The Perception of CT-optimal and non-optimal Touch in Females with Autistic Traits

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Abstract

Social touch represents an essential aspect of everyday life. A specific form of social touch is CT-optimal touch, a slow and gentle form of touch. While this touch is generally perceived as more pleasant than CT-non-optimal touch, high levels of autistic traits have been linked to decreased pleasantness ratings of CT-optimal touch. The present study aimed to investigate whether these findings could be extended to the observation of CT-touch. A mediation analysis was conducted to test whether the effect of autistic traits in females on the perceived pleasantness of CT-optimal and non-optimal touch could be mediated by empathy. While the mediation effect was not significant, autistic traits had a positive effect on the perceived pleasantness of CT-non-optimal touch and empathy. The results suggest that individuals with high autistic traits perceive observed CT-non-optimal touch as more pleasant than CT-optimal touch and that autistic traits in females are linked to increased empathy. More research is needed to explore the influences of autistic traits on the observation of CT-touch.

Keywords: CT-optimal touch, CT-non-optimal touch, autistic traits, social touch, empathy

The Perception of CT-optimal and non-optimal Touch in Females with Autistic Traits

Human beings are social animals, with social interactions being as essential to human survival as food or sleep (Baumeister & Leary, 1995; Orben et al., 2020). One form of these essential social interactions is social touch. Within social touch, there is a distinction between affective and non-affective touch (Haggarty et al., 2020). Affective touch can be defined as a slow and gentle type of touch with a stroking speed of 1-10 cm/s and ideally at 3cm/s (McGlone et al., 2007). It activates specific mechanosensory C-fibers, more specifically C-tactile (CT) afferents, and is thus also defined as CT-optimal touch (McGlone et al., 2007, 2014). As the CT system is directly related to the neural regions involved in affective and emotional processing (Banerjee et al., 2021; Löken et al., 2009), CT-optimal touch is generally perceived as more pleasant than CT-non-optimal touch which is delivered at 30cm/s (McGlone et al., 2007, 2014). There are, however, individual differences in the pleasantness perception of CT-optimal touch, such as age (Sehlstedt et al., 2016), gender (Croy et al., 2014), longing for touch (Meijer et al., 2022), or the occurrence of a psychological disorder (Croy et al., 2016).

For instance, autism spectrum disorder (ASD), or generally high levels of autistic traits have been linked to decreased pleasantness ratings of CT-optimal touch (Croy et al., 2016). Additionally, research showed decreased neural responses in individuals with high autistic traits when experiencing CT-optimal touch (Haggarty et al., 2020; Voos et al., 2013) as well as a "negative affective touch awareness score", which indicates that CT-non-optimal touch was rated as more pleasant than CT-optimal touch (Croy et al., 2016). Generally, research on ASD has shown that the disorder represents the extreme end of a continuum, with autistic traits being normally distributed in the general population (Baron-Cohen et al., 2001; De Groot & Van Strien, 2017; Peled-Avron & Shamay-Tsoory, 2017). Therefore, it is presumed that ASD and autistic traits have a common aetiology (Lundström, 2012; Robinson

et al., 2011) and that findings on individuals with autistic traits can also be applied to individuals with an ASD diagnosis and vice versa.

