

University of Trento

CIMeC - Center for Mind/Brain Sciences

MASTER'S COURSE IN COGNITIVE SCIENCE

www.mcs.unitn.it



**UNIVERSITY
OF TRENTO - Italy**

MASTER'S COURSE IN COGNITIVE SCIENCE

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SCOPE AND OBJECTIVES

The Master's course in Cognitive Science is a two-year full time program of intensive study and research. The course is open to and aimed at students from different backgrounds. All courses are given in English by top scientists who have experience working within a wide network of international collaborations. The aim is to prepare talented candidates for both academic and industry careers.

The Master's provides a unique opportunity for hands-on experience working together with international scientists using cutting-edge research methodologies, such as fMRI, MEG, EEG, single-cell neurophysiology, near infrared spectroscopy, computational modeling, machine learning and eye-tracking. An extensive internship and a research project leading to the Master's dissertation are a vital part of the experience and take advantage of the unique resources available at the University and at those of its partners.

The University of Trento, first place in the national university ranking, has focused on excellence since its inception in 1962 and it now enjoys a strong global reputation. It has 10 departments, 3 research centers, more than 500 professors and 16,000 students.

Despite its relatively small size compared with other universities, it was ranked among the 225 top universities (and first among the Italian universities) in the Times Higher Education Rankings 2013-2014 and among the 450 top universities in the QS World University Ranking 2013-14. The ANVUR Report on the Evaluation of Quality of Research places the University of Trento first for the scientific production in the category of medium-sized Italian universities.



THE CENTER FOR MIND/BRAIN SCIENCES

The Center for Mind/Brain Sciences (CIMEC) is an international research institute specialized in mind and brain studies, psychology and human-computer interaction, and offers both Master and Doctoral level programs. Scientists involved in research and teaching in MCS include: Daniel Adams, Liliana Albertazzi, Marco Baroni, Raffaella Bernardi, Luigi Cattaneo, Olivier Collignon, Jim Haxby, Clayton Hickey, Jorge Jovicich, Sang Ah Lee, Angelika Lingnau, David Melcher, Gabriele Miceli, Alessandro Moschitti, Marius Peelen, Massimo Poesio, Jens Schwarzbach, Nicu Sebe, Katya Tentori, Massimo Turatto, Luca Turella, Giorgio Vallortigara, Wieske Van Zoest, Nathan Weisz, Roberto Zamparelli, Massimiliano Zampini.

FINAL DEGREE

After successful completion of the curriculum and fulfillment of the Master's course requirements, students will be awarded a Master's degree (Laurea Magistrale) in Cognitive Science (LM-55).

CAREER OPPORTUNITIES

This Master's course in Cognitive Science offers a unique opportunity for students aiming to train as scientists. Its main objective is to prepare talented Doctoral candidates who are well trained and who can be competitive and confident in performing research in international settings, by featuring a close relationship between teaching and research practices, and a constant interplay between biology-based and technology-based explorations of the human mind.



PROGRAM OVERVIEW

Main application deadline	March each year (check www.mcs.unitn.it for updates)
Extended application deadline	July each year (only for EU or non-EU students living in Italy- check www.mcs.unitn.it for updates and possible deadline extensions)
Intake	September each year
Duration	2 years full-time
Minimum requirements	Bachelor's degree and fluency in English
Selection criteria	CV, English test, motivation letter, references
Scholarships and funding	• “Opera Universitaria study grant” (partial or total exemption from the fees, grant for living costs, housing at reduced prices) • “SISSA-Unitn Fellowship” (free university accommodation, 2500 euros/year award, possibility to study for one year at Unitn and one year at SISSA, earning joint degree)
Further information	www.mcs.unitn.it mcs@unitn.it

PROGRAM STRUCTURE

The program is offered in English over four semesters and leads to the Master degree in Cognitive Science (Laurea Magistrale). Students choose between two tracks offering a selection of specialized courses to allow students to tailor their training to their academic interests: Cognitive Neuroscience (CNS) and Language and Multimodal Interaction (LMI).

All students are actively involved in developing research projects and have access to the laboratories during the master's program, thus gaining invaluable hands-on experience with the latest research technologies, including fMRI, EEG, MEG, TMS, eye tracking and computational simulation tools. This opportunity provides the type of technical skills required in industry and necessary for acceptance into competitive Ph.D. programs.

