

**EVOLUTION OF SOCIAL COGNITION: COMPARISONS  
AND INTEGRATION ACROSS A WIDE RANGE OF HUMAN  
AND NON-HUMAN ANIMAL SPECIES (CompCog)**

Standing Committee for the Social Sciences (SCSS)

Standing Committee for Life, Earth and Environmental Sciences (LESC)



**COMPCOG**

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## Introduction

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The European Science Foundation (ESF) is an independent, non-governmental organisation, the members of which are 80 national funding agencies, research-performing agencies, academies and learned societies from 30 countries.

The strength of ESF lies in the influential membership and in its ability to bring together the different domains of European science in order to meet the challenges of the future.

Since its establishment in 1974, ESF, which has its headquarters in Strasbourg with offices in Brussels and Ostend, has assembled a host of organisations that span all disciplines of science, to create a common platform for cross-border cooperation in Europe.

ESF is dedicated to promote collaboration in scientific research, funding of research and science policy across Europe. Through its activities and instruments ESF has made major contributions to science in a global context. The ESF covers the following scientific domains:

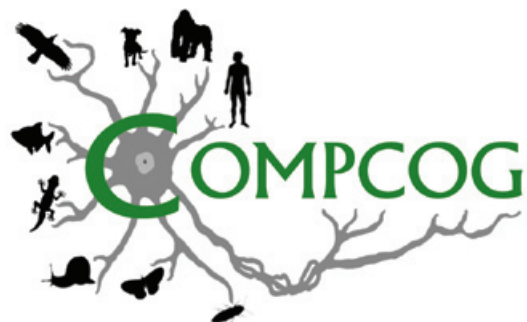
- Humanities
- Life, Earth and Environmental Sciences
- Medical Sciences
- Physical and Engineering Sciences
- Social Sciences
- Marine Sciences
- Nuclear Physics
- Polar Sciences
- Radio Astronomy Frequencies
- Space Sciences

The study of cognition in different animal species and humans has traditionally suffered from being very fragmented. This has historical reasons. Comparative psychology, including both behaviourism and cognitive psychology, as well as ethology, comparative neurophysiology and even modern philosophy and cognitive sciences have their own way of approaching questions on human and animal minds. This diversity of existing theoretical approaches accompanied by the seemingly unending circular debates and methodological problems prevent or slow down the development of comparative social cognition as a unified scientific field studying the animal and human mind. However, as the modern evolutionary theory became the foundation for biological research there is an imminent need for a unified comparative approach to study mental processes in divergent species and to understand how minds evolve.

CompCog is an ESF Research Networking Programme titled **The Evolution of Social Cognition: Comparisons and integration across a wide range of human and non-human animal species**. The programme brings together 28 European laboratories from 11 countries. It is financed by the Standing Committee for the Social Sciences and the Standing Committee for Life, Earth, and Environmental Sciences of the European Science Foundation.

The main objective of CompCog is to facilitate the development of an evolutionary framework for comparing cognitive abilities across a wide range of vertebrate and invertebrate species (including humans) with a coherent theoretical background, unified terminology and standard methods. It is also our goal to make the achievements of this field transparent for and integrated with other areas of science including social sciences, molecular and evolutionary genetics, physiology, animal welfare, and robotics.

The running period of the ESF CompCog Research Networking Programme is five years from May 2008 to April 2013.



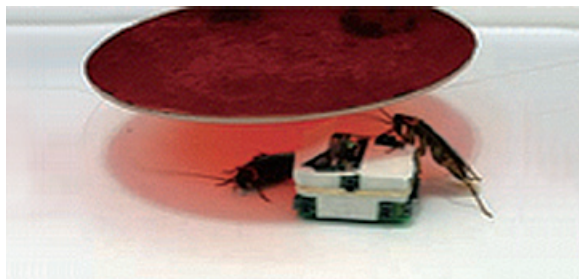
# Background

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The CompCog programme is the result of the initiative by the participants of an **ESF LESC-SCSS Exploratory Workshop** titled *Towards 'real' comparative social cognition: Integrating theories, terminology and methods across a wide range of human and non-human animal species*, organised by Zsófia Virányi and Ádám Miklósi and was held in Alsóörs, Hungary on 4-8 October 2006. Thanks to the active and constructive contribution of the 24 participants the workshop was very successful and the participants decided to continue their collaboration in a long-term project. Further European labs joined the members of the Exploratory Workshop, and a proposal for an ESF Research Networking Programme was submitted in 2007 by **György Gergely**, **Nicola S. Clayton** and **Michael Tomasello**.



