C-tactile mediated erotic touch perception relates to sexual desire and performance in a gender-specific way

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Introduction

C-tactile afferents play an important role in the perception and conduction of caressing and pleasant touch sensations and significantly contribute to the concept of erotic touch perception. In our study, we investigated coherences between the perception of touch mediated by C-tactile afferents and sexual desire as well as sexual performance.

Methods

Seventy healthy individuals (28 male, 42 female; mean age 24.84 ± 4.08 years SD, range from 18 to 36 years) participated in a psychophysical experiment that involved standardized and highly controlled tactile stimulation of the forearm using C-tactile optimal (1, 3 and 10 cm/s) as well as C-tactile suboptimal (0.1, 0.3 and 30 cm/s) stroking velocities. Participants rated the perceived pleasantness, eroticism and intensity of the applied tactile stimulation on a visual analogue scale, filled in the Sexual Desire Inventory and answered questions about sexual performance.

Results

In general, ratings of perceived pleasantness and eroticism aligned with previous knowledge about the discharge frequency of C-tactile afferents. Furthermore, erotic touch perception was related to sexual desire and sexual performance in a gender-specific way: In women, differences in eroticism ratings between CT-optimal and sub-optimal velocities correlated positively with sexual desire for interaction with a partner. In men, this difference correlated to a reduced frequency and longer duration of partnered sexual activities.

Conclusion

The present results provide further evidence that C-tactile afferents play a role in the complex mechanism of erotic touch perception. The ability to differentiate between CT-optimal and non-optimal stimuli relates to sexual desire and performance in a gender-specific way. Implications for the treatment of sexual disorders, such as low sexual desire in women are discussed.
Is it you or is it me? Differentiating between self- and other-touch

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Differentiating between others and ourselves is crucial for social cognition. To be able to interact with others, we have to know where our body ends and where the world around us begins. On the most basic level, we need differentiate if a stimulus is socially salient or originates from our own activity. In this study, we set out to find the neural signatures that differ between affective self-touch and being touched by someone else. Twenty-seven healthy volunteers participated in an fMRI experiment, where they stroked their own arm or an object or were stroked by the experimenter. Our results show differentiation between self- and other-touch in a widespread network, including insula, anterior and posterior cingulate cortex, superior temporal sulcus, the striatum, prefrontal areas, parahippocampal gyrus and midbrain areas. Furthermore, we found that this differential activation is related to the individual self-concept strength. These results add to the theory of cancellation effects of self-produced stimuli and suggest further study of self-other differentiation in psychiatric populations.
Hands off our children: challenging the touch taboo in education and care contexts

Robert Cameron

Pillars of Parenting Social Enterprise

Why is this issue so important?

Affective touch is a powerful medium for conveying empathy between people, for example when acknowledging that a child is highly successful, anxious or upset. A large body of recent neurobiological and psychological research clearly demonstrates that affective touch activates a crucial nerve system in the skin of all mammals that defends against stress and promotes feelings of well-being.

In the UK and in many of the British Commonwealth countries, guidelines on showing physical affection and approval to children and young people tend to be based on legal reactions to abuse, as opposed to good practice in childcare. In the stampede to reduce child abuse, the exclusive focus in education and public care has been on limiting abusive practice, however, this has constrained childcare practice, reduced opportunities for teachers and carers to show essential warmth and affection to all children, but especially those children and young people who have been deprived of such positive experiences in their home lives. Such guidelines have also led to considerable male reluctance to work in early years teaching and in childcare.

As applied psychologists, we believe that there is a need for clarification of the confusion experienced by many teachers, residential and foster carers, indeed most adults who spend time with children, when it comes to touching children and young people in their care, whether it is to show affection, provide comfort and empathy, recognise extra effort or success, give confidence and reassurance, or prevent the child from inflicting hurt on herself/himself or others.
Novel characterization of affective response to deep pressure touch
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Moderate and deep pressure touch are commonly utilized in massage therapy and have been linked to reductions in stress, depression, and pain. Yet there is no understanding of how pressure exerts these affective benefits. We propose that unmyelinated pressure-sensitive afferents identified in animals (e.g. Mense & Meyer, 1985) may exist in humans and underlie these effects. Such a mechanism would parallel the pleasantness of light stroking touch, which has been linked to the activation of C low-threshold mechanoreceptor (C-LTMR) fibers (Gordon et al., 2013; Olausson et al., 2002).

We conducted psychophysical studies to initiate this line of research. We programmed a compression sleeve to administer oscillating, massage-like limb compression. We utilized this device to identify the most pleasant location, intensity, and frequency of limb compression. We then compared the affective benefits of pressure to those of light stroking. Participants received blocks of gentle stroking, moderate compression, and painful and non-painful heat and rated their intensity, pleasantness, wanting, liking, and mood on visual analog scales. Participants also rated qualitative touch descriptors on the Touch Perception Task (Guest et al., 2011) to further characterize their affective experience. This pressure paradigm generated significant ratings of pleasantness of a comparable magnitude to ratings of gentle stroking. Similar affective touch descriptors were endorsed for gentle brushing and moderate compression. Higher baseline ratings of good mood and calm correlated with higher ratings of touch pleasantness. Compression significantly increased ratings of calm. These results suggest that deep pressure induces a pleasant affective response, even when delivered by a mechanical apparatus. Given its similar perceptual qualities (level of pleasantness ratings and touch descriptors), deep pressure touch might be conveyed by pathways similar to those involved in affective gentle stroking.
Dynamic tactile mother-child interaction
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C-tactile fibers moderate affective touch perception and recent research showed that mothers stroke their babies in a way that may stimulate those fibers in the child. We examined factors that relate to the stroking velocity mothers use to caress their babies and hypothesized an impact of maternal heart rate and bonding.

In a first study, 30 healthy mothers (aged 20 to 43 years) were asked to stroke their respective baby (aged 4 to 45 weeks) in a rest condition and after experimental manipulation of the maternal heart rate (sport condition). The maternal stroking was tracked using a novel method which involves video capturing and semi-automatic analysis of the video data. Furthermore, the mothers answered questionnaires about postpartal depression, mother-child bonding, and social touch behavior. In a second study, the maternal stroking behavior of mothers with mother-child bonding disorders was investigated.

The results show that mothers stroked their baby in a very rhythmic way with velocities that target C-tactile fibers during the rest condition. After experimental increase of the maternal heart rate, however, the mothers’ stroking velocities increased significantly. Stroking velocities did not relate to any of the questionnaire data in the group of healthy mothers (study one). Preliminary results from mothers with mother-child bonding disorders show some subtle stroking differences and will be presented as well.

