Festival of Touch

4-7 Jul 2023
Marseille
France

Table of contents

Brain-machine interface learning is facilitated by distributed cortical feedback that is spatially and temporally structured

Aamir Abbasi [1], Henri Lassagne [2], Luc Estebanez [2], Dorian Goueytes [2], Daniel Shulz [*†] [2], Valérie Ego-Stengel [2]

[1] Center for Neural Science and Medicine, Cedars-Sinai Medical Center, Los Angeles, CA – United States

[2] Institut des Neurosciences Paris-Saclay – Université Paris-Saclay, Centre National de la Recherche Scientifique – France

Neuroprosthetics offer great hope for motor-impaired human patients. One obstacle is that fine motor control requires near instantaneous, rich somatosensory feedback. Such distributed touch feedback may be recreated in a brain-machine interface using distributed artificial stimulation across the primary somatosensory cortex surface. Here, we hypothesized that this neuronal stimulation must be contiguous in its spatial organization and temporal dynamics in order to be efficiently integrated by sensorimotor circuits. Using a closed-loop brain-machine interface, we trained head-fixed mice to control a virtual cursor by modulating the activity of motor cortex neurons. We provided artificial feedback in real time, consisting of distributed optogenetic stimulation patterns in the primary somatosensory cortex. We found that the mice only developed a specific motor strategy and sustained task performance when the optogenetic feedback pattern was contiguous while it moved across the topography of the somatosensory cortex. These results reveal new properties of cortical integration, and set new constraints on the design of neuroprosthetics.

Keywords: brain machine interface, somatotopy, barrel cortex, motor cortex

[*]Speaker

[†]Corresponding author: daniel.shulz@cnrs.fr

BodySense: a collaborative research platform for development of simple, open source and replicable somatosensory research tools

Rochelle Ackerley * [1], Roger Watkins *

[1] Laboratoire de Neurosciences Cognitives – Aix Marseille Univ, Centre National de la Recherche Scientifique - CNRS – France

The BodySense research platform is a technical resource which provides somatosensory researchers with simple tools for use in touch experiments, as well as for examining the other senses further, such as in proprioceptive, vestibular, visual, and auditory research. The platform provides collaborative support for the development of tools that provide stimulation and quantify behavior in a variety of sensory modalities. The focus of the platform is production of simple, affordable and open-source tools. The development of several projects in tactile and vestibular research will be presented, which incorporate the design of 3D printed components that can be made with simple integrated sensors and stimulators. These devices can be readily duplicated and incorporated into a system that allows for the precise synchronization of the stimulators and recordings with particular expertise in compatibility physiological measures with critical timing requirements (EEG, EMG, and neural activity, such as in microneurography) as well as co-ordinated behavioral video capture.

Keywords: microneurography, touch, temperature, affective touch, wetness

*Speaker

Understanding individual differences in attitudes towards touch with a focus on faith

Ramisa Ahmed * [1], Aikaterini Vafeiadou [1], Michael Banissy [2]

[1] Department of Psychology [Goldsmiths University of London] – United Kingdom
[2] University of Bristol [Bristol] – United Kingdom

It is well known that human beings are inherently social creatures. With touch being one of the earliest senses to develop and to subsequently remain an integral part of our lives, it is unsurprising to see research highlight how touch can have a significant impact on both our physical and mental well-being. Attitudes, recency and use of touch all show evidence for individual differences on many levels, including gender, sex, attachment styles and culture. Faith/ religion is one aspect that is yet to be fully explored, despite research having shown how faith/religion play a large role in the formulation of attitudes and morals. With a growing religious population in the west it becomes pertinent to investigate any faith based differences, as these will impact how we act with one-another in the workplace, treatment setting and social interactions. This study acts as the first investigation into the differences between individuals who are religious and non-religious on their attitudes towards touch. The current dataset was drawn from a larger online survey (known as the Touch Test) designed to explore attitudes and experiences towards touch. The scores on three scales; touch experiences and attitudes questionnaire (TEAQ), social touch questionnaire (STQ) and touch in health scale (THS) were investigated. Overall we found the religious group had a more positive attitude towards touch on all three of the scales. This study provides a valuable first step into understanding attitudes towards touch and how this may differ based on an individual's religious affiliation.

Keywords: Affective touch, religion, faith, individual differences

*Speaker

Non-pharmacological Methods of Histamine Evoked Itch Reduction Focusing on the Pleasant Touch Pathway.

Hasan Ali *† [1], Timo Giesbrecht [2], Nicholas Fallon [3], Carl Roberts [3]

[1] Department of Psychology [University of Liverpool, UK] – United Kingdom
[2] Unilever RD [Unilever, Port Sunlight, UK] – United Kingdom
[3] Department of Psychology [University of Liverpool, UK] – United Kingdom

Itch is commonly experienced in skin diseases such as eczema. Currently, treatments such as anti-histamines work primarily for acute itch which is associated with allergic response. Treatments for chronic itch, namely topical corticosteroid medications, provide some relief but also result in side-effects such as skin thinning and in certain cases, topical corticosteroid withdrawal. Previous research indicates a relationship between itch, pain and pleasant touch (slow, stroking gentle touch signalled by C-tactile afferents) where pain has been shown to reduce itch and pleasant touch reduces pain. The overlap between these somatosensory modalities highlights a possible relationship between itch and pleasant touch. The study investigates whether pleasant touch relieves histamine evoked itch. Itch was induced via histamine iontophoresis on 58 participants on the dorsal side of both forearms and the wrist. Participants were then brushed at 3cm/s (condition 1; affective touch), 18-30cm/s (condition 2; non-affective touch) and had brush tapping at 1Hz (condition 3; active control) in a pseudorandomised manner for a total of 18 trials per condition across three blocks. Participants were asked to rate the itch severity and brushing pleasantness after each trial. Individual variations in touch and bodily awareness were also investigated. Affective 3cm/s ($p < .001$) brushing significantly reduced itch severity compared to non-affective 18-30cm/s brushing ($p < .001$) and brush tapping ($p < .001$). Individual differences did not correlate with itch ratings. These results suggest that pleasant touch has a relieving effect on histamine induced itch and provides impetus for further exploration as a mechanism for non-pharmacological intervention for itch.

Keywords: itch, pleasant touch, histamine, iontophoresis

*Speaker
†Corresponding author: Hasan.Ali@liverpool.ac.uk

Skin-to-skin contact as the place for care: Protocol for an observational study with preterm infants in a Neonatal Intensive Care Unit

Joana Antunes *† [1,2], Ana Mesquita [3], Susannah Walker [2], Francis Mcglone [4], Adriana Sampaio [1]

[1] University of Minho – Portugal
[2] Liverpool John Moores University – United Kingdom
[3] ProChild CoLAB – Portugal
[4] University of Liverpool – United Kingdom

Despite significant improvements in perinatal healthcare, primarily due to technological advancements, there is a growing movement for humanizing care, addressing issues such as mother-newborn separation, which is frequently observed in preterm births. The need to address the detrimental impact of such procedures led to an increased awareness for practices that maintain the dyad together, such as the integration of Kangaroo Mother Care in the healthcare practices for preterm infants hospitalized in the Neonatal Intensive Care Unit, which includes the component of skin-to-skin contact. The conceptualization of nurturescience (Bergman et al., 2019) also supports this paradigm shift, proposing skin-to-skin contact as the biologically expected place for care. Nonetheless, there is insufficient monitoring of skin-to-skin contact to inform how this practice is being implemented. Moreover, the mechanisms underlying reported beneficial outcomes remain to be better elucidated, particularly after hospital discharge. To address these concerns, a protocol for an observational study has been developed to monitor the implementation of skin-to-skin contact when born preterm, as well as to explore its effects on physiological stability during hospitalization and on developmental outcomes after hospital discharge. Additionally, the mediating role of epigenetic mechanisms involving affiliative neurophysiological systems will be examined. The study will be carried out in a Neonatal Intensive Care Unit in Portugal and preterm newborns with a gestational age between 28 and 36 weeks and 6 days will be eligible for inclusion. Findings will contribute to promote evidence-based practices, enhancing the quality of healthcare.

Keywords: skin–to–skin contact, Kangaroo Mother Care, preterm, NICU, infancy

*Speaker
†Corresponding author: J.SimoesAntunes@ljmu.ac.uk

Tactile sensitivity during approach-avoidance movements

Belkis Ezgi Arikan *† [1], Meaghan Mcmanus [1], Katja Fiehler [1]

[1] Experimental Psychology, Justus Liebig University Giessen – Germany

Tactile sensitivity is typically reduced during voluntary movements. This phenomenon, known as tactile suppression, is argued to stem from an internal forward model that predicts and down-regulates sensory feedback signals arising from the movement. While predictions are used to suppress movement-related afferences, incoming sensory feedback is used to guide the movement; hence there are task -relevance-dependent modulations of predictive and feedback signals. Here we asked whether anticipated future consequences of a movement, defined in terms of its affective content (approach vs. avoidance), modulate how predictive and feedback signals are utilized. We also examined whether arm extension and flexion modulate tactile suppression, as they were previously shown to facilitate behavioral tendencies of approach and avoidance, respectively. Participants flexed and extended their arm towards a positive or away from a negative stimulus in virtual reality (VR). We probed tactile suppression by presenting brief vibrations during movement through the VR-controller held in the participant's hand. Participants then responded whether they detected this vibration or not. Detection thresholds were significantly larger in all movement conditions compared to when the arm was at rest, indicating tactile suppression. Interestingly, movement goal and movement type modulated tactile suppression additively, in which both avoiding and arm extension resulted in larger detection thresholds. These results highlight the role of affective context on movement-related tactile sensitivity, whereby avoidance results in increased reliance on predictive signals. They also suggest that feedback signals become more important for actions directed towards the body, independent of affective content of the stimulus being acted on.

Keywords: tactile suppression, approach, avoidance, virtual reality

*Speaker

†Corresponding author: arikan.ezgi@gmail.com

The electrophysiological underpinnings of tactile improvement transferring from one hand to another

Malika Azaroual-Sentucq * [1], Dollyane Muret [2,3], Eric Koun [1,4], Roméo Salemme [1,4], Luke Miller [1,5], Alessandro Farnè [1,4,6]

[1] Equipe IMPACT – Centre de Recherche en Neurosciences de Lyon (CRNL), CNRS UMR 5292, INSERM UMRS 1028, Université Claude Bernard Lyon 1, Lyon – France
[2] Université de Paris, NeuroDiderot, Inserm – NeuroDiderot – France
[3] Université Paris-Saclay, NeuroSpin-UNIACT, CEA – CEA - NeuroSpin - Université Paris Saclay – France
[4] Hospices Civils de Lyon, Neuro-immersion Mouvement et Handicap – Hospices Civils de Lyon – France
[5] Donders Centre for Cognition of Radboud University – Netherlands
[6] Center for Mind/Brain Sciences (CIMeC), University of Trento – Italy

Hand somatosensory deficits affect the patient's dexterity and quality of life. Yet, research on touch rehabilitation remains scarce. One notable approach in this regard is Repetitive Somatosensory Stimulation (RSS), improving tactile acuity of the stimulated finger by inducing transient plasticity in the corresponding primary somatosensory (S1) representation after passive mechanical stimulation. Recent work from our group showed remote tactile improvement (TI) on the unstimulated hand: RSS on the right index finger (rD2) induced TI at this finger and at the left thumb (lD1) and middle finger (lD3), while tactile acuity at rD1 and rD3 remained stable. But the physiological mechanisms underlying these remote effects remain unknown. Given this specific pattern of improvement, we hypothesize that RSS produces remote TIs by modulating inhibitory processes between S1 fingers' representations within and between hemispheres.We conducted a double-blind sham-controlled study in 40 volunteers undergoing, before and after RSS on rD2, electroencephalography (EEG) recordings of somatosensory evoked potentials to indirectly measure the level of inhibition between digits within (rD2-rD3 and lD2-lD3) and between (rD2-lD2 and rD3-lD3) hands. Tactile acuity was assessed on these fingers using the 2-point discrimination task. Preliminary results from 21 participants tend to replicate the transfer of improvement to the other hand following RSS on rD2 (TI on rD2 and lD3, unchanged acuity on lD2 and rD3). EEG data showed a trend for an increased inhibition between rD2-rD3 as well as rD2-lD2. These preliminary results suggest that RSS remote effects may be mediated by increased interhemispheric inhibition between homologous S1 regions.

Keywords: Repetitive Somatosensory Stimulation, Tactile acuity, Primary somatosensory cortex, Cortical inhibition, EEG

*Speaker

Parent-delivered massage protocol decreases severity of tactile abnormalities in autism and improves child-to-parent interactions. A study overview.

Sabine Baeyens * [1]

[1] Make Children Better – Belgium

This abstract discusses Dr. Louisa Silva's research on parent delivered QST massage therapy for children with autism. (QST = Qigong Sensory Training) Dr. Silva sadly passed away in 2018.
Dr. Silva spent 17 years perfecting and studying the outcomes of her QST massage protocol, which is a cutting-edge, proven treatment for sensory impairment in autism that parents can do themselves.

The massage therapy is designed to address sensory difficulties and improve reactions to touch, based on a model that proposes that developmental abnormalities in autism are due in part to an impairment of the sense of touch. Two randomized controlled trials evaluating five months of daily treatment in preschool children with autism reported improvement in defensive behaviour, social/communication skills, and sensory symptoms. Five-month outcomes replicated earlier studies and showed significant normalisation of scores, including a decrease in autism severity, and improvement in tactile abnormalities, self-regulatory capacity, defensive behaviour, and receptive language. Parents also reported improved child-to-parent interactions and bonding, as well as a large decrease in parenting stress.

The QST massage protocol for autism is introduced as a viable early-intervention treatment that considers the needs of children with autism, the preferences of caregivers, and the realities on the ground. The research outcomes over 17 years are shared to provide insight into this remarkable therapy.

RESEARCH: https://www.qsti.org/published-studies/

Video: https://www.youtube.com/watch?v=lXIBVBtWKlY
Author: Sabine Baeyens

Keywords: autism, c, tactile fibres, study overview, social communication

*Speaker

Tactile perception of auditory roughness

Corentin Bernard *† [1,2], Solvi Ystad [2], Etienne Thoret [2]

[1] MIRA Recherche – Aflokkat – France
[2] Perception, Representation, Image, Sound, Music (PRISM) – Centre national de la recherche scientifique - CNRS (France), Aix-Marseille Université - AMU – France

Roughness is a perceptual attribute associated with several of our senses. Usually, roughness is a perceptual attribute that relates to touch and characterizes the surface of a texture. Interestingly within the auditory domain, roughness relates to very fast fluctuations in sounds. It is closely related to the perception of dissonance in musical sounds. It also plays a crucial role in animal and human vocalizations to convey aversiveness or alarm signals. It is often studied by summing two pure tones with close frequencies which results in sounds amplitude modulations. However, there is a clear distinction between auditory roughness and surface roughness: auditory roughness is a temporally based perceptual property experienced through hearing whereas surface roughness is spatiotemporal and assessed by touch In contrast to previous studies, here we show that the sensation of auditory roughness can also be experienced through touch by means of vibrations from the same two-tone signals used in the auditory domain. With two psychophysical experiments, we showed that the degree of perceived roughness varies with respect to the modulation frequency similarly for hearing and touch. This suggests that auditory and tactile sensory systems shared similar processing in the perception of modulations. It attests to the relevance of such stimuli for future work on multisensory integration.

Keywords: Roughness, Tactile perception, Audition, mMltisensory integration

*Speaker
†Corresponding author: bernard@prism.cnrs.fr

Balancing Physical, Emotional, and Mental States with Subtle Touch Therapy

Anita Blanchard * [1]

[1] Doctoral Programme in Psychology – United States

The relevance of touch in attachment, affiliation, bonding, well-being, emotional regulation, trust, and human development in general, promoted extensive research on affective touch and the afferents conducting that experience. Research on haptics, robotics, and the logistics of human sensorial learning, exploration, and adaptation focused on the discriminative afferents that enhanced environmental mastery and adaptation. Pethö Sándor (1916-1992) recognized that affective touch alone was not enough to support the complex development of emotional life. Only the integration of emotional "regulation" (affective touch), i.e., soothing, containing, comforting, bonding, and relaxing, with "processing" (discriminative touch), i.e., identifying, naming, attributing meaning, and creating a narrative could lead to a healthy regulation of physical, emotional and cognitive levels.
Separately, the affective and discriminative systems could tend to addictive behaviors (emotional regulation based on comfort-seeking and hedonic behaviors) or to anxiety and depression (denial of emotions in favor of rationalization), respectively. Calatonia (Sándor, 1969) brought integrative touch therapy to the forefront since WWII. Furthermore, touch therapies incorporate the body-physical as the seat of emotional and cognitive events.
Calatonia subtle touches stimulate Aβ afferents concurrently with C and CT afferents in a passive form, emphasizing slow adapting receptors of glabrous skin that respond to light touch (Ruffini, Merkel, some free nerve endings), whilst also stimulating hairy skin afferents for three minutes in each of several points of contact. Additionally, this passive, stationary, and long-duration touch has implications for a set of brain networks and the motivational system.

Keywords: Subtle Touch Therapy, Touch for Affective and Cognitive Integration

*Speaker

The impact of female breast size on cutaneous thermal, wetness and tactile sensitivity

Hannah Blount * [1], Alessandro Valenza [2], Jade Ward [1], Silvia Caggiari [1], Grant Simmons [3], Pete Worsely [1], Davide Filingeri [1]

[1] University of Southampton – United Kingdom
[2] Università degli studi di Palermo - University of Palermo – Italy
[3] Nike Sport Research Lab, Nike Inc. – United States

Tactile, wetness and thermal sensations across the female breast can significantly impact bra comfort. Little is known about the impact of breast size despite breast development varying largely amongst individuals. We aimed to investigate breast-size dependent, regional differences on tactile, wetness and thermal sensations in rest and exercise.
Fifteen healthy females (24±7yr) with varying breast sizes (breast surface area (BrSA) range=147.2-480.5cm2) reported on two visual analogue scales wetness and thermal sensations arising from cold- and warm-wet stimuli (±5 from local skin temperature) applied to the nipple, 3cm above and below, and bra triangle, under resting thermo-neutral conditions. Tactile thresholds were also determined at the nipple, areola edge, and 3cm below, at rest and following 50-min running in 32∘C heat. Linear regression analysis was used to evaluate the association between cutaneous sensitivities and BrSA.

Cold-wetness (R2=0.32, p=0.03) and warm-thermal sensitivities (R2=0.46, p=0.01) increased with decreasing BrSA, although this applied to the nipple and above the nipple only. Tactile sensitivity increased with decreasing BrSA at all tested skin sites (nipple: R2=0.30, p=0.03; areola: R2=0.39, p=0.01; 4cm below: R2=0.36, p=0.02), and it also decreased post-exercise at the nipple ($p < 0.001$) and across all breast sizes.
Our findings indicate that cutaneous sensitivity increases with smaller breasts, although the consistency of this varies depending on the skin site and sensory modality (e.g. thermal vs. tactile). Variations in cutaneous innervation density amongst breast sizes may drive the observed differences, although neuro-anatomical and -physiological evidence is required to confirm this.

Keywords: Thermal sensation, Wetness perception, Tactile sensation, Breast, Female thermoregulation

*Speaker

Mother-infant bed-sharing and infant stress resilience

Ingrid Boedker [*†] [1], Tina South [1], Francis Mcglone [2], Helen Ball [3], Sam Roberts [1]

[1] Liverpool John Moores University – United Kingdom
[2] University of Liverpool – United Kingdom
[3] Durham University – United Kingdom

During early sensitive periods, touch shapes an infant's stress response (Liu et al., 1997). Most caregiving research has focussed on daytime parenting, omitting night-time practices (Barry, 2019). Bed-sharing is when a caregiver and infant share the same sleep surface (Ball, 2009), increasing opportunities for touch (Mitchell & Scragg, 1993). In adults, bed-sharing may improve stress resilience, with touch as a possible mechanism (Van Puyvelde & Mairesse, 2022). Whilst some infant bed-sharing research has investigated touch (e.g., Lerner et al., 2020), it has not done so with a knowledge of affective touch mechanisms.
Objective: To understand the impact of bed-sharing on infant stress resilience, as mediated by touch.

Participants: A subsample from the Liverpool Night-time Caregiving Project (a longitudinal study on infant sleep, touch behaviours, and behavioural outcomes) will be recruited. Previously-collected data will allow for (i) identification of 'high' bed-sharing ("HB"; N=30) and 'low' bed-sharing (i.e., mainly solitary-sleeping; "LB"; N=30) mother-infant dyads, and (ii) the impact of control variables, including: touch behaviours, demographics, infant feeding, maternal mental health, social support, and sleep quality.

Methods : We will compare physiological responses to an acute stressor (The Still Face Paradigm, "SFP", Tronick et al., 1978) between HB and LB infants. We will collect infant ECG, respiration, and cortisol.
Analyses: Analyses will focus on the impact of infant sleep location and other variables on infant ECG, respiration, and cortisol using multilevel modelling. We hypothesise that HB infants will show better stress resilience (i.e., recovery during the 'reunion' phase of SFP) than LB infants.

Keywords: infant sleep, co, sleeping, bed, sharing, Still Face Paradigm, stress, caregiving, affective touch

[*]Speaker
[†]Corresponding author: i.a.boedker@2022.ljmu.ac.uk

Spinal cord oxytocin circuits modulate pain responses by engaging circuits of affective touch.

Manon Bohic * [1], Aman Upadhyay [2], Mark Gradwell [2], Ahmed Negm [3], Shibin Du [2], Jessica Keating [2,4], Yuanxiang Tao [2], Amaury Francois [5], Cedric Peirs [3], Emmanuel Bourinet [5], Victoria Abraira [2]

[1] Rutgers University System – United States
[2] Rutgers University System – United States
[3] Neuro-Dol – Institut National de la Santé et de la Recherche Médicale, Université Clermont Auvergne – France
[4] Oregon Health and Science University [Portland] – United States
[5] Institut de Génomique Fonctionnelle – Institut National de la Santé et de la Recherche Médicale, Centre National de la Recherche Scientifique, Université de Montpellier – France

Top-down modulation of spinal sensory processing is constantly at play in our everyday life but it varies depending on our internal state (fear, stress, positive emotions) and neuromodulators play a key role in this descending modulation. Positive tactile interactions (caress, hug, massage, hand-holding...) induce the release of a key neuromodulator, oxytocin, by neurons of the hypothalamus in the central nervous system, including the spinal cord. We investigated whether underexplored spinal oxytocin circuits might influence how the spinal cord processes touch and pain peripheral input before the information is sent to the brain. We found that oxytocin-positive fibers project mainly to the superficial dorsal horn of the spinal cord, which overlaps with expression of the oxytocin receptor in spinal neurons that process pain input and social touch. We correlated this finding with similar expression patterns in the human spinal cord. Using anatomy, pharmaco- and opto-genetics, behavior and electrophysiology, we discovered that this superficial spinal oxytocin circuit can drastically reduce sensory-evoked and ongoing neuropathic pain in mice. In conclusion, descending oxytocin projections tune the sensitivity of superficial spinal oxytocin circuits to modulate the first step of touch and pain processing. Our findings will provide a framework for the use of oxytocin for pain treatment and should inform us on how combined oxytocin administration and touch therapy can provide pain relief.

Keywords: affective touch, oxytocin, pain, spinal cord, descending modulation, neuromodulators

*Speaker

Haptic stimulation during virtual reality interactions aimed at tactile and proprioceptive feedbacks

Sarah Bonnet *† [1], Heidy Daumas‡ [2], Rochelle Ackerley§ [1]

[1] Laboratoire de Neurosciences Cognitives [Marseille] – Aix Marseille Université, Centre National de la Recherche Scientifique – France
[2] V.RTU – V.RTU – France

This thesis project focuses on the rôle of vibro-tactile stimulation in the integration of tactile and proprioceptive information, in order to extract important parameters for haptic stimulation in virtual reality. The data collection will be carried out on healthy adult participants. The tactile and proprioceptive perception of the participants will be evaluated through questionnaires and psychophysical assessments. Touch-induced physiological vibrations will be measured using an accelerometer system positioned on the participants' hand and forearm and muscle activity will be recorded using electromyography (EMG). The participants' movements will be captured by video and analysed by a tracking system developed by the company V.RTU. The pressure exerted during the touch will be recorded with a force cell, electrodermal activity and temperature will also be collected. Different specific experiments will be performed. A first approach will be to ask participants to perform tactile and proprioceptive explorations in order to collect data on the integration of information. Different tactile environments and textures will be explored. A second approach will explore the sensations induced by vibro-tactile stimulation via a haptic device proposed by the company V.RTU at the level of the hand and wrist, during tactile exploration in a natural environment and an augmented reality environment. This study will explore the role of physiological vibrations in tactile and proprioceptive integration, in order to model these vibrations for application in a multisensory context in virtual reality. Psychophysical evaluations will in turn allow the modelling of vibrations to be refined.

