What Makes Touch Comfortable? An Examination of Touch Giving and Receiving in Two Cultures

Personality and Social Psychology Bulletin
2023, Vol. 49(9) 1392–1407

DOI: 10.1177/01461672221105966
journals.sagepub.com/home/pspb
SAGE

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Abstract

This study examined how touch role and culture shape affective touch experiences. Germans ($N = 130$) and Chinese ($N = 130$) were surveyed once as toucher and once as touchee. For different touch actions, they (a) provided free-text descriptions of what prompts touch, (b) indicated with whom touch feels comfortable, and (c) highlighted areas of touch comfort on a body outline. Overall, touch was prompted by affectionate feelings, was more comfortable with more closely bonded individuals, and when directed at the upper arms, shoulders, and upper back. Touch role mattered for the experiences prompting touch in that touchees felt less positive than touchers. Culture differentiated touch comfort topographies. Compared with Chinese, Germans felt more comfortable with more intimate touch to the torso and upper back and less comfortable with more public touch to the hands. Notably, however, examining touch role and culture revealed more overlap than divergence, ensuring mutual comfort as individuals physically connect.

Keywords

C-tactile, social touch, affect, culture

Received October 29, 2021; revision accepted May 21, 2022

Starting from birth, humans engage in friendly physical contact with close others. This physical contact, which science refers to as affective touch, stimulates a dedicated somatosensory system (McGlone et al., 2014) that modulates neuronal activity in emotional and social processing networks (Morrison, 2016) and engages affiliative cognition. Together, these effects facilitate bonding and contribute to stress regulation and homeostasis (Dagnino-Subiabre, 2022; Van Puyvelde & Mairesse, 2022). Yet, how affective touch is processed and to what extent it benefits the individual may depend on various factors including, for example, whether touch is actively given or passively received (Triscoli et al., 2017) and how touch is culturally situated (Sorokowska et al., 2021). Here we sought to shed light on this by examining the comfort of touch giving and receiving in both a Western and an Eastern culture.

Affective Touch: Modes and Functions

Positive social interactions are often accompanied by gentle tactile exchanges. For example, when meeting a friend, we may pat, embrace, or kiss each other. There is a growing literature showing that such affective touch is relevant for mental and physical well-being (Debrot et al., 2013). Research on child development (Feldman et al., 2010), adult platonic interactions (Beßler et al., 2020; Schirmer et al., 2015; Sorokowska et al., 2021), as well as romantic relationships (Carmichael et al., 2021; Debrot et al., 2021; Jakubiak & Feeney, 2017) has highlighted the importance of affective touch for the emergence and maintenance of social bonds. In addition, it has identified affective touch as a pleasant stimulus that can dampen responses to threatening or distressing events (Gallace & Spence, 2010). For example, holding a partner's hand was found to ease stress responses arising from electric shock (Coan et al., 2006) or social conflict (Jakubiak & Feeney, 2019).

Current perspectives link the benefits of affective touch to both basic somatosensory processes as well as higher-order socio-affective effects. At a somatosensory level, a touch's pleasantness correlates with the activity of C-tactile (CT)

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afferents (Löken et al., 2009; Olausson et al., 2002; Vallbo et al., 1993). CTs are unmyelinated nerve fibers that are optimally excited by low force, gentle stroking with a velocity between 1 and 10 cm/s, which overlaps with the typical velocity of affective touch (Croy et al., 2016; Lo et al., 2021). CTs are also thermosensitive and display a preference for skin temperature touch (Ackerley et al., 2014). Their central projections from the thalamus may bypass somatosensory cortex and directly reach the posterior insula, a multisensory hub that supports interoceptive and affective processes (Björnsdotter et al., 2010). Because of this and because CT firing positively predicts the perceived pleasantness of affective touch, CTs are generally believed to endow touch with reward value. Note, however, that other percepts such as the degree to which a tactile stimulus feels like human touch compare in their response to pleasantness and could be equally relevant in explaining CT function (Wijaya et al., 2020).

At a socio-affective level, affective touch may have meaning for those who give and those who receive it. For example, some authors argue that those who give touch convey feelings of closeness and care toward a touchee who in turn may feel bonded and safe (Debrot et al., 2013; Jakubiak & Feeney, 2019). As has been proposed for other nonverbal modalities, including facial expressions, the meaning of touch may be naturally understood (Jakubiak & Feeney, 2019; Schirmer, Croy, & Schweinberger, 2022). Evolutionary pressure on the biological substrates that support human social interactions may have shaped neural processes to spontaneously map affective touch onto mental states associated with bonding and trust. In addition, meaning may emerge from past experiences and learning. For example, if children receive affective touch as part of a loving and caring relationship with their parents, they will come to associate such touch with love and care. Thus, affective touch later in life may evoke this kind of social meaning (Croy et al., 2022; Jakubiak & Feeney, 2017).

Please note that existing work typically treats affective touch as one kind. Yet, affective touch divides into different kinds such as embracing, tickling, or kissing with each of these actions having a unique bodily topography and situational context. For example, self-reports have linked embracing to the comforting of another, tickling to the dispelling of boredom or being playful, and kissing to expressions of love (Schirmer et al., 2021). Thus, these actions may have different functions that are supported by specialized somatosensory and socio-affective mechanisms. Moreover, they may constitute something like an affective touch "vocabulary" that addresses specialized somatosensory mechanisms and that individuals knowingly or unknowingly employ in affectionate social interactions.

Touch Giving Versus Receiving

Current insights into affective touch derive largely from research on receiving touch (Croy et al., 2016, 2020; Schirmer & Gunter, 2017) or from work that failed to discriminate receiving from giving (e.g., Beßler et al., 2020; Schirmer et al., 2021; Sorokowska et al., 2021). Thus, what role one plays in touch has not received much attention and is seemingly justified by the fact that many forms of touch are reciprocal involving analogous actions of each party in touch (e.g., hugs). Moreover, nonreciprocal touch such as petting someone on the back may trigger a pet in return. Yet, we reason that affective touch is more frequently initiated by one individual rather than by two individuals at the exact same time and that, hence, touch giving and receiving should be conceptually dissociated. In line with this, research shows that the frequency of touch giving and receiving may be unbalanced within and across individuals longitudinally as implied by research in romantic relationships (Debrot et al., 2013). Moreover, studies have identified perceptual and socio-affective differences that make it necessary to pursue touch giving and receiving as separate phenomena.

Perceptually, differences arise from the body parts that are used to give and receive touch. Touch actions such as petting, holding, or stroking are typically performed with the palm contacting a partner's arm, shoulder, or back (Schirmer et al., 2021; Triscoli et al., 2017). The palm is densely innervated by fast-conducting Aß fibers, while CTs are scarce or absent (McGlone et al., 2012, 2014). By contrast, arm, shoulder, and back are hairy body parts with reduced Aß but substantial CT innervation (Ackerley, 2022; Vallbo et al., 1993). Thus, the tactile systems activated by touch giving and receiving differ such that the latter more readily benefits from CT signaling. In addition, active relative to passive touching more likely involves motor processes and engenders predictions about associated somatosensory consequences (Blakemore et al., 1998; Boehme et al., 2019). As such it is more effortful and characterized by inhibitory processes that dampen the awareness of emerging somatosensory impressions (Boehme & Olausson, 2022).

Research implies corresponding differences at a socio-affective level concerning, for example, an individual's power or status. We perceive those who touch others as feeling more positive (Schirmer et al., 2015) and to be more in charge (J. Hall et al., 2005) when compared with those who receive touch. In line with this, higher-ranking individuals, as defined by their sex, age, or socioeconomic status, more readily initiate informal affective touch when compared with lower-ranking individuals (J. A. Hall, 1996; Henley, 1973). In addition, touch giving between bonded individuals often results from an impulse to help a partner regulate negative emotions or stress. Leveraging on this, a study by Debrot and colleagues (2013) asked individuals in romantic relationships to complete four surveys a day for the duration of 1 week recording, among other things, the physical contact they had initiated toward their partner in response to the partner's affect. The results showed that although both touch giving and receiving boosted positive affect, only touch receiving was associated with long-term benefits for psychological well-being.