Overall, impairments in social abilities are one of the central features of autistic traits (Zhao et al., 2019) and as not only the experience but also the observation of social touch has an impact on social interactions (Willemse et al., 2016) it is important to also research the observation of CT-touch in relation to autistic traits. Generally, research has shown that the observation of CT-optimal touch activates similar brain areas as the experience of the touch (Lee Masson et al., 2018). Further, studies found that in line with research on the experience of CT-optimal touch participants rated videos displaying CT-optimal touch as more pleasant than videos displaying CT-non-optimal touch (Meijer et al., 2022; Willemse et al., 2016). Research on the effect of autistic traits on observed social touch found that participants with high autistic traits had stronger neural responses in brain regions associated with the processing of social and emotional information when presented with human touch compared to control images (Peled-Avron & Shamay-Tsoory, 2017). According to the authors, this is reflective of touch hypervigilance linked to autistic traits (Peled-Avron & Shamay-Tsoory, 2017). In line with other studies, they also found a positive correlation between autistic traits and aversion to social touch (Peled-Avron & Shamay-Tsoory, 2017). Their neural findings, however, contrast with the abovementioned studies that found high levels of autistic traits to be associated with decreased neural responses when experiencing CT-optimal touch. As an explanation, the authors argue for a potential hypo-activation after an initial increased neural response, as for individuals with high autistic traits social touch might elicit anxiety and following inhibited social-emotional processing to prevent dealing with an aversive experience (Peled-Avron & Shamay-Tsoory, 2017). They argue that while their study measured the initial increased neural activity, previous studies have measured the subsequent decreased brain activation (Peled-Avron & Shamay-Tsoory, 2017).

Generally, it becomes evident that there is a lack of research on CT-non-optimal touch, as most studies only research the effect of CT-optimal touch. Therefore, the current study is going to research the effect of autistic traits by comparing the perception of CT-optimal and CT-non-optimal touch.

A factor that could influence this relationship is empathy. Empathy can be defined as "the individual's ability to feel or understand the actual or expected emotional state of others" (Georgiou et al., 2019). Generally, studies have found a negative relationship between autistic traits and empathy (Georgiou et al., 2019; Zhao et al., 2019), with some describing decreased empathy as one of the central aspects of autistic traits (Broekhof et al., 2015; Georgiou et al., 2019; Lombardo et al., 2007). Furthermore, empathy has been described as vital for successful social interactions (Georgiou et al., 2019; Hoffman, 2008; Riva et al., 2018). Research on the effect of empathy on social touch has found that empathy modulated both behavioural and neural reactions to observing social touch, with individuals with higher empathy scoring social touch as more pleasant (Peled-Avron et al., 2016). The authors argued that highly empathic individuals rated social touch as more pleasant as empathy has been found to motivate prosocial behaviour (Decety & Michalska, 2010). Thus, a decreased motivation towards prosocial behaviour of the individuals with lower empathic traits led to lower ratings of social touch (Peled-Avron et al., 2016). Additionally, research has suggested a link between empathy and observed social touch through mirror neurons, which are activated when performing and observing an action (Farina et al., 2020) and have also been linked to empathy (Corradini & Antonietti, 2013). Consequently, the current study aims to research whether empathy can mediate the relationship between autistic traits and CT-optimal and non-optimal touch.

Overall, research on the relationship between autistic traits and observed CT-touch is needed since there is a lack of research on this topic, especially on the perception of CT-non-

optimal touch. As interpersonal touch is an essential aspect of social interactions and social-emotional development, researching the ways in which specific forms of social touch are processed by different individuals is important (Peled-Avron & Shamay-Tsoory, 2017). Further, research on characteristics associated with high autistic traits such as empathy can be used for early detection of high autistic traits and can as such aid in the earlier diagnosis of ASD.

In conclusion, the research question of this study is: Does empathy have a mediating effect on the relationship between autistic traits and the perceived pleasantness of CT-optimal and non-optimal touch? This will be tested in form of a mediation analysis. It is hypothesised that higher levels of autistic traits will be related to decreased pleasantness ratings of CT-optimal touch, based on the findings by Croy et al. (2016) and Peled-Avron & Shamay-Tsoory (2017). For CT-non-optimal touch it is hypothesised that higher levels of autistic traits will be linked to higher pleasantness scores, in line with findings by Croy et al. (2016). It is theorised that in line with studies by Georgiou et al. (2019), Peled-Avron et al. (2016) and Zhao et al. (2019) this relationship will be mediated by empathy, with higher levels of autistic traits being related to lower levels of empathy and consequently leading to decreased perceived pleasantness for both types of touch. In line with previous research on the topic age, longing for touch and a previous ASD diagnosis will be included as control variables (Meijer et al., 2022; Sehlstedt et al., 2016).