Figure 1: Visualization of the study. Each mother was asked to participate in a rest and in a sport condition. The order of conditions was randomized. The heart rate was monitored during both conditions. Afterwards, the mothers were asked to stroke their child, while the stroking was tracked. Stroking typically followed a rhythmic curve (here: example data) and a dominant frequency could be extracted from the data. The stroking velocities and the dominant frequency were compared between both conditions.
The Mindedness of Maternal Touch: A longitudinal Investigation of Maternal Mind-Mindedness and Mother-Infant Touch Interactions

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Touch plays a vital role in early social development. An increasing body of evidence highlights the unique role that touch plays in mother-infant interaction, and more generally to both mental and physical health. This is also supported by studies showing the dramatic consequences that touch deprivation might have for development. However, it is not merely the presence or absence of maternal touch that affect infant behaviour, but also the quality of that touch. Recent evidence shows that maternal touch may promote emotion regulation in infants, however less is known about how higher-order cognitive abilities in parents are translated into tactile, affect-regulatory behaviours. During 10 minute book-reading, mother-infant sessions when infants were 12 (N = 45) and 18 (N = 34) months old, we investigated maternal mind-mindedness (MM), the social cognitive ability to understand an infant’s mental state, by coding the contingency of maternal verbal statements towards the infants’ needs and desires. We also rated spontaneous tactile interactions in terms of their emotional contingency. We found (at 12 months only) that frequent non-attuned mind-related comments were associated with touch behaviours that were not contingent with the infant’s emotions; ultimately discouraging affective tactile responses from the infant. However, comments that were more appropriate to infant’s mental states did not necessarily predict more emotionally-contingent tactile behaviours. These findings suggest that there is not a one-to-one relation between parental high-order social cognitive abilities and embodied tactile interactions, but when these parental abilities are compromised, they are also likely to translate into inappropriate, tactile affect regulation, particularly when the babies are less mobile and most depended on their mother. Implications and future directions of these findings in relation to social interactions, embodied cognition and infant development will be discussed.
The relation between affective touch and pupil size.

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Interpersonal touch is known to influence human communication and emotion. Affective touch is defined as soft stroke on hairy skin with a velocity of 1-10 cms⁻¹. This type of touch activates low-threshold unmyelinated mechanoreceptors, known as C-tactile afferents, which have been proposed to play a unique role in hedonic valence and emotion of touch. For other sensory modalities, hedonic processing has been associated with pupil dilation. However, it is unclear whether pupil dilation can be modulated by hedonic touch. The current study investigated how pupil size reacts to both affective and non-affective stroking. Pupil size data was obtained to investigate differences between stroking conditions. Additionally, an adjusted version of the Touch Perception Task (TPT) was used to assess subjective touch pleasantness ratings.

Two experiments were performed. In experiment 1 affective (3 cms⁻¹) and non-affective stroking (0.3 and 30 cms⁻¹) stroking was applied to the dorsal side of the right hand. Results revealed that stroking velocity had a significant effect on TPT-item scores, showing higher positive and lower negative ratings for the affective touch compared to non-affective touch, thereby replicating previous studies. Results, however, revealed no specific pupil dilation for the 3 cms⁻¹ condition, instead a logarithmic relation was found between pupil size dilation and stroking velocity.

In experiment 2, stroking on the dorsal side of the hand at the same velocities as in experiment 1 was compared to stroking on the palm of the hand, an area which does not contain C-tactile receptors. Skin conductance was recorded as an additional measure of arousal. The results confirmed a logarithmic relation between stroking velocity and pupil size dilation, with no specific effect for 3 cms⁻¹ dorsal side stroking. The skin conductance showed a similar pattern. Overall, suggesting that pupil size dilation is related to stimulus intensity (e.g. stroking velocity) rather than specific C-tactile stimulation.
The brain’s response to gentle touch recorded with magnetoencephalography

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How C-tactile (CT) afferents contribute to pleasantness of touch is currently not known. Touch to the hairy skin activates both the fast Aβ afferents and slow CTs; hence tactile sensory perception requires the integration of both types of mechanosensation.

In this study, combined MEG and electroencephalography (EEG) was recorded in 21 healthy volunteers (22-45 years) with an Elekta Neuromag® TRIUX system during 200 ~3 cm/s brush strokes using a custom-made MEG-compatible brush robot that provided precise and replicable timing, length, and velocity of brush stroke stimuli.

Two conditions were performed. In the first condition, brush strokes were delivered to the left upper arm proximal to the elbow. In the second condition, brush strokes were delivered to the left forearm proximal to the wrist. Based on previous EEG work we expected that CT-related brain activity should have a very late onset (>400 ms post stimulation) due to slow peripheral conduction velocity. Altering the stimulation sites i.e., brushing on the upper arm vs the forearm should give rise to a time-delay of CT-related brain activity with approximately 200 ms between the two conditions. However, this effect was not observed.

This is the first study to investigate the MEG-patterns to CT-optimal touch. Results show clear and consistent somatosensory evoked fields (SEFs) to the onset and offset of the brush strokes i.e., contact with the skin, and time-frequency analyses show patterns of early-onset beta and alpha desynchronization that are most prominent over parietal areas. These patterns reflect the signalling from fast Aβ afferents. Moreover, there are indications of a very late (onset >400 ms post stimulation) alpha synchronization over midline parietal sensors. Preliminary analyses using the DICS beamformer method show that this alpha synchronization localises to posterior medial parietal areas i.e. the precuneus, which have been implicated in playing a role in reflective self-awareness.
CT-optimal brushing reduces noxious-evoked brain activity in infants

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Background:
Infants cannot verbally report the level of pain they perceive, making its measurement and treatment in hospitalised infants challenging. The measurement of noxious-evoked potentials following acute experimental noxious stimuli (which activate A- and C-nociceptors (Magerl 2001)) provides an opportunity to objectively quantify nociceptive brain activity and investigate pain relief techniques in infants. It has been shown in adults that a gentle brushing stimulus, which preferentially activates another class of cutaneous C-fibres called C-tactile (CT) afferents, reduces pain (Liljencrantz 2017). In infants both massage and gentle stroking have been reported to provide pain relief, with numerous studies reporting that these interventions reduce evoked changes in pain-related behaviour and physiology (Jain 2006; Diego 2009). Here we test in term infants whether CT-optimal brushing prior to an experimental noxious stimulus reduces the noxious-evoked brain activity.

Methods:
Experimental noxious stimuli (force=128 mN, PinPrick, MRC Systems, Germany) were applied to the heel in 31 term infants. Noxious stimulation was preceded by either slow (3cm/s), fast (30cm/s), or no brushing in a randomised order. Brushing was applied to the lower leg for 5-seconds (SENSElab™ Brush-05, Somedic.com, Sweden). The magnitude of the noxious-evoked brain activity, recorded using electroencephalography (EEG), was quantified using a template identified in an independent sample of infants (Hartley 2017).

Results:
Noxious stimulation of the infant foot evoked a significant increase in noxious-evoked brain activity, compared to background activity (p<0.05). Slow brushing prior to the noxious stimuli significantly reduced the magnitude of the noxious-evoked brain activity (p<0.05), whereas fast brushing did not cause a significant change.

Conclusion:
CT-optimal brushing prior to a nociceptive event reduces noxious-evoked brain activity in the infant. Further work is being undertaken to investigate whether CT-optimal brushing can reduce noxious-evoked brain activity following clinically-essential blood sampling.
Early and late neural responses to affective touch.

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An ultra-late positive potential (ULPP) evoked by robotically delivered touch, specifically targeted to activate C-tactile afferents (CTs), has previously been identified over frontal and central electrodes (Ackerley et al 2013). Here, using a manually delivered tactile stimulus, we aimed to replicate this finding and compare the time course of the response to that evoked by a faster, non-CT optimal stimulus, which preferentially activates myelinated A\textbeta afferents.

Seventeen participants received brush strokes to the dorsal surface of their right forearm. The strokes were delivered manually by a researcher, using a soft cosmetic brush, in a proximal-distal direction, over 10cm of skin. The velocity of stroke was guided by a visual metronome. The experiment was divided into twenty blocks of five trials. In order to maintain vigilance, participants were asked to decide whether the stroke they felt was delivered at the target speed (CT-optimal 3cm/sec or non-CT-optimal 30cm/sec depending on block) or at an oddball speed of 15cm/sec. Each block began with the target velocity of 3cm/sec or 30cm/sec and included between zero and two oddball strokes. A total 43 strokes were delivered for each of the target stimuli. ERPs were time locked to the brush breaking a laserbeam located over the participants arm at the start of each trial.

