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## Extraversion and adult attachment dimensions predict attitudes towards social touch

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### Abstract

Attitudes and experiences of touch vary considerably between individuals and also shift in response to societal change. This preregistered study examined predictors of inter-individual variability in touch attitudes and experiences in a large and diverse UK healthy adult sample ( $N = 15,166$ ). Trait extraversion was the strongest predictor of day-to-day social touch attitudes (e.g., handshakes), where greater extraversion predicted more positive attitudes. Attachment avoidance and anxiety most strongly predicted attitudes and experiences of intimate touch (e.g., kissing, caressing). This study is the first to analyse the relative contribution of individual difference predictors to this broad range of touch attitudes and experiences. Findings highlight the complex interplay between perceiver and context in shaping touch experiences.

**Keywords:** Touch, personality, extraversion, attachment style

## 1. Introduction

Touch plays a fundamental role in our everyday social relationships, affecting our behaviour in social settings and impacting our mental and physical health and wellbeing (see Field, 2010; Noone & Mckenna-Plumley, 2022). The benefits of interpersonal touch are well-documented, for example, in strengthening social bonds (e.g. Gullledge et al., 2003), reducing stress symptoms, and promoting physical and mental health (e.g. Grewen et al., 2003; van Raalte & Floyd, 2021). However, attitudes and experiences of touch vary between individuals and contexts (Trotter et al., 2018; Wilhelm et al., 2001; Saarinen et al., 2021), meaning touch may not always be welcomed. It is, therefore, crucial to understand individual variability in touch attitudes and experiences, and the factors that predict them.

Certain demographic and personality factors are associated with differences in touch attitudes and experiences. For instance, older adults report finding touch more pleasurable (Sehlstedt et al., 2016), and being more comfortable with interpersonal touch, than younger adults (Webb & Peck, 2015). However, this prior work has examined only a limited range of touch experiences – i.e., gentle stroking (Sehlstedt et al., 2016) and day-to-day public forms of touch such as hugs and handshakes (Webb & Peck, 2015). To our knowledge, only one study has assessed age and touch attitudes across a broader range of contexts (Touch Experiences and Attitudes Questionnaire (TEAQ); Trotter et al., 2018). Here, older adults reported **less positive** attitudes to intimate partner touch, and self-care experiences such as massages (although note that effect sizes were small and did not meet cut-offs stipulated by the authors). These conflicting findings highlight the need for further investigation into touch attitudes across contexts and the adult lifespan.

Similar to age, gender differences in touch attitudes may be limited to certain types of touch. Prior work has identified that women tend to find gentle stroking more pleasant than men (see Russo et al., 2020). Women also report greater comfort with touch in day-to-day social settings (Webb & Peck, 2015). However, research employing the TEAQ (Trotter et al., 2018) showed that men have more positive attitudes towards unfamiliar touch (i.e., from less close acquaintances) than women, and no gender differences were found in relation to intimate touch attitudes. Further research is therefore needed to substantiate these initial context-dependent findings.

Big-five personality traits of agreeableness and openness to experience have been linked to more positive perceptions of touch from a romantic partner (Dorros et al., 2008). In the case of agreeableness, this related to touch to any body region, whereas openness was linked only to differences in non-intimate body regions (e.g., the arms, head, and back). In this study, extraversion did not predict experiences of partner touch. However, extraverted individuals are more motivated to engage in social contact more generally (Wilt & Revelle, 2009). Greater extraversion is also associated with decreased somatosensory cortical activity in response to touch, indicating reduced tactile sensitivity (Schaefer et al., 2012). This evidence suggests that extraversion may be linked to a greater motivation to seek tactile stimulation. With this in mind, the relationship between touch (beyond partner touch) and key domains of personality is worthy of further investigation.

Recent evidence indicates that adult attachment **dimensions** may be a key predictive factor in touch attitudes and experience. **Adult attachment is commonly measured along two dimensions:** attachment anxiety, characterised by difficulty trusting others in relationships and worry about abandonment, and attachment avoidance, characterised by fear of intimacy and preference for maintaining independence in relationships (Brennan et al., 1998). Greater attachment anxiety has been linked to increased effectiveness of pleasant C-tactile afferent (CT) optimal touch (i.e., gentle stroking) in reducing pain. In contrast, attachment avoidance was associated with reduced effectiveness (Krahé et al., 2018). These results indicate that touch may be more welcome for individuals with **greater attachment anxiety**. In line with this, recent research has shown that increased attachment anxiety and avoidance are both associated with a perceived absence of touch. Still, only attachment anxiety predicts a longing for touch (Beltrán et al., 2020), and attachment avoidance may indicate a reduced desire for touch (Jakubiak et al., 2021). It is, therefore, important to consider adult attachment in an analysis of individual variability in touch attitudes.