Further, the current research is going to study this effect solely in women since previous studies have found gender differences in empathy (Rueckert & Naybar, 2008; Schulte-Rüther et al., 2008) and autistic traits (Hull et al., 2017a; Rubenstein et al., 2015; Young et al., 2018). Thus, only women will be included to not affect the sensitivity of the statistical analyses. Additionally, a multitude of research on autistic traits has been done on

men and there is a lack of research on autistic traits in women (Hull et al., 2017a; Lockwood Estrin et al., 2020).

Method

Participants

An a priori power analysis was conducted to establish the necessary sample size. Using the software tool "G*Power" (Faul et al., 2007), the calculation disclosed a required sample size of 85 participants to achieve a power of 80% in detecting a medium-sized effect. 123 participants were recruited, with 44 having to be removed due to not meeting the study's criteria. These included not identifying as female, not consenting, or not completing the study. The final data set consisted of a total of 79 participants. As the final number of participants was less than the number calculated in the power analysis, a post hoc power analysis was calculated. Again using "G*Power", the analysis revealed an approximate power of 77% to detect a medium-sized effect (Faul et al., 2007).

The majority of the participants were from Europe (88.6%) and the age range was 18 to 61, with a mean of 26.19 (SD = 9.72). Respondents were contacted via social media or recruited using the Social and Behavioural Sciences research participation system of Utrecht University, where they were compensated with 0.5 PPU for participating in the study.

Measures

Longing for Touch

Longing for touch was measured using a 2-item questionnaire in line with previous research ("*Currently I would prefer to be touched by others …*" and "*Currently I would prefer to touch others …*"; Meijer et al., 2022). Respondents rated their answers on a scale from 0 to 100, with 0 referring to a preference to be touched or touch others less and 100 to preferring to be touched or touch others more. The ratings were calculated into a mean score,

with a higher score indicating more longing for touch. A Cronbach's alpha of .87 indicated high internal reliability.

Perceived Pleasantness of Touch Videos

To quantify the perceived pleasantness of observing touch, participants were shown two 10s videos. Both videos displayed a hand stroking a forearm, either at CT-optimal (3 cm/s) or CT-non-optimal (30 cm/s) speed. After each clip respondents completed a 5-item touch perception questionnaire ("*1. How did the videoclip make you feel? 2. How do you think the person giving the touch would rate the touch? 3. How do you think the person being touched would rate the touch? 4. How would you rate the touch? 5. How much would you like to be touched like that?*"; Meijer et al., 2022). Answers were ranked on a scale from 0 to 100, with 0 indicating *very unpleasant* and 100 indicating *very pleasant*, whereas in the fifth question, 0 corresponded to *not at all* and 100 to *very much*. Again, the ratings were computed into a mean score, with higher scores signifying increased pleasantness ratings. Calculating Cronbach's alpha revealed high internal consistency, with a score of .92 for CT-optimal and .93 for CT-non-optimal touch.

Autistic Traits

Autistic traits were measured using the 28-item Autism Spectrum Quotient Short (AQ-S; Hoekstra et al., 2011). Participants used a 4-point Likert scale ranging from 1 = *definitely agree* to 4 = *definitely disagree* to indicate how strongly they thought statements applied to them. The statements described situations characteristic of high levels of autistic traits, such as "I find it hard to make new friends.". The total score consisted of a sum score, with a higher score indicating increased levels of autistic traits. Previous studies identified the instrument as valid, with high sensitivity and specificity (.94 and .91; Nobili et al., 2020), and reliable with Cronbach's alphas between .77 and .86 (Hoekstra et al., 2008). For the current data set a calculated Cronbach's alpha of .82 also showed high internal reliability.

