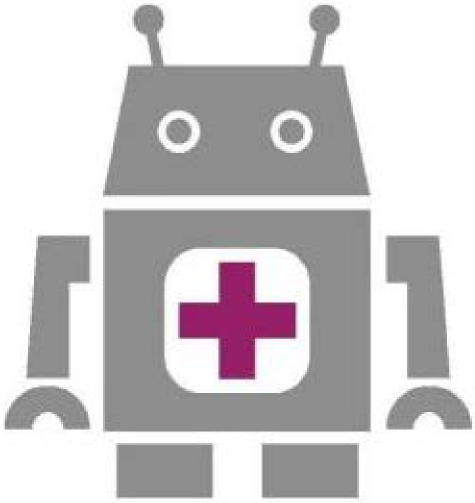
COST Workshop on Social Robotics

The future concept and reality of Social Robotics: challenges, perception and applications

The role of Social Robotics in current and future society



Perception

Working Group Booklet

Tuesday 11 - Thursday 13 June 2013
International Press Centre (IPC), Résidence Palace
Brussels, Belgium

http://www.cost.eu/events/socialrobotics
#socialrobots

COST is supported by the EU Framework Programme

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Programme

Monday 10 June 2013
Hotel NH Du Grand Sablon, Rue Bodenbroek 2/4, 1000 Brussels (BE)
17.30 – 19.00: Workshop Registration
19.00 – 19.30: Welcome words by **COST representatives**
19.30 – 20.00: **Gian Piero Brunetta** (University of Padua, IT) "Robots in the cinema"
20.00 – 22.00: Dinner

Tuesday 11 June 2013
International Press Centre, Rue de la Loi 155, 1000 Brussels (BE)
8.30 Workshop Registration
9.00 – 13.00: Plenary Session (Polak Room) - Chair: Leopoldina Fortunati (University of Udine, IT)

- 9.00 – 9.15: Official Opening by **Tatiana Kovacikova**, COST Office Head of Science Operations
- 9.15 – 9.30: Workshop Introduction by **Leopoldina Fortunati**, Head of the Organising Committee
- 9.30 – 10.00: **Anne Bajart** (EC/DG Connect A2 Robotics) "The EU-funded research programme in robotics: achievements and perspectives"
- 10.00 – 10.30: **Fabrizio Sestini** (EC/DG Connect) "Collective Intelligence, Internet Ethics and Sustainability: Issues for Social Robots"
- 10.30 – 11.00: **Sakari Taipale** (University of Jyväskylä, FI) "European perceptions of robots and related implications for the policies of the social"
- 11.00 – 11.30: Coffee break
- 11.30 – 12.00: **Atsuo Takanishi** (Waseda University, JP) "Some Aspects of Humanoid Robot Design"
- 12.00 – 12.30: **Antonio Bicchi** (University of Pisa, IT) "From Social Robots to Societies of Robots"
- 12.30 – 13.00: **Naomi Baron** (American University Washington D.C., US) "Shall We Talk? Conversing with Humans and Robots"

13.00 – 14.00: Lunch break
14.00 – 16.00: Working Group Session I
Working Group "Challenges" (Maelbeek Room)
Chair: James E. Katz (Boston University, US)

- 14.00 – 14.20: **James Katz** (Boston University, US) "Attitudes toward robots suitability for various jobs as affected robot appearance"
- 14.20 – 14.40: **Matthias Rehm** (Aalborg University, DK) "Culture Aware Robotics"
- 14.40 – 15.00: **Shuzhi Sam Ge** (National University of Singapore, SG) "Era of Social Robots"
- 15.00 – 15.20: **Christine Linke** (University of Berlin, DE) "Phenomena of Human-Social Robot-Interaction: The Social Construction of Reciprocity, (Inter-)Subjectivity and Relationship"
- 15.20 – 16.00: Panel Discussion

Working Group "Perception" (Passage Room)
Chair: Ryad Chellali (Italian Institute of Technology, IT)

14.00 – 14.20: **Maria Bakardjieva** (University of Calgary, CA) “This Bot Hurt my Feelings: Ethics and Politics for Social Bots”
14.20 – 14.40: **Nikhil Bhattacharya** (Institute for Liberal Arts, US) “With Our Technology, In Our Image: A Philosophical Analysis of Social Robots”
14.40 – 15.00: **Charles Ess** (University of Oslo, NO) “Robots and Humans as Virtuous Agents? Core questions and challenges”
15.00 – 15.20: **Michaela Pfadenhauer** (Karlsruhe Institute of Technology, DE) “The Contemporary Appeal of Artificial Companions”
15.20 – 16.00: Panel Discussion

Working Group “Applications” (Polak Room)

Chair: Alessandro Saffiotti (Orebro University, SE)

14.00 – 14.20: **Rytis Maskeliunas** (Kaunas University of Technology, LT) “Gaze tracking based emotional status determination”
14.20 – 14.40: **Timo Kaerlein** (Universität Paderborn, DE) “The robotic moment in mobile media. An inquiry into new intimacies in human-technology relationships”
14.40 – 15.00: **Pelachaud Catherine** (CNRS, FR) “Socio-emotional humanoid agent”
15.00 – 15.20: **Barbara Lewandowska Tomaszczyk and Paul A. Wilson** (University of Lodz, PL) “Affective robotics - modelling and testing cultural prototypes “
15.20 – 16.00: Panel Discussion

16.00 – 16.30: Coffee break

16.30 – 18.30: Working Group Session II

Working Group “Challenges” (Maelbeek Room)

Chair: James E. Katz (Boston University, US)

16.30 – 16.50: **Amparo Lásen** (University Complutense of Madrid, ES) “The Shared Agency between People and Technologies in the Context of the ‘Affective Paradox’ ”
16.50 – 17.10: **Maria Teresa Riviello** (Second University of Naples and IIASS, IT) “A Cross-Cultural Study on the Effectiveness of Visual and Vocal Channels in Transmitting Dynamic Emotional Information”
17.10 – 17.30: **Juha Röning** (University of Oulu, FI) “Natural Human Robot Interaction”
17.30 – 17.50: **Stefan Benus** (Constantine The Philosopher University, SK) “Social aspects of entrainment in spoken interactions”
17.50 – 18.30: Panel Discussion

Working Group “Perception” (Passage Room)

Chair: Ryad Chellali (Italian Institute of Technology, IT)

16.30 – 16.50: **Sara Rosenblum** (University of Haifa, IL) “Brain-hand language secrets as reflected through a computerized system”
16.50 – 17.10: **Kimmo Vanni** (Tampere University of Applied Sciences, FI) “Social robotics as a tool for promoting occupational health”
17.10 – 17.30: **Shirley Elprama and An Jacobs** (Vrije Universiteit Brussel, BE) “Robots in the operating room”
17.30 – 17.50: **Elizabeth Broadbent** (The University of Auckland, NZ) “The social and emotional impact of robots in healthcare”
17.50 – 18.30: Panel Discussion

Working Group “Applications” (Polak Room)

Chair: Alessandro Saffiotti (Orebro University, SE)

16.30 – 16.50: **Patrick Law** (The Hong Kong Polytechnic University, HK) “Biomedical Engineering: The case of rehabilitation program in Hong Kong”

16.50 – 17.10: **Rui Loureiro** (Middlesex University, UK) “Social robots in the rehabilitation of cognitive and motor function”
17.10 – 17.30: **Anthony Remazeilles** (Tecnalia Research and Innovation, ES) “Development of mobile robots for providing assistance to the elderly population: experience acquired”
17.30 – 17.50: **Filippo Cavallo** (Scuola Superiore Sant'Anna, IT) “Social Robotics for healthcare applications: the Robot-Era experience”
17.50 – 18.10: **Renaud Ronsse** (Université Catholique de Louvain, BE) “Primitive-based entrainment in upper- and lower-limb periodic movement assistance by using adaptive oscillators”
18.10 – 18.30: Panel Discussion

Wednesday 12 June 2013

International Press Centre, Rue de la Loi 155, 1000 Brussels (BE)

8.30 – 9.00: Workshop Registration

9.00 – 11.00: Plenary Session (Polak Room) - Chair: Anna Esposito (Second University of Naples and IIASS, IT)

9.00 – 9.30: **Satomi Sugiyama** (Franklin College Switzerland, CH) **and Jane Vincent** (University of Surrey, UK) “Consideration of the mobile device as a form of social robot”
9.30 – 10.00: **Kerstin Dautenhahn** (University of Hertfordshire, UK) “Social robotics and real world applications – an interdisciplinary perspective”
10.00 – 10.30: **Anniina Huttunen** (University of Helsinki, FI) “Does Intelligence Matter? - Legal Ramifications of Intelligent Systems”
10.30 – 11.00: **David Cohen and Mohamed Chetouani** (University Pierre and Marie Curie, FR) “Social Signal Processing in Developmental Psycho-Pathology”

11.00 – 11.30: Coffee break

11.30 – 13.30: Working Group Session III

Working Group “Challenges” (Maelbeek Room)

Chair: Harmeet Sawhney (Indiana University, US)

11.30 – 11.50: **Carlo Nati** (Education 2.0, IT) “Cad software to introduce robotic design process at school”
11.50 – 12.10: **Chung Tai Cheng** (The Hong Kong Polytechnic University, HK) “The technologicalization of education in China and the case study of Home-School Communication System”
12.10 – 12.30: **Michele Viel and Giovanni Ferrin** (University of Udine, IT) “Taming social robots through playfulness and do it yourself: children in action”
12.30 – 12.50: **Linda Giannini** (MIUR, IT) “Pinocchio 2.0, robot and other stories”
12.50 – 13.30: Panel Discussion

Working Group “Perception” (Passage Room)

Chair: Guglielmo Tamburrini (University of Naples “Federico II”, IT)

11.30 – 11.50: **Nadia Berthouze** (University College London, UK) “Body Movement and touch behaviour as means to recognize and enhance affective experience”
11.50 – 12.10: **Marcin Skowron** (Austrian Research Institute for Artificial Intelligence, AT) “From Virtual to Robot Bartender: insights from the affective dialogue system”
12.10 – 12.30: **Anna Esposito** (Second University of Naples and IIASS, IT) “Emotional expressions: Communicative displays or psychological universals?”