A growing body of work has also established a connection between touch and body perception. This has linked exteroceptive perceptions of touch with interoception (i.e., the perception of internal bodily sensations). **In a recent framework, measurement of interoception is classified in terms of what is measured (accuracy at detecting bodily signals vs. attention to bodily signals) and how it is measured (objective performance vs. self-reported beliefs) (Murphy et al., 2019b). Greater cardiac interoceptive accuracy on an objective heartbeat counting task has been linked to increased perceived pleasantness of touch (Crucianelli et al., 2018). It has also been argued that perception of CT-optimal touch: slow, gentle stroking which optimally activates C-tactile afferents (Löken et al., 2009), should be considered a form of interoception due to shared anatomical pathways with other aspects of interoceptive processing (Björnsdotter et al., 2010; Craig, 2003) and contribution to the sense of self (e.g. Kirsch et al., 2020). Since self-reported beliefs regarding interoceptive accuracy have been shown to correlate with heartbeat counting task performance (Murphy et al., 2019a), such beliefs may also be expected to relate to touch perception (however, also see Plans et al., 2021).** A closely related aspect of body perception, body image, is also related to perceptions of touch. Anorexia nervosa, a disorder of body image, has been linked to impaired cardiac interoceptive accuracy on a heartbeat counting task, self-reported interoceptive impairments across domains (Pollatos et al., 2008), and reduced pleasantness of touch (Crucianelli et al., 2021). Negative body image feelings and attitudes at a trait level have also been associated with reduced comfort with physical touch (Orbach & Mikulincer, 1998). **This evidence indicates an association between body perception and attitudes and experiences of touch.**

**The current study aims to identify individual difference factors predicting variability in touch attitudes and experiences in a UK healthy adult sample. This is the first investigation of this broad a range of individual difference factors in relation to touch within one study. Such research allows us to identify key predictors of touch attitudes and experience that withstand controlling for other traits, for the first time. Additionally, the variety of touch contexts explored allow an identification of the nuance of touch preference, beyond general liking or disliking. The following predictions were made:**

- 1) Older adults would express more positive attitudes towards touch than younger adults (**Sehlstedt et al., 2016; Webb & Peck, 2015**).
- 2) Women would report more positive attitudes towards touch than men, except for items relating to intimate forms of touch (**Russo et al., 2020; Trotter et al., 2018; Webb & Peck, 2015**).
- 3) Higher trait agreeableness, openness to experience, and extraversion would be associated with more positive attitudes toward touch. Based on previous work (**Dorros et al., 2008**), we predicted associations between agreeableness and all touch attitudes. For openness to experience, this relationship is predicted only for items relating to non-intimate forms of touch. We also expected associations between extraversion and items pertaining to all interpersonal forms of touch (**Schaefer et al., 2012; Wilt & Revelle, 2009**).
- 4) **Greater attachment avoidance** would be associated with less positive attitudes towards touch. **Greater attachment anxiety** would be associated with more positive attitudes towards touch, more specifically, we predicted that the largest effect sizes would be observed for subscales related to intimate touch, which refer to stroking or caressing (i.e., CT-optimal touch) (**Beltrán et al., 2020; Jakubiak et al., 2021; Krahe et al., 2018**).
- 5) Greater **self-reported** interoceptive accuracy would be associated with more positive attitudes towards touch (**Crucianelli et al., 2018; Murphy et al., 2019a**). Specifically, we predicted an association with items relating to intimate touch, which refer to CT-optimal touch (**Björnsdotter et al., 2010; Craig, 2003; Kirsch et al., 2020**).
- 6) Greater body image acceptance would be associated with more positive attitudes towards touch on the STQ and the TEAQ across all subscales (**Orbach & Mikulincer, 1998**).

## 2. Methods

### 2.1 Design

Data for the current study were obtained from The Touch Test (Bowling et al., 2020), an online self-report science engagement survey of touch attitudes and experiences, conducted in collaboration with BBC Radio 4 and Wellcome Collection as part of a Science Communication project. The survey was open from 20/01/2020 until 31/03/2020 and represented a snapshot of perspectives at the beginning of the Covid-19 pandemic. The timeframe covers the period before and the beginning of the national lockdown in the UK, which began on 23/03/2020. The current study was pre-registered on the Open Science Framework (Pre-Registration Link). The pre-registration included the study design, planned stopping rule and minimum sample, inclusion/exclusion criteria, and planned analyses. Deviations from these plans are reported in the manuscript. We report all manipulations, measures, and exclusions here. A full list of measures included in the Touch Test, the current dataset and analysis code are also available on the OSF.

### 2.2 Participants

Our sample size was constrained by the period of data collection, which was set by the BBC. Our stopping criteria was therefore the survey closing date. A priori power calculations were carried out using G\*Power (Faul et al., 2009) and stated in our pre-registration. This dictated a minimum target sample of 240, for a hierarchical regression analysis with 13 predictors, to achieve .95 power to detect a medium effect size of  $f^2 = .15$ . Since we anticipated being able to recruit a large sample for the project, a more stringent alpha of .01 was selected.