Empathy

The Toronto Empathy Questionnaire (TEQ) was used to measure empathy (Spreng et al., 2009). Using a 5-point Likert scale, ranging from 1 = *never* to 5 = *always*, respondents were asked to read 16 statements and rate how frequently they feel or act in the manner described. An example statement is: "I enjoy making other people feel better.". The ratings were calculated into a sum score, with a higher score reflecting higher empathy. Previous research confirmed the instrument as valid, as it was shown to correlate with the Empathy Quotient ($r = 0.80$, $p < .001$; Spreng et al., 2009) and internally reliable with a Cronbach's alpha of .87 (Spreng et al., 2009). This study calculated a Cronbach's alpha of .79, displaying high consistency.

Procedure

The study was presented to participants as an online questionnaire in Qualtrics. Respondents were asked to read an information sheet advertising the study as researching observed touch and provide informed consent. After, participants were asked for their demographic information which included age, gender, demographic origin, and previous ASD diagnosis. Participants were also asked for other demographics which are not included in this study. Next, participants' levels of longing for touch were measured. Afterwards, participants were shown two videos displaying CT-optimal and CT-non-optimal touch. The order in which participants saw the videos was randomised for each individual. After each video, respondents were asked to rate the perceived pleasantness of the observed touch. Next, participants' autistic traits and empathy levels were measured. Further measurements were included that will, however, not be analysed in this study. Lastly, respondents were thanked for their participation.

The estimated completion time was 15 minutes. The order of the questions was randomised for every participant to avoid bias and no IP addresses were recorded to ensure

anonymity. The study received ethical approval from the Ethical Review Board of the Faculty of Social and Behavioural Sciences of Utrecht University (protocol number 22-1932).

Statistical Analyses

The statistical analyses were conducted using IBM SPSS Statistics. The dataset was examined for missing values and possible outliers (± 3SD from the mean). All assumptions necessary for a multiple linear regression were tested, including linearity, normality, homoscedasticity, independence of errors, and absence of multicollinearity. Descriptive statistics were calculated to display frequency distributions, mean, median, and standard deviation. Cronbach's alpha was computed to test the internal reliability of the scales. Multiple regressions were conducted to test the effect of the control variables as well as a paired t-test to determine whether the two types of touch were perceived differently. As only one participant indicated a previous ASD diagnosis the variable was disregarded from the analyses. Two mediation analyses were run using model 4 of PROCESS macro for SPSS. For the first analysis, autistic traits served as the independent variable, empathy as the mediator and the perceived pleasantness of CT-optimal touch as the dependent variable. The second regression analysis included the same mediator and independent variable but the perceived pleasantness of CT-non-optimal touch as the dependent variable.

Results

Descriptive Statistics

Descriptive Statistics were calculated and can be found in Table 1. The histogram and p-p-plot disclosed all variables to be normally distributed. Collinearity diagnostics revealed no indication for multicollinearity, as VIF values were far below 10. The scatterplot showed a normal distribution of the residuals and supported the assumption of homoscedasticity. A Durbin-Watson test was calculated to ensure independency of the residuals and disclosed a

value close to 2. Cook's distance was calculated to check for multivariate outliers, and there were no significant outliers detected as no values were greater than 1.

Table 1

Descriptive Statistics and Correlations

		n	*M*	*Median*	*SD*	*Range*	1	2	3	4	5
Perceived Pleasantness	1. CT-optimal Touch	76	57.84	59.16	19.20	77.96	—				
	2. CT-non-optimal Touch	76	26.60	24.52	16.98	72.95	-.04	—			
3. AQ-S		67	76.73	76.00	10.54	68.00	-.01	.25*	—		
4. TEQ		71	47.99	49.00	6.78	32.00	.04	-.12	.36**	—	
5. Longing for Touch		75	57.45	58.99	20.66	94.35	.17	.14	.36**	.23	—

Note. *p < 0.05, ** p < 0.01

Preliminary Analysis

To ensure the touches were perceived differently, a paired t-test was conducted. The results showed a significant difference between the perceived pleasantness of CT-optimal (M = 57.84; SD = 19.21) and CT-non-optimal touch (M = 26.60; SD = 16.98); $t(75) = 10.41$, $p < .001$.