12.30 – 12.50: **Kristrún Gunnarsdóttir** (Lancaster University, UK) “Robot assistance: prominent visions and problem domains”

12.50 – 13.30: Panel Discussion

Working Group “Applications” (Polak Room)

Chair: Sara Rosenblum (University of Haifa, IL)

11.30 – 11.50: **Hicham Atassi** (Brno University of Technology, CZ) “An Autonomous intelligent system for Call Centres Surveillance and Assessment”

11.50 – 12.10: **Tatsuya Matsui** (Flower Robotics Inc., JP) “A design approach for the robots to be accepted in the society”

12.10 – 12.30: **Claudia Pagliari** (University of Edinburgh, UK) “Roles, relationships and rights in interactions between real and virtual humans: insights and implications from a study on Avatar-supported eHealth”

12.30 – 12.50: **Vanessa Evers** (University of Twente, NL) “Human Robot Co-existence”

12.50 – 13.30: Panel Discussion

13.30 – 14.30: Lunch break

14.30 – 16.30: Working Group Session IV

Working Group “Challenges” (Maelbeek Room)

Chair: Harmeet Sawhney (Indiana University, US)

14.30 – 14.50: **Ryad Chellali** (Italian Institute of Technology, IT) “The Social Robot: myths, reality and perspectives”

14.50 – 15.10: **Raul Pertierra** (Manila University, PH) " The person in the machine: the machine in the person”

15.10 – 15.30: **Joachim Hoeflich and Afifa El Bayed** (University of Erfurt, DE) “The Acceptance of Social Robots in Today’s Germany and its Prospects”

15.30 – 15.50: **Nello Barile** (Iulm, University of Milan, IT) “The automation of taste: anthropological effects of Shazam and another apps used as search engines in the everyday life”

15.50 – 16.30: Panel Discussion

Working Group “Perception” (Passage Room)

Chair: Guglielmo Tamburrini (University of Naples “Federico II”, IT)

14.30 – 14.50: **Davide Fornari** (Supsi University of Applied Sciences and Arts of Southern Switzerland, CH) “Face as interface: anthropomorphic and zoomorphic artefacts”

14.50 – 15.10: **Takaaki Kuratate** (Technical University of Munich, DE) “Mask-bot: a retro-projected talking head for social interaction media applications”

15.10 – 15.30: **Carl Vogel** (Trinity College Dublin, IE) “Intending no offence”

15.30 – 15.50: **Etienne Burdet** (Imperial College London, UK) “Adaptive nature of human-human interaction”

15.50 – 16.10: **Peter Sinčák** (Technical University of Kosice, SK)

16.10 – 16.30: Panel Discussion

Working Group “Applications” (Polak Room)

Chair: Sara Rosenblum (Haifa University, IL)

14.30 – 14.50: **Milan Gnjatović** (University of Novi Sad, SR) “The Child, the Therapist, and the Robot: Adaptive Dialogue Management in Three-Party Interaction”

14.50 – 15.10: **Sonya Meyer** (Haifa University, IL) “Social Robots as possible Celiac Disease management mediators for supporting adherence to a healthy lifestyle”

15.10 – 15.30: **Hideki Kozima** (Miyagi University, JP) “Social robot for autism therapy”

15.30 – 15.50: **Frano Petric** (University of Zagreb, HR) "Application of Humanoid Robots in Diagnostics of Autism"
15.50 – 16.30: Panel Discussion

16.30 – 18.00: Social Robots Exhibition (opened by private reception)

Thursday 13 June 2013

International Press Centre, Rue de la Loi 155, 1000 Brussels (BE)

8.30 – 9.00: Workshop Registration

9.00 – 10.30: Plenary Session (Polak Room) - Chair: Thierry Keller (Tecnalia Research & Innovation, ES)

9.00 – 9.30: **Paolo Dario** (Scuola Superiore Sant'Anna, IT) "Robot Companions for Citizens: a Vision to Address Societal Challenges and to Improve Quality of Life"
9.30 – 10.00: **Aude Billard** (École Polytechnique Fédérale de Lausanne, CH) "Issues when transferring knowledge from humans to robots"
10.00 – 10.30: **Alessandro Vinciarelli** (University of Glasgow, UK) "Social Signal Processing"

10.30 – 11.00: Coffee break

11.00 – 13.00: Working Group Session V

Working Group "Challenges" (Maelbeek Room)

Chair: Maria Bakardjieva (University of Calgary, CA)

11.00 – 11.20: **Alessandro Saffiotti** (Orebro University , SE) "Towards a human robots-environment ecosystem: opportunities and challenges"
11.20 – 11.40: **António Brandão Moniz** (Karlsruhe Institute of Technology, DE) "Intuitive interaction between humans and robots in industrial environments: the social robotics role"
11.40 – 12.00: **Maria Koutsombogera** (Institute for Language And Speech Processing, EL) "Developing resources of social interactions"
12.00 – 12.20: **Costanza Navarretta** (University of Copenhagen, DK) "The annotation and use of multimodal corpora for modelling believable social robots"
12.20 – 13.00: Panel Discussion

Working Group "Perception" (Passage Room)

Chair: Valèria Csèpe (Hungarian Academy of Sciences, HU)

11.00 – 11.20 **Valéria Csépe** (Hungarian Academy of Sciences) "Augmented reality and assisted perception"
11.20 – 11.40 **Angelo Cangelosi** (Plymouth University, UK) "Embodied Language Learning in Human-Robot Interaction"
11.40 – 12.00 **Agnieszka Wykowska** (Ludwig Maximilians Universität, DE) "Cognitive- and social neuroscience for social robotics - how the present challenges can tell us where to go in the future"
12.00 – 12.20 **Karola Pitsch** (Bielefeld University, DE) "Social Learning from an Interactional Perspective. The role of a robot's feedback in tutoring situations in human-robot-interaction"
12.20 – 13.00: Panel Discussion

Working Group "Applications" (Polak Room)

Chair: Alicia Casals (Universitat Politècnica de Catalunya, ES)

11.00 – 11.20: **Thierry Keller** (Tecnalia Research & Innovation, ES) "Robotics for Neurorehabilitation: Current challenges and approaches"

11.20 – 11.40: **Alicia Casals** (Universitat Politècnica de Catalunya, ES) “Social Acceptance in robotics for health”

11.40 – 12.00: **Peter Friedland** (Peter Friedland Consulting, US) “Developing Trust in Human-Machine Interaction”

12.00 – 12.20: **Marcos Faundez Zanuy** (Escola Universitaria Politecnica de Mataro, ES) “Xnergic: a Tecnocampus initiative to promote engineering vocations”

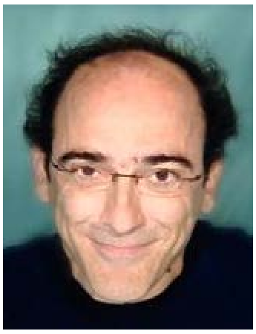
12.20 – 13.00: Panel Discussion

13.00 – 14.00: Lunch break

14.00 – 15.30: Summaries by Working Groups’ Chairs - Chair: James Katz (Boston University, US)

15.30 – 16.00: Conclusions and Follow-Up - Chair: Leopoldina Fortunati (University of Udine, IT)

Working Group Speakers



Ryad Chellali
Working Group Chair
Sessions I and II (11 June)

Organisation Istituto Italiano di Tecnologia

E-mail ryad.chellali@iit.it

Biography Ryad Chellali is a senior scientist at the Department Pattern Analysis and Computer Vision (PAVIS), Istituto Italiano di Tecnologia. He obtained his PhD in Robotics from University of Paris in 1993 and his Dr. Sc from Univesrity of Nantes (France) in 2005. His main research interests include robotics, human robots interactions, human behavior analysis (social signal processing and a
ffective computing). Telepresence virtual and augmented realities, are also keywords of his activity. He worked in 1992 at the French Institute of Transports (INRETS). From 1993 to 1995 he was ass-prof at University of Paris. From 1995 to 2006, he joined Ecole des Mines de Nantes(France), heading the automatic control chair. He joined IIT in 2006 as a senior scientist, where he created the Human-Robots Mediated Interactions Lab. Ryad Chellali co-authored more than 100 papers. In 2000 and 2005 he was awarded by the French Government "Creation of innovative technologies".

Abstract **The Social Robot: myths, reality and perspectives**

The engineering approach to find working solutions is a three steps process: what, why and how. Indeed, for an engineer to promote their work, he or she follows the known convincing sequence: What is the problem you want to solve, why your solution is/will be unique, and finally you show that your solution is/will work, is robust and cost-effective. For social robotics, we know why we need social robots: they could help elderly or disabled people, in terms of their social lives, etc. On the other hand, we invent some toys problem (simplified problems solved under controlled conditions) to convince others (and ourselves) that social robots can work (the HOW). Importantly only few of us can specify exactly what is a social robot. There is no absolute need to define “social robotics” and it seems that it is also not absolutely necessary to define the means to demonstrate that our research will lead to effective solutions. However, we have to keep in mind that two fundamental questions are pending. My presentation starts by listing some of the myths in and around robotics, in order to understand the current state of robotics. I continue with describing my own experiences in addressing problems of human-machines interactions. I finish with my vision of the future of the social robotics and the means to achieve the specified ends. Myths in and about robotics Before addressing the robotics myths, I first introduce some historical facts about artificial intelligence and control theory and their relations to robotics. Indeed, AI suffered and is still suffering since its origins. In the 50’s a group of researchers established a roadmap for developing this field for the following 20 years. AI was considered as the absolute way to solve any kind of problem, far beyond human capabilities. Robots at that time were

