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ORIGINAL PAPER

Individual Differences in Conversational Self-Touch Frequency Correlate with State Anxiety

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Abstract
Self-touches are frequently performed in everyday conversations. Although self-touch appears to relate to itching skin sensations or grooming needs, there has been cumulating evidence that the production of self-touch is associated with emotional regulation and cognitive control. Yet, individuals vary greatly in how often they perform self-touch in conversations. The present study investigated how individuals' anxiety levels (i.e., state and trait anxiety), personality traits (i.e., neuroticism, agreeableness, extraversion, conscientiousness, and openness), and inhibition ability can contribute to the individual differences in conversational self-touch frequency. Spontaneous self-touch was elicited from a hundred and twenty-seven participants in an animated cartoon description task and a social dilemma-solving task. Results from the correlational analysis showed that the self-touch frequency was significantly positively related to individuals' state and trait anxiety levels and their neuroticism scores but was significantly negatively related to their agreeableness scores. However, when all predictor variables were entered simultaneously into a multiple regression analysis, the result showed that the state anxiety score was the only significant predictor of the conversational self-touch frequency. This result is consistent with the proposal that self-touch behaviors are produced to regulate negative emotional states such as anxiety and stress. The findings of the present study shed new light on the function of self-touch behaviors in conversations, and highlight the importance of using a broad correlational approach with simultaneous consideration of multiple predictors in future research aiming to understand individual differences in self-touch behaviors.

Keywords Self-touch · Anxiety · Personality · Inhibition · Individual differences

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Self-touch refers to the single or bi-manual movements that involve rubbing, scratching, or grooming one's own body or adornments (e.g., clothes and accessories; Harrigan, 1985; Harrigan et al., 1987). Self-ouch movements are frequently performed in everyday

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conversations. Unlike hand gestures or instrumental acts, self-touch movements are not related to the meanings of speech or any ongoing task, and they are produced with little or no conscious awareness (Ekman & Friesen, 1969; Freedman et al., 1972). Traditionally, the production of self-touch was considered to satisfy merely personal needs. For example, scratching skin is commonly viewed to relieve sensory stimulation (e.g., itch) whereas, combing hair and readjusting clothes or glasses are thought to satisfy grooming needs (Ekman & Friesen, 1969).

Nonetheless, there has been cumulating evidence that self-touch is associated with negative affect and anxiety, and is involved in psychological regulation such as self-calming and self-stabilization. Research has shown that people self-touched more in stressful situations and reported less negative emotional load after the production of self-touch (e.g., Grunwald et al., 2014; Mohiyeddini & Semple, 2013). Besides, it has also been proposed that the production of self-touch is associated with attentional focusing and inhibition of distractions (e.g., Barroso & Feld, 1986; Barroso et al., 1980; Mueller et al., 2019). Finally, research has found a relationship between self-touch and specific personality traits such as neuroticism (e.g., Mohiyeddini et al., 2015) and agreeableness (e.g., Schut et al., 2014, 2018).

Although self-touch is a ubiquitous behavior in everyday conversation, there are substantial individual differences in the frequency of conversational self-touch movements (Ruggieri et al., 1980; Wild et al., 1983). To date, little is known about the factors that contribute to such individual differences. To fill this knowledge gap, the present study aimed to investigate how individuals' anxiety state, personality, and inhibition ability may explain the individual variations in the frequency of conversational self-touch movements during face-to-face communication. In the sections below, we explain how we derived the predictor variables (i.e., anxiety, personality, and inhibition ability) from previous research. It should be noted that the present study is correlational in nature; its results cannot test the causal links between the predictor variables and self-touch production. To do so, one has to experimentally manipulate either the predictor variables or the self-touch production (e.g., by forbidding hand movement) and observe the effect on the other. However, findings from the present study might provide further insight into the function of self-touch. This is because if experimental evidence suggests that self-touch can facilitate emotion regulation and inhibition control, one might expect that people with a higher level of anxiety or lower inhibition ability would produce more conversational self-touch movements to help them reduce their anxiety level and to focus their attention when they speak, compared to those with lower anxiety level or higher inhibition ability.

Self-Touch and Anxiety

There has been plenty of evidence that self-touch is associated with anxiety (e.g., Ekman & Friesen, 1972; Grunwald et al., 2014; Harrigan, 1985; Troisi et al., 2000). Self-touch is proposed to cope with unpleasant emotions such as anxiety, stress, discomfort, and hostility (e.g., Ekman & Friesen, 1969, 1974; Ruggieri et al., 1982). Hence, people tend to produce more self-touch during more intense emotional states (e.g., Freedman & Bucci, 1981; Heaven & McBrayer, 2000). For example, Heaven et al. (2002) found that participants self-touched significantly more frequently after listening to and discussing the texts about leeches (stimulus presumed to induce anxiety) than about canaries (stimulus presumed not to induce any anxiety), with an average difference of 2.6 self-touches per minute between the two conditions. However, given that participants' anxiety was not measured directly in

these studies, it is unclear whether conversational self-touch was caused by anxiety or other emotional states, such as psychological discomfort and arousal (Morry & Enzle, 1994; Reinecke et al., 2020).