Participants were recruited through broadcasts on the BBC and other media. Participants needed to be 18 or over and have access to the internet on a computer, smartphone, or tablet. There were no other restrictions to participation. Participants received no monetary incentives for participation. All participants gave informed consent before starting the survey and were debriefed after completion. Participants had seven days to return and complete the survey once they had started it. For the current study, UK-based participants who reported no disability, long-term condition or impairment, and had completed every item of at least one of the STQ or TEAQ scales, were sampled. One further participant was excluded from the sample as they reported confusion over the STQ items. This resulted in a total participant sample of 15,166 (11,329 female, 3,697 male, 36 non-binary, 51 prefer to self-describe, 47 prefer not to say; age 18-92 years,  $M = 56.1$ ,  $SD = 13.8$ ). There was a disproportionately large number of participants reporting their age as 18 years old ( $n = 105$  compared with  $n = 31$  aged 19). For this reason, regression analyses involving age (section 3.2) were repeated with these participants excluded to account for the possibility that the age they disclosed was inaccurate. Note that the samples used for each analysis vary slightly and are described below.

### 2.3 Measures

The Touch Test survey consisted of several measures. A complete list of measures included in the Touch Test can be found on the OSF. Measures required for this study are described below:

The 20-item Social Touch Questionnaire (STQ; Wilhelm et al., 2001) measuring attitudes towards social touch. Lower scores indicate more positive attitudes towards touch. Responses from a Portuguese sample have previously identified three underlying subscales: Dislike of Physical Touch, Liking of Familiar Physical Touch, and Liking of Public Physical Touch. The authors report convergent validity and adequate internal consistency ( $\alpha = .68 - .75$ ) for the scale (Vieira et al., 2016). Reliability and validity within the current sample are examined below.

12 items were selected from the 57-item Touch Attitudes and Experiences Questionnaire (TEAQ; Trotter et al., 2018), examining touch attitudes and experiences. These items represent six subscales: Childhood Touch, Friends and Family Touch, Current Intimate Touch, Attitude to Intimate Touch, Attitude to Self-Care, and Attitude to Unfamiliar Touch. Scores on each subscale range from 2-10, with higher scores indicating more positive attitudes to touch. Items were selected by taking the top two highest-loading items from each subscale, as reported by Trotter and colleagues. This was done to reduce the overall length of the Touch Test, which contained several measures, with the aim of reducing attrition. Good internal consistency ( $\alpha = .81 - .93$ ) and convergent validity are reported for the full 57-item version of the scale (Trotter et al., 2018). The reliability and validity of the 12-item version in the current sampler are examined below.

The 15-item GSEOP Big Five Inventory (BFI-S; Hahn et al., 2012) comprises five subscales identifying traits Neuroticism, Extraversion, Openness to Experience, Agreeableness and Conscientiousness. Scores on each subscale range from 3-21, with higher scores indicating greater expression of that trait. The authors report that reliability is acceptable for Conscientiousness ( $\alpha = .60$ ), Extraversion ( $\alpha = .76$ ) and Neuroticism ( $\alpha = .66$ ), although weaker for Agreeableness ( $\alpha = .44$ ) and Openness ( $\alpha = .58$ ). In the current sample, internal consistency was slightly higher on all subscales, including Conscientiousness ( $\alpha = .63$ ), Extraversion ( $\alpha = .80$ ) and Neuroticism ( $\alpha = .80$ ), although again lower for Agreeableness ( $\alpha = .52$ ) and Openness ( $\alpha = .67$ ). **Lower  $\alpha$  values may be attributed to the low number of subscale items ( $n = 3$ ) (Ponterotto & Ruckdeschel, 2007; Vaske et al., 2017) while attempting to capture the full breadth of the trait, improving validity. In support of this, correlations with the same five traits on the 240-item NEO-PI-R (Ostendorf & Angleitner, 2004) were significant ( $r = .50 - .75$ ,  $p < .01$ ), demonstrating convergent validity of the scale (Hahn et al., 2012).**

A 12-item version of the Experiences in Close Relationships Questionnaire (ECR-12; Lafontaine et al., 2015) measuring Anxiety and Avoidance in adult attachment. Scores for these two subscales range from 6-42, with high scores indicating greater attachment anxiety or avoidance. Lafontaine and colleagues report good internal consistency ( $\alpha = .79 - .87$ ) and validity. Internal consistency was similar in the current sample ( $\alpha = .70 - .85$ ).

The 21-item Interoceptive Accuracy Scale (IAS; Murphy et al., 2019a) measures self-reported interoceptive accuracy (i.e., **beliefs regarding one's** ability to detect internal bodily sensations accurately). Scores range from 21-105, with higher scores indicating greater interoceptive accuracy. The authors report good internal consistency ( $\alpha = .88$ ) and validity for the scale. Internal consistency was similar in the current sample ( $\alpha = .90$ ).

Five items comprise the English translation of the Body Acceptance subscale of the Dresden Body Image Questionnaire (Scheffers et al., 2017). Subscale scores range between 5-25, with higher scores indicating a greater degree of body acceptance. Excellent internal consistency ( $\alpha = .93$ ) and validity are reported for the scale's Dutch translation. Internal consistency was similar in the current sample ( $\alpha = .92$ ).