considered no more than printers: just a terminal allowing displaying the power of AI. The 50’s roadmap was in fact lacking at least two crucial points: i) that intelligence needs embodiment; ii) that similar problems may have a variety of alternative solutions. The first point discarded de facto all the developmental/evolutionary aspects of a system working within physical environments. The second point delayed all the stochastic and bio-inspired approaches from being used as successful solutions to handle complex and real-life systems. The second myth in robotics is related to the control theory. This theory, given a model of the world, allows generating optimal controls to command any dynamic system and make this system perform exactly as predicted or desired. This theory worked perfectly for simple and simplified worlds (with hundreds of state variables), however it fails when facing complexity, mainly, when humans are present in the control loop. The list of myths is non-exhaustive and we can continue by pointing out the way existing theories have been misused. Such a list, however, enables addressing the specific problem of our interest: the human-robot hybrid system. Current general trends in robotics contrast with previous approaches. Robots are today the central objects of research: we develop and adapt techniques and methodologies for the robot itself rather than using it as a demonstration platform. This shift allows crystallizing efforts on a single technological object and enables performing a vast amount of research leading to many fundamental and practical advances. However, roboticists should keep in mind that these successes are also the fruits of the continuous cross-fertilization and inspiration across disciplines. Some experiences I'll give two types of collaborations I have had in the past. From each, I got different outputs and lessons about the necessity of addressing the SR issues within cross-disciplinary frameworks. The first example is concerned with the work we have done with Neuroscientists, and specifically from neuroscientists dealing with motor control, to investigate sensory-motor coupling in reaching for objects. This research showed us that the embodiment is a key aspect, and coupling of perception and motor control could improve our understanding of how motor actions improve perception. It took 3 years before obtaining the first results. Most of this time was dedicated to understanding each other’s approaches and to have clear ideas about mutual expectations. Last piece of research has been done with colleagues from experimental cognitive psychology. We joined our efforts to answer a simple but fundamental question: does the robot’s shape affect the way humans represent robot actions? Beyond the research-line itself, the principal success is the fact that after years of discussions and exchanges, we found, after three years a common language to address exactly the same key question from different angles; rather than having representatives of each of the discipline tackling different questions without a common overarching line of thought. I’m convinced that most of people addressing issues related to social robotics experienced similar situations and found that multi-disciplinary ways are the most effective. The manifold approaches developed by SR community are nowadays a reality and should be strongly encouraged. However, one should be aware that this is an iterative process, which needs time. The future of social robotics Social robotics is in its infancy and needs to be strongly stated as a research discipline. SR, by essence, investigates humans in the presence of robots (e.g, the robot as stimuli generator), or robots interacting with humans (e.g. HRI). There is a clear dichotomy of studying separately robots on the one hand and humans on the other in addressing SR issues and this is reflected in the literature (conferences, journals, etc.). SR should shift to a new paradigma: the human-robot system as a central research topic. This idea itself is not new and many similar ideas have been proposed in the past. However, considering the HR system as a whole: a unique system treated as a unit of examination, should remove confusions, redundancies and should open doors to new fundamental questions. Mixing different research areas in a well-organized way will be the key of success for SR. We have in mind many of the domains that should be involved at different levels: Sensing, data-mining, signal processing, machine learning, statistics, control, mechatronics, design, cognitive sciences, psychology, experimental psychology, cognitive psychology, neurosciences, neuro-cognition, neurophysiology, motor control, developmental sciences, linguistics, social sciences, material sciences, etc. This list is an open one and has to be filled and extended to new topics. The efforts in developing SR should consider at least two main directions: 1) Developing a strong and open community, 2) Grounding the scientific foundations of SR. a) Some ideas to develop the SR community Classical communication tools should be setup to allow potential contributors to be involved in the development of the community (datasets, websites, dedicated workshops). • b) Some other ideas to strengthen common scientific basement of SR Here also, SR community should develop usual paths toward creating the right ecosystem allowing having fast and fruitful exchanges. • Encouraging the creation of a “common language” through summer schools, • Creation Open sources repository,

Maria Bakardjieva

Organisation University of Calgary, Canada

E-mail bakardji@ucalgary.ca

Biography Maria Bakardjieva is Professor in the Department of Communication and Culture, University of Calgary, Canada. She is the author of Internet Society: The Internet in Everyday Life (2005, Sage) and co-editor of How Canadians Communicate (2004 and 2007, University of Calgary Press). Currently, Maria is the editor-in-chief of the Journal of Computer-Mediated Communication. Her research has examined Internet use practices across different social and cultural context with a focus on the ways in which users understand and actively appropriate new media. Her work on the topics of Internet use in everyday life, online community, e-learning and research ethics has been published in numerous international journals and edited collections. Her current projects look at the interactions between traditional and new media with a view to identifying opportunities for citizen participation in the public sphere.

Abstract **This Bot Hurt my Feelings: Ethics and Politics for Social Bots**

As individuals amass friends, update status and ‘groom’ relationships on social media sites, the labour of socializing and maintaining networks gradually becomes too much to bear. A typical human response to unbearable labour throughout history has been first mechanization, and consequently – automation. The mechanization stage on Web 2.0 has arrived in the form of simple one-click responses, recorded phrases, like and dislike icons. While we are employing social machines like this, the individual operator still has to exert the effort to select, to navigate, to click, or put together a three-syllable tweet. The next stage is just around the corner. Some say it is already here. The automation of social communication promises relief from the burden of reading our friends’ posts or spending time in our day to maintain web presence. Social bots offer to do it for us. When sociality is based on simple reactions and quantification, robots come to offer a logical solution. The more our human friends behave like robots, the more likely are robots to displace our human friends. If we do not know that all the support or approval we have received for our posts online has come from automated agents, we might feel happy and comfortable just as well. With automated sociability looming on the horizon, the issues of integrity, deceit, betrayal, confidentiality breach, and a whole host of other ethical standards applying to relationships between people are going to arise with regard to social bots. Ethics is closely followed by politics. When social bots start signing petitions, voting in online referenda, following politicians’ tweets, posting in political forums, etc., the online representation of political life could be severely distorted. This presentation will reflect on what all these possibilities mean for the design of social bots and what the place of ethics and politics should be in the process.

Nikhil Bhattacharya

Organisation Institute for Liberal Arts

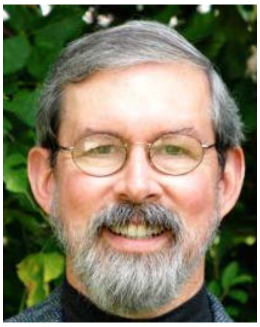
E-mail nikhil.bhattacharya@gmail.com

Biography Nikhil Bhattacharya was formally trained in both physics and philosophy. After teaching theoretical physics, he studied philosophy at Boston University. His dissertation (“Knowledge and Human Practice”) was on traditions of epistemological realism in the works of Karl Popper, John Dewey, and Karl Marx. Bhattacharya’s basic research concerns epistemology, particularly from a historical perspective. His interest in robots and cognition stems from his work in epistemology. Having also served as an academic administrator, presently he is working on the question of how to articulate the epistemological problems of the contemporary university from a shared multidisciplinary perspective. Since retiring from university teaching, he has continued his research on epistemology, the history of science, and the university through the Institute for Liberal Arts, a non-profit research organization.

Abstract **With Our Technology, In Our Image: A Philosophical Analysis of Social Robots**

How should we think about human-robot interactions within a social space? Since the invention of industrial robots sixty years ago, most robots have remained on factory floors, only more recently being used in more exotic contexts such as defusing explosives. Other types of devices commonly called robots are essentially instruments for telepresence or teleoperations at a distance, like the Da Vinci surgical machines enabling surgeons sitting in the US to operate on severely injured American soldiers in Iraq or the Mars Rover, which explores the surface of the Red Planet under the direction of humans on earth. Only in recent years have there been attempts to design “social robots” that interact with and aid people. In this paper, when I use the term “robot”, I mean an independent, autonomic programmed machine that responds to inputs and communicates verbally with people – an electromechanical analogue, however limited, of a biological human being, programmed to assist individuals. Our current understanding of physical science suggests there are serious conceptual and technical problems in constructing such machines. Nevertheless, there is progress being made, and, if technical R&D can be supported, we can expect at least some development of such machines. The possibility of social robots possessing even restricted capabilities raises three questions: (1) What we do want such machines to be able to do? (2) What are the limits of such machines? (3) What sort of society will result when biological humans communicate and cooperate with electromechanical, cognitive, humanoid machines? To consider the first question, we need to examine the recent history of robotic development in the United States and Japan. We will consider the specific socio-cultural circumstances and values that led to different robotic developments in the two countries.

The second question – what are the limits of such machines? – has two parts. The first part lies in the history of physical science itself. Physics research, from Galileo until the end of the Cold War, has been fundamentally directed towards military development. With the end of centuries of warfare among western European states, the formation of the EU, and the collapse of the Soviet Union, the history of state-supported physics seems to have come to an end. As a result, it is unclear if physical science has a future. For robotics research, this circumstance means that even though significant technical advances in the machine's power and capability are still possible, future developments will probably rely upon existing physical knowledge. We will be able to significantly improve robotic functions, but not qualitatively expand them. The second set of constraints is epistemological. The robot, somewhat like the human brain, is a device that transforms input into output. The input is of two kinds: verbal and sensory. Much of the research in artificial intelligence over the last several decades has focused on the development of deductive logic machines in which the inputs are verbal statements carrying information and the outputs are logical conclusions. However, the development of such expert systems represents only a narrow segment of the cerebral processes that connect input and output in the human mind. For instance, one critical problem is the mind's capacity to form classes, generalizing from particular experiences to universals, so that the brain knows how to react to a new situation based on past experience. It is only quite recently that neural networks have been developed for computers to try to cope with the problem of universals. But the successes are, necessarily, limited. Looking at the human brain, it is extremely difficult to even identify the subtle complexities of structure and function that have evolved over millions of years, and it is theoretically impossible to replicate them. As a result, in cognition and its processing, the social robot will remain a limited creature. The third and final question we must consider is whether the introduction of social robots will create a new society and require a new understanding of what human society is. To consider the implications of this possibility, we need to re-examine the variety of ways we have come to understand human society; that is, we need to review the history of social thought and the social sciences. Though probably affected in part by the encounter with native American peoples in the eighteenth century, the fundamental idea of a "society" was a product of the Counter-Enlightenment in Germany (Hamann, Herder, Hegel) and France (Maistre). At the heart of the Enlightenment lay the rise of mathematical physics – the work of Galileo, Descartes, Newton, and their eighteenth century followers, who described a determinist, mechanical nature not susceptible to supernatural influence. In this world, Descartes defined the human as an ens rationis that could logically construct mathematical physics, coupled to a mechanical body, the so-called "ghost in the machine". This model of the human being as a combination of mechanics and reason had to be universal and served as the basis for the Enlightenment notion of universal egalitarian humanity, a central conceptual pillar of the French Revolution. Religious-nationalist opponents of the Enlightenment attempted to construct an alternative model of the human being that was not the universal Cartesian logico-mechanical robot. To explain the distinctiveness of different groups of human beings, the anti-Enlightenment opposition began to think of societies as distinguished by particular, unique histories, which, in turn, defined those individuals. "Society" and "history" in our modern senses grew out of this specific historical and cultural context. With the purging of the religious-nationalist elements from the idea of “society”, the social sciences emerged from Comte to Durkheim. What does this historical discussion have to do with social robots? Our ideas of “society” were developed in contradistinction to a world of Cartesian human robots. The world of humans – social spaces – was sharply demarcated from that of mechanical objects. With the rise of social robots, we are now faced with a very different notion of society in which humans and machines communicate (and collaborate) in ways that hitherto were strictly confined to humans. From this perspective, we need to rethink what “society” might mean now.



