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Individual differences in affective touch: Behavioral inhibition and gender define how an interpersonal touch is perceived

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A R T I C L E I N F O

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A B S T R A C T

Receiving a tender caress from a caregiver or spouse reduces stress and promotes emotional well-being, but receiving the same caress from a stranger makes us feel uncomfortable. According to recent neurophysiological findings, we not only react differently to the invited versus uninvited touch but also perceive the touch differently depending on context. A virtual reality experiment was conducted to investigate whether individual differences regarding behavioral inhibition system (BIS) and gender contribute to this affective touch perception. Touch perception was measured directly using self-reports and indirectly using the touch-related orienting response. The results showed that touch perception depended on the emotional expression of the virtual agents. High-arousal approach-related (happiness, anger) and avoidance-related (fear) expressions increased self-reported touch intensity, while happiness reduced the orienting response to touch. Moreover, interpersonal differences in behavioral inhibition and gender played distinct roles: BIS sensitivity in males was associated with stronger affective touch perception, particularly with high-arousal emotions whereas in females BIS sensitivity did not affect touch perception. The results suggest that individual differences that are related to preferences regarding tactile communication also determine how touch is perceived.

1. Introduction

Decades of social-psychological research demonstrate the remedial power of human touch: being touched reduces stress (Ditzen et al., 2007), promotes relationship satisfaction (Gulledge, Gulledge, & Stahmannn, 2003) and enhances prosocial behavior (Guéguen & Fischer-Lokou, 2003; Crusco & Wetzel, 1984). However, not every touch is considered pleasing or calming. Uninvited physical contact is rarely reciprocated with acts of kindness, but rather experienced as an offensive breach of one's personal space (Sussman & Rosenfeld, 1978). One of the critical differences between touch and communication in the visual or auditory modalities is that it requires a very close distance between interactants. Perhaps due to this intimacy, the occurrence of tactile communication is particularly dependent on situational and individual norms (Remland, Jones, & Brinkman, 1995).

Research on individual differences has consistently shown that characteristics related to social tolerance are of particular importance when it comes to physical contact. Social anxiety, for example, is marked by a tendency to avoid interpersonal proximity and by feelings of discomfort when touched by others (Wilhelm, Kochar, Roth, & Gross, 2001). Moreover, our social environment creates multitudes of gendered norms when it comes to physical contact. For example, in Western cultures heterosexual males have been shown to avoid touch while interacting with same-sex partners (Roese, Olson, Borenstein, Martin, & Shores, 1992). Violation of this norm, particularly for persons with homophobic tendencies, causes aversive feelings (Floyd, 2000) and can remove the effects of touch on generosity (Dolinski, 2010).

The context of touch—that is, who touches whom and when—may thus result in differential affective outcomes, but recent neuropsychological findings suggest a touch could actually *feel* different depending on the context. For instance, a recent fMRI study found that the primary somatosensory cortex of heterosexual males responded differently depending on whether they believed they were being touched sensually by a man or woman (Gazzola et al., 2012). Similarly, recent studies found that emotional stimuli can alter somatosensory processing (Montoya et al., 2005; Sel, Forster, & Calvo-Merino, 2014; Spapé, Hoggan, Jacucci, & Ravaja, 2015). Thus, the social-emotional context of a touch defines what a touch is felt like, and the same touch could feel stronger or weaker depending on surrounding affective cues. This modulatory effect can be labeled “affective touch perception.”

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Most studies investigating affective touch perception (e.g., Montoya et al., 2005; Sel et al., 2014) have presented the tactile and emotional stimuli originating from independent sources: a participant is shown pictures meant to elicit emotion while the researcher touches his or her arm with a tactile device or hand. In real interpersonal touch, however, emotional and tactile stimulation are situated in the same person, who, for instance, smiles when reaching out to touch the recipient. In this case the emotional cues are perceived as an inevitable part of the tactile message as both communication channels originate from the same embodied source. Along with other bodily cues, facial expressions may be of particular importance when it comes to touch, as they inform the recipient of the sender's behavioral intentions (Adams, Ambady, Macrae, & Kleck, 2006). An angry expression, for instance, communicates hostile intentions, with a tendency to approach and harm the emotional target, while a fearful face implies a withdrawal tendency to keep distance from the target (Marsh, Ambady, & Kleck, 2005). It seems likely, therefore, that expressions would have a particularly pronounced effect on affective touch perception given that touch is strongly tied to physical proximity. Indeed, recent study by Ellingsen et al. (2014) showed that (static images of) smiling faces increased, whereas angry faces reduced, pleasantness of concomitant touch.