**Role of touch in work was measured with a single item: "Do you think that touch plays an important role in your work?", and was included for participants who had previously indicated that they were in employment. Responses were given on a five-point scale from Strongly Disagree – Strongly Agree. Scores then ranged between 1-5, with higher scores indicating that touch played a more important role in that participant's work.**

Completion date was measured in days from the survey launch (20/01/2020) and ranged between 0-72 days. This information was automatically stored by the survey platform when a participant completed the survey. The variable was included to account for the increasing threat of the COVID-19 pandemic between January and March 2020, which may have impacted attitudes and/or experiences of interpersonal touch (Field et al., 2020), and to be consistent with prior work published using this dataset, which also controlled for the completion date. This prior work has found some differences in sleep across the time period (Dueren et al., 2023; Madrid-Valero et al., 2022) and an association between completion date and perceived communication facilitation via touch in medical and healthcare settings (Vafeiadou et al., 2022). However, note that there were not significant associations with other touch-related variables not analysed here (Krahé et al., 2023; Vafeiadou et al., 2022).

#### 2.4 Deviations from pre-registered analysis

Analyses were conducted according to the pre-registered plans. Some changes were made to the original plans for the regression analysis. Firstly, all predictor variables of interest were entered into regression analyses, not only those variables that showed a significant correlation with the outcome variable. This decision was made to control for the variability attributed to those predictors. Secondly, only participants identifying as women or men were included in these regressions, as the number identifying as non-binary was low (0.2% of the total sample).

### 3. Results

Prior to the analysis of individual differences in touch attitudes and experiences, the psychometric properties of the two touch attitudes scales, the STQ (Wilhelm et al., 2001) and a shortened version of the TEAQ (Trotter et al., 2018) were examined. Analyses are presented in Supplementary Results. In summary, confirmatory factor analysis confirmed a three-factor structure for the STQ in this sample; but reduced the 20-item scale to a 17-item scale. Factor analysis on a 12-item version of the TEAQ (Trotter et al., 2018) suggested a five-factor model. Correlations between STQ and TEAQ subscales supported the convergent validity of both scales. We also report a six-factor combined scale created from 27 items from the STQ and TEAQ. Since the six-factor model provided a good fit, and is more parsimonious, this was used to examine our hypotheses. The six factors comprised: Dislike of Physical Touch (DPT,  $\alpha = .89$ ); Childhood Touch (ChT,  $\alpha = .86$ ); Attitude to Intimate Touch (AIT,  $\alpha = .81$ ); Current Intimate Touch (CIT,  $\alpha = .81$ ); Liking of Physical Touch (LPT,  $\alpha = .83$ ); Attitude to Self-Care (ASC,  $\alpha = .56$ ). Internal consistency was good for all subscales except ASC, but note that this subscale contained only 3 items, and Cronbach's  $\alpha$  is commonly lower for scales with a small number of items (Ponterotto & Ruckdeschel, 2007; Vaske et al., 2017). Scores on each subscale ranged from 1-5, with a higher score indicating more positive attitudes and experiences of touch.

For the purposes of the psychometric analyses described above, the dataset was split into two (see Supplementary Results). Analysis of individual differences in touch attitudes and experiences was carried out on the dataset used for the combined CFA (i.e., the second half of the split data). The number of participants indicating non-binary gender was low, and so only male and female participants were included in the following analyses with gender as a predictor variable. Only those participants who completed at least 80% of each scale and subscale were included. Missing items were replaced with the mean of that scale/subscale. In the final sample  $N = 3,682$  (2,795 female, 887 male; age 18-83 years,  $M = 51.9$ ,  $SD = 12.2$ ). Initial data screening identified a number of multivariate outliers based on Mahalanobis distance ( $n = 72$ ). The results presented below include those outliers in the sample, but analyses were also repeated for comparison with outliers removed. This did not change the pattern of results described below. Results are shown in Supplementary Table 7.

Pearson's correlations were first used to examine the relation between demographic and individual difference variables (age, gender, whether touch plays an important role in your work, survey completion date, personality, attachment **dimensions**, interoceptive accuracy and body image acceptance) and with touch attitudes and experiences. The six subscales of our combined touch attitudes scale were used for this purpose (see section 3.1). Correlations are shown in **Table 1**.

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Table 1: Correlations between variables used in regression analyses

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Age	-												
2. Gender	-.06***	-											
3. Role of touch in work	.07***	.10***	-										
4. Completion date	.07***	-.02	-.02	-									
5. Neuroticism	-.16***	.09***	-.05**	-.01	-								
6. Extraversion	.05***	.11***	.18***	-.03	-.32***	-							
7. Openness to experience	.12***	.01	.13***	.01	-.09***	.31***	-						
8. Agreeableness	.06**	.07***	.14***	-.01	-.14***	.17***	.13***	-					
9. Conscientiousness	.12***	.13***	.05**	-.02	-.20***	.19***	.14***	.17***	-				
10. Attachment avoidance	.05**	-.05**	-.11***	.03	.11***	-.30***	-.14***	-.19***	-.11***	-			