Keywords: Haptic, Touch, Proprioception, Multisensory Integration, Virtual Reality, Augmented Reality

*Speaker
†Corresponding author: sarah.bonnet.1@etu.univ-amu.fr
‡Corresponding author: daumas.h@vrtu.fr
§Corresponding author: rochelle.ackerley@univ-amu.fr

Haptic sensorimotor strategies of exploration of daily surfaces

Sarah Bonnet * [1], Johan Wessberg [2], Michael Wand [3], Rochelle Ackerley [4], Mariama Dione† [1]

[1] Laboratoire de Neurosciences Cognitives [Marseille] – Aix Marseille Université – France
[2] Department of Physiology, Institute of Neuroscience and Physiology, Sahlgrenska Academy, University of Gothenburg, Gothenburg – Sweden
[3] IDSIA, USI SUPSI, Lugano-Viganello, Switzerland and MeDiTech, SUPSI, Lugano-Viganello – Switzerland
[4] Laboratoire de Neurosciences Cognitives [Marseille] – Aix Marseille Université, CNRS : UMR7291 – France

Humans use stereotyped haptic strategies of exploration to interact with objects. For example, to detect the shape of an object we follow its contours, to detect its temperature we apply a light contact to it, etc. These sensorimotor strategies may play an essential role in perception, e.g. by potentiating the response of specific types of skin receptors among others to improve the percept quality. In the present study, our aim was to explore if similarly-stereotyped strategies exist in the context of surface exploration, in particular when the exploration is executed with specific intentions (e.g. evaluate the stickiness). 19 participants were instructed to freely explore 18 daily surfaces (e.g. sandpaper, leather chamois) with the index fingerpad and to rate them according to the four main dimensions of touch (roughness, stickiness, hardness, and pleasantness). Numerous recordings were made to support the description of the sensorimotor strategies evaluating physical (force, acceleration, position), physiological (electromyography, EMG) and emotional (facial EMG) components. Preliminary results revealed that the texture qualities were adequately recognized (e.g. the stickiest textures are rated as such), and that specific movement features may exist to enable recognition of the initial intention using for example machine learning. Future analyses may include such type of computational methods to reveal whether humans do use specific strategies as a function of their touch intention. The knowledge gained will help us designing future ecological microneurography studies mimicking the natural strategies and will guide us in developing technologies that aim at enhancing touch in virtual environments.

Keywords: active touch, texture coding, haptic exploratory procedures, virtual touch

*Speaker
†Corresponding author: mariama.DIONE@univ-amu.fr

Individual variability in touch attitudes and experiences

Natalie Bowling * [1], Aikaterini Vafeiadou [2], Michael Banissy [3]

[1] University of Greenwich – United Kingdom
[2] Goldsmiths University of London – United Kingdom
[3] University of Bristol [Bristol] – United Kingdom

Touch is integral to our everyday lives, but attitudes and experiences of touch vary considerably between individuals. The present study examined predictors of inter-individual variability in touch attitudes and experiences in a large (N = 7,332) UK healthy adult sample. Predictors examined included personality traits, relationship attachment style (avoidance and anxiety), age and gender. Trait extraversion was the strongest predictor of attitudes towards day-to-day social touch (such as handshakes), where greater extraversion was associated with more positive attitudes. Attachment avoidance and anxiety most strongly predicted attitudes and experiences of intimate touch (such as kissing and caressing). Attachment anxiety was associated with more positive attitudes towards intimate touch, while attachment avoidance was linked to less positive attitudes, although avoidance and anxiety were both associated with less regular experiences of intimate touch. The results highlight the importance of context in understanding attitudes and experiences of touch, and the factors that predict them.

Keywords: Individual differences, attitudes, personality, extraversion, attachment

*Speaker

Reduced Autonomic Response to Pleasant Touch in ASD Children

M.rosa Bufo *† [1], Marco Guidotti [2], Yassine Mofid [1], Frederique Bonnet-Brilhault [1], Nadia Nadia Aguillon Hernande [1], Claire Wardak‡ [1]

[1] UMR 1253 IBrain Imagerie Cerveau Equipe 1 : "Psychiatrie Neuro-Fonctionnelle" – imagerie et cerveau, Centre Hospitalier Régional Universitaire de Tours, Exac-t, EXcellence Center in Autism and neurodevelopmental disorders, CHU de Tours - Hopital Bretonneau – France

[2] UMR 1253 IBrain Imagerie Cerveau Equipe 1 : "Psychiatrie Neuro-Fonctionnelle" – imagerie et cerveau, Centre Hospitalier Régional Universitaire de Tours, Exac-t, EXcellence Center in Autism and neurodevelopmental disorders, CHU de Tours - Hopital Bretonneau, Centre Hospitalier du Chinonais – France

Touch includes different aspects like discrimination and affective components. Affective touch, mediated by CT-fibers of the hairy skin and essential in the development of interpersonal non-verbal interactions, could be affected in some neurodevelopmental disorders such as Autism Spectrum Disorders (ASD). Previous studies have shown that affective touch can evoke measurable ANS responses, however it has never been tested in ASD patients. We aimed at measuring ANS responses during pleasant tactile stimulation targeting the affective and/or the discriminative tactile pathways in ASD children and typically developing (TD) children. We recruited twenty 6-12 years old ASD children (108±16 months; 18 males) and twenty TD age-matched children (111±18 months; 7 males). We performed 10 stimulations (four seconds each) on the forearm (high CT-fibers density) and 10 stimulations on the palm of the hand (very low CT-fibers density) with a soft texture tool. We recorded simultaneously: pupil diameter, skin conductance, and heart rate. Participants looked at a screen for the whole length of the procedure while staying still on the armchair. We showed that our pleasant stimulation evoked a heart rate deceleration, larger in TD than in ASD children ($p < 0.01$). We also found a reduced SCR latency ($p< 0.05$) and larger SCR amplitude ($p< 0.01$) in TD compared to ASD children. The small sample of ASD children with a pupil recording due to head movements prevented any significant statistical analysis, even if pupil dilation following the tactile stimulation seemed reduced in ASD compared to TD children.

Keywords: autonomic nervous system, autism, skin conductance, heart rate, pupil diameter

*Speaker

†Corresponding author: mariarosa.bufo@studio.unibo.it

‡Corresponding author: claire.wardak@inserm.fr

The effect of contextual cues on goal-directed reaches to visual and somatosensory targets

Nick Butler * [1], Sadiya Abdulrabba , Gerome Manson [1]

[1] Queen's University – Canada

When reaching for an object on a crowded table, visual information about the position of other objects must be factored into the movement plan. Previous studies have found that movements to visual targets were more accurate when non-target visual information (e.g. contextual cues) were present in the reaching environment compared to when reaching in a dark environment. Although visual contextual cues play a role in movement planning to visual targets, it is unknown if this information is also used when planning movements to somatosensory targets (e.g., body positions). The goal of this study is to determine if the presence of visual contextual cues influences movements to somatosensory targets. Ten neurologically-healthy participants performed upper limb reaches to unseen somatosensory targets (e.g., fingers on the non reaching hand) and seen visual targets. Participants performed movements to both target modalities with and without contextual cues. To assess the impact of contextual information, radial error, angular error and temporal kinematic variables (e.g. time to peak velocity) were computed. Results indicated that the presence of contextual cues did not influence radial error when reaching to somatosensory targets. Movements to somatosensory targets also had a higher time to peak velocity than movements to visual targets indicating that planning processes differed between target modalities. These results provide evidence that contextual information may be less relevant when reaching to somatosensory versus visual targets. Thus the findings of this study argue that environmental sensory information may be weighted differently depending on the task and sensory conditions.

Keywords: Reaching, somatosensory, visual, multisensory integration.

*Speaker

I see how you are touching: similarities and differences in vicarious execution vs. reception of interpersonal affective touch

Niccolò Butti *† [1,2], Cosimo Urgesi [3,4], Francis Mcglone [5], Rosario Montirosso [1], Valentina Cazzato [6]

[1] 0-3 Centre for the At-risk Infant, Scientific Institute, IRCCS E. Medea, Bosisio Parini, Lecco, Italy – Italy
[2] Department of Life Sciences, University of Trieste, Trieste, Italy – Italy
[3] Neuropsychiatry and Neurorehabilitation Unit, Scientific Institute, IRCCS E. Medea, Bosisio Parini, Lecco, Italy – Italy
[4] Laboratory of Cognitive Neuroscience, University of Udine, Udine, Italy – Italy
[5] Institute of Psychology, Health and Society, University of Liverpool, Liverpool, UK – United Kingdom
[6] School of Psychology, Faculty of Health, Liverpool John Moores University, Liverpool, UK – United Kingdom

Unmyelinated CT fibres, particularly represented in the hairy skin, are activated by caress-like touch, eliciting a pleasant sensation that decreases for static and faster stroking. Previous studies documented this effect also for vicarious observation of affective touch, and pointed to mirror mechanisms to perceive observed interpersonal touch as if we were receiving a similar tactile stimulation. Notably, less is known about simulation of vicarious execution of touch, i.e., as if we were giving gentle touch. To address this issue, we adapted a validated task during which 53 healthy adult participants were asked to complete self- and other-directed touch ratings for both executer (toucher-referred) and receiver (receiver-referred) with touch being delivered at CT-optimal (3cm/s) and non-CT optimal velocities (0cm/s and 30cm/s), on hairy (i.e., hand dorsum) and glabrous (i.e., palm) skin sites. Consistent with the CT fibres properties, for both self- and other-directed judgements of touch execution and reception, participants provided higher ratings for touch delivered at CT-optimal vs. other velocities, and when CT-optimal touch was delivered to the hand-dorsum compared to the palm. However, higher ratings were attributed to reception compared to execution of CT-optimal touch. Notably, whilst greater emotional empathy was associated with other-directed pleasant touch awareness, individual differences in interoceptive trusting and attitude to interpersonal touch were positively correlated with overall pleasantness of touch. These findings suggest that both toucher- and receiver-referred vicarious touch perceptions are specifically attuned to CT-optimal touch, even though they might rely on different mechanisms to understand affective information conveyed by interpersonal tactile interactions

Keywords: Affective touch, Vicarious touch, Motor simulation

*Speaker
†Corresponding author: niccolo.butti@lanostrafamiglia.it

Invited to Touch: How Tactile Expertise and Personality traits influence the Aesthetic appraisal of visually presented tactile materials

Marella Campagna * [1], Rebecca Chamberlain [1]

[1] Goldsmiths University of London – United Kingdom

The haptic modality plays a crucial role in humans' existence, promoting social bonding, favouring information gathering, providing high levels of arousal. So far, tactile aesthetics' field, has revealed some underlying preferences in the haptic exploration related to intrinsic stimulus properties, the principle of unity and variety and the Gestalt laws of grouping (Gallace & Spence, 2011; Klatzky & Peck, 2012). However, attractiveness to human touch has emerged to be also influenced by individual's characteristics, e.g., the innate proclivity to touch objects for hedonic purposes, and degree of familiarity, according to a mere exposure effect, further highlighting the impact of top-down processes on haptic hedonic reactions (Etzi et al., 2014; Nagano et al., 2013).
This study aims to investigate how individuals' differences (e.g., tactile expertise, need for touch, familiarity, personality traits) impact the aesthetic appraisal of eighteen videos, depicting a manipulation of usual (e.g., sandpaper) and unusual (e.g., crinoline) materials, by means of a 7-point Semantic differential scale.

Judgments of liking, interest, pleasantness, perceived haptic invitation will be derived and correlated with surfaces physical properties and individuals' characteristics.

Pleasantness ratings are expected to be influenced by participants degree of familiarity, tactile expertise and surface's conveyed comfort, whereas materials touch-ability is assumed to be affected by subjective need for touch, Openness to experience, expertise.
The present study will contribute to gain knowledge in a field still partially known, while also pointing to individual differences as potential crucial factors that might be incorporated into product design, to better target, fulfil consumers' tactile needs.

Keywords: Haptic aesthetics, personality traits, touch perception, textures perception, need for touch, haptic expertise

*Speaker

Predictive processing of tactile sensory information in mice engaged in a locomotion task

Max Chalabi * [1], Enora Hervagault [1], Timothé Jost-Mousseau [1], Daniel Shulz [1], Isabelle Ferezou [1]

[1] NeuroPSI – Paris Saclay Institute of Neuroscience, Université Paris Saclay, CNRS – France

The primary somatosensory area of the mammalian cerebral cortex is known to play a key role in tactile sensory processing and touch perception, which may not be restricted to an efficient analysis of the incoming sensory flow. Indeed, according to predictive coding theories, the cerebral cortex could compute, based on past experience, a dynamic model of our interactions with our environment, allowing to anticipate future sensory inputs. Sensory perception would therefore imply a continuous comparison of the expected sensory inputs with those actually received. The error signals generated in case of deviation between these two types of information would allow to readjust current motor commands, as well as updating the internal model, which is key to optimize future behaviour. We seek for neuronal signatures of these predictive mechanisms in the mouse primary somatosensory cortex, at the mesoscopic scale, in the context of a whisker-guided locomotion task. To do so, we record calcium-sensitive signals over this area through a bundle of optical fibres in mice trained to navigate and avoid obstacles in predictable spatial arrangements, in complete darkness. We record neuronal activity in such familiar contexts, and when an obstacle is suddenly removed, thus creating a mismatch between expected and received tactile inputs. By simultaneously recording the animal's movements and whisking strategy using high-speed videography, we intend to link behavioural markers of tactile prediction with the cortical dynamics recorded synchronously, at the millisecond timescale, whilst the animal is navigating and gathering tactile information in an ethologically relevant manner.

Keywords: Predictive processing, barrel cortex, calcium imaging, freely moving mice

*Speaker

Characterizing Human-Pet Affective Touch

Clare Cham * [1], Annett Schirmer† [2], Vanessa Kaufmann [2]

[1] The Chinese University of Hong Kong [Hong Kong] – Hong Kong SAR China
[2] University of Innsbruck – Austria

Although touch plays a pivotal role in human-pet interactions, we still do not know how such touch unfolds and what its characteristics are. To fill this gap, the current study used an online self-report measure to examine a range of typical touch actions performed by pet owners (e.g., stroking) and their pets (e.g., licking). Study participants answered several questions concerning these actions including the touch location on the body, its frequency, temporal and situational context and the associated affect. We plan to explore these variables using separate linear mixed models, ANOVAs and discriminant analyses with the goal to compare and contrast the different touch actions as performed by owners and pets. Based on prior work on human-human touch, we hypothesize that different actions can be functionally differentiated across the examined variables, implicating that each action plays a unique role in the relationship between pet owners and their pets. Our analysis results will provide valuable insights into the study of affective touch and contribute to a deeper understanding of the emotional and physical bonds between humans and their animal companions.

Keywords: Social touch, Affect, Pets, Companion animals

*Speaker
†Corresponding author: Annett.Schirmer@uibk.ac.at

Comparing Different Tactile Stimulation Methods in Affective Touch Research

Xiaoqin Cheng *† [1], Annett Schirmer [1]

[1] Leopold Franzens Universität Innsbruck - University of Innsbruck, Department of Psychology – Austria

Experimental research on affective touch has grown exponentially over the last few decades. Yet, little attention has been paid to the kind of stimulation methods used to deliver affective touch. Here, we compare and contrast the advantages and disadvantages of four such methods: experimenter touch, touch from the rotatory tactile stimulator (RTS), touch from a cable-driven robot, and touch from a robot arm. Experimenter touch is the most naturalistic and easiest to implement. However, it is difficult to execute specific parameter like velocity, distance, and force and to maintain these parameters consistently across an experiment. Touch from the RTS circumvents these problems as stroking parameters can be programmed. However, as the RTS moves with only one degree of freedom, its touch stimulus is physically limited (e.g., force varies along its arc). Like the RTS, the cable-driven robot offers precise control over important touch parameters with the added advantage of a customisable stroking trajectory. However, its force control and access to a participant's body parts are limited. A robot arm addresses these issues but creates significant technical challenges in the implementation of force and velocity control. In reviewing these different stimulation methods, we highlight their suitability for different research questions and make suggestions with regards to their optimal implementation in the study of affective touch.

Keywords: Stimulation methods, touch stimuli, affective touch, robot, stroking, force, velocity, touch parameters

*Speaker

†Corresponding author: xiaoqin.cheng@uibk.ac.at

Plantar cutaneous afferent responses to behaviorally relevant forces

Luke Cleland *† [1,2], Erika Howe [3], Christopher Nester [4], Kristen Hollands [4], Reeves Joanna [5], Nicholas Strzalkowski [6], Leah Bent [3], Hannes Saal [1,2]

[1] Active Touch Laboratory, Department of Psychology, University of Sheffield – United Kingdom
[2] Insigneo institute for in silico medicine, University of Sheffield – United Kingdom
[3] Neurophysiology Lab, Department of Human Health and Nutritional Sciences, University of Guelph – Canada
[4] School of Health Sciences, University of Salford – United Kingdom
[5] Department of Public Health Sport Science, University of Exeter – United Kingdom
[6] Department of Biology, Mount Royal University – Canada

The foot sole is the primary interface between the body and environment, carrying information about the surface upon which we are standing and contributing to balance and gait. Existing research into the responses of tactile afferents at the foot sole has used carefully controlled low-amplitude stimuli to identify afferent firing thresholds and characterise response properties. However, such stimuli are not reflective of those experienced by the foot sole during everyday behaviour, limiting the generalisability of current experimental results to real-world behaviour. To fill this gap, we presented load profiles comparable to those experienced during gait, with forces of up to 35 N/cm2, and recorded afferent responses using microneurography. We found that greater forces and slower rates of loading influence afferent classes to different extents: slowly adapting afferents exhibit greater firing rates to high force-low derivative stimuli, whereas fast adapting afferents respond more to low force-high derivative stimuli. We then use a computational model of foot sole cutaneous afferents to replicate experimental firing rates observed during microneurography. Using this new knowledge, we simulate tactile responses in response to spatiotemporal pressure patterns during gait. Combining experimental and computational methods affords the opportunity to provide new-found insight into the role that tactile feedback plays during natural behaviours, such as standing balance and gait.

Keywords: Gait, Touch, Computational modelling, Microneurography

*Speaker
†Corresponding author: ldcleland1@sheffield.ac.uk

The development of the visuo-tactile temporal binding window for infants aged 4- to 8-months-old.

Alice Cousins * [1], Roger Newport [2], Danielle Ropar [3], Giulia Orioli [1], Andrew Bremner [1]

[1] University of Birmingham – United Kingdom
[2] Loughborough University – United Kingdom
[3] University of Nottingham – United Kingdom

Previous studies have shown that audio-visual temporal binding windows decrease in duration from infancy to adulthood. But this developmental trend may not be seen across all sense pairings (e.g., due to differences in the sensorimotor biomaturational constraints across sensory modalities). Here we investigated whether there are developmental changes in visuo-tactile temporal binding between 4-8 months of age concerning visual and vibrotactile stimuli presented on infants' feet. This age range was chosen as infants typically develop reaching behaviour (another visuo-tactile skill) during this age span. Therefore, a short reaching task was also carried out to explore potential connections between this ability and infants' visuo-tactile temporal binding. Infants were first habituated to vibrotactile and visual stimuli presented simultaneously. Stimuli were presented for 700 milliseconds on alternating feet with an interstimulus interval of 1500 milliseconds. Trials continued until the infant looked away for 2 continuous seconds. Once an infant had reached the habituation criterion (50% less total looking across the most recent 3 trials compared to the first 3 trials), they were presented with four test trials: the familiar synchronous trial and three asynchronous trials (where the light's onset was delayed by 100ms, 250ms, and 400ms respectively). The order of these four test trials was counterbalanced across infants. Infants' total looking times in each test trial were recorded, along with their age (in days), sex, and reaching ability. Preliminary findings from 28 participants indicate that infants are able to segregate visual and tactile stimuli presented with 100ms between them across the age range.

Keywords: Developmental, Self perception, Body representation, Visuotactile

*Speaker

Subtle Touch Therapy for Children

Maria Irene Crespo Çonçalves *† [1], Anita Blanchard *

[2], Céline Lothiois

[1] Instituto Sedes Sapientiae – Brazil
[2] University of Barcelona – Spain

Touch therapy was effectively combined with movement-based techniques in therapeutic projects at the juvenile detention center for boys (children and adolescents), who had been adjudicated for delinquency. Including the body therapeutically helped to reorganize their confined physical energy, which manifested in tumultuous ways. Initially, the boys were extremely agitated and resistant to group activities. Gentle touch strengthened their therapeutic bond, facilitated emotional resignification, and transformed their feelings of rebellion, distrust, and rivalry in an environment of cooperation and trust. In this process, these boys engaged in therapeutic group techniques instead of bullying and physically acting out.

Similar projects were run in group homes and orphanages for younger children, who were taken in due to abandonment, negligence, or abuse. In these cases, Subtle Touch sequences helped transform aggression and helplessness into a positive caretaking experience, an attitude of receptiveness and hope, de-escalation of traumatic experiences, enhancement of attachment, and psychological and motor development.
In Subtle Touch therapy (Sandor, 1969), including the Calatonia, the child receives a series of touches in a passive state, generally in a prone or supine position. The touches are mostly extremely light, at specific points of contact: the soles of the feet and hands, the back, the legs and arms, the abdomen, the face, and the head. The touches take the form of small circles and strokes, gentle pressure or contact, which are delivered with hands, soft brushes, leaves, water drops, or puffs of air, engaging the children in a play-like activity.

Keywords: suble touch, children, orphanages

*Speaker
†Corresponding author: irenecrespo1@yahoo.com.br

Modeling affective touch: Individual differences in the perception of tactile pleasantness

Laura Crucianelli * [1], Marie Chancel [2], H. Henrik Ehrsson

[1] Karolinska Institutet, Department of Neuroscience – Sweden
[2] Laboratoire de Psychologie Neurocognition, Grenoble-Alpes University, Grenoble – Grenoble-Alpes University – France

Touch is perceived most pleasant when delivered at velocities known to optimally activate the C-tactile afferent system. At the group level, pleasantness ratings of touch delivered at velocities in the range between 0.3 and 30 cm/s follow an inverted-U shape curve, with maximum pleasantness between 1 and 10 cm/s. However, the prevalence, reliability, and stability of this function at the individual level and across skin types based on hair density remains unknown. Here, we tested a range of seven velocities (0.3, 1, 3, 6, 9, 18, 27 cm/s) delivered with a soft brush, on both hairy (forearm and dorsal hand) and non-hairy skin (palm) in 123 participants. Our results suggest that the relationship between pleasantness and velocity of touch is significantly best described by a negative quadratic model at the individual level in the majority of participants both on hairy (67.1%) and non-hairy (62.6%) skin, a larger extent than previously reported. Higher interoceptive accuracy and self-reported depression were related to a better fit of the quadratic model and the steepness of the curve, respectively. The prevalence of the quadratic model at the individual level was stable across body sites (62.6%, *experiment 1*), across two experimental sessions (73%–78%, *experiment 2*), and regardless of the number of repetitions of each velocity (*experiment 3*). Thus, the individual perception of tactile pleasantness follows a characteristic velocity-dependent function across skin types and shows trait characteristics. Future studies can investigate further the possibility to use affective touch as a behavioral biomarker for mental health disorders.

Keywords: affective touch, CT afferents, interoception, mental health, tactile pleasantness

*Speaker

Affective Touch perception in Borderline Personality Disorder: a behavioral and psychophysiological approach

Gianluca Cruciani * [1], Pietro Zingaretti [2], Vittorio Lingiardi [1], Sergio De Filippis [2], Grazia Spitoni [1]

[1] Department of Dynamic and Clinical Psychology, and Health Studies, Faculty of Medicine and Psychology, Sapienza University of Rome, Via degli Apuli 1, 00185 Rome, Italy – Italy
[2] Villa von Siebenthal Neuropsychiatric Hospital and Clinic, Via della Madonnina 1, Genzano di Roma, Rome, Italy – Italy

Research on somatosensation in Borderline Personality Disorder (BPD) suggested a blunted processing of nociception which could foster self-injurious behaviors. Nevertheless, other submodalities of somatosensation, especially Affective Touch (AT), are still underexplored. Thus, 30 BPD patients and 30 matched healthy controls were enrolled in 4 consecutive experiments to investigate AT perception. In the first experiment, participants underwent a somatosensory battery assessing all the principal submodalities of somatosensation; results showed abnormal pain perception and tactile sensitivity in BPD patients, but no differences emerged neither for tactile acuity nor for AT. The second experiment investigated BPD patients' tactile pleasantness perception of stimulations delivered at CT-optimal velocity (i.e., 3 cm/s) with objects characterized by different textures, compared to controls; we found lower pleasantness ratings for soft objects and higher ratings for coarse and punctuate objects in BPD than in controls. In the third experiment, participants were free to select object, velocity and pressure to self-stimulate themselves in a pleasant way and results showed a higher rate of choice among coarse and punctuate objects and significantly higher pressure levels in the BPD group. Lastly, in the fourth experiment we explored the effect of AT on cardiac psychophysiological indices (HR, HRV, and interoceptive awareness) in BPD patients compared to control and we found a soothing effect of AT on all the considered indices in both groups. Results point to a preserved AT processing but also suggest a possible interplay between pleasure and pain systems in BPD.