Recent behavioral and neurophysiological studies have provided further support to the direct relationship between anxiety and self-touch (e.g., Grunwald et al., 2014; Mohiyeddini & Semple, 2013). Mohiyeddini and Semple (2013) assessed the self-reported stress from a sample of 42 healthy adult men before and after a stress-induced test (i.e., the Trier Social Stress Test), and quantified participants' self-touch during the test. It was found that self-touch rate was positively correlated with state anxiety ($r = 0.326$), but not correlated with trait anxiety. Furthermore, the self-touch rate was negatively correlated with the experience of stress ($r = -0.360$), as if those who produced more self-touch movements in the stress-induced test showed a larger decrease in self-reported stress. These results suggested that self-touch is related to the process of stress regulation. Furthermore, neurophysiological studies also gave support to the hypothesis that self-touch reflects the process of stress regulation. For example, Grunwald et al. (2014) measured the cortical power changes before and after facial self-touch in a memory task. They found that theta power dramatically decreased just before each self-touch and returned to the baseline level after a self-touch. This result supports the assumption that self-touch is associated with negative emotion regulation, as theta activity has been consistently found to be an indicator of processing negative stimuli and regulating negative emotions (e.g., Aftanas et al., 2001; Ertl et al., 2013). Nevertheless, the EEG study of Grunwald et al. (2014) could not specify the type of emotion regulation associated with self-touch. The present study aimed to directly examine the correlation between self-touch movements and anxiety during face-to-face communication.

Self-Touch and Personality

The Big Five Inventory (John et al., 1991) is one of the most representative and widely used questionnaires to measure personality. Additionally, the Big Five Inventory is claimed to account for most of the personality-based variations in behaviors such as grade point average, alcohol consumption, and tobacco consumption (e.g. Paunonen, 2003). However, only a limited number of studies have investigated the relationship between personality and self-touch behavior.

Self-Touch and Neuroticism

Neuroticism is a trait disposition that predisposes individuals with a greater level of it to experience negative affect such as anxiety, depression, worry, and fear (Leary & Hoyle, 2009). People high in neuroticism appear to have difficulty in monitoring emotion and interpreting ordinary situations as threatening while people low in neuroticism appear to be more confident and emotionally stable (Widiger & Oltmanns, 2017). Previous studies consistently showed people with a higher level of neuroticism were more susceptible to anxiety (Jorm et al., 2000). Considering the evidence that anxiety is positively correlated with self-touch (e.g., Grunwald et al., 2014; Mohiyeddini & Semple, 2013), it can be conjectured that people with a higher level of neuroticism may self-touch more. Indeed, a recent study found that neuroticism was positively correlated with the self-touch rate ($r = 0.280$) during a stress-induced test (i.e., the Trier Social Stress Test; Mohiyeddini et al., 2015).

Self-Touch and Agreeableness

Agreeableness is a trait disposition related to one's pro-sociality behavior such as altruism, sympathy, warmth, consideration, and cooperation during social interaction (Hostetter et al., 2012). People with high agreeableness care about interpersonal relationships and maintain harmony with others, whereas those with low agreeableness appear to be cold, hostile, and lack empathy (Hostetter et al., 2012; Nettle, 2009). There has been evidence that agreeableness is related to self-touch behavior. For example, Schut et al. (2018) found that when atopic dermatitis patients were exposed to videos that induced itching and scratching, 38% of the variance of increase in scratch movements could be predicted by agreeableness. Additionally, patients with a higher level of agreeableness reported more concern about how others think about them and described scratching as rude, aggressive, and less agreeable. These findings were successfully replicated in patients with psoriasis (another type of skin disease that is accompanied by intense itchiness; Schut et al., 2015). Considering that self-touch movements are associated with negative impressions (Harrigan et al., 1986, 1991), we expected people with higher agreeableness to produce less self-touch movements.

Self-Touch and Extraversion, Conscientiousness and Openness

We found two studies examining the relationship between extraversion and self-touch, and both studies failed to show any significant relationship between extraversion and self-touch (Campbell & Rushton, 1978; Riggio et al., 1990). Furthermore, to our knowledge, there have been no studies examining the relationships between self-touch and conscientiousness or openness. Thus, we do not make any predictions regarding the relationships between these three personalities and self-touch frequency.