To test whether the suggested covariates affected the outcome variables, multiple regressions were run. There was no effect of longing for touch on the perceived pleasantness of CT-optimal touch, $t(74) = 1.35$, $p = .181$, or CT-non-optimal touch, $t(74) = 1.40$, $p = .166$. Age did also not have an effect on the perceived pleasantness of CT-optimal touch, $t(74) =$

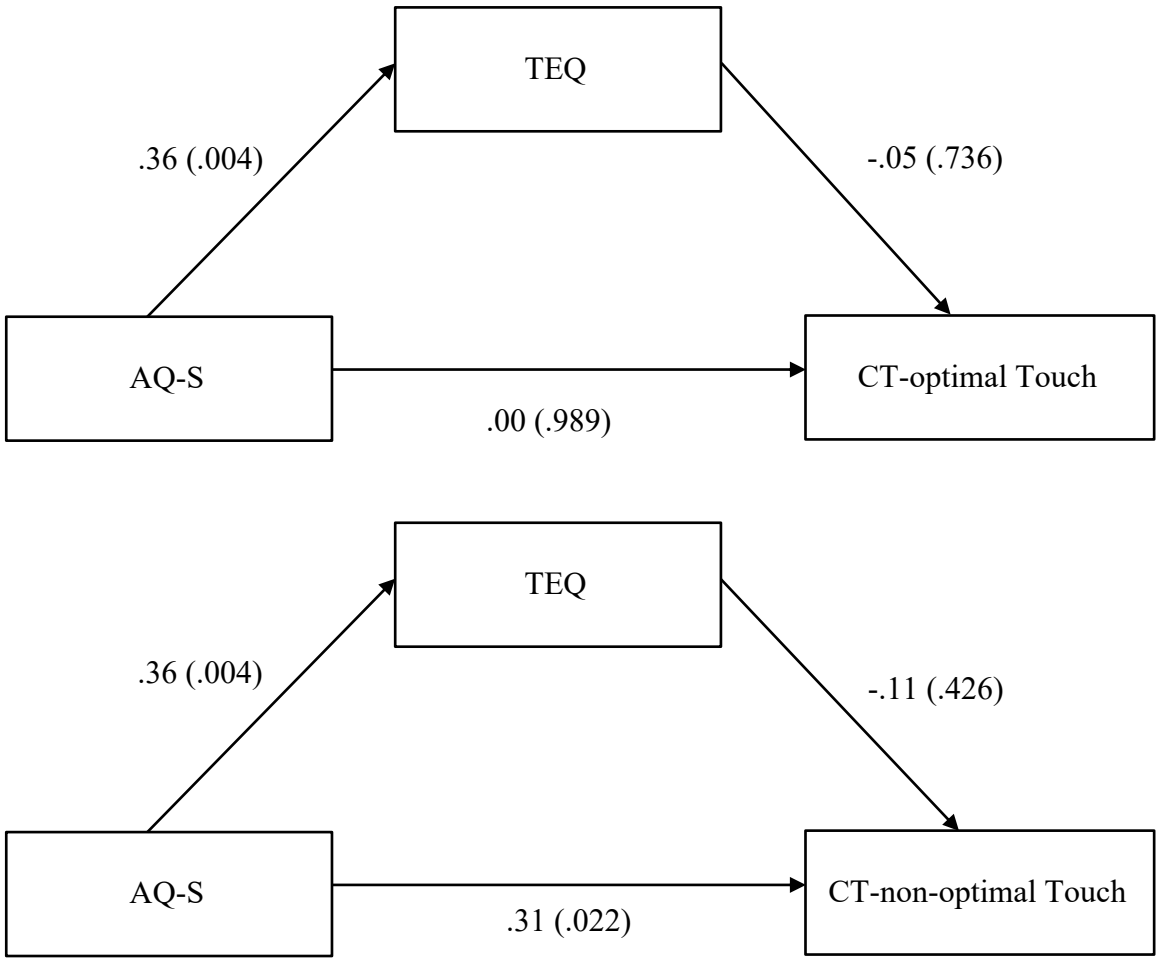
.79, p = .435, CT-non-optimal touch, $t(74)$ = -1.20, p = .233 or empathy, $t(70)$ = .27, p = .788. Therefore, the variables were not included as controls in the main analyses.

