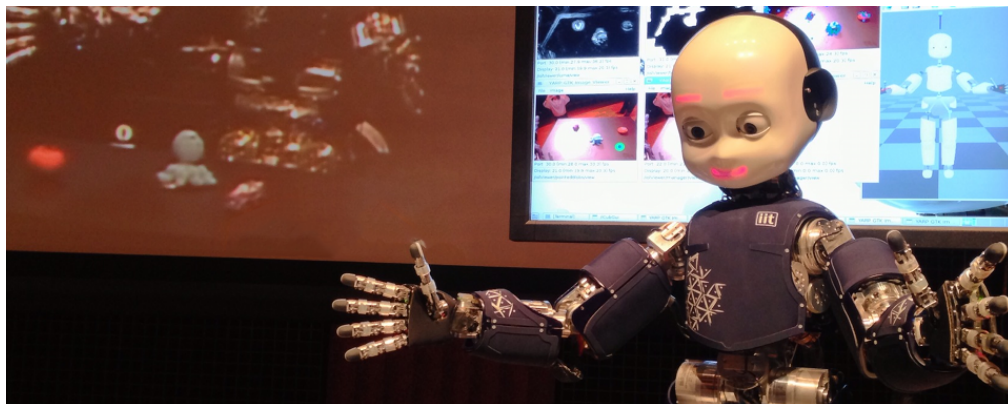




## Workshop

**HRI: a bridge between Robotics and Neuroscience.  
From understanding humans to assisting humans and back.**



**Organizers: Alessandra Sciutti, Katrin Lohan and Yukie Nagai**



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## **Abstract**

A fundamental challenge for robotics is to transfer the human natural social skills to the interaction with a robot. At the same time, neuroscience and psychology are still investigating the mechanisms behind the development of human-human interaction. HRI becomes therefore an ideal contact point for these different disciplines, as the robot can join these two research streams by serving different roles. From a robotics perspective, the study of interaction is used to implement cognitive architectures and develop cognitive models, which can then be tested in real world environments (e.g., [1,2,3]). From a neuroscientific perspective, robots could represent an ideal stimulus to establish an interaction with human partners in a controlled manner and make it possible studying quantitatively the behavioral and neural underpinnings of both cognitive and physical interaction (e.g., [4,5]) . Ideally, the integration of these two approaches could lead to a positive loop: the implementation of new cognitive architectures may raise new interesting questions for neuroscientists, and the behavioral and neuroscientific results of the human-robot interaction studies could validate or give new inputs for robotics engineers. However, the integration of two different disciplines is always difficult, as often even similar goals are masked by difference in language or methodologies across fields. The aim of this workshop will be to provide a venue for researchers of different disciplines to discuss and present the possible point of contacts, to address the issues and highlight the advantages of bridging the two disciplines in the context of the study of interaction.

The organizers:

Alessandra Sciutti, Katrin Lohan and Yukie Nagai

Website: <http://www.macs.hw.ac.uk/~k1360/HRI2014W>



# HRI: a bridge between Robotics and Neuroscience

9:00 – 9:15	<b>Opening</b> (A. Sciutti, K. Lohan and Y. Nagai)	
9:15 – 9.50	Invited talk by <b>Prof. Malinda Carpenter</b>	<b>7</b>
9:50 – 10:10	<b>Bridging the Gap between HRI and Neuroscience in Emotion Research: Robots as Models</b> (Lola Canamero)[S16]	<b>11-18</b>
10:10 – 10:30	<b>The Cognitive Correlates of Anthropomorphism</b> (Séverin Lemaignan, Julia Fink, Pierre Dillenbourg, Claire Braboszcz) [S12]	<b>19-24</b>
10:30 – 11:00	<i>Coffee Break</i>	
11:00 – 11:35	Invited talk by <b>Prof. Giulio Sandini</b>	<b>7</b>
11:35 – 11:55	<b>A Robot for Brain–Controlled Grasping</b> (Matthias Kennel, Christoph Reichert, Ulrich Schmucker, Hermann Hinrichs, Jochen W. Rieger) [S4]	<b>25-31</b>
11:55 – 12:05	<b>Poster Teasers</b>	
12:05 – 13:00	<b>Poster Session</b>	<b>33-69</b>
	<ul style="list-style-type: none"> <li>Neuroscience-inspired robot empathy (A. Lim and H. G. Okuno) [S3]</li> <li>Exploring the Estimation of Cognitive Load in Human Robot Interaction (O. Palinko and A. Sciutti) [S6]</li> <li>Memories and Dreams of Social Interaction (G. Gordon and C. Breazeal) [S8]</li> <li>Evaluating the Influence of Automatic Attentional Mechanisms in Human-Robot Interaction (P. Lanillos, J. F. Ferreira and J. Dias) [S9]</li> <li>Toward analysis of emotional development using physiological and behavioral data (Takato Horii, Y. Nagai and M. Asada)[S10]</li> <li>A Biologically Inspired Model for Coding Sensorimotor Experience Leading to the Development of Pointing Behaviour in a Humanoid Robot (I. Kajic, G. Schillaci, S. Bodiřoža and V. V. Hafner) [S11]</li> <li>Building a Literal Bridge Between Robotics and Neuroscience using Functional Near Infrared Spectroscopy (NIRS) (M. Strait and M. Scheutz) [S13]</li> <li>Neuro-Robotic Technologies and Social Interactions (K. McDowell, A. R. Marathe, B. J. Lance, J. S. Metcalfe, P. Sajda) [S14]</li> </ul>	

- Autism assessment through a small humanoid robot  
(S. M. Anzalone, S. Boucenna, D. Cohen and M. Chetouani) [S15]

13:00 – 14:35 *Lunch Break*

14:35 – 15:10 Invited talk by **Prof. Brian Scassellati** **7**

15:10 – 15:30 **Affective Developmental Robotics: How can we design the development of artificial empathy?** (Minoru Asada)[S7] **73-80**

15:30 – 16:00 *Coffee Break*

16:00 – 16:35 Invited talk by **Dr. Alessandro D'Ausilio** **7-8**

16:35- 16:55 **Uncanny Valley Related Behavioral Responses Are Driven by Neural Processes of Face Perception** (Astrid M. Rosenthal-von der Pütten, Fabian Grabenhorst, Stefan Maderwald, Matthias Brand and Nicole C. Krämer) [S2] **81-88**

16:55 – 17:30 ***Closing Remarks and Discussion***

## **Invited Speakers**

### **Prof. Malinda Carpenter, University of St Andrews on research leave at Max Planck Institute for Evolutionary Anthropology**

Malinda Carpenter is a Professor of Developmental Psychology in the School of Psychology and Neuroscience at the University of St Andrews in Scotland. She is currently on research leave in the Department of Developmental and Comparative Psychology at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, where she has worked since 1999. She studies social cognition and social behaviour, mainly in typically-developing infants and young children, but also in apes (and, in the past, children with autism). Her research interests include imitation, participation in shared activities (joint attention, communication, collaboration), prosocial and affiliative behaviour, relations with in- versus out-group members, understanding of others' mental states (intentions, attention, knowledge, and beliefs), and differences between ape and human social cognition.

### **Prof. Giulio Sandini, Istituto Italiano di Tecnologia**

Director of research at the Italian Institute of Technology and full professor of bioengineering at the University of Genoa. His main research interests are in the fields of Computational and Cognitive Neuroscience and Robotics with the objective of understanding the neural mechanisms of human sensorimotor coordination and cognitive development from a biological and an artificial perspective. He graduated in Electronic Engineering (Bioengineering) at the University of Genova. He has been assistant professor at the Scuola Normale Superiore in Pisa and Visiting Scientist at the department of neurology of the Harvard Medical School and at the Artificial Intelligence lab at MIT. Since 2006 he is Director of Research at the Italian Institute of Technology where he leads the Department of Robotics, Brain and Cognitive Science.