Charles Ess

Organisation University of Oslo

E-mail c.m.ess@media.uio.no

Biography Charles Ess has authored Digital Media Ethics (Polity Press, 2009; 2nd edition in 2013), edited three volumes, and co-edited five volumes – most recently (with Mia Consalvo), The Handbook of Internet Studies (Blackwell, 2011) and (with P. Cheong, P. Fischer-Nielsen and S. Gelfgren) Digital Religion, Social Media and Culture (Peter Lang, 2012). He has published in journals such as new media and society, Nordicom Information, Javnost, and AI and Society, as well as edited special issues of new media and society, Philosophy and Technology, Ethics and Information Technology, Etikk i Praksis, and the Journal of Computer-Mediated Communication.

Ess has researched and published in both Information Ethics and Media Studies – and at their intersections, including Internet Research Ethics (IRE). A co-author of the first ethical guidelines for Internet research endorsed by the Association of Internet Researchers (AoIR, 2002) and continuing member of the AoIR ethics working committee, he is regularly invited to lead "hands-on" workshops on IRE for faculty and PhD students attempting to come to grips with the multiple ethical challenges in research in communication venues facilitated by the Internet.

A former President of AoIR (2007-2009), he currently serves as President of the International Society for Ethics and Information Technology (INSEIT), with responsibilities for conference organization for both INSEIT's CEPE'13 (Computer Ethics: Professional Inquiries) and ETHICOMP'14. Conferences.

Abstract **Robots and Humans as Virtuous Agents? Core questions and challenges**

To state the obvious: the rise of social robotics raises a host of questions and issues, including a wide range of problems and analyses raised within the frameworks of Information and Computing Ethics (ICE), an interdisciplinary field that seeks to conjoin the art and science of various approaches to computation and computer networks with philosophically-informed frameworks and analyses. From within this range, I find two sets of questions to require particular attention and discussion.

1. Virtues for robots? Are robots capable of (fully) ethical judgment – phronesis – and responsibility?

This question centers on whether – and if so, how far – robots may be successfully programmed to exercise a particular kind of ethical judgment. Since Plato and Aristotle, Western ethics has emphasized the central importance of phronesis, often translated as "practical wisdom" or prudential judgment. Phronesis is an especially demanding but utterly core facility in our making ethical judgments in a broader sense. That is, in much of our ethical lives we proceed quite nicely with what is called

determinative judgments – judgments that simply deduce from accepted general principles (e.g., do not kill) to particular conclusions based on additional premises determined by a given situation. As a simple example: while the inconsiderate, perhaps even reckless actions of the driver in front of us may infuriate us (e.g., as he suddenly swerves in front of us without warning) – and while, at least in the U.S. context, it would not be uncommon to shout in anger "I'll kill the S.O.B.!" – in practical ethical terms the errant driver has nothing to fear. Virtually all of us accept the general principle "Do not kill" and can draw the immediate conclusion that we must not do so under the current circumstances. Indeed, we ordinarily do not reason so explicitly, but rather (with important and sometimes tragic exceptions) proceed without having to even think about such an ethical choice – because, in part at least, because this simple argument and the relatively pacifist behavior it enjoins have been so deeply engrained in us as to simply be automatic.

By contrast with such determinative judgment, phronesis is a more reflective judgment – one that comes into play precisely in those contexts where we are profoundly uncertain as to what the correct ethical choice(es) may be. In part, at least in many cases, this uncertainty is not because we are unaware of important general ethical principles. On the contrary, the problem is precisely that the vexing situation we find ourselves in is vexing just in part because it can call into play several general ethical principles, not just one: moreover, one or more of the potential principles may conflict with one another, forcing us to have to prioritize one over the other. Hence, the problem facing phronesis is: in contrast with determinative judgments which can move easily from a single general principle "downward" to a particular conclusion – phronesis must first move, so to speak, from the ground up, i.e., from the fine-grained details of our immediate, distinct context, to determine precisely which general principles should come into play, and in what prioritized order. To say this somewhat differently: in such situations, there appears to be no immediately obvious general principle – a "meta-principle" or "über-principle" – that allows us to straightforwardly choose more precise general principles and then move deductively downward. Rather, phronesis seems to proceed in a non-deductive and non-generalizable fashion to discern first of all what general principles (and in what priority) should apply.

A central question in robot ethics, then, is whether or not phronesis is computable? That is, is it possible to develop algorithms that are capable of fully replicating human phronesis – where phronesis appears to be a stolidly non-algorithmic process?

The question is clearly critical. If robots can (eventually) be programmed with the fully functional equivalent of phronesis, then we can en-trust such robots with the full range of ethical judgments and thus ethical responsibilities that we regularly accord to (most) humans. If computational-robotic phronesis, however, should be limited by comparison, then humans will have to accord trust in such limited judgment and thus responsibility accordingly.

There is considerable debate over this question in robot ethics, and the first part of my presentation will seek to provide an overview of the current views, arguments, and empirical findings.

2. Virtues for humans in a world of robots?

In virtue ethics, phronesis is regarded as a primary virtue – i.e., a capacity or ability that must be trained and practiced in order to be developed as fully as possible. Such a virtue is argued to be necessary – along with other virtuous capacities such as empathy, trust, patience, etc. - to achieving the good life (understood as a life of contentment and harmonious living in community).

The virtue ethicist Shannon Vallor has raised important questions as to how far the replacement of human caregivers with “care-bots” may risk significant losses for humans. That is, in addition to the multiple ways in which such care-bots may relieve human caregivers of considerable burdens – doing so may further mean the loss of important contexts and opportunities for acquiring and enhancing such basic virtues as empathy. Vallor’s analysis forces us to look more carefully into how far the introduction and diffusion of carebots – as well as warrior-bots, sex-bots, and so forth – into the human lifeworld may hold unforeseen consequences for the human pursuit of virtue and contentment. In the second part of my presentation, I will elaborate on Vallor’s analysis and explore further examples of core virtues that may be inadvertently truncated, displaced, and/or possibly enhanced through the growing presence of robots in our lives.

Michaela Pfadenhauer

Organisation Karlsruhe Institute of Technology

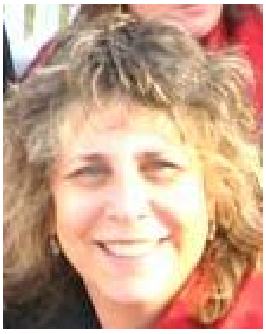
E-mail pfadenhauer@kit.edu

Biography Michaela Pfadenhauer, received her Master's degree for political science from Bamberg University in 1994. She attained her PhD in 2002 from Dortmund University. 1994-1997 she was a senior researcher and lecturer at the Ludwig-Maximilians-University of Munich, from 1997-2002 and 2003-2007 at the Dortmund University. 2002-2003 she was a senior researcher and lecturer at the University St. Gallen, Switzerland. Since 2007 she is a professor for Sociology of Knowledge at the Karlsruhe Institute of Technology. Since 2012 she is the Vice Dean at Department of Humanities and Social Sciences. She is a Co-Editor of the Book Series Culture and Technology, KIT Scientific Publishing, and a Member of the editorial board of the sociological journals Soziologische Theorie and Soziale Interaktion. She is a member of the board of the German Sociological Association and the Research Network Sociology of Knowledge. Since 2011 she is National delegate for Germany in the DC ISCH in COST

Abstract **The Contemporary Appeal of Artificial Companions**

“Universal projection” is the term Thomas Luckmann uses to denote man's innate capacity to project his own “living body” onto everything he encounters in the world. In an essay entitled “On the Boundaries of the Social World”, Luckmann lists a number of qualities that cancel the projection. For example, the lack of perceptible transformations on the outside of the object is perceived as an indication of the absence of a responsive “inside”. This list can serve as a how-not-to guide to building that piece of advanced technology known nowadays as an “artificial companion”. Without prejudice to the social theoretical differences of opinion, there is consensus that drawing the border of the social world alongside that of the human world—which is typical of Western modernity—is not an ontological given but rather an evolutionary outcome, i.e., the result of social construction. The de-socialization of large parts of the life-world leads to its de-animation, which is closely linked to the emergence and organization of a separate religious symbolic reality (Luckmann 2007b). The tendency to endow objects with qualities reminiscent of living subjects contrasts markedly with this. This tendency is encouraged not least by theoretical traditions that postulate the death of the subject. Because ascription processes are a central sociological problem, the empirically observ-able ascription of the capacity to act independently to objects must be the subject of sociological investigation—as distinct from post-social theorizing. The possibility of programming advanced machines in accordance with one's own wishes, and machines' “ability to learn,” appear to play an important role in the ascription process. The distinction between “person” and “persona” is useful when interpreting the way in which objects are endowed with

subjectivity. In certain situations, people temporarily assign the status of “persona” to machines such as robots, navigation aids, etc., because of their functional efficiency. Social Scientists recognize one of the origins of this development in the meta-process of individualization. From a psychoanalytical perspective, modern Westerners are suffering from relationship fatigue. This fatigue prompts us to endeavor to substitute human relationships with relationships with “nonhumans”. Mediatized communication practices have a supportive effect in this regard. They recognize in contemporary individuals a “longing for resonance”. The relationship to a “subject-simulating” or emotion-stimulating machine—rather than to a god, another human being, or a house pet—may prove to be a contemporary response to individualization. The paper will discuss these interpretations and contrast it with an alternative hypothesis on the Appeal of Artificial Companions.