MCS

CNS - COGNITIVE NEUROSCIENCE

Cognitive neuroscience is the study of the mind and brain, investigating how and why people perceive, think and act the way they do. The knowledge and skills gained in the Master's course will provide a foundation for advanced scientific research, but also prepare for professional applications in the fields of education, consumer and economic decision making, psychology and clinical research.

The Master's track in Cognitive Neuroscience at the University of Trento provides research-focused training with a varied, international group of faculty and researchers.

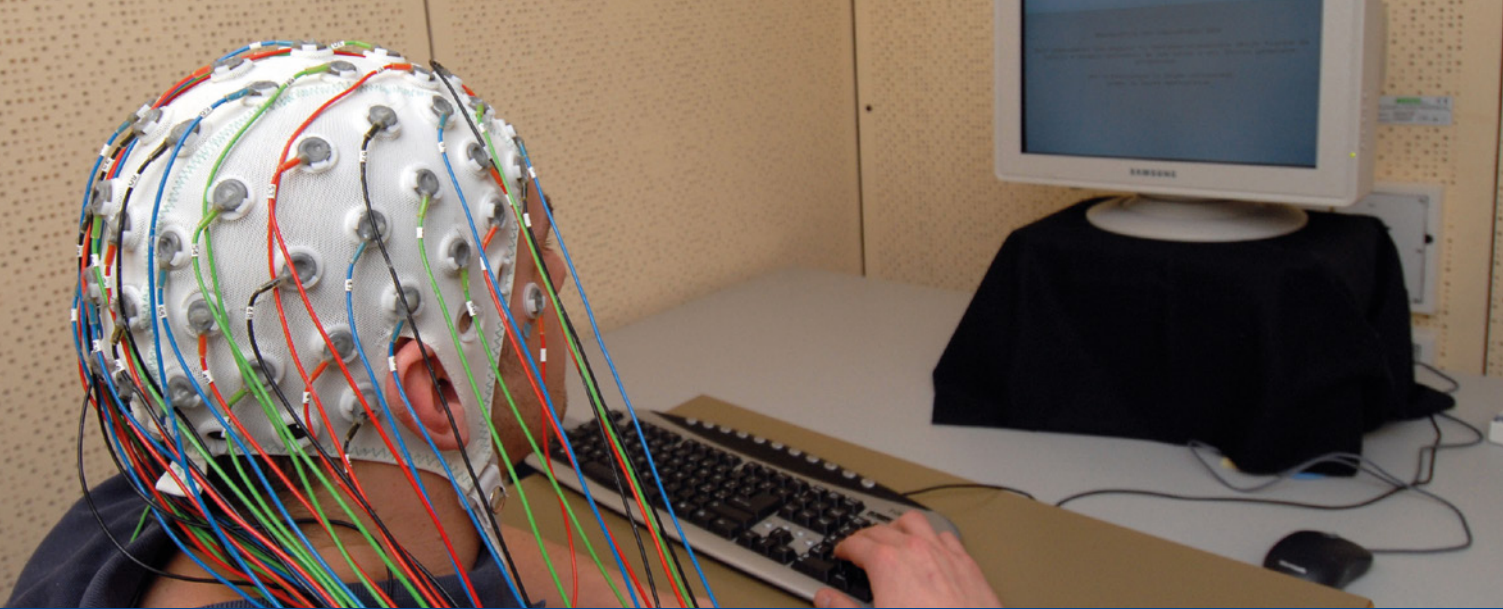
The program combines courses in neuroscience, cognition, statistics, advanced signal and data analysis with hands-on training in cutting-edge research techniques. These include functional magnetic resonance imaging (fMRI), transcranial magnetic stimulation (TMS), magnetic encephalography (MEG), computational modeling, comparative cognition (animal models), EEG, eye tracking, cinematic motion tracking and psychophysics.

LMI - LANGUAGE AND MULTIMODAL INTERACTION

Communication via language and other modalities is a fundamental component of human activity. It is therefore not at all surprising that technologies originating from the scientific study of these activities are having a major impact on modern society. One has only to think about the role played by Google in everyday life, or the crucial importance of interface design in the success of technologies such as the iPhone.

The Language and Multimodal Interaction track provides students with the interdisciplinary training necessary to operate in this area, whether in an academic environment or in an industrial setting.

The two-year Master's course combines a solid foundation in scientific and cognitive methods - modules in language science, neuroscience, and psychology, including an introduction to advanced methods such as eye tracking, EEG, and fMRI - with an extensive training in computational methods for the statistical analysis of large amounts of language and perceptual data, and in interface design. Theoretical knowledge will be supplemented by the experience acquired in substantial practical projects carried out in research and industry labs.