11. Attachment anxiety	-.14***	.02	-.01	.01	.38***	-.11***	-.01	-.07***	-.17***	.12***	-		
12. Interoceptive accuracy	.11***	.05**	.08***	-.02	-.07***	.15***	.16***	.09***	.12***	-.12***	-.10***	-	
13. Body image acceptance	.08***	-.10***	.10***	-.01	-.31***	.17***	.12***	.09***	.19***	-.18***	-.29***	.10***	-
14. Dislike of Physical Touch	.15***	-.07***	.24***	.00	-.25***	.41***	.16***	.21***	.05**	-.24***	-.11***	.13***	.17***
15. Childhood Touch	-.17***	.08***	.10***	-.01	-.07***	.22***	.05**	.11***	.01	-.21***	-.05**	.05***	.09***
16. Attitude to Intimate Touch	-.00	-.13***	.11***	.01	-.11***	.23***	.17***	.13***	.01	-.36***	.10***	.11***	.15***
17. Current Intimate Touch	-.14***	-.00	.14***	-.07***	-.07***	.19***	.05**	.08***	.05**	-.43***	-.19***	.08***	.15***
18. Liking of Physical Touch	.13***	.09***	.28***	-.01	-.13***	.49***	.22***	.23***	.07***	-.31***	.04*	.15***	.13***
19. Attitude to Self-Care	-.15***	.32***	.14***	-.04*	-.00	.23***	.15***	.11***	.07***	-.18***	.10***	.11***	.01

\*\*\* $p < .001$ , \*\* $p < .01$ , \* $p < .05$

As shown here, many correlations reached statistical significance despite low effect sizes, due to the large sample. The largest effect sizes between individual difference variables were observed between neuroticism and extraversion ( $r(3680) = -.32, p < .001$ ), neuroticism and attachment anxiety ( $r(3680) = .38, p < .001$ ), neuroticism and body image acceptance ( $r(3680) = -.31, p < .001$ ), and extraversion and openness to experience ( $r(3680) = .31, p < .001$ ). Moderate effect sizes were also observed between extraversion and attachment avoidance ( $r(3680) = -.30, p < .001$ ), and attachment anxiety and body image acceptance ( $r(3680) = -.29, p < .001$ ). Individual difference variables that correlated most consistently with touch attitudes and experience included extraversion and attachment avoidance. The largest effect sizes were observed between extraversion and social touch attitudes, including dislike of physical touch ( $r(3680) = .41, p < .001$ ), and liking of physical touch ( $r(3680) = .49, p < .001$ ). Attachment avoidance correlated most strongly with intimate forms of touch, including attitudes to intimate touch ( $r(3680) = -.36, p < .001$ ) and current intimate touch ( $r(3680) = -.43, p < .001$ ).

Regression analyses were carried out to examine the extent to which individual difference variables of interest predicted touch attitudes and experiences, while controlling for age, gender, completion date, and the role of touch at work. A two-step hierarchical regression analysis was conducted for each of the six touch-related outcomes. Age, gender, completion date, and the role of touch at work were entered in Step 1, while personality, attachment **dimensions**, interoceptive accuracy, or body image acceptance variables were entered in Step 2. All were entered in the same block since we did not have prior hypotheses about the relative importance of each individual difference predictor. The six subscales of our combined touch attitudes scale were used to represent touch attitudes and experiences in the following regression analyses. Results are shown in **Table 2**. Analyses were also repeated using the 20-item STQ and the 12-item TEAQ scales. Results for this are presented in Supplementary Tables 8 and 9. **As with the correlation analyses, many predictors reached significance due to the large sample size. We therefore use effect size as a guide for identifying meaningful predictors (Lakens et al., 2018).**

**Table 2:** Regression analyses examining the relation between individual difference variables and touch attitudes and experiences

Model	Dislike of Physical Touch		Childhood Touch		Attitude to Intimate Touch		Current Intimate Touch		Liking of Physical Touch		Attitude to Self-Care	
	<i>B</i>	$\beta$	<i>B</i>	$\beta$	<i>B</i>	$\beta$	<i>B</i>	$\beta$	<i>B</i>	$\beta$	<i>B</i>	$\beta$
<i>Step 1</i>												
Constant	2.66***		3.79***		4.75***		4.15***		2.18***		2.39***	
Age	0.01***	0.13	-0.02***	-0.17	-0.00	-0.02	-0.02***	-0.15	0.01***	0.12	-0.01***	-0.14
Gender	-0.17***	-0.09	0.18***	0.06	-0.29***	-0.15	-0.09	-0.03	0.16***	0.07	0.73***	0.30
Role of touch in work	0.14***	0.24	0.10***	0.10	0.08***	0.12	0.15***	0.15	0.20***	0.27	0.09***	0.12
Completion date	0.00	-0.00	0.00	0.00	0.00	0.01	-0.00***	-0.06	-0.00	-0.01	-0.00	-0.02
<i>R</i> <sup>2</sup>	0.08***		0.04***		0.03***		0.05***		0.10***		0.14***	
<i>Step 2</i>												
Constant	1.90***		3.34***		3.85***		5.50***		0.05		0.76***	