Analysis revealed that stimuli delivered at 30cm/sec stimuli elicited a robust ERP peak over electrodes Cz & Pz, between 200-600 ms after stimulus onset. This P300 was of significantly higher amplitude than that evoked by CT-optimal 3cm/sec strokes. In addition, consistent with the previous report of Ackerley et al (2013), an ULPP was measured for CT-optimal touch over frontal electrodes 2500-3500 ms after stimulus onset.

This study adds further support for an ERP response evoked by activation of CT afferents, that can be differentiated from earlier brain potentials seen in response to A\textbeta activation, that occur less than 1 second after stimulus onset.
Oxytocin and Cortisol levels in dog owners and their dogs are associated with behavioural patterns: an exploratory study.

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Previous research shows that dog-owner interaction results in increasing oxytocin levels in owners and dogs, decreasing cortisol levels in owners but increasing cortisol levels in dogs. The present study aimed to investigate whether oxytocin and cortisol levels in both owners and dogs were associated with their behaviours during an interaction experiment.

Ten female volunteer dog-owners and their male Labrador dogs participated in a 60 minutes interaction experiment, with interaction taking place during 0-3 minutes. Blood samples were collected at 0, 1, 3, 5, 15, 30, and 60 minutes. They were taken simultaneously from dog and owner and analysed for oxytocin and cortisol by EIA.

The entire experiment was videotaped with the following variables noted; the different types of sensory interaction applied by the owner and the frequency of these, the number of times the owner touched her dog, the dog’s positions and duration of time spent in each position. The behavioural analysis was divided into interaction (0-3 min) and remaining time (4-60 min) and were correlated to basal oxytocin levels, maximum oxytocin levels, delta oxytocin levels, basal cortisol levels and cortisol levels at 15 and 30 minutes.

The lower the dogs’ oxytocin levels, the more stroking they received (Rs=-0.717, p=0.041). Owners with lower oxytocin levels touched their dogs more frequently (0 min: Rs=-0.683, p=0.042; oxytocin maximum: Rs=-0.783, p=0.013) and the more they scratched their dog, the lower their cortisol levels (30 min: Rs=-0.633, p=0.067).

The more frequent activating touch applied by the owner, the higher the dogs’ cortisol levels (15 min: Rs=0.661, p=0.038; 30 min: Rs=0.673, p=0.033). The higher the owners’ basal cortisol levels, the longer time the dogs spent standing (0 min: Rs=0.683, p=0.041) whereas the higher the owners’ maximum oxytocin level the shorter time the dogs spent sitting (Rs =-0.786, p=0.036), but the longer time they spent lying down (Rs=0.628, p=0.054) and fewer position changes during the experiment (Rs=-0.817, p=0.007).

In conclusion, oxytocin and cortisol levels, both in dogs and in their owners, are associated with how the owners interact with their dog and also with the effects on hormonal levels and behaviour caused by the interaction.
Effects of stroking velocity and touch stimulus on perceived pleasantness in observed affective touch

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In two crowdsourcing studies (N = 177 and N = 228, respectively) we investigated how stroking velocity is related to pleasantness perceptions of stroking touch observed from videos. In addition, we investigated how the touch stimulus is related to pleasantness perceptions.

In the first between-subjects study videos depicted a male person’s arm being stroked by either a female person, a social robot, a mannequin arm, or a plastic tube. Participants were asked to indicate how pleasant they thought the touch felt to the person in the videos using a visual analog scale (VAS). Results revealed a velocity dependent inverted U-curve pattern for reported pleasantness. No statistically significant differences between stimulus conditions were found. A regression analysis revealed a significantly better fit for a negative quadratic regression model than for a linear approach (\(F(2, 882) = 80.30, p < .001, \ R^2 = .154\)).

In the second study the same video stimuli were used in a within-subjects design to allow participants a direct comparison between stimulus conditions. It was hypothesized that human touch would be rated the most pleasant overall. Indeed, overall pleasantness ratings were significantly higher for the human touch condition than for all other conditions (Greenhouse-Geisser correction applied, \(F(2.70, 2445.77) = 70.51, p < .001, \ \text{partial eta}^2 = .237\)). Results revealed a velocity dependent inverted U-curve pattern for reported pleasantness, that was most pronounced for the human touch condition. A regression analysis revealed a significantly better fit for a negative quadratic regression model than for a linear approach (\(F(2, 1137) = 53.93, p < .001, \ R^2 = .087\)).

The findings of both studies provide insights into the role of stroking velocity and touch stimulus on the perceived pleasantness of observed touch. In addition, the studies provide insights in the design of affective touch interactions between humans and social robots.
Healing touch: 
The effects of mediated social touch on reducing stress and anxiety

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Social touch can have powerful effects in ameliorating stress and alleviating anxiety, as has been demonstrated in relation to various stressors, including social stress from having to give a public presentation (Ditzen et al., 2007) and anxiety from electrical shocks (Coan, Schaefer and Davidson, 2006).

In some circumstances, however, one may not have access to a loved one for touch (e.g., a child in an isolation ward; a soldier wounded on a remote battlefield). In these circumstances, mediated social touch technologies may offer a promising solution. Mediated touch can be defined as touch over distance, through the use of tactile or haptic displays (Haans & IJsselsteijn, 2006). However, to date, it remains unclear how such technologies should be designed in order to effectively reduce stress and anxiety. One challenge is that the perceptual qualities of tactile displays are still quite far removed from the variety and richness of unmediated touch. The aim of our work is to investigate what combinations of touch cues are critical for obtaining positive health effects. Is it the warmth of touch, stroking motion (Erk, Toet & van Erp, 2015), or another characteristic? Or is it the context of touch—the presence of another person (Haans & IJsselsteijn, 2006), and his/her intention and empathy?

On this poster, we will present the approach that this project will take, showing the research methods that will be used. We start out with a more qualitative user centred design approach, focussed on uncovering the possible design space of mediated social touch technologies, including the type of tactile display, the coupling and potential transformations between input and output devices (direct or delayed, e.g., using pre-recorded touches). In our work, we will develop mediated touch prototypes that will be used in both controlled laboratory experiments as well as real life stress situations.

References


Perceived pleasantness of positive affective touch is modulated by the visual appearance of the arm

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CT afferents and other mechanoreceptors play an important role in conveying affective touch. At this point it is unclear whether besides these somatosensory bottom-up processes, other factors, such as vision, may play a role in the perceived (un)pleasantness of affective touch. The aim of the present study was to investigate whether a manipulation of visual context would alter the subjective experience of how pleasant positive affective touch signals were perceived by participants.

We manipulated the visual appearance of the participant’s arm (normal vision (A), no vision (B), pixelated moving static projected onto the arm (i.e. crawling skin, C), see Figure 1). After slow-velocity (positive affective touch) and high-velocity stroking (control condition) participants (N=23) rated the emotional valence of the touch they felt. The experiment had a within subjects design.

In the positive affective touch condition ratings on perceived pleasantness – but not perceived unpleasantness – were modulated by visual condition. Specifically, participants rated gentle stroking with normal vision of their arm as more pleasant than gentle stroking with no vision of their arm or pixelated vision.

Taken together this result shows that contextual processes are able to affect the perception of positive affective touch. These findings imply that besides somatosensory bottom-up processes, contextual processes may also play a role in how gentle touch on the skin is subjectively perceived.