Self-Touch and Inhibition

Apart from anxiety and personality traits, the production of self-touch has also been proposed to associate with individuals' cognitive functions, especially the ability to actively suppress responses to the distracting stimulus that is irrelevant to the current task (MacLeod, 2007). For example, Barroso et al. (1978) found that participants spent a significantly higher proportion of time on self-touch when performing an inhibition task (i.e., a Stroop task where participants needed to name the ink color of the word "red" printed with blue ink) than when performing a non-inhibition task (i.e., a water-jar problem where participants needed to obtain a certain amount of water by using two different sizes of containers), with an average difference of 22.53% between the two conditions. The authors proposed that self-touch reflects the process of preventing internal or external distractions from interfering with communication. The finding was successfully replicated by Barroso et al. (1980) who showed further that those who self-touched more performed better in the inhibition task. Thus, the present study expected a negative relationship between inhibition ability and the self-touch frequency. Instead of the Stroop task used in Barroso et al. (1978), the current study used the Flanker task (Eriksen & Eriksen, 1974) to measure individuals' inhibition ability. This is because the Flanker task does not require participants to respond verbally; therefore, it can purely

measure the inhibition function without the confounding of verbal (dis)fluency effect on their inhibition performance.

Present Study

The present study aimed to investigate how anxiety (i.e., state and trait anxiety), personality traits (i.e., agreeableness, extraversion, neuroticism, conscientiousness, and openness), and inhibition ability may contribute to the production of conversational self-touch during face-to-face communication.

Self-touch was elicited by two everyday life communication tasks, including an animated cartoon description task and a social dilemma-solving task. The dependent variable was the conversational self-touch frequency calculated by using the self-touch duration divided by the verbal response duration. The predictor variables included state and trait anxiety levels, personality traits (i.e., neuroticism, agreeableness, extroversion, conscientiousness, and openness), and inhibition ability.

Correlational and multiple regression analyses were conducted to examine the relationships between the conversational self-touch frequency and the predictor variables. We expected the conversational self-touch frequency to be positively correlated with individuals' anxiety and neuroticism levels, but to be negatively correlated with their agreeableness level and inhibition ability. In contrast, we did not expect the conversational self-touch frequency to be related to extraversion, conscientiousness, and openness.

Method

Participants

A hundred and twenty-seven participants (125 were native English speakers and 2 were fluent English speakers) aged 17 to 39 ($M = 21.48$, $SD = 3.55$) took part in this study. There were 33 male and 94 female participants. Participants were recruited from the University of Aberdeen and the Aberdeenshire region. They were compensated with course credits or with a £7 monetary reward. The experiment has received ethical approval from the Psychology Ethics Committee at the University of Aberdeen (PEC/3710/2017/9).

Self-Touch Elicitation Tasks

Self-touch was elicited by two communication tasks. In the animated cartoon description task, participants watched two 1–2 min cartoon clips. The first cartoon was from the Tweety and Sylvester series involving Sylvester chasing Tweety, but ended up with Sylvester being thrown into a bowling alley by Tweety using a bowling ball. The second cartoon was from the German cartoon series "Die Sendung mit der Maus" involving a mouse and an elephant exercising on a pull-up bar, but then the elephant broke the pull-up bar, which was fixed by a magician with his hat. Each cartoon clip was played once, and the computer screen turned blank after each clip. Participants were asked to describe what they had just seen to the experimenter. In the social dilemma-solving task, participants first read two social dilemma stories. The first story was about a character who found it hard to allocate her time to her old friends and her new friend who did not get along with her old friends. The second story was about a character who

struggled to decide whether she should tell her best friend Amy that she noticed Amy's boyfriend had been getting very close to another girl. There was no time limit in reading the stories. After reading each story, participants explained how they would solve the social dilemma and what they thought the other characters would think or feel about their decision. The written story remained on the screen until the participants finished their explanations. The order of the two tasks was counterbalanced across participants, but the order of the items within each task remained fixed. The two communication tasks lasted for approximately 10–15 min. Self-touch was not mentioned in the instructions for the two self-touch elicitation tasks. Participants were asked to face the experimenter when narrating the cartoon clips and responding to the social dilemmas. The experimenter sat opposite the participant with eye contact throughout their responses. The participants' responses were recorded by a Canon HD camera (25 frames per second) placed next to the experimenter (see Fig. 1).

Anxiety Questionnaire

The State-Trait Anxiety Inventory for Adults (STAI-AD) was used to measure participants' self-reported anxiety (Spielberger et al., 1983). The first part of the STAI-AD has 20 items assessing the state anxiety (e.g., 'I feel calm', 'I am worried', and 'I feel pleasant'), which reflects participants' anxiety in the present moment. The second part of the STAI-AD has 20 items assessing the trait anxiety (e.g., 'I feel nervous and restless', 'I make decisions easily', and 'I feel satisfied with myself'), which reflects participants' general and long-standing anxiety quality. For the state anxiety items, participants had to rate the extent to which the items described themselves *at this moment* on a 4-point scale ranging (1 = *not at all*, 2 = *somewhat*, 3 = *moderately so*, 4 = *very much so*). For the trait anxiety items, participants had to rate the degree to which the statements described how they *generally feel* on a 4-point scale (1 = *almost never*, 2 = *sometimes*, 3 = *often*, 4 = *almost always*). Overall, the higher scores on STAI-AD indicated greater anxiety.