Sara Rosenblum

Organisation University of Haifa, Department of Occupational Therapy

E-mail rosens@research.haifa.ac.il

Biography Sara Rosenblum is an associate professor in occupational therapy and head the laboratory for Complex Human Activity and Participation (CHAP), with special interest in the characteristics of human daily function. Rosenblum aim to gain better insight into interactions between varied body functions (e.g., cognitive, motor, sensory), activity performance and participation abilities of people faced with functional deficits in everyday life. A main focus is placed on trying to understand the relationships between brain mechanisms and actual daily functions among varied populations along life cycle. The ICF concepts (WHO, 2001) constitute the frame for description and evaluation of ability and disability in her research. Consequently, her studies concentrate on populations of children and adults with Hidden disabilities such as ADHD, DCD, LD, and those with chronic illness whose daily function confrontations have not yet received appropriate expression in research.

Abstract **Brain-hand language secrets as reflected through a computerized system**

Brain-hand language secrets as reflected through a computerized system and their possible contribution to the field of social robotics. The field of social robotics is in its developing stage while questions regarding how to design and build social robots are being discussed. Consequently, there is no clear insight as to the possible impacts of this development on the therapeutic domain area, although some literature describes robot therapy for people with special needs. In this context, interdisciplinary research which combines diverse sources of knowledge may enrich the development process of social robotics. The aim of this presentation is to exhibit knowledge acquired within the occupation science concerning human performance characteristics of participants with ‘clumsiness’ diagnosed by the DSM4 as Developmental Coordination Disorders (DCD). Specifically, features of children's and adults with DCD performance of a specific task which reflects brain-hand language, in other words, handwriting, will be presented. Information about their handwriting performance features was gathered using the Computerised Penmanship Evaluation Tool (ComPET) which detects the writing process, as well as supplementary self report questionnaires. Studies were conducted with 180 participants, 90 children and adults with DCD compared to 90 children and adults with Typical Development (TD). Results indicated that the temporal spatial and pressure measures of participants with DCD handwriting performance differed significantly from those of TD participants. Furthermore, several handwriting features predicted their Activities of Daily Living (ADL) performance level. Results such as these shed light on the meaning of motor coordination deficits to participants with DCD (clumsiness) daily function and may constitute a

source of knowledge for social robotic development to improve their motor function, automaticity and control. Furthermore, it may particularly contribute to improving handwriting performance enabling more effective brain hand language expression. Possible implications for the social robotics field will be described with focus on use of computerised information to develop robots for evaluation and therapeutic intervention among children and adults with DCD, aimed to improve their achievements and quality of life.

Kimmo Vanni

Organisation Tampere University of Applied Sciences

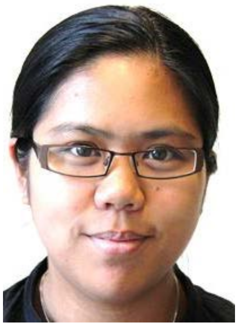
E-mail kimmo.vanni@tamk.fi

Biography Mr Kimmo Vanni works as the Development Manager of Tampere University of Applied Sciences. He holds M.Sc degree in mechanical engineering, M.Sc degree in well-being technology, executive MBA degree in international business and B.Sc degree in construction engineering. He currently researches and writes his doctoral thesis in occupational health regarding employee performance. He spent an academic year 2009-2010 in Sendai, Japan at Miyagi University. His 10-year research experience regarding human performance, productivity loss studies as well as engineering background and knowledge of social robotics gives a good starting point for an innovative social robotics development projects.

Abstract **Social robotics as a tool for promoting occupational health**

Robotics and automation are well-known technology in industry but recently robotics has affected service and health care sectors also. Telerobotics systems like DaVinci and rehab robots have increased quality of treatment and shortened recovery times. Service robotics is expected to assist elderly people and therefore increase the feeling of independence and coping. Traditional robotics systems are cost effective and give possibility to provide therapy oversight, motivation, and coaching with little supervision by therapist. Patients can use robotics as a self-rehab method before and after hospitalization. Experiments have demonstrated that robotics as a therapist tool is potential for autism, ADHD, and stroke recovery. The emerging topic of health care related robotics is social robotics or social assistive robotics which uses multimodal detection such as face, voice and posture, and tries to understand human's emotions. Social robots are able to offer channel between patient and therapist or between patient and patient. Social robots are able to oversight and motivate users even if therapist is not available. The relevant idea is to develop the big picture of social robotics which includes digital and/or physical robot devices, servers, smart sensors, and data terminal equipment, cloud computing applications, user interfaces, and society of developers, specialist and the end users. The robot itself without any connection to databases and operation environment does not offer us anything else than having nice time playing with technical device. Social robot development should have functional focus in some field. Traditionally those are elderly or health care. Our focus is a bit different compared to traditional viewpoint. We are researching and developing together with Japanese researchers a solution for using social robotics in occupational health and as a personal coach. The costs of stress and depression are huge in Europe. Researchers estimated that in year 2004 the costs or depression were about €118 billion whereas in year 2002 the costs of stress were about

€20 billion. Both depression and stress are common and are cutting productivity and company performance. Social robotics and related services might give us tools for detecting the early stage of both disorders and therefore make possible to intervene before disorders are getting worse. Our research and development is taking early steps and we know that it is not so simple to detect disorders by web cams and audio devices. However, we trust that developing a social robot which is able to assist, coach, support and advice the end users we might get positive results for cutting some of the stress and depression costs. The open questions are how well the end users and companies are able to adapt new technology and how close the solution is the medical solution which requires authorized therapist for giving advices. The good starting point could be to develop a 'gamelike' social robot which works as a personal coach and companion. In sum, the drivers for developing social robotics for occupational health are socio-economic. Better outcome and quality with less effort are welcome, especially when the median age of work force and number of elderly people are increasing. The social robot as such is not enough. We need robots, software, service providers, server solutions, and the community of the end users. The development of social robotics could be compared to computer game industry.



Shirley Elprama

Organisation I Minds Smit Vrije Universiteit Brussel

E-mail selprama@vub.ac.be

Biography Shirley Elprama is a researcher working at iMinds-SMIT-Vrije Universiteit Brussel since 2011 after obtaining her master degree in Human Technology Interaction (Eindhoven, University of Technology, 2011). Her thesis was on privacy and place attachment of students in Eindhoven. Her research interests are broad and include human technology interaction, environmental and social psychology, robots, and material culture. Currently, she is working on the Telesurgery project. She is investigating current practices in the operating room for both minimal invasive procedures and robotic procedures by combining methods such as depth interviews with medical personnel and observations in the operating room. Previously, she has worked on projects such as ICOCOON focusing on topics like as presence, privacy and trust. She has experience with a range of different methods, for example: interview, observation, survey, usability testing, paper prototype and scenario.

An Jacobs

I Minds Smit Vrije Universiteit Brussel

an.jacobs@gmail.com

Abstract **Robots in the operating room**

Although the development of minimal invasive surgery had some advantages such as being cost-effective and being better for the patient, there were also some disadvantages such as limited degrees of freedom and 2D imaging (Doarn & Moses, 2011). These limitations were overcome with the development of surgical robots by introducing advantages such as 3D imaging, more degrees of freedom and tremor reduction (ibid). One of these surgical robots is the da Vinci Surgical System® from the company Intuitive Surgical. During robot-assisted surgery, the surgeon sits behind a console while manipulating the four arms of the robot that can hold up to three different tools and a 3D camera. The surgical team during robot-assisted surgery or minimally invasive surgery usually consists of a surgeon, possibly an assistant, a scrub nurse, a circulating nurse and an anesthetist. Robot-assisted surgery adds a new actor to the operating team, which affects how the team works in comparison with minimal invasive surgery. To investigate

how team dynamics changed, we used conducted interviews and observed surgeries. First, we interviewed surgical team members (n = 7) who were experienced with minimal invasive surgeries to learn more about work practices during these procedures. Second, we observed both minimal invasive (n = 5) and robot-assisted surgeries (n = 9) in four hospitals in Flanders, Belgium to study the differences between the two procedures with regard to work practices. A major difference between robot-assisted surgery and minimally invasive surgery is the distance between the patient and the surgeon. During the latter, surgeons stand next to the patient, while in robotic-assisted surgery the surgeon sits mainly behind the console. Only at the start and the end of the procedure, the surgeon is scrubbed in and standing next to the patient. During robotic-assisted surgery, surgeons are both visually and physically removed from both the patient and the rest of the surgical team. This seclusion affects (non-verbal) communication since it becomes more difficult to hear or see the surgeon. On multiple occasions we observed that the surgeon said something while not the entire operating team heard the message. To our knowledge, this did not lead to medical incidents during the observations at which we were present, but incidents could occur in similar situations. While our research was focused on the experience of surgeons and their surgical team, we did not focus on the patient side. To our knowledge, little research has been done on patient's perception of surgical robots. For instance, it is unclear how patients decide between robot-assisted surgery or other alternatives, although Abrishami (2011) suggest the name “Da Vinci” in combination with “robot” might play a role in the image this robot has. In its appearance, the da Vinci robot does not look like a “stereotypical” robot as often portrayed in movies or cartoons. In the context of health care, the appearance of robots is a well-researched topic (e.g. Broadbent, Stafford & MacDonald, 2009); however, the lack of research into the appearance of the da Vinci robot suggests its appearance is less important for acceptance for use in surgery, although more research is needed to support this hypothesis. This could be explained by the perception of the da Vinci Robot as an industrial robot, while the aforementioned robots in healthcare, can be viewed more as social robots who are used in a private and domestic atmosphere.
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Elizabeth Broadbent

Organisation University of Auckland

E-mail e.broadbent@auckland.ac.nz

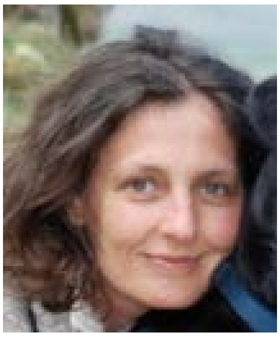
Biography Elizabeth Broadbent received her BE (Hons) in Electrical and Electronic Engineering from the University of Canterbury, and her MSc and PhD degrees in Health Psychology from the University of Auckland, New Zealand. Elizabeth is currently a Senior Lecturer in Health Psychology at the Faculty of Medical and Health Sciences, the University of Auckland. Her research interests include illness perceptions, psychoneuroimmunology, and human robot interaction, with a particular interest in emotional reactions to robots and mental models of robots. She has worked in the area of healthcare robotics and older people, looking especially at social and psychological effects.