Mediation Analysis

Two mediation analyses were conducted to test whether the relationship between autistic traits and the perceived pleasantness of CT-optimal and CT-non-optimal touch could be mediated by empathy. A visualisation of both mediation models can be found in Figure 1.

Figure 1

Results of the Mediation Analyses



Note. The model includes the standardised coefficients *ß* with corresponding significance levels p in brackets.

The first analysis included the perceived pleasantness of CT-optimal touch as the outcome variable. The model was not a significant predictor for the perceived pleasantness of

CT-optimal touch, $F(1, 63) = .01$, $p = .909$, $R^2 = .000$. It was found that the total effect was not significant, $\beta = -.02$, $t(63) = -.12$, $p = .909$. The regression of autistic traits on empathy was significant, $\beta = .36$, $t(63) = 3.03$, $p = .004$. Keeping autistic traits constant, empathy did not have a significant effect on the perceived pleasantness of CT-optimal touch, $\beta = -.05$, $t(62) = -.34$, $p = .736$. The direct effect was not significant, $\beta = .00$, $t(62) = .01$, $p = .989$. Looking at the indirect effect of autistic traits on the perceived pleasantness of CT-optimal touch through empathy revealed a non-significant effect, $b = -.03$, 95%BCa CI [-0.20, 0.15].

In the second mediation analysis, the perceived pleasantness of CT-non-optimal touch served as the outcome variable. The model was a significant predictor for the perceived pleasantness of CT-non-optimal touch, $F(1, 63) = 4.88$, $p = .031$, $R^2 = 0.07$. The total effect was significant, $\beta = .27$, $t(63) = 2.21$, $p = .031$. The regression of autistic traits on empathy was also significant, $\beta = .36$, $t(63) = 3.03$, $p = .004$. Empathy did not have a significant effect on the perceived pleasantness of CT-non-optimal touch, $\beta = -.11$, $t(62) = -.80$, $p = .426$. The direct effect was significant, $\beta = .361$, $t(62) = 2.35$, $p = .022$. Examining the indirect effect of autistic traits on the perceived pleasantness of CT-non-optimal touch through empathy disclosed a non-significant effect, $b = -.06$ 95%BCa CI [-0.19, 0.09].

Discussion

The aim of the current study was to research the effect of autistic traits on the perception of CT-optimal and non-optimal touch. It was hypothesised that higher levels of autistic traits would be related to decreased pleasantness ratings for observed CT-optimal touch, but increased pleasantness ratings for observed CT-non-optimal touch. Further, it was theorised that this relationship would be mediated by empathy, with higher levels of autistic traits being related to lower levels of empathy which in turn would lead to lower pleasantness ratings for both forms of touch.

The findings only partially confirmed the hypotheses. There was no significant effect of autistic traits on the perceived pleasantness of CT-optimal touch. Further, there was no significant effect of empathy on either CT-optimal or CT-non-optimal touch and, thus, no significant mediation effect. However, contrary to expectations, autistic traits were related to increased perceived pleasantness of CT-non-optimal touch. Also not in line with the hypotheses was the significant effect of autistic traits on empathy, with higher levels of autistic traits being related to higher levels of empathy in both models. These findings will be discussed in further detail below.