Fig. 1 Screenshot of video recording to demonstrate the setting of the self-touch elicitation tasks

Personality Questionnaire

The Big Five Inventory (BFI) is a 44-item self-reported questionnaire that is used to assess personality traits, including neuroticism (e.g., "is emotionally stable, not easily upset"), agreeableness (e.g., "likes to cooperate with others"), extraversion (e.g., "is talkative"), conscientiousness (e.g., "is a reliable worker"), and openness (e.g., "prefers work that is routine"; John & Srivastava, 1999). Each personality trait is assessed by 8 to 10 items. Participants were instructed to rate the extent to which each statement describes themselves on a 5-point Likert scale (1 = *disagree strongly*, 2 = *disagree a little*, 3 = *neither agree nor disagree*, 4 = *agree a little*, 5 = *agree strongly*). Overall, the higher average score of a trait indicated a higher possession of that trait.

Inhibition Task

Participants' inhibition ability was assessed by a Flanker task (Eriksen & Eriksen, 1974). Participants were asked to indicate the direction (left or right) of the central arrow by pressing the correspondent arrow buttons on the keyboard. In the congruent condition, the central target arrow and the surrounding flanker arrows pointed in the same direction (e.g., '> > > > > >'). In the incongruent condition, the central target arrow and the surrounding flanker arrows pointed in the opposite direction (e.g., '> > < > > >'). In the neutral condition, the central target arrow was surrounded by dashes (e.g., '– < –'). Each condition consisted of 24 trials that were presented randomly. There were six practice trials prior to the main experiment. Each trial started with a fixation cross presented for 250 ms, followed by a 1000 ms blank screen. Subsequently, the central target arrow and the surrounding flankers/dashes were presented until participants responded. Participants were told to respond as quickly and accurately as possible. If the participant did not respond within 1,500 ms, the trial was terminated and the next trial started. The inter-trial interval was 1000 ms. The Flanker effect was measured by subtracting the reaction time of the congruent condition from the reaction time of the incongruent condition. The larger flanker effect indicated a lower inhibition control ability.

Other Tasks

Participants also completed a digit span task (Wechsler, 1939), a visual pattern task (Della Sala et al., 1997), a mental rotation task (Shepard & Metzler, 1971) and the Empathy Quotient (Baron-Cohen & Wheelwright, 2004). These tasks were designed to investigate individual differences in gesture production.

Procedure

Participants were tested individually in a quiet room. The whole testing session lasted for approximately an hour. After filling out the general consent form and the audio–video recording consent form, participants completed the two self-touch elicitation tasks. Participants then completed four cognitive tasks in a fixed order: the digit span task, the visual pattern task, the mental rotation task, and the flanker task. Each cognitive task took approximately 5 to 10 min. Finally, participants filled out three questionnaires in a fixed

order: the Big Five Inventory, the State-Trait Anxiety Inventory for Adults, and the Empathy Quotient. Each questionnaire took approximately 5 min to complete. Participants were debriefed and thanked at the end of the experiment.

Self-Touch Coding

Self-touch was coded in the ELAN software (Version 6.2, 2021), which is a tool for annotating audio and video recording and allows frame-by-frame analysis. Self-touches, also called "self-adaptors" (Ekman & Friesen, 1969) or “body-focused movements” (Freedman et al., 1972), refer to the hand movements that touch one’s own body or its adornments. The onset of a self-touch was defined as the moment when the hand(s) contacted one’s own body or adornment, and the offset of a self-touch was defined as the moment when the self-touch movements stopped and the hand(s) returned to a resting position or when a new gesture, practical action, or self-touch is initiated. Self-touch was coded when participants narrated the cartoon stories or explained their solutions to social dilemmas. The self-touch frequency was calculated as the total self-touch time divided by the total narration/explanation time.

Intercoder Reliability

To establish the intercoder reliability of the self-touch coding, a second trained coder independently identified all self-touches from 26 randomly selected participants. The proportions of the self-touches checked by the second coder out of all self-touches identified by the first coder were 27%. The intercoder agreement was measured by calculating the correlations of the self-touch frequency in each trial between the primary and secondary coders. The correlations were 95%.

Data Screening

Considering that correlational and regression analyses are sensitive to extreme outliers, any value that was outside three standard deviations from the mean was trimmed to three standard deviations from the mean. This method has been used in Miyake et al. (2000) and Chu et al. (2014). This trimming procedure was chosen to prevent losing participants with extreme values while ensuring the extreme values would not bias the results. In total, this trimming procedure only affected less than 1% of all observations.

Results

Table 1 presents the descriptive statistics of conversational self-touches, which include the mean number of self-touches per participant, the percentage of trials that contained at least one self-touch, and the mean frequency of self-touches (total self-touch time divided by the total narration/explanation time).

Table 2 summarizes the descriptive statistics for the State-Trait Anxiety Inventory for Adults (STAI-AD), the Big Five Inventory (BFI), and the Flanker task performance.