Cultural Diversity in Touch

Although affective touch can be found in any human culture, over the years, researchers have documented differences in touch behaviors. Self-reports and the observation of interactions in public places led to the dissociation between high- and low-contact nations (Knapp et al., 2013). For example, more touching has been documented among Southern when compared with Northern Europeans (Remland et al., 1995), touch over larger body areas was observed in Northern Europeans when compared with North-East Asians (McDaniel & Andersen, 1998), touch pleasantness was reported as higher by British when compared with Japanese individuals (Suvilehto et al., 2019), and Mexican Americans were found to be more accepting of affective touch when compared with European Americans (Burleson et al., 2019).

Recently, this work has been extended by an impressive collaboration across 45 countries (Sorokowska et al., 2021). Apart from showing differences in the frequency with which individuals from different countries touch, this study identified a range of variables that potentially explain this variation. For example, conservatism, as measured with Henningham's (1996) Conservatism Scale, negatively predicted touch. In this context, Germany with its relatively liberal society was among the countries with the most affective touch, whereas China with its relatively conservative society was among the countries with the least affective touch. Indeed, the frequency of affective touch in Germany compared with that of more Southern European countries that were previously identified as high-contact nations (Remland et al., 1995). In addition, data by Sorokowska and colleagues highlighted that cultural differences in touch are relatively smaller for very close others such as one's romantic partner or child when compared with individuals outside the closest family circle such as friends.

Insights into the culture of touch are interesting because they help us appreciate the diversity of human touch behaviors and may facilitate cross-cultural communication. In addition, they shed light on underpinning processes. Whereas evidence for cultural convergence points to a shared affective touch biology, evidence for cultural variation supports a role of experience and learning in tactile meaning. Accordingly, findings that, across cultures, affective touch is more likely the more closely bonded individuals are (Sorokowska et al., 2021; Suvilehto et al., 2019) support a shared affective touch biology in the context of social bonds. By contrast, findings that some cultures touch more than others point to a role of societal norms in regulating human physical contact especially with more socially distant and unfamiliar others (Sorokowska et al., 2021; Suvilehto et al., 2019).

The Present Study

Taken together, past research established affective touch as an important aspect of human social interactions. Moreover, findings imply that the experiences and consequences of affective touch may differ between those who give and those who receive touch as well as between cultures. Yet many aspects of what is shared and what differs are still unexplored. For example, there is currently little known about what characterizes and differentiates touch giving and receiving. Moreover, the measurements used in past studies were focused largely on the frequency of touch behaviors and neglected other aspects such as the affective experiences prompting touch or the comfort derived from touching.

The present study sought to address these issues by examining touch and its experiential context from a touch giving and receiving perspective in German and Chinese individuals. We selected these two cultures because they were previously found to contrast in their self-reported touch frequency for a range of touch scenarios (Sorokowska et al., 2021). For example, on a 100-point scale, touch prevalence in romantic relationships scored 99 in Germans and 57 in Chinese, who ranked lowest across all 45 countries included in the study. Using a specifically designed online tool, we assessed a broad range of affective touch actions including embracing, holding, kissing, leaning, petting, squeezing, stroking, and tickling as informed by previous research (Beßler et al., 2020; Schirmer et al., 2021). Participants completed two sessions. In one session, they adopted the role of the person giving touch, whereas in the other session, they adopted the role of the person receiving touch. In each session, participants completed two open-ended questions reporting their own and an interaction partner's experience that would prompt a given touch action. In addition, they indicated their touch comfort with different person groups in their social circle and colored on a body outline the parts where a given touch action felt comfortable.

Our goal was to identify general effects as well as effects specific to a person's touch role and culture. In terms of general effects, we expected the personal experiences prompting affective touch to be largely positive and for touch with close others to be more comfortable than with distant others (Beßler et al., 2020). We also anticipated that the body coloring task would reveal areas that maximize affective touch comfort irrespective of touch role and culture and could thus provide important directions for the future mapping of relevant somatosensory processes.

In terms of role-specific effects, we speculated that the feelings preceding and prompting touch differ between toucher and touchee with the former feeling more positive than the latter. This assumption has been implicit in previous work (Debrot et al., 2013; Jakubiak et al., 2021) but has not yet been explicitly tested. In addition, we hypothesized that touchers and touchees differ in the comfort they derive from actually being touched. In light of evidence that touch facilitates emotion regulation (Dagnino-Subiabre, 2022; Van Puyvelde & Mairesse, 2022) and that touchers rate touch pleasantness lower than touchees (Triscoli et al., 2017), we

reasoned that touch giving may produce less comfort than touch receiving.

Last, we formulated two hypotheses as regards culture-specific effects. Based on evidence that affective touch is more prevalent in Germans than in Chinese (Knapp et al., 2013; Sorokowska et al., 2021), we anticipated corresponding cultural differences in the comfort with such touch. Do note, however, that we were cognizant of the fact that touch frequency and comfort are distinct measures such that cultural differences obtained with the former may not show for the latter. Finally, we expected an interaction between culture and role for touch comfort. Indeed, existing emotion research found that, on average, Asians are less emotionally expressive when compared with Westerners, while both seem to feel emotions with similar intensity (Jack et al., 2012; Matsumoto, 2007; Schouten et al., 2020). As touch giving entails an overt behavioral act, whereas touch receiving is strictly experiential, a potential comfort difference between touch giving and receiving may be exaggerated in Chinese when compared with Germans.

Method

The data and analysis scripts that are forming the basis of this report have been made available at the open science framework: https://osf.io/xyuje/?view_only=7def3ac6d26342318 6252eb0c2f11a6f

Participants

We recruited via campus advertising at the Chinese University of Hong Kong and the Technical University Dresden. Our sample size was informed by previous studies using a similar methodology (Nummenmaa et al., 2014; Schirmer et al., 2021; Suvilehto et al., 2015) and enabled us to observe a medium-sized ($d = .45$) interaction between role and culture with 99% power (https://jakewestfall.shinyapps.io/pangea/).

The data were collected between September 11, 2020 and September 13, 2021. Of the participants who started this survey, 260 completed two sessions—one in the role as touch giver and one in the role as touch receiver. All participants with complete data were included in our analysis.

Our data comprised 130 participants (half female) for each recording site. Chinese participants were on average 22.3 years old (*SD* 5), whereas German participants were on average 23.4 years old (*SD* 5.8). In terms of ethnic background, the Chinese sample included 129 Chinese and 1 Indian. The German sample included 126 Germans, 1 Chinese, 1 Pakistani, and 1 Korean (1 person unspecified). In terms of sexual orientation, the Chinese sample included 114 heterosexual, 8 bisexual, 6 homosexual, and 1 individual with another sexual orientation (1 person unspecified). The German sample included 113 heterosexual, 10 bisexual, 5 homosexual, and 2 individuals with another sexual orientation. Among the Chinese participants, 22 women and 26 men were currently in a romantic relationship. Among the German participants, 27 women and 43 men were currently in a romantic relationship. In Hong Kong and Dresden, all participants operated the mouse with their right hand with the exception of one and three individuals, respectively.

This study was approved by the Survey and Behavioral Research Ethics Committee at The Chinese University of Hong Kong and aligned with the Declaration of Helsinki. Participants gave informed consent electronically prior to commencing study participation.

Materials

Online setup. After providing informed consent, participants received an instruction and a personalized link to a questionnaire that was to be completed within 1 week. One day after they completed the first questionnaire, participants received another link to complete the second questionnaire. The order in which participants completed touch giving and receiving questionnaires was counterbalanced.