Keywords: affective touch, borderline personality disorder, heart rate variability, pleasant touch, interoception

*Speaker

An open computational toolbox to analyze microneurographic MSNA recordings

Giacomo D'alesio * [1], Paolo Sciarrone [2], Chiara Borrelli [2], Alessandro Navari [2], Francesco Gentile [2], Sara Ballanti [1,3], Andrea Mannini [3], Claudio Passino [2], Michele Emdin [1,2], Alberto Giannoni [1,2], Alberto Mazzoni [1], Calogero Maria Oddo [1]

[1] Scuola Superiore Sant'Anna – Italy
[2] Fondazione Toscana Gabriele Monasterio – Italy
[3] Fondazione Don Gnocchi – Italy

Microneurographic recordings provide a means to study action potentials of postganglionic sympathetic fibers at different levels, from compound to single unit analysis. However, most existing computational toolboxes used for the analysis of microneurographic recordings are not open-ended or limited in scope. Additionally, conventional burst-based metrics have limitations in pathological conditions and are highly sensitive to electrode distance from the active fibers. To address these challenges, we developed an open-source toolbox that offers advanced analysis capabilities for studying autonomic reflexes and physiological responses to sympathetic nerve activity. Our toolbox leverages the observation of temporal sequences of action potentials within the cardiac cycle, introducing innovative methods and indexes to enhance analysis accuracy. Importantly, we have designed our computational toolbox to be accessible to users without engineering backgrounds. This includes researchers and professionals in healthcare domains, such as clinical medicine, life sciences, and related fields. By prioritizing user-friendliness, our software application serves as a valuable resource for the scientific community, allowing researchers to extract advanced indexes of neural activity and evaluate their impact on other physiological variables in a consistent and standardized manner.

Keywords: Microneurography, Computational toolbox, Data analysis

*Speaker

Influence of bilateral vestibulopathy on self-location and body ownership measured by multisensory illusion in virtual reality

Zoé Dary * [1], Jacques Léonard [1], Jean-Marie Pergandi [2], Charlotte Hauterfort [3], Pierre Denise [4], Christophe Lopez† [1]

[1] Aix-Marseille Université – LNC - Aix-Marseille Université – France
[2] Aix-Marseille Université – CRVM – France
[3] AP-HP – AP-HP, APHP – France
[4] Université Caen – Université de Caen, COMETE – France

Studying behaviour and perception in patients with a bilateral vestibulopathy is essential to understand the vestibular contributions to space, self and body representations. Here, we compared the experience of self-location and self-identification in a virtual environment and experience of depersonalization in 29 patients with a bilateral vestibulopathy and 29 healthy volunteers matched for age and sex. We used a full-body illusion based on synchronous visuo-tactile stimulation in an immersive virtual environment. A tactile stimulation was applied to the participant's back and reproduced in synchronous or asynchronous (with a delay of 1s) manner on the avatar's back which was situated 2 metres in front of the participant in a virtual environment. In the control group, our preliminary analysis showed a statistically significant larger self-relocation toward the avatar after synchronous visuo-tactile stimulation when compared to asynchronous stimulation, in accordance with previous studies (Lenggenhager et al., 2007; Nakul et al., 2020). However, there was no significant difference in the perceived self-location between synchronous and asynchronous stimulation in patients with bilateral vestibulopathy. These results suggest different multisensory mechanisms for encoding self-location in patients with bilateral vestibulopathy. Moreover, depersonalization scores did not differ significantly between both groups of participants, suggesting that a bilateral vestibulopathy doesn't modify the experience of a bodily self as measured with questionnaires, or affects it less than in patients with unilateral vestibular disorders (Lopez & Elzière, 2018).

Keywords: self, location, bilateral vestibulopathy, bodily self

*Speaker
†Corresponding author: christophe.lopez@univ-amu.fr

Dead skin encodes the perception of microscale textures

Thomas Daunizeau *† [1], Sinan Haliyo [1], Vincent Hayward [1]

[1] Institut des Systèmes Intelligents et de Robotique – Centre National de la Recherche Scientifique, Sorbonne Universite, Centre National de la Recherche Scientifique : UMR7222 – France

Dynamic touch provides us with greater resolving power than our eyes do, making the finger pad an instrument of choice for the perception of fine textures and materials. Recently, researchers have discovered that humans can tactually discriminate sinusoidal gratings that are one to two orders of magnitude smaller than a single skin cell. In this study, we present a psychophysical evaluation demonstrating that humans can discriminate microscopic periodic features not only by their size but also by their direction. To explain this remarkable ability, we investigated the concurrence of multiple phenomena, including adhesive and interlocking frictions as well as cutaneous viscoelastic stiffening. Through high-fidelity tribological measurements, we obtained evidence that the keratinized outermost skin layer, known as the stratum corneum, undergoes a frequency-driven phase transition. This arises from the numerous consecutive interactions that occur when sliding against microscale features. We formulated a novel dynamic model of microscale contacts to capture this effect. It unveils the mechanism by which skin cells transition from a soft, rubbery state to a rigid, glassy state, resulting in significant variations in adhesive friction. These findings establish the basis of a pre-neuronal mechanical coding of microscale rugosity. Consequently, the viscoelastic properties of our outermost skin layer may contribute to our ability to identify natural materials like wood, owing to their fractal roughness.

Keywords: Skin mechanics, Tribology, Texture perception

*Speaker

†Corresponding author: thomas.daunizeau@sorbonne-universite.fr

Does affective touch promote autonomic self-regulation after emotional distress?

Letizia Della Longa * [1], Teresa Farroni [1]

[1] University of Padova, Developmental Psychology and Socialization Department – Italy

Affective touch, mediated by activation of C-tactile afferents, has been shown to foster autonomic self-regulation and modulate affective states in situations of distress in early infancy (Feldman et al., 2010) and across the lifespan (Fotopolou et al al., 2022). In the present study we presented adults (N=95) with emotion-eliciting videos of an infant babbling (positive affect) and an infant crying (negative affect; Ruffman et al., 2019). Each video lasted 2min and was followed by 2min of touch (either affective - slow stroking with a brush or non-affective - gentle tapping with the brush handle as between-subject condition). Participants were also presented with a neutral video of babbles (2min) as baseline (before stimulation) and recovery (after stimulation). During the experiment we measured heart rate variability (HRV), which reflects oscillations of heart rate associated with autonomic regulation and it is considered an index of the parasympathetic activity. Results revealed a decrease of HRV during video presentation and an increase of HRV during tactile stimulation. Moreover, the relative increase of HRV during the touch phase compared to the video phase was higher in the affective touch group than in the non-affective touch group, but only after viewing an infant crying. These results suggest that affective touch promotes autonomic self-regulation and it may be more effective than non-affective touch in a situation of emotional distress.

Keywords: Affective touch, autonomic regulation, heart rate variability, emotional distress

*Speaker

Therapeutic application of affective touch: the psychoactive massage

Karl Devreese *† [1], Mariell Kiebgis‡ [2], Bruno Müller-Oerlinghausen§ [3], Michael Eggart¶ [4]

[1] VIVES Kortrijk – Belgium
[2] Praxis und Ausbildungszentrum für psychoaktive Massage, Kressbronn am Bodensee – Germany
[3] Charité - UniversitätsMedizin = Charité - University Hospital [Berlin] – Germany
[4] Medizinische Hochschule Brandenburg Theodor Fontane / Brandenburg Medical School Theodor-Fontane – Germany

Psychoactive massage (PAM GMK), developed by body therapist Gabriele Mariell Kiebgis relies on the demonstrated effects of affective touch in addition to the already widely accepted activation of oxytocinergic neurons (Uvnäs Moberg, 2003) and differs profoundly from classical massage techniques. Conditions that prioritise affective touch are incorporated in PAM GMK: gentle, caring strokes of body areas with CT fibres (Olausson, 2016; Schirmer & McGlone, 2022), body temperature of 34∘C (Ackerley, 2018), clarity of intention during massage (Sailer et al, 2020) and the need for repetition (Schleip, 2012). As a massage technique, PAM GMK is detailed and clearly structured and involves the whole body with a focus on the coherence and evenness of all body parts (Kiebgis, 2023). Several meta-analysis studies (Baumgart et al, 2011; Moyer et al., 2014; Hou et al., 2014) confirm positive effects of massage therapy for people with depression (PmD). An experimental study by Arnold et al (2020) indicates that psychoactive massage by PmD leads to significant clinical improvements in internal unrest, unpleasant physical body sensations and feelings of hopelessness (Müller-Oerlingshausen & Eggart, 2020). PAM GMK works therapeutically because of the repetitiveness of the sessions to address the characteristic features of anhedonia and vital inhibition in PmD, restoring the disrupted interoceptive network, counts on insular processing and its modulatory effect on the amygdala. All this leads to a pleasant experience and a growing higher-quality body experience (Kiebgis & Müller-Oerlinghausen, 2018).

Keywords: psychoactive massage, depression, affective touch

*Speaker
†Corresponding author: devreesekarl@gmail.com
‡Corresponding author: gmkiebgis@t-online.de
§Corresponding author: bruno.mueller-oerlinghausen@web.de
¶Corresponding author: michael.eggart@gmx.com

Can the somatosensory system integrate a tactile model for an extra robotic body part?

Lucy Dowdall *† [1], Giulia Dominijanni [2], Maria Molina [1], Dani Clode [1], Tamar Makin [1]

[1] MRC Cognition and Brain Sciences Unit, University of Cambridge, Cambridge, UK – United Kingdom
[2] Bertarelli Foundation Chair in Translational NeuroEngineering, Center for Neuroprosthetics and School of Engineering, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland – Switzerland

Augmentation technology is a rapidly expanding field, and with it there is growing interest in how such devices interface with the body. When learning to control augmentation devices, one important sensory input is the tactile feedback received from where the device is worn on the body, described as intrinsic touch. We asked whether the brain gathers information from intrinsic tactile inputs to construct an internal representation of the device. To investigate such changes in somatosensory processing, we are using a supernumerary robotic finger (the Third Thumb, Dani Clode Design). In our ongoing study, we are assessing changes to inter-finger sensory representations before and after a week of altered finger-synchronisation motor training: either due to extended Third Thumb training, or training to play the keyboard. We are using fMRI to study the representational similarity patterns across the biological fingers and Third Thumb (via intrinsic touch) before and after training using a soft pneumatic actuator stimulation system. We are also using a psychophysics paradigm to explore changes in sensory integration, examining tactile temporal order judgements involving the biological fingers and the Third Thumb. Preliminary results show improved localisation ability, and increased neural representational similarity, in the Third Thumb training group between the Third Thumb and the biological fingers it collaborates with most frequently. This is because the brain has gained familiarity integrating these somatosensory inputs. This work will allow us to demonstrate the brain's ability to integrate an artificial limb into the biological body's sensory model.

Keywords: Touch, Somatosensory, Tactile, Feedback, Sensory Feedback, Localisation, fMRI, Augmentation, Technology, Prosthetics, Robotics

*Speaker
†Corresponding author: lucy.dowdall@mrc-cbu.cam.ac.uk

Material-texture confounds in haptic perception: Exploring a potential metameric relationship between surface roughness and material elasticity

Karina Driller * [1,2], Camille Fradet , Richard Goossens [1], Vincent Hayward [2], Jess Hartcher-O'brien

[1] Technische Universiteit Delft – Netherlands
[2] Institut des Systèmes Intelligents et de Robotique – Sorbonne Universite – France

Perceptual metamers result from the inability of our sensory apparatus to resolve the entirety of the physical properties of objects, leading to confounds, where different physical stimuli can be perceived to be identical. Here we will present data exploring the interdependent relationship between surface roughness and material elasticity in determining the perceived roughness and softness of textured, elastic surfaces. Everyday-life encountered surfaces are often self-affine, exhibiting fractal properties over many different length scales. However, research focusing on perceived surface roughness has typically used simple stimulus material (e.g., sandpapers or periodic gratings). Furthermore, in everyday surface interactions, changes in surface characteristics are frequently accompanied by alterations in material properties. Despite this, the joint influence of these parameters on haptic surface and material perception has been investigated very little. Here we use a database of 49 stochastically-rough silicone rubber samples, resembling natural textures in some of their features, without compromising on the control needed for haptic experiments. The samples are varied systematically in their statistical microscale roughness (Hurst exponent) and elasticity (shore hardness). We employ a 2AFC-discrimination procedure, embedded in a non-parametric Bayesian inference framework, to determine the probability of any given sample in our stimulus space as being perceived as rougher or softer. Our hypothesis posits that if both cues – surface roughness and material elasticity – influence the perceptual outcome (roughness or softness), there should be perceptual regions where A) one cue dominates the other and B) the two cues provide confounding percepts (metamers).

Keywords: roughness, elasticity, material & texture perception, self, affine, metamer, perceptual confound

*Speaker

Imaging skin deformation during pincer grasp.

Sophie Du Bois De Dunilac * [1], David Córdova Bulens [1], Stephen Redmond [1]

[1] University College Dublin [Dublin] – Ireland

Tactile feedback is crucial for dexterous manipulation, but the underlying mechanisms are not well understood due to the complex interplay between predictive and feedback control in setting our grip force (GF) in response to varying load forces (LF). The GF-LF relationship has been investigated for decades using instrumented objects that measure forces, but these instrumented objects do not measure tactile feedback. Recent developments in skin strain imaging have provided a proxy measurement of tactile feedback during the manipulation of such instrumented objects. However, these instrumented objects only image a single finger, providing an incomplete picture of cutaneous tactile feedback.
To address this limitation, we present a novel instrumented object capable of imaging both the index finger and thumb in a pincer grasp with high contrast. Our pilot study aims to investigate the beginning of grip and lift phases using a size-weight illusion paradigm which renders visual cues and anticipatory scaling of GF unreliable. Without the ability to reliably predict the GF, we expect any subsequent GF adjustments to be informed by tactile feedback, including cutaneous sensation from the finger and thumb. We anticipate that our device will provide a more comprehensive understanding of the role of tactile feedback in GF adaptation.
Our pilot study's findings may help establish a causal link between partial slips and grip force adaptation, shedding light on the underlying mechanisms of dexterous manipulation.

Keywords: Instrumented object, Grip force, Tactile feedback

*Speaker

Imaging vibration induced skin deformations with reference to psychophysics and primary somatosensory neurons activity in humans

Basil Duvernoy [*†] [1], Ewa Jarocka [2], Anders Fridberger [1], Sarah Mcintyre[‡]
[1]

[1] Department of Biomedical and Clinical Sciences, Linköping University – Sweden
[2] Physiology Section, Department of Integrative Medical Biology, Umeå University – Sweden

Tactile mechanoreceptors consist of neurons whose afferents innervate end-organs embedded in the skin. The characteristics of human mechanoreceptors are usually inferred from the properties of stimuli acting on the skin surface. This means that current definitions of the mechanoreceptors' functional properties fail to account for how the stimulus is modified as it passes through the skin layers. Here we present a pre-registration plan for a project with the aim of determining the skin's role in mechanoreceptor activation and touch perception.
We plan to measure sub-micrometre deformations of subcutaneous skin tissue with a novel imaging technique. We obtain phase-resolved measurements using an SD-OCT (spectral domain optical coherence tomography) system capable of tracking high frequency vibrations. The OCT system also enables us to identify specific landmarks in the skin indicating the expected locations of the end-organs.

Using microneurography we will measure frequency-dependent (5-500Hz) vibration thresholds of single primary afferent tactile neurons with receptive fields in human glabrous skin. With SD-OCT, we will measure the skin deformations below a receptive field "hot spot" at the expected location of the end-organ. In a separate psychophysics experiment, we will measure the frequency-dependent perceptual thresholds, and use SD-OCT to measure skin deformations. In both microneurography and psychophysical experiments skin deformations will be measured at amplitudes above and below neural and perceptual thresholds, respectively.
These experiments should reveal the amount of deformation required at the end-organ to reach neural and perceptual thresholds, and allow us to measure any mechanical filtering of tactile stimuli occurring in the skin.

Keywords: microneurography, OCT, skin deformation, frequency sensitivity

*Speaker
†Corresponding author: basil.duvernoy@liu.se
‡Corresponding author: sarah.mcintyre@liu.se

Features of the CT-system in babies at familial risk of autism: a discussion of the design of a longitudinal study

Eva Dydenkova * [1]

[1] Moscow affective touch laboratory – Russia

Introduction: It is known that people with ASD do not have full access to the benefits of the CT-system (Cascio, 2008). Avoidance of tactile contact by 9-month-old infants predicts further autistic social impairment (Mammen, 2015). The heritability of ASD is highly probable (Sherlly, 2019), which makes it possible to study the development of the CT-system at an earlier age in babies with older siblings with ASD (especially sisters (Stefan, 2019).
Sample: Babies at high familial risk of autism aged 0-3 months (n> 30) and term babies without risk of autism aged 0-3 months (n> 30) considering gender balance.

Aim of the study: Study 1. We research EEG and ECG dynamics to identify indicators of possible therapeutic effect in different infants and compare them with psychometric measures.

Study 2. The sample from Study 1 is divided into experimental and control groups by randomization. Participants in the experimental group are exposed to an intervention (tactile contact training program) for 6 months. Study 2 takes place 6 months after Study 1. We compare the characteristics of the response of the CT-system and changes of social-emotional development in both groups.
Methods: Scale for early assessment of emotional and social development ADBB (assessment by video recording of 8-min interaction with the baby), dynamics of EEG components during gentle maternal tactile stimulation (also PRE/POST), ECG parameters of mother and infant. Diagnosis takes place at mother's home.

Keywords: design EEG study, CT, afferents, gentle touch, autism.

*Speaker

What factors drive differences in cortical representation of the body? Influence of innervation density, stimulus statistics and resource constraints.

Laura Edmondson * [1], Hannes Saal† [1], Alejandro Jimenez Rodriguez [2]

[1] Active Touch Lab, University of Sheffield – United Kingdom
[2] Sheffield Hallam University – United Kingdom

Cortical topographic representations in sensory systems often exhibit non-proportional scaling to the size of input regions, with some regions magnified greatly beyond their physical size. In touch, the fingertip representation occupies a much larger cortical region compared to other parts of the body. Similarly, the fovea is magnified in the visual cortex. What drives this allocation regime? Several reasons have been proposed. One possibility is that allocations simply reflect afferent densities across the body, for example, the greater innervation of the fingertips and fovea. Another factor is the typical usage of body parts, resulting in variations in stimulus statistics. For instance, hands play a crucial role in everyday interactions and object manipulation, and the fingertips tend to have higher contact frequencies. In vision, representations have been successfully studied using mathematical models based on efficient coding principles. Building on this work in touch, we consider how regions of varying receptor densities and contact statistics may be allocated given some restriction on the amount of neural resources available- a sensory bottleneck. We find that the width of this bottleneck is a crucial factor in optimal resource allocation, inducing either expansion or contraction of input region representation. Both receptor density and stimulus statistics affect representation and jointly determine allocation for wider bottlenecks, where more neural resources are available. Additionally, we consider a model system, the star-nosed mole, where both density and usage of their tactile rays have been extensively studied, and find a correspondence between the predicted and empirical cortical allocations.

Keywords: somatotopy, topography, modelling, cortical representation

*Speaker
†Corresponding author: h.saal@sheffield.ac.uk

Continuity within the somatosensory cortical map facilitates learning

Valérie Ego-Stengel * [1], Henri Lassagne [1], Dorian Goueytes [1], Daniel Shulz [1], Luc Estebanez [1]

[1] Institut des Neurosciences Paris-Saclay – Université Paris-Saclay, Centre National de la Recherche Scientifique – France

The topographic organization of sensory cortices is a prominent feature, but its functional role remains controversial. Particularly, it is still unknown how integration of activity within a cortical area depends on its topography during sensory-guided behavior. Here, we trained water-restricted mice expressing channelrhodopsin in cortical excitatory neurons to track a photostimulation bar that rotated continuously over the primary somatosensory cortex (S1). Mice could obtain reward by licking while the photostimulation resided within a specific range of angles. When the photostimulation was aimed at the whisker representation in S1, which contains a continuous representation of the animal whiskers, mice could learn to discriminate angular positions of the bar to obtain rewards. In contrast, they failed to learn the task in three other conditions: 1) when the spatiotemporal continuity of the photostimulation was disrupted, 2) when the photostimulation was aimed at the representation of the trunk and legs in S1, which contains multiple map discontinuities and 3) when the photostimulation was done on the posterior parietal cortex that does not contain a topographic map. Mice demonstrated anticipation of reward availability, specifically when cortical topography enabled to predict future sensory activation. These findings could be particularly helpful for incorporating tactile or proprioceptive sensation into neuroprostheses, through direct cortical stimulation.

Keywords: cortex, mouse, optogenetics, somatotopy, sensory discrimination, whisker system

*Speaker

Mapping the social, emotional and sensory qualities of interpersonal touch

Flavia Esposito *† [1], Isabella Püschel [2,3], Emma Kindström [1], Sarah Mcintyre *

1

[1] Center for Social and Affective Neuroscience (CSAN), Linköping University, Linköping – Sweden
[2] Department of Clinical Psychology, Friedrich Schiller University – Germany
[3] Department of Psychotherapy and Psychosomatic Medicine, University Hospital Carl Gustav Carus Dresden, Technische Universität Dresden – Germany

The perceived meaning of touch is likely to be informed by its sensory features together with the social context and personal characteristics. However, most affective touch research has minimised contextual information. The aim of this study is to map physical features to social, emotional and sensory descriptors of social touch interactions.
We recruited 1000 English-speakers internationally for an online survey, who viewed short video clips (7-9 secs) showing the perspective of a person being touched. The stimuli consisted of a hand touching a forearm using 24 touch expressions that reflect the range of previously measured physical parameters present in naturalistic touch. The expressions varied by contact (hand, finger), direction (horizontal, vertical), speed (3, 9, 18 cm/s), and force (light, strong). Respondents answered open-ended questions to capture three domains of description: sensory, emotional, and social context. They also rated the valence and arousal of the touches.
Respondents rated the touches mostly positively, and ratings varied depending on the physical features. Arousal was mostly neutral. Word frequency analysis revealed that imagined social scenarios involved a variety of body locations and occurred predominantly at home. Relationships to the toucher were primarily close ("friend" or "romantic partner") and varied by touch features. Touch delivered by the hand was more frequently described with the words "warm", "comfort" and "calm" than finger touches. Horizontal movement was described with "calm" and "love" and associated with "romantic partner", while vertical movement was more associated with "child", and vertical finger expressions were described with "annoy" or "attention".

Keywords: social touch, social context, sensory descriptors, affective touch, lexicon

*Speaker
†Corresponding author: flavia.esposito@liu.se

Towards a sensorimotor forelimb prosthesis for the mouse model

Édouard Ferrand , Daniel Shulz , Valérie Ego-Stengel , Luc Estebanez [*†] [1]

[1] NeuroPSI – Paris Saclay Institute of Neuroscience, Université Paris Saclay, CNRS – France

Research towards the restoration of upper limb function through bidirectional, BMI-controlled prostheses calls for tractable experimental models. A mouse forelimb neuroprosthesis would make this animal model a highly relevant neuroprosthetics research platform with its unique genetic and molecular toolboxes.
Here we take advantage of a mouse bidirectional BMI that we previously built in the team (Abbasi et al. 2018, Goueytes et al. 2022), and combine it with a miniature, mouse-scale 3D-printed forelimb prosthesis with four degrees of freedom and a tracking system to ensure its accuracy. Electrophysiological activity of neurons is recorded in the primary motor cortex and converted into a command. This command can be either the joints angles, a cartesian coordinates of the tip of the limb or even a combination of predefined trajectories. In preliminary experiments, we trained a mouse to control the forelimb prosthesis in a physiological 2-degrees of freedom space in order to obtain water by bringing the prosthesis to the mouth, and back to a water reservoir to refill the drop carried by the prosthesis paw.

In our next experiments, we will probe the ability of mice to control this prosthesis in a 3 dimensions polar space, and we will finalize the implementation of touch/proprioceptive feedback based on camera tracking and embedded force sensors. We now aim to test the impact of this feedback on the accuracy and overall speed of the prosthesis motor control.

Abbasi et al 2018: https://iopscience.iop.org/article/10.1088/1741-2552/aabb80/meta

Goueytes et al. 2022: https://iopscience.iop.org/article/10.1088/1741-2552/acab87

Keywords: Brain, machine interface, mouse, prosthesis, limb, hand

[*]Speaker
[†]Corresponding author: luc.estebanez@cnrs.fr

Blindness does not hamper extension of touch localization on tools

Cécile Fabio *† [1], Salam Bahmad [1], Roméo Salemme [1,2], Luke Miller [3,4], Alessandro Farnè [1,2,5]

[1] Centre de recherche en neurosciences de Lyon - Lyon Neuroscience Research Center – Université Claude Bernard Lyon 1, Université de Lyon, Université Jean Monnet - Saint-Etienne, Institut National de la Santé et de la Recherche Médicale, Centre National de la Recherche Scientifique – France
[2] Hospices Civils de Lyon, Neuro-immersion – Hospices Civils de Lyon, Neuro-immersion – France
[3] Donders Institute for Brain, Cognition and Behaviour – Netherlands
[4] Radboud university [Nijmegen] – Netherlands
[5] Center for Mind/Brain Sciences – Italy

Tactile events frequently occur outside the body and on external objects. For example, tools can be used to extend tactile perception beyond the body-a classic example being when blind individuals use canes to pick up information about their surroundings. We recently found that sighted participants can accurately localize where an object touches a hand-held tool when they actively make contact with it. However, localization performance drops when tool-object contact is passive, suggesting that certain factors such as motor variables or tactile feedback play a role in forming the spatial percept. Despite being a paradigmatic case to address the debate about touch superiority in the blind, it remains unknown whether blind individuals surpass sighted individuals in tool-sensing abilities. To fill this gap, we compared sighted and blind participants on their ability to localize touch on the surface of a held-hand tool in both active and passive sensing conditions. To do so, we developed a novel paradigm that allowed participants to haptically report where an object made contact with the tool. Consistent with our prior findings, localization was more accurate and precise during active sensing compared to passive sensing. Surprisingly, we found no difference in performance between the sighted and blind participants in either condition, supporting the arguments against touch superiority in the blind.