We collapsed the self-touch frequency data across the two communication tasks for two reasons. First, the self-touch frequencies were significantly correlated across the two tasks,

Table 1 Descriptive statistics for conversational self-touch

Type of self-touch	Cartoon narration task			Social-dilemma-solving task		
	Mean number (*SD, Skewness, Kurtosis*)	Percentage of trials	Mean frequency (*SD, Skewness, Kurtosis*)	Mean number (*SD, Skewness, Kurtosis*)	Percentage of trials	Mean frequency (*SD, Skewness, Kurtosis*)
Conversational self-touch	5.48 (4.84, 1.30, 2.21)	81. 50%	24.50% (0.25, 1.11, 0.59)	14.52 (9.61, 0.57,− 0.43)	95.67%	36.40% (0.25, 0.24,− 1.09)

Table 2 Descriptive statistics for STAI-AD, BFI, and Flanker effect

		Mean	*SD*	Minimum	Maximum
STAI-AD	State anxiety (out of 80)	39	9.43	23	68
	Trait anxiety (out of 80)	47	10.30	23	70
BFI	Neuroticism (out of 40)	27	6.32	9	39
	Agreeableness (out of 45)	35	5.20	14	45
	Extraversion (out of 40)	26	6.08	9	38
	Conscientiousness (out of 45)	30	5.71	16	41
	Openness (out of 50)	35	6.12	18	50
Flanker effect (incongruent–congruent RT in ms)		131.26	67.96	9.42	455.02

$r\,(125) = 0.549$, $p < 0.001$. Second, the present study did not aim to examine the differences between the cartoon narration task and the social dilemma-solving task. Instead, the two tasks together can better represent everyday conversation topics, which include both concrete and abstract ones.

Table 3 shows the correlations between all predictor variables and the dependent variable. The conversational self-touch frequency was significantly positively correlated with state and trait anxiety scores, and the neuroticism score, but was significantly negatively correlated with the agreeableness score. As the conversational self-touch frequency was correlated with more than one predictor variable and some of these predictor variables were correlated with each other, multiple regression analysis was conducted to examine the independent contribution of each predictor variable to the frequency of conversational self-touch.

Our sample size was adequate for multiple regression analysis with eight predictor variables (Green, 1991; Harris, 1985; Van Voorhis & Morgan, 2007). The Durbin–Watson test showed that the assumption of independence of errors was met as the Durbin–Watson value was 1.97, and it fell within the range of 1–3. Furthermore, multicollinearity was checked by examining correlations between predictor variables and the variance inflation

Table 3 Pearson correlation coefficients for the predicator and dependent variables ($N = 127$)

	1	2	3	4	5	6	7	8
1. State anxiety	–							
2. Trait anxiety	.62***	–						
3. Neuroticism	.44***	.78***	–					
4. Agreeableness	−.20*	−.23**	−.17	–				
5. Extraversion	−.29**	−.43***	−.36***	.17	–			
6. Conscientiousness	−.28**	−.30**	−.24**	.24**	.14	–		
7. Openness	.03	−.001	.05	.07	.06	−.02	–	
8. Flanker effect	−.18*	−.19*	−.18*	.13	.10	.17	.09	–
9. Conversational self-touch frequency	.32***	.27**	.24**	−.21*	−.14	.02	.01	−.12

*$p < .05$; **$p < .01$; ***$p < .001$

factor (VIF), which assesses how much the variance of an estimated regression coefficient increases if the predictors are correlated. Since no inter-predictor correlations were larger than 0.8 and the VIF values were well below 10, the assumption of no multicollinearity was met (Field, 2009). Cook's distance analysis was used to measure the overall influence of a single case on the regression model. As no value exceeded 1, there were no outlier cases that needed to be excluded from the regression analysis (Cook & Weisberg, 1982). Finally, visual inspection of residuals scatterplots between the dependent variable and errors of predictors indicated that the assumptions of normality, linearity, and homoscedasticity were met in the regression analysis (Field, 2009).

Using forced entry method, the multiple regression model was significant, $R^2 = 16\%$, F (8, 118) = 2.85, $p = 0.006$. The contributions of the predictor variables are shown in Table 4. Results showed that state anxiety was the only significant predictor of the conversational self-touch frequency, which suggested that people with higher state anxiety produced more conversational self-touches.

It is worth noting that the State-Trait Anxiety Inventory was not completed immediately after the self-touch elicitation tasks, but rather it was completed after the cognitive tasks. Since participants were told at the beginning of the experiment that they would be completing cognitive tasks, which can be anxiety-provoking, after the conversation tasks (i.e., the self-touch elicitation tasks), some participants might have experienced more state anxiety than others during the self-touch elicitation tasks simply because they felt more anxious about the following cognitive tasks than others. If conversational self-touches produced in the self-elicitation tasks were associated with the state anxiety induced by knowing of the existence of cognitive tasks, then we should expect a significant positive correlation between self-touch frequency in the cognitive tasks and the state anxiety score as well. Therefore, we examined the relationship between the self-touch frequency in the cognitive tasks (i.e., the digit span and the visual pattern tasks) and state anxiety.

