Andrea Chiba
Department of Cognitive Science, University of California, San Diego
Title: Touch for Attention's Sake
Abstract: Orienting attention to relevant events is an important feature of sociality. The cadence and pressure of touch can signal the importance of an event as well as the relative urgency. The subcortical pathways mediating touch converge in multi-modal cortical areas, justifying a means by which touch can integrate with other sensory domains to realize fluid attention to shared events.

William Harwin
School of Systems Engineering, University of Reading
Title: How robots and humans control contact force and why might this be important in healthcare
Abstract: Humans are able to control the force of contact remarkably well. We can adjust our impedance and adapt our movements to meet the demands of the task. This is despite the fact that we have a relatively slow system in control systems terms. Partial understanding of our interactions with the world has allowed us to engineer haptic interfaces - in effect a robot - able to mimic reach and grasp tasks, as well as find applications in areas such as skills training and advanced computer interfaces. However we have not been able to engineer robots to achieve stable contact forces so as to perform simple tasks in unstructured environments, much less learn to adjust these forces as appropriate for the task. It appears that one key element missing (in most robots) is the ability to predict an interaction, anticipate the consequences and hence learn to adapt. In an effort to gain some insight into this oversight we are considering some structures that could be applied to robots to investigate these processes.

Guy Hoffman
Sibley School of Mechanical and Aerospace Engineering, Cornell University
Title: Robot Emotion Expression Through Material and Material Changes
Abstract: The advent of soft robotics and computational materials offers a new way for social robots to express internal and affective states. In the past, robot used mainly rotational and prismatic degrees of freedom for emotional expressions. How can new actuation technologies, such as shape-memory alloys, pneumatics, and 4D printed structures contribute to new feedback methods and interaction paradigms. Can we integrate traditional materials, such as wood, metals and ceramics to support the robot's expressive capacity?

Deborah Forster
Qualcomm Institute, University of California, San Diego
Title: Perceptual Primitives in a Kid-Friendly Robot. The Case History of RUBI-PAL
Abstract: TBA

Ting-Shuo Chou and Jeffrey L. Krichmar
Department of Cognitive Sciences, Department of Computer Science, University of California, Irvine

Title: A Socially Assistive Robot That Interacts With People Through Tactile And Bi-Directional Learning

Abstract: Autism Spectrum Disorder (ASD) and Attention-Deficit Hyperactivity Disorder (ADHD) are common neuropsychiatric developmental disorders. According to the Center for Disease Control, ASD affects 1 in 68 children. ADHD is estimated to affect between 3% and 11% of children and adolescents. In addition to other symptoms, children with ADHD and ASD show a disturbance in sensory processing and integration of tactile stimulus. Sensory integration therapy (SIT) has been used to address hypo- or hyper-responsiveness to sensory input found in ASD and ADHD by using child-directed, one-on-one play between the therapist and the child. However, SIT therapies for ASD or are labor intensive and requires caretakers, special clinics, surveys by parents, videotaping and analysis. We developed CARBO (CAretakerRoBOt), a self-contained Socially Assistive Robot (SAR) that focuses on the sense of touch, to automate SIT and interactive therapy. CARBO's tactile sensing is achieved by employing inexpensive trackballs, which are typically found in cellphones and other devices, in a matrix covering a large curved surface. These trackballs signal the direction and velocity of tactile stimulus. The robot's surface also has the capability to signal or communicate by displaying animated colorful patterns formed by LEDs co-located with trackballs. Many measurements that a clinician might be interested in, such as frequency of interaction, rate of learning, and the type of interaction can be saved on-board the robot for later analysis. We have built a suite of co-robotic interactive games, in which the robot learns a pattern of interaction with the child, and the child learns how to best interact with the robot. In pilot studies we have demonstrated that CARBO is engaging for children with ASD and ADHD, and is able to collect important diagnostic measurements. Over the long-term, we expect the co-robotic interaction will transfer to interaction with people, and lead to behavioral improvements in children with ASD or ADHD.

Francis McGlone
Neuroscience, School of Natural Sciences & Psychology, Liverpool JM University, UK.
Title: Sensing Touch & Feeling Touch: Two States – Two Systems
Abstract: It is now known that some skin nerves send 'feel good' signals to the brain when activated by gentle stroking touch, and that this kind of touch plays an important role is all manner of social communication. Research into the sense of touch - the first of our senses to come 'on-line' in the developing foetus - has traditionally focussed on the fingertips, which have been described, in an analogy with vision, as the 'fovea' of this sensory modality. We therefore have a reasonably good understanding of the specialised mechanoreceptors in the fingers that code for touch, and how their exquisite sensitivity enables us to detect the microscopic physical surface properties of handled objects, such as their roughness or softness as well as more global properties such as shape and object identity – haptic qualities. Information from these receptors is conveyed to discriminative somatosensory areas of the brain by fast-conducting nerve fibres, enabling this information to be processed in 'real-time' – an important factor when handling objects or tools. However, touch has another dimension beyond the purely discriminative that we are all familiar with such as that feeling one gets when touched gently by someone – an emotional one. It is this affective property of touch that communicates the emotional quality of 'feeling', as opposed to that of simply 'sensing'.

David J. Reinkensmeyer
Mechanical and Aerospace Engineering, University of California, Irvine
Title: Interactive robotic movement training after stroke and the role of somatosensation
Abstract: Robots that physically assist patients in moving their limbs continue to be increasingly used in rehabilitation therapy after stroke, yet some studies suggest robotic assistance discourages effort and reduces motor learning. I will discuss a recent study of robot-assisted finger training protocol in which we varied the amount of robotic assistance while controlling the number, size, and exerted effort of training movements. Participants (n = 30) with a chronic stroke and moderate hemiparesis actively moved their index and middle fingers to targets to play a musical game similar to GuitarHero three hours/week for three weeks. The participants were randomized to receive high assistance (causing 82% success at hitting targets) or low assistance (55% success). Participants performed about 8,000 movements during the nine training sessions. Both groups improved significantly at the one-month follow-up on an array of functional- and-impairment based motor outcomes, on depression scores, and on self-efficacy of hand function. High assistance boosted motivation. Individuals with impaired finger proprioception at baseline did not benefit from the training. Robotic assistance enhances motivational mechanisms, and its therapeutic effectiveness appears to derive at least in part from somatosensory stimulation.

Veronica J. Santos
Mechanical and Aerospace Engineering, University of California, Los Angeles
Title: Haptic perception for physically interactive robots
Abstract: Haptic perception remains a grand challenge for artificial hands. I will present an overview of ongoing work to enhance the functionality and control of artificial hands in human-machine systems. I will touch upon our work to develop tactile sensor technologies and sensorized robot testbeds. The functionality of artificial manipulators could be enhanced by artificial "haptic intelligence" that enables identification of objects and their features via touch alone. This could be especially useful when other sensory modalities, such as vision, are unavailable. I will describe efforts to teach robots how to haptically perceive salient geometric features such as edges and fingertip-sized bumps and pits using machine learning techniques. More recently, we have used reinforcement learning to teach robots goal-based policies for a functional contour-following task: the closure of a ziplock bag. Results will be shown for Q-learning and Contextual Multi-Armed Bandit algorithms. Importantly, our approach tightly couples robot actions to the tactile and proprioceptive consequences of the actions, and selects future actions based on prior experiences, the current context, and a functional task goal. Real-time haptic perception and decision-making capabilities could be used to advance human-robot interactions, socially assistive robots, and semi-autonomous behaviors for co-robot systems.

Michael Tolley
Mechanical and Aerospace Engineering, University of California, San Diego
Title: TBA
Abstract: TBA