Keywords: touch, blindness, tool use, tactile localization, tool, blind

*Speaker
†Corresponding author: fabio.cecile@yahoo.fr

Bionic Breast : Neural basis of tactile and affective sensations related to breast stimulation in humans

Sophia Faresse * [1], Rochelle Ackerley

[1] Laboratoire de neurosciences cognitives-Marseille – Centre National de la Recherche Scientifique - CNRS, Aix-Marseille Université - AMU – France

Breast cancer is the first cancer in women in France and one of the leading cause of death by cancer in women worldwide. One of the efficient treatment is mastectomy, a surgical procedure consisting of a breast amputation. Although it has been shown to improve survival, it removes the endings of the cutaneous branches of the intercostal nerves that innervate the skin of the breast, resulting in a loss of sensation. But, breast sensation is important in women's lives: for embodiment, for communication through touch, and for erogenous sensations.
Years of research have led to major innovations in the development of peripheral nerve interfaces for hand and arm amputees that can reproduce a sense of touch. Despite the importance of breast sensation, little is known about its neural basis, which are needed to develop a peripheral nerve interface to improve breast sensation.
My thesis project consists in characterizing the neural bases of tactile and affective breast sensations. To do so, we will use psychophysics measurements and innovative techniques to precisely record and stimulate the nerves in awake humans : Temporal Interference Nerve Stimulation (TINS), a non invasive technique that allows a focal and depth stimulation and Microneurography, that allow to record from the axons of single neurons of peripheral nerves. We will use them to map the tactile sensations evoked by a stimulation of the peripheral nerves responsible for tactile sensations in the human chest. We will also investigate the need to improve the breast sensation using a questionnaire.

Keywords: Touch, Breast sensation

*Speaker

Day-to-day variability in female breast sensitivity to touch, temperature, and wetness

Flavia Figlioli *† [1,2], Hannah Blount [1], Jade Ward [1], Antonino Bianco [2], Alessandro Valenza [2], Peter Worsley [1], Davide Filingeri [1]

[1] University of Southampton – United Kingdom
[2] Università degli studi di Palermo - University of Palermo – Italy

Skin' sensitivity to touch, temperature, and wetness across the female breast may vary during the menstrual cycle; yet only few studies performed sensory assessments over multiple days and with high frequency. The aim of this study was to evaluate with high frequency the day-to-day variability in female breast sensitivity to touch, temperature, and wetness during several, consecutive menstrual cycles occurring over a period of six months, in young healthy women.
Three young women (26±1y) characterised by normal menstrual cycles (ID1) or various contraceptive use (Intra Uterine Device, ID2; Vaginal Ring, ID3) and a male (acting as control, IDM; 36y) took part in this prospective study. During each visit, participants underwent well-established quantitative sensory testing of tactile, thermal, and wetness sensitivity at the breast (or chest) and at the xiphoidal process.

Data collection and analysis is ongoing. At the time of writing, women participants have been tested during 10 separate days. Preliminary analyses indicated that when considering e.g. warm sensitivity at the breast women presented grater day-to-day changes (variation= 48%) than the male control (variation=18%). However, when considering tactile, temperature and wetness sensitivity altogether, we observed this trend only in 3 out the 10 stimuli applied to each participant.
Our preliminary observations support the feasibility of our approach and provide initial, albeit partial, support to the potential fluctuations in breast skin' sensitivity over the course of menstrual cycle. Completing our prospective data collection will help determining the repeatability of sensory fluctuations and their potential rhythmicity with menstrual cycles.

Keywords: Sensitivity, temperature, wetness, menstrual cycle, breast, perception

*Speaker
†Corresponding author: flavia.figlioli@unipa.it

Affective touch in young adult couples

Yvonne Friedrich * [1], Marie Hoffmann [1], Katharina Rehling [1], Uta Sailer [2], Ilona Croy [1]

[1] Department of Clinical Psychology, Friedrich-Schiller University Jena – Germany
[2] Faculty of Medicine, University of Oslo – Norway

In adulthood, partners are the most frequent and desired touch givers. Studies have highlighted the importance of partner touch in stress reduction, personal well-being and relationship satisfaction. However, basic information about partner touch is still lacking. Surprisingly, we do not know how often partners touch each other and how this relates to individual and relationship factors. Previous studies have been limited by survey character and short observation periods. Therefore, we used an ecological-momentary assessment method to follow more than 100 young adult couples for 7 days. Subjects (18-35 years) documented the touches they received from their partner with a mechanical counter. Beforehand, subjects were asked about relationship and individual characteristics. At the end of the week, they reported details about the most positive and the most negative touching event. Preliminary results showed that young adults received an average of about 50 touches per day from their partners. This correlated positively with their touch wish and relationship satisfaction and negatively with relationship duration and individual age. Final results will be presented at the conference.

Keywords: affective touch, relationship satisfaction, EMA

*Speaker

Tactile self-other distinction in ADHD

Morgan Frost-Karlsson * [1], Andrea Johansson Capusan [1,2], Hakan Olausson [1,3], Rebecca Boehme [1]

[1] Center for Social and Affective Neuroscience, Linköping University – Sweden
[2] Department of Psychiatry, Linköping University Hospital – Sweden
[3] Department of Clinical Neurophysiology, Linköping University Hospital – Sweden

Distinction between tactile sensations produced by oneself and others is crucial for healthy social development and in the creation of a bodily self. Difficulties with social cognition and tactile sensitivity are present in ADHD but mechanisms are poorly understood. Using fMRI, we have previously found differences in neural activation during self and other touch in a group of adults with ADHD, potentially indicating a heightened sense of the bodily self. Using somatosensory evoked potentials (SEP) on the radial nerve during self and other touch, we here explore if these differences are replicable on a cortical level and present at the spinal level, and if any such differences are related to severity of ADHD symptomatology. Preliminary data show differences in tactile processing in people with ADHD, indicating a potential pathway for impaired social cognition and tactile hypersensitivity.

Keywords: ADHD, self other distinction

*Speaker

Short-latency somatosensory evoked potentials following vibrotactile stimulation

Elena Fuehrer * [1,2], Lisa Maurer [2,3], Katja Fiehler [1,2]

[1] Experimental Psychology, Justus Liebig University Giessen – Germany
[2] Center for Mind, Brain and Behavior (CMBB), University of Marburg and Justus Liebig University Giessen – Germany
[3] Institute of Sport Science, Justus Liebig University Giessen – Germany

Somatosensory evoked potentials (SSEPs) are typically elicited through electrical nerve stimulation yielding short- (P9, N9, P11, N11, P13/P14, N18, P20, N20, N30, P45) and long-latency (P100, N150, P250, P350) components. However, for certain experimental paradigms, researchers may prefer using more naturalistic vibrotactile stimuli. While long-latency SSEPs can be reliably evoked using vibrotactile stimulations, there is limited information available on short-latency SSEPs due to their smaller amplitudes. To address this gap and facilitate future SSEP research, we aimed to characterize the short-latency potentials produced by brief vibrotactile stimulations at different amplitudes. Twenty participants received 200 repetitions each of sinusoidal vibrotactile stimulations (20 ms, 280 Hz) at four supra-threshold amplitudes (42, 97, 134, and 190 μm) in a randomized order. The inter-stimulus interval was set to 2200 ms. Our findings reveal a centro-parietal short-latency (44 - 48 ms) positive peak corresponding to a P45 at the CP3 electrode, located near the somatosensory cortex contralateral to the stimulation. The latency of the P45 component did not differ significantly among the four stimulation amplitudes. Furthermore, a preliminary analysis of the averaged signal during the P45 peak (36-56 ms) demonstrated a significant difference in SSEP amplitude at CP3 based on the stimulation amplitudes. To better contrast short-latency SSEPs elicited by electrical and vibrotactile stimulations, we plan to retest the participants using electrical stimulations. Additionally, we intend to conduct further detailed analyses of all components and their topographies, aiming to present a comprehensive overview of SSEPs following electrical versus vibrotactile stimulations.

Keywords: EEG, SSEP, vibrotactile

*Speaker

Investigating the Sensory Experience of Virtual and Real Touch During Painful Stimulation

Martina Fusaro *† [1], Valentina Nicolardi [2], Luca Provenzano [3]

[1] Fondazione Santa Lucia [IRCCS] – Italy
[2] IRCCS Eugenio Medea Brindisi – Italy
[3] Italian Institute of Technology – Italy

Research suggests that pleasant touch can influence pain perception by down-regulating the insula and the anterior cingulate cortex, areas responsible for the subjective experience of pain. These brain regions are also activated during the perception of pleasant touches and, interestingly, also when observing vicarious touches on others. In previous studies, we demonstrated that vicarious touch can be observed in immersive virtual reality, also from a first-person perspective (1PP), leading to heightened sensations of pleasantness compared to a third-person perspective. Here, we aimed at comparing the sensations elicited by slow and fast touches perceived in the real world with touches in virtual reality on an embodied avatar in 1PP. Participants received laser stimulation to induce a painful transient sensation while perceiving and observing touches. They were asked to rate the unpleasantness and intensity of pain, as well as the pleasantness of the touches. We found that while touches in the real world were perceived as more pleasant, the pattern of results was consistent between the two conditions: slow touch was perceived as more pleasant than fast touch. Moreover, slow touch reduced the perception of unpleasantness and intensity of the induced pain, particularly in the real-world condition. Our findings suggest that there are similarities between real and virtual touches, and future studies incorporating EEG may help to understand the processes underlying pain modulation. Understanding these mechanisms can contribute to the development of interventions for pain management and enhance our knowledge of the integration between physical and virtual sensory experiences.

Keywords: Pleasant Touch, Immersive Virtual Reality, Pain modulation

*Speaker
†Corresponding author: m.fusaro@hsantalucia.it

Quantifying Tactile Emotional Communication through Anthropomorphic Artificial Skin

Martina Giancane * [1], Sara Ballanti† , Mariangela Filosa‡ , Calogero Maria Oddo§

[1] School of Advancend Studies Sant'Anna, Pisa – Italy

Interpersonal touch plays a crucial role in social interaction and communication, preceding verbal language (Hertenstein, 2002/2009; Ackerley et al., 2014). While previous studies have shown the effectiveness of touch in conveying emotions, the specific strategies and physical characteristics of tactile interaction remain less explored (Jung et al., 2015; Masson & Op de Beeck, 2018). This study aims to quantify tactile emotional communication strategies through anthropomorphic artificial skin (e-skin) (Massari et al., 2022) with sensing capabilities used to extract quantifiable signals and features related to tactile communication. Additionally, the study aims to establish a tactile lexicon by classifying individual emotions based on extracted features. The findings will contribute to developing biologically faithful tactile technologies and designing naturalistic stimuli to be employed in research and experimental practice. Participants are instructed to communicate emotions by touching the e-skin using the tactile modalities they deem most effective. The signals extracted are visualized as wavelengths and analyzed using signal segmentation and Dynamic Time-Warping (DTW) techniques. Distinct features associated with each emotion are identified, and patterns across the study population are detected. Preliminary analysis of a sample population revealed recurring patterns characterizing individual emotions conveyed through touch representative of tactile modalities employed (e.g., caressing, grabbing, etc.). Within-subject DTW demonstrated consistency between trials, with participants using the same touch modalities for the same emotion and different modalities for different emotions. Moreover, the promising ongoing between-subject analysis showed congruency of tactile patterns revealing the possibility of communicative modalities common among different subjects.

Keywords: Affective touch/artificial skin/humans/tactile communication

*Speaker

†Corresponding author: sara.ballanti@santannapisa.it

‡Corresponding author: mariangela.filosa@santannapisa.it

§Corresponding author: calogero.oddo@santannapisa.it

The role of the Vision in body representations: a study on hand distortions in Blind and Sighted individuals

Michelle Giraud *† [1], Luigi Tamè [2], Elena Nava [1]

[1] Università degli Studi di Milano-Bicocca = University of Milano-Bicocca – Italy
[2] University of Kent [Canterbury] – United Kingdom

Several studies have shown, in healthy individuals, the presence of large distortions for tactile stimuli represented on different body parts. The tactile distance between two touches on the dorsum of the hand is perceived as larger when they are oriented mediolaterally than proximodistally. Other studies showed that a temporarily altered visual experience of the body affects perceived tactile distances. This is because the system tends to preserve tactile size constancy by rescaling the distorted body representation into an object-centred space. This rescaling requires that the brain possesses a representation of the physical size of the stimulated body part. However, it is unclear what vision's role is in tactile size constancy. Here, we investigated the role of vision in body representation by asking blind and sighted individuals to estimate tactile distances between pairs of points on the back of the dor and on the fingers. The results showed that, regardless of visual experience, both groups of subjects showed typical hand distortions. This suggests that visual information does not seem to influence, at least, the participants' representation of the back of the hand. However, concerning the fingers, blind and sighted individuals show a difference in how they perceive them. This seems to align with the idea that the scaling of distorted body representations induced by touch occurs on the basis of visual cues.

Keywords: Body representation, Blind, tactile stimulation

*Speaker
†Corresponding author: m.giraud@campus.unimib.it

Mindful-Touch Education

Rita Griesche * [1]

[1] Mindful-Touch Education – Spain

The COVID-19 pandemic has forced humanity to rethink how we teach and learn, and digitalisation is deeply changing our lifestyles. As a result, the sense of touch and its potential for health and well-being has come into focus. Humans are social creatures and touch is a need. It defines and connects us.
However, children are being more touch deprived than ever before. This disconnect has culminated in the highest rate ever in bulling, aggression, violence, and suicide. One educational warning is the increasing number in mental health and behavioural disorders at schools.

Supportive and caring touch improves our relationships and fosters self-awareness, bonding, and learning. Touching prevents serious personality disorders and enhances our immune system. However, evidence of abusive touch has increased the fear and has developed into a taboo of social touch at schools.

In our human history we have developed tools and skills that use the "power of touch" for wellbeing and health. When children are taught positive and mindful touch at school, they can learn how "to make contact" and "care" for each other, how to "respect" boundaries, ask for permission and learn about limits, for themselves and others.
Mindful-Touch Education acts by proposing to incorporate the sense of touch into primary school education as part of an integrative initiative for 21st century education. This creative, respectful, and interactive project is contributing to enhance SDG 4 on the UN global agenda and EU vision of holistic human health perspective and more peaceful and balanced community welfare.

Keywords: Mindful Touch at School, Mindful Education, Mental Health

*Speaker

Skin type and nerve effects on cortical tactile processing: a somatosensory evoked potentials study

Marco Guidotti *† [1], Clément Beaurieux [2], Pierre Marionnaud [2], Frederique Bonnet-Brilhault [3], Marianne Latinus [4], Claire Wardak [4]

[1] UMR 1253 IBrain Imagerie Cerveau Equipe 1 : "Psychiatrie Neuro-Fonctionnelle" – imagerie et cerveau, Centre Hospitalier Régional Universitaire de Tours, Exac-t, EXcellence Center in Autism and neurodevelopmental disorders, Centre Hospitalier du Chinonais – France
[2] UMR 1253 IBrain Imagerie Cerveau Equipe 1 : "Psychiatrie Neuro-Fonctionnelle" – imagerie et cerveau – France
[3] UMR 1253 IBrain Imagerie Cerveau Equipe 1 : "Psychiatrie Neuro-Fonctionnelle" – imagerie et cerveau, Exac-t, EXcellence Center in Autism and neurodevelopmental disorders, Centre Hospitalier Régional Universitaire de Tours, Centre Hospitalier Régional Universitaire de Tours – France
[4] UMR 1253 IBrain Imagerie Cerveau Equipe 1 : "Psychiatrie Neuro-Fonctionnelle" – imagerie et cerveau, Exac-t, EXcellence Center in Autism and neurodevelopmental disorders – France

Objective: Tactile cortical processing is a complex phenomenon and is still not completely understood. Somatosensory evoked potentials (SEP) can be used to characterize its time-course and processing steps, but existing studies rarely considered 1) skin type at the stimulation site, 2) the nerve being stimulated, and 3) middle latency (> 30 ms) components. Our aim was to investigate middle latency SEPs following simple mechanical stimulation of two skin types innervated by two different nerves.
Methods: 18 adults aged 20 to 32 received 400 mechanical stimulations over four territories of the right hand (two nerves: radial/median; two skin types: hairy/glabrous skin) while their EEG was recorded, in front of a screen projecting a black cross on a gray background.
Results: Four middle latency components were identified for all subjects: P50, N80, N130 and P200. Consistent with previous reports, significantly shorter latencies and larger amplitudes were found over the contralateral hemisphere for all components. A skin type effect was found for the N80: larger amplitude was induced by glabrous skin stimulations than hairy skin stimulations. Regarding nerve effects, median stimulations induced larger P50 and larger amplitudes and longer latencies of the N80 component than radial stimulations. A significant nerve by electrode interaction was found for the P50, emphasizing differences in the topographies for median and radial nerves.
Conclusions: This study showed that skin type and stimulated nerve modulate middle latency SEPs, highlighting the importance of taking them into account.

Keywords: glabrous skin, middle latency SEP, median nerve, radial nerve

*Speaker
†Corresponding author: marco.guidotti@univ-tours.fr

Working Memory for Painful and Non-painful Touch: A transcranial magnetic stimulation study

Louisa Gwynne *† [1], Luigi Tamè‡ [2], Brianna Beck§ [2]

[1] University of Kent [Canterbury] – United Kingdom
[2] University of Kent [Canterbury] – United Kingdom

Neural regions underlying the transient retention of tactile inputs to the skin's surface have been identified as those also subserving initial tactile encoding. Such regions are likewise implicated in the detection of nociceptive inputs however, to our knowledge, no study has yet investigated their causal involvement in working memory for painful tactile stimulation. In the current study, participants complete either a painful or non-painful 2-alternative forced choice intensity discrimination task. On every trial, two different intensity electro-tactile stimulations are consecutively delivered to the index finger. The two pulses are separated by an interstimulus delay during which inhibitory single-pulse TMS is applied over S1, S2 or a control site (lateral occipital cortex; LOC) at one of three-time points: 300, 600 or 1200 ms. Preliminary data shows a trend in the reduction of task accuracy at early working memory delay ($\leq$600 ms) in both painful and non-painful conditions by TMS over S1 and S2 but not by LOC. This direction of effects remains to be determined over the coming weeks as I collect further data.

Keywords: TMS, Pain, Touch

*Speaker
†Corresponding author: lg497@kent.ac.uk
‡Corresponding author: l.tame@kent.ac.uk
§Corresponding author: b.c.beck@kent.ac.uk

Effects of mechanical stimulation of CT afferents on relapse-predicting biomarkers and alcohol craving in Alcohol Use Disorder during early abstinence

Juliana Harkki *† [1], Pauli Tuovinen [1], Veikko Jousimäki [2], Goncalo Barreto [3], Pekka Rapeli [4], Jussi Palomäki [5], Jonne Annevirta [1], Anna-Helena Puisto [1], Francis Mcglone [6], Heikki Nieminen [1,3], Hannu Alho [7]

[1] Neurodesign Lab, Dept Neuroscience Biomedical Engineering, Aalto University – Finland
[2] Aalto NeuroImaging, School of Science, Aalto University – Finland
[3] MEDUSA, Dept. of Neuroscience Biomedical Engineering, Aalto University – Finland
[4] Helsinki University Central Hospital, Department of Psychiatry, Helsinki – Finland
[5] Department of Digital Humanities, University of Helsinki – Finland
[6] University of Liverpool [Liverpool] – United Kingdom
[7] Clinicum, Faculty of Medicine, University of Helsinki – Finland

Alcohol use disorder (AUD) is one of the largest global health threats and among the most undertreated psychiatric disorders. Alcohol craving is one of the characteristic behavioral symptoms of this chronic brain disease and an important contributor to relapses. Affective touch has been shown to increase dopamine and to modulate the m-opioid system which both have a key role in AUD. C-tactile (CT) stimulating touch is postulated to increase oxytocin and to reduce stress system activity both of which have a beneficial effect on prevention of alcohol craving. CTs project to the insular cortex, a brain area involved in cue-induced craving and its stimulation has been suggested as a treatment method for AUD. This pilot study aims to assess whether acute mechanical stimulation of CTs influences relapse-predicting biomarkers (heart rate variability (HRV), salivary cortisol) and subjective alcohol craving in AUD patients during early abstinence. In this randomized controlled study, up to 40 patients who meet the DSM-5 criteria for mild to moderate AUD, will be exposed to alcohol-related, stress-inducing and neutral/relaxing images, while they receive either CT-optimal stimulation or non-CT-optimal control treatment. Saliva samples are collected at the baseline, before, and 3 times after each type of visual stimuli. HRV is derived from blood volume pulse, measured with a biosensor wristband throughout the experiment. Subjective craving is assessed with visual analog scale at the baseline and after the visual stimuli. The testing will continue until mid-June 2023. The preliminary results will be reported.

Keywords: C tactile, alcohol use disorder, addiction, relapse, craving

*Speaker
†Corresponding author: juliana.harkki@aalto.fi

Longing for Touch and Quality of Life during the COVID-19 Pandemic

Birgit Hasenack * [1,2], Larissa Meijer† [1], Jonas Kamps [1], Andy Mahon [1], Giulia Titone [1], Chris Dijkerman [1], Anouk Keizer [1]

[1] Experimental Psychology, Faculty of Social and Behavioural Sciences, Utrecht University – Netherlands
[2] Clinical Psychology, Faculty of Social and Behavioural Sciences, Utrecht University – Netherlands

To combat the spread of the COVID-19, regulations were introduced to limit physical interactions. This could induce a longing for touch in the general population and subsequently impact social, psychological, physical and environmental quality of life (QoL). The aim of this study was to investigate the potential association between COVID-19 regulations, longing for touch and QoL. A total of 1978 participants from different countries completed an online survey, including questions about their general wellbeing and the desire to be touched. In our sample, 83% of participants reported a longing for touch. Longing for touch was subsequently associated with a lower physical, psychological and social QoL. No association was found with environmental QoL. These findings highlight the importance of touch for QoL and suggest that the COVID-19 regulations have concurrent negative consequences for the wellbeing of the general population.

Keywords: longing for touch, quality of life, touch deprivation, COVID, 19

*Speaker
†Corresponding author: l.l.meijer@uu.nl

Embodiment of a prosthesis through direct optogenetic stimulations of the cortex in the mouse model

Zineb Hayatou * [1], Dan Shulz [1], Valérie Stengel [1], Luc Estebanez† [1]

[1] Institut des Neurosciences Paris-Saclay – Université Paris-Saclay, Centre National de la Recherche Scientifique – France

Invasive neuroprostheses offer a major opportunity for patients with severe motor disorders. However, these prostheses are presently hampered by the lack of embodiment by the patients, synonymous with discomfort and loss of interest for the prosthesis.
We aim to study the embodiment of a prosthesis in a mouse model, by building on the human illusion of the rubber hand (Botvinick & Cohen 1998). In this embodiment model, the participants are placed in front of a static prosthesis while their own hand is hidden. In optimal conditions, the synchronous tactile stimulation of the prosthesis and the hand induces a strong feeling of embodiment towards the prosthesis.

We succeeded in reproducing this paradigm with the right forepaw of the mouse, by exposing the animals to a static prosthesis touched by a brush simultaneously with their paw. We then threatened the prosthesis, and measured the intensity of the reaction to this threat. It turns out to be significantly stronger after synchronous stimulation, which serves as a measure of prosthesis embodiment.
Based on this new test, and the optogenetic methods mastered by the team (Abbasi et al. 2018), we now plan to explore the conditions of embodiment when tactile stimuli are replaced by direct optogenetic activations of the somatosensory cortex. This study is essential to identify tactile feedback strategies in the context of neuroprostheses that would guarantee an efficient control of the prosthesis, but also an optimal embodiment. Such neuroprostheses may then become tools to limit the development of pain in phantom limbs.

Keywords: embodiment, somatosensory feedback, BMI, prosthesis, limb

*Speaker
†Corresponding author: luc.estebanez@cnrs.fr

Exploring the neural correlates of self-generated versus social touch

Danielle Hewitt *† [1,2], Grace Whitaker [3], Francis Mcglone [2,4], Andrej Stancak [2], Jessica Henderson [2], Charlotte Krahé [2,4]

[1] University of Oxford – United Kingdom
[2] University of Liverpool – United Kingdom
[3] Universidad Tecnica Federico Santa Maria [Valparaiso] – Chile
[4] Liverpool John Moores University – United Kingdom

This study investigated the perception and neural processing of self-touch vs. touch from another person (social touch). According to efference copy theory, the perception of self-produced stimuli is suppressed; yet, we frequently engage in self touch to self-soothe and regulate emotions. Here, we examined cortical activation changes during dynamic touch by the self vs. an experimenter, and their relationship with subjective touch experience. We contrasted slow, gentle "affective" touch, important for signalling prosocial intentions and linked both to C-tactile (CT) fibre activation and perceived pleasantness, with faster 'non-CT-optimal' touch, generally perceived as more neutral. Touch stimuli were applied to the participants' left forearms during four pseudorandomised blocks differing in velocity (slow: 3cm/s, fast: 18cm/s) and agent (participant: self-touch, experimenter: social touch). Subjective pleasantness ratings were collected. Whole-brain EEG was recorded (N=23 after data cleaning). Multivariate analyses of variance were conducted separately for alpha (8-13 Hz), beta (16-24 Hz) and theta (4-7 Hz) frequency bands to evaluate the role of touch agent, velocity, and their interaction on cortical activation changes during touch. Preliminary results show distinct cortical activation changes during self-generated vs. social touch. Greater frontal theta synchronisation and central beta desynchronisation during self-touch point towards enhanced attentional processing and sensorimotor cortex activation, which challenge sensory attenuation during active touch. Further exploration of this dataset, with focus on temporal dynamics in touch processing and the modulating impact of touch preferences and experience, holds the potential to broaden our understanding of the affective and discriminatory dimensions of social and self-generated touch.