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Age	0.01***	0.11	-0.02***	-0.18	-0.00	-0.01	-0.02***	-0.15	0.01***	0.12	-0.01***	-0.15
Gender	-0.21***	-0.11	0.14**	0.05	-0.30***	-0.15	-0.15**	-0.05	0.06	0.03	0.69***	0.28
Role of touch in work	0.09***	0.15	0.05**	0.05	0.03**	0.04	0.10***	0.10	0.12***	0.16	0.05***	0.06
Completion date	0.00	0.01	0.00	0.01	0.00	0.02	-0.00**	-0.04	0.00	0.00	-0.00	-0.02
Neuroticism	-0.02***	-0.09	-0.00	-0.01	-0.02***	-0.07	0.02**	0.05	0.00	0.02	-0.01	-0.02
Extraversion	0.07***	0.31	0.05***	0.17	0.02***	0.10	0.03***	0.08	0.10***	0.39	0.03***	0.13
Openness to experience	-0.00	-0.01	-0.01	-0.02	0.02***	0.06	-0.01	-0.02	0.01	0.03	0.03***	0.09
Agreeableness	0.04***	0.11	0.03***	0.06	0.02***	0.05	-0.01	-0.01	0.04***	0.11	0.01*	0.03
Conscientiousness	-0.02***	-0.08	-0.02**	-0.05	-0.01**	-0.05	-0.00	-0.01	-0.02***	-0.05	-0.00	-0.00
Attachment avoidance	-0.01***	-0.11	-0.02***	-0.13	-0.04***	-0.31	-0.07***	-0.37	-0.02***	-0.16	-0.01***	-0.09
Attachment anxiety	0.00	0.00	-0.01	-0.03	0.02***	0.20	-0.03***	-0.16	0.02***	0.13	0.02***	0.13
Interoceptive accuracy	0.00**	0.04	0.00	0.02	0.01***	0.07	0.00	0.02	0.01***	0.05	0.01***	0.06

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Body acceptance	image	0.01*	0.04	0.01*	0.05	0.02***	0.09	0.01*	0.04	0.01**	0.04	0.00	0.02
$\Delta R^2$		0.18***		0.07***		0.19***		0.20***		0.25***		0.07***	

\*\*\* $p < .001$ , \*\* $p < .01$ , \* $p < .05$

Journal Pre-proofs

***Hypothesis 1: Older adults would express more positive attitudes towards touch than younger adults***

**Age differences in touch attitudes and experience** were not consistent across different types of touch. Age was the strongest predictor of the ChT subscale, where older participants were less likely to report experiencing regular childhood touch. Older participants were also less likely to experience current intimate touch and had less positive attitudes to self-care. However, attitudes to general social touch (DPT and LPT subscales) were more positive among older participants (although note these were small effect sizes). There was a larger than expected number of participants in the sample reporting their age as 18 years old. To account for the possibility that the age they disclosed was not accurate, the analysis was repeated with these participants excluded. This did not change the pattern of results involving age. Results are reported in Supplementary Table 10.

***Hypothesis 2: Women would report more positive attitudes towards touch than men, except for items relating to intimate forms of touch***

**Similar to age, gender differences in touch attitudes and experience varied across domains.** Gender was the strongest predictor of self-care, where women showed more positive attitudes than men. However, men showed more positive attitudes towards intimate touch than women. Women did not significantly differ from men on the LPT subscale, after controlling for personality factors, but women did score lower than men on DPT (although note this was a small effect size). This indicates that while men and women do not greatly differ in their general attitudes to social touch, women feel greater discomfort from touch that is unwanted or disliked.

***Hypothesis 3: Higher trait agreeableness, openness to experience, and extraversion, would be associated with more positive attitudes toward touch***

Extraversion was the strongest predictor of the DPT and LPT subscales. This confirms that more extraverted people feel more positive about day-to-day social forms of touch. **Associations between extraversion and intimate touch attitudes and experiences were weaker. Agreeableness and openness to experience also showed only weak associations with touch attitudes and experiences ( $\beta_s \leq .11$ ).**

***Hypothesis 4: Greater attachment avoidance would be associated with less positive, and greater attachment avoidance with more positive attitudes towards touch, with the largest effect sizes related to intimate touch***

**Attachment dimensions most strongly predicted attitudes and experiences of intimate touch.** Those with greater attachment avoidance had less positive attitudes to intimate touch, while those with greater attachment anxiety reported more positive attitudes. Attachment avoidance and anxiety both predicted a reduced likelihood of current intimate touch experiences.

***Hypothesis 5: Greater self-reported interoceptive accuracy would be associated with more positive attitudes towards touch***

Interoceptive accuracy did not strongly predict touch attitudes or experience. It should be noted that five items on the IAS relate to symptoms of COVID-19 (i.e. breathing, cough, temperature, tired/sore muscles and taste). To account for the possibility that increased vigilance towards these body sensations at the time of testing influenced the above results, regression analyses were repeated with these five items excluded from IAS scores (see Supplementary Table 11). The same pattern of results was observed here, showing weak relationships between the IAS and touch outcomes ( $\beta_s \leq .07$ ).

***Hypothesis 6: Greater body image acceptance would be associated with more positive attitudes towards touch***

Body image acceptance did not strongly predict touch attitudes or experiences while controlling for other individual difference factors. While associations with some aspects of touch reached statistical significance (e.g., AIT, LPT subscales), effect sizes were nonetheless small ( $\beta s \leq .09$ ).

