

6. What is colour. Colour in our brains. The construction of colour and light. Colour is more than the mixture, colour is context: Hering’s colour opponent theory. From medieval miniatures to Monet’s lily pads.

NEUROSCIENCE AND HUMANITIES

7. Neuroscience and Art. Beauty and meaning. The evolutionary history of the beauty and history of art. The evolutionary logos of aesthetic universals. Artists as intuitive neurologists. Is cubism a *neurological fiasco*?

MT exam

8 Hearing. The inner ear. The auditory brain. Auditory objects. Sound localisation: what we learn from owls and bats.

WEEK 22-26 APRIL

9. Bring your own Artwork session Students will produce a piece of art for a neuroscientific discussion. Submit before Monday April 22nd

10. Music, hearing and brain: from hair cells of ecstasy. Musical scales and language. Beethoven and Rolling Stones, the masters of suspense.

11. Brain and language. The genetic nature of language. Language and perception. Language and music. A discussion with Porf. JM Castellà, Humanitats, UPF

12. Perception and knowledge: Plato, “the allegory of the cave” and the Neurosciences. The limits of knowledge. Science and belief. The neurology of post-truth. Virtual reality.

WEEK 29A – 3 MAY

13 Neuroscience and Philosophy. More about aesthetics: a discussion with Prof. Pol Capdevilla UPF

14 Genes and culture I: Early experience and perception. The "critical periods" of postnatal development. Cerebral plasticity: interactions between the brain and the environment. The question of "nature and nurture"

15. Genes and culture II: The question of "nature and nurture". Correlation and causation. Genes, environment and chance. Chance and necessity.

WEEK 6-10 MAY

15. General discussion and exam review

TERM PAPER AND CLASS PRESENTATIONS: THE "CHALK TALKS" (see AG)

For the Chalk Talks, students will make an oral presentation to their classmates and teachers. Every student will select a topic from a proposed list, or they may propose their own related to the subjects of the course. Topic selection is on the basis of first to come, first served. The activity includes: 1) One page abstract of no more than one page, 550 words (Arial 10) containing the relevant information and up to three references. A figure may be included if appropriate. 2) A talk of 10 minutes + 5 minutes discussion. 3) The presentation will be on the blackboard, a so-called "chalk talk", Power-Point or other supports not allowed.

PO1 Student's presentations

PO2 Student's presentations

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PO3 Student's presentations

WEEK 13-17 MAY

PO4 Student's presentations

Final exam review

Evaluation

The assessment will be based on academic performance in the following tests, and on a scale from 0 to 10:

50%: Written test (continuous evaluation). There will be two written tests (short questions and problems), one for the first three blocks, lessons 1-12, and a second one for the remaining two blocks, lessons 13-21. The final mark will be the average of the two exams. Each exam will be marked on a scale of 10.

20%: Work in seminars. This will be evaluated during the activities of the seminars and discussion groups.

30%: Essay and paper presentation. Oral presentations (chalk-talks) will be held before the teaching staff who will evaluate it.

Requirements: To overcome the activity, the student must participate in scheduled activities and add up to 5 points (50%) or higher among the different activities mentioned above. However, note that **the mark obtained in each of the written tests must be above 5 over 10** for allowing further consideration.

Criteria for the recovery process: Students that after the evaluation process have not passed the course, have the option of a recovery test in the month of July. This will be a written test (short questions & problems) on the lessons of the syllabus above. In no case the activity assessed during the teaching process can be recovered and the student will maintain qualification obtained during the course. Therefore, the final grade will correspond with results of the recovery test with the abovementioned requirements, plus the results of the continuous evaluation.

Bibliography and resources

Textbooks

KANDEL, ER, SCHWARTZ JH, JESSEL, TM SIEGELBAUM SA AND HUNDSPETH, A.J. (2013) Principles of Neural Science. Fifth Edition. McGraw-Hill, New York, USA

PURVES, D., HEAD, A., HUETTEL SA, LABAR KS, PLATT ML WOLDORFF, MG (2013) Principles of Cognitive Neuroscience, Second Edition., Sinauer Ass. Inc. Publishers, USA

WOLFE, J.M., KLUENDER, K. & LEVI, D.M. (2015) Sensation & Perception, Fourth Edition.- Sinauer Ass. Inc. Publishers, USA

Further reading Reading assignments, articles for seminars and "Chalk Talks" will be provided along the course.

NEUROSCIENCE AND HUMANITIES

Teaching resources

Webpages:

Wolfe Companion Website: <http://www.sinauer.com/cogneuro/animations.html>

Purves, D. Neuroscience <http://www.ncbi.nlm.nih.gov/books/NBK10799/>

Other pages and resources will be provided along the course.

Methodology

The course will use flipper-classroom-inspired methodology, and combined with a set of short talks 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.