Abstract **The social and emotional impact of robots in healthcare**

The talk will cover the design, development, and testing of healthcare robots in an aged care facility. The robots have a mixture of companion and functional healthcare roles. A series of studies conducted over the course of five years will be presented. Methods include focus groups, questionnaires, cross-sectional trials, longitudinal studies, and randomised controlled trials. Social, cognitive, and emotional factors that contribute to acceptance will be presented, as well as the effects of the robots on older people's health.

Guglielmo Tamburrini
Working Group Chair
Sessions III and IV (12 June)

Organisation	Universitá di Napoli Federico II, DIETI Electrical Engineering and Information Technologies
E-mail	tamburrini@unina.it
Biography	Guglielmo Tamburrini is Professor of philosophy of science at University of Naples “Federico II”. His research interests include methodology and epistemology of robotics, human-robot interaction, ICT and cognitive neurosciences.



Nadia Berthouze

Organisation University College London

E-mail n.berthouze@ucl.ac.uk

Biography Dr Nadia Berthouze is Associate Professor in the University College London Interaction Centre. She received her PhD in computer science from the University of Milano. From 1996 to 2000 she has been a postdoc fellow at ETL in Japan working in the area of Kansei Engineering. From 2000 to 2006, she was a lecturer in computer science at the University of Aizu in Japan. Her main area of expertise is the study of body posture/movement and touch behaviour as modalities for recognising, modulating and measuring human affective states in HCI. She has published more than 140 papers in affective computing, HCI, and pattern recognition. She was awarded the 2003 Technical Prize from the Japanese Society of Kansei Engineering and she has been invited to give a TEDxStMartin talk in 2012. She is PI on the Emo&Pain project, and Co-I on the Digital Sensoria project and on the ILHAIRE project investigating the role of affective body and touch expressions in clinical, entertainment and design contexts.

Abstract **Body Movement and touch behaviour as means to recognize and enhance affective experience**

Recent years have seen the emergence of technology that involves and requires its users to be engaged through their body. This has opened the possibility to better understand and exploit this modality to capture, respond to and regulate users' affective experience. Indeed, various studies in psychology have shown that our posture and body movement affect our emotional state, our cognitive abilities and our attitude towards the environment around us. In the first part of my talk, I will report on our studies aimed at understanding posture, body movement and touch behaviour as a means for recognizing affective states, including laughter, in whole-body games and in clinical contexts. Then, through the Digital Sensoria project, I'll discuss how tactile experience can be measured, supported and communicated to enrich the digital affective communication channels. Finally, I will report on our studies aimed at investigating how body movement qualities can be used to steer the user experience providing a principled approach to the design of multi-modal affective technology. I will conclude discussing possible implications of this work in the area of social robotics.

Marcin Skowron

Organisation Austrian Research Institute for Artificial Intelligence

E-mail marcin.skowron@gmail.com

Biography Marcin Skowron is a research scientist at the Austrian Research Institute for Artificial Intelligence (OFAI). He received an MA degree from the Gdansk University, Poland in 2000, and a PhD degree from Hokkaido University, Japan in 2005. His primary research interests are in cognitive and affective sciences, human-computer interaction and natural language processing. His recent work is focused around the EU FP7 ICT project CYBEREMOTIONS, where he leads the research related to the development and evaluation of affective human-computer interaction systems, and sentiment-oriented analysis of data on text-based human-computer and human-human online interactions.

Abstract **From Virtual to Robot Bartender: insights from the affective dialogue system**

In this talk we present an overview of a series of experiments conducted with an affective dialog system, applied as a tool for studying the role of emotions and social processes in online communication. The conducted experiments demonstrate its capability to conduct realistic and enjoyable dialogs comparable to communication with a human and to establish an emotional connection with users in short interactions. The users' ratings of the system and the influence of interactions with it on users' self-reported emotional states conformed with the applied affective profile, i.e.: positive, negative and neutral. The analyses of interaction patterns demonstrated an ability to realize fine-grained communication scenarios such as social sharing of emotions and to simulate the social exclusion interaction scenario in a triadic (1+2) setup. The studies provide also insights on the differences between the reception of human and artificial communication partners in the online chatting environments. Based on these findings we propose to extend the scope of experiments to different context, including human-robot interaction scenarios.

Anna Esposito

Organisation Second University of Naples, Department of Psychology and International Institute for Advanced Scientific Studies (IIASS)

E-mail iiass.annaesp@tin.it

Biography Anna Esposito is currently Associate Professor in Computer Science at the Department of Psychology, Second University of Naples and Senior Researcher at the IIASS, in Vietri sul Mare, Salerno, IT. She has been research professor in the Department of Computer Science and Engineering at Wright State University, to which she is currently research affiliate. Anna current research interests are on the perceptual features of verbal and nonverbal communicative signals, in particular on cross-modal analysis of speech, gesture, and expressions of emotions. Further research interests are on language disorders, timing in language, signal processing and models and applications of neural networks. She is author of more than 130 publications on international journals, books, and international conference proceedings, and editor of 18 international books.

Abstract **Emotional expressions: Communicative displays or psychological universals?**

Emotional feelings permeate our everyday experience, consciously or unconsciously driving our daily activities and constraining our perception, actions and reactions. In the daily body-to-body interaction, our ability to decode emotional expressions plays a vital role in creating social linkages, producing cultural exchanges, influencing relationships and communicating meanings. In this context, emotional information is simultaneously transmitted through verbal (the semantic content of a message) and nonverbal (facial expressions, vocal expressions, gestures, paralinguistic information) communicative tools and relations and exchanges are highly affected by the way this information is coded/decoded by/from the addresser/addressee as well as by the contextual instance and the environmental conditions. Research devoted to the understanding of the perceptual and cognitive processes involved in the decoding of emotional states during interactional exchanges is particularly relevant both for build up and harden human relationships and for developing friendly and emotionally coloured assistive technologies. The accuracy above the chance to decode emotional expressions from faces, speech and gestures suggested the idea of universal psychological. However this idea has been debated by several authors according to whom our expressions are social messages dependent upon context and personal motives and highly affected by the character and direction the ongoing social interaction is taking. Therefore expressions of emotions are learned to efficiently and effectively express intentions and negotiate relations and thus they vary across cultures. This hypothesis was further supported by the fact that sophisticated measurements, such as facial EMGs (Electromyography) to asses facial

muscle changes when emotional information was not visually perceptible proved that distinction among primary emotions and more generally, among negative and positive emotions was not possible. Recent theoretical models have attempted to account for both universality and cultural variations by specifying which particular emotional aspects show similarities and differences across cultural boundaries. A prevalent view states that emotional expressions are triggered by emotionally underlying events even though expressions are, to some degree, shaped by contextual factors and cultural and personal display rules, such as social rules and individual emotion regulation strategies. This view was challenged by data showing a very loosely coupling of facial expressions to emotion specific-event or appraisals. These open questions are discussed at the light of experimental data obtained from subjects speaking different languages. Research devoted to the understanding of the perceptual and cognitive processes involved in the decoding of emotional states during interactional exchanges is particularly relevant in the field of Human-Human, Human-Computer Interaction and Robotics both for build up and harden human relationships and for developing friendly, emotionally and socially believable assistive technologies.

Kristrún Gunnarsdóttir

Organisation Lancaster University

E-mail k.gunnarsdottir@lancaster.ac.uk

Abstract **Robot assistance: prominent visions and problem domains**

This contribution will address dominant visions of assistive capabilities and societal needs, drawing on recent developments in the field. It will highlight prevailing tensions between visions of increasing device autonomy in ordinary situations and progressions towards more intimate human-machine interaction for assistive purposes.

Davide Fornari

Organisation SUPSI University of Applied Sciences and Arts of Southern Switzerland

E-mail davide.fornari@supsi.ch

Biography Davide Fornari holds a PhD in Design sciences from University Iuav of Venice and is a tenured teacher researcher at the Laboratory of visual culture of SUPSI University in Lugano, where he teaches Interaction design and History of graphic design. In 2011 he edited the Italian translation of Heinrich Wölfflin's "Prolegomena to a Psychology of Architecture" and the collection of essays "Estetiche del camouflage". In 2012 he authored the essay on humanoid artefacts "Il volto come interfaccia". He is the coordinator of the research project "Mobile A2K: Culture and Safety in Africa" on the impact of public art on urban security in three African cities (Douala, Johannesburg, Luanda), financed by the Swiss Network for International Studies.

Abstract **Face as interface: anthropomorphic and zoomorphic artefacts**

My aim is to define a remit of interest for design and designers in the field of products and services employing human and animal face as an interface with users. For my Ph.D. thesis I have worked on the issue of humanoid artefacts from the point of view of design culture: both product design and visual communication. The use of face as interface in human-computer interaction adds analogic content to interaction processes in an unmediated and unobtrusive way, transferring human-computer interaction to the field of interpersonal communication. Nevertheless the field of anthropo- and zoomorphic artefacts is generally neglected by designers and rather controlled by engineers and experimental psychologists. In normal practice, engineers design these interfaces, and psychologists assess their usability and social acceptability through a range of experiments. Starting from a definition and taxonomy of humanoid artefacts (bi- or three-dimensional, static or dynamic, perceptual or artifactual), my aim is to describe the paradigm of human-computer interaction with humanoid artefacts, whose specificity is connected with human perceptual and cognitive processes and the pragmatic of human communication. More specifically, the history of technology and applied arts offers a number of proofs for the use of human and animal shapes as means for transferring cutting edge technological solutions to the domestic domain, due to the simplicity of interaction between users and human-like or animal-like devices. Through an analysis of case studies ranging through different typologies of artifacts (e.g. Ikea's Anna, Modulus, Ifbot), I intend to highlight several criteria for the evaluation of humanoid artefacts from the point of view of a designer. These factors encompass a discussion of the Uncanny valley hypothesis, facial prominence, and the Japanese concept of sonzai-kan. Roger Caillois' camouflage paradigm together with his study on robots offer a three-way approach to humanoid artefacts that can guide designers in their approach to such a complex field.