#### *Further observations*

Completion date showed only a weak association with touch attitudes and experiences. Participants who felt that touch played an important role in their work also indicated more positive attitudes towards day-to-day social touch (DPT and LPT subscales). Since including the 'Role of touch in work' variable required restricting the participant sample to those in employment, regression analyses were repeated without this variable. The same patterns in touch attitudes and experiences were found to hold in this larger sample, including participants both in and out of work. Results are presented in Supplementary Table 12.

#### 4. Discussion

The present study examined individual differences in touch attitudes and experiences in a large UK sample. **To examine our hypotheses, a six-factor model of touch attitudes and experiences was developed from 27 items from the STQ and TEAQ scales used. Hypotheses were partially supported and are discussed below.**

In line with predictions, older adults expressed more positive attitudes towards day-to-day social touch than younger adults. This finding supports previous research showing that older adults are more comfortable with interpersonal touch (Webb & Peck, 2015). However, in contrast with predictions, our results show that older adults reported less family touch during childhood, less current intimate touch, and less positive attitudes toward tactile self-care. These findings align with those Trotter and colleagues (2018) report. **It cannot be determined from the current results, nor previous work in this area (Sehlstedt et al., 2016; Trotter et al., 2018; Webb & Peck, 2015), whether associations with age are due to changing attitudes and experiences through the lifespan, or to cohort effects. Age differences in recollections of childhood touch may be attributed to changes in parenting practices, where in the 1930s-1950s nurturing touch between parents and children was discouraged (see Montagu, 1995). Current touch attitudes in younger and older adults may also differ due to these formative childhood experiences. Alternatively, attitudes may change over time due to changes in perceptual processing. Prior work reports that older adults perceive gentle touch less intensely than younger adults (Sehlstedt et al., 2016), which may result in an increased desire to seek out interpersonal tactile stimulation in older age. Further research with a longitudinal approach is necessary to examine these potential mechanisms. What we can establish from the current results is that there are age differences in touch attitudes and experience, and that these differences are not uniformly positive or negative; but vary according to the type of touch being explored.**

Gender differences in touch attitudes and experiences also varied across different aspects of touch, in a way that largely aligned with our hypotheses. Gender was the strongest predictor of attitudes to tactile self-care, where women reported more positive attitudes. We expected to see more positive attitudes towards day-to-day social touch in women. However, gender differences on the Liking of Physical Touch subscale were not significant. Across Dislike of Physical Touch, and Attitudes to Intimate Touch, men reported more positive attitudes than women. In previous work, male participants have reported more positive attitudes to unfamiliar touch than female participants (Trotter et al., 2018). This aligns with our findings on the DPT subscale, which includes items related to touch from strangers and unfamiliar people. The current results regarding intimate touch differ from previous work using the TEAQ, which reported no significant gender differences on the AIT subscale and higher scores for women than men on CIT. These contrasting results could reflect differences in the participant sample across the two



studies. The current study involves a larger participant sample with a higher mean age than the previous study (Trotter et al., 2018). Given that older age was related to less frequent intimate touch experiences in this sample, this may partly explain the contrasting results obtained.

In the current results, trait extraversion was a stronger predictor of all touch attitudes and experiences than any other personality trait. In contrast with predictions, this extended to intimate as well as non-intimate forms of touch, although note that effect sizes for intimate touch subscales were smaller. A potential explanation comes from Eysenck's (1963) theory that extraverted individuals are driven to seek external stimulation due to reduced cortical arousal compared to introverts. In support of this theory, neuroimaging research has shown reduced somatosensory cortical activity in response to touch among more extraverted individuals (Schaefer et al., 2012). This suggests that extraverted people may feel touch less intensely, and introverted people feel touch more intensely. As a result, extraverted people may be more likely to seek out interpersonal touch and find it more rewarding than introverts, who are more likely to become fatigued or overwhelmed by touch. **However, note that causal relationships cannot be established from the current study alone, and further research is necessary to directly investigate the mechanisms underlying the observed association between touch attitudes and extraversion.**

Personality traits of agreeableness and openness were less important in predicting touch attitudes and experience than predicted. Although there were positive relationships with some touch variables, in the direction of our hypothesis, effect sizes were small. These results differ from previous work (Dorros et al., 2008), which emphasised the importance of agreeableness and openness in touch attitudes. However, this previous study focused specifically on touch from a romantic partner, whereas the current study did not specify the toucher. Also, the previous work distinguished between intimate and non-intimate body regions, whereas this study asked only about intimate and non-intimate types of touch, without specifying the region. Further work is therefore needed to clarify how personality traits may relate to touch across different body regions and from different touchers.