Keywords: Affective touch, EEG, Sensorimotor integration, Social touch

*Speaker
†Corresponding author: danielle.hewitt@ndcn.ox.ac.uk

A Touch of Compassion: a qualitative study with support workers in services used by learning-disabled adults

Lorraine Horton * [1], Rachel Shaw [2]

[1] Touch Therapist, Birmingham Community Healthcare NHS Foundation Trust (UK), Aston University, UK (Visiting Scholar) – United Kingdom
[2] Health Psychologist, Institute of Health and Neurodevelopment, Aston University, UK – United Kingdom

Background: Many learning-disabled people do not communicate verbally. Support Workers (supporters) use touch in their care role. To date, there is little research exploring how supporters intentially use everyday touch as a means of communicating and connecting with people who do not express verbally. This study sought to understand the kinds of touch used in daily care; supporters' awareness of the potential to communicate and connect through touch and whether they considered this a medium to demonstrate compassion.
Method: Individual semi-structured interviews were conducted (recorded and transcribed) with 16 volunteer supporters from residential and day-care services. Data was analysed using inductive thematic analysis.
Results: Themes generated:
- uses of touch
- communication through touch
- relationship building through touch
- organisational support

Touch is complex and multidimensional. The relationship between care receivers and supporters exists in the context of the "constant" touch required. Touch is essential in intimate care. Interviews afforded supporters a unique opportunity to reflect upon their touch, realising their potential to communicate through touch with "intellectual kindness", thus impacting positively on the care relationship. None of the care organisations involved held explicit policies or specific training on touch. Supporters received little support in their use of touch and its complex communicative function.
Conclusion: Further research is required to fully understand the significance of touch, particularly interactive touch, in the lives of learning-disabled people when communication is otherwise difficult. National guidance and training will enable supporters and care receivers to confidently use touch as a reciprocal communicating medium and sense of connection.

Keywords: Touch, interactive touch, communication, non, verbal communication, compassion, learning disability, care, support workers, carers

*Speaker

Shank3-KO mice display itch hypersensitivity and peripheral mechanosensory dysfunctions

Damien Huzard * [1], Amaury Francois† , Emmanuel Bourinet , Melanie Marias

[1] Institut de Génomique Fonctionnelle – Institut National de la Santé et de la Recherche Médicale, Centre National de la Recherche Scientifique, Université de Montpellier – 141, Rue de la Cardonille 34094 Montpellier cedex 5, France

Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder characterized by persistent difficulties in social interaction, increased repetitive behaviors and altered sensory perception. Responses to touch are often perceived differently in ASD patients. Studies on ASD mouse models demonstrated that peripheral nervous system dysfunction is responsible for some deleterious phenotypes. However, we still ignore which component of touch is altered in ASD. Additionally, a recent study showed that a mouse model of autism was sensitive to inflammation which could be related to social deficits. Our study focuses on Shank3-KO mice to investigate primary somatosensory neuron functions and modalities (such as itch). We studied the tactile experience by performing behavioral phenotyping combined with in-depth analyses of the somatosensory system. We showed that Shank3-dC/dC mice elicited an hypersensitivity to develop mechanical and pharmacological itch. We performed ex-vivo skin nerve recordings and identified some alterations in the electro-physiological responses of the C-LTMRs somatosensory fibers. Finally, we suggest that it might become important to consider alterations in sociability in ASD mouse models by including analyses of the peripheral integration of tactile stimuli. Moreover, ASD mice could have a particular susceptibility to inflammation (and/or environmental stress), which could relate to both tactile integration and social experiences.

Keywords: autism, c, ltmr, skin, somatosensory system, itch, mice, Shank3

*Speaker

†Corresponding author: amaury.francois@igf.cnrs.fr

Is parental attitude related to the amount of time devoted to skin-to-skin contact with their preterm baby?

Hilde Jacobsen * [1], Uta Sailer [2], Bente Tandberg [3], Nina Kynø [4]

[1] University of Oslo – Norway
[2] University of Oslo – Norway
[3] Vestre Viken Hospital Trust – Norway
[4] Oslo Metropolitan University – Norway

Preterm babies have an increased risk of long-term health problems and delayed neurological development, which can be reduced by skin-to-skin contact (SSC). Nevertheless, some parents spend limited time in SSC. To better understand why, we investigated if parents' own attitudes to and experience with touch are related to the time spent with SSC.
81 parents of preterm babies registered the time spent in SSC and holding their baby daily during one week, and answered a questionnaire about the experience with and attitudes to touch (TEAQ). Additionally, parents assessed the pleasantness of CT-targeted stroking and faster stroking shown on video.

Parents spent between 4 minutes to 8,5 hours per day with SSC. Parents with higher education and parents with more positive experiences and attitudes to physical touch with friends and family spent more time in SSC. Parents with more positive attitudes to self-care (i.e. using body lotions) spent more time holding their baby. Neither any of the other scales or affective touch awareness were related to SSC or holding.
Although some of parents' attitudes to and experiences with touch are associated with the amount of SSC and holding they provide, factors other than attitudes may be more important. Increasing knowledge about the benefits of SSC, particularly among parents with lower educational levels, seems to be essential.

Keywords: Affective touch, c tactile, parental touch, parents attitudes, skin to skin contact, TEAQ, preterm

*Speaker

Reading the mind in the touch – Part 2: Context and individual differences influence how emotions and intentions are read from (imagined social) touch

Paul Jenkinson * [1], Charlotte Krahé [2], Aikaterini Fotopoulou [3], Claudia Hammond [4], Michael Banissy [5], Athanasios Koukoutsakis [6]

[1] ISN Psychology – Australia
[2] Liverpool John Moore University – United Kingdom
[3] University College London – United Kingdom
[4] University of Sussex – United Kingdom
[5] University of Bristol – United Kingdom
[6] University College, London – United Kingdom

Background: Touch is a key channel for conveying meaning in social interactions. Previous experimental research indicates that touch meaning is shaped by the physical characteristics of touch (i.e. slow vs. fast touch), but the influence of other contextual (e.g., relationship between the giver and receiver of touch) and person variables (e.g., differences in exposure to touch) remain unknown.
Method: We used data (N = 23,428) from the world's largest touch survey to examine how context (touch source) and person variables (gender, degree of positive childhood touch, and attachment style) shaped positive (love, desire, support) and negative (fear, anger, warning) emotions and intentions ascribed to imagined social touch (gentle stroking touch and hugs).

Results: Love, desire, and support were rated more highly when participants had their partner (vs. someone else) in mind. Women (vs. men) gave lower ratings for desire regardless of source. Gentle stroking felt most arousing and conveyed most arousal when participants had their partner in mind. More positive childhood touch was associated with more positive emotions and intentions, as were higher secure and anxious attachment. Avoidant attachment was associated with lower ratings for positive emotions and intentions. Positive childhood touch and anxious attachment were related to greater discrimination between distinct emotion and intention categories. Greater avoidant attachment was associated with reduced discriminability.
Conclusion: Our study highlights the importance of contextual and individual factors in communicating emotions and intentions via touch. Our findings have implications for enhancing social interactions and promoting wellbeing through touch.

Keywords: imagined touch, emotion, intention, attachment, individual differences

*Speaker

Distinction of self-touch and other-touch occurs in the spinal cord

Reinoud Kaldewaij , Adam Enmalm , Robin Kämpe , Paula Salamone , Juergen Finsterbusch , Alexandra Tinnermann , Håkan Olausson , Rebecca Boehme * [1]

[1] Linköping University – Sweden

Through touch we can perceive the physical border between our own body and the outside world. The distinct experiences of 'being touched' and 'touching oneself' are reflected in primary sensory brain areas, but also regions associated with social cognition and interoception. Early electrophysiological evidence suggests that self-vs-other touch is differentially processed at the level of the spinal cord, but the exact mechanisms are not yet understood.
During simultaneous functional MRI of the brain and spinal cord, participants touched their own left forearm, or an object, or were touched by an experimenter. Touching consisted of slow and gentle stroking typical for real-life social touch. Two fields of view for the spinal cord were investigated: cervical level 5-7 (sample 1) and cervical level 4.5-6.5 (sample 2).

Brain activation patterns for self/other/object-touch replicated previous findings. In sample 1, two clusters of differential activation in the spinal cord for self/other/object-touch reflected sensory and motor processing of the touching hand. In sample 2, an additional spinal cord activation cluster reflected attenuated processing for self- vs. other touch on the left forearm.
Spinal cord showed activation differences related to efferent right-hand motor signalling and afferent right-hand and left-forearm sensory signalling. Importantly, processing of self-produced touch on the forearm appeared to be attenuated compared to social touch from others. This indicates that self-vs-other-touch is already differentially processed at the level of the spinal cord.

Keywords: social touch, self, other, distinction, spinal cord, fMRI

*Speaker

Effects of human-animal touch on well-being

Vanessa Kaufmann * [1], Clare Cham [2], Annett Schirmer [3]

[1] University of Innsbruck – Austria
[2] University of Hong Kong – Hong Kong SAR China
[3] University of Innsbruck – Austria

Although having a companion animal is very common, it is currently unknown whether tactile interactions with such an animal are beneficial. We explored this possibility using a custom online questionnaire with dog and cat owners. We assessed their well-being in terms of life satisfaction, mental and physical health. Touch was assessed by asking participants to indicate, for a range of touch actions, how physical contact is established in terms of its frequency, feelings prompting the action, and feelings elicited by the action. Further, body areas for touch giving and receiving were recorded with a coloring task. We plan to examine whether the frequency of touching positively predicts our outcome measures, whether participants report improved affect after touching, and whether touch area and size are relevant for potential touch benefits. Moreover, we will explore whether certain touch actions such as stroking or the participant's role in touch (give/receive) moderate how touch shapes affect and health. We have already collected data from over 400 participants and will present the results from this group.

Keywords: human animal touch, wellbeing

*Speaker

Mechanical, neural and perceptual aspects of tactile transparency

Emma Kindström *† [1], Maida Muhtar [1], Saad Nagi [1], Ewa Jarocka [2], Ilona Szczot [1], Bengt Ragnemalm [1], Gregory Gerling [3], Håkan Olausson [1], Sarah Mcintyre *

1

[1] Center for Social and Affective Neuroscience (CSAN), Linköping University, Linköping – Sweden
[2] Physiology Section, Department of Integrative Medical Biology, Umeå University – Sweden
[3] School of Engineering and Applied Science, University of Virginia – United States

A material has tactile transparency when it comes between the skin and an external stimulus, but we can still feel the external stimulus. We experience this frequently in our daily lives, for example with clothing. However, materials with tactile transparency change how the external stimuli feel, which is particularly apparent when wearing gloves. We have conducted multiple experiments studying tactile transparency, using a 40 microns thin plastic film attached to the skin. Specifically, we measured changes in mechanical skin displacement, neural- and perceptual thresholds and perceived intensity when applying force-controlled mechanical indentation.
Optical coherence tomography showed that the plastic film reduced the vertical displacement required to achieve the same force from the mechanical indenter. Microneurography showed that the film increased force thresholds for C-tactile fibers, while slowly adapting mechanoreceptor thresholds were unaffected. Psychophysical experiments showed that the film caused an increase in detection thresholds and a reduction in perceived intensity.
We have shown that even with an extremely thin film, tactile transparency has measurable mechanical, neural and perceptual consequences. Our measurements suggest that this is because the film reduces skin displacement of force-controlled indentation. The psychophysical results indicate that these small effects are functionally meaningful. Particularly interesting is that CT afferents were more sensitive to this effect than SA afferents, suggesting a possible role for CTs in force perception. If thresholds and perceived intensity depend on the overall quantity of peripheral inputs, reduced CT input could explain our results. However, other afferent types not tested might also play this role.

Keywords: tactile transparency, indentation, microneurography, psychophysics, skin mechanics

*Speaker
†Corresponding author: emma.kindstrom@liu.se

Two cross-cultural studies on affective touch: behavioural, self-report, and neurophysiological data from the United Kingdom, South Africa, and Chile

Charlotte Krahé *† [1,2], Danielle Hewitt [1,3], Sahba Besharati [4], Victoria Williams [4], Grace Alma Whitaker [5], Francis Mcglone [1,2], Andrej Stancak [1], Jessica Henderson [1]

[1] University of Liverpool – United Kingdom
[2] Liverpool John Moores University – United Kingdom
[3] University of Oxford – United Kingdom
[4] University of the Witwatersrand [Johannesburg] – South Africa
[5] Universidad Tecnica Federico Santa Maria [Valparaiso] – Chile

Touch is an integral part of interpersonal interactions. Early in life, we rely on our caregivers' touch to meet our basic needs, and across the lifespan, touch signals affiliation, social support, and has beneficial effects on wellbeing. A particular type of slow, gentle, stroking touch ("affective touch") activates unmyelinated c-tactile (CT) afferents. CT-optimal stroking is commonly perceived as pleasant and can communicate prosocial intentions.

While affective touch is generally perceived as pleasant, increasing evidence highlights that its perception is shaped by individual factors, such as exposure to touch or adult attachment style. Furthermore, cultural factors may also influence the perception of affective touch, but most touch research is still being carried out in western, educated, industrialised, rich and demographic (WEIRD) contexts, neglecting cross-cultural differences. How the perception of affective touch varies across contexts is important to study given cultural and social influences on the frequency and types of touch individuals are likely to experience from early childhood through adulthood.

Here, we present data from two cross-cultural studies on affective touch. We collected data on individual touch experiences and attitudes, pleasantness and liking ratings for affective (vs. neutral) touch, and neural correlates of dynamic stroking touch (measured using electroencephalography) in the United Kingdom (UK), South Africa, and Chile. The UK is a relatively low-contact culture, with low allowed touch, while touch is more acceptable in Chile and South Africa (higher-contact cultures). We will present initial findings on individual and cultural influences on affective touch from these exciting datasets.

Keywords: affective touch, cross, cultural research, attachment style, electroencephalography

*Speaker
†Corresponding author: C.M.Krahe@ljmu.ac.uk

Placing by touching: the importance of tactile sensing for stable object placement

Luca Lach * [1,2]

[1] Universität Bielefeld – Universitätsstraße 25 D-33615 Bielefeld, Germany
[2] PAL Robotics – Carrer de Pujades, 77, 08005 Barcelona, Spain

This work deals with a practical everyday prob- lem: stable object placement on flat surfaces starting from unknown initial poses. Common object-placing approaches require either complete scene specifications or extrinsic sensor measurements, e.g., cameras, that occasionally suffer from occlusions. We propose a novel approach for stable object placing that combines tactile feedback and proprioceptive sensing. We devise a neural architecture that estimates a rotation matrix, resulting in a corrective gripper movement that aligns the object with the placing surface for the subsequent object manipulation. We compare models with different sensing modalities, such as force-torque and an external motion capture system, in real-world object placing tasks with different objects. The experimental evaluation of our placing policies with a set of unseen every- day objects reveals significant generaliza- tion of our proposed pipeline, suggesting that tactile sensing plays a vital role in the intrinsic understanding of robotic dexterous object manipu- lation. Code, models, and supplemen- tary videos are available on https://sites.google.com/view/placing-by-touching.

Keywords: robotics, machine learning, force control, object manipulation

*Speaker

Velocity and ridge-to-ridge distance frequency modulate mechanoreceptive sfferent unit firing during passive stimulation

Victoria Ashley Lang * [1]

[1] University of Gothenburg – Sweden

The firing activity of single unit mechanoreceptor afferents in the human hand is recorded while robotically stimulated by a sliding surface varying in the spatial period of surface ridges, normal force, and sliding velocity. We find that firing activity is not time-locked, but rather firing is significantly modulated at the fundamental frequency determined by the ratio of the sliding velocity and spatial period of the surface.

Keywords: LTMs, Mechanoreceptor, Microneurography

*Speaker

RÉ-CONFORT® design and tactile aesthetics of soothing spaces in psychiatric settings

Sophie Larger * [1]

[1] École nationale supérieure des Arts Décoratifs – Université Paris sciences et lettres – France

"Re-comfort: design and tactile aesthetics of soothing spaces in psychia-tric settings" is a design research project on the conception of experi-mental kits (system of objects) allowing the patient to regain his calm and tranquility.
This research is based on a phenomenological approach centered on the patient, on his haptic perceptions and his emotional and psychological feelings. Practical experiments with users (caregivers and patients) have been set up and are underway in several psychiatric units: at the UHSA Paul Guiraud (Villejuif), the EPS Ville-Evrad (Aubervilliers) and the GHU Paris (G05, G19, G25 and G26).
The first experiments validated our intuitions. Patients and caregivers feel a sense of calm and tranquility after the Ré-confort* tactile relaxations. The majority of the workshops at GHU Paris and UHSA Villejuif took place with carer. The workshops at the EPS Ville-Evrad systematically involved patients and caregiver. Contrary to some reservations on the part of the caregivers, the patients all reacted positively. The experiences brought them peace. The experiences (lasting between 20 minutes and 1 hour) are always followed by a time of exchange and discussion. These exchanges are recorded and listened to again a few days later. Each workshop is the subject of a detailed report, written in the days following the workshop (text explaining the process, photos, discussions, verbatim).
Workshops that involve patients and caregivers are appreciated. They transform the patient-caregiver relationship and create more horizontality. Patients note that a calmed caregiver soothes the patient and vice versa.

Keywords: Experimentation, Aesthetics, Imagination, Environment, Perception, Care, Standard

*Speaker

Sensory Impact of Removing Pure Tones from Complex Vibrations

Thanh-Loan Le * [1], Gilles Bailly [1], Eric Vezzoli [2], Malika Auvray [1], David Gueorguiev [1]

[1] Institut des Systèmes Intelligents et de Robotique – Centre National de la Recherche Scientifique, Sorbonne Universite, Centre National de la Recherche Scientifique : UMR7222 – France
[2] Interhaptics – Razer Inc. – France

Compared to sinusoidal vibrations (one tone), little is known on the mechanisms underlying the ability to discriminate between complex signals (> one tone), that are more representative of those occurring in natural tactile scene. Firstly, studies have found that comparing two simple signals appears easier than comparing two complex signals, suggesting that complexity affect discrimination. Secondly, harmonic relationship between frequency seems to be also a potential cue. However, most of the studies predominantly focused on signals composed of two frequencies which were usually chosen in the range of the Pacinian channel. The present study aims to evaluate the effect of removal frequency on the perception of vibrotactile signals encompassing up to four pure tones with varying complexity and harmonicity targeting both Meissner and Pacinian channel.
Thirty vibrotactile signals were created from two sets of four pure tones: 60, 120, 180, 240 Hz (Harmonic condition) and 75, 135, 195, 255 Hz (Non-harmonic condition) to create complex signals with the sum of two, three or four tones. The participants performed a task to differentiate two signals, one of which had a pure tone removed. The signals were presented through a voice-coil actuator attached to the participants' index finger. A total of 448 signals per participant were analyzed using a Generalized Linear Mixed Model including. The results showed that the lowest pure tone from the reference signal led to strong discrimination. Finally, there is no effect of complexity and harmonicity since the effect of removed pure tone is similar across complexity and harmonicity levels.

Keywords: complex vibrotactile signals, pure tones, harmonicity, tactile channels, inter, frequency interval

*Speaker

Naturalistic social behavior of mice with a Nav1.7 loss of function in C-Low threshold mechanoreceptors

Olivia Le Moëne *† [1], Steven Middleton [2], David Bennett [2], Max Larsson [1]

[1] Linköping University – Sweden
[2] University of Oxford – United Kingdom

The voltage-gated sodium channel Nav1.7 encoded by the SCN9A gene has recently been shown to be required for the normal function of C-low threshold mechanoreceptors (C-LTMRs). Mice presenting a conditional C-LTMR-specific Nav1.7 loss of function are slightly hyposensitive to mechanical stimuli and exhibit reduced sensitivity to cooling. In light of the involvement of C-LTMRs in affective touch, we investigated the effect of this mutation in groups of mice hosted under naturalistic conditions. Following tamoxifen injection (50mg/kg), Nav1.7-WT and Nav1.7-KO mice were placed in groups of 5 individuals (4F+1M) in a seminatural environment and left undisturbed for 6 days. On Day 5, at dusk, mouse social behavior was observed continuously for 30 min. During this period, WT mice initiated longer anogenital sniffing episodes towards KO mice than towards other WT. In a co-occurrence analysis of the same time-period, KO mice were under-represented as emitters of social behaviors while receiving a large part of the social interactions initiated by WT mice. Throughout the diurnal phase of Day 5, KO mice spent more time huddling in groups but showed no difference in resting behavior when alone or in pairs. These results suggest an imbalance in social interactions, in which mice presenting an abnormal C-LTMR function due to loss of Nav1.7 are overall socially withdrawn despite active investigation from control mice.

Keywords: C, LTMR, social behavior, seminatural environment, affective touch, Nav1.7

*Speaker
†Corresponding author: olivia.le.moene@liu.se

Age Effects on Static and Dynamic Touch in Estimation and Discrimination Tasks

Min Li * [1], Roberta Roberts [1], Harriet Allen [2]

[1] University of Birmingham [Birmingham] – United Kingdom
[2] University of Nottingham, UK – United Kingdom

The perceived roughness of a touched surface is determined by spatial and vibratory cues arising during contact between that surface and the fingertips. Spatial cues can result from static contacts whereas sliding movements are necessary to produce vibratory cues to roughness. Understanding the interactions between exploration dynamics and perception is especially important in the elderly in whom the morphology and density of spatially sensitive mechanoreceptors (SA1's) are affected by age. To this end we assessed roughness perception under sliding and pressing contacts in younger and older adults. We measured both the subjective sense of roughness (using absolute magnitude estimation) and objective roughness sensitivity (using Two-Alternative-Forced-Choice procedures). Participants, ranging in age from 18 to 74, explored raised-dot surfaces with spatial periods (SP) of 1000-3240μm using sliding or pressing movements. In some blocks they reported their subjective sense of the surface's roughness, in others which of two surfaces was rougher. While there was no significant difference in subjective roughness ratings between older and younger participants, the slope of the functions describing perceived roughness were steeper with sliding than with pressing contacts. Subjective ratings using pressing contacts plateaued at SP 1800μm but continued to increase with sliding until SP 2680μm. A consistent pattern was found for roughness discrimination, with no age effects but improved perception under sliding compared with pressing exploration. Overall, we found that that sliding contacts, and likely consequent vibrational cues, not only improves roughness sensitivity but also affects subjective roughness of coarse surfaces in both young and older people.

Keywords: aging, touch perception, psychophysics

*Speaker

Touch in times of skin hunger

Els Messelis * [1]

[1] LACHESIS OFFICE OF EXPERTISE ON AGEING AND GENDER – Belgium

There is no age or year on skin hunger. From the first sigh to the last breath: everyone needs human contact, connection and touch to some extent. Due to COVID-19, many suddenly realized and recognized that touch was and is not a fine surplus but an essential desire; this is not only for people who have high-quality family and friendship relationships. In post covid times, skinhunger still exists. For my book 'Touch in Times of Skin Hunger' -Garant Uitgeverij- 20 in-depth interviews were conducted where the life story around an emotionally charged subject was discussed: skin hunger and how to deal with it, both among young and old and this both among individuals and professionals. Many tips for inspiration are provided to deal with skin hunger. Strength and comfort are also drawn from the countless haunting and resilient life stories of the extremely fascinating characters. Illustrations also show images behind the life stories.

Keywords: Affective touch, skin hunger

*Speaker

The impact of acute hydration & dehydration on skin sensation: from transduction to perception

Adarsh Makdani *† [1], Aurélie Porcheron * [2], Julie Latreille [2], Warren Moore [3], Andrew Marshall [3], Marie-Héloïse Bardel [2], Francis Mcglone [3]

[1] Research Centre For Brain Behaviour, School of Psychology, Liverpool John Moores University – United Kingdom
[2] Neurosciences Department – CHANEL Parfums Beauté – France
[3] University of Liverpool – United Kingdom

There is a close, two-way relationship between the dermatological properties of skin, and cutaneous innervation and sensitivity. Previous research has considered the impact of skin hydration on tactile perception but has focused primarily on glabrous skin, and discriminatory touch mediated by A-β afferents.
This study aims to expand on this work, using microneurography (an electrophysiological technique) and psychophysics (subjective ratings), to explore the impact of both acute *hydration* and *dehydration* on cutaneous afferents in hairy skin (i.e. the majority of the human body), with a particular focus on gentle dynamic touch, chosen to optimally activate unmyelinated C-low threshold mechanoreceptors (C-LTMRs), which have previously been linked to social and affective touch.
The results compare stimulus-evoked responses before and after treatment of the receptive field, in a range of cutaneous afferents, and relate those responses to subjective ratings showing that soft slow brushing was more pleasant when applied to hydrated, moisturised skin, than to dehydrated skin. Taken together, these findings suggest that mechanical changes in skin affecting afferent activity are key parts to the perceptual reward mechanisms that underpin grooming behaviour.