Takaaki Kuratate

Organisation Institute for Cognitive Systems, TU München

E-mail kuratate@tum.de

Biography Takaaki Kuratate received a Ph.D. in Information Science from the Nara Institute of Science and Technology, Japan in 2004. He worked at the TOSHIBA R&D Center, Japan (‘91-‘00), and the Advanced Telecommunication Research Institute (ATR), Japan (‘97-‘06) as a researcher working on topics in computer graphics, speech & image processing, and computer vision, with his primary emphasis on auditory-visual speech processing, and 3D face analysis and synthesis. He was a postdoctoral research fellow at MARCS Auditory Laboratories, Univ. of Western Sydney, Australia (‘06-‘09) where he developed a text-to-auditory visual speech system based on extended face database research from ATR. Since 2010, he is working as a senior researcher at the Institute for Cognitive Systems, Technical University Munich, where he heads development of the Mask-bot platform. His research explores topics in building machines able to communicate naturally with people, and includes both graphical and robotic solutions.

Abstract **Mask-bot: a retro-projected talking head for social interaction media applications**

At the Institute for Cognitive Systems, Technical University Munich (www.ics.ei.tum.de), various research themes are being actively studied to provide robots with the capacity to understand human behaviors and to communicate and interact with people via multiple cognitive channels. We explore face-to-face communication, artificial skins, biologically-inspired systems (vision, biped walking), autonomous manipulations of robot bodies, semantic reasoning of human motions, skill acquisition, affective brain-computer interfaces and brain-compatible robotics. Some of this research requires unique devices and equipment, inspiring us to develop our own hardware and software solutions such as multi-modal tactile sensors and high-performance electro-hydraulic actuator. Mask-bot [1], a retro-projected talking head animation system, is one of the systems developed to study communication possibilities between people and robots. It’s hardware consists of a small LED projector equipped with a fisheye lens and a macro adapter, and a 3D face screen. Carefully calibrated facial animation is projected onto the 3D face screen, resulting in realistic 3D heads (web.ics.ei.tum.de/~kura/maskbot.html). An additional pan-tilt unit improves the positive impression even using only an approximation of actual human head motion. Mask-bot was inspired by "Singing Busts", one of the classic attractions displayed at the Haunted Mansion in Disneyland, which used a statue as a screen and projected an actor’s singing face image from the front to make the statue look ghostly and alive. Following these singing busts, various engineering solutions were proposed [2,3,4], beginning with MIT’s Talking Head Projection in 1980. Most of these attempts project non-

realistic computer graphics characters or very simple cartoonish faces. In contrast, our Mask-bot can present both abstract or realistic faces grounded in 3D facial animation and 3D face analysis and synthesis research. We use large 3D face databases to select individual faces, or to create a new 3D model starting from photographs, or from a single image captured from a web cam [5]. The current Mask-bot system is connected to an OpenHRI-based speech communication interface [6], so we can incorporate simple conversation tasks based on keywords recognition in English, Japanese and German. The newer Mask-bot version 2i can replace its mask screen easily, and can interact with users using built-in microphones and a USB camera [7]. Furthermore, our own 3 degree-of-freedom (DOF) head platform will yield more expressive head motion compared to the original off-the-shelf 2DOF pan-tilt unit. We are also developing a desktop version (life size and half size: which can be easily mountable on smaller humanoids), and various 3D mask screens for personalized and averaged faces using the 3D face database. Of course, mechanical robotic faces covered with skin-like material can present the most realistic appearance to users. However, because their appearance is fixed, re-design based on new information is costly. Developers must rebuild not only the mechanically sophisticated structures, but also replace the flexible skin, which requires extra care around lip and eye corners. In contrast, retro-projected systems like Mask-bot stand out for their flexibility: they are able to present a variety of faces varying in both realism and individual appearance, which means the face can easily change to fit the application or the user preference. Additionally, their communication abilities have the capacity to express nuanced, subtle gestures often missing from many of today's mechanical robot faces, and they can easily and iteratively improve the underlying software display algorithms as better methods are uncovered. Lastly, the systems are generally lighter and less complicated than their mechanical counterparts, being comprised of just a small projector, optics and a face screen, with the face screen yielding a better 3D presence than flat screens. Along with these advantages come the same disadvantages of standard data projectors: they are difficult to see in strong illumination conditions, including daylight. There is the possibility of perceptual mismatch caused when the face is animated, but the mask is stationary. Because of these aspects, retro-projected heads need to be evaluated for general aspects such as likability to gain a better understanding of how they are perceived by people during interactions. Despite these limitations, retro-projected systems provide flexible platforms for a myriad of applications involving face-to-face encounters, including communication studies, video conference interfaces, and various human-robot applications. Thus far we emphasize the study of Mask-bot’s face-to-face applications. With it, we can provide various controlled behaviour studies. Furthermore, if we can adapt a promising dialogue management system, a robust speech recognition system and an expressive text-to-speech system (for expressing emotional speech, non-verbal speech cues, realistic breathing pauses and noise), Mask-bot can be used for realistic interactive communication studies and applications, in part to ascertain if the system is robust enough to become a talking companions for elders, or a teaching assistant for children, for example. We believe that Mask-bot and similar retro-projected face technologies can be one of the important, effective solutions for human-robot and human-computer interfaces: low cost, low maintenance, changeable face animation, and replaceable 3D mask screens can be used for personalized face output. Their appearance in physical space is more compelling than face animation on a flat screen, or on a 3D TV requiring special glasses.

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Carl Vogel

Organisation Trinity College Dublin

E-mail vogel@tcd.ie

Biography Vogel is a Fellow of Trinity College Dublin, Director of the Centre for Computing and Language Studies, and Director of Research for the School of Computer Science and Statistics at TCD. Linguistic anomaly is the theme which unifies the various strands of his research. Published works address synchronic analyses of natural language syntax and semantics and also aspects of linguistic innovation such as through creative metaphorical language and non-standard syntax which lead to diachronic effects, beginning with uptake in dialogue. He has published on models and simulations of natural language evolution and language change, as well as works on idiolects. His basic research in text classification and machine learning has been funded by Science Foundation Ireland. Applications have proven useful in forensic, medical, political and literary analysis. Intellectual property in document translation quality analysis is protected by patent application with the European Patent Office.

Abstract **Intending no offence**

Acceptance of robotics into everyday life will depend a great deal on their sensitivity to social signals and their own deployment of social signals in ways appropriate to pragmatic contexts. This promises to re-invigorate research into the pragmatics of social signals and the theory of linguistic politeness. Recent research into linguistic politeness and politeness theory has argued for a reinterpretation of the classical model of politeness which depends heavily on a metaphor of performance. In one new model of politeness theory, the theory of face preservation is replaced by offence management. Conceptually, a maxim of interaction along the lines of "Minimize offence" is more simple than attending to the needs of interlocutors' "positive face" and "negative face". With focus on offence management, it may be easier to drive robot strategies in deployment of social signals and forms of linguistic politeness. Therefore, a research program on assessing the flow and consequences of social signals in communicative interaction is sketched in relation to robotics.

Etienne Burdet

Organisation Imperial College London

E-mail e.burdet@imperial.ac.uk

Biography Dr. Etienne Burdet is Professor of Human Robotics at Imperial College, and visiting Professor at Université Paris VI. He has obtained a M.S. in Mathematics in 1990, a M.S. in Physics in 1991, and a Ph.D. in Robotics in 1996, all from ETH-Zurich. He was a postdoctoral fellow with TE Milner (McGill, Canada), JE Colgate (Northwestern U, USA). Dr. Burdet is doing research at the interface of robotics and bioengineering, and his main interest in human machine interaction. With his group, he uses an integrative approach of neuroscience and robotics, to i) investigate human motor control, and ii) design efficient assistive devices and virtual reality based training systems for neuro-rehabilitation and robot-aided surgery.

Abstract **Adaptive nature of human-human interaction**

‘Practice makes perfect’ is the fundamental principle guiding nearly all physical training activities, from sports to dancing and playing of musical instruments. However, this principle is challenged by our results, which demonstrate that it is in fact practice together that makes perfect. Using a novel dual robotic system, we could analyse the effect of unconscious physical interaction on two individuals practicing a new motor task. The results were surprising but very consistent. First, subjects who were connected to a partner while practicing a motor task performed significantly better than subjects who practiced the task alone for the same time. Second, the improvement was most prominent when the partners were similar, such that interaction with a human is more beneficial than guidance by a non-human agent, and interaction with a peer novice is more beneficial for task performance than interaction with an expert. Systematic analysis of these surprising results showed that physical connection enables humans to read their partner’s behaviour and obtain more accurate knowledge of the environment then when they work alone. We developed a computational model of this interaction and implemented it as a robot partner, which exhibited similar advantages as the interaction with a real human. These results encourage the introduction of collaborative paradigms into sports and physical rehabilitation and may lead to improved robot-assisted training.

Peter Sinčák

Organisation	TU Kosice, Slovakia
E-mail	peter.sincak@tuke.sk

Valèria Csèpe
Working Group Chair
Sessions V (13 June)

Organisation Hungarian Academy of Sciences

E-mail csepe.valeria@titkarsag.mta.hu

Biography Valéria Csépe is distinguished professor of the Institute of Cognitive Neuroscience and Psychology at the RCNS HAS. In 1990-92 she worked as Humboldt scholar at the University of Münster. Her recent research interest includes the neural processing of acoustic patterns and that of spatial information (real and virtual environment). She is d She has more than 200 publications in English and Hungarian. She is member of many national and international scientific organizations, and editorial boards of scientific journals. Since 2012 she is member of the ICSU CSPR. She has been decorated with different awards for outstanding scientific achievement. She is corresponding member of the Hungarian Academy of Sciences. She was elected in 2008 and in 2011 for a second term as deputy secretary general becoming the first female chief executive officer of HAS.