### **Prof. Brian Scassellati, Yale University**

Brian Scassellati is a Professor of Computer Science, Cognitive Science, and Mechanical Engineering at Yale University and Director of the NSF Expedition on Socially Assistive Robotics. His research focuses on building embodied computational models of human social behavior, especially the developmental progression of early social skills. Using computational modeling and socially interactive robots, his research evaluates models of how infants acquire social skills and assists in the diagnosis and quantification of disorders of social development (such as autism). His other interests include humanoid robots, human-robot interaction, artificial intelligence, machine perception, and social learning.

### **Dr. Alessandro DAusilio, Istituto Italiano di Tecnologia**

Alessandro DAusilio studied Experimental Psychology (1998-2003) and obtained a PhD in Cognitive Psychology from the Sapienza University of Rome in 2007 (Department of Psychology - Prof. Olivetti Belardinelli). During the PhD he spent extended research periods both at MIT (Brain and Cognitive Sciences Department, McGovern Institute for Brain Research - Prof. Bizzi) and the Eberhardt-Karls-Universitt in Tbingen (Institut fr Medizinische Psychologie und Verhaltensneurobiologie - Prof. Birbaumer and Prof. Lotze). After the PhD he had a three years post-doctoral fellowship at the University of Ferrara (Neurolab - Prof. Fadiga and Prof. Craighero). Then, in 2010 he joined the Italian Institute of Technology, first as a senior post-doc (Prof. Sandini and

Prof. Fadiga) and then since 2012, as a Researcher in the Robotics, Brain and Cognitive Sciences Department. He is author of more than 30 peer-reviewed journal papers for which has received more than 500 citations. He gave more than 15 invited talks on his research activity and received several prizes for young researcher (Italian Association of Psychology, Italian Neuropsychological Society, etc.). He currently plays a key role in the Mirror Neurons and Interaction Lab at IIT. His scientific interests revolve around the issue of sensorimotor communication via vocal and bodily movements.