Three participants' digit span tasks and two participants' visual pattern tasks were not recorded due to technical errors. Table 5 presents the descriptive statistics of self-touches in the two cognitive tasks, which include the mean number of self-touches per participant, the mean percentage of trials that contained at least one self-touch, and the mean frequency of self-touches (total self-touch time divided by the total recall time).

We collapsed the self-touch frequency data across the two cognitive tasks, as the self-touch frequencies were significantly correlated across the two tasks, r (121) = 0.53, $p < 0.001$. Table 6 presents the correlations among the self-touch frequency in the cognitive and the communication tasks and all the predictor variables. The cognitive self-touch

Table 4 Summary of the multiple regression analysis with the co-speech self-touch frequency as the dependent variable

Predictors	*SE B*	*t*
State anxiety	.27	2.47*
Trait anxiety	.02	0.09
Neuroticism	.11	.81
Agreeableness	−.17	−1.85
Extraversion	<.01	−.08
Conscientiousness	.17	1.90
Openness	.02	−.187
Flanker effect	−.06	−.67

*$p < .05$

Table 5 Descriptive statistics for cognitive self-touch

Type of self-touch	Digit span task			Visual pattern task		
	Mean number (*SD, Skewness, Kurtosis*)	Mean percentage of trials (*SD, Skewness, Kurtosis*)	Mean frequency (*SD, Skewness, Kurtosis*)	Mean number (*SD, Skewness, Kurtosis*)	Mean percentage of trials (*SD, Skewness, Kurtosis*)	Mean frequency (*SD, Skewness, Kurtosis*)
Cognitive self-touch	19.02 (5.20,– 0.31,– 1.11)	55.44% (0.33,– 0.19,– 1.29)	31.03% (0.28, 0.76,– 0.43)	22.50 (4.31,– 1.64,– 0.43)	50.91% (0.31, 0.01,– 1.25)	19.93% (0.21, 1.38, 1.27)

Table 6 Pearson correlation coefficients for the predicator and dependent variables ($N = 127$)

	1	2	3	4	5	6	7	8	9
1. State anxiety	–								
2. Trait anxiety	.62***	–							
3. Neuroticism	.44***	.78***	–						
4. Agreeableness	− .20*	− .23**	− .17	–					
5. Extraversion	− .29**	− .43***	− .36***	.17	–				
6. Conscientiousness	− .28**	− .30**	− .24**	.24**	.14	–			
7. Openness	.03	− .001	.05	.07	.06	− .02	–		
8. Flanker effect	− .18*	− .19*	− .18*	.13	.10	.17	.09	–	
9. Conversational self-touch frequency	.32***	.27**	.24**	− .21*	− .14	.02	.01	− .12	–
10. Cognitive self-touch frequency ($N = 126$)	− .02	− .05	− .04	.06	.12	.10	− .01	.04	.003

*$p < .05$; **$p < .01$; ***$p < .001$

frequency did not correlate with any predictor variables or with the conversational self-touch. The results showed that there was no significant relationship between the self-touch frequency in the cognitive tasks and state anxiety. In addition, none of the other predictor variables significantly correlated with the self-touch frequency in the cognitive tasks. Finally, there was no significant correlation between the self-touch frequency in the self-touch elicitation tasks and the cognitive tasks. Taken together, it seems that self-touch was more likely to be associated with momentary anxiety induced by the conversation itself. Detailed descriptions of the digit span and the visual pattern tasks and the self-touch coding in these two tasks can be found in the Appendix Supplemental Materials.

Discussion

The present study aimed to investigate the sources of individual differences in self-touch frequency during face-to-face communication. The predictor variables were participants' state and trait anxiety levels, personality traits, and inhibition ability. The dependent variable was participants' self-touch frequency when they narrated animated cartoon clips and solved social dilemmas. Results showed that speakers varied substantially in the frequency of their self-touches (see Table 1). The correlational analysis showed that the self-touch frequency was significantly positively related to individuals' state and trait anxiety levels and their neuroticism scores but was significantly negatively related to their agreeableness scores. However, when all predictor variables were entered simultaneously into a multiple regression analysis, the result showed that the state anxiety score was the only significant predictor of the conversational self-touch frequency.

Self-Touch and Anxiety

Previous studies have shown that self-touch co-occurs with negative affect and functions as anxiety regulation during conversations. For example, people produced more self-touch when talking about topics that induce anxiety (e.g., leeches) than when talking about topics

that do not induce anxiety (e.g., canaries; Heaven & McBrayer, 2000; Heaven et al., 2002). Although the present study was not designed to test the function of conversational self-touch, the positive correlations between anxiety measures and the conversational self-touch frequency were consistent with the proposal that the self-touch can reduce the anxiety level during conversations.