**Figure 1:** The visual manipulations that were used in the experiment. Panel A depicts normal vision, panel B depicts no vision and panel C depicts pixelated moving static projected onto the arm (i.e. crawling skin).
Embodied Emotional Egocentricity Bias:
A new approach to the distinction between self and other affective states

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We are in constant interaction with others, in a multisensory environment, where touch is an important component but often neglected. Tactile experience can shape our emotional state. Moreover, the way we perceive others is shaped by numerous factors, such as context and previous experience. However, there is a lack of research investigating the role of tactile experience in judging other’s emotional state, in particular how tactile experience on the self is influencing the way we perceive others, and seeing others influences our emotional state.

In a series of experiments, we created a new paradigm to evoke different emotional states thanks to tactile stimulations, in a self-other affective judgment task. Participants were touched in the same time as watching another participant’s arm being touched without any vision of themselves (Experiment 1-3). This design allowed a unisensory experience of self (tactile only) and other (vision only), that could be either congruent or incongruent and pleasant (e.g. cotton) or unpleasant (e.g. scourer); creating positive or negative emotional state in both self and other. Overall, results showed a positive embodied egocentricity bias, suggesting that participants’ tactile experience was influencing their judgement of others’ experience, in particular when participants had to judge the pleasantness of the touch on the other participant; they were influenced by their own experience. This was modulated by personality traits such as autistic traits and empathy. We are now using the same paradigm combined with galvanic vestibular stimulation to modulate emotional biases, as well as exploring these emotional biases in different psychopathology such as functional motor disorder.

I will be putting together the results of this strand of research, shedding some lights on how we are projecting the self into others, in tactile emotional contexts.
The effect of affective touch on betrayal aversion, altruism, and risk taking

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Slow, gentle touch is perceived as pleasant and increases the release of oxytocin. Oxytocin, in turn, has been extensively studied with regards to its effects on trust and prosocial behavior, but results remain inconsistent. We investigated the effect of affective touch on betrayal aversion, altruism, and risk taking. Participants ($n = 120$) performed three standard economic decision-making tasks, once while being stroked on the left forearm with a soft brush at CT optimal velocity and once in a no-touch control condition (in counterbalanced order). The decision tasks included the Betrayal Aversion Elicitation Task (which consists of a trust game and an equivalent non-social, risk-only trust game), a no-risk dictator game (distributing a sum of money between oneself and a charitable organization), and the Balloon Analog Risk Task. Results indicate no significant effect of touch on any of the outcome measures, neither within nor between subjects. Furthermore, there were no significant interactions between touch and gender or attachment styles. These results are unsurprising given the lack of consistency in previous research investigating the effect of oxytocin on trust and prosocial behavior. It is possible that the effect is constrained not only by individual-difference factors but also by contextual factors.
Neural mechanisms of third-party affective touch experiences

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Humans can effortlessly extract the affective meaning of touch delivered to another person’s skin as well as their own. Interpersonal touch communication conveys discrete emotion and intention. For example, we can easily imagine experiencing a warm feeling when observing a person being hugged. Previous findings about simple touch observation suggested that this phenomenon could be linked to somatosensory resonance and the theory of mind (ToM). Yet, concerning more complex interpersonal affective touch, our understanding of how such mechanisms work is still limited. Thus, in the current study we generated a novel socio-affective touch database of 39 stimulus videos, covering both pleasant (e.g., hugging a person) and unpleasant (e.g., slapping a person) touch scenarios, and investigated how the human brain processes different types of interpersonal affective touch during passive observation. First, 21 participants evaluated pleasantness and arousal of each touch video. Subsequently, the same participants watched the same videos in the scanner. Importantly, we also provided the participants with both positive and negative touch stimulation in the scanner to capture actual touch sensitive cortices which we used as parts of regions of interest (ROI) along with social brain regions. Using correlational multivariate pattern analysis (MVPA) methods, neural spaces of affective touch were obtained in ROIs, followed by multiple regression analysis between the group neural matrix in each ROI and affective ratings. The results suggest that both actual touch sensitive cortices and social brain regions represent valence information after controlling the effects of arousal and other visual factors. Our findings highlight the involvement of social understanding and a mirror somatosensory system during observation of other’s affective touch interactions in the absence of actual touch.

Figure 1: The figure shows representative still frames from the stimulus videos, showing different types of affective touch events (positive (the first six stimuli in the 1st, the 2nd and the 3rd rows), neutral (the last stimuli in the 1st, the 2nd and the 3rd rows) and negative touch events (six stimuli in the 4th, 5th and the 6th rows)).
The skin as a multisensory social organ: Gender differences in the perception of affective touch may reflect gender-specific variation in visual and social-cognitive processing

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The social-affective role of the tactile system is a relatively new concept in somatosensory neuroscience. C-Tactile afferents – the peripheral nerves relaying affective tactile signals to the central nervous system – are a well-documented phenomenon. Recent studies have focussed on the hedonic effects of CT-mediated touch and its representation within the ‘social brain’ network. However, our understanding of this subdomain remains in its infancy, with much unchartered territory concerning its relationship with other sensory and social-cognitive systems. Of particular interest is the CT system in the context of multisensory integration and interpersonal touch.

The present study focused on visual and social experience of affective touch, by manipulating (1) viewing of receiving touch, (2) touch source - soft brush-stroking vs. hand-caressing – and (3) location - forearm vs. palm. Subjective ratings of touch liking and wanting were measured.

Contrary to hypotheses, brush-stroking elicited greater pleasantness and wanting than skin-skin-caressing in females at both sites, whereas no preference was shown in males. A similar pattern was demonstrated for location, whereby the typical preference for forearm over palm touch was evident in females; for males pleasantness remained consistent across sites. Generally, seen touch was perceived as more pleasant than unseen, but due to reduced power the effects fell below statistical significance for individual locations. When collapsing across location, however, a visual*source interaction for wanting of touch was observed, whereby viewing of brush-stroking was the most desirable condition - again, the effect was only significant in females.

Despite many limitations, this exploratory study has identified further avenues for investigation and suggests that processing of affective touch, similarly to discriminative touch, may be cross-modally modulated by visual and social-cognitive perception. Differences in tactile perception may reflect gender-specific variation in multisensory and social processing, tying-in with recent evidence of gender differences in the development of ‘social brain’ mechanisms for processing CT-touch.

\textbf{Figure 1} | Mean wanting ratings between males and females for the Visual*Source*Gender interaction. Wanting ratings were indicated on a scale of 1-10 (1 = wanted least, 10 = wanted most).

\textbf{Figure 2} | Mean Pleasantness Ratings between Males and Females for Location. Pleasantness ratings were indicated on a scale of 1-10 (1 = least pleasant, 10 = most pleasant).
Microneurography: My bounty is as boundless as the C
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Microneurography is a neurophysiological technique developed (relatively recently) by Åke Vallbo and Karl-Erik Hagbarth in the 1960s, which allows the real-time monitoring and recording of peripheral nerve impulses in awake human subjects. One of the first studies[2] investigated the discharge characteristics of mechanosensitive afferents in the skin—and included recordings of mass activity from bundles of mechanoreceptors, and single-fibre recordings—activity from single mechanosensitive myelinated afferent nerve fibres. The technique was adapted to allow recordings from single C-Fibres[3] initially dismissed as “not possible”[4]

Intraneural Microstimulation (INMS) during Microneurography uniquely enables investigations into the sensations and conscious percept associated with direct electrical stimulation of single nerve fibres, revealing even more about their function and specificity.

