THE INTERNATIONAL ASSOCIATION FOR THE STUDY OF AFFECTIVE TOUCH: INAUGURAL CONGRESS

FRIDAY 20 TO SUNDAY 22 MARCH 2015

Sunday – the Research Presentations

11:45–13:30: **Chair: Nadia Berthouze**

Nadia Berthouze *is a Reader at 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 the Electrotechnical laboratory 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 as a modality 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 TEDx StMartin talk (2012). She is PI on the Emo & Pain project (EP/H007083/1, 2010-2014) to design affective technology to support rehabilitation in chronic pain; co-I on the Digital Sensoria project (EP/H007083/1, 2009-2012) investigating the use of biosensors to measure subjective responses to tactile experiences; co-I on the ILHAIRE project (FET-EU-FP7, 2011-2014) investigating laughter in human-avatar interaction; www.ucl.ac.uk/uclic/people/n_berthouze*

Rochelle Ackerley: ***C-tactile Afferents are Tuned to the Temperature of a Skin-Stroking Caress***

Human C-tactile (CT) afferents respond vigorously to gentle skin stroking and have gained attention for their importance in social touch. Recordings were made from single CT axons in the arm of human participants, using the technique of microneurography, during which the receptive field of the CT was stroked using a custom-made robot. Five different stroking velocities (0.3, 1, 3, 10, and 30 cm/s) at three temperatures (cool, 18°C; neutral, 32°C; warm, 42°C) were used. We show that CTs are unique among mechanoreceptive afferents: they discharged preferentially to slowly moving stimuli at a neutral (typical skin) temperature, rather than at the cooler or warmer stimulus temperatures. In contrast, myelinated hair mechanoreceptive afferents proportionally increased their firing frequency with stroking velocity and showed no temperature modulation. Furthermore, the CT firing frequency correlated with hedonic ratings to the same mechano-thermal stimulus only at the neutral stimulus temperature, where the stimuli were felt as pleasant at higher firing rates. We conclude that CT afferents are tuned to respond to touch with the specific characteristics of a gentle caress delivered at typical skin temperature. This provides a peripheral mechanism for signalling pleasant skin-to-skin contact in humans, which promotes interpersonal touch and affiliative behaviour.

Rochelle Ackerley *received her PhD in Physiology from the University of Bristol in 2006, working on sensorimotor pathways. After, she spent time working at Unilever, concentrating on touch and multisensory interactions, as well as completing a post-doc at the University of Manchester. She moved to the University of Gothenburg in 2010 to use microneurography to record from single touch receptors and has produced a number of papers on the encoding and processing of affective touch.*

Elisa Burato: ***Touch in Osteopathy: an Exploration of its Role in the Clinical Setting***

Introduction: Osteopathy is a system of manual medicine, which utilizes manual techniques mainly directed at the musculoskeletal system, to induce localized and widespread physiological changes. In osteopathy, as in most other forms of manual medicine, touch plays a paramount role in the clinical setting, as it is used both in diagnosis and treatment. Despite this, its role in everyday clinical practice is largely under researched. **Methods**: We explored the experiences, attitudes and opinions of osteopaths regarding the role of touch in osteopathic patient care. Fifteen semi-structured qualitative interviews were carried out on a convenience purposeful sample of practising osteopaths involved in undergraduate and postgraduate education. An element of judgemental approach was

applied during the selection criteria to maximise a heterogeneous background amongst participants. Verbatim transcribed material was analysed using Content Analysis consistent with elements of Grounded Theory. **Results**: Six sub-themes emerged under the main theme of touch in treatment. Osteopaths believe touch plays an important role in restoring healthy physiology in the tissues as well as having an important psychological component in reassurance, placebo, proprioceptive awareness, and pain modulation. Its role in non-verbal communication is used across both diagnosis and treatment. **Discussion**: Our results are largely in line with recent literature. Concerning its role in patient care, osteopaths believe that touch and proprioception influence higher cognitive centres enhancing body awareness and embodiment. Localised changes in tissues tension promote homeostasis. Gentle and pleasant touch transduced likely via C-tactile afferents is likely to influence affective and reward centres in the brain and play a role in placebo responses. Therapeutic touch is also likely to promote the release of oxytocin and arginine vasopressin, which have analgesic properties. **Conclusions**: Touch plays a central role in the osteopathic clinical setting. From a treatment standpoint, we argue that therapeutic tactile and proprioceptive stimulation normally used in osteopathy can have an important role on the somatotopic representation of the body and in the modulation of pain. In particular, the use of gentle touch is likely to access limbic areas and its possible application during the osteopathic encounter should be developed further.