## Acknowledgements

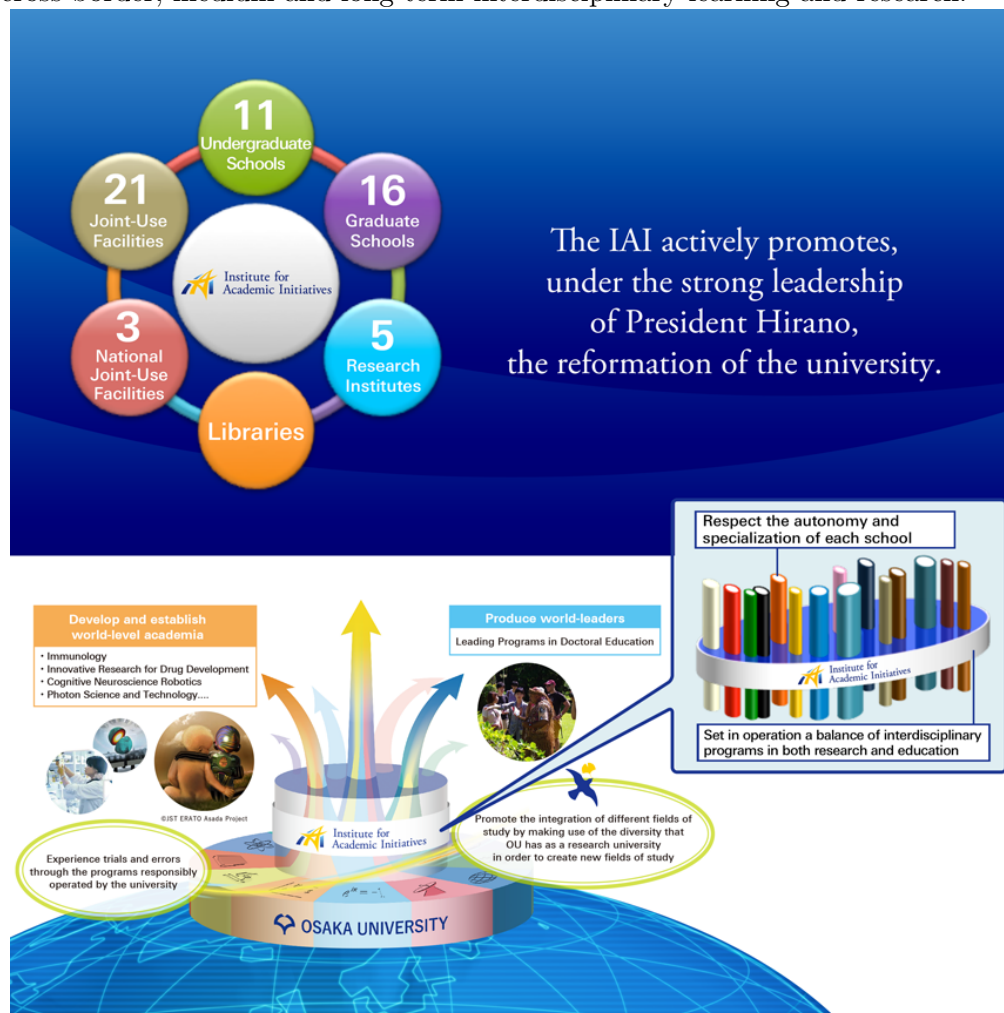
We would like to thank the support given by our departments (RBCS at IIT, Emergent Robotics Lab at Osaka University and MACS at Heriot-Watt University). Furthermore, we like to thank for the financial support of the HRI consortium, the Osaka University, the Italian Institute of Technology, the Heriot-Watt University, EU CODEFROR project: FP7-PIRSES-2013-612555 and the Institute for Academic Initiatives (2012-2015).

Gratefully, Yukie Nagai, Alessandra Sciutti and Katrin S. Lohan



The Osaka University Institute for Academic Initiatives (IAI) was set up in order to promote, under the leadership of President Hirano, interdisciplinary cross-boundary education and research. Each of Osaka University's schools conducts education and research in professional fields; however, modern society faces many challenges that require creative approaches, approaches that require scholarship from more than one field. Thus, the IAI was set up for the purpose of promoting such cross-border, medium- and long-term learning and research, strategies for a future viewed as a whole.

The Institute for Academic Initiatives (IAI) was set up in order to promote interdisciplinary education and research under the leadership of President Toshio HIRANO. Excellence in education and research has always been pursued at Osaka University's schools. However, modern society faces many challenges that require creative approaches, approaches that call upon scholarship from more than one field, one s@eco;tu. Thus, the IAI was set up for the purpose of promoting such cross-border, medium-and long-term interdisciplinary learning and research.







## **COgnitive Development for Friendly RObots and Rehabilitation**

FP7-PEOPLE-2013-IRSES

MARIE CURIE ACTIONS: International Research Staff Exchange Scheme

<http://codefror.eu/>

### **Project Summary**

The objective of the joint exchange project is to investigate aspects of human cognitive development with the double goal of developing robots able to interact with humans in a friendly way and of designing and testing protocols and devices for sensory and motor rehabilitation of disabled children. The methodology we intend to follow will combine science driven investigation of human cognitive development and engineering based implementation of devices and protocols. The intended focus is on social interaction and how the knowledge of this aspect of development could lead to robots able to communicate with humans in a natural and biological way (friendly robots), and/or give rise to training and rehabilitation techniques for children with sensory, motor and cognitive disabilities.