Microneurography underpins our understanding of human neurophysiology—from mapping and characterising cutaneous receptor complexes, to identifying mechanisms, pathways, and cortical representations. By recording from and stimulating peripheral nerves (A-fibres and C-fibres), we understand more about that which drives the human somatosensory experience, including discriminative touch, temperature sensation, pain, itch, and pleasant, affiliative touch.

The Somatoensory and Affective Neuroscience group (SomAffect), LJMU has one of the few labs in the world which focuses on single-fibre, a.k.a. single-unit Microneurography; aiming to discover more through exploring a variety of body sites (and nerve bundles), applying novel stimuli and ligands to the receptive fields of single units, and testing the responses (both psychological and physiological) under different conditions.

A selection of recordings will be presented to showcase the power of the technique, and specifically to highlight the boundless variety and importance of C-fibres - the nerve fibres that drive emotionally charged sensations such as Pain, Itch and Affective Touch.

References:
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Touching the maternal abdomen. A frame by frame analysis of fetal behavioural responses.

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Objectives: The present project examined whether fetuses respond to the touching of the mother’s abdomen, and if they do, whether they differentiate based on familiarity and the source of the touch, utilizing 3D real-time (4D) sonography.

Design and Methods: Behavioral responses of 28 fetuses (20th to 33rd week of gestation; N=15 in the 2nd and N=13 in the 3rd trimester) were frame-by-frame coded using a coding system comprising 20 codes and were analyzed in four conditions, during the touch of the (1) mother, (2) the father, (3) the stranger and in a (4) no-touch, control condition.

Results: Results indicated fetuses’ differential responses to the touch. In particular, the duration of their reaching out to touch the uterus wall, and self-touch was different across the four conditions dependent and dependent on the gestational age of the fetus. When the mother touched, fetuses in the 3rd trimester touched the uterus wall significantly longer than fetuses in the 2nd trimester, compared to the control condition. At the same time, fetuses in the 3rd trimester also touched themselves less during the mother’s touch, compared when the stranger and the control conditions.

Conclusions: Older fetuses’ differential response to the touch of the mother’s abdomen might be due to the maturation of the central nervous system, and may indicate the emergence of a proprioceptive self-awareness by the 3rd trimester.
Wanting and liking of food and social rewards

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It is the matter of intense scientific debate whether identical or separate neural networks underlie the processing of and the responding to primary rewards (e.g. food), and social rewards (e.g. physical contact and social interaction with pairs). The relevance of this question is provided by the observation that people with autism spectrum disorders might have specific social motivation deficits.

However, much of prior work in humans has investigated only one type of reward, making a direct comparison impossible, and often relied mainly on participants’ subjective ratings, which are prone to social desirability bias. Therefore, the development of comparable paradigms testing both types of reward is fundamental.

Here, using a within-subjects design, healthy male and female participants were tested in a real effort task, to determine their subjective (ratings of wanting and liking) and objective (squeezing of hand dynamometer) responses to both primary and social rewards.

As a primary reward, small amounts of milk with different concentrations of cacao were delivered using computer-controlled pumps. As a social reward, participants received forearm caresses at different speeds by a same-sex experimenter. Moreover, in each trial the amount of muscular effort exerted by the participant determined the probability of receiving one of two rewards (e.g. 100% or 25% of cacao).

Preliminary subjective and behavioral data suggest comparable responses of wanting and liking to both food and social rewards.
Pleasantness of tactile motion does not vary with speed when C-Tactile activation is held constant

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Recent evidence suggests that in the periphery, C-fibre tactile (CT) afferents play an important role in signalling affective touch. CT afferents are tuned to the speed of gentle stroking across the skin, and are optimally activated at speeds of 1-10 cm/s. This is the same speed range that observers rate stroking as most pleasant. However, slow stroking is similarly perceived as pleasant on the palm of the hand, where no CT afferents have been found in the glabrous skin. This suggests a role for non-CT neural pathways in signalling affective touch, which we aimed to investigate. We used the ‘apparent motion’ illusion, which occurs when neighbouring regions of skin are stimulated in sequence to produce a sensation of motion across the skin. The features of the individual taps never change, but the timing between taps can be varied to change the speed. This allowed us to produce tactile motion at different speeds, while keeping local activation of primary afferents (including CTs) uniform. The global features of the motion are only present in the combined inputs to many primary afferents and must therefore be processed centrally. Ten participants were asked to rate the pleasantness of the apparent motion applied to the dorsal forearm at a variety of speeds (0.3 – 30cm/sec). Four ratings were made for each speed on a visual analog scale (VAS). We used quadratic regression to test for the ‘inverted U’ shape that is typical of pleasantness ratings and CT responses to brush stroking. The quadratic regression was not significant (F = 0.62, p = 0.43), and VAS scores appear flat with respect to speed of motion. This result strengthens the case for a privileged role for CT responses in affective touch. However, this does not rule out alternative neural pathways for affective touch.
As well as the well-known social communication challenges indicative of ASD oft forgotten is that sensory abnormalities are also considered diagnostic of these conditions. In DSM-V criteria insensitivity to pain is cited as an example of this sensory abnormality, however limited research evidence or consideration of what about pain can be measured exists here. It is now essential for research scientists with an interest in mental health to consider how the initial processing of these sensory experiences might contribute to the behaviours seen in these conditions. Based on a recent systematic review (Moore, 2015) this poster will consider evidence for alterations in pain sensitivity in terms of self-report, observations of behavioural changes in response to pain, and response to experimental pain models as well as what any changes might tell us about pain in ASD. The findings of this review show that both self/parent report and clinical observations appeared to report hyposensitivity to pain, whereas observations of medical procedures and experimental manipulation suggested normal or hypersensitive responses to pain. The current state of the research however leave a large number of questions unanswered and fail to consider the reasons for or implications of altered pain perception in ASD.
Massage is more than just a rub. The newborn baby, the dying person; how do we know what they are feeling when we touch them? Generally, we have to guess, at these two points in a human being’s life, neither can verbally communicate their feelings to us. Touch can convey a sense of how a person is feeling “happy” or “sad” and their behaviour “pulling away” or “snuggling in”. This helps the person touching another, observe and get a sense of what another human being is feeling in real time.

Since 1983, I have integrated affective touch, massage therapy, therapeutic touch as part of my working day, as part of my health care practice, teaching massage courses and work-shops from Community Education to Further and Higher Education.

I have worked on many projects that have provided Massage to new born babies, peer massage in schools, teenage mums, parenting courses, mums and children experiencing domestic abuse, adult survivors of childhood sexual abuse, patient’s receiving palliative care and to their relatives, people with neurological conditions, cardiovascular conditions, brain injuries, people experiencing long term mental health conditions, the elderly, frail and people diagnosed with Dementia.

I would like to explore with you, the extent of my observations of what benefits I have seen in others before, during and after positive affective touch.
In-vivo electrophysiological recordings from Aβ brush-sensitive and brush-insensitive mechanoreceptors in humans

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Recent findings on circumferential endings in mouse hairy skin (Bai et al. 2015, Cell) have shown that Aβ-field-LTMRs, a class of fast-conducting brush-sensitive low-threshold mechanoreceptors (LTMRs), “exhibit hallmarks of myelinated nociceptors”. In the current study, we tested whether human Aβ-field-LTMRs display nociceptor-like properties.

We performed single-unit axonal recordings (microneurography) from the peroneal nerve of 82 awake healthy participants. We also investigated the sensations evoked by microstimulation of single afferents. In addition, psychophysical experiments were performed on another 20 healthy participants and a large-fibre deafferented patient.