While the current study did not find support for the proposed mediation effect, some of the findings are nevertheless in line with previous research. Firstly, as hypothesised, there was a positive effect of autistic traits on the perceived pleasantness of CT-non-optimal touch. This is in line with findings by Croy et al. (2016) who found a "negative affective touch awareness" for individuals with high autistic traits. Similar to the findings in the present study, participants scoring high on autistic traits rated CT-non-optimal touch as more pleasant than CT-optimal touch. While the authors do not offer an explanation for the effect, a possibility is a difference in neural activation. Research has described touch with a stroking speed of 30cm/s, as used in this study, as Aβ-targeted touch (Haggarty et al., 2020). Aβ-afferent nerves (Aβs) are responsible for the skin's sensory discriminative functions compared to the affective function of CT-optimal touch (Haggarty et al., 2020). Thus, a possible explanation is that females with autistic traits perceive Aβ-targeted touch as more pleasant than CT-optimal touch. Further research is needed to test this hypothesis by comparing the neural activity of individuals with autistic traits when experiencing Aβ-targeted and CT-targeted touch.

Contrary to expectations was the non-significant effect of autistic traits on the perceived pleasantness of CT-optimal touch. This is opposed to previous research which

found a link between autistic traits and decreased pleasantness (Croy et al., 2016). It is important to point out the differences in sensory modalities, as the abovementioned research analysed the *experience* of CT-optimal touch whereas the present study focused on the *observation* of this touch. However, previous research suggested that the experience and the observation of CT-optimal touch are perceived similarly (Croy et al., 2016; Meijer et al., 2022; Willemse et al., 2016). A possible explanation is that the aversion to CT-optimal touch for individuals with high autistic traits does not present itself when observing CT-optimal touch. This could be related to an impaired theory of mind (ToM) which has been linked to autistic traits (Lee Masson et al., 2018; Stewart et al., 2020). ToM has not only been defined as perspective taking but also as the awareness of inner states, including emotions (Hughes & Leekam, 2004). Thus, an impaired ToM might lead to a decreased awareness of the negative emotions related to CT-optimal touch which becomes apparent when observing touch as it requires higher levels of ToM than experiencing touch. However, further research is needed to test whether in ToM negative emotions are more impaired than positive emotions as there was no influence of this sensory difference on the effect of autistic traits on observed CT-non-optimal touch.

Further, while the present study found an effect of autistic traits on empathy, the direction of the effect is contrary to expectations as in line with previous studies a negative effect was expected (Georgiou et al., 2019; Zhao et al., 2019). However, the current findings showed that higher autistic traits were linked to increased empathy. A possible explanation is that while previous research did not differentiate between genders (Georgiou et al., 2019; Zhao et al., 2019), the present study only included female participants. Generally, studies have found higher empathy in females compared to males, but this effect was not researched in women with autistic traits (Baron-Cohen & Wheelwright, 2004; Rueckert & Naybar, 2008). However, research on autistic females has found high levels of camouflaging (Hull et

al., 2020; Livingston et al., 2019; Tierney et al., 2016), which refers to the utilisation of strategies in social situations to mask autistic traits (Hull et al., 2017b; Lai et al., 2011). This compensation behaviour has also been linked to non-diagnosed individuals with high autistic traits (Livingston et al., 2020). Further, research has found one form of camouflaging to be the development of empathic skills (Tierney et al., 2016). Therefore, a possible explanation for the present findings could be that participants with high autistic traits reported increased empathy as a form of social camouflaging. More research, however, is needed to test the influence of social camouflaging on empathy in females with autistic traits.