Keywords: Microneurography, Hydration, Dehydration, Affective Touch

*Speaker
†Corresponding author: a.makdani@ljmu.ac.uk

Is the pleasure of scratching an itch encoded in cutaneous sensory nerves? – Evidence from a neuronopathy patient.

Adarsh Makdani *† [1], Andrew Marshall [2], Jonathan Cole [3], Francis Mcglone [2]

[1] Research Centre For Brain Behaviour, School of Psychology, Liverpool John Moores University – United Kingdom
[2] University of Liverpool – United Kingdom
[3] University Hospitals Dorset NHS Foundation Trust – United Kingdom

Background: Itch is "an unpleasant sensation of the skin leading to the desire to scratch". In chronic itch, the itch/scratch cycle is reinforced by the intense pleasure and reward gained from scratching – despite negative consequences. It is hypothesised here that the pleasure derived from scratching is mediated by (or contributed to) by a class of c-fibers coding for the rewarding (pleasant) properties of touch - C-tactile afferents.
Methods: Psychophysical and physiological responses to acute itch and scratching were obtained from healthy subjects, and compared to responses from IW, a participant with large-fibre sensory neuronopathy below C3, but intact A-delta and c-fibre function.

Results: In the forearm, IW's responses to thermal QST measures, and physiological responses to histamine iontophoresis (wheal and axon reflex flare) match healthy subjects. IW perceived both Histamine & Cowage induced itch, although self-reported peak intensities were lower than for controls and required a greater dose to elicit a comparable itch percept. Rough, scratching touch was rated significantly more intense on itchy skin by both Healthy Subjects and IW and improved touch localisation in IW (which is typically low). Scratching an itch on the forearm is pleasurable – even for IW - despite the lack of large myelinated fibres.
Conclusions: Preferential activation of mechanosensitive Aδ and/or C fibre afferents with *high threshold* stimuli is integral to the pleasure of scratching an itch. This raises the question: in itch-states, is nociceptor activation perceived as more pleasant, or are other c-fibres (such as C-LTMs) signaling increased pleasantness?

Keywords: Itch, C, Fibres, Neuronopathy

*Speaker
†Corresponding author: a.makdani@ljmu.ac.uk

The tactile perception of uppercase, lowercase and manuscript letters in children and adults

Marie Manote [1], Rochelle Ackerley [2], Anne Kavounoudias [2], Felipe Pegado * [3]

[1] Aix-Marseille Université – Laboratoire de Psychologie Cognitive, Aix-Marseille Université – France
[2] Aix-Marseille Université – Centre National de la Recherche Scientifique, Laboratoire des Neurosciences Cognitives (UMR 7291) – France
[3] Université Paris Cité – Institut de Psychologie, Université Paris Descartes, Sorbonne Paris Cité, Laboratoire de Psychologie du Développement et de l'Education de l'Enfant (LaPsyDÉ - UMR CNRS 8240), Pôle pilote AMPIRIC, Institut National Supérieur du Professorat et de l'Education, Aix-Marseille Université, Marseille, France, Centre National de la Recherche Scientifique - CNRS – France

Reading acquisition is inherently a multimodal learning process, requiring an audio-visual mapping between the sounds of language and visual letters. We have proposed a multimodal synergy hypothesis where multiple representations of letters in different systems could facilitate the visual recognition of ambiguous letters (Pegado et al., *Frontiers* 2014). We have probed this hypothesis by showing that multimodal training improves visual recognition, writing and reading fluency in 1st graders (Torres et al., *Current Biology* 2021). To understand a potential contribution of *tactile* perception of letters to such "multisensory mental model of letters" we studied here what type of letter format (uppercase, lowercase or manuscript) in Latin alphabet is the most suitable for tactile perception. We made this characterization in both 2nd graders children (n = 15) and literate adults (n = 24). We found good *spontaneous* blind tactile recognition without any training: out of the 26 letters (M= 19.58) in adults and (M = 10.58) in children. In both groups a higher recognition rate was found for uppercase > lowercase > manuscript letters. Importantly, analysis of *specific* letters shows extreme variations in recognition rate (ranging from _˜25 to 100% in each format in adults). Interestingly, ambiguous letters for the visual system (mirror-letters such as p-q) are easily recognized by tactile perception. These results suggest that the tactile system can convey reliable information about some but not all letters and suggest its potential as a complementary source of information in early stages of literacy acquisition, especially targeting visually ambiguous letters.

Keywords: tactile perception, letters, multimodal, mental model

*Speaker

The perception of local skin wetness during visuotactile interactions at the fingerpad.

Charlotte Merrick *† [1], Rodrigo Rosati [2], Davide Filingeri [3]

[1] THERMOSENSELAB, School of Design and Creative Arts, Loughborough University – United Kingdom
[2] Procter and Gamble Service GmbH, Schwalbach am Taunus – Germany
[3] THERMOSENSELAB, Skin Sensing Research Group, School of Health Science, University of Southampton – United Kingdom

Introduction
Many sensory modalities underlie humans' experience of wetness, yet we know little of how tactile inputs are affected by visual cues during haptic interactions with wet materials. We aimed to investigate the effect of visuotactile vs. visual only interactions on wetness perceptions with stimuli varying in physical stain volume, intensity, and size.
Methods
Eighteen participants (10F/8M; 22.3±3.6y) performed two trials during which they either visually observed (visual only trial) or visually observed and used their index fingerpad to touch (visuotactile trial) absorbent materials varying in physical stain wetness (0, 2.16x10-4 or 3.45x10-4 ml/mm2 of saline), intensity (clear, light, dark) and size (1150 or 5000 mm2). Participants rated wetness perception using a 100 mm visual analogue scale (very dry to very wet).

Results
Wetness perceptions differed between visuotactile and visual only interactions ($P < 0.001$). Specifically, during visuotactile interactions participants perceived different magnitudes of wetness in line with the physical wetness levels of stimuli, whereas without the tactile component participants could only discern whether the stimuli were dry or wet. During both trials, greater stain intensity resulted in increased wetness perception ($P < 0.001$; $P < 0.001$), but stain size had no significant effect in either visual only ($P=0.330$) or visuotactile interactions ($P=0.079$).
Conclusions
Visuotactile interactions allow improved wetness magnitude discrimination over visual only cues, highlighting the key role of touch over vision in the multisensory integration of wetness perception. Findings are relevant for the design of wetness management products and in augmented or virtual realities.

Keywords: wetness, tactile, visual, skin, sensation

*Speaker
†Corresponding author: ckmerrick@live.co.uk

Hand on Heart: A Cardiac Rubber Hand Illusion

Jamie Moffatt *† [1], Manos Tsakiris [1], Gianluca Finotti [1]

[1] Royal Holloway [University of London] – United Kingdom

Body illusions such as the Rubber Hand Illusion (RHI) have highlighted how the multisensory pairing of vision and touch can be integral to the sense of one's own body. Internally arising interoceptive sensations such as the heartbeat also provide information about the body, but it is not yet clear how they influence embodiment.
In a pre-registered study, 42 participants completed a cardiac variation of the RHI, where taps to the finger occurred either in time with the heartbeat (at systole), or between heartbeats (at diastole), and either in or out of synchrony with taps delivered to a rubber hand. Participants also completed two heartbeat detection tasks to assess accuracy at perceiving interoceptive sensations.

We replicated the RHI effect, showing that synchronous but not asynchronous touch to the real and rubber hand significantly increased sensations of embodiment over the rubber hand and caused a shift in the perceived hand location. However, there were no significant influences of cardiac timing on embodiment, nor did it interact with visuo-tactile synchrony. An exploratory analysis found a three-way interaction between synchrony, cardiac timing and interoceptive accuracy as measured by a heartbeat counting task, such that greater interoceptive accuracy was associated with lower embodiment ratings in the systole condition compared to diastole, but only when taps were synchronous.
Although our novel methodology successfully replicated the RHI, our findings suggest that interoceptive senses may make little contribution to the sense of one's body beyond the multisensory integration of vision and touch.

Keywords: interoception, touch perception, multisensory integration, embodiment, body ownership

*Speaker
†Corresponding author: jamie.moffatt@rhul.ac.uk

Human C-low-threshold-mechanoreceptor afferents respond to hair deflection

Warren Moore *† [1], Otmane Bouchatta [2], Kevin Ng [2], Adarsh Makdani [3], Håkan Olausson [2], Francis Mcglone [1], Saad Nagi [2], Andrew Marshall [1]

[1] University of Liverpool – United Kingdom
[2] Linköping university hospital – Sweden
[3] Liverpool John Moore University – United Kingdom

Mammalian hairy skin is innervated by a population of unmyelinated afferent fibres which are exquisitely sensitive to gentle stroking touch. In mice these afferents, termed C-low-threshold-mechanoreceptors (C-LTMRs), express tyrosine hydroxylase (TH) and form lanceolate endings around hair follicles. Whether human C-LTMRs innervate hair follicles is unknown - it is not possible to selectively stain C-LTMRs in human skin and responses of C-LTMRs to hair deflection have been poorly described. To determine the 'functional anatomy' of peripheral C-LTMR endings in humans we recorded the response of eight consecutive single C-LTMRs, identified during microneurography, to hair manipulation. All fibres responded robustly to gentle slow stroking (_˜3cm/s) with a soft brush. All fibres had mechanical thresholds less than 0.4g (M = 0.06g). Hairs in the receptive field were carefully deflected using either a fine probe or forceps under magnification, ensuring no contact with the skin; or using a custom-built device capable of deflecting and pulling hairs. A response to hair deflection, defined as a minimum of two spikes during stimulation, was seen in eight C-LTMRs**.** C-LTMRs (**6 out of 8**) also responded to gentle hair pull and **6 out of 6** exhibited after-discharges on mechanical hair removal. The findings indicate that human C-LTMRs are very likely to have a close anatomical arrangement to hair follicles, which may explain their exquisite mechanical sensitivity to gentle stroking touch to hairy skin.

Keywords: C, tactile Afferent, CLTM, Hair Deflection, Hair Pulling, Somatosensation, Nociception

*Speaker
†Corresponding author: w.moore@liverpool.ac.uk

Discrimination of wetness levels with a robotic prosthetic device

Jonathan Muheim * [1], Federico Morosato [2], Emanuele Gruppioni [2], Davide Filingeri [3], Silvestro Micera [1], Solaiman Shokur [1]

[1] Bertarelli Foundation Chair in Translational Neural Engineering, Neuro-X Institute, Ecole Polytechnique Fédérale de Lausanne – Switzerland
[2] Centro Protesi, INAIL – Italy
[3] THERMOSENSELAB, Skin Sensing Research Group, School of Health Sciences, The University of Southampton – United Kingdom

In the effort to restore the rich catalogue of sensations lost after hand amputation, few remain unaddressed. One among them is the ability to perceive whether an object is wet or dry. Here, we propose a sensory substitution approach taking advantage of the wetness illusion that a rapid drop in skin temperature can trigger to restore this peculiar capability. First, we verified the possibility of inducing an illusionary sensation of moisture with a Peltier element on two body parts: the ventral upper arm and the abdomen. When applying cold dry stimuli on their skin a majority of participants (12/14) reported a sensation of moisture on the stimulation locations. Then, we used the MiniTouch, a portable thermal device, to mediate in real-time the thermal drop associated with the contact of a sensorized prosthetic finger with wet samples. The six healthy participants were able to discriminate the contact with 4 moisture levels (ranging from dry to soak wet) with an accuracy above the chance level (arm: 53.3%, abdomen: 62.5%, chance level with $P < 0.01$: 40%). Finally, to demonstrate the validity of our system in a more plausible setting, we mounted the MiniTouch on the prosthetic robotic hand of a male transradial amputee and allowed him to scan the samples autonomously. The subject could accurately distinguish the three levels of moisture (arm: 86.6%). Interestingly, when turning off the device the performance dropped (33.3%) proving that he relied mainly on thermal clues.

Keywords: wetness, sensory substitution, prosthetics

*Speaker

The legacy of preterm birth: An investigation into touch attitudes and experiences

Laura Mulligan * [1], Susannah Walker† [1], David Moore‡ [1], Adarsh Makdani§ [1], Francis Mcglone¶ [2]

[1] Liverpool John Moores University – United Kingdom
[2] University of Liverpool – United Kingdom

Survival rates of infants born pre-term have increased but neurodevelopmental disabilities and poor mental health are common outcomes. This may in part be due to atypical sensory experiences during critical early stages of neurodevelopment, as repeated exposure to noxious stimuli is a risk factor for dysregulated neuroendocrine responses to stress. Evidence points to the critical role of touch in supporting physiological stability and healthy neuro-behavioural development. However, tactile stimulation, while present in utero, is notably absent for a preterm infant in an incubator. This study explored if being born preterm alters adults' perception of social touch and how this relates to self-reported social and emotional processing. Ninety-two participants (mean age 38.76 +/- 11.89, 62 women) were recruited, with 47 born preterm (before 37 weeks) and 45 born full-term. Self-reported levels of depression, stress, and autistic traits were measured, along with participants' experiences of and attitudes towards touch. In line with previous research, adults born pre-term reported significantly higher levels of depression, stress, and autistic traits than adults born full-term. Moreover, while groups did not differ in experienced levels of childhood touch or attitudes to self-care, the adults born pre-term experienced significantly lower levels of, and reported more negative attitudes towards, social touch than the group born full term. While higher levels of intimate touch predicted lower levels of depression, no interaction was found between groups. This suggests, social touch is beneficial in both groups, yet less sought and experienced by adults born pre-term.

Keywords: Affective touch, Adults born preterm, depression, attitudes towards touch

*Speaker
†Corresponding author: s.c.walker@ljmu.ac.uk
‡Corresponding author: D.J.Moore@ljmu.ac.uk
§Corresponding author: a.makdani@ljmu.ac.uk
¶Corresponding author: mcglonef@liverpool.ac.uk

On the emergence of somatosensory maps in the first months after birth: preliminary data

Dollyane Muret *† [1], Alexia Gerard [2], Sara Neumane [2], Lucie Hertz-Pannier [2], Marianne Barbu-Roth [3], Jessica Dubois [2]

[1] NeuroDiderot U1141, INSERM, Paris – Université Paris Cité – France
[2] NeuroDiderot U1141, INSERM, Paris – Université Paris Cité – France
[3] INCC UMR8002, CNRS, France – Université Paris Cité – France

The somatosensory cortex plays a major role in our ability to perceive and use our body to interact with our environment (e.g., locomotion, grasping) and others (e.g., speech, writing). Since the seminal work of Penfield and Boldrey (1937), the last thirty years of sensorimotor research focused primarily on its functional characterisation in adult individuals. However, recent studies comparing individuals who lost a hand at different developmental stages (Hahamy et al, 2017) re-emphasised the crucial role of early development in determining sensorimotor organisation. Surprisingly, while touch is the first sense to develop in humans, very little is known about how somatosensory maps evolve in the first months after birth. Only a handful of neuroimaging studies reported the existence of proto-maps in neonates and infants (Meltzoff et al, 2018; Dall'Orso et al, 2018). We aimed to address this gap by scanning (3T MRI) typically-developing full-term infants at 1 month (n=4 out of 7 included) and 3 months of age (n=3 out of 4 included). All infants received tactile pneumatic stimulation of the cheek, dorsum of the hand and sole of the foot on the right side, during natural sleep. A block design with 8s of stimulation interleaved with 7s of rest was used. A variable number of data was collected for each infant depending on their sleep duration (6 to 12 blocks per condition). I will present preliminary univariate fMRI data obtained in these infants as a first proxy to i) characterise somatosensory maps, and ii) assess the viability of our paradigm.

Keywords: development, primary somatosensory cortex, functional MRI, infants

*Speaker
†Corresponding author: dollyane.muret@gmail.com

Interpersonal Touch and Allostatic Load: The Importance of Romantic Partners for Older Adults' Neuroendocrine Health

Gabriele Navyte *† [1], Helge Gillmeister [1], Meena Kumari [1]

[1] University of Essex – United Kingdom

Interpersonal touch is an essential aspect of human interaction that has the ability to regulate physiological stress responses. Prolonged exposure to stress can have cumulative physiological effects; this is referred to as allostatic load. Despite the increased susceptibility of social isolation for older adults, there is a paucity of research attention regarding the efficacy of touch in regulating stress responses among this population. It is also unknown whether touch confers benefits regardless of the person with whom it is shared. This study investigates the difference in physiological stress based on the frequency of touch (hugs, holding, or other close physical contact) shared with romantic partners as compared to other close adults (family, friends, and neighbours) in an older adult population. Data was analysed from a sample of 1,419 respondents, with a mean age of 69.35 from wave one of the National Social Life, Health, and Aging Project (NSHAP). Principal components analysis (PCA) was employed to determine whether the markers of allostatic load used in the NSHAP function as a singular system or as distinct components. Analyses revealed three distinct components of allostatic load: metabolic, cardiovascular, and neuroendocrine stress. The results of stepwise multiple regression models revealed that a higher frequency of interpersonal touch shared with romantic partners was associated with lower neuroendocrine stress (but not with lower metabolic or cardiovascular stress), while touch from other close adults did not show any significant associations. These findings highlight the importance of promoting interpersonal touch with romantic partners for older adults' neuroendocrine health.

Keywords: Touch, allostatic load, neuroendocrine, ageing, stress

*Speaker

†Corresponding author: gnavyt@essex.ac.uk

Human foot outperforms the hand in mechanical pain discrimination

Kevin K. W. Ng *† [1], Odai Lafee [1], Otmane Bouchatta [1], Andrew Marshall [2], Håkan Olausson [1], Sarah Mcintyre [1], Saad S. Nagi [1]

[1] Center of Social and Affective Neuroscience, Linköping University – Sweden
[2] Institute of Life Course and Medical Sciences, University of Liverpool – United Kingdom

Tactile discrimination has been extensively studied, but mechanical pain discrimination is more poorly characterised. Here, we investigated the psychophysical and peripheral neural mechanisms underlying mechanical pain discrimination. Twenty healthy participants underwent a two-alternative forced choice paradigm, using force-calibrated punctate stimuli (Semmes-Weinstein monofilaments) with different forces applied to the hand and foot dorsa. Perceptual sensitivity was assessed using the Weber fraction (WF). The results demonstrate significantly better capacity for discriminating noxious mechanical forces in the foot than in the hand (WF: foot, 0.51; hand, 0.88; $p < 0.0001$), and lower mechanical pain thresholds in the foot than in the hand (645 mN vs 951 mN; $p < 0.0001$). To explore whether this body region difference could be explained by differences in the sensitivity of primary afferent nociceptors, microneurography was employed to record from A-fibre (10 radial and 11 peroneal) and C-fibre (10 radial and 7 peroneal) high-threshold mechanoreceptive afferents. No difference was found between the hand and foot in the discrimination performance of either class of nociceptors ($p = 0.2095$ and $p = 0.6215$, respectively). In conclusion, the human foot exhibits higher sensitivity for mechanical pain discrimination. However, this difference cannot be explained by the responses of primary afferent nociceptors, inviting speculation that skin biophysics or central mechanisms may be involved.

Keywords: force discrimination, von Frey, psychophysics, microneurography, human

*Speaker
†Corresponding author: kevin.ng@liu.se

The drug methylenedioxyamphetamine (MDMA) enhances plasma oxytocin and modulates cortical responses during affective touch

Giovanni Novembre * [1], Hanna Molla [2], Irene Perini [3], Harriet De Wit [2], India Morrison† [1]

[1] Division of Neurobiology, Department of Biomedical and Clinical Sciences, Linköping University – Sweden
[2] Department of Psychiatry and Behavioral Neuroscience, University of Chicago – United States
[3] Center for Social and Affective Neuroscience, Department of Biomedical and Clinical Sciences, Linköping University – Sweden

Oxytocin (OT) is a key mediator of social attachment across many mammalian species, yet little is known about endogenous OT neuromodulation of key neural pathways of affective touch in humans. We investigated this question by manipulating perception of touch after administration of 1.5 mg/kg of the drug methylenedioxyamphetamine (MDMA) or placebo during functional magnetic resonance imaging (fMRI) in n = 22 healthy adult volunteers. MDMA is an amphetamine derivative associated with prosocial effects, enhancement of pleasantness of affective touch and facilitation of peripheral OT release. In this study, each participant completed two counterbalanced fMRI sessions (drug and placebo), in which they were gently stroked at two velocities (3 cm/s and 30 cm/s). OT samples were collected pre- and post-session to measure any change in endogenous OT. MDMA increased subjective effects of drug, measures of friendliness, blood pressure, heart rate, and a range of affective and social self-report ratings, as well as pleasantness of touch at both stroking speeds. Plasma OT showed main effects of drug and OT change, with greater OT change during the MDMA session. Hemodynamic responses in the brain showed a main effect of MDMA vs placebo in bilateral precentral gyri, alongside an interaction between OT, drug, pleasantness, and stroking velocity in medial prefrontal (mPFC) and inferior temporal gyrus (ITG) clusters. These findings indicate that MDMA influences endogenous OT and cortical responses to touch. Neuromodulation of mPFC and ITG responses depending on MDMA, OT and pleasantness points to their critical role in augmenting the perception of social touch.

Keywords: MDMA, Oxytocin, Touch, fMRI

*Speaker
†Corresponding author: india.morrison@liu.se

Exploring Central and Peripheral Mechanisms of Affective Touch through Apparent Motion

Laura Pehkonen *† [1], Ilona Szczot [1], Bengt Ragnemalm [1], Håkan Olausson [1], Sarah Mcintyre [1]

[1] Center for Social and Affective Neuroscience (CSAN), Linköping University, Linköping – Sweden

Although the general outlines of pleasant touch perception and CT-afferents have been sketched out, the current extent of knowledge still pales in comparison to the depth of information surrounding other neural pathways and somatosensory modalities, e.g., pain and nociceptive C-fibres.
This project explored the peripheral and central mechanisms in affective touch, through comparing gentle stroking with apparent motion – an illusory perception of movement constructed by successively presented tactile stimuli. If similar patterns in the relationship between pleasantness-ratings and velocity were observed despite the elimination of lateral movement, then central modulation may govern the velocity dependence of the perception of pleasant touch.

To investigate this relationship, pleasantness-ratings were collected across an array of velocities (1, 3, 10, 30, 100 and 300 mm/s), under these two conditions, in 23 healthy participants.

Linear and quadratic regression analysis were performed on group- and individual-level, for both conditions. For brushing-like motion, a significant negative quadratic term was observed (R-square=0.126, F=29.033, p< 0.001, β=-1.275), with peak pleasantness achieved at 19.7 mm/s. For apparent motion, a similarly significant inverted-U shaped curve was observed (R-square=0.051, F=10.938, p< 0.001), accompanied by a statistically significant linear term (R-square=0.015, F=6.287, p=0.013). Overall, multiple significant differences and similarities were observed.
In summary, these findings suggest that the perception of pleasant, affective touch is a complex construct relying on not only the unique peripheral properties of CT-afferents, but even other pathways and central modulation. In particular, the velocity tuning of pleasantness in apparent motion cannot be attributed to velocity tuning of individual CT-afferents.

Keywords: Affective touch, CT, afferents, Apparent motion

*Speaker
†Corresponding author: laupe912@student.liu.se

Electrophysiological signatures of affective touch

Ana Rita Pereira *† [1], Márcia Silva [1], A. Ribeiro Carreira [1], Joana Coutinho [1], Adriana Sampaio [1], Alberto J. González-Villar [1]

[1] Psychological Neuroscience Laboratory (PNL), Research Center in Psychology (CIPsi), School of Psychology, University of Minho, Braga, Portugal – Portugal

The affective dimension of touch is conveyed by low-threshold mechanoreceptors known as C-Tactile (CT) afferents. Recent evidence suggests that the activation of CTs directly correlates with subjective pleasantness ratings and can modulate nociception and pain. Nevertheless, brain oscillatory modulation by affective touch is largely unknown. The main aim of the present study was to provide background knowledge about the brain oscillatory dynamics of CT afferents stimulation, by comparing the brain electrical activity of affective and discriminative touch. The sample included twenty-one healthy participants (14 female) that received tactile stimulation with a cosmetic brush (to activate CT fibers) at CT-optimal speeds, or vibrotactile stimulation (using a linear resonant actuator at around 200 Hz), on the dorsum of the forearm. Participants evaluated the pleasantness and intensity ratings of the stimulation, while an electroencephalogram was recorded. Behavioral data analysis revealed significantly higher pleasantness ratings for the stroking stimulation compared to the vibrotactile stimuli, but no significant differences in the intensity ratings were found. Microstates EEG data showed no significant differences between conditions, namely in the parameter's duration, occurrence, and coverage. Power Spectral Density results revealed a significantly higher power for the vibration condition than for the stroking condition, for alpha/mu and beta bands in central/Rolandic areas. This desynchronization in the alpha/mu and beta bands for the stroking condition indicated increased sensorimotor cortical excitability, suggesting that this form of touch may be a prioritised type of information.