Abstract **Augmented reality and assisted perception**

Augmented reality and assisted perception Valéria Csépe, Ágoston Török and Ferenc Honbolygó Institute of Cognitive Neuroscience and Psychology, Research Centre of Natural Sciences of the Hungarian Academy of Sciences csepe.valeria@ttk.mta.hu Augmented Reality (AR) is a broadly used expression for the creation of environment of real word view (RWV) based on digital information. As a consequence of intensive technological development, AR moved from the tracking toolkits' area of context-aware methods to new approaches in human-computer interactions. Although AR evoked a particular attention of engeneering, the knowledge of disciplines on human behavior and the cognitive architecture changing from childhood to the end of adulthood characterised by modified profiles is still not well represented in planning and designing the new methods and devices. However, if an application of the AR broader than the one used nowdays in the areas of entertainment, travel, advertisment and social communication is expected , developers have to take into account the knowledge accumulated in a multidisciplinary area called cognitive sciences that emerged decades ago and growing rapidly in recent years. Withi the broad field of cognitive siences psychology has a crucial role in having question, irrespectively the technology - AR or VR (virtual reality) the latter with less varied media representation – about the cognitive profile including perception influencing the human behavior in AR or VR. Moreover, there is acricial question arising recently that is the assumed similarity of the reality and its virtual counterpart as the platform of cognitive processes influencing and mediating the human behavior. As the human factors are very often the part of the evaluation only, it's time to draw the developers' attention to the importance the human cognitive system investigated with methods of the cognitive psychology,

linguistics, neuroscience and involve the state of the art knowledge of the cognitive infocommunication in the research and technological development. The first trials have already been made, especially what concerns the visual modality including the investigation of visual augmentation. A very recent focus of the developers is the 3D space as well as the online operations done by human participants in VR environments. It is more than clear for many developers, that not only the visual spatial perception should be taken into account when designing 3D applications especially what concerns animations resembling the real environment. Spatial cognition is more than just visual, the processing of acoustic space including spatial characteristics of speech is processed by the human brain in integration with the visual one and this should be taken into account. During the last 2-3 years cognitive psychology and neuroscience started to focus on measuring online the human spatial cognition in VR. There are not too many data at the moment, although one can expect a data explosion soon due to to the rapid development of high tech devices . On the same time we better keep in mind that cognitive psychology and infocommunication can break through a field barrier with combining VR and experimental cognitive psychology. Our research group in collaboration with a research group of the Aix-Marseille Université, CNRS (VISIONAIR 262044 project) investigated the audio source localization ability by measuring the participants' performance in multimodal situations (Török et al, submitted). The experiments' main objective was to study how surround systems may support the visualization and creation of near-realistic perceptual situations. The participants had to localise sound sources occurring synchronously with vertically displaced visual distractors. The results showed how the visual distractor position affected the subjects' localization judgements, especially in case of sounds presented centrally. In a further experiment sounds and visual distractors with horizontal offsets were presented in order to see how the visual distractors affected the sound localization for sounds presented in the center. Our results highlight the importance of visual capture and multimodal stimulation to prevent perceptual changes caused by imperfection of sound source modelling.

Angelo Cangelosi

Organisation Plymouth University

E-mail acangelosi@plymouth.ac.uk

Biography Angelo Cangelosi is Professor of Artificial Intelligence and Cognition and the Director of the Centre for Robotics and Neural Systems at Plymouth University (UK). Cangelosi's main research expertise is on language and cognitive modelling in humanoid robots, on language evolution in multi-agent systems, and the application of bio-inspired techniques to robot control (e.g. swarm of UAVs). He is the coordinator of the Marie Curie ITN "RobotDoC: Robotics for Development of Cognition" (2009-2013) and the UK EPSRC project “BABEL: Bio-inspired Architecture for Brain Embodied Language” (2012-2016), and of the FP7 project "ITALK” completed in 2012. Cangelosi has produced more than 200 scientific publications, is Editor-in-Chief of the journal Interaction Studies, and has chaired numerous workshops and conferences including the IEEE ICDL-EpiRob 2011 Conference (Frankfurt, August 2011). In 2012 he was nominated Chair of the International IEEE Technical Committee on Autonomous Mental Development.

Abstract **Embodied Language Learning in Human-Robot Interaction**

Growing theoretical and experimental research on action and language processing and on number learning and space representation clearly demonstrates the role of social interaction and embodiment in cognition. These studies have important implications for the design of communication and linguistic capabilities in social robotics, and have led to the new interdisciplinary approach of Cognitive Developmental Robotics. In the European FP7 project “ITALK” (www.italkproject.org) and the Marie Curie ITN “RobotDoC” (www.robotdoc.org) we follow this integrated view of action and language to develop cognitive capabilities in the humanoid robot iCub. During the talk we will present ongoing results from iCub experiments on embodiment biases in early word acquisition studies, word order cues for lexical development and number and space interaction effects.

Agnieszka Wykowska

Organisation Ludwig Maximilians Universität, Munich

E-mail agnieszka.wykowska@psy.lmu.de

Biography I am a postdoc researcher/lecturer at the Department of Psychology, Ludwig-Maximilians-Universität (LMU), Munich, Germany. I obtained my PhD in Psychology from the LMU in 2008. My background is cognitive neuroscience (M.Sc. in Neuro-cognitive Psychology) and philosophy (M.A. in Philosophy). Since 2006, I have been employed in the Department of Psychology, LMU, being involved in a Cluster of Excellence CoTeSys (Cognition for Technical Systems) – an interdisciplinary project aiming at developing robots with cognitive capabilities. I have worked in projects “Cognitive models for everyday manipulation tasks”; “Action control” as well as “Improving human-robot interaction by modeling human gaze control in social situations”. My research interests are visual attention and perception, action-perception links, action planning, social attention and joint action; as well as human-human and human-robot interaction. In my research, I use psychophysics and the EEG/ERP methodology.

Abstract **Cognitive- and social neuroscience for social robotics - how the present challenges can tell us where to go in the future**

Since social robotics is an enterprise that in its essence is highly interdisciplinary, it needs to meet the great challenge of proper communication and dialogue between various disciplines, as well as the quest for a true interdisciplinary research - that only as such can contribute to the design of actual social robots. This is a particular challenge, since the disciplines involved in the enterprise have often very different aims and approaches, address incomparable questions and employ discrepant methodologies. In my talk I will address critical issues that make truly interdisciplinary work difficult and I will give examples from the areas of social cognitive neuroscience and engineering which illustrate the variety and incommensurability of questions and aims on the one hand, and importance of informed interdisciplinary joint approach on the other. The particular examples that I will provide will cover: (i) robots developed for children diagnosed with autism; (ii) robotic platforms designed for remote communication; (iii) social robots with human-like gaze behavior. I will describe the questions that have been posed by cognitive neuroscience in the context of such robotic platforms and the aims that have been set by engineers. Hence, through focus on these examples, I will discuss the difference in approaches, questions and aims of cognitive/social neuroscientists on the one hand and roboticists on the other. I will focus on the following dichotomies: explanation and fundamental research vs. practice and applied research; controlled experiments vs. ecological validity; and quantitative vs. qualitative research. I will also address various methodological standards, especially in the context of publishing research. The talk will

therefore aim at providing an outline of theoretical, methodological and practical consequences of different approaches of various disciplines involved in social robotics; and how this factor challenges the true interdisciplinarity. Ultimately, I will sketch possible remedies that could be developed for the current challenges and difficulties – both theoretical and practical – that arise in the endeavors of social robotics.

Karola Pitsch

Organisation Bielefeld University

E-mail karola.pitsch@uni-bielefeld.de

Biography Karola Pitsch heads the research group “Interactional Linguistics & Human-Robot-Interaction” at Bielefeld University (CITEC), Germany. She received her PhD in Linguistics from Bielefeld University (2006) and has held positions as postdoctoral researcher in EU-projects at King’s College London, UK (2005-2008) and the Research Institute for Cognition and Robotics, Bielefeld University (2008-2011). In 2011, Karola became a Dilthey Fellow (Volkswagen Foundation) and is Principal Investigator of projects within the CRC 673 ’Alignment in Communication’ and the CITEC. Her research focuses on Multimodal Communication in everyday, professional and technologically mediated settings. She investigates the practices by which participants coordinate and organize their courses of action. She uses insights from interactional research to inform the design and modeling of Human-Robot-Interaction (Social Learning, Multimodal Dialog), and explores how users perceive and coconstruct a robot’s skills.

Abstract **Social Learning from an interactional perspective: The role of a robot’s feedback in tutoring situations in human-robot-interaction**

If at some point robotic systems (and other autonomous technologies) were to be deployed in everyday life situations, they would need to be equipped with a means for flexible adaptation to new situations and tasks. In this context, researchers strive to develop mechanisms that make it possible for lay users to teach a system new behaviors by way of ordinary language and interaction. Within this “Social Learning” paradigm, tutoring and imitation scenarios play an important role: a human tutor presents and explains a task to a robot, who is then supposed to observe the human, understand the action and, in turn, attempt to reproduce it (Breazeal & Scassellati 2002; Steels & Kaplan 2002; Wrede et al. 2008; Cangelosi et al. 2010). As such, beyond sophisticated online learning algorithms, success also depends on the quality and nature of the tutor’s presentation. While one line of research focuses on advancing methods for detecting and analyzing the tutor’s performance, we suggest the importance to further explore the ways in which the robot could best exploit the interaction with a human tutor. In this talk, we propose an interdisciplinary research approach starting from the participants’ ‘mutual monitoring’ and ‘online analysis’ (Mondada 2006) in human social interaction to investigate their effects in human-robot-interaction. This contrasts with current studies on human-robot-interaction, in which the tutor is e.g. confronted with a static image of the robot to which he should present some action (Herberg et al. 2008), or where, if a dialogic perspective is taken, the robot exhibits positive/negative statements after the tutor has finished the presentation (Alissandrakis et al 2011). In a first study, investigating tutoring in adult-

child-interaction we have revealed that the tutor's hand motions during his action presentation are co-produced by the infant-observer's shifting gaze (Pitsch et al 2009). Based on this, we suggest that a robot - when using adequate online feedback strategies - has at its disposal an important resource with which it could pro-actively shape the tutor's presentation and help generate the input from which it would benefit most (Pitsch et al. 2009). Then, we conducted two HRI studies with a robot system using different gaze strategies while the tutor was presenting an action. They revealed that (1) a robot's gaze conduct indeed influences the shape of the tutor's emerging manual action (Pitsch et al., in press) and (2) leads to systematically different verbal formulation strategies of the tutor explaining an action (Pitsch et al. 2012). These results advance our understanding of robotic 'Social Learning' in that they suggest to consider human and robot as one interactional learning system.

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