Lastly, it was hypothesised that lower empathy would be related to lower pleasantness ratings for both forms of touch. However, no significant effect was found. This is in contrast with previous research showing that individuals with higher empathy scored observed social touch as more pleasant (Peled-Avron et al., 2016). One possible explanation is that while Peled-Avron et al. (2016) utilised pictures to display the various types of social touch, the present study used videos. Thus, by using pictures the forms of touch were possibly not perceived as CT-optimal or non-optimal touch, as both are defined by a stroking element which could not be depicted with fixed-images. The authors themselves argue that due to the use of pictures, participants may or may not assume movement (Peled-Avron et al., 2016). Therefore, the forms of touch in the study by Peled-Avron et al. (2016) might not be comparable to the touch utilised in this research and thus empathy might not be related to CT-optimal and non-optimal touch. Further research is needed to test this hypothesis and analyse whether CT-afferents are also activated when the touch is displayed on pictures.

As there was no effect of empathy on either form of touch, consequently the mediation effect could not be significant (Hayes & Rockwood, 2017). Thus, the relationship between autistic traits and the perceived pleasantness of CT-optimal and non-optimal touch might be better explained by a different mediator. For instance, future research could include

hypersensitivity or theory of mind which have been linked to autistic traits and social touch (McGlone et al., 2014; Stewart et al., 2020; Ujiie & Takahashi, 2022).

Overall, the present study adds to the body of literature on observed touch and the specifics of social impairments related to autistic traits while narrowing the gap in literature on autistic traits in females. As it was shown that higher autistic traits were related to increased pleasantness ratings of observed CT-non-optimal touch, the study's findings can be used for the early detection of females with high autistic traits. This could be done by including videos of CT-optimal and non-optimal touch as well as perceived pleasantness ratings in screening instruments for ASD. As research has shown that ASD in females is often identified late, misdiagnosed, or overlooked (Giarelli et al., 2010; Loomes et al., 2017; Mandy & Tchanturia, 2015), the present findings could aid in making screening instruments more applicable to females by including characteristics that have been shown to be related to autistic traits in females.

There are, however, limitations to the research design that might have influenced the results. Firstly, while the study only included female participants it did not use a measurement instrument targeted at detecting autistic traits in females. This is because, to the author's knowledge, there is no such instrument. Thus, as, as mentioned above, there are gender differences in autistic traits (Hull et al., 2017a; Rubenstein et al., 2015; Young et al., 2018) and most clinical tools are designed for the male phenotype (Lockwood Estrin et al., 2020), there is the need to develop an instrument to measure autistic traits in females. The use of an instrument not designed for measuring the female phenotype might have measured autistic traits incorrectly in this study and thus biased the results. Additionally, it is possible that the non-significant mediation effect was due to the influence of undetected variables that should have been controlled for (Hayes & Rockwood, 2017). Therefore, future studies should include other covariates, for instance, prosocial behaviour, which has been linked to autistic

traits and CT-optimal touch (Boyd et al., 2011; Portnova et al., 2020; Zhao et al., 2019). Future research could analyse hypersensitivity as a mediator while controlling for prosocial behaviour. Furthermore, the present study only researched observed CT-optimal and non-optimal touch and did not compare it to the experience of these forms of touch. Future research should include both the observation and the experience of touch to adequately analyse the differences.

Nevertheless, the current findings still provide important insights due to the study's methodological strengths. High Cronbach's alphas were calculated for all measurements, revealing high reliability. Further, the focus on females allowed the study to make reliable proclamations about autistic traits in females. Additionally, both CT-optimal and non-optimal touch were well conceptualised as a manipulation check showed a significant difference in pleasantness ratings for both videos.

In conclusion, the present research investigated the effect of autistic traits on the perceived pleasantness of CT-optimal and non-optimal touch while analysing empathy as a possible mediator. Whereas no significant mediation effect was found, there was a significant positive effect of autistic traits on empathy as well as a significant positive effect of autistic traits on the perceived pleasantness of CT-non-optimal touch. Overall, the study adds to the growing body of literature on the observation of CT-optimal and non-optimal touch, as well as autistic traits in females. While more research is needed, the findings of the current study provide new insights into the processing of CT-optimal and non-optimal touch in healthy individuals with clinical traits. Additionally, the findings can be used to stimulate the development of new screening instruments for the female phenotype of ASD.

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