Keywords: C, Tactile afferents, Affective touch, Discriminative touch, EEG, Alpha/mu band, Beta band

*Speaker

†Corresponding author: soaresppereirarita@gmail.com

The perception of affective and discriminative touch in blind individuals

Dominika Radziun * [1], Laura Crucianelli [1], Maksymilian Korczyk [2], Marcin Szwed [2], H. Henrik Ehrsson [1]

[1] Department of Neuroscience, Karolinska Institutet – Sweden
[2] Institute of Psychology, Jagiellonian University – Poland

Enhanced tactile acuity in blindness is among the most widely reported results of neuroplasticity following prolonged visual deprivation. However, tactile submodalities other than discriminative touch are profoundly understudied in blind individuals. Here, we examined the influence of blindness on two tactile submodalities, affective and discriminative touch, the former being vital for social functioning and emotional processing. We tested 36 blind individuals and 36 age- and sex-matched sighted volunteers. In Experiment 1, we measured the perception of affective tactile signals by asking participants to rate the pleasantness of touch delivered on the palm (nonhairy skin, sparsely innervated with C tactile (CT) fibers) or the forearm (hairy skin, densely innervated with CT fibers) in a CT-optimal versus a CT-nonoptimal manner using a paradigm grounded in studies on tactile sensory neurophysiology. In Experiment 2, we implemented a classic task assessing discriminative touch abilities, the grating orientation task. We found that blind individuals rated the touch as more pleasant when delivered on the palm than on the forearm, while the opposite pattern was observed for sighted participants, who rated stimulation on the forearm as more pleasant than stimulation on the palm. We also replicated the previous findings showing enhanced discriminative tactile acuity in blind individuals. Altogether, our results suggest that blind individuals might experience affective touch differently than sighted individuals, with relatively greater pleasantness perceived on the palm. These results provide a broader insight into somatosensory perception in blind individuals, for the first time taking into consideration the socioemotional aspect of touch.

Keywords: blindness, neuroplasticity, affective touch, discriminative touch

*Speaker

Aging effects on contact dynamics in roughness perception

Roberta Roberts * [1]

[1] University of Birmingham [Birmingham] – United Kingdom

The hands carry out a range of tasks from purely sensory to predominately motor. Some aspects of touched objects can be perceived from static contact alone. However, objects are commonly and optimally explored by moving the hands (active touch). Previously, we found the contact forces used by young adults to discriminate the roughness of touched surfaces were related to the accuracy of their judgments. Both manual dexterity and the sensations arising from the hands are known to show age related changes. To understand the effects of aging on the interaction between movement and sensation, we carried out a further study in which old and young volunteers were asked to make non-goal directed contact with pairs of textures. We found that exploratory force differences between the young and older groups were correlated with group differences in sensory and skin frictional properties. In the present, ongoing, work we measure roughness sensitivity, tactile spatial sensitivity, manual dexterity and the control of contact forces during pressing and sliding contacts with textured surfaces. This is done by asking both young and older adults to discriminate the roughness of the touched surfaces. The perceptual results are consistent with duplex theory of roughness perception, as well as our previous findings for both roughness perception and tactile spatial acuity. Interestingly, aging effects on roughness perception are most evident during static contacts. Age related differences in contact forces also follow patterns we have previously observed. The relationship between perceptual measures and contact dynamics will be elaborated in our poster.

Keywords: Roughness discrimination, Aging, Active Touch, Movement

*Speaker

Feeling yourself when your self is altered, a study in Schizophrenia

Paula Salamone *† [1], Adam Enmalm , Reinoud Kaldewaij , Charlotte Medley , Andrea Johansson Capusan , Rebecca Boehme‡

[1] Linköping University – Sweden

The current criteria and diagnosis, of psychiatric conditions is based on symptoms rather than biological mechanisms. Science is trying to move forward towards a mechanism-based classification, which would likely improve patient care and treatment. It has been suggested that people with schizophrenia (SZ) may have altered interoceptive mechanisms and self-other distinction.
In order to assess these mechanisms in SZ we designed a study including behavioral, electrophysiological and neuroimaging tasks. An easy way to study bodily self-perception is to compare self-touch with touch from others: both provide comparable stimulation of the skin, but the brain must be able to distinguish between the two types of touch. Interoception is tested using a heartbeat detection task and questionnaires.
Preliminary results (questionnaires, behavioral and Somatosensory evoked potentials) show some alterations in self and interoception domains with respect to neurotypical volunteers. A disturbance of these processes can have far-reaching consequences for the establishment of an adequate bodily self-perception which may lead also to alterations in allostasis and in higher order cognitive domains. This study may increase our understanding of self-perception and body awareness in SZ. In the long run, the results may enable the development of new treatment strategies.

Keywords: schizophrenic patients, affective touch, interoception, self

*Speaker
†Corresponding author: paula.salamone@liu.se
‡Corresponding author: rebecca.bohme@liu.se

Tactile sensitivity of glabrous and hairy skin over the life span

Léonard Samain-Aupic * [1], Rochelle Ackerley [1], Mariama Dione [1], Edith Ribot-Ciscar [1], Jean-Marc Aimonetti† [1]

[1] Laboratoire de Neurosciences Cognitives [Marseille] – Aix Marseille Université, Centre National de la Recherche Scientifique, Aix Marseille Université : UMR7291, Centre National de la Recherche Scientifique : UMR7291 – France

Tactile sensitivity is often impaired in older adults, which contributes to the loss of manual dexterity and mobility function. Here we tested a validated method to determine tactile spatial discrimination on the index finger pad and compared these data with a classical test of force detection sensitivity applied at this same glabrous skin site, but also on two hairy skin sites, the forearm and cheek. Spatial discrimination was estimated through the ability of participants to evaluate the distance between bands printed on poly-methyl-methacrylate sheets, as explored using the dominant index finger. Calibrated nylon monofilaments were applied at the dominant index finger, forearm, and cheek of 96 healthy women aged from 20 to 75 years. Tactile spatial discrimination and tactile force detection on the index finger significantly decreased with the age. Tactile force detection on the forearm was significantly correlated with tactile force detection on the index and the cheek, although this sensitivity was well-preserved with age on the cheek and forearm. These data confirm the existence of some sparing of tactile sensitivity in hairy skin, but less so on glabrous skin. This opens discussion about the impact of daily activities upon the mechanisms of tactile transduction at the palmar side of the hand, but also the function of hairs in tactile sensitivity. Finally, we discuss the need of new methods for evaluating tactile sensitivity upon the hairy skin.

Keywords: touch, glabrous skin, hairy skin, aging, discriminative touch

*Speaker

†Corresponding author: jean-marc.aimonetti@univ-amu.fr

Mapping human proprioceptive projections of the upper limb muscles through spinal cord fMRI

Raphaëlle Schlienger *† [1], Caroline Landelle , Sergio Hernandez-Charpak , Daniela Pinzón , Jean-Luc Anton , Julien Sein , Bruno Nazarian , Olivier Felician , Jocelyne Bloch , Grégoire Courtine , Anne Kavounoudias

[1] Aix-Marseille University, CNRS – LNC - Aix-Marseille Université – France

Recent advances in functional magnetic resonance imaging (fMRI) have allowed investigation of the somatosensory and motor networks in the human spinal cord (Landelle et al. 2021; Rowald et al. 2022). Maps of different upper limb myotomes have been revealed by motor tasks (Kinany et al. 2019) but no fMRI study has investigated the precise location of muscle proprioceptive projections in the cervical spinal cord. Here, we explored the rostrocaudal activation patterns during upper limb proprioceptive stimulation to better characterize the spinal proprioceptive circuits in 14 healthy volunteers.
We exploited amagnetic vibrators to specifically stimulate proprioceptive afferences innervating six muscles in wrist, elbow and shoulder joints of participants' left arm. This kind of stimulation activates muscle spindles and elicits illusory sensations of movement by recruiting full sensorimotor pathways (Kavounoudias et al. 2008). Functional MR images were acquired between C2 and C8 vertebrae and preprocessed with the Spinal Cord Toolbox (De Leener et al. 2017).

Group-level analysis revealed a rostrocaudal organization of proprioceptive projections from C3 to C7-C8 that matched the expected proximo-distal location of upper-limb proprioceptive neurons, although a substantial inter-subject variability was observed. Activations were primarily distributed along the extent of the left dorsal hemicord, though ventral and contralateral hemicords were also activated to a lesser extent.
This study reveals muscle proprioceptive maps of the cervical spinal cord based on functional MR recordings. These maps are essential for improving our understanding of the healthy and injured spinal cord, guiding neurosurgical interventions, and helping the design of neuroprosthetic treatments.

Keywords: Proprioception, spinal cord, fMRI, mechanical vibration

*Speaker
†Corresponding author: raphaelle.schlienger@univ-amu.fr

Affectionate touch affects individuals' well-being and endogenous oxytocin in times of prolonged stress

Ekaterina Schneider * [1,2], Dora Hopf [1,2], Monika Eckstein [1,2], Dirk Scheele [3], Corina Aguilar-Raab [1,2], Beate Ditzen [1,2]

[1] Heidelberg University Hospital – Germany
[2] Heidelberg University – Germany
[3] Ruhr-University Bochum – Germany

Background: Affectionate touch is vital for mental and physical health but was restricted during the Covid-19 pandemic. This study investigated the association between momentary affectionate touch and subjective well-being as well as salivary oxytocin and cortisol in everyday life during the pandemic.
Methods: In a cross-sectional (N=254) and a longitudinal (N=196) assessment during lockdowns in Germany, participants completed a 2-day ecological momentary assessment (EMA) protocol (collecting six saliva samples on two consecutive days each and simultaneously reporting on affectionate touch, stress, and burden levels) in 2020, as well as one year later, in 2021.

Results: Hierarchical linear modeling revealed that affectionate touch was associated with higher salivary oxytocin concentrations, and lower cortisol and stress levels in their everyday life during the pandemic. Preliminary results of longitudinal data showed that affectionate touch and oxytocin levels measured in 2020 significantly predicted subjectively reported lower stress levels in 2021.
Discussion: These results suggest that in times of pandemic affectionate touch is linked to higher endogenous oxytocin in times of pandemic and might buffer stress on a subjective and hormonal level. These findings might have implications for preventing mental burden during social contact restrictions.

Keywords: affectionate touch, Covid, 19, oxytocin, well, being, stress

*Speaker

Expanding the Reach of Tactile Stimulation Research: The MultiTAC

Edgardo Silva *† [1], Grace Whitaker *

[2], Alejandro Weinstein [3], Wael El-Deredy [3], Francis Mcglone [4]

[1] Facultad de Medicina, Universidad de Valparaíso – Chile
[2] The Advanced Center for Electrical and Electronic Engineering (AC3E), Federico Santa María Technical University – Chile
[3] Universidad de Valparaíso – Chile
[4] University of Liverpool – United Kingdom

Our behavior as a social species is shaped by social interactions mediated by neurobiological and psychological mechanisms, such as our sense of touch. C-tactile afferents (CT) are a population of cutaneous nerves that are hypothesized to play a crucial role in encoding the affiliative and positive aspects of skin-to-skin interactions.
Standard methods of CT stimulation involve controlled light strokes on small areas of the body with varying forces and velocities. To broaden the scope of CT-mediated gentle touch exploration, here we present two novel devices, the MultiTAC and VibroTAC, designed to deliver CT targeted stimulation using light strokes and vibration, respectively.

In a study with 23 participants, tactile stimuli were applied to the forearm at six different speeds, and the resulting pleasantness ratings on a visual analogue scale (VAS) were compared to those from a gold standard approach (the Robotic Tactile Stimulator; RTS).

Our results indicate that brush strokes that move across the skin at CT-preferred velocities, as well as sequential vibration applied on the surface of the skin, elicit positive pleasant responses. In addition, the MultiTAC device was found to be valid for use in psychophysical approaches involving C-Tactile.
The MultiTAC offers mobility and versatility, making it suitable for exploring almost any part of the human body. The VibroTAC is one of the first devices to stimulate individuals using sequential vibrations to produce this type of pleasant response. Both devices encourage the exploration of touch-mediated social interactions and offer new possibilities for research related to C-Tactile and gentle touch.

Keywords: Tactile stimulation, Pleasantness, CT, preferred velocities, MultiTAC, VibroTAC

*Speaker
†Corresponding author: edgardo.silva@uv.cl

How does CT stimulation affect Temporal Summation of Second Pain?

Márcia Silva *† [1], Ana Rita Pereira , A. Ribeiro Carreira , Adriana Sampaio , Joana Coutinho , Alberto J. González-Villar

[1] Psychological Neuroscience Laboratory (PNL), Research Center in Psychology (CIPsi), School of Psychology, University of Minho, Braga, Portugal – Portugal

Affective touch is associated with pleasant or emotionally related responses and is conveyed by specialized receptors sensitive to gentle, slow touch, known as C-tactile afferents (CT). CT stimulation has been found to decrease subjective pain ratings in temporal summation of second pain (TSSP), a phenomenon characterized by an increase in pain perception due to repeated noxious stimuli, and potentially reflecting central sensitization processes. This study aimed to evaluate the effects of CT stimulation on TSSP. Specifically, 37 participants received trains of 11 painful heat pulses (0.33Hz) on left and right volar forearms, while being subject to stroking (administered by a brush- CT stimulation), vibration, or no touch, in the left arm, while recording an EEG. Subjective pain ratings and the N2-P2 complex, an evoked potential related to conscious aspects of noxious processing, were assessed. Behavioral results revealed a significant condition effect, with lower pain ratings in the condition with pain stimuli combined with CT stimulation vs pain combined with vibration. We also observed a significant hand effect, with lower pain ratings in the left hand vs right hand. Finally, a lower N2-P2 complex amplitude when nociceptive stimuli were combined with CT stimulation was observed when compared to pain alone or pain combined with vibration. These findings provide insights into the underlying neural processes involved in pain modulation, suggesting that CT stimulation can modulate the neural response to painful stimuli and highlight this modulation as a potential mechanism for alleviating pain.

Keywords: C, Tactile stimualtion, Temporal Summation of Second Pain, EEG, Affective touch

*Speaker

†Corresponding author: marcia.fernanda.silva@hotmail.com

Touch me or Touch me not: Benefits of affective touch on emotion regulation in adults

Valentina Silvestri* [1], Michelle Giraud † [1], Viola Macchi Cassia [1], Elena Nava [1]

[1] Università degli Studi di Milano-Bicocca = University of Milano-Bicocca – Italy

AT (i.e., a slow and pleasant touch, likely mediated by CT fibres) has a special role in promoting bonding and emotional regulation during early development. Moreover, recent studies in adults suggested that AT promotes establishing and maintaining social connections and mitigating the effects of social conflict and ostracism.Here, we explored whether the AT effectively provides positive outcomes in mitigating adults' experience of negative emotions as reflected in participants' behavioural and physiological responses to emotionally arousing stimuli. Adult women were stimulated on their forearms through AT or neutral touch (i.e., Tapping) while they viewed a series of emotionally arousing (e.g., dead bodies) and neutral images (e.g., bicycles). We measured their skin conductance response and their explicit rating of the images' unpleasantness while also exploratory assessing the observed impact on individual traits such as empathy, high sensitivity and sensitivity to AT itself. Our findings showed that AT reduced the arousal and the negative perception of highly emotional stimuli but not the neutral ones, revealing the soothing role of AT in emotional contexts. Further, preliminary findings on individual traits revealed that, while empathy did not predict changes in emotional processing irrespective of tactile stimulation, individuals with higher traits of sensitivity reported AT as less pleasant. In turn, AT leads highly sensitive individuals to report the emotional images as more disturbing when associated with AT than seen alone. Our findings will be discussed in light of the possible factors mediating the observed interindividual variability in affective touch perception.

Keywords: Affective touch, emotion regulation, skin conductance, arousal, individual differences

*Corresponding author: v.silvestri11@campus.unimib.it
†Speaker

Towards a better understanding of ecologically valid parent-infant affective touch research

Louise Staring * [1,2], Martine Van Puyvelde [1,2,3]

[1] Psychology Educational Sciences [Vrije Universiteit Brussel] – Belgium
[2] Royal Military Academy – Belgium
[3] Liverpool John Morres University - LJMU (UK) – United Kingdom

BACKGROUND. Affective touch is crucial for the healthy development of infants, with C-Tactile afferents, conducting affective information about interpersonal touch, occupying a far-reaching role. However, studying infants is challenging and there exists debate regarding the appropriate methodology for experimental touch research. Standardized laboratory studies are the norm with adult populations, while infants – inherently irritable and sensitive – require a more ecologically valid setting. Thereby, situational-dependent behaviours can cause metabolic changes which affect cardiorespiratory parameters, potentially confounding results.
AIM. We explored a golden mean in ecologically valid yet standardized experimental affective touch research with infants.

METHODS. To test ecological validity, we measured the effect of a 3-min stroking touch period on mother-infant physiological self-regulation, adding the use or omission of oil, and vanilla baselines pre- and post-stroking touch where the mother stroked a pillow to stabilize metabolic activity. Electrocardiogram (ECG) and respiration of 21 mother-infant dyads (infants aged 5-15 weeks) were measured to calculate RR-intervals (RRI), respiration rates (fR) and respiratory sinus arrhythmia (RSA).
CONCLUSIONS. Infants' RSA significantly increased during the post-stroking vanilla baseline but not during stroking touch, indicating a delayed effect. We propose that this can be attributed to the disruption of the infants' ecological context within this standardized experimental setup. The novel interactive context potentially required the infants to acclimate. Furthermore, the use or omission of oil did not influence infant cardio respiration, and overall no changes were observed in the mothers' physiology. These findings highlight the importance of conducting ecologically valid and tailored experimental research when studying infants.

Keywords: parental touch, affective touch, oil, vanilla baseline, ecological validity, respiratory sinus arrhythmia

*Speaker

Modeling Population Receptive Fields of the Fingertips in Human Primary Somatosensory Cortex

Susanne Stoll * [1,2,3], Falk Lüsebrink [3,4,5], D. Samuel Schwarzkopf [6], Hendrik Mattern [3,4,7], Peng Liu [1,2,3], Esther Kuehn [1,2,3,7]

[1] Hertie Institute for Clinical Brain Research, Tübingen, Germany – Germany
[2] Institute for Cognitive Neurology and Dementia Research, Otto-von-Guericke University Magdeburg, Germany – Germany
[3] German Center for Neurodegenerative Diseases, Magdeburg, Germany – Germany
[4] Biomedical Magnetic Resonance, Otto-von-Guericke-University Magdeburg, Germany – Germany
[5] Nuclear Magnetic Resonance, Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany – Germany
[6] School of Optometry and Vision Science, The University of Auckland, New Zealand – New Zealand
[7] Center for Behavioral Brain Sciences, Magdeburg, Germany – Germany

Although between-fingertip maps have been extensively studied in human primary somatosensory cortex (S1), surprisingly little is known about their fine-grained architecture. To address this issue, we set out to estimate 2D population receptive fields (pRFs) of the tip of the index finger in human S1. Using 7T-fMRI at submillimeter resolution and prospective motion correction, we recorded S1 responses whilst participants sensed a row of vibrotactile pins moving along cardinal axes over a portion of the fingertip. To estimate pRF position and size, we fit a 2D Gaussian pRF model to the data (as is common in vision science). Our results show that the recorded S1 responses do not contain enough information to obtain plausible pRF estimates without further modeling constraints. Simulation analyses suggest this is likely because the size of pRFs in S1 surpasses the area on the fingertip that was stimulated, resulting in an incomplete mapping of pRFs. When constraining the fitting procedure and the 2D Gaussian pRF model (by keeping pRF size constant), our results for pRF position suggest that the ulnar-to-radial axis spanning the fingertip might be represented along a superior-to-inferior axis in S1. Although this representation is largely replicable, cross-validation and simulation analyses indicate that our constrained 2D Gaussian pRF model performs only slightly better than a pRF model without any spatial tuning, which might be yet another consequence of partial pRF mapping. Both the putatively "large" pRF size and the pRF position gradient we uncover here appear compatible with receptive field properties in monkeys.

Keywords: population receptive field modeling, fingertip, primary somatosensory cortex, 7T, fMRI, human, simulations

*Speaker

When mechanical engineering inspired from physiology improves postural-related somatosensory processes

Chloe Sutter * [1], Alix Moinon , Livia Felicetti , Francesco Massi , Jean Blouin , Laurence Mouchnino

[1] Laboratoire de neurosciences cognitives – Aix-Marseille Université - AMU, CNRS : UMR7291, FR 3C – France

Although in the standing position, stimulation comes from the relative movement between the feet and the supporting surface, most of the investigations have ignored this mechanical contact behavior. Mechanical friction between the foot skin and the contact surface induces vibrations that stimulate receptors of the plantar skin (i.e., mechanoreceptors). We hypothesized that a biomimetic surface inspired by the characteristics of the mechanoreceptors and skin dermatoglyphs (i.e., biomimetic) would potentiate early cortical processes associated with somatosensory inputs involved in balance control.
We recorded by EEG and measured the amplitude of the somatosensory potential (i.e. SEP) evoked by the production of the contact force during unexpected supporting surface translation, and the amplitude of the induced vibrations with an accelerometer glued to the first right toe. 25 participants stood with their eyes closed on a biomimetic or smooth surface and underwent a low acceleration supporting surface translation.

The amplitude of the SEP was greater and the P1 latency shorter when standing on the biomimetic surface. Power spectral density (PSD) analysis of the accelerometer signal showed a different vibration signature on the biomimetic surface with greater power at 215Hz and the presence of a peak at 310Hz.
It would appear that the biomimetic surface amplifies tactile information by bringing out a characteristic vibratory profile dominated by frequencies within the optimal sensitivity range of specific mechanoreceptors. These observations provide neurophysiological evidence that the transmission of somesthetic afferents can be potentiated when the mechanical behavior of contact with the skin allows the amplification of subcutaneous vibrations.

Keywords: plantar sole afferents, biomimetic surface, balance, EEG, somatosensory evoked potentials (SEP)

*Speaker

Probing temporal rules for artificial tactile feedback in a sensory-motor brain-machine interface

Alexandre Tolboom * [1], Henri Lassagne [1], Daniel Shulz [1], Luc Estebanez [1], Valérie Ego-Stengel [1]

[1] Institut des Neurosciences Paris-Saclay – Université Paris-Saclay, Centre National de la Recherche Scientifique – France

Brain-Machine-Interfaces (BMIs) aim to improve the autonomy of human patients. Nevertheless, beyond the restoration of movement, the fine control of prosthetics requires the recovery of tactile sensory feedback. Although BMIs with artificial somatosensory inputs have recently been implemented in patients, few studies have focused on the temporal constraints of feedback integration.
In this study, we aim to explore the impact of the temporal latency between a motor command and the feedback update after movement. Therefore, we have developed an ultra-fast bidirectional BMI based on chronic electrophysiological recordings in M1 and 2D patterned optogenetic stimulation of the primary somatosensory cortex (S1) in mice. Thanks to our control algorithm based on the incremental displacement of the prosthesis triggered by single spikes, we achieved a 4.4-ms minimal latency for the complete loop - the fastest closed-loop BMI to our knowledge.

In our protocol, single M1 neurons were conditioned to control the rotation of a virtual bar. The photostimulation pattern on S1 provided feedback of the prosthesis angular position to the animal. On a subset of animals, we showed that such optostimulations could generate perceptions similar to the ones evoked by equivalent tactile stimuli.
Results showed that our incremental algorithm was efficient to achieve fine control. We obtained well-guided trajectories by using a 50-ms latency for tactile feedback. Decreasing/increasing the latency to 5/300-ms impaired the ability of the animals to move and stabilize the prosthesis in the target area, suggesting the existence of a specific range of time windows in the S1-M1 dialogue.

Keywords: Tactile feedback, Somatosensory feedback, Brain Machine Interfaces, BMI, Latency, Feedback latency, Patterned optogenetics, S1, Prosthesis

*Speaker

Affective Touch and How It Relates to Psychopathology: The Pursuit of Early Trauma Traces on Body-Brain-Mind-Skin Axis

Hilal Uney *† , Clara Mucci [1], Andrea Scalabrini [1], Sezgi Sarikaya Solak [2]

[1] Bergamo University – Italy
[2] Trakya University – Turkey

Skin is the largest organ covering the entire body, where we perceive the world through tactility. From a developmental perspective, the most primitive and influential communication channel of touch is of utmost importance to understanding more complex issues about social cognition, empathy (Di Plinio et al., 2022), and the primitive sense of Self (Gallese, 2009). Also, these early intercorporeal experiences are engraved in a child's developing body-brain-mind systems and therefore, they shape future interpersonal and intrapersonal patterns, body ownership, interoception, multisensorial integration, etc. and consequently, they predict future psychopathologies. As recent neuroscientific studies have shown, the earlier trauma, the more severe damage to the body. So that reason, this study was conducted with 10 psoriasis patients (whose skin axis has already been damaged) to investigate the social, relational, and intercorporeal roots of psoriasis disease encoded in the soma through psychoanalytic interviews and Rorschach Test at the dermatology department of Trakya University Faculty of Medicine in 2022. The content analysis of Parisian School was used to find a relationship between early traumatic experiences and the pathogenesis of psoriasis by looking through tactual responses and body image responses in Rorschach Test. Hypotheses of the study based on the relationship between psoriasis and early traumatic experiences have been largely confirmed. Finally, the complexity of skin disorders has been discussed neuropsychodynamically in the scope of early relational trauma, affective touch, and neurogenic inflammation context between psychoanalysis, neuroscience, and dermatology disciplines.