For the German sample, the questionnaires were written in German, whereas for the Chinese sample, questionnaires were written in English. We opted for English here because the Chinese sample used English as the language of instruction and because this facilitated the development, administration, and analysis of the questionnaire. Moreover, although there is evidence that language may influence some self-reports in bilinguals (Ralston et al., 1995), language-associated cultural elements are nevertheless relevant for the bilinguals' daily life and thus were not considered a confound. Although there was a possibility that an English questionnaire reduced differences between the two cultural samples, such a reduction was expected to be small.

Each session took about 25 min and could be done with self-set breaks. It had to be completed on a computer rather than a tablet or phone. Participants could save their answers and continue the questionnaire anytime using their personalized link. The questionnaire is provided in the Supplementary Materials.

Participant background information. First, participants filled in their demographic information including age, sex, sexual orientation, handedness, mouse hand, ethnicity, and current country of residence. This was followed by a page listing potential social partners for which participants had to indicate how many of them formed part of their social circle. The listed social partners included romantic partners, close family members, distant family members, close friends, distant friends, and acquaintances and the meaning of each category was shortly explained to the participant. For each category, participants were given male and female options. The only exception was romantic partners for which the sex was not specified. This was because we expected the majority of participants to have heterosexual partners, which would make the analysis of partner sex statistically problematic. Moreover, we also

reasoned that the comfort of friendly, nonsexual touch with hetero- and homosexual partners would be comparable.

Affective touch information. The next section of the questionnaire started with a list of tactile actions including embracing, holding, leaning, kissing, stroking, squeezing, and tickling. This list was informed by earlier work (Beßler et al., 2020; Schirmer et al., 2021; Yohanan & MacLean, 2012) and comprised a variety, albeit nonexhaustive, list of behaviors that seemed relevant in the context of friendly social exchange. Participants were given a short definition for each touch action and asked to consider only friendly and nonsexual touch.

The following questions and tasks were then completed for each action separately with the action order randomized across participants. This entailed participants indicating the type of social partners whom they would feel comfortable touching in the specified manner. In addition to the person categories specified above, we included a "stranger" and a "not applicable" option. Again, for each partner category, excepting the romantic partner, participants were given male and female options.

Next, participants were asked to describe their own and their touch partner's experience that would prompt a specific touch action. For the touch giving questionnaire, these questions were phrased from the perspective of the touch giver, whereas for the touch receiving questionnaire, they were phrased from the perspective of the touch receiver. For example, the touch giving questionnaire asked, "What might you experience that would prompt you to embrace him or her?" and "What might the other person experience that would prompt you to embrace him or her?" Taking the touch giver and receiver perspective on both self and other experience enabled us to assess/rule out a potential influence of perspective taking on the reported experiences.

Last, adopting a method used previously (Nummenmaa et al., 2014; Schirmer et al., 2021; Suvilehto et al., 2015), we presented participants with a body outline for which they should color those parts they felt comfortable touching or being touched on in the specified manner with interaction partners for whom such touch typically feels comfortable. The front side showed the dorsal and the back side the volar aspects of hands and feet. The order of the front and back body outlines was counterbalanced and was the same across actions for a given participant. Participants were instructed to color parts for which touch was especially comfortable with stronger intensity than parts for which touch was less comfortable. Coloring was done with the computer mouse and repeated coloring of one area increased color intensity.

Measures and Analysis

The questionnaire was implemented in JavaScript using the jsPsych library (de Leeuw, 2015) and hosted on the Google Cloud Platform. The participant-wise data were stored and retrieved using Python and Google Datastore. All subsequent analyses were performed in R (R Core Team, 2015). This comprised three sets of analyses directed at (a) the affective experiences prompting touch giving and receiving, (b) the social circle of touch comfort, and (c) the bodily touch topographies. Analyses reported below were conducted across touch actions (i.e., embracing, holding, kissing, leaning, petting, squeezing, stroking, and tickling) to facilitate examination of our primary hypotheses. Analyses with touch actions as an additional factor are reported in the Supplementary Material.

Affective experiences prompting touch giving and receiving. The ultimate goal of analyzing free-text entries was to assess the affective valence of touch-prompting experiences as a function of role and culture. This required a couple of text preprocessing steps that were followed by an automated sentiment analysis as explained below.

First, we checked for typos and translated all German submissions into English using GoogleTranslate online services via the googleLanguageR package (Edmondson, 2020). A bilingual speaker checked all translations to ensure that they were accurate and made minor corrections. Corrections were made in only two cases. The German word "Nähe" was mistranslated as "vicinity" rather than "closeness" and the German expression "rum albern" was mistranslated as "rum silly" rather than "being silly." We then removed inappropriate answers (e.g., "not applicable," "I don't do"), non-letter signs, and edited all answers that included negators (e.g., not pay attention, not happy) by converting them into their closest synonyms (e.g., inattentive, unhappy). This step was necessary because the sentiment analysis applied below could not deal with negations. Responses like "not happy" would have been classified as positive rather than negative.

Subsequently, all submissions were tokenized using the cnlp_annotate function of the cleanNLP package (Arnold, 2017). This function separated text entries into words and added lexical information. For example, a response like "to comfort the partner" was divided into four word entries that were classified as particle, verb, article, and noun, respectively. Subsequently, we removed redundant words (e.g., kiss when asked about kissing), stop words (e.g., articles, particles), and pronouns retaining only adjectives, adverbs, nouns, and verbs. Across touch actions, roles, and questionnaire perspectives, the number of participants with a word in at least one of these categories ranged from 114 to 129 for the Chinese data and from 117 to 129 for German data.

Finally, we submitted the tokenized text entries to a sentiment analysis allowing us to examine the affective valence of touch context descriptions. To this end, we retrieved the normed affective value of individual words using the get_sentiments function from the tidytext package with the Bing lexicon (Silge & Robinson, 2016). This function looked up a given word in the Bing lexicon (Hu & Liu, 2004), which relies on WordNet (Strapparava & Valitutti, 2004), and

retrieved each word's affective label from there. Thus, each word was labeled as positive, neutral, or negative and analyses focused on the number of words in each affect category.

For statistical analysis, we computed for each participant and condition an affective score that reflected the probability of words being positive. Specifically, we counted the number of positive and negative words for each answer and divided the number of positive words by the combined number of positive and negative words to arrive at the probability score. To facilitate assessment of whether answers were overall more positive than negative, we subtracted 0.5. This returned a signed value such that answers that were generally more positive had a positive sign, while answers that were generally more negative had a negative sign. Please note that this sort of linear transformation had no impact on the statistical analysis. It was merely cosmetic and facilitated the interpretation of results. Affective scores for participants and conditions without positive or negative words were set to 0.

Social circle of touch comfort. The social circle analysis relied on binary data, as participants had to indicate whether or not touch with a specified person group was comfortable. To simplify the recorded data, we generated a numerical variable called proximity that ranged from 0 to 3 for unknown others (female and male strangers combined), distant others (female and male distant family/friends/acquaintances combined), close others (female and male close family/friends combined), and the partner, respectively. For categories that combined multiple person groups (i.e., close, distant, unknown), we computed the mean comfort value. Next, we summed the obtained comfort values across the eight touch actions and divided this sum by eight. This gave us a touch comfort probability that was amenable to linear mixed effect (LME) modeling. We opted for this kind of modeling to account for empty cells in our design (i.e., participants without a partner). Modeling was performed using the "mixed" function from the afex package (Singmann et al., 2019). The significance of main and interaction effects was determined using the Satterthwaite method, an established approach for estimating the effective degrees of freedom (Keselman et al., 1999). Follow-up analyses of interactions were conducted on the full model using the "emmeans" function of the emmeans package (Lenth, 2018) with Bonferroni correction. This function computes the estimated marginal means for specified factors or factor combinations in linear models.

Bodily touch topographies. The body coloring data comprised 83,798 pixels that we subjected to pixel-wise statistical testing as was done previously (Nummenmaa et al., 2014; Schirmer et al., 2021; Suvilehto et al., 2015). For each pixel, we conducted an analysis of variance (ANOVA) with *Role* (giver/receiver) as a repeated measures factor and *Culture* (German/Chinese) as a between-subjects factor. To correct for multiple comparisons, we set our *p*-threshold to .001.