We recorded from 47 Aβ-field-LTMRs, mostly innervating the dorsal foot region, in addition to other brush-sensitive Aβ-LTMR subtypes. We also found a novel class of brush-insensitive high-threshold mechanonociceptors (Aβ-MNs) with conduction velocities similar to Aβ-LTMR subtypes. Contrary to findings in mice, the monofilament thresholds of human field-units were indistinguishable from other LTMR subtypes, and their responsiveness to increasing force indentations was discordant with psychophysical reports of pain intensity. Using intra-neural microstimulation, a painful percept was never reported for field-units (with ‘buzzing’ as the most frequently chosen descriptor). The spike activity of field-units increased with faster brushing, akin to other Aβ-LTMR subtypes, corresponding with psychophysical reports of increasing touch intensity. Conversely, the Aβ-MNs were insensitive to soft brushing (hence not an LTMR), displayed high mechanical threshold, encoded force in the perceptibly noxious range (concordant with psychophysical pain reports) and evoked intense “sharp pain” during microstimulation. In a large-fibre deafferented patient with preserved Aδ function, psychophysical testing revealed aberrant processing of noxious punctate stimuli.

We demonstrate that human Aβ-field-LTMRs likely contribute to the discriminative aspects of touch akin to other Aβ-LTMR subtypes. We also demonstrate, for the first time, a distinct type of fast-conducting (Aβ-range) mechanonociceptor in human skin which likely contributes to pain processing.
A-touchment – is pleasant touch discriminability dependent on attachment history?

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The skin is innervated by two classes of touch nerves, one for discrimination and one for affect; i.e. one for sensing and one for feeling. The latter, called c-tactile afferents (CTs), display a preference for slow moving gentle touch as would be delivered via nurturing care of an infant. CTs are hypothesised to provide the neurobiological substrate for affiliative touch and are argued to be a key ingredient in the developing social brain leading to healthy inter-personal and social functioning. At present, a limited number of studies look at the relationship between velocity preference and measures of healthy functioning. Here, we tested whether a preference for touch at the velocity of c-tactile fibres is related to secure attachment.

A student sample completed an experiment in which they were stroked on the forearm at different velocities by a mechanical device, in addition to completing a questionnaire measuring attachment styles. Whereas securely attached individuals generated a typical preference for touch curve, where velocities around 5 cm/sec are rated as most pleasant c.f. faster or slower stroking velocities, insecurely attached individuals failed to show a typical curve, with no discrimination between c-tactile- and a higher velocity. The findings suggest that a healthy attachment history may play a role in facilitating the development of a preference for touch at c-tactile velocity.
Pleasure to See you in Me: Affective Touch Enhances Self-Face Recognition

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Multisensory integration is a powerful mechanism for constructing body awareness in the brain and key for the sense of selfhood. Recent evidence has shown that the specialised C tactile modality that gives rise to feelings of pleasant, affective touch, can enhance the experience of body ownership during multisensory integration. Nevertheless, no study has examined whether affective touch can also modulate psychological identification with our face, the hallmark of our identity. The current study used the enfacement illusion paradigm to investigate the role of affective touch in the modulation of self-face recognition during multisensory integration. In the first experiment (N = 30), healthy participants were stroked on the cheek while they were looking at another face being stroked on the cheek in synchrony or asynchrony with affective (slow; CT-optimal) vs. neutral (fast; CT-suboptimal) touch. In the second experiment (N=38) spatial incongruence of touch (cheek vs. forehead) was used as a control condition instead of temporal asynchrony. Overall, our data suggest that CT-optimal, affective touch enhances self-face recognition during multisensory integration, over and above the effects of temporal synchrony. We discuss the role of affective touch in shaping the more social aspects of our self.
The relationship between autonomic regulation and sensitivity to CT touch

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C-tactile afferents (CTs) are a class of unmyelinated, mechanosensitive nerve fibre that respond optimally to slow moving (1-10 cm/second), gentle touch, typical of caress. Their response is positively correlated with subjective ratings of touch pleasantness. It is hypothesised that CTs communicate the rewarding value of touch from conspecifics, providing the neurobiological basis for social support through physical contact. Accumulating psychophysiological and behavioural research supports the notion that CT touch carries a positive affective value.

The aim of the present study was to examine the relationship between trait differences in autonomic nervous system (ANS) regulation, as indexed by resting state heart rate variability (HRV), and sensitivity to CT optimal touch. 45 healthy participants were divided into high and low HRV-HF groups on the basis of an electrocardiogram. Since high levels of high frequency HRV (HRV-HF) have been associated with enhanced sensitivity to social cues, it was hypothesised we would see a greater preference for CT optimal over non-CT optimal stroking speeds in this group.

After the 5 minute baseline electrocardiogram, participants were asked to rate the pleasantness of robotically delivered touch that fell within (1-10 cm/sec) or outside (<1 or >10 cm/sec) the CT optimal velocity range. They also completed several behavioural tests of executive function.

Those participants with the lowest levels of high-frequency HRV (HRV-HF) showed reduced sensitivity to the rewarding value of CT activating touch. Consistent with previous research, these participants also showed some evidence of poor executive functioning. Together these results indicate that, in individuals with poor regulation of the ANS, sensitivity to the specific affective value of CT touch is decreased. This is in line with neuro-visceral models of autonomic control and previous observations that higher HRV-HF is associated with enhanced sensitivity to social cues.
How does affective touch modulate arousal states? An investigation in early development

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Caregiver-infant interaction through touch was shown to have long-term effects on child's cognitive development, but the mechanisms are poorly understood. Our aim is to investigate how affective touch (slow gentle caressing) affects arousal states in young infants. Previous work with 9-month-old infants found that affective touch (slow touch) leads to a decrease in heart rate, while non-affective touch (fast touch) leads to an increase (Fairhurst et al., 2014).

We tested 1-3 months-old infants (n=32) to investigate if these effects are observed at an earlier time in life. The choice of this age group was also motivated by animal work that identified early infancy as a critical period for touch to elicit its effects on a number of measures, including response to stress and emotional reactivity, later in life.

In this experiment, each infant received both slow and fast touch (administered in a semi-randomized order via a soft brush). We hypothesized that if affective touch represents for young infants such an important signal (as suggested by animal models), they will discriminate between the two types of touches at the physiological level showing decreased arousal in response to the affective touch. Instead we found that, in our sample, infants show a response in the same direction to slow and fast touch: a decrease in heart rate follows tactile stimulation, regardless of speed, but this returns to baseline after a few seconds and does not last throughout stimulation. Contrary to our hypothesis, our results suggest that the response to touch is still indiscriminate in this age-group.
Balancing Ownership: Visual Capture of Proprioception and Affectivity During Vestibular Stimulation

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The experience of our body as our own involves weighting different sensory inputs. When sensory information concerning the body is conflicting, one modality can override the others; e.g. vision typically dominates over touch and proprioception. Recently, two other modalities have been identified as contributing to body ownership: the vestibular system and the C-Tactile (affective touch) system.

Here we used Galvanic Vestibular Stimulation (GVS) in healthy participants (N=26) to investigate how vestibular stimulation (left vs. right hemisphere vs. sham) influences the balance between vision and proprioception, and affects body ownership, following mere visual exposure to a rubber hand. Furthermore, we manipulated the synchronicity (synchronous vs. asynchronous) and CT-optimality of touch (CT-optimal/pleasant vs. non-CT optimal/neural) during a Rubber Hand Illusion, to investigate if vestibular stimulation would enhance the seen affectivity.