Furthermore, previous studies on self-touch and anxiety rarely specifically discussed how state and trait anxiety might be related to self-touch differently. In the present study, although the correlational analysis showed that both the state and the trait anxiety were significantly positively related to the conversational self-touch frequency, the result of multiple regression revealed that only the state anxiety, but not the trait anxiety, was the significant predictor of the conversational self-touch frequency. This suggests that conversational self-touch was more likely to be associated with momentary anxiety induced by the conversation task itself than to be associated with individuals' general tendency to attend to and experience anxiety in daily life.

Although the results revealed a positive relationship between state anxiety and conversational self-touch frequency, the underlying mechanism of this link remains unclear. The fact that state anxiety only predicted the self-touch frequency in the conversation tasks but not in the cognitive tasks suggests that conversational self-touch was most likely to be related to the state anxiety induced by the conversation task itself rather than anxiety related to the cognitive tasks or the general setups of the experiment. We speculate that there are at least two possible sources of anxiety in the conversation task. First, some participants might be more anxious than others when talking to the experimenter, who was a stranger to them. It has been found that when speaking to a stranger, socially anxious individuals exhibited more anxious behaviors, such as behaving fearfully or timidly, expressing insecurity, and avoiding interaction, than socially comfortable individuals (Creed & Funder, 1998). According to the anxiety/uncertainty management theory (Gudykunst & Nishida, 2001), anxiety and uncertainty are the main factors that affect the effectiveness of communication with strangers. Second, some participants might be more anxious than others when speaking in front of a video camera. It has been shown that video recording can cause anxiety (e.g., Gardner et al., 1992; Steinberg & Horwitz, 1986). To better understand the underlying mechanism underlying the link between state anxiety and conversation self-touch, future studies should narrow down the possible sources of state anxiety in face-to-face conversations. For example, one could manipulate the familiarity of the conversation partner or manipulate the visibility of the video camera to examine their effects on the state anxiety level and the relationship between anxiety and self-touch.

Self-Touch and Personality

Although correlational analysis showed that neuroticism and agreeableness scores were significantly correlated with the conversational self-touch frequency, neither of them turned out to be significant predictors of the conversational self-touch frequency in the multiple regression analysis. Possible explanations are provided in the following sections.

Self-Touch and Neuroticism

Neuroticism predisposes individuals to experience negative affect and has been consistently demonstrated to be a dominant predictor of trait anxiety (e.g., Jorm et al., 2000; Leary & Hoyle, 2009). The previous study observed that men who were high in neuroticism

produced significantly more displacement behavior (mostly self-touch movements) during a stress-induced test (i.e., simulated job interview) as compared to those low in neuroticism (Mohiyeddini et al., 2015). However, in the present study, although the neuroticism score was significantly positively correlated with the conversational self-touch frequency in the correlational analysis, the neuroticism score was not a significant predictor of conversational self-touch frequency in the multiple regression analysis. One possible explanation for the inconsistent findings might be that only male participants took part in the study of Mohiyeddini et al. (2015), whereas in the present study, 74% of all participants were females. When analyzing the male and female participants separately, the neuroticism score was indeed only significantly positively correlated with conversational self-touch frequency within the male participants, $r\,(31) = 0.39$, $p = 0.027$, but not in the female participants, $r\,(92) = 0.15$, $p = 0.152$. Unfortunately, the male sample size was not large enough to carry out the multiple regression analysis to test the independent contribution of neuroticism to the conversational self-touch frequency.

Self-Touch and Agreeableness

Given that self-touch is associated with negative impressions such as anxiety (e.g., Grunwald et al., 2014), we expected that people with a higher level of agreeableness would produce fewer self-touch movements to avoid a negative impression from their listener. However, although the agreeableness score was significantly negatively correlated with conversational self-touch frequency in the correlational analysis, the agreeableness score was not a significant predictor of the conversational self-touch frequency in the multiple regression analysis. Previous studies on patients who experienced intense itchiness and were urged to relieve itch by scratching showed that a higher level of agreeableness predicted fewer scratchings in these patients (Schut et al., 2015, 2018). However, it is worth noting that the significant relationship between agreeableness and self-touch frequency in the studies of Schut et al., (2015, 2018) was only found in the patient group but not in the healthy control group. Thus, it was not surprising that agreeableness was not a significant predictor of conversational self-touch frequency in the present study, as a majority of the participants in the current study are healthy younger adults. Patients with intense itchiness might have a stronger need to suppress impulsive self-touch movements to avoid embarrassment and negative impressions than healthy adults do; therefore, agreeableness was only related to the self-touch frequency in the patient group.

Self-Touch and Extraversion, Conscientiousness, and Openness

The present study failed to show any significant relationships between conversational self-touch frequency and extraversion, conscientiousness, and openness, which implied that these personalities traits may not be relevant to the production of self-touch.