In addition, we were interested in whether we could replicate our previous observation that different affective touch actions have unique body topographies (Schirmer et al., 2021) and whether their differentiation, which might point to a "vocabulary" of touch, differs as a function of role and culture. Hence, we subjected the color maps to a machine learning routine comprising a principal component analysis (PCA) followed by a set of linear discriminant analyses (LDAs). The PCA served to reduce data dimensionality. It was conducted on vectorized data in which uncolored pixels were set to 0 and colored pixels to 1. Vectors were combined into a matrix in which each participant and action presented one row and each pixel a column. The PCA results were inspected for the distribution of eigenvalues and cumulative explained variance. Based on the drop in explanatory power from the 1st to the 20th component, we selected the first 20 components for further analysis. These components then entered a set of LDAs to see whether they entailed information that could be used to automatically recognize individual touch actions. The specific LDAs are explained in more detail below.

Results

Affective Experiences Prompting Touch

Free-text entries underwent a preprocessing routine as described in the "Method" section. This routine identified the affective connotation of nouns, verbs, adjectives, and adverbs. Figure 1 illustrates positive and negative exemplars as a function of their frequency in the current sample. Based on the identified affective words, we obtained a continuous affective score that ranged from 1 to −1 for answers that were entirely positive to answers that were entirely negative. We then subjected this score to an ANOVA with *Role* (give/receive questionnaire) and *Perspective* (self/other) as repeated-measures factors and *Culture* (German/Chinese) as a between-subjects factor.

The results included an interaction of *Role* and *Perspective,* $F(1, 258) = 88.87$, $p < .0001$, ges = .052, as well as a main effect of *Culture,* $F(1, 258) = 46.07$, $p < .0001$, ges = .093, and an interaction between *Culture* and *Perspective,* $F(1, 258) = 4.05$, $p = .045$, ges = .001. All other effects were nonsignificant ($ps > .161$).

We pursued these effects by examining each level of *Perspective*. As expected, when participants described their own touch-prompting experiences, descriptions were more positive when adopting the role of the touch giver when compared with the touch receiver, $F(1, 258) = 42.24$, $p < .0001$, ges = .05. The opposite was the case when they described their partner's experiences, $F(1, 258) = 43.91$, $p < .0001$, ges = .054. In addition, Germans were more positive than Chinese when reporting from their own perspective, $F(1, 258) = 49.38$, $p < .0001$, ges = .115, and, to a lesser degree, when reporting from the other person's

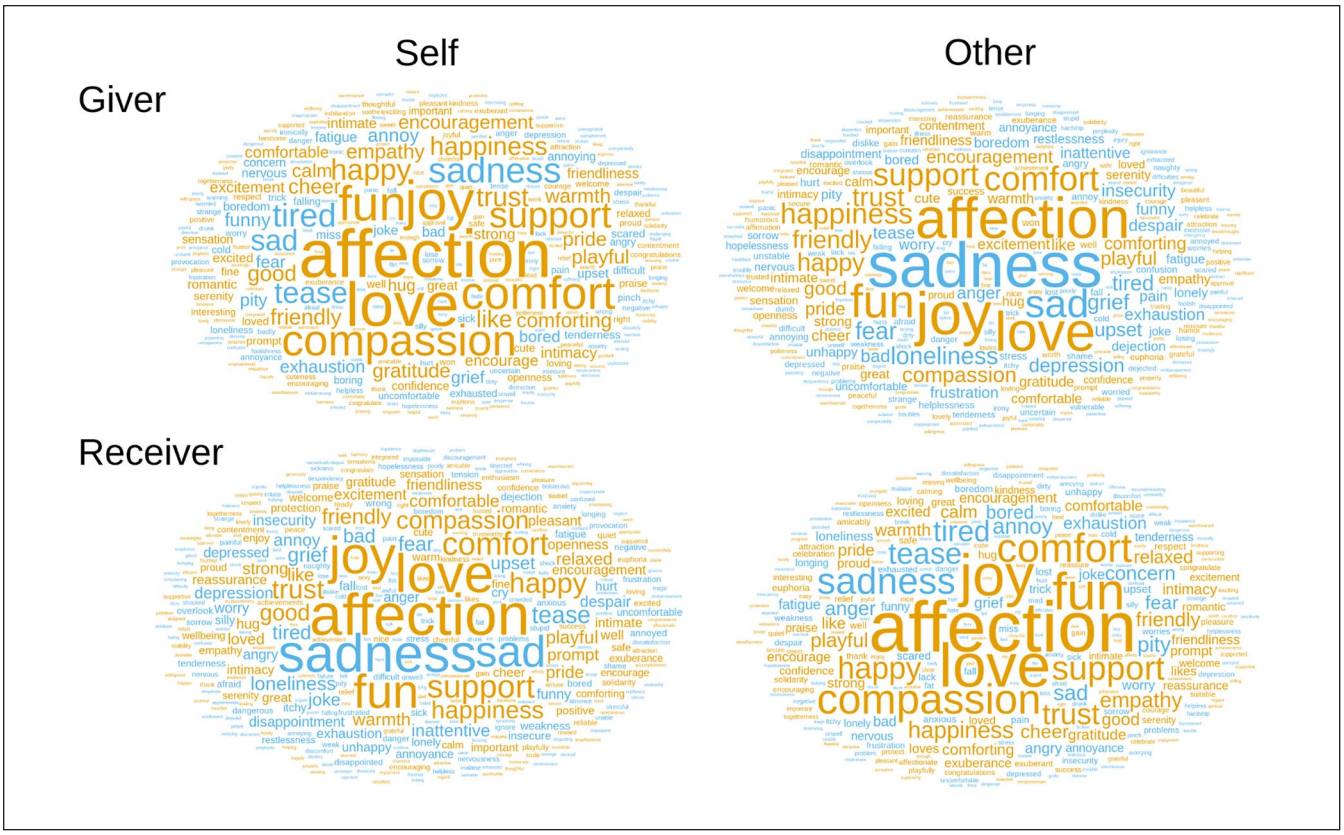

Figure 1. Text clouds showing positive and negative sentiments associated with experiencing touch across all touch actions.
Note. Participants were asked to adopt the role of a touch giver or receiver and reflected on what they themselves and what the partner was experiencing that might prompt the touch in each role. Giver/self and receiver/other are functionally equivalent and evoked similar sentiments. The same applies to giver/other and receiver/self.

perspective, $F(1, 258) = 30.48$, $p < .0001$, ges = .072. These results are illustrated in Figure 2.

Social Circle of Touch Comfort

Similar to previous research, participants indicated whether or not they felt comfortable with different touch actions in interactions with different person groups. Preprocessing of their reports yielded a continuous score which is illustrated in Figure 3. We subjected this score to an LME model with *Role* (giver/receiver), *Proximity* (partner, close, distant, unknown—coded 0–3), and *Culture* (German/Chinese) as well as all interactions as fixed effects and the participants' intercepts as random effects. Each participant contributed only one data point per cell in the design which is why slopes could not be modeled.

Results included a marginal effect of *Role,* $F(3, 1{,}493) = 3.56$, $p = .059$, suggesting that touch comfort probability tended to be greater for touch receiving when compared with giving. In addition, we observed a main effect of *Proximity,* $F(3, 1{,}526) = 3{,}126$, $p < .0001$, and an interaction of *Proximity* with *Culture,* $F(3, 1{,}526) = 2.76$, $p = .04$. As expected, touch comfort probability was greater for partners than for close others (beta = 32.3, $SE = 1.14$, $df = 1{,}570$, $t = 28.28$, $p < .0001$), for close others than for distant others (beta = 40.8, $SE = .81$, $df = 1{,}497$, $t = 50.45$, $p < .0001$), and for distant others than for unknown others (beta = 17.3, $SE = .81$, $df = 1{,}497$, $t = 21.46$, $p < .0001$). Despite the interaction between *Proximity* and *Culture*, the effect of *Culture* was nonsignificant for each level of *Proximity* ($ps > .17$).