RESEARCH FACILITIES

Students are encouraged to access the laboratories listed below during the Master's course, in order to acquire hands-on experience with the latest research technologies, including fMRI, EEG, MEG, TMS and eye tracking:

- Animal Cognition and Comparative Neuroscience Labs (ACN)
- Language, Interaction and Computation Labs (CLIC)
- Center for Neurocognitive Rehabilitation (CERiN)
- Experimental Psychology Labs (EPL)
- Neuropsychology Labs (NP Labs)
- Functional Neuroimaging Labs (LNIF)

LANGUAGE

All courses are taught in English. Students whose first language is not English, or whose language in instruction in the previous degree is not English, are asked to provide evidence of a good command of English. The following English tests are accepted:

- BEC
- BULATS
- EFB
- ESOL
- FCE
- ICFE
- IELTS
- IESOL
- ILEC
- JETSET
- PTE
- TOEFL

Other certificates may be considered.

Italian language courses will be offered by the University Language Center (CLA) to students wishing to familiarize themselves with the Italian culture.



ADMISSION REQUIREMENTS

Ideal applicants are highly motivated individuals holding a Bachelor from an accredited university, and fluent in English. Since admission is selective and there is intense competition for student places, prospective candidates should apply online as soon as possible in the period between January and March (for non-European) or January and July (for European citizens).

Students will be selected on the basis of their academic achievement, strength of their intellectual and working ability as described in their CV, their motivation and interest in the field, and reference letters. We are open to candidates from any academic background.

APPLICATION INFORMATION

In order to apply, candidates must register online and then proceed by filling in the online application form. The required documents must be scanned (in PDF format) and uploaded in the specific area. No paper applications will be accepted.

You can access the online application at <https://webapps.unitn.it/Apply/en/Web/Home/master>

FEES AND FUNDING

The yearly tuition fee is approximately 3,000 euro for European students and approximately 6,000 euro for non-European students: the fee may be reduced depending on the student's financial situation.

Qualified candidates are encouraged to apply for scholarships. The "Opera Universitaria scholarship" is awarded on the basis of income and merit, and covers partial or total living expenses. Each year scholarships and tuition waivers will be made available depending on the financial sources available at the time of students' selection.

Candidates who apply to the Cognitive Neuroscience Track are encouraged to participate in the selection for the SISSA-Unitn Fellowship, available to a maximum of 4 students every year.

FURTHER INFORMATION

Master's course in Cognitive Sciences
Center for Mind/Brain Sciences
University of Trento
Corso Bettini, 31 - 38068 Rovereto, TN – Italy
e-mail: mcs@unitn.it
website: www.mcs.unitn.it



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PROGRAM STRUCTURE

In both tracks, the course workload is 60 ECTS (credits) per year. In the first year students choose a combination of introductory and elective courses. The second year includes a research project/thesis (30 ECTS) and an internship (15 ECTS).

COURSE DESCRIPTIONS

COGNITIVE NEUROSCIENCE TRACK

Foundations of Cognitive Psychology

(9 ECTS, mandatory)

Cognitive psychology is the study of the mental processes underlying our ability to perceive, pay attention, think, categorize, use language and remember. Historically, cognitive psychology began with the information processing approach but we will also explore recent research on topics such as emotions and numerical cognition, and will include insights from neuropsychology, neuroimaging and lifespan development. The teaching methods will include demonstrations, class discussion and lectures and will emphasize the critical link between theory and experimentation.

Foundations of Cognitive Neuroscience

(9 ECTS, mandatory)

This course will examine the neural basis of higher mental functions, including brain systems supporting perception, object recognition, attention, memory, spatial functions, language, and decision making. We will explore the neuroanatomical and neurophysiological basis of cognitive functions, considering evidence from functional neuroimaging and clinical studies. Cognitive neuroscience approaches to disorders such as autism, schizophrenia, and Alzheimer's disease will also be explored. The teaching methods will include lectures, demonstrations, patient videos, class discussion and practical sessions in different neuroimaging labs. This first part of the course will concentrate on language, memory, perception and attentional mechanisms.