Self-Touch and Inhibition

Contrary to our expectation, no significant correlation was found between inhibition and conversational self-touch frequency in either the correlational or the multiple regression analyses. Previous studies observed that people self-touched more in the Stroop interference task than the color-naming task (i.e., the control condition of the Stroop task), and

those who self-touched more in the Stroop interference task performed significantly better (Barroso et al., 1978, 1980). Hence, it was suggested that self-touch may function as inhibitory regulation. The inconsistent findings between the present study and previous studies may result from the different cognitive processes involved in the two tasks. In the interference condition of the Stroop task, participants need to name the ink color of a color word (e.g., "Green") that is printed in a different ink color (e.g., red color) where the ink color mismatches the color word (e.g., "GREEN"). Thus, the Stroop task mainly measures the inhibition ability during speech production when multiple meanings from word and ink color compete for resources. In contrast, the Flanker task is a nonverbal task and measures the inhibition ability that involves ignoring highly salient visual cues that distract from the target (e.g., having to respond "right" when the target is surrounded by arrows all pointing to the left). Thus, conversational self-touch production may be only related to the inhibition process involved in the speech production process, and this might be the reason why we failed to find a relationship between the conversational self-touch frequency and the inhibition ability measured by the nonverbal Flanker task.

Furthermore, in addition to the Flanker task and the Stroop task, both of which measure attentional inhibition (i.e., resist interference from distracting stimuli), there are other inhibition tasks, such as the go-no-go task and the stop-signal task, that measure response inhibition (i.e., suppress a prepotent motor response; Nigg, 2000). Although attentional inhibition and response inhibition are moderately positively correlated, there has been clear evidence that these two types of inhibition controls are independent constructs (Tiego et al., 2018). To our knowledge, no empirical research has examined the relationship between self-touch production and response inhibition. Future studies should address this issue.

Limitations and Future Research

There are some limitations of the present study and future research should address these issues. First, the present study only relied on subjective self-reported questionnaires. Although anxiety was associated with physiological symptoms, individuals with a higher level of anxiety may overestimate their physiological arousal. For example, a study found that youth high in anxiety tended to exaggerate their perceived physiological arousal (e.g., heart rate and sweaty palms) and reported experiencing a higher level of anxiety as compared to the objective measured arousal level through skin conductive reactivity. Accordingly, participants' self-reported anxiety levels may be largely dependent on their subjective interpretation of the physiological arousal (Miers et al., 2011). To increase the reliability of the present results, future studies may use both subjective (i.e., the State-Trait Anxiety Inventory for Adults) and objective measurements such as skin conductance to assess participants' anxiety levels in real-time and avoid misinterpretation of physical responses.

Second, future studies could test a more diverse group of participants. In the current study, only younger native English speakers with a mean age of 21 years old were included. A large number of studies have shown that anxiety decreases with age (e.g., Kessler et al., 2005; Teachman & Gordon, 2009). For instance, the prevalence of anxiety disorders in adults aged 60 or older was 15.3%, whereas those younger than 60 years old ranged between 30 and 35%, which indicated that anxiety decreased with age (Kessler et al., 2005). In addition, there are also cultural differences in self-touch production. For example, Hatta and Dimond (1984) found that British participants produced significantly more self-touches (17 to 50 times per hour) than Japanese participants (7 to 14 times per hour) while

listening to a lecture. This cross-cultural difference might reflect different social norms in self-touch behavior between the two cultures. Since self-touch is thought to be an important cue for self-awareness (i.e., a conscious representation of one's own body; Gallagher & Meltzoff, 1996), it is possible that people from individualist cultures (e.g., British) have stronger self-awareness and therefore produce more self-touch than people from collectivist cultures (e.g., Japanese). Hence, whether our results would generalize to older speakers or speakers with different cultural backgrounds remains to be established.

Finally, although the positive correlation between the state anxiety level and the conversational self-touch frequency found in the current study was consistent with the view that self-touch serves to regulate negative emotions such as anxiety, it is not possible to draw causal conclusions from a correlational study. To understand the causal relationship between anxiety and self-touch, one has to experimentally manipulate either the anxiety level or the self-touch production (e.g., by forbidding hand movement) and observe the effect on the other. In such research, it is important to distinguish the origins or causes of self-touch and the function of self-touch. To understand the origin of self-touch, it is necessary to manipulate the anxiety level in a speech production task and test whether the self-touch frequency increases with the anxiety level. In contrast, to understand the functions of self-touch, it is necessary to manipulate the availability of self-touch (e.g., allowed vs. prohibited) and then observed the effect on participants' anxiety levels. It is important to note that people self-touch more when they are more anxious does not necessarily mean that self-touch can reduce the anxiety level during conversations.

Conclusion

The present study investigated how individuals' anxiety, personality traits, and inhibition ability contribute to individual differences in the conversational self-touch frequency during face-to-face communication. We found that the state anxiety level was a significant and positive predictor of the conversational self-touch frequency. However, personality and inhibition were not significant predictors of the conversational self-touch frequency. The findings of the current study show that a broad correlational approach with simultaneous consideration of multiple predictors is likely to be useful in future research aiming to understand individual differences in self-touch behaviors.

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Code Availability Not applicable.

Declarations