All other effects were nonsignificant ($ps > .168$).

Bodily Touch Topography

We first examined general patterns of touch comfort by averaging color maps across touch actions and touch roles. One-sample *t* tests were done for the overall painting of the body front and back sides and for the difference between the front and the back, respectively. The results are shown in Figure 4. The greatest touch comfort was associated with the arms, shoulders, and upper back. The least comfort with friendly, nonsexual touch was associated with the genital regions and lower legs. Touch was more comfortable on the front side of the body when it involved the cheeks, lower arms, hands, and upper legs. It was more comfortable on the back side of the body, when it was directed at the upper torso.

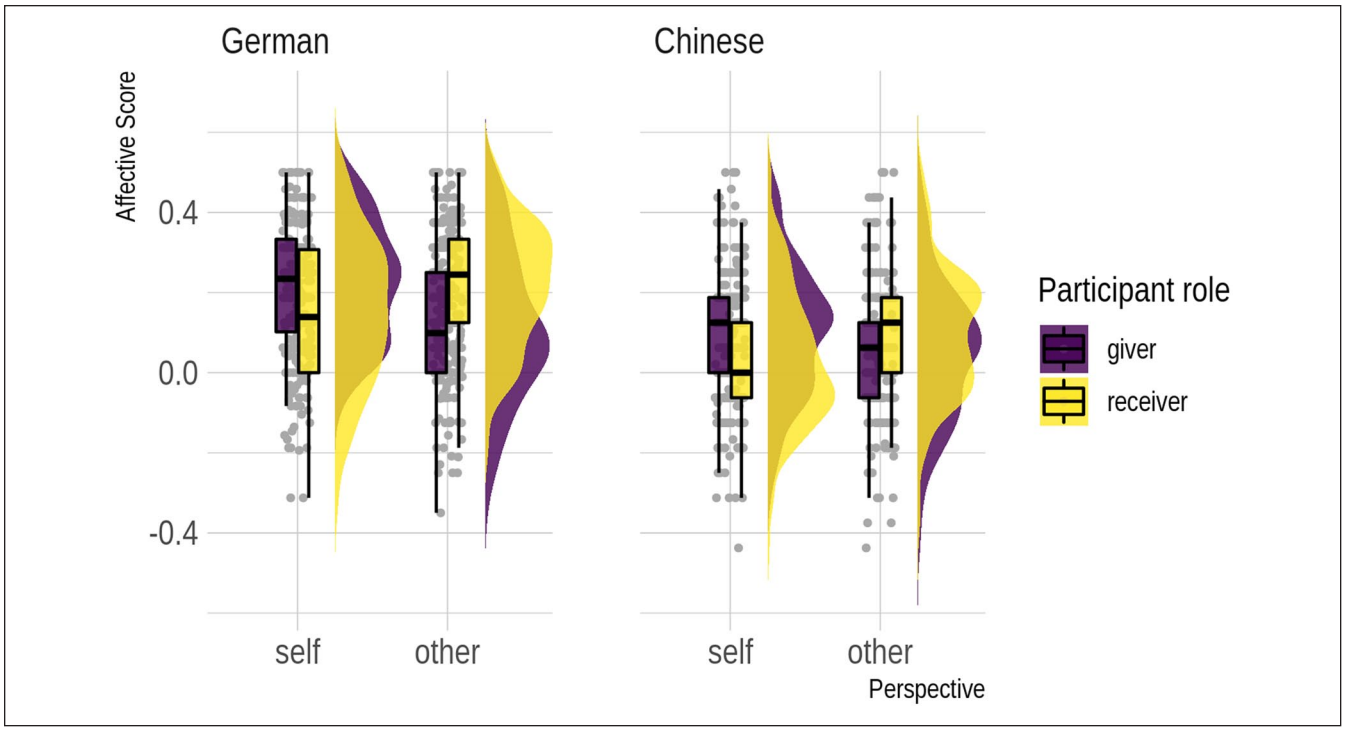

Figure 2. Affect of touch-evoking experiences.
Note. The left graph illustrates results for German participants while the right graph illustrates results for Chinese participants. Gray dots mark the affective scores of individual participants. Superimposed are box and whisker plots with smoothed histograms to the right.

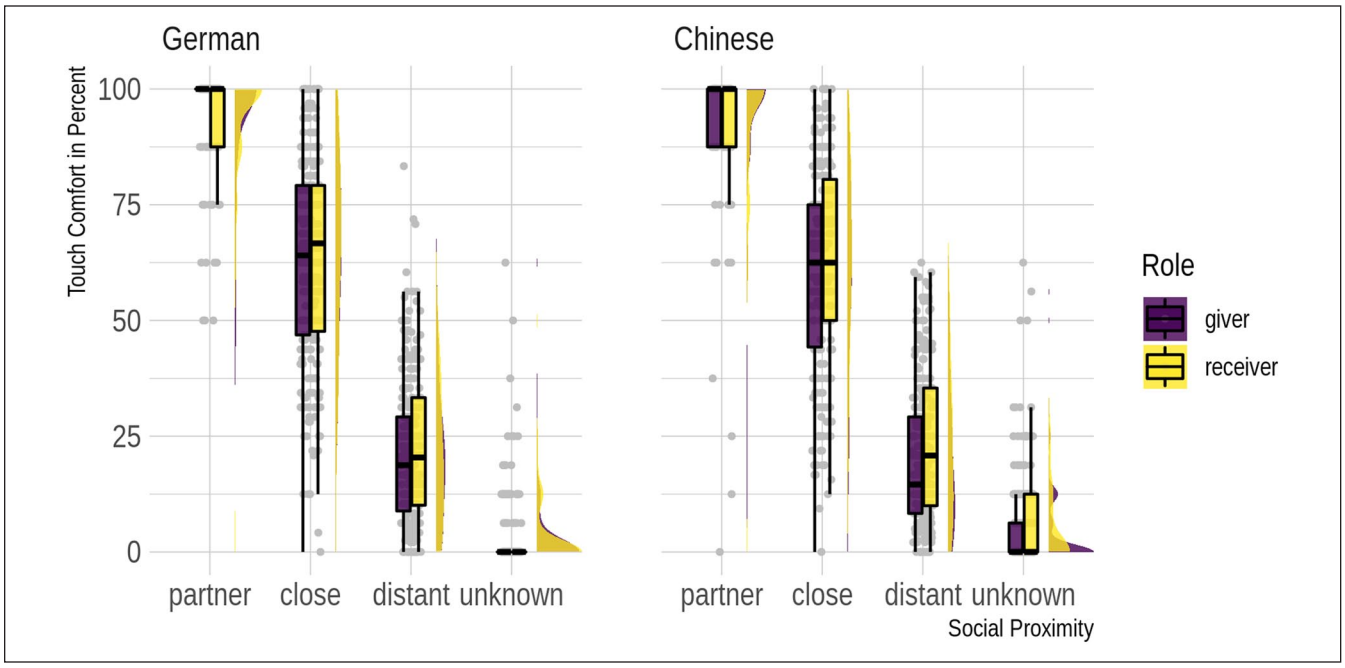

Figure 3. Touch comfort as a function of social proximity.
Note. The left graph illustrates results for German participants, the right graph illustrates results for Chinese participants. Gray dots mark the comfort scores of individual participants. Superimposed are box and whisker plots with smoothed histograms to the right.

Next, we conducted pixel-wise ANOVAs as described in the "Method" section. Main effects of *Role* and *Culture* as well as the interaction between both factors are illustrated in Figure 5. As can be seen, the *Role* effect was nonsignificant.