At present CompCog brings together **28 laboratories from 11 European countries**. The rapid development of comparative social cognition was pioneered, to a great extent, by the inventive research performed by European researchers. This could be due to a stronger influence of ethological thought that recognises the integrative role of a biologically grounded behavioural science. The CompCog Network includes experts in **animal cognition and behaviour** and representatives of **other disciplines ranging from philosophy and social sciences to robotics**.



From Halloy *et al.* (2007): Social integration of robots into groups of cockroaches to control self-organised choices. *Science*, 318, 1155-1158.

The researchers (and laboratories) were chosen to represent:

- all major clades of animal species
- different fields of social cognition and behaviour
- applied as well as theoretical approaches
- different levels of biological organisation.

**Communication across all these different fields and disciplines** is challenging. What makes CompCog an extraordinary organisation is precisely the fact that the participants are ready to work on a **common language** in order to inform each other.



# Challenges for Comparative Cognition

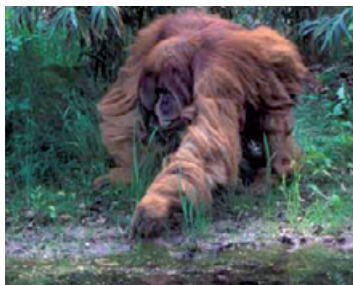
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## Cognition across human and non-human animal species

Understanding and explaining how human and non-human animal minds function, how humans and other animals perceive, and how they experience and represent their world are among the most exciting challenges. The wide variety of skills of perception, learning and understanding in diverse animal species and humans are to be explained in an evolutionary and ecological framework.

## Difficulties in comparative behavioural sciences

The comparative investigation of human and non-human animal behaviour had two independent origins, which have hampered research to the present day: comparative psychologists attempted to discover general behaviour-organising mechanisms (e.g. learning mechanisms) across species, and comparative ethologists were interested in the ecological function and the evolutionary history of specific behaviours in specific species. Accordingly, the scientific examination of animal behaviour has been conducted by psychologists and biologists separately, resulting in serious theoretical, terminological and methodological differences. Recent developments, however, have recognised the importance of establishing a unified field to integrate the study of behavioural mechanisms into a functional and evolutionary framework. A meaningful comparative social cognition research agenda requires a clear understanding of both the evolutionary history and the developmental constraints of the behaviour being studied.



## Tools for the study of comparative cognition

Cognitive methods and terminology were primarily developed for the study of human mental capabilities, and although they have been applied to comparative work on primates, they might be less suitable for a more general comparative approach of the evolving mind in other species. Conversely, the scientific tools and concepts of behavioural ecology can be flexibly applied to various species. Consequently, one of the biggest challenges for this Network on comparative social cognition is to facilitate the establishment of a unified terminology and



theoretical background, which can be used to formulate scientific questions and hypotheses and evaluate results for experiments on a wide spectrum of distantly related species.

## Theoretical and methodological foundations for comparative investigations

The recent increase in the number and diversity of species whose socio-cognitive abilities have been scrutinised highlights the need for a common framework for scientific theorising in which questions of the evolutionary history and ecological determination cannot be ignored. One of the main problems is how to use cognitive and functional behavioural definitions as a basis for experimental investigations. For example, for many years scientists have been struggling to come up with *behavioural* criteria for 'mental state attribution' in diverse species that correspond to this internal (and unobservable) representation.

## Animal minds and the human mind

Traditionally, research has focused on comparisons between humans and other primates in order to grasp human-specific behavioural traits that emerged during the evolution of our species. Although recently the interest in studying cognitive abilities of animals has widened, our primary interest in our own species is undeniable. Recent ethologically inspired research (predominantly from European laboratories) has indicated that evolution resulted in functionally equivalent 'human-specific abilities' in some animals. This offers the possibility of using a much greater range of animal species as models for understanding human social cognition. The merits and limits of this comparative research has to be verified, as well as the question of whether these shared abilities are homologous or based on convergent evolutionary processes.

# Objectives and Methods



From Martin *et al.* (2007): Localisation of legged robots based on fuzzy logic and a population of extended kalman filters. *Robotics and Autonomous Systems*. 55, 870-880.

## Understanding of the mind is possible only through an interdisciplinary approach

Recent advances in this field clearly indicate a need for interdisciplinary research in order to gain a broad understanding of the evolutionary and developmental processes that determine the functioning of the mind, and how it controls socio-cognitive behaviour. This requires explanations at different levels of biological organisation and relies on the integration of insights from behavioural genetics, neuroanatomy, neurochemistry, neurophysiology, behavioural and human social sciences. This trend can be even widened by promising novel research in artificial intelligence and robotics, where such knowledge can be put to the test.



