

A Workshop/Tutorial proposal for the  
IEEE International Symposium on Robot and Human Interactive  
Communication (IEEE RO-MAN 2016)

New York, USA, August 26-31, 2016.

**Title**

*Cognitive Neuroscience Methods in Human-Robot Interaction*

**Format**

*Workshop, full day*

**Main organiser**

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**Abstract**

*Neuroscience methods such as brain imaging are increasingly used to address research questions in robotics, robot-human communication and interaction. We (Dr Burcu A. Urgan, Dr Ayşe P. Saygin, Dr Emily S. Cross) propose a workshop to provide an overview of state-of-the-art work at the intersection of human-robot interaction and human neuroscience, to show how cross-disciplinary collaboration can be a win-win, and to help increase communication between researchers from different yet complementary disciplines, with the hope of catalyzing new ideas and collaborations. Neuroscientists with expertise in several topics of interest for RO-MAN 2016 (e.g., embodiment, empathy, social cognition, body movements, gestures, facial expressions, anthropomorphism, learning and imitation, social presence, inference of human states, machine learning and brain-machine interfaces) will introduce the methods used, and present empirical work exemplifying their application to robotics, highlighting not only how such studies have led to insights on*

*neural mechanisms of interaction, communication, and collaboration, but also how the findings inform the design and development of new robots, robot-human collaborative systems, interaction modalities and interfaces. We will solicit papers from the broader community that address these themes. Robotics and neuroscience both being active, rapidly developing, and high priority research areas, and the combination of expertise across disciplines holding great promise for advances in both theory and applications, the workshop will serve an important role by bringing together researchers coming from different backgrounds. Panel sessions will address challenges for interdisciplinary and novel research and discuss ideas for increasing synergy and impact future work.*

### **Statement of objectives – intended audience**

*Cognitive neuroscience methods such as brain imaging have been increasingly used in human-robot interaction (HRI) in recent years. This workshop aims to address challenges of interdisciplinary research that takes place at the intersection between HRI and cognitive neuroscience, and improve communication between HRI researchers who are new to neuroimaging and human neuroscience approaches, and cognitive neuroscientists who use neuroimaging methods to address questions in HRI, but are not as familiar with the priorities and concerns of the HRI field. To this end, the workshop will introduce neuroimaging methods to HRI researchers who are new to these methods in tutorial format and highlight exemplar studies that use these methods to advance our understanding of HRIs. The workshop concludes with a multi-part panel discussion in which interdisciplinary challenges of the field, peer-review process, and future directions will be explored with all participants of the workshop.*

### **List of speakers**

*The workshop will consist of talks by Ayse P. Saygin, Emily Cross, James Thompson, Thierry Chaminade, and Susanne Quadflieg who have been leaders in interdisciplinary work between cognitive neuroscience and robotics, as well as empirical papers (full papers for oral presentation), and a panel discussion. The empirical papers will include applications of various neuroimaging methods such as functional magnetic resonance imaging (fMRI), electroencephalography and magnetoencephalography (EEG/MEG), and transcranial magnetic stimulation (TMS) in HRI. The invited morning speakers will be asked to form their talks in two parts: a short tutorial of the specific neuroimaging method they use, and the actual empirical study or studies that use the method. The afternoon speakers will be selected from submissions to Call for Papers. The panel will consist of several parts in which experts in the field will discuss challenges of interdisciplinary nature of HRI, peer-review process of neuroimaging papers in HRI and tips about neuroimaging, and future directions.*

*Below is a tentative schedule:*

#### **Morning Session**

*9:00-9:15 - Opening remarks/Introduction*

*9:15-10:00 – Keynote*

*10:00-10:15 - Coffee break*

10:15-11:05 – Speaker 1 (fMRI)  
11:05-11:25 – Speaker 2 (EEG)  
11:25-11:45 – Speaker 3 (TMS)  
11:45-13:00 - Lunch

**Afternoon Session**

13:00 – 13:45 – Keynote  
13:45 – 14:00 – Coffee break  
14:00-14:20 – Speaker 4  
14:20-14:40 – Speaker 5  
14:40-15:00 – Speaker 6  
15:00-15:30 – Coffee break  
15:30-17:00 - Panels: *Interdisciplinary research between HRI and Cognitive Neuroscience*  
15:00 – 15:30 - Part 1 – *Challenges of interdisciplinary research*  
15:30 – 15:40 - Break  
15:40 – 16:10 – Part 2 – *Peer-review process and tips about neuroimaging for HRI researchers*  
16:10 – 16:20 – Break  
16:20 – 16:50 – Part 3 - *Review Process*  
16:50 – 17:00 – *Closing remarks*

**Plan for documenting the workshop:**

Upon conclusion of the workshop, we will propose a theme issue on the convergence of human neuroscience, social cognition and robotics to Philosophical Transactions of the Royal Society B. At over 350 years old, Philosophical Transactions of the Royal Society B is the world's first science journal, and previous authors include icons such as Charles Darwin, Alexander Fleming, James Watson and Francis Crick and Dorothy Hodgkin. The current impact factor of the journal is 6.314. This journal only commissions theme issues that are deeply interdisciplinary in nature, and our special issue will fill a unique gap in the literature by bringing together contributions from roboticists and neuroscientists that explore how these disciplines might best inform and advance one another.

*Our theme issue proposal will include 12-15 papers featuring empirical work, reviews and opinion pieces based on the contributions from the workshop. Depending on the number and quality of submissions to the workshop, we will reserve the option of soliciting additional contributions from leaders working at the intersection between robotics and neuroscience, in order to maximize the impact and scope of the theme issue.*

*One of the organizers (E. Cross) has first-hand experience proposing and editing a theme issue at Philosophical Transactions of the Royal Society B, thus placing the organizers in a strong position for navigating the competitive process for getting the theme issue proposal accepted.*

*Crucially, by publishing the rich content, debates and opinions raised at this workshop in such a preeminent outlet, this will maximize the impact and reach of research seeking to bring together cognitive neuroscience and human-robot interaction.*

## **List of topics**

*We plan to accept submissions based on how informative neuroimaging has been to address questions in HRI. We plan to include all possible neuroimaging methods available for HRI: fMRI, EEG/MEG, and TMS.*

**Keywords:** *cognitive neuroscience, neuroimaging, human-robot interaction, fMRI, EEG, TMS*