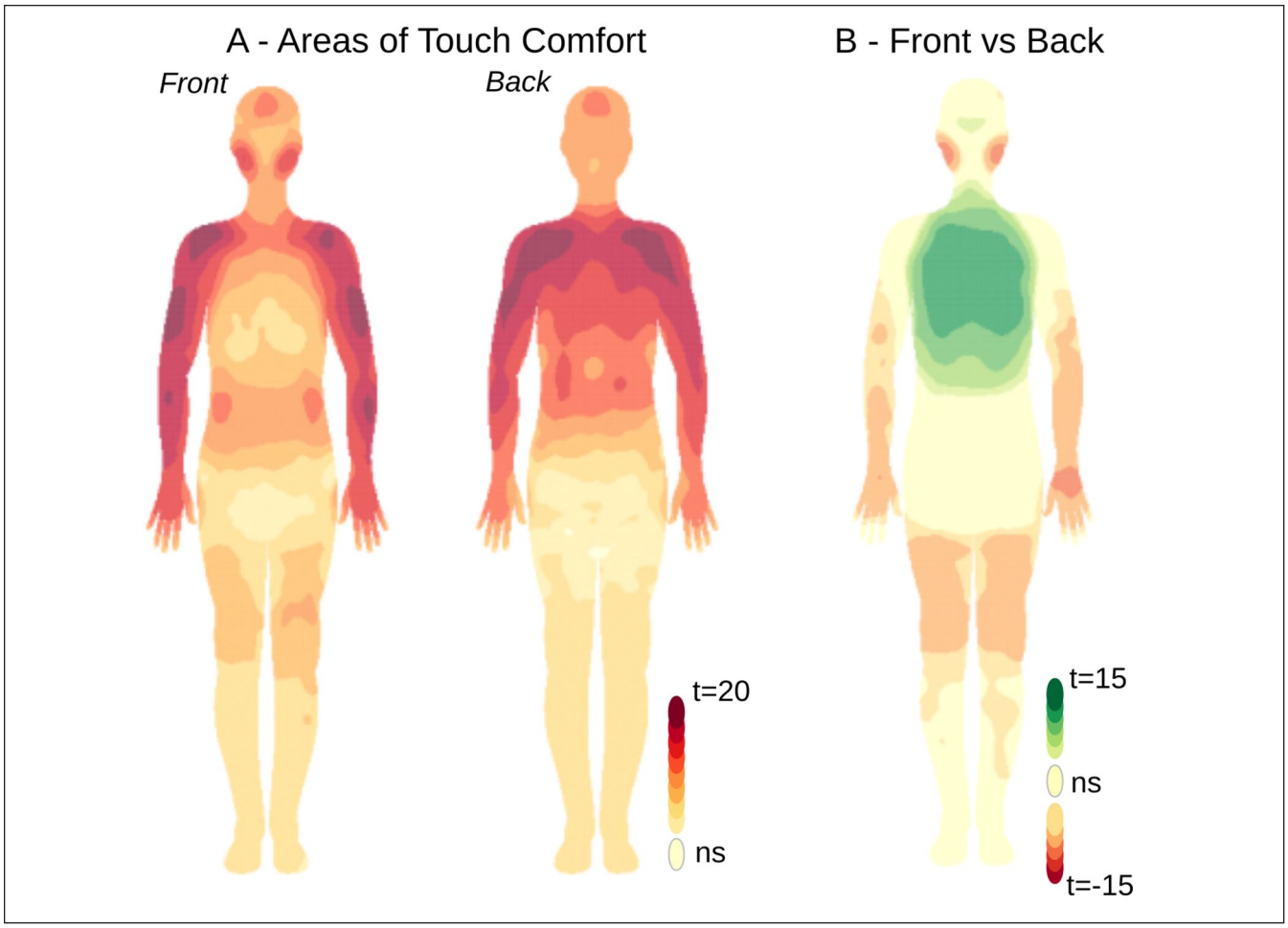

Figure 4. Body maps of affective touch comfort.
Note. (A) Illustrated are the results of one-sample *t* tests revealing areas of significant touch comfort ($p < .001$). The lightest yellow marks nonsignificant areas and the darker shades mark significant areas. (B) Illustrated are the results of a paired *t* test comparing front and back sides of the body. Red colors mark significantly greater touch comfort on the front, whereas the green colors mark significantly greater touch comfort on the back side ($p < .001$). Again, the lightest yellow marks nonsignificant areas. Color legends scale to the pixel-wise *t* scores.

Touch giving and receiving were associated with overlapping comfort topographies. However, we observed a significant effect of Culture ($N = 9{,}498$ pixels). Germans were more comfortable with touch to the torso ($N = 7{,}018$ pixels), whereas Chinese participants were more comfortable with touch to the hands extending, on the left side, into the arm ($N = 2{,}439$ pixels), and a small cluster in the lower part of the face ($N = 41$ pixels). The interaction between *Role* and *Culture* reached significance for only a small negligible cluster on the right arm ($N = 28$ pixels).

Last, we computed a set of LDAs to determine whether the different touch actions could be inferred based on their coloring maps and to probe the universality of this kind of touch "vocabulary." In the absence of role effects in the above analysis, we focused this final step strictly on cultural effects. Specifically, we first divided both the German and the Chinese PCA results randomly into a test ($N = 65$ participants) and a training set ($N = 65$ participants). We then submitted each training set to an LDA aimed at classifying input into touch actions and then used the resultant classification model to classify the test set of the same country into touch actions. This final step yielded an overall accuracy of 62% in the German data and of 46% in the Chinese data (chance = 12.5%). Thus, although there was strong evidence that different touch actions target unique body areas in both participant groups, the associated touch "vocabulary" was more clearly defined in Germans when compared with Chinese. In a second step, we used the data from one country for LDA training and data from the other country for LDA testing. This served to determine whether the touch "vocabulary" used in one country compares with that used in the other and thus might be universal. The results supported this possibility. German body maps could be classified based on a model trained with the Chinese body maps with an accuracy of 49%, which was well above chance. Likewise, when the German maps were used in training, the Chinese body maps could be classified with 42% accuracy.

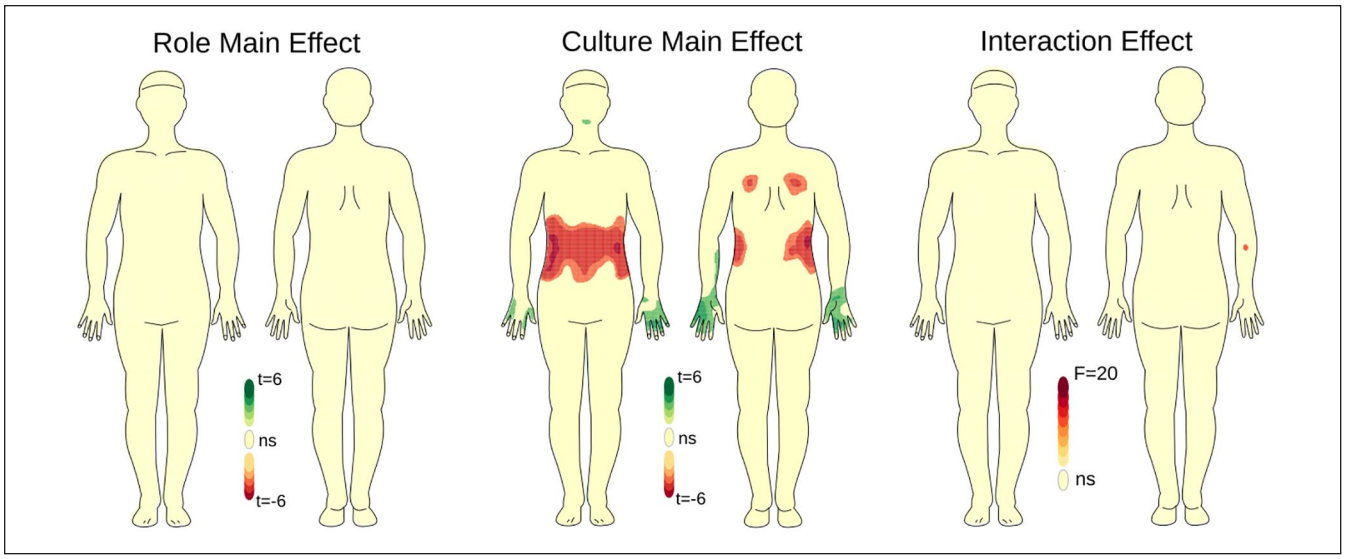

Figure 5. Effects of culture and role on affective touch comfort topographies.
Note. Significant *F* or *t* values associated with a given pixel of the body are color coded ($p < .001$). Superimposed on areas with a significant culture main effect are *t* values from a pixel-wise unpaired *t* test (unlike the *F*, the *t* is signed and thus more useful for illustrating group differences). Red colors mark significantly greater touch comfort for Germans, whereas the green colors mark significantly greater touch comfort for Chinese. For the *Role* main effect and the interaction of *Role* and *Culture*, we show the *F*-test results. Nonsignificant *F* or *t* values are shown in light yellow. Color legends scale to the pixel-wise *t* and *F* scores.