Keywords: affective touch, intercorporeality, skin disorders, neurogenic inflammation, trauma, psychopathology, Rorschach Test

*Speaker
†Corresponding author: uneyhilal@gmail.com

Assessing individual differences in attitudes towards touch in treatment settings: Introducing the touch & health scale

Aikaterini Vafeiadou [*†] [1], Natalie C. Bowling [2], Claudia Hammond [3], Michael J. Banissy [4,5]

[1] Department of Psychology, Goldsmiths, University of London – United Kingdom
[2] School of Human Sciences, University of Greenwich – United Kingdom
[3] Department of Psychology, University of Sussex – United Kingdom
[4] School of Psychological Science, University of Bristol – United Kingdom
[5] Department of Psychology, Goldsmiths, University of London – United Kingdom

Individuals commonly receive touch in treatment settings, but there is limited research on how they perceive it. The current project sought to address this gap by: 1) developing the Touch & Health Scale (THS) - a novel instrument to measure attitudes to touch in treatment settings 2) assessing inter-individual differences in THS scores, and 3) examining the association between individuals' THS scores and wellbeing. Data of a large U.K. adults sample ($N >$ 12,000) were used. THS showed Cronbach's α between 0.636 and 0.816 and significant correlations ($p <$ 0.001) with day-to-day attitudes to touch. THS scores differed as a function of extraversion and avoidant attachment style. Participants with more positive attitudes to touch in treatment settings showed greater wellbeing. Overall, the study highlights the importance of a personalised approach to touch in treatment settings and provides a new scale that may act as a screening tool for this purpose.

Keywords: attachment style, personality traits, touch attitudes, wellbeing

[*]Speaker
[†]Corresponding author: kvafe001@gold.ac.uk

Comforting touch in human-robot interaction: factors influencing pleasantness and trust.

Irene Valori [*†] [1,2], Yichen Fan [3,4], Merel Jung [5], Merle Fairhurst [1,2,4]

[1] Centre for Tactile Internet with Human-in-the-Loop (CeTI), Technische Universität Dresden – Germany
[2] Chair of Acoustics and Haptics, Technische Universität Dresden – Germany
[3] Chair of Industrial Design Engineering, Technische Universität Dresden – Germany
[4] 6G-Life – Germany
[5] Department of Cognitive Science and Artificial Intelligence, Tilburg University – Netherlands

Our lives are permeated by interactions with technologies that are not just tools but increasingly have social characteristics that make them interaction partners. Humanoid robots are a special case of technology designed for social interaction. However, the social norms that apply to human-robot interaction are still to be understood (and perhaps constructed), which is particularly important for more intimate exchanges, as in the case of social touch. Do we want to be able to touch and be touched by a robot? What would the effects of social touch in this context be? Here we present an online study in which participants observed scenes of human-human or human-robot interactions involving comforting touch. In a 2x2 design, we manipulated the characters' roles, with either the human or the robot being in a vulnerable situation or comforting the other, initiating or reciprocating touch. The results are discussed with respect to how real, appropriate and pleasant the touch is perceived, and how trustworthy the characters are rated in the different scenarios. We discuss how ratings are influenced by individual social touch preferences and predisposition to trust others in everyday life. A future step of the study sees the use of virtual reality to immerse people in similar first-person human-robot touch scenarios. These studies offer fundamental insights to guide the implementation of social touch in human-robot exchanges, which is too often simply trying to replicate the principles and uses of touch between humans, instead of understanding its specific potential, applications and limitations.

Keywords: Human, Robot interaction, comforting touch, trust, initiation, reciprocity, vulnerability

[*]Speaker
[†]Corresponding author: irene.valori@tu-dresden.de

Haptotherapy for patients with cancer: the impact of affective touch

Agnes Van Swaay *† [1], Kris Vissers [1], Yvonne Engels [1], Marieke Groot [2]

[1] Radboud University Medical Center, Anesthesiology, Pain and Palliative Care – Netherlands
[2] Rotterdam University of Applied Sciences – Netherlands

Background: Several well-known psychotherapies are (also) applied to patients with cancer. However, the question is whether sufficient attention is paid to the shifts in the way patients perceive their altered and damaged body, and to their emotional impact. The connection between these two is precisely the core issue of haptotherapy for patients with cancer.
Objective: Patients with cancer who had haptotherapy during their disease and recovery trajectory gave high value scores to haptotherapy. However, it is unknown in what way the different components of haptotherapy contribute to such positive outcomes. Therefore, the aim of the present study is to come to a detailed description of the haptotherapeutic treatment of patients with cancer, and obtain insight in experiences, perceptions and opinions of patients and haptotherapists about content, efficacy and value of haptotherapy.

Methods: Qualitative in-depth interviews with patients with cancer and haptotherapists; thematic content analysis to analyze the data.

Results: Fourteen patients and nine haptotherapists were interviewed. The combination of conversation and affective touch was unanimously considered crucial. Patients mentioned that being touched by the haptotherapist specifically triggered the awareness that they lost the connection with (parts of) their body. Moreover, haptotherapists emphasized the importance of affective touch to help patients to (re)incorporate the affected – and accordingly neglected – parts of, or even their entire body.
Conclusion: This qualitative study shows that haptotherapy has the potential to help patients becoming aware of and restoring their connection with their body, including the affected and neglected parts, which is assumed to facilitate emotional processing.

Keywords: Haptotherapy, Affective Touch, Cancer, (Psycho)Oncology, Qualitative Research

*Speaker
†Corresponding author: Agnes.vanSwaaij@radboudumc.nl

Effect of Temporal Dispersion on Vibrotactile Frequency Encoding

Richard Vickery *† [1,2], Daniel Shahrokni [3], Sarah Mcintyre‡ [4], Ingvars Birznieks§ [1,2]

[1] School of Biomedical Sciences, UNSW Sydney – Australia
[2] Neuroscience Research Australia – Australia
[3] Faculty of Medicine and Health Sciences, Linköping University – Sweden
[4] Department of Biomedical and Clinical Sciences, Center for Social and Affective Neuroscience, Linköping University – Sweden

Background: For coherent perception of touch inputs, the nervous system must solve the problem of temporal dispersion caused by different conduction velocities in different peripheral afferents. One potential solution is that action potentials that occur close in time, *i.e.* within a "burst", are perceptually grouped together as one peripheral event. We have previously shown that perceived vibrotactile frequency on the fingers depends on the "burst gap": the interval between two successive bursts of mechanically-evoked action potentials.
Aim: To test the burst gap integration window for vibrotactile stimuli applied to feet compared with existing data from the hand. It is predicted that the longer conduction distance to CNS from the foot will cause greater dispersion that will result in a burst extending over a longer time envelope.

Methods: Healthy subjects discriminated the frequency of mechanical two-pulse stimuli applied to the toe compared with regular trains of acoustic stimuli. The intraburst spike interval was varied from 4 to 56 ms.

Results: The burst gap code was found to determine frequency perception in toes as in the fingers. The integration window for bursts was 5 ms longer for the toes compared to fingers.
Discussion: Although an increased integration time window was observed with toe stimulation, it is not sufficient to account for the expected doubling of dispersion related to the increased conduction path. This confirms the essential similarity of upper and lower limb vibrotactile perception, and suggests that other mechanisms play the key role in determining the burst integration envelope.

Keywords: temporal coding, frequency perception, dispersion, foot, psychophysics, peripheral nerve

*Speaker
†Corresponding author: richard.vickery@unsw.edu.au
‡Corresponding author: sarah.mcintyre@liu.se
§Corresponding author: i.birznieks@unsw.edu.au

Behavioral and neurophysiological evidence for a tactile-based control of voluntary movements

Marieva Vlachou * [1], Juilette Legros [2], Cécile Sellin [1], Martin Simoneau [3], Laurence Mouchnino [4], Jean Blouin *

1

[1] Laboratoire de Neurosciences Cognitives – Aix-Marseille Université - AMU – France
[2] Laboratoire de Neurosciences Cognitives – Aix-Marseille Université - AMU – France
[3] Centre interdisciplinaire de recherche en réadaptation et intégration sociale du CIUSSS de la Capitale-Nationale – Canada
[4] Laboratoire de Neurosciences Cognitives – Aix-Marseille Université - AMU – France

The sense of touch does not only provide information about the external environment but also acts as a crucial auxiliary proprioceptive cue. Activation of cutaneous mechanoreceptors enables us to perceive the relative motion between our hand and a surface. Yet, it remains unknown whether tactile feedback contributes to control spatially oriented movements. To assess this, we used an established paradigm during which the performance of a visually-guided motor task is perturbed by conflicting visual and somatosensory inputs. In this context, the greater the weight given to somatosensory input, the worse the tracing performance. We expected an increased sensory conflict due to tactile feedback, resulting in a deteriorated tracing performance. Participants traced the outline of a polygon on a surface with their index finger (Cutaneous group, N=16) while looking both at the polygon and their hand directly (NoConflict) or through an inclined mirror (Conflict). The same tasks were performed by a control group (NoCutaneous group, N=15) wearing a finger splint to reduce tactile stimulation. In line with our hypothesis, tracing accuracy was smaller in the Cutaneous group, implying a greater weight given to somatosensory information. Furthermore, previous EEG studies have revealed an increased gating of somatosensory inputs during the incongruent visuo-proprioceptive condition. This sensory gating was observed only in the Cutaneous group, supporting the argument of tactile interference to the sensory conflict. Collectively, our results provide evidence for a pivotal contribution of cutaneous feedback to motion control and shed new light on the interplay between proprioception and touch in active tasks.

Keywords: Electroencephalography, Tactile, Somatosensory, Sensory conflict, Vision, Sensory gating, Finger movement, Somatosensory cortex

*Speaker

The effects of skin hydration levels on local skin wetness perception at the underarm

Jade Ward * [1], Emilio Verucchi [1], Dave Swaile [2], Peter Worsley† [1], Davide Filingeri * ‡ [1]

[1] University of Southampton – United Kingdom
[2] Proctor Gamble – United States

Changes in skin hydration could alter skin properties leading to a change in wetness sensitivity. However, how the biophysical status of the skin impacts local wetness perception (WP) remains unclear. This study aimed to investigate the effect of skin hydration levels on local WP. Ten participants (5M/5F; 29±7y) took part in two trials, where they underwent a quantitative sensory test of WP at baseline and following localised overhydration (OVH;+22%) or dehydration (DEH;-44%) of the underarm' skin. Participants reported on a visual analogue scale the perceived magnitude of WP (anchor points: 0=dry; 100=completely wet) from the short-duration static application of a cold-wet (i.e. 5∘C below local skin temperature, Tsk), neutral-wet (i.e. equal to Tsk) and warm-wet (i.e. 5∘C above Tsk). Pearson's chi-squared tests of independence were used to examine the association between changes in WP from baseline and skin hydration status for each temperature stimulus.

A statistically significant association ($X^2(2)=6.9$, $p=0.03$) was found between skin hydration status and changes in WP during neutral-wet stimulation. Specifically, 60% of participants reported an increase in WP following OVH, whilst 30% reported a decrease following DEH. A similar trend was observed during cold-wet stimulation ($X^2(2)=5.4$, $p=0.07$). No significant association was found between changes in WP and skin hydration status during warm-wet stimulation ($X^2(2)=0.3$, $p=0.865$).
We conclude that skin hydration levels may influence WP, although this effect is dependent on stimulus temperature. Furthermore, inter-subject variability may modify the effect of skin hydration levels on WP, which requires further investigation.

Keywords: Wetness perception, Skin hydration, Overhydration, Dehydration, Thermal sensitivity

*Speaker
†Corresponding author: p.r.worsley@soton.ac.uk
‡Corresponding author: D.filingeri@soton.ac.uk

Neuromorphic optical tactile sensing - bridging artificial and biological touch

Benjamin Ward-Cherrier * [1]

[1] University of Bristol [Bristol] – United Kingdom

My long-term research aim is to build upper-limb prosthetics with tactile sensing that seamlessly integrates with the human body. I believe neuromorphic tactile sensing technologies will help to achieve this goal. Our research group builds neuromorphic optical tactile sensors and develops spike-based algorithms to solve tactile perception problems such as texture identification, slip detection or contour following. I will present in this talk/poster our work in hardware development to miniaturise optical tactile sensors, our efforts in developing spiking neural network algorithms and why we believe these are key to achieving fast biomimetic tactile sensing, as well as our intentions for future shared autonomy control protocols for upper-limb prosthetics.

Keywords: Neuromorphic touch, tactile sensors

*Speaker

Tactile intensity perception is shaped by temporal integration: evidence from single afferent recording and stimulation in humans

Roger Watkins * [1], Rochelle Ackerley , Mario Amante , Johan Wessberg

[1] Laboratoire de Neurosciences Cognitives [Marseille] – Aix Marseille Université, Centre National de la Recherche Scientifique, Aix Marseille Université : UMR7291, Centre National de la Recherche Scientifique : UMR7291 – France

In glabrous hand skin, four types of fast-conducting mechanoreceptive afferent encode different aspects of touch. Temporal firing patterns in these afferents reflect stimulus quality, whereas the overall firing rate relates to perceived intensity. We used broadband vibration reflecting real world tactile interactions and found intensity ratings dropped markedly with stimulus duration < 400ms. We used microneurography to relate these perceptual equivalence judgements of intensity at different durations to coding in single mechanoreceptive afferents. Afferent firing rate gave a poor prediction of perceived intensity, which was instead best predicted by binned firing rate across 100ms windows. We also stimulated single afferents with intraneural microstimulation to evoke precise spike trains and associated tactile percepts. For type I afferents, intensity was perceived as lower at durations below 100 ms, but delivering the same number of impulses produced equivalence. In type II afferents, intensity judgements were reduced at longer stimulus durations (> 200ms). These data suggest that tactile intensity perception is integrated over short time windows for type I afferents, but this might be different in type II afferents. This has implications for the design of tactile feedback, where temporal aspects may be utilized to provide efficient modulation of vibrotactile and prosthetic neurostimulation intensity feedback.

Keywords: microneurography, microstimulation, perception

*Speaker

Tactile Simulation of Textile Fabrics: Design and Control of the Simulation Signals

Benjamin Weiland *† [1], Anis Kaci [2], Floriane Leclinche [1], Brigitte Camillieri [1], Betty Lemaire-Semail‡ [2], Marie-Ange Bueno§ [1]

[1] Laboratoire de Physique et Mécanique Textiles - LPMT - UR4365 – Université de Haute-Alsace (UHA) Mulhouse - Colmar – France
[2] L2EP – Univ. Lille, Arts et Metiers Institute of Technology, Centrale Lille, Junia, ULR 2697 - L2EP, F-59000 Lille, France – France

The aim of this project, named TacFib, is to simulate the touch of textile surfaces thanks to a tactile simulator, named STIMTAC, by modulating the contact friction. This project has many applications, from the co-design of tactile prototype to the e-commerce for garments. In this study, there are three main steps that will be addressed: i) the acquisition of pertinent tribological signals between 6 fabrics and an artificial finger, ii) the definition of a systematic signal processing to design the control signals used to simulate the fabrics, and iii) the evaluation of the stimulator performance as regarding the tactile perception from a trained panel.
An artificial finger was rubbed against the 6 fabrics following an identified protocol. The signals from the normal and tangential forces are processed to obtain a signal representing the contact between the finger and the fabric and used to control the stimulator.
The performance evaluation is done by comparing the perception intensity obtained by a trained panel on the real and virtual fabrics, i.e. simulated fabrics with STIMTAC, through three descriptors: smooth/rough (Rp), unpleasant/pleasant (Pp) and slippery (Sp). The approach is to compare the 'hand' obtained with the real and virtual fabrics.

Keywords: Tactile stimulator, friction, induced vibration, perception

*Speaker
†Corresponding author: benjamin.weiland@uha.fr
‡Corresponding author: betty.semail@polytech-lille.fr
§Corresponding author: marie-ange.bueno@uha.fr

Sensory-based and action-based predictions operate to facilitate the unexpected touch at the expense of the expected one

Ziliang Xiong * [1,2], Xavier Job [1], Konstantina Kilteni† [1,2]

[1] Karolinska Institute – Sweden
[2] Donders Institute for Brain, Cognition and Behaviour – Netherlands

Self-generated touch is thought to be reliably predicted and perceptually attenuated given the prediction provided by motor commands. However, outside of action, predictions such as those based on learned temporal associations, are thought to operate in the opposite direction by up-weighting expected inputs rather than down-weighting them. The disparity between these two predictive accounts is particularly pertinent in the tactile domain where studies manipulating both sources of expectations simultaneously are scarce. Here, participants discriminated the touch delivered to their index finger that was either externally or self-generated (action-based). Temporal expectations (sensory-based) were simultaneously manipulated with probabilistic cues signaling the likely onset time of the delivered touch, rendering the expected (i.e., the cue validates the onset) and unexpected condition (i.e., the cue invalidates the onset). We found that temporal expectations modulated the perceptual precision of the externally generated touch, for which the action-based prediction was unavailable. In contrast, the action-based prediction consistently attenuated the perceived magnitude of the self-generated touch compared to the external one, regardless of temporal expectations. All effects were replicated in a second experiment and further explored with an additional baseline condition where a non-predictive cue controlled for temporal expectations. Results showed that the sensory-based effect was driven by the expected touch being downregulated with decreased precision, while the action-based attenuation dominated sensory-based influences. Together, our results suggest that sensory- and action-based predictions operate to facilitate the processing of the unexpected touch in terms of perceptual precision and magnitude respectively, at the expense of the expected touch.

Keywords: Action, based prediction, motor prediction, sensory, based prediction, temporal expectation, self, generated touch, somatosensory attenuation

*Speaker
†Corresponding author: konstantina.kilteni@ki.se

An active whisker-dependent task to seek neuronal signatures of tactile sensory prediction in the mouse sensorimotor cortex

Fan Yang * [1,2], Sophie Hubatz [1,2], Luc Estebanez [2], Thomas Deneux [2], Daniel Shulz [2], Jean-François Léger [1], Isabelle Ferezou† [2], Laurent Bourdieu [1]

[1] Institut de biologie de l'ENS Paris – Département de Biologie - ENS Paris, Institut National de la Santé et de la Recherche Médicale, Centre National de la Recherche Scientifique – France
[2] Institut des Neurosciences Paris-Saclay – Université Paris-Saclay, Centre National de la Recherche Scientifique – France

Cortical circuits are thought to be involved in the computation of an internal model of our interactions with the environment. According to predictive coding theories, in case of mismatch between expected and actual sensory inputs, an error signal is generated, which is key to update the internal model and adjust the motor commands, thus optimising behaviour.
To study the predictive mechanisms involved in tactile sensory perception, we designed a new tactile sensorimotor task in which head-fixed mice are trained to contact several times two fixed objects back-and-forth with a spared single whisker (C2) to obtain a reward. Then, during sessions performed with expert animals, we randomly interleave 'omission' trials, in which the object is removed between two whisks, creating a deviance between expected and received tactile inputs.
To reveal the neuronal correlates of such predictive mechanisms at mesoscopic scale, we perform voltage sensitive dye (VSD) imaging during the task over the somatosensory-motor cortical areas.

Keywords: Tactile sensory prediction, Active whisking, Sensorimotor cortex, Voltage, sensitive dye imaging

*Speaker
†Corresponding author: isabelle.ferezou@cnrs.fr

Effects of repetitive somatosensory stimulation on motor behaviour

Antonio Zafarana *† [1], Dollyane Muret [2], Luigi Tamè‡ [1], Alessandro Farnè [3]

[1] University of Kent [Canterbury] – United Kingdom
[2] Université Paris-Saclay – NeuroSpin, CEA, Gif-sur-Yvette, Université Paris-Saclay, France – France
[3] Centre de recherche en neurosciences de Lyon - Lyon Neuroscience Research Center – Université Claude Bernard Lyon 1 – France

Somatosensory signals are essential to motor system control and tactile impairments can result in a significant reduction in the quality of motor abilities. Repetitive somatosensory stimulation (RSS) at a finger is known to improve performance in a two-point discrimination task (2PDT), supposedly thanks to the increase of the cortical representation of the stimulated body part in the somatosensory cortices. Yet, whether the RSS-induced improvement in touch perception affects the activity of the motor cortex remains unknown. Here we assessed the effects of RSS on the motor system. Tactile performance and motor skills were evaluated before and after 3 hours of the training phase by using a 2PDT and a grooved pegboard task. The training phase consisted of either an RSS or a sham RSS. Results showed that the tactile performance increased for the trained finger (right index) only after the RSS and not sham RSS. Results on motor performance showed that execution times for the grooved pegboard task were shorter after RSS only with the left hand, whereas participants in the sham group did not show any significant change. We suggest that RSS can have an inhibitory effect on the participants' motor performance possibly through sensorimotor interactions.

Keywords: Repetitive Somatosensory Stimulation, Two point discrimination, Manual dexterity, Sensorimotor, Tactile training.

*Speaker
†Corresponding author: antonio.zafarana1@gmail.com
‡Corresponding author: luigi.tame@gmail.com

Affective Touch perception in patients suffering from Fibromyalgia

Ludovica Zanini * [1], Gianluca Cruciani [1], Valentina Russo [2], Martina Mirabella [2], Grazia Spitoni [1]

[1] Department of Dynamic and Clinical Psychology, and Health Studies - Sapienza University of Rome – Italy
[2] Department of Psychology, Sapienza University of Rome – Italy

Fibromyalgia (FM) is a syndrome characterized by persistent and widespread chronic pain in the absence of inflammatory or structural musculoskeletal abnormalities. Although the etiopathogenesis of FM remains unclear, it is often regarded as a central sensitization syndrome in which the perception of pain is amplified. Recent studies have observed a soothing effect of gentle touch on pain perception, suggesting that there may be a relationship between nociception and the Affective Touch (AT) system. The aim of the present study was therefore to explore AT perception in FM patients compared to healthy controls. All participants were screened for general symptomatology and basic somatosensory functions, including tactile acuity and sensitivity. AT perception was assessed by asking participants to rate the pleasantness of AT optimal and non-AT optimal stimulations, performed at a speed of either 3 cm/s or 30 cm/s, respectively. The initial screening revealed that FM patients were more psychologically distressed, and that the two groups were comparable in terms of basic somatosensory functions. AT results revealed significant main effects of both group and stimulation speed, as well as a significant interaction between group and speed. As opposed to the control group, which rated CT optimal stimulations as significantly more pleasant than non-optimal ones, FM patients did not differentiate between the two speeds. Furthermore, FM patients rated CT optimal stimulations specifically as significantly less pleasant than healthy controls. These findings confirm and extend previous results, suggesting that chronic pain may be associated with an impaired perception of touch pleasantness.

Keywords: Fibromyalgia, chronic pain, Affective Touch, pleasant touch, gentle touch

*Speaker

Thermosensory atypia in newborns mutant for the autism-related gene Magel2

Ugo Zayan *† [1,2,3], Valéry Matarazzo‡ [1,2,3], Anastasia Ludwig [4], Stefania Sarno [1,5], Dmitrii Suchkov [1,3], Françoise Muscatelli [1,6], Claudio Rivera [1,2,4]

[1] Institut de Neurobiologie de la Méditerranée – Aix Marseille Université, Institut National de la Santé et de la Recherche Médicale – France
[2] Faculté des Sciences – Aix Marseille Université – France
[3] Institut National de la Santé et de la Recherche Médicale – Institut National de la Santé et de la Recherche Médicale - INSERM – France
[4] Helsinki Institute of Life Science – Finland
[5] CENTURI – CENTURI – France
[6] Centre National de la Recherche Scientifique – Centre National de la Recherche Scientifique - CNRS – France

Atypical responses to sensory stimuli are considered a core aspect and early life marker of Autism Spectrum Disorders (ASD). Although recent findings performed in mouse ASD genetic models report sensory deficits, these were explored exclusively during the juvenile or adult period. Our research concentrates on neonate mice lacking the autism-associated gene Magel2. MAGEL2 is an imprinted gene highly expressed in the hypothalamus that is paternally expressed and for which paternal deletion and point mutation cause Prader-Willi and Schaaf-Yang respectively; two syndromes with a high prevalence of ASD. We recently found that under a cool environment, neonatal mice lacking Magel2 present pup calls hypo-reactivity and are retrieved with delay by their wild-type dam. Intranasal administration of oxytocin to Magel2 neonates was able to rescue both the atypical thermosensory response and the maternal pup retrieval. Our previous results suggest a dysfunction in the neural coding of thermoception that we need now to investigate. By recording thermal cortical evoked potentials through both in vivo mesoscopic calcium imaging and in vivo electrophysiological multi-channel recording we aim to: (1) identify the existence of early activity in the somatosensory cortex induced by cool thermal stimulation; 2) Compare cortical activity between control and Magel2 deficient mice; 3) Investigate how oxytocin can influence the coding of thermosensory information during the first weeks of life. The project will establish for the first-time deficits in thermosensory integration in early life and focus on oxytocin as a potentially beneficial treatment for atypical sensory reactivity.

Keywords: autism, somatosensory cortex, thermsensation, oxytocin

*Speaker
†Corresponding author: ugo.zayan@inserm.fr
‡Corresponding author: valery.matarazzo@univ-amu.fr

Author Index