Our results show that proprioceptive drift was significantly increased during right-hemisphere activation and mere visual exposure to the rubber hand (i.e. enhanced visual capture). Moreover, right-hemisphere activation with synchronous stroking applied at a CT-optimal (pleasant) velocity significantly enhanced participants’ embodiment of the rubber hand (i.e. visual capture of affective touch). These findings suggest that the vestibular system influences body ownership by enhancing vision over proprioception, and especially the affectivity of seen touch.
Age-related changes in the neural correlates of empathy for pleasant and unpleasant touch

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The aim of the present study was to investigate the age-related changes of the neural activity underlying empathy for pleasant and unpleasant touch. To this purpose, eighty-eight participants of different age took part to the study. 28 adolescents, 32 young adults and 28 older adults underwent MRI scanner while performing the task. Participants were firstly induced with neutral, pleasant and unpleasant emotions by means of visuo-tactile stimulation. After each stimulation, they were required to rate the pleasantness/unpleasantness of the stimulation on an analogical scale. In the second condition, participants were asked to empathize with another participant’s feelings undergoing the same types of stimulation. Similar to the first condition, after the stimulation phase, participants were instructed to rate other participant’s feelings. In the functional analysis, pleasant and unpleasant conditions were compared with neutral conditions. Both group comparisons and correlational analyses were performed.

Ratings analysis didn’t reveal any age differences across the life-span. At the neural level, group comparisons analysis showed a reduced activation of the bilateral anterior insular cortex in older compared to younger adults in both the empathy conditions (pleasant and unpleasant, see Fig.1). Regression analysis further supported this result by revealing a negative correlation between age and anterior insula activation in empathy for both pleasant and unpleasant touch. Years of education, Theory of Mind and grey matter volume didn't account for age differences in empathy-related insula activation.

The present study suggests that while empathy-related neural activity seems to have already reached a mature stage in adolescence, older age is characterized by a reduced brain response in empathy-related areas while empathizing for both pleasant and unpleasant touch. By confirming and extending previous results on empathy for pain (Chen et al. 2014), these findings provide the first systematic evidence of age-related decrease in insula activity while empathizing for pleasant and unpleasant touch.

![Fig 1. The figure represents the activity of the bilateral insular cortex found to be reduced in older adults compared to young adults. Left side: empathy for the pleasant touch. Right side: empathy for unpleasant touch.](image)
The relation between affective touch and emotion regulation in borderline personality disorder

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Borderline personality disorder (BPD) – is among the most severe and perplexing behavioral disorders that typically includes emotion dysregulation, distorted sense of self, and engagement in self-harm behavior. BPD patients usually misinterpret their bodily sensations linked to particular emotions for instance perceive heat as anger or pain as sadness. Emotional experience and physiological arousal are inseparable and, in fact, in order to (correctly) perceive and regulate emotions it is highly important to correctly perceive and interpret bodily signals. Although emotion regulation and awareness of bodily signals are related, bodily experiences in BPD have been little investigated over time.

The aim of the present study was to investigate whether the perception of interoceptive signals is related to emotion regulation in BPD, using affective touch as a measure of interoception. Specifically, this study demonstrates whether BPD patients perceive their affective signals differently than healthy participants and whether the perceived pleasantness of affective touch was linked to emotion regulation.

After slow-velocity (positive affective touch) and high-velocity stroking participants (N=20, females) rated the emotional valence of the touch they felt. The experiment had a within subjects design. Data collection is still in progress, results will be discussed on the poster.
**Seen and felt affective touch delivered by a rotary tactile stimulation device: a human psychophysical study**

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The discovery that pleasant touch is coded by C-tactile fibers has generated considerable research interest and increased understanding of the skin as a channel for social information via cutaneous senses. However, no study has differentiated between the pleasant response to visual and tactile non-human stimulations.

Our study investigated pleasant touch in which the visual and haptic touch information was obtained from an affective, but non-social experience, by a custom-built non-human device. Participants (n=19) received soft brush strokes on their lower left arm delivered by a rotary tactile stimulator (haptic session) or watched a video of an arm being stroked by a rotary tactile stimulator (visual session). The brush strokes were delivered at the same velocities (0.3, 1, 3, 10, 30 cm/s) and force (0.4 N) in both sessions. After each trial, participants rated the pleasantness of the touch.

Analysis of variance was used to assess the effects of velocity and modality (seen touch vs. felt touch) on the pleasantness rating. Participants rated strokes between 1–10 cm/s as most pleasant under both conditions. The pleasantness rating patterns differ significantly among velocities; however, no significant differences were found between modalities.

Seen and felt (without human-to-human interaction) touch elicited similar behavioral responses, including an inverted U-shaped perception of pleasantness. These findings suggest that the pleasantness of touch is influenced by the velocity of the strokes in both seen and felt touch with a non-human stimulation.
The lips are exquisitely sensitive to touch and play a significant role in discriminating the texture and temperature of, for example, foods during exploratory ingestive behaviours (Essick & Trulsson, 2008). However, the lips are also considered erogenous zones, as exemplified during romantic kissing and intimate interactions. Their discriminative function is known to be served by fast conducting low threshold mechanoreceptors (Nordin & Hagbrath, 1989), but the receptors driving their sensuous and erogenous function is unknown. Here we speculate that the ‘pleasure’ experienced during a romantic kiss may be mediated by a class of unmyelinated mechanosensitive c-fibres that are known to innervate the hairy skin of the body called C-tactile afferents (CTs) (Vallbo, et al., 1999). CTs were first discovered in humans in facial skin (Johansson, Trulsson, Olsson, & Westberg, 1988) and respond optimally to a slow-gentle stroking (between 1cm/s – 10cm/s), such as a human caress, and are considered as coding for the rewarding aspects of interpersonal touch (Loken, et al., 2009). Here we asked if gentle stroking touch of the lips generated the same velocity tuned inverted-U function we have previously shown for CT-innervated skin sites on the body.

Forty six participants aged 18 to 35 (M = 23.07, SE = 3.43) participated in the study. Strokes were administered with a glass roller bottle, topped with a plastic rollerball at three different speeds (0.5cm/s, 3cm/s and 20cm/s) to three locations (the lower lip, the oral mucosa and cheek). Participants rated how pleasant or unpleasant they found the touch on a VAS scale.

Significant main effects of location, velocity and their interaction were identified (p's< .001). Stroking touch applied to the mucosa was rated as significantly less pleasant than on the lower lip and cheek (p's<0.001). While, touch on the cheek was rated significantly more pleasant than on the lower lip (p<0.05). In terms of velocity, stroking at 3cm/s on the cheek & lip was rated significantly more pleasant than faster and slower stroking speeds. However, such differentiation between velocities was not seen for the oral mucosa.

Here we show that dynamic touch on the lips is rated in the same velocity dependent manner as touch to the cheek, an area known to be innervated by CTs. The fact ratings of touch on the lips reflect the classic inverted-U found by Essick, James and McGlone (1999) indicates CTs may also innervate this region, perhaps explaining why the lip is experienced as an erogenous zone. Further study of the lip region is needed to establish if CT’s are present, for example using microneurography.
Get In Touch with Touch: A Powerful Tool at the Service of Psychotherapy

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In this presentation, I will explore how trauma-sensitive psychotherapists evaluate how to touch their clients and what can constitute the 'right' touch. A deep understanding and moment-to-moment dynamic assessment of the possibilities of the level of contact, connection and context must be considered when getting in touch with touch. As a principle, the information which guides touch in the psychotherapeutic encounter is comprised of the same intentions, ethical boundaries, and guidelines originating in the psychotherapeutic framework as any other psychotherapeutic intervention.