Discussion

Here, we sought to examine the processes relevant to human comfort with affective touch. Our results included general effects, that showed across touch roles and cultures, in line with a shared touch biology that facilitates mutually positive feelings for both parties involved in touch. At the same time, there were also role and culture-specific effects pointing to specialized, contextually situated tactile processes. In what follows, we will consider general and specific effects and how they determine comfort as we physically connect.

General Facets of Touch Comfort

Despite the importance of friendly interpersonal touch, existing research has paid little attention to the situational aspects prompting such touch outside parental caregiving. While it is often assumed that affective touch serves to communicate positive interpersonal attitudes (Jakubiak & Feeney, 2017; Sailer & Leknes, 2022), this assumption has not been formally tested. To offer such a test, we recorded verbal descriptions of touch-prompting experiences and subjected these descriptions to an automated sentiment analysis. This analysis revealed that relevant experiences are more likely to be positive than negative. Indeed, "affection" was the most frequent non-neutral word participants offered, implying that toucher and touchee tend to relate to each other in a positive manner. Other frequent words included "love," suggesting that affective touch is bound to emerge between closely bonded individuals, and "joy" and "fun," characterizing touch as a tool for sharing positive feelings and/or for playfully engaging with a partner.

Previous work established differences in how we employ affective touch in interactions with different person groups. Among others, this work suggests that we touch socially close others such as partners or friends more frequently than distant others such as acquaintances or strangers (Beßler et al., 2020; Schirmer et al., 2021; Sorokowska et al., 2021) and that we typically want more affective touch than we get, especially from individuals with whom we are closely bonded (Beßler et al., 2020; Schirmer et al., 2021). The present touch comfort data corroborate and extend these observations. Like touch frequency, touch comfort was reported as greatest within romantic relationships and declined with an increasing social distance between interaction partners. Convergent with the present experiential descriptions, this highlights the importance of affective bonds for touching. Not only does touching help shape such bonds, such bonds also seem necessary for touch to be perceived as comfortable. As a logical consequence, a touch's benefit for an individual's mental and physical well-being may depend on the perceived closeness to a toucher. In support of this, research on romantic relationships has identified a negative correlation between measures of relationship quality, on one hand, and negative affect, perceived stress, and life dissatisfaction, on the other hand (Coan et al., 2013; Jakubiak, 2022).

The present study offers new insights into the body topography of touch comfort. Looking across role and culture, we identified a number of regional hot spots associated with touch comfort including the upper arms, shoulders, and the

upper back. Indeed, the upper back was the single most touched area on the back side of the body, in line with the notion that the back may be particularly relevant for affective touch (Walker et al., 2017). This area is difficult to reach with self-touch and linked to greater expected touch pleasantness when compared with other body regions (Walker et al., 2017). Importantly, however, compared with the back side, the front side of the upper body was more broadly marked by touch comfort.

Interestingly, our results dissociate from earlier research outlining how touch acceptability distributes across the body (Suvilehto et al., 2015, 2019). Similar to what was done here, this research required participants to color the body parts for which touch is acceptable with different person categories (e.g., partner, parents, friends, strangers) and identified the hands as most acceptable for touching irrespective of whom we touch. By contrast, the arms, shoulders/chest, and especially the belly were less acceptable with more distant individuals. We show here that, although touch to the hands is also comfortable, comfort increases rather than decreases the further touch moves up the arms and onto the shoulders and that, like the hands, the belly is linked to touch comfort. This dissociation between accessibility and comfort highlights that a range of variables may determine the experiences that unfold during physical contact. Indeed, touch to areas accessible to only closely bonded and trusted individuals may be particularly comfortable for touch.

The overall comfort topography we observed sheds light on the somatosensory processes that are relevant to touch effects on affect and well-being. As mentioned earlier, affective touch plays an important regulatory function that many believe depends on engaging CT afferents, a special mechanosensory fiber tuned to gentle skin-to-skin contact (McGlone et al., 2014). Microneurography has demonstrated CTs are present in face, forearm, dorsal hand, and thigh, which also represent typical recording targets (Vallbo et al.,1999, 2009). Findings, furthermore, imply that CTs are densely distributed in the face but scarce in the lower leg (Vallbo et al., 1999, 2009) convergent with our results. Yet, because microneurography recordings are very labor-intensive and done from only one afferent at a time, microneurography's potential for mapping CT topography is extremely limited. Moreover, additional techniques are needed to help us understand the links between CTs, touch comfort, and well-being. We venture that this could include a recently discovered event-related potential component, a possible cortical index of CT signaling. Like CT firing (Ackerley et al., 2014; Löken et al., 2009), this component relates to stroking velocity in an inverted u-shaped manner and predicts subjective pleasantness for touch to hairy but not glabrous skin (Schirmer, Lai, et al., 2022). Future research could probe this component across the body guided by the comfort maps established here. Specifically, we speculate that regions more strongly modulating its amplitude might also be the ones associated with greater touch comfort.

Touch Comfort as a Function of Touch Giving and Receiving

Apart from pursuing general mechanisms of touch comfort, the present study explored potential experiential differences between those who give and those who receive touch. To date, such differences have received very little attention. With respect to the feelings prompting touch, we could identify only a couple of relevant studies. In one study, the authors conceptualized touch as something we bestow on a partner based on how the partner feels and reported that touch giving benefited both the toucher's and the touchee's affect (Debrot et al., 2013). Notably, however, the nature of the feelings that prompted touch was not reported in the paper. Another study examined partner and self-focused touch motives as a function of attachment style in romantic relationships. The results showed that attachment avoidance was linked to a reduced partner- and self-focused touch motivation, whereas attachment anxiety had an ambivalent effect on both (Jakubiak et al., 2021). Unfortunately, the extent to which touch is partner- versus self-focused was left uncertain.

In line with past research and our hypotheses, we found that role mattered in touch. For all affective touch actions, excepting leaning (see Supplementary Material), experiences prompting touch were described more positively for the toucher than the touchee irrespective of whether participants were reflecting on themselves or a partner. Whereas touchers more readily associated with "compassion," touchees more readily associated with "sadness." This role effect agrees with the fact that observers rate touchers as more positive and aroused when compared with touchees (Schirmer et al., 2015) and that touch occurs when there is some sort of imbalance in an interaction (J. A. Hall, 1996; Sorokowska et al., 2021) as a tool of influence (Edinger & Patterson, 1983; Schirmer et al., 2016). For example, research found that distress prompts individuals to solicit touch from a partner and that being touched provides comfort (Robinson et al., 2015) and helps regulate negative affect (Debrot et al., 2013; Jakubiak, 2021). Note, however, that these and the present results do not imply that touchees must feel negatively or that an affective imbalance is necessary for touch to emerge. Indeed, overall sentiment scores were positive and marked by between- and within-subject variation suggesting that interpersonal or contextual factors moderate the role of experienced affect in touch.

