



ENACTIVE

Enactive Interfaces

Knowledge and Interface Technologies
Strategic Objective MULTIMODAL INTERFACES
Network of Excellence ENACTIVE INTERFACES

The creation of a research community on enactive knowledge

Enactive Interfaces

The general objective of the ENACTIVE Network is the creation of a multidisciplinary research community with the aim of structuring the research on a new generation of human-computer interfaces called Enactive Interfaces.

Enactive Interfaces are related to a fundamental "interaction" concept which is not exploited by most of the existing human-computer interface technologies. As stated by the famous cognitive psychologist Jerome Bruner, the traditional interaction with the information mediated by a computer is mostly based on symbolic or iconic knowledge, and not on enactive knowledge. While in the symbolic way of learning knowledge is stored as words, mathematical symbols or other symbol systems, in the iconic stage knowledge is stored in the form of visual images, such as diagrams and illustrations that can accompany verbal information. On the other hand, enactive knowledge is a form of knowledge based on the active use of the hand for apprehension tasks.

Enactive knowledge is not simply multisensory mediated knowledge, but knowledge stored in the form of motor responses and acquired by the act of "doing". A typical example of enactive knowledge is constituted by the competence required by tasks such as typing, driving a car, dancing, playing a musical instrument, modelling objects from clay, which would be difficult to describe in an iconic or symbolic form. This type of knowledge transmission can be considered the most direct, in the sense that it is natural and intuitive, since it is based on the experience and on the perceptual responses to motor acts.

Notwithstanding the wide literature available in exploring human computer interaction, enactive interaction is a rather unexplored mean of communication within the interaction capabilities between users and computers. The control processes based on the computer related to this kind of interaction would require not only faster

computers and systems able to cope with more complex information, but also new kinds of interfaces, computing architectures and software modules able to work with the users at a more complex degree of information representation. A thorough understanding of the systems, mechanisms, algorithms and the representation forms related to this kind of interaction is fundamental to develop the future generation of "human mediated computer interaction".

The proposed paradigm shift is probably of the same importance that the introduction of standard in graphical inputs during the 70s.

At that time, the change in the role and the architecture of what was called, at that time "graphical inputs", transformed fundamentally the standard in Computer Graphics. Following this stage, the graphical inputs have been nested inside the graphic kernel systems and so doing, they became the foundations of contemporary interactivity concepts linking graphical icons and gestural inputs.

The recent introduction in the field of Virtual Environments and Robotics of haptic devices that strongly link actions and perceptions, as well as the enthusiasm that this caused in most of the IST-related research domains, indicates that the ENACTIVE Network is trying to participate in a major change in the design of human-computer interfaces and, beyond, of human-computer and human-to-human

communications. In the contemporary context of high degree of development that "action-iconic" interfaces drives, the concept of Enaction, is able to push further the first revolution of interactivity.

The driving concept of *Enactive Interfaces* is then the fundamental role of motor action for storing and acquiring knowledge (action driven interfaces). Enactive Interfaces are then capable of conveying and understanding gestures of the user, in order to provide an adequate response in perceptual terms. *Enactive Interfaces* can be considered a new step in the development of the human-computer interaction because they are characterised by a closed loop between the natural gestures of the user (efferent component of the system) and the perceptual modalities activated (afferent component). *Enactive Interfaces* can be conceived to exploit this direct loop and the capability of recognising complex gestures. Intelligent interfaces recognise the gesture of the user at the beginning of the action and are able to interpret the gestures (in terms of intentions, skills and competence) and to adapt to them in order to improve the users performance.

A prototypical existing example of what can be considered a preliminary Intelligent Enactive system is constituted by Reactive Interfaces, i.e. robots working always in contact with the human hand and capable of interpreting hand's movements and correct/guide them with the aim of skillfully performing manipulative tasks.

Enactive Interfaces are a rather unexplored field of research with a high degree of future potential impact. In order to co-ordinate the development activities in this field the ENACTIVE Network addresses three main sets of objectives, such as: integration, research and dissemination.