Social interaction is a bidirectional process based on a shared representation of actions and on mutual understanding and its study will help discovering how infants develop the understanding of actions, intentions and emotions to progressively improve their social behaviors. In addition, implementing models derived from humans studies on robots provides an additional constructive approach to investigate cognitive development and could benefit both robotics (better robots) and neuroscience, providing a test-bed for the proposed theories.

To be successful this multidisciplinary program calls for a wide range of expertise both in terms of scientific communities (developmental psychology, robotics, sensory and motor rehabilitation), and in relation to engineering implementation (robots as well rehabilitation devices) and social exploitation (sensory and motor rehabilitation). The exchange program proposed has the goal of joining the forces and expertise of the participating partners and of helping the formation and establishment of an international community of young researchers that shall effectively bridge the involved groups and their expertise in order to be effective in the long term.



## IEEE ICDL-EPIROB 2014

### The Fourth Joint IEEE International Conference on Development and Learning and on Epigenetic Robotics

Palazzo Ducale, Genoa, Italy

October 13-16, 2014

<http://www.icdl-epirob.org/>



## Conference description

The past decade has seen the emergence of a new scientific field that studies how intelligent biological and artificial systems develop sensorimotor, cognitive and social abilities, over extended periods of time, through dynamic interactions with their physical and social environments. This field lies at the intersection of a number of scientific and engineering disciplines including Neuroscience, Developmental Psychology, Developmental Linguistics, Cognitive Science, Computational Neuroscience, Artificial Intelligence, Machine Learning, and Robotics. Various terms have been associated with this new field such as Autonomous Mental Development, Epigenetic Robotics, Developmental Robotics, etc., and several scientific meetings have been established. The two most prominent conference series of this field, the International Conference on Development and Learning (ICDL) and the International Conference on Epigenetic Robotics (EpiRob), are now joining forces for the fourth time and invite submissions for a joint conference in 2014, to explore and extend the interdisciplinary boundaries of this field.

## Important dates

30.04.2014 paper submission deadline

15.07. 2014 author notification

31.08.2014 final version (camera ready) due

13-16.10.2014, conference





## Workshop at Ro-Man 2014:

### Developmental and bio-inspired approaches for memory and emotion modelling in cognitive robotics

Ruby Valverde Ibanez<sup>1</sup> and Katrin Solveig Lohan<sup>1</sup> and Micael Couceiro<sup>2</sup> and Patricia A. Vargas<sup>1</sup>

<sup>1</sup>Heriot Watt University

<sup>2</sup>University of Coimbra

Edinburgh, UK

August 25, 2014

<http://www.macs.hw.ac.uk/~kl360/Ro-Man2014W>



The aim of this workshop is to present recent research conducted into the field of cognitive neuroscience and study the harmonious relationship between memory and emotion in social cognitive robots. Emotion plays an important part in social interactions, and in order to correctly interact with humans, robotic agents need to understand how emotions can affect memory and vice versa.

We know that emotional states are important for young children to learn positive lifelong abilities, such as anger management, self-esteem, self-awareness, impulse control, empathy and compassion. By using emotional stimuli, robotic agents can develop their memory and grow to be more socially acceptable. By being more socially acceptable, the robotic agents will also be able to interact with their surroundings far easier than before, not to mention interact with their caregivers in a smile and understandable manner.

In cognitive neuroscience, we know that neural mechanisms rely on different impulses from different areas of the brain, i.e., emotional memories are created by interactions between the Amygdala and the Hippocampal complex. By understanding these mechanisms, we will be able to create new models for memory storage in robotic agents.

Bearing these ideas in mind, a synchronic design between biological neural mechanisms and robotic memory is crucial in the advancement of socially acceptable robotic agents. This workshop is intended for an audience from multiple different disciplinary backgrounds and will attempt to provide an equal exposure between observations, robotics and computational neuroscience models.

### Important Dates

02.05.2014 Submission

28.05.2014 Notification

25.08.2014 Workshop