Despite being well-powered, the present study found only a marginal role difference for the touch comfort with different person groups. Although in line with our predictions, the small benefit of touch receiving over touch giving failed to reach statistical significance. We also failed to identify role effects for the colored body maps which overlapped perfectly for touch giving and receiving.

Thus, how comfortable body contact is with different person groups and for different body regions seems largely

independent of whether such contact is actively sought or passively received. This points to a mapping of active and passive touch preferences and nicely demonstrates that touch behaviors are not random but finely tuned to elicit mutual interaction comfort.

Touch Comfort as a Function of Culture

Last, we pursued culture as a variable that might shape an individual's comfort with touch. With respect to the experiences prompting touch, we found a main effect of culture indicating that compared with Chinese, Germans reported feeling more positive especially when reporting on themselves as opposed to the partner. This finding may suggest that affective touch is more positively situated in Germany when compared with China. Alternatively, however, Germans may feel generally more positive than Chinese do (Tsai et al., 2006; Ye et al., 2015) due to cultural differences in self-construal or other factors that may shape a person's outlook on life (e.g., environmental stressors such as crowding, pollution). Importantly, the interaction between culture and role was nonsignificant. Cultural differences showed irrespective of whether participants adopted the role of the toucher or the touchee. Indeed, role differences showed similarly in the German and the Chinese sample pointing to overlapping and potentially universal socio-emotional triggers for touch. Such overlap agrees with the importance of touch for regulating affect and well-being in the context of close relationships (Field, 2010; Jakubiak & Feeney, 2017).

Conflicting with our hypotheses, self-reported touch comfort with different person groups was comparable between Germans and Chinese. Thus, although West and East differ in touch frequency especially in the context of socially distant touch (Knapp et al., 2013; Sorokowska et al., 2021) and in touch acceptability in the context of socially close touch (Suvilehto et al., 2019), they compare in their actual comfort with touch. Moreover, the dissociation between touch frequency/acceptability and touch comfort raises the interesting possibility that differences between high- and low-contact nations arise largely from cultured rules about how to use touch in social interactions rather than from how individuals feel about such touch. This aligns with our observation of general touch comfort effects and underscores the importance of pursuing a variety of measures to characterize touch culture.

A comparison between German and Chinese body maps revealed much overlap as well as points of divergence suggesting a role for both shared biological and learned cultural processes. Evidence for overlap comes from an action-based machine learning classification of body maps. This classification served to explore systematic topographical differences between touch actions that could support something like a touch "vocabulary." Our results yielded above-chance classification accuracy ($>12.5\%$) in both the German (62%) and the Chinese sample (46%) and showed that this accuracy is fairly well preserved when training is done in one group and testing in the other (49% and 42%, respectively). Thus, at least for the two cultures studied here, there are basic commonalities in how individuals employ different touch actions. Moreover, the finding that different touch actions target different body parts similarly across different cultures implies a shared behavioral relevance and regulatory function.

Importantly, however, we also observed differences. For one, German body map classification was 16% more accurate than Chinese body map classification. Perhaps a greater frequency of touching in German relative to Chinese individuals (Sorokowska et al., 2021) is associated with more precise touch prototypes and facilitates a communicative function for affective touch. In addition, a direct contrast between German and Chinese body maps identified robust differences in comfort topography. Compared with Chinese, Germans preferred touch to the belly and upper back more, whereas the reverse was true for the hands. In light of data on touch acceptability (Suvilehto et al., 2015, 2019), this suggests that Germans are more comfortable with touch to more intimate body areas, whereas Chinese are more comfortable with touch to more public body areas. Similar to cultural differences in touch frequency, these topographical effects may be linked to differences in liberal versus conservative values (Sorokowska et al., 2021).

Note that perhaps counterintuitively Chinese were more comfortable than Germans touching a small spot in the lower part of the face likely overlapping with the mouth/chin. An exploratory analysis of action-based culture effects (see Supplementary Materials) suggests this difference is driven by a single touch action, namely kissing. Here, Chinese focused more strongly on the face, whereas Germans addressed a broader range of body parts with a greater preference for the top of the head. Although kissing is an intimate action, existing touch acceptability data imply that face and head are more public when compared with the torso (Suvilehto et al., 2015, 2019). Thus, cultural differences observed for the face are not necessarily in disagreement with those observed for other body parts.

Caveats and Future Directions

When considering the relevance of the present findings, we must note that data collection coincided with the Covid-19 pandemic (for details please see Supplementary Materials) and that disease threat may have altered affective touch patterns and the participants' survey responses. For example, one might speculate that the current data underestimate touch comfort with distantly familiar or unknown individuals, emphasize touch comfort with closely bonded individuals, and perhaps miss cultural differences present without the disease. In line with this, recent survey data suggest that the pandemic increased loneliness (MacDonald & Hülür, 2020) and a craving for intimate touch (von Mohr et al., 2021). Thus, it will be important to collect post-pandemic data and

to compare results with those reported here. Please note, however, that result discrepancies would not invalidate our findings. Rather, they would help elucidate the malleability of tactile affect and cultural differences due to dynamically changing environments.

A second point to note concerns the present sample. As we relied primarily on students, with only a subset in romantic relationships, future studies must expand to other ages and socioeconomic groups. Moreover, our sample was drawn from only two countries. Although this two-country approach has a long tradition within psychology, it is limited in that one can only interpret differences but not similarities as the latter cannot preclude a role of culture for touch. Moreover, as shown by previous research, cultures differ, apart from their sociopolitical background, in multiple ways many of which affect tactile interactions (Sorokowska et al., 2021). For example, the level of industrialization has been shown to differentiate skin-to-skin contact between parents and children. Whereas industrialized societies limit such contact in the context of parental employment and nursing schools, hunter-gatherer societies maximize tactile care by breastfeeding and carrying children for a number of years (Hewlett & Lamb, 2017). Such differences may engender differences in the manner in which children later seek out and value touch and should be pursued in further studies.

Finally, when designing the present assessment tool, we had to trade off the time investment of participants against the measurement detail of variables of interest. This was especially of concern as we wished for participants to complete our survey twice, once as the toucher and once as the touchee. Therefore, we pursued more general insights reasoning that these might guide more specific future inquiries. For example, the recorded verbal descriptors of touch elicitors may help design more nuanced tools to measure the feelings of interactions partners that lead to touch. Assessment of social proximity effects may be improved by using a continuous rather than categorical systems. In addition, body coloring maps may be provided for different person groups (e.g., partner, friend, stranger) and include assessment of the body parts that touchers use for touching (e.g., hands, arms). Ultimately, however, such self-report data need to be complemented by studies that measure affective touch in everyday life. Currently, such studies face a number of practical challenges. However, the development of small portable autonomic monitors as well as smart materials that could record touch (Loke et al., 2021) promise exciting future opportunities.

Conclusion

The present study examined three facets of affective touch pursuing both overlap and divergence between different touch roles and cultures. Overlapping effects characterize affective touch as something that arises from affectionate feelings and is most enjoyable with closely bonded individuals, and when it involves the touchee's upper arms, shoulders, and upper back. Divergent effects as a function of touch role revealed an affective discrepancy between those who give and those who receive touch in line with an importance of touch for stress regulation and well-being. Notably, touch role had nonsignificant effects on both social proximity and body topography suggesting that touch giving and receiving are tuned to maximize mutual comfort. Cultural divergence was apparent for the overall affect-prompting touch and for where on the body affective touch actions are comfortable. Touch action specificity in body topography was greater in Germans than in Chinese. In addition, compared with Chinese, Germans preferred touch to certain intimate regions (e.g., belly) more and to public regions less (e.g., hands). Nevertheless, affective touch commonalities were greater than differences qualifying prior findings concerning the frequency of touch. Together, the present data characterize affective touch as an important social behavior and delineate novel directions for studying how this behavior helps us connect with each other and benefits our collective well-being.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was supported by the Humanities and Social Sciences Prestigious Fellowship Scheme (34000219) awarded to A.S. by the Research Grants Council of Hong Kong.

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Supplemental Material

Supplemental material is available online with this article.

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