The central aims of CompCog are:

- To facilitate the **development of a coherent theoretical background, scientific terminology and methodology** in the field of comparative social cognition by forming a European network of several laboratories with different scientific backgrounds and experiences related to various non-human species and humans;
- To assist in training a **new generation of researchers** who are already endowed with the knowledge and experiences that are needed for designing real comparative studies;
- To establish a unified, easy-to-use depository **database** for the available comparative results; and consequently
- To make the field more transparent and **integrated into** the main stream of **biological research** aimed at understanding the mind at various levels of biological organisation ranging from genetics to neuroscience; and
- To make it **accessible and informative to other disciplines** such as robotics and social sciences by providing a comprehensive approach.

In order to achieve these aims CompCog supports:

- **Regular discussions and interdisciplinary research activity throughout Europe:** CompCog provides regular forums to exchange views, to gain novel input and to discuss both long-debated and newly emerging problems of comparative cognition. This is the most effective way to facilitate research on theoretically highly relevant topics in various species in a truly comparative way. CompCog finances both larger transfer-of-knowledge conferences and smaller workshops of two kinds.
- **Systematic collection of research results:** CompCog is developing the Comparative Mind Database which is a unified system to collate terminology, research methods and results across various species. The systematic collection and interpretation of data require standard methods, terminology and a coherent theoretical background, and will enhance the study of social cognition in an operationally comparative way.
- **Training of future researchers:** CompCog provides the opportunity for PhD students and young researchers to gain their own experiences with different species and first-hand information from experts and peers either on short-term research visits or intensive lab visits. We envisage a new generation of researchers who have a broader insight and knowledge about a wide range of species as well as about various research methods, theoretical and applied approaches.

# CompCog Activities

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## Comparative Mind Database

This CompCog module supports the research using innovative, advanced information technologies and methods from the philosophy of science, statistics, experimental design and data/text mining. The components include

**Concepts:** Text-mining tools help to map, learn and navigate the conceptual fields that characterise the topics of interest in order to facilitate communication and a better understanding between experts.

**Database:** Comparative cognition could capitalise on a comprehensive, integrated database that promotes tools for the acquisition, handling and analysis of data. The database could also facilitate unified documentation, synthesis and repository of much existing information.

**Methodology:** CompCog will aim to develop experimental protocols and data-description formats including video protocols which should provide a significant step towards finding a common language.

**Ontology:** Cross-species comparisons and different markers necessitate a formal, flexible representation of animal and human data currently supported by ICT methods commonly called 'ontologies'. Developing ontologies could also support and standardise statistical analyses.

**Design and Analysis of Experiments:** The use of different statistical methods or different markers can be handled by modern tools that can be integrated into easy-to-use, automated platforms. Such platforms could also assist researchers in designing experiments and provide new techniques to help (re)evaluate new and old results.

## Transfer-of-knowledge conferences

These open conferences, which are expected to last for **three to four days** and to host **100 to 120 participants**, provide a regular European **interdisciplinary forum** where both junior and senior researchers can present the latest research developments in comparative social cognition as well as other related fields (genetics, physiology, neurosciences, animal welfare, robotics, philosophy etc.). Discussion between the participants is expected to stimulate new research initiatives leading to a better understanding of how the human and non-human mind works and to enhance unification of terminology, theories and methods of comparative social cognition. Young researchers are encouraged to present their work and to enter discussion with experts and peers in various related fields.

## Expert workshops

These smaller meetings bring together mainly senior researchers with diverse scientific backgrounds, both in terms of the species they work on and the approach

and methodology they use. Their discussions are aimed to facilitate the development of novel theoretical and empirical syntheses that can lead to new, groundbreaking research. **Regular workshops** bring together 12 to 15 experts and last for three to four days with paper presentations and discussions. **Discussion meetings** give an opportunity for up to 12 experts to come together for two days and discuss a specific topic without any formal requirements. These meetings were specifically created for facilitating highly targeted, project-related communication, and as such, they are expected to be the crystallisation points of already ongoing, vigorous discussions.



## Lab visits

In order to provide **intensive training** for up to six pre-doctoral and post-doctoral students, research groups can organise one-week-long visits in their laboratories, experimental facilities and field stations. During this week the students can:

- receive **theoretical and practical education**
- **observe** how to apply the **methods** used
- **participate in experiments** on the species studied
- **present their work** and have **meetings and discussions** with the local students and researchers.

## Exchange visits

Qualified pre-doctoral and post-doctoral students have the opportunity to spend two months in another lab to run short-term research projects and thereby learn different research methodologies and theoretical approaches as well as experience working directly with different species.