Numerous lines of research on other perceptual modalities suggests also that facial expressions can critically affect basic perception of a stimulus (cf. Vuilleumier, 2005). For instance, the mere presence of a fearful face has been shown to potentiate attention and facilitate subsequent visual perception (Phelps, Ling, & Carrasco, 2006). This affective modulation has been suggested to arise from increased neural communication between visual cortical areas and emotion-related subcortical structures (Vuilleumier & Pourtois, 2007). Interestingly, the peripheral organs, such as the heart, also take part in enhancing the perception (Bradley, 2009). For example, presenting a threatening emotional cue results in brief cardiac deceleration, also called a cardiac orienting response (OR; Bradley, Lang, & Cuthbert, 1993). Cardiac orienting has been related to biological processes involved in extracting information from the environment and is thus used as an index of enhanced sensory intake (cf. Bradley, 2009).

The degree to which affective cues affect perceptual processing has been shown to vary as a function of individuals' characteristics (Smolewska, McCabe, & Woody, 2006). Traits related to negative affectivity have especially been associated with facilitated sensory processing in response to emotional cues (for review see Aron, Aron, & Jagiellowicz, 2012). One of these traits is behavioral inhibition system (BIS) sensitivity, which reflects cross-individual variation in neurobiological systems motivating avoidance of negative and painful experiences (Carver & White, 1994; Fowles, 2000). People with high BIS sensitivity show heightened cardiac OR in response to negative and emotionally arousing visual stimuli (Balconi, Falbo, & Conte, 2012) and perceive sad and angry expressions as more sad and hostile than persons with low BIS sensitivity (Knyazev, Bocharov, Slobodskaya, & Ryabichenko, 2008).

Also, the gender of the receiver is of particular importance when it comes to affective touch perception. As already noted, gender has a strong effect on the preferences regarding interpersonal touch. However, it has also been shown to influence the way a person extracts information from facial expressions (Montagne, Kessels, Frigerio, de Haan, & Perrett, 2005). A meta-analytic review by McClure (2000) showed that females are overall more sensitive to perceive emotional facial cues. Therefore, it can be concluded that the perceiver's gender as well as motivational tendencies can be considered as relevant individual-level factors involved in affective touch perception.

2. Present study

The purpose of the current study was to investigate whether individual characteristics and emotional expressions influence the perception of interpersonal affective touch. We utilized an immersive virtual reality (VR) paradigm to measure affective touch perception in the context of an emotionally expressive virtual character (VC). Haptic technology was used in order to provide the illusion that, following a facial emotional expression, the VC touched the participant. This novel methodological approach allowed us to control for visual (reaching gestures, facial dynamics) and haptic (tactile location, intensity) aspects without compromising the ecological validity of the touch experience (Blascovich et al., 2002).

Supporting the notion of affective touch perception, we expected that emotional expressions would change how touch was experienced in terms of its intensity and pleasantness as well as cardiac OR. More specifically, we expected that a touch preceded by a VC's angry facial expression would be rated as less pleasant and more intense compared to other facial expressions. Furthermore, we investigated whether individual differences contributed to the affective touch perception. Taking into account the fact that high-BIS persons perceive angry faces as more hostile compared to low-BIS persons (Knyazev et al., 2008), we expected that high-BIS persons would rate touch preceded by angry expression as less pleasant and more intense and show more enhanced touch-related OR compared to low-BIS persons. Finally, given that males show usually more aversion of same-sex touch (Roese et al., 1992) we assumed males to rate male VC's touch as less pleasant and more intense especially when accompanied by negative expressions.

2.1. Participants

The sample consisted of 41 (19 female) Finnish undergraduates. They were right-handed, with no history of neurological or psychopathological disorders (or other acute health issues) and had normal or corrected eyesight. Before signing informed consent, participants were informed of the content and purpose of the study, as well as their rights to withdraw from the study at any moment without any negative consequences. At the end of the experiment, each participant received 40 € in compensation for their time. Data from two participants (both females) were excluded from analysis due to technical complications with the ECG recordings. The resulting gender groups had a similar age range (females: 25.88 ± 3.96, and males: 24.86 ± 3.99). The study followed the guidelines of the National Advisory Body on Research Ethics in Finland and was approved by the Research Ethics Committee of X University.

2.2. Procedure

After filling out the personality questionnaire, participants were seated at a desk equipped with a glass table and assisted in putting on a head-mounted display (HDM) and tactile glove. Within VR, they could see a 3-D model of their right hand resting on a table with a green area to the left of their hand (see Fig. 2, Panel A). As they touched the area, the VC appeared, wearing a neutral expression (B). The emotional expression animation only started (C) after participants moved their hand forward to a blue cue. Then, after a randomized interval of 1 to 3 s, the VC reached out and, 1 s later, touched the participant's hand (D), at which time tactile stimulus was delivered. The VC remained in view for another 1 s after which participants were instructed to get ready for the next trial or to answer (in the first 20 trials of each block) a short questionnaire. There were 100 trials per block, and five blocks with breaks in between. The experiment took ca. 90–120 min.

2.3. Stimuli and apparatus

Unity 3D 4.5.4 software (Unity Technologies, San Francisco, CA), operating on a PC running Windows 7, was utilized to present stimuli and collect responses. Visual stimuli were presented via a head-mounted display (Oculus Rift Developer Kit 2, Oculus VR Inc., Irvine, CA), which