# Lecture Notes in Computer Science 9961

*Commenced Publication in 1973*
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

## Editorial Board

More information about this series at http://www.springer.com/series/7409

Luciano Gamberini · Anna Spagnolli
Giulio Jacucci · Benjamin Blankertz
Jonathan Freeman (Eds.)

# Symbiotic Interaction

5th International Workshop, Symbiotic 2016
Padua, Italy, September 29–30, 2016
Revised Selected Papers

Springer

OPEN

*Editors*
Luciano Gamberini
University of Padua
Padua
Italy

Anna Spagnolli
University of Padua
Padua
Italy

Giulio Jacucci
University of Helsinki
Helsinki
Finland

Benjamin Blankertz
TU Berlin
Berlin, Berlin
Germany

Jonathan Freeman
Goldsmiths University
London
UK

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Computer Science
ISBN 978-3-319-57752-4 ISBN 978-3-319-57753-1 (eBook)
DOI 10.1007/978-3-319-57753-1

Library of Congress Control Number: 2017938156

LNCS Sublibrary: SL3 – Information Systems and Applications, incl. Internet/Web, and HCI



Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

# Preface

The Symbiotic Workshop is the primary venue for presenting scientific works dealing with the symbiotic relationships between humans and computers and for discussing the nature and implications of such relationships.

This volume collects the papers presented at the 5th International Workshop on Symbiotic Interaction, which was held in Padua (Italy) during September 29–30, 2016. Previous editions of the workshop were held in Padua, London, Helsinki, and Berlin. The proceedings are published this year with an open access license by Springer, to improve their accessibility and dissemination.

The workshop was co-sponsored by the MindSee project (http://mindsee.eu, FP7-ICT n. 611570) and by the Department of General Psychology of the University of Padua and connected to the Open Innovation Days, a three-day national event organized by the University of Padua and the leading Italian economic newspaper *IlSole-24Ore*. It also benefited from the hospitality of Comune di Padova (Padua Municipality) in its historical city hall.

All papers were received in response to a public call and underwent at least two rounds of reviews: In the first round, three members of the scientific committee reviewed each paper double-blind; the 13 accepted papers were then revised by the authors and iteratively checked by the proceedings editors. This led to an acceptance rate of 50%, which is much lower than in the previous editions of this workshop, and to a multiple-step quality check that is the standard for scientific journals more than for conference proceedings. The paper "Prediction of Difficulty Levels in Videogames from Ongoing EEG" by L. Naumann, M. Schultze-Kraft, S. Daehne, and B. Blankertz was awarded best presentation, based on the audience preferences.

In addition to the papers selected through the process described above, the proceedings also include the short abstracts of the presentations by the three keynote speakers (Steve Benford, Hans Gellersen, Sid Kouider), the report of an interdisciplinary panel on the risks of symbiotic systems involving five experts (Mauro Conti, Jonathan Freeman, Giorgia Guerra, David Kirsh, and A. van Wynsberghe), and an introductory note from the two Symbiotic 2016 co-chairs. Some of the posters included in the program were expanded and published in a special issue of the on-line journal *PsychNology* (www.psychnology.org).

We would like to express our gratitude to the colleagues who attended the conference, submitted their work, and reviewed the submissions, for their ideas, attention, and time.

December 2016

Luciano Gamberini
Anna Spagnolli
Benjamin Blankertz
Giulio Jacucci
Jonathan Freeman

# Organization

## Program Committee

| | |
|---|---|
| Ilkka Arminen | University of Helsinki, Finland |
| Fabio Babiloni | University of Rome Sapienza, Italy |
| Benjamin Blankertz | Technische Universität Berlin, Germany |
| Marc Cavazza | University of Kent, UK |
| Mauro Conti | University of Padua, Italy |
| Manuel Eugster | Aalto University and HIIT, Finland |
| Stephen Fairclough | Liverpool John Moores University, UK |
| Jonathan Freeman | Goldsmiths College, University of London, UK |
| Luciano Gamberini | University of Padua, Italy |
| Dorota Glowacka | University of Helsinki, Finland |
| Jaap Ham | Eindhoven University of Technology, The Netherlands |
| Giulio Jacucci | Helsinki Institute for Information Technology, Finland |
| David Kirsh | University of California, San Diego, USA |
| Peter König | University of Osnabrück, Germany |
| Christian Licoppe | Telecom Paristech, France |
| Juan C. Moreno | Consejo Superior de Investigaciones Científicas, Spain |
| Anton Nijholt | University of Twente, The Netherlands |
| Anna Spagnolli | University of Padova, Italy |
| Paul Verschure | UPF, ICREA, Spain |

## Additional Reviewers

Lal, Chhagan
Lazzeretti, Riccardo

# Keynote Speakers Abstracts

# Rethinking Eye Gaze for Symbiotic Human-Computer Interaction

Hans Gellersen

Lancaster University, Lancaster, UK

Eye tracking has a long history and its use for human-computer interaction predates the ubiquitous computing era. While the technology has been maturing and become affordable for widespread use, there has not been much innovation in the use of eye gaze for interaction. For over 25 years, gaze pointing has remained the prevailing usage paradigm, although it overloads the sensory role of the eyes with a control function. In this talk I will present work that explores new ways of using eye movement for interaction. I will discuss gaze and touch: how hands and eyes can naturally work together; gaze and motion: how the natural gaze-following of moving stimuli enables new types of interface; and gaze and games: how gaze can be social and fun.

# Neural Markers of Perceptual Consciousness

Sid Kouider

Ecole Normale Supérieure LSCP, Paris, France

Consciousness is one the most intriguing phenomenon in contemporary science. After a long period of denial, scientists are now actively trying to understand how the brain gives rise to our conscious experience. More specifically, modern brain imaging techniques allows us to uncover the interplay between the conscious and unconscious mind, not only in human adults but also in infants and animals. This lecture describes how scientists are tackling this difficult issue and how much progress has been made so far in determining the neural structures and mechanisms that are responsible for consciousness. I will focus on three main issues. First, I will address recent findings showing that attention and consciousness, classically thought to be equivalent phenomena, are subserved by distinct brain functions. Secondly, I will address how much information can be processed by the brain in the absence of consciousness, by looking at neural responses to stimuli presented either subliminally or during sleep. Finally, I will address how neural signatures of consciousness can be used when verbal report is impossible, in animals, vegetative patients and preverbal infants.

# On the Pleasures of Giving Up Control

Steve Benford

University of Nottingham, Nottingham, UK

If there is one thing that rollercoasters teach us it is that giving up control to the machine can be a thrilling experience. I'd like to invite you, the audience, to strap yourselves in and join me on a ride through creative and entertaining examples of relinquishing control to 'the machine'. From the thrills and spills of a breath-controlled bucking bronco, to a meditative brain-controlled movie, to musicians improvising around music recognition systems, I will seek to illustrate the creative possibilities of partial and negotiated control – both of machines and ultimately of our own bodies and thoughts. I will introduce new taxonomies of control as well as the idea of deliberately designing uncomfortable interactions as a route to entertainment, enlightenment and social bonding.

# Contents