# Funding

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ESF Research Networking Programmes are principally funded by the Foundation's Member Organisations on an *à la carte* basis. CompCog is supported by:

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*German Research Foundation, Germany*
- **Max-Planck-Gesellschaft (MPG)**  
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*Ministry of Science and Innovation, Spain*
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- **Schweizerischer Nationalfonds (SNF)**  
*Swiss National Science Foundation, Switzerland*
- **Biotechnology and Biological Sciences Research Council (BBSRC)**  
*United Kingdom*

# CompCog Steering Committee

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**Professor Ádám Miklósi (Chair)**

Department of Ethology  
Eötvös Loránd University  
Pazmany P. s. 1/C.  
1117 Budapest • Hungary  
Tel: +36 1 3812179  
Fax: +36 1 3812180  
Email: miklosa@ludens.elte.hu

**Dr. Josep Call**

Wolfgang Köhler Primate  
Research Center  
Department of Developmental  
and Comparative Psychology  
Max Planck Institute for Evolutionary  
Anthropology  
Deutscher Platz 6  
04103 Leipzig Sachsen • Germany  
Tel: +49 341 3550 418  
Fax: +49 341 3550 444  
Email: call@eva.mpg.de

**Professor Jean-Louis Deneubourg**

Unité d'Écologie Sociale (USE)  
ULB CP 231  
Campus de la Plaine  
Bd du Triomphe  
1050 Brussels • Belgium  
Tel: +32 2 650 57 76  
Fax: +32 2 650 59 87  
Email: jldeneub@ulb.ac.be

**Professor Ludwig Huber**

Department of Neurobiology  
and Cognition Research  
Faculty of Life Sciences  
University of Vienna  
Althanstrasse 14  
1090 Vienna • Austria  
Tel: +43 1 4277 54480  
Fax: +43 1 4277 54509  
Email: ludwig.huber@univie.ac.at

**Professor Henrik Høgh-Olesen**

Department of Psychology  
Aarhus University  
Nobelparken  
Jens Chr. Skous Vej 4  
8000 Aarhus C • Denmark  
Tel: +45 89 42 49 43  
Fax: +45 89 42 49 01  
Email: h2o@psy.au.dk

**Dr. Elena Jazin**

Department of Development  
and Genetics  
Uppsala University  
Norbyvägen 18 A  
751 05 Uppsala • Sweden  
Tel: +46 18 471 64 63  
Fax: +46 18 471 26 83  
Email: elena.jazin@ebc.uu.se

**Professor Tadeusz Jezierski**

Department of Animal Behaviour  
Institute of Genetics and Animal  
Breeding  
Polish Academy of Sciences  
Jastrzebiec ul. Postepu 1  
05-552 Wólka Kosowska • Poland  
Tel: +48 22 756 17 11 ext. 270  
Fax: +48 22 756 14 17  
Email: t.jezierski@ighz.pl

**Professor Hans-Peter Lipp**

Division of Neuroanatomy  
and Behaviour  
Institute of Anatomy  
University of Zurich  
Winterthurerstrasse 190  
8057 Zurich • Switzerland  
Tel: +41 44 635 5330  
Fax: +41 44 635 5702  
Email: hplipp@anatom.unizh.ch

**Professor Vicente Matellán  
Olivera**

Autonomous Systems Group  
Department of Mechanical  
and Computer Engineering  
Escuela Ing. Industrial e Informática  
University of León  
Campus de Vegazana  
24071 León • Spain  
Tel: +34 987 291 472  
Fax: +34 987 293 065  
Email: vicente.matellan@unileon.es

**Professor Daniel Mills**

Department of Biological Sciences  
University of Lincoln  
Riseholme Park  
Riseholme  
Lincoln LN2 2LG • United Kingdom  
Tel: +44 1522 895 356  
Fax: +44 1522 886 880  
Email: dmills@lincoln.ac.uk

**Professor Gün R. Semin**

Faculty of Social Sciences  
Utrecht University  
Heidelberglaan 1  
3584 CS Utrecht • The Netherlands  
Tel: +31 30 2534 575  
Email: G.R.Semin@uu.nl

**Acting Programme Coordinator****Dr. Zsófia Virányi**

Konrad Lorenz Institute for Evolution  
and Cognition Research  
Adolf Lorenz Gasse 2  
3422 Altenberg • Austria  
Tel: +43 2242 3239013  
Email: zsofi.viranyi@gmail.com

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**ESF Liaison****Dr. Frank Kuhn**

*Science*

**Ms. Caroline Eckert**

*Administration*

Social Sciences Unit (SCSS)  
European Science Foundation  
1 quai Lezay-Marnésia  
BP 90015  
67080 Strasbourg cedex • France  
Tel: +33 (0)3 88 76 71 42  
Fax: +33 (0)3 88 37 05 32  
Email: ceckert@esf.org

For the latest information on this  
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consult the CompCog websites:  
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