Results supported the hypothesis that attachment avoidance would be associated with less positive attitudes to touch, and this was seen across all touch subscales. We predicted that the largest effect sizes would be observed for subscales related to intimate touch, which was also observed in these findings. The hypothesis that attachment anxiety would be associated with more positive attitudes to touch was supported for the LPT, ASC and AIT subscales. Attachment anxiety was also associated with a reduced likelihood of current intimate touch. This distinction is important as it indicates that although individuals with **greater attachment anxiety** may crave touch more, they report receiving touch less. This pattern of findings in attachment avoidance and anxiety supports that found by Beltrán and colleagues (2020). The discrepancy between touch that is wanted and touch that is received may be particularly relevant for wellbeing (von Mohr et al., 2021), and so these results have important implications for how attachment anxiety may have a broader psychological impact.

Our hypotheses regarding interoceptive accuracy and body image acceptance were not fully supported. While greater **self-reported** interoceptive accuracy and body image acceptance showed positive relationships with touch attitudes and experience, in the direction of our hypotheses, effect sizes were small in each case. Previous work has linked **objective measures of cardiac** interoceptive accuracy with increased pleasantness of felt touch (Crucianelli et al., 2018), however this was limited to certain velocities of stroking, and so may not extend to other forms of touch. **Further, the current study involved a self-report measure of the participant's beliefs about their interoceptive accuracy (IAS; Murphy et al., 2019a), rather than a performance-based measure such as a heartbeat counting task (e.g., Schandry et al., 1981). IAS scores do not always predict performance-based measures of interoceptive accuracy. An association has been observed with between the IAS and accuracy on a heartbeat-counting task (Murphy et al., 2019a) but not on a phase adjustment task (Plans et al., 2021). Self-reported beliefs and objective performance related to interoceptive accuracy also represent different components of a recent interoception framework (Murphy et al., 2019b). It is perhaps not surprising then, if self-reported and performance-based measures show different relationships with touch. Further work is needed to investigate this distinction.** In terms of body image, a negative body image has been linked to reduced pleasantness and comfort with physical touch in prior work (Crucianelli et al., 2021; Orbach & Mikulincer, 1998), but we did not find strong evidence for such relationships here. We found only weak relationships between body image

acceptance and touch attitudes after controlling for attachment anxiety, which strongly predicted both touch attitudes and body image in this sample (see Table 1). This could perhaps account for the discrepancies observed, as prior work examining the link between body image and touch attitudes did not control for relationship attachment **dimensions**. This highlights the need to account for key factors such as extraversion, **attachment avoidance and anxiety**, in future work examining touch attitudes.

The current study benefitted from a large sample of healthy adults based in the UK. However, it remains to be seen whether the same relationships will be found in populations worldwide, or among individuals with long-term health conditions, disabilities or neurodiversity that may affect their relationship with touch. Previous research has identified that while interpersonal touch is an important aspect of social bonding across cultures, there are cultural differences in touch behaviours and attitudes (Dibiase & Gunnoe, 2004; Suvilehto et al., 2015; Suvilehto et al., 2019). For instance, participants from the UK perceived social touch as more pleasurable than participants from Japan (Suvilehto et al., 2019). The current results therefore cannot be generalised worldwide, and further work is needed to identify whether individual difference variables predict touch attitudes and experiences across cultures in the same way that we have seen here. We also know that certain health conditions and neurodiversity can impact on tactile perception. For example, autistic people can sometimes perceive social touch as more aversive (Kern et al., 2007; Penton et al., 2022), and so again we might see different relationships between touch attitudes and individual difference factors.

**The present results have implications for guiding real-world social interactions, as well as future touch research. A better knowledge of the individuals and situations where touch is welcomed could help to avoid discomfort and improve relationships across public and private settings. For example, in the workplace (Penton et al., 2023), and in adult close relationships where sharing affective touch has been linked to relational, psychological, and physical well-being (Jakubiak & Feeney, 2017). In research, given the association between extraversion and day-to-day touch attitudes, and between attachment dimensions and intimate touch, we encourage researchers to consider these individual difference factors in future touch study designs. The present findings also represent an important first step in guiding wellbeing interventions based on social touch (see Field, 2010). For example, individuals with greater attachment anxiety reported more positive attitudes toward intimate touch, but a relative lack of it. Such individuals might therefore benefit the most from relationship interventions involving touch. Further research is needed to investigate these potential implications for wellbeing, but can be guided by the findings reported here.**

In summary, the present research has demonstrated the importance of individual difference factors such as age, gender, extraversion, and adult attachment dimensions in understanding attitudes and experiences of touch. It is important to note that predictors did not have a uniform relationship with touch attitudes and experiences across different contexts. The findings represent an important step towards understanding individual differences in touch attitudes today.

#### **Author Contributions**

N.B., A.V, and M.B. designed the study and its hypotheses. N.B. and A.V. contributed to data pre-processing and data analysis. All authors contributed to writing the manuscript.

#### **Open Practices**

This study was pre-registered ([Pre-Registration Link](#)), data and materials are open access and available on the [OSF](#).

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## Highlights

- Extraversion predicts more positive attitudes towards everyday social touch.
- Attachment avoidance and anxiety are stronger predictors of intimate touch.
- Interoceptive accuracy and body image only weakly predict touch outcomes.
- Results were obtained from a large and diverse UK healthy adult sample.



- Highlights the interplay between perceiver and context in shaping touch perception.

Journal Pre-proofs