Research Design

(9 ECTS, mandatory)

This course will cover some fundamentals of algebra, probability theory, and statistics. Furthermore the course will cover all aspects of a research project, such as , sample sizes, measures, and type of experimental designs. Students will present and comment on their own research projects in progress. Discussions also include presentations of research to various audiences, abstracts, reviews, grant process, and scientific ethics.

Foundations of Brain Imaging

(6 ECTS, mandatory)

This course will cover basic neural anatomy and methodology for the application of the main neuroimaging techniques used in cognitive neuroscience, such as functional and structural Magnetic Resonance Imaging, Transcranial Magnetic Stimulation, Magnetoencephalography and EEG.

Computational Methods for Data Analysis

(6 ECTS, mandatory)

Computational methods, such as machine learning, are essential in solving complex problems in research area such as neuroimaging, HCI, pattern recognition, natural language processing, computer vision, etc. The goal of this course is to provide the basic elements in computational methods, such as machine learning, that will allow the students to understand further problems in the abovementioned areas.

Computational Skills in Cognitive Science

(6 ECTS, mandatory)

The course introduces computer programming, focusing on those aspects that are most relevant to behavioral and neuroimaging studies in cognitive neuroscience.

Intro to Human Language

(6 ECTS, elective)

This module is an introduction to language science (linguistics) covering phonetics and phonology, morphology and lexical knowledge, syntax, phrase semantics, discourse, and anaphora. No previous knowledge of linguistics is required.

Advanced Topics in Language/Cognition

(6 ECTS, elective)

This course is designed for students who already have a strong background in the study of language. This advanced course provides an opportunity for an in-depth study of a particular area of language science.

Neural Decoding

(6 ECTS, elective)

This course examines the methods used in cognitive neuroscience to link patterns of neural activity to specific stimuli or brain states. In particular, the course focuses on the application of neural decoding and “mind reading” with fMRI.

Hands on Methods Course

(6 ECTS, elective)

The first part of the class focuses on fMRI data analysis, i.e. the statistics of fMRI data analysis and how that should influence your design decisions and conclusions. By understanding the statistical concepts of fMRI data analysis, students will understand the rationale of the preprocessing pipeline in fMRI and the types of choices fMRI researchers have to make when designing their experiments. By actually modeling and analyzing fMRI, data students will get a deeper understanding of fMRI data analysis and, at the same time, gain experience that will make it easier for them to read fMRI papers and to perform their own imaging studies in the future. The second part of the course involves the hand on analysis of MEG data.

Neuroscience

(6 ECTS, elective)

This course will look at a number of the major neural systems in detail, examining their structure and function. Contemporary studies will provide much of the teaching material and a strong emphasis will be placed on the latest developments in each field. Subjects to be covered will include the visual system, the auditory system, motor pathways, attention mechanisms, eye movements and memory.



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Independent Studies

(6 ECTS, elective)

The independent studies course is a short research internship. The goal is for students to gain first-hand experience with experimental research. The course includes the writing of a report of the performed activities.

Current Debates in Cognitive Neuroscience

(6 ECTS, elective)

This advanced course provides an opportunity for an in-depth study of current issues and debates in the area of cognitive neuroscience.

Current Issues in Neuroscience: Animal Models

(6 ECTS, elective)

The course will provide the theoretical and empirical foundations of comparative research on animal cognition. It will cover all the traditional topics in animal cognition - perception, learning and memory, categorization, thinking and reasoning, and communication/language. Practical work in the animal cognition lab will be part of the course.

Clinical Neuroscience

(6 ECTS, elective)

This course examines the application of neuroscience methods to the clinical setting. Topics include the application of neuroimaging in the daily hospital setting and advanced MR techniques for clinically oriented research on neurodegenerative and neuropsychiatric diseases. The course includes lectures, case studies and practical work.

Advanced Topics in Perception and Attention

(6 ECTS, elective)

This course is designed for students who already have a background in the study of perception and attention. This advanced course provides an opportunity for an in-depth study of current work in perception and attention, through seminars, readings and discussions.

Advanced Topics in Cognition

(6 ECTS, elective)

This course is designed for students who already have a background in the study of cognition. This advanced course provides an opportunity for an in-depth study of a particular area of cognition, through seminars, readings and discussions.

Philosophy of Language

(3 ECTS, elective)

Philosophy of language is a field of research intersecting many others in Cognitive Science, such as linguistics, anthropology, ontology, perception, mind, and cognition. The course focuses on how different languages semantically organize information in the mind. The course presents the fundamental notions of semantics, conceptualization, categorization, and conceptual spaces. Lectures will be developed mainly on the presentation and discussion of key papers on the topic.