The Network of Excellence

PERCRO

Scuola Superiore Sant'Anna
Pisa, ITALY
Carlo Alberto Avizzano - carlo@sssup.it

ICA Laboratory

Institut National Polytechnique de Grenoble
Grenoble, FRANCE
Annie Luciani - annie.luciani@imag.fr

Biomedical Physics Group

University of Exeter
Exeter, UNITED KINGDOM
Ian Summers - I.R.Summers@exeter.ac.uk

CEIT

Centro de Estudios e Investigaciones Tecnicas de
Guipuzcoa
San Sebastian, SPAIN
Emilio Sánchez - esanchez@ceit.es

Centre for Research in Sport Sciences

Universite Paris XI
Paris, FRANCE
Benoît Bardy - benoit.bardy@staps.u-psud.fr

Department of Design Sciences

Lunds Universitet
Lund, SWEDEN
Charlotte Magnusson
charlotte.magnusson@certec.lth.se

Costech

Université de Technologie de Compiègne
Compiègne, FRANCE
John Stewart - John.Stewart@utc.fr

Department of Psychology

Uppsala Universitet
Uppsala, SWEDEN
Gunnar Jansson - gunnar.jansson@psyk.uu.se

Institute of Robotik und Mechatronik

DLR
Oberpfaffenhofen, GERMANY
Carsten Preusche - Carsten.Preusche@dlr.de

EDM Expertise center for Digital Media

Limburgs Universitair Centrum
Diepenbeek, BELGIUM
Karin Coninx - karin.coninx@luc.ac.be

Sound Processing and Control Laboratory

Faculty of Music, McGill University
Montreal, CANADA
Marcelo Wanderley - mwanderley@acm.org

Human Factors Research Laboratory

University of Minnesota
Minneapolis, USA
Thomas Stoffregen - tas@umn.edu

Fundacion Labein

Bilbao, SPAIN
Teresa Gutiérrez - tere@labein.es

Max-Planck Gesellschaft zur Foerderung der Wissenschaften E. V.

Muenchen, GERMANY
Heinrich Buelthoff
heinrich.buelthoff@tuebingen.mpg.de

MIRAlab

Universite de Geneve
Geneve, SWITZERLAND
Nadia Magnenat-Thalmann
thalmann@miralab.unige.ch

Virtual Reality Laboratory

Ecole Polytechnique Federale de Lausanne
Lausanne, SWITZERLAND
Daniel Thalmann - daniel.thalmann@epfl.ch

Dipartimento di Ingegneria dell'Informazione

Universita degli Studi di Padova
Padova, ITALY
Giovanni De Poli - depoli@dei.unipd.it

Sony Computer Science Laboratory

Sony France s.a.
Paris, FRANCE
Olivier J.-M. D. Coenen - coenen@csl.sony.fr

Palpable Machines Group

Medialab Europe
Dublin, IRELAND
Sile O'Modhrain - sile@media.mit.edu

Institut Jean Nicod

Ecole des Hautes Etudes en Sciences Sociales
Paris, FRANCE
Roberto Casati - casati@ehess.fr

Dipartimento di Informatica, Sistemistica e Telematica - InfoMus Lab

Universita degli Studi di Genova
Genova, ITALY
Antonio Camurri - music@dist.unige.it

Association pour la Creation et la Recherche sur les Outils d'Expression

Grenoble, FRANCE
Claude Cadoz - Claude.Cadoz@imag.fr

Université Pierre Mendès France

Grenoble, FRANCE
Théophile Ohlmann
theophile.ohlmann@upmf-grenoble.fr

Laboratoire de Psychologie Expérimentale CNRS

Université Paris V
Paris, FRANCE
Kevin O'Regan - oregan@ext.jussieu.fr



*Massimo Bergamasco
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Contacts

Web site

<http://www.enactivenetwork.org>

Project coordinator

Massimo Bergamasco - bergamasco@sssup.it

Deputy project coordinator

Annie Luciani - annie.luciani@imag.fr