UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Cognitive Neuroscience

2526-1-F5109P002

Learning area

Applied Experimental Psychological Sciences

Learning objectives

Knowledge and understanding
This course provides a strong background in systems-level neuroscience and allows students to develop integrative research interests that cross domains. This knowledge will be based upon the most recent developments in the field, supported by relevant litterature and research examples. During the course, the critical thinking abilities of students will be supported through the discussion of research protocols in the field of cognitive neuroscience, to help them to understand the strength and weaknesses of different research methods and how to exploit them to improve our knowledge on the brain-cognition relationship through experimental actions. The laboratory will allow students to learn how to program basic experiments in cognitive neuroscience, also based upon the integration of their knowledge of psychological processes.

Applying knowledge and understanding
Students will gain a thorough understanding of the intellectual issues that drive this rapidly growing field, as well as expertise in the major methods for research on higher brain function. Students will also learn to apply the acquired knowledge in designing and carrying out empirical studies in the field of cognitive neuroscience. In particular, they will learn how to design experiments in PsychoPy (www.psychopy.org), a program designed to facilitate the conception of any experiment that uses a computer as an interface between the subject and the experimenter.

Making judgement
Students will gain the ability to independently integrate methodological and theoretical skills in the field of cognitive neuroscience and to apply them in different contexts, taking into account specific critical aspects of various operational situations. Students will also gain the ability to reorganize the acquired knowledge in order to promote innovative and original solutions through judgment based on empirical data and a critical reading of the

complexities inherent to the field of cognitive neuroscience.

Communication skills
Students will acquire communication skills that allow an effective interaction with various types of professionals from different cultural and scientific backgrounds, both in the public and private sectors, to propose innovative research projects in cognitive neuroscience and communicate one's results and conclusions to an audience of specialists and non-specialists in a clear, detailed, and scientifically grounded manner, referring to specific disciplinary lexicons. Students will also learn how to coordinate and facilitate team work and collaborate effectively with other agents fluently and competently in English.

Learning skills
The course will promote the acquisition of the ability to adopt new developments and innovations emerging from international scientific results in cognitive neuroscience, updating one's skills to the rapid evolution of the field and making use of specialized bibliographic resources and various professional development initiatives. The course will also promote the ability to understand and apply in-depth scientific literature review in order to apply the most advanced knowledge and tools available in an original way.

Contents

The course provides a thorough update and review of fundamental issues in cognitive neuroscience, also considering most recent methodological approaches within the field. It will cover recent developments in research on the neural bases of memory and attention.

Detailed program

• Basics and history of mind-brain investigations

• Research methods in cognitive neuroscience
o Neurostimulation and neuromodulation (transcranial electrical stimulation and single pulse and repetitive transcranial magnetic stimulation)
o Functional Magnetic resonance imaging

• Cognition and the brain
o Neural bases of memory processes
o Neural bases of attention
o Neural bases of consciousness

• Laboratory: programming in PsychoPy
o Creating experiments with “no-coding” in PsychoPy’s Builder interface
o Running experiments online with PsychoPy’s Pavlovia platform
o Coding in Psychopy

Prerequisites

This course requires a basic knowledge of anatomy and physiology of the nervous system and its cognitive functions. No prior programming skills are required.

Teaching methods

The course will be held in presence. Teaching will consist of 42 hours of lecture-based lessons, and also interactive classwork, discussion on scientific papers, and assignments. There will also be 16 hours of practical course with PsychoPy that will take place in the laboratory, with practical computer exercises, using the Unimib's LIBaaS VMware environment. All course material (e.g., slides, readings) will be made available on the e-learning website of the course, so that also non-attending students can use it.

Assessment methods

1. The exam will consist of 30 multiple choice questions and 1 open question covering all the topics of the course.
   a. Multiple choice questions will be graded 1 if correct and 0 if incorrect.
   b. The open question will be evaluated 0-30 and will be averaged with the multiple choice results for the final grade.

2. For those students who request it, or if the teacher considers it necessary, an oral interview can be arranged: the mark obtained in the oral test will be averaged with that obtained in the written test. The evaluation criteria are: the correctness of the answers, the ability to argue, synthesize, create links, and critically discuss the course topics.

3. Knowldege of programming PsychoPy as imparted by the course will be assessed at the end of the laboratory practicum, by means of assigned problems such as implementing a new experiment. For those students who could not attend the PsychoPy Lab, an equivalent test will be integrated in the final course exam.

4. Dissertation on a desired topic could be produced, and will integrate the final grade (0-3 points).

A pre-assessment will be held at the end of the course and will consist of a written examination (as in 1).

Textbooks and Reading Materials

The reference textbook is:

Principles of Cognitive Neuroscience.
Dale Purves; Kevin S. LaBar; Michael L. Platt; Marty Woldorff; Roberto Cabeza; Scott A. Huettel
Publisher: Sinauer Associates
Print ISBN: 9780878935734, 0878935738
eText ISBN: 9781605354316, 1605354317

Further learning materials for the classes and laboratory will be indicated during the course and will be uploaded on the course web-site. This material should be studied in preparation for the exam.

Sustainable Development Goals