Elisa Burato, M.Ost; Dr Jorge E Esteves PhD MA BSc DO

Elisa Burato *is a practicing osteopath with over sixteen years experience in the field of manual therapy. She recently graduated from the British School of Osteopathy (BSO) where her master dissertation project, focusing on the role of touch in diagnosis and treatment, was awarded the yearly prize for research and presented to three international osteopathic conferences in Europe. Her research focus continues to be the neurophysiology of touch in manual therapy.*

Younbyoung Chae: *The Role of Body Ownership in Neurophysiological Responses to Acupuncture Stimulation*

Background: Acupuncture and its underlying mechanisms have attracted much scientific interest in the past few decades. From the perspective of neuroscience, acupuncture- induced sensation is not only coming from the bottom-up modulation of ¡®simple needling¡¯ in the somatosensory receptor, but also from the reciprocal interaction with the top-down modulation of the brain. Acupuncture stimulation increases local blood flow around the site of stimulation and induces signal changes in brain regions related to the pain matrix. The rubber hand illusion (RHI) is an experimental paradigm that manipulates important aspects of bodily self-awareness**. Objectives**: The present study combined psychophysical and neuroimaging methods and investigated the role of body ownership in the physiological effect of acupuncture on the brain and the body. The present study aimed (1) to investigate whether or not reduced body ownership using the RHI decreases local blood flow and cerebral responses to the acupuncture needle stimulation on the real hand and (2) to investigate whether or not acupuncture stimulation on the incorporated body produce similar brain responses to acupuncture stimulation on the real hand. **Methods**: During the RHI, acupuncture needle stimulation was applied to the real hand while measuring blood microcirculation with a LASER Doppler imager (Experiment 1, N=28) and concurrent brain signal changes using functional magnetic resonance imaging (fMRI; Experiment 2, N=17). After experimentally modification of body ownership, acupuncture needle stimulation was applied to LI4 acupoint on their incorporated rubber hand while brain activity was measured by fMRI (Experiment 3, N=17). Finally, an fMRI study was conducted with one upper limb amputee, investigating brain responses to acupuncture stimulation in three conditions (Experiment 4, N=1): (a) intact hand, (b) prosthetic hand, and (c) fake hand. **Results**: When the body ownership of participants was reduced by the RHI, acupuncture stimulation resulted in a significantly lower increase in local blood flow (Experiment 1), and significantly less brain activation was detected in the right insula (Experiment 2). When the rubber hand was fully incorporated into the body, acupuncture stimulation on the rubber hand resulted in DeQi sensation as well as in brain activations in the dorsolateral prefrontal cortex, insula, secondary somatosensory cortex, and visual area (MT). Insula activation was also associated with the DeQi sensation from the rubber hand (Experiment 3). A patient with unilateral arm amputation perceived greater DeQi sensation as well as brain activation in the insula and the sensorimotor cortex only when he received acupuncture stimulation in his incorporated prosthetic hand (Experiment 4**). Conclusions**: This study found changes in both local blood flow and brain responses during acupuncture needle stimulation following modification of body ownership. Psychophysical and neurophysiological responses following acupuncture in incorporated items can be influenced by enhanced bodily awareness of the specific body part through top-down modulation of the interoceptive system in the brain. Further research is necessary to ascertain whether the clinical effects of acupuncture are associated with enhanced bodily self-awareness and, if so, how strongly.

Dr. Younbyoung Chae *is an associate professor at Acupuncture and Meridian Science Research Center, Kyung Hee University, Seoul, Korea. He received his first Ph.D. in Korean Medical Science from Kyung Hee University, and his second Ph.D. in Engineering in the department of Brain cognitive engineering from Korea University. His research interests focus on the top-down modulation of acupuncture in the brain and the underlying mechanisms of acupuncture from the perspective of cognitive neuroscience. He has been leading his research team for many years on neurophysiological and psychobiological mechanisms of acupuncture effects over 60 SCI publications.*

Jan van Erp: *Mediated Social Touch: How Behavioural and Computer Science go Hand in Hand*

Touch is our primary nonverbal communication channel for conveying intimate emotions, and as such essential for our physical and emotional wellbeing. In our digital age, human social interaction is increasingly mediated. Even though there is ample evidence that mediated touch affords affective communication, current communication technology (e.g. Skype using sound and vision) still does not support touch communication. As a result mediated communication still does not provide the intense affective experience of face-to-face communication. The need for touch as a more intuitive way of mediated social communication is even further emphasized by the growing interest in the use of touching agents and robots for healthcare, teaching and telepresence applications.