Touch is an integral part of Biodynamic Body-Psychotherapy, which allows psychotherapeutic work within the framework of the body. Two of the main ‘bottom-up’ methods in Biodynamic Psychotherapy - Vegetotherapy and Biodynamic massage - are powerful methods for emotional and physiological regulation which use attuned touch. The name ‘biodynamic massage’ encompasses fourteen different systematic methods of touch, guided by biofeedback based on non-invasive vagal nerve stimulation.

Touch is not a singular phenomenon. There are many ways to touch which have multisensoric impacts upon human neurobiology and psychology. At the same time, there is a multiplicity of meaning in the ways in which two people in the therapy room, the psychotherapist and the client, perceive touch. Therefore, touch in the psychotherapeutic context is a complex non-linear phenomenon with a long history of debate, prohibition and taboo.

Touch in a therapeutic encounter is an embodied intersubjective engagement, a tool of haptic human communication which has an impact upon self-identity, perception, and the capacity for intimacy with another person. Touch has the power to change interactive and perceptual systems. The ‘right’ touch is attuned to the history and current life situation of the client. Attuned touch interventions enable and assist the construction of new possibilities for adaptive regulation and modulation in all aspects of human intrasubjectivity and intersubjectivity: emotionally, relationally, spiritually and physiologically.
Do not touch me! – Disrupted neural processing of social touch in patients with PTSD associated with interpersonal-traumatization

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Social touch is a key aspect of human interaction. Especially gentle, slow-stroking social touch is a very comforting experience, which is moderated by specialized unmyelinated afferent fibers. The experience of repetitive interpersonal traumatization however dramatically changes the percept of gentle social touch. We examined the neural processing of such touch in a sample of 20 patients suffering from posttraumatic stress disorder (PTSD) with functional magnetic resonance imaging. All of the patients reported a history of repetitive interpersonal traumatization, which involved sexual abuse. The data was compared to a group of 20 age- and sex-matched healthy control participants.

Results show that the patients reported the social touch conditions as highly aversive, while the control participants appreciated this touch. The social touch aversion in patients was accompanied by a pronounced suppression of blood-oxygen-level-dependent responses in the hippocampus. This suppression was significantly correlated to the reported frequency of traumatic re-experience in daily life. Moreover, we observed valence-related activity in the superior temporal gyrus (STG), such that higher response in this structure was associated both with increased pleasantness and increased unpleasantness of the tactile percept as rated by participants. No significant group differences were observed in the primary or secondary somatosensory cortices. Hence, social touch aversion in interpersonal-trauma-related posttraumatic stress disorder appears to be mediated by the superior temporal gyrus, which is believed to contribute to the assignment of meaning to affective stimuli. The hippocampal suppression as well as patients reports furthermore indicates that gentle social touch may facilitate re-experience of traumatic events.

Figure 1 – Neural-response-by-pleasantness scatterplots for social and non-social touch conditions in patients and controls. In both conditions, superior temporal gyrus activation exhibits a quadratic relation to pleasantness ratings. This effect was more pronounced for the social ($R^2=0.29$) than for the non-social ($R^2=0.13$) condition.
Cultural Universalism in Social Touch

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**Background** - Touching is the most intimate form of human communication. Previous studies have shown that patterns of human social touch are highly relationship-specific, and similar across a wide range of European cultures. This suggests that spatial patterns of social touch reflect a mechanism supporting the maintenance of social bonds. Here we tested whether relationship-specific patterns of social touch are similar across West Caucasian (WC) versus East Asian (EA) individuals.

**Methods** - Altogether 255 Japanese and 384 British individuals completed an online questionnaire about their background and provided information about selected members of their social network. They were then shown front and back silhouettes of a human, and asked to colour, on separate trials, the bodily regions where each individual in their social network would be allowed to touch them.

**Results and Discussion** - Topographical maps of touch allowances in Japanese and British samples were generally concordant, although Japanese subjects allowed their aunts, uncles and acquaintances to touch them in larger areas than British subjects. Opposite effects were found for romantic partners. Despite these differences, in both groups there was a similar positive correlation between the proportion of body area that a given person is permitted to touch and the emotional bond with that person (Figure 1). Analyses of touchability based on anatomical regions of interest in EA and WC subjects indicate that while culture indeed modulates the touchability of an area, its impact is modest compared to that of social relationship or emotional bond. We conclude that the correlation between strength of social relationships and extent of social touching is quite similar in European and Asian cultures, with small but interesting differences.

**Figure 1**: Correlation between the Touchability Index associated with a person and the emotional bond with that person is consistent in WC and EA cultures.
Quantitative Sensory Testing in Autism:
The disentanglement of underlying mechanisms of somatosensory dysfunction.
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Altered sensory perception in patients with autism has been widely noted clinically but remains understudied and poorly understood. The first step to understanding these behaviours is to determine the functioning of underlying mechanisms (receptors and associated nerve fibres) involved in somatic sensory perception.

Therefore, the well-established standardised Quantitative Sensory Testing (QST) protocol of the German Research Network on Neuropathic Pain was utilised to investigate 13 somatosensory parameters in 13 individuals with autism and 13 age and gender matched neurotypical controls.

There were no group differences in QST parameters with the exception of Mechanical Detection Threshold (MDT) and Mechanical Pain Threshold (MPT); individuals with autism showed sensory loss. Only in the case of MDT did participants with autism show a loss of nerve fibre function: A-β. Individuals with autism showed sensory distinctive features in the form of Paradoxical Heat Sensations (PHS) and Dynamic Mechanical Allodynia (DMA) which are not typically found in healthy subjects, including the neurotypical control group.

These findings independently replicate those reported by Frundt et al. (2017; similarly used the full QST battery) which is vitally important for understanding pain sensitivities in this population, especially in light of the wider replication debate. Findings suggest that central rather than peripheral dysfunctions probably determine somatosensory alterations in autism.
Affective touch and attachment anxiety modulate pain in romantic couples: A laser-evoked potentials study

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A key role of social connection is to provide support in the face of threat and pain. In particular, gentle caress-like touching is one of the most intimate means for showing affection and support in every day’s life, being highly present in romantic relationships. However, it remains unknown whether slow affective touch, which recent studies suggest is mediated by a specific C tactile (CT) neurophysiological system, influences the perception of pain in the context of a romantic relationship. Therefore, in thirty-two romantic couples, taking into account individual attachment styles, we investigated whether slow affective touch (at CT-optimal speeds; 3 cm/s) versus fast neutral touch (at non-CT optimal speeds; 18 cm/s) led to a significant decrease in self-reported pain as well as early and later electrophysiological responses to noxious stimulation. As predicted, slow affective touch (at CT-optimal speeds; 3 cm/s) led to a significant decrease in self-reported pain as well as early and later electrophysiological responses to noxious stimulation. We have interpreted these findings under an allostatic regulatory framework, in which allostatic predictions associated with a partner’s slow affective touch may attenuate early and later stages of pain processing. Further, while the neural processing of noxious stimuli is modulated by the partner’s affective touch, it does not depend on an individual’s attachment style. However, attachment anxiety seems to moderate the effects of affective touch on self-reported pain. These findings provide insight into our understanding of affective touch and more generally, to the role of active embodied social support on pain in the context of a romantic relationship.

Figure 1. (A) Effect of touch condition on the N1 waveform measured at the contralateral side of stimulation (C6). (B) Effect of touch condition on the N2-P2 waveform measured at the vertex (Cz). X-axis, time (ms); y-axis, amplitude (μV).

Figure 2. Touch condition by attachment anxiety effects for pain ratings. Statistically significant differences are marked by asterisk.