MCS

LANGUAGE AND MULTIMODAL INTERACTION TRACK

Cognitive Psychology

(6 ECTS, mandatory)

Cognitive psychology is the study of the mental processes underlying our ability to perceive, pay attention, think, categorize, use language and remember. Historically, cognitive psychology began with the information processing approach but we will also explore recent research on topics such as emotions and numerical cognition, and will include insights from neuropsychology, neuroimaging and lifespan development. The teaching methods will include demonstrations, class discussion and lectures and will emphasize the critical link between theory and experimentation.

Computational Linguistics

(9 ECTS, mandatory)

The course introduces the basics of linguistic/semantic text processing, focusing in particular on the creation and exploitation of large scale text databases (corpora), the automated annotation of corpora with various forms of linguistic information and computational/statistical methods to extract semantic information from text. The second part of the course gives an overview of lexicalized formal grammars and of the syntax-semantics-interface.

Foundations of Cognitive Neuroscience

(9 ECTS, mandatory)

This course will examine the neural basis of higher mental functions, including brain systems supporting perception, object recognition, attention, memory, spatial functions, language, and decision making. We will explore the neuroanatomical and neurophysiological basis of cognitive functions, considering evidence from functional neuroimaging and clinical studies. Cognitive neuroscience approaches to disorders such as autism, schizophrenia, and Alzheimer's disease will also be explored. The teaching methods will include lectures, demonstrations, patient videos, class discussion and practical sessions in different neuroimaging labs. This first part of the course will concentrate on language, memory, perception and attentional mechanisms.

Research Design

(9 ECTS, mandatory)

This course will cover some fundamentals of algebra, probability theory, and statistics. Furthermore the course will cover all aspects of a research project, such as sample sizes, measures, and type of experimental designs. Students will present and comment on their own research projects in progress.

Independent Studies

(6 ECTS, mandatory)

The independent studies course is a short research internship. The goal is for students to gain first-hand experience with experimental research. The course includes the writing of a report of the performed activities.

Intro to Human Language

(6 ECTS, elective)

This module is an introduction to language science (linguistics) covering phonetics and phonology, morphology and lexical knowledge, syntax, phrase semantics, discourse, and anaphora. No previous knowledge of linguistics is required.

Advanced Topics in Language/Cognition

(6 ECTS, elective)

This course is designed for students who already have a strong background in the study of language. This advanced course provides an opportunity for an in-depth study of a particular area of language science.

Introduction to ML for NLP

(6 ECTS, elective)

This class presents a survey of methods from the fields of statistics and machine-learning aimed at extracting generalizations from example data, and using them to automatically analyze new data. The class focuses on case studies in the analysis of different components of natural language.

Computational Methods for Data Analysis

(6 ECTS, elective)

Computational methods such as machine learning are essential in solving complex problems in research area such as neuroimaging, HCI, pattern recognition, natural language processing, computer vision, etc. The goal of this course is to provide the basic elements in computational methods such as machine learning that will allow the students to understand further problems in the abovementioned areas.

Knowledge Representation

(6 ECTS, elective)

The course aims at providing participants with the conceptual and technological tools which will allow them to understand, evaluate and use state-of-the-art semantic and knowledge-based technologies for network-based applications, such as knowledge portals, e-commerce platforms, e-applications.

Intro to AI

(6 ECTS, elective)

This course is an introduction to Artificial Intelligence from a cognitive perspective. It will cover knowledge representation and reasoning, learning, and natural language understanding, discussing in each area both the psychological evidence and computational models. The course includes lab work during which the students will acquire familiarity with artificial intelligence programming and tools.

Logical Structures in Natural Language

(6 ECTS, elective)

A general introduction to the study of meaning in natural language using the tools of formal semantics. Topics include the relation of predicate logic with natural language operators; lexical semantics, compositional semantics, nominal and verbal quantifications; modification; event semantics; genericity, and the semantics of grammatical features.

Computational Skills for Text Analysis

(6 ECTS, elective)

The course introduces computer programming, focusing on those aspects that are most relevant to text processing: regular expressions, text segmentation, extraction of lexical and linguistic information from text.