At TNO and the University of Twente (both in The Netherlands) we have been studying discriminative touch and information systems for several decades. Recently we joined forces to investigate the importance of (social) touch in our daily life and to study the available evidence that affective touch can be mediated reliably between humans and between humans and (embodied) systems (including robots). We argue that affording affective touch in mediated communication will (a) intensify the perceived social presence of remote communication partners and can induce similar social responses as a real human touch, (b) enable computer systems to more effectively perceive and convey affective information, and (c) afford intuitive and affective interaction with robots and agents. Mediated affective touch may effectively promote feelings of trust and affection, which are essential in social support and nursing care, and may serve to establish bonds between humans and avatars or robots. Research topics include: • automatic understanding of social touch between humans and artifacts through automatic detection and classification using machine learning [3] • artificially generating (components of an) affective touch, such as simulations of body temperature, or vibrotactile strokes. We investigate the role of (body) temperature in mediated touch communication, and we are particularly interested in the opportunities of social thermo- regulation at distance • the use of affective touch by digital agents, for example in scenarios where digital agents and human users have to collaborate [2] • investigating inter-human mediated touch (communication at a distance) through the design, and testing of wearable interfaces [1]. We approach these topics from both behavioural-, computer- and neuroscience.

References [1] Huisman, G., Darriba Frederiks, A., Van Dijk, E., Heylen, D., Kröse, B.: The TaSST: Tactile Sleeve for Social Touch. In: Proceedings of WHC '13, IEEE (2013) 211–216 [2] Huisman, G., Kolkmeier, J., Heylen, D.: Simulated social touch in a collaborative game. In Auvray, M., Duriez, C., eds.: Haptics: Neuroscience, Devices, Modeling, and Applications. Lecture Notes in Computer Science. Springer Berlin Heidelberg (2014) 248–256 [3] Jung, M.M., Poppe, R., Poel, M., Heylen, D.K.J.: Touching the void – introducing CoST: Corpus of social touch. In: Proceedings of the 16th International Conference on Multimodal Interaction. ICMI '14, New York, NY, USA, ACM (2014) 120–127

Jan B. F. van Erp *is a senior scientist and program manager in the Department of Perceptual and Cognitive Systems at The Netherlands Organization for Applied Scientific Research TNO and full professor of tangible user interaction In the Human Media Interaction group at the University of Twente. His research focuses on advanced human-computer interaction including multimodal interaction and brain-computer interfaces. Jan holds several board and advisory functions, is on the editorial board of the Taylor and Francis journal BCI and the Frontiers journal HMI, editor of the international standard on haptic and tactile interaction and the current president of the EuroHaptics Society. He received his M.Sc. in experimental psychology from Leiden University and his Ph.D. in computer science from Utrecht University, both in The Netherlands.*

Antje Gentsch: *Social Softness Illusion – The Perceptual Experience of Active Interpersonal Touch*

Most people seem to instinctively love skin-to-skin contact. Given the unique role of affiliative touch for human wellbeing, it is surprising that most research focuses exclusively on the experience of receiving affective touch and ignores the experience of giving it. The question of what motivates and sustains the human tendency to touch others in a pro-social manner has not been addressed in the literature. Here, a set of experiments will be presented that investigated the perceptual experience arising from active touch directed to oneself versus someone else. 108 healthy women participated in pairs and were asked to perform stroking movements on each other's skin. In each trial, the active participant alternated between self-touch (applied to her own left arm) and other-touch (applied to the passive participant's left arm), and was asked to make comparative judgments on the subjective intensity of sensations experienced at the actively touching fingers. A first experiment demonstrated that participants experienced an illusory feeling of the other participant's skin as being softer and smoother than their own skin when touching the forearm. It will be referred to as the Social Softness Illusion in the following. Additional control conditions confirmed that this illusion reflects a sensory phenomenon and not a mechanism operating only at higher-cognitive levels. A second experiment revealed that the Social Softness Illusion was most pronounced in conditions in which the active participant performed the exploratory stroking movements at CT-afferent optimal speeds (between 1-10cm/s), which suggests that the subjective intensity of sensations at the active fingers when touching someone else's skin is influenced by the receiver's pleasure experience. A potential mechanism mediating these effects could be the predictive cancellation of sensations associated with self-generated action. In the field of somatosensory research, a classical and well-established phenomenon is that active self-touch is perceived as less intense and is associated with less somatosensory activation than externally generated touch. Such sensory self-attenuation might lead to the observed perceptual illusion of increased softness of someone else's skin. This hypothesis was supported by a third experiment showing that the Social Softness Illusion disappeared in conditions of reduced availability of motor control signals due to externally generated movement. Overall, our findings from this set of experiments suggest that affective touch is associated with greater sensory reward when directed to someone else versus oneself, and this may be grounded in expectations of the touch receiver's affective experience. The proposed interpretations will be discussed in the light of properties of the CT-afferent system and the somatosensory touch system more generally.

Antje Gentsch *is a psychologist and postdoctoral researcher at University College London. She completed a doctoral program in philosophy and neuroscience at the Berlin School of Mind and Brain, and received a Ph.D. in Psychology from Humboldt-University Berlin in 2012. Her dissertation research in Cognitive Neuroscience was carried out at the Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig. She has performed research on self-awareness and action in the context of an embodied cognition framework, and with an emphasis on the mechanisms underlying the sense of agency and its disturbances in Obsessive Compulsive Disorder. Her current research interests focus on interoceptive self-awareness, including studies on the affective dimension of interpersonal touch.*

Uta Sailer: *Brain Representation of Long-Lasting Pleasant Touch*

Introduction: Touch plays an important role in individuals' subjective well-being and social bonding. This may explain why touch is experienced as pleasant for a rather long time (Triscoli et al. 2014). The aim of the present study was to investigate brain activation during such long-lasting touch. **Methods**: 25 Subjects were stroked on their left forearm for 40 minutes by a custom-built MR-compatible robotic device. Stroking velocity was held constant at 3 cm/s. Subjects were scanned during 18 blocks of 2 minutes each, the first and the last of which constituted a baseline. Subjective ratings of pleasantness were collected in-between the stroking blocks. **Results**: Subjective ratings decreased over the stroking blocks, but still remained in the pleasant range at the end of the experiment. Across all 16 stroking blocks, activation was observed in both tactile regions such as somatosensory cortices and posterior insula, and regions in the reward circuit such as nucleus accumbens, putamen, caudate and orbitofrontal cortex. During the course of stroking, activation in tactile regions decreased, whereas activation in reward areas increased. This was paralleled by increased functional connectivity of tactile and reward areas. **Conclusion**: The results point at opposing processes of habituation in tactile areas and sensitization in reward areas. Underlying mechanisms for increased activation in reward areas may involve strengthened input from tactile-relevant areas or the release of neuropeptides, e.g. oxytocin. A long-lasting increase of reward value may help to experience the stimulus as relevant and maintain in a stroking situation for a long time.

Uta Sailer, Chantal Triscoli, Håkan Olausson, Ilona Croy

Uta Sailer *is professor of psychology at the University of Gothenburg, Sweden. She did her PhD at the Dept. of Neurology, Ludwig-Maximilians-University Munich, Germany, about eye-hand coordination, and was postdoc at the University of Umeå, Sweden, and the University of Vienna, Austria. Her current main research interest is the processing of various kinds of rewards.*

Oliver Turnbull: *The Neuroscience of Erogenous Zones*

Introduction: Erogenous zones have paradoxical response properties, producing erotic feelings from body surfaces distant from the genitalia. Ramachandran has suggested an intriguing neuroscientific explanation for the distribution of erogenous zones, based on the arrangement of body parts (such as the adjacent positioning of the genitals and the feet) in primary somatosensory cortex (S1). The present study represents the first systematic survey of the magnitude of erotic sensations from various body parts, as well as the first empirical investigation of the S1 theory of erogenous zones, by analysis of whether evaluations of erogenous magnitude from adjacent S1 sites tend to correlate. **Methods**: A sample of some 800 participants, primarily from the British Isles and Sub-Saharan Africa, completed a survey of 41 body parts, each rated for erogenous intensity. **Results**: Ratings for the feet were surprisingly low. However, there were remarkable levels of correlation between ratings of intensity, regardless of the age, sexual orientation, nationality, race and, more surprisingly, the sex of our participant sample (R2 values ranging between .90 and .98). Multiple regression and factor analysis investigated whether body parts nearby in S1 were significantly correlated. **Conclusion**: The S1 hypothesis appears to lack support, because of the low level of foot ratings, the lack of inter-correlation between ratings for nearby S1 sites, and the previous literature suggesting that cortical stimulation of S1 does not appear to be erotogenic. The consistency across demographic variables is open to multiple interpretations. However, it may be that individual experience or cultural differences (a starting point for some accounts of erogenous zone distribution) are not substantial determining variables. Thus, while S1 does not appear to be the likely site that would support Ramachandran's neural body map proposal, we suggest that the origins of erogenous distribution may derive from a map located elsewhere in the brain.

Prof Turnbull *is a neuropsychologist (and a clinical psychologist), with an interest in emotion and its many consequences for mental life. His interests include: emotion-based learning, and the experience that we describe as intuition; the role of emotion in false beliefs, especially in neurological patients; and the neuroscience of psychotherapy. He is the author of a number of scientific articles on these topics, and of the popular science book 'The Brain and the Inner World'. He is a Professor in the School of Psychology of Bangor University, where he is also Pro Vice Chancellor (Teaching & Learning).*