HCI & Multimodal Systems

(6 ECTS, elective)

This course addresses the fundamentals of Human-Computer Interaction with emphasis on interaction design for multimodal systems. The main part of the course will introduce the core of User-Centered Design providing concepts and hands-on practice on techniques for collecting user needs, lo-fi and hi-fi prototyping, formative and summative evaluation. In the final part of the course, students will work in teams to focus on a number of specific advanced topics, such as tabletop interaction, mobile computing, ubiquitous computing etc.



Machine Learning

(6 ECTS, elective)

The aim of the course is to provide solid theoretical and practical foundations in the main areas of machine learning. The course will focus on probabilistic reasoning and learning, probabilistic graphical models, discriminative learning and kernel machines. Hints at the most recent advancements in machine learning will be also provided.

Computational Vision

(6 ECTS, elective)

This course will cover the basic concepts in computer vision. First, the class will present an introduction to low level image analysis methods, including image formation, edge detection, color analysis, feature detection, and image segmentation. Furthermore advanced topics will be discussed including methods for reconstructing three-dimensional scene information using techniques such as depth from stereo, structure from motion, and shape from shading. Finally, the course will present the techniques for motion and video analysis as well as three-dimensional object recognition approaches.

Philosophy of Language

(3 ECTS, elective)

Philosophy of language is a field of research intersecting many others in Cognitive Science, such as linguistics, anthropology, ontology, perception, mind, and cognition. The course focuses on how different languages semantically organize information in the mind. The course presents the fundamental notions of semantics, conceptualization, categorization, and conceptual spaces. Lectures will be developed mainly on the presentation and discussion of key papers on the topic.

Note: According to the Sorbonne (1998) and the Bologna (1999) Declarations, degree courses in the European Higher Education Area are structured in university credits = ECTS.

A university credit corresponds to 25 hours of student workload, time for personal study included. The average annual workload of a full-time student is conventionally fixed at 60 credits.



SCUOLA INTERNAZIONALE
SUPERIORE DI STUDI AVANZATI
International School
for Advanced Studies

JOINT STUDY PROGRAMS

SISSA-UNITN PROGRAM

SISSA was established in Trieste (Italy) in 1978 as a dedicated and autonomous scientific Institute. SISSA is the first Italian school to set up post-graduate courses aimed at attaining the PhD degree (Doctor Philosophiae), and it pursues three major goals: developing top-level research in mathematics, physics, astrophysics, biology and neuroscience; providing qualified post-university expertise to Italian and foreign graduates, to train them to carry out research and academic teaching; synthesizing among different fields and disciplines by merging various types of expertise. Today SISSA is one of the leading scientific institutions in Italy and a renowned center on the international stage.

The University of Trento and the International School for advanced Studies (SISSA) in Trieste offer a joint education program named "Graduate Program in Cognitive Science". The two-year program is open to international students. Admitted students who succeed in fulfilling the requirements of the program will obtain the official Italian degree (Laurea Magistrale) in Cognitive Science from UNITN and the Diploma (Magister) in Cognitive Science from SISSA. Every year up to four selected students can participate in the joint SISSA-Unitn program and they will receive economic benefits during their stay in the respective locations.

DOUBLE DEGREE

The double degree is an integrated study program established by two or more universities. It allows students to attend part of their university career at the University of Trento and another at a partner university, thus obtaining both the Italian and the foreign qualifications at the same time. We offer this program with the universities listed below.

OSNABRÜCK (DE)

The University of Osnabrück is a public university with about eleven thousand students. It is known for its interdisciplinary programs, many of which are unique in Germany, including its diploma and graduate studies in cognitive science. Research areas include artificial intelligence, computational linguistics, neuropsychology, neuroinformatics and philosophy of mind.



EUROPEAN MASTERS PROGRAM IN LANGUAGE AND COMMUNICATION TECHNOLOGIES (LCT)



The Master's in Cognitive Science is part of the consortium offering the Erasmus Mundus European Masters Program in Language and Communication Technologies (LCT). This program is designed to meet the demands of industry and research in a rapidly growing area. It offers education and training opportunities for the next generations of leaders in research and innovation. It provides students with profound knowledge and insight into the various disciplines that contribute to the methods of language and communication technologies and it strengthens their ability to work according to scientific methods. Moreover, the students acquire practice-oriented knowledge by choosing appropriate combinations of modules in Language Technology, Computational and Theoretical Linguistics, and Computer Science.

The LCT program involves studying one year each at two different universities of the consortium. After completing all study requirements, the student will obtain two already approved Master of Science/Arts degrees with legal value in the countries of issue.

For more information on the LCT Master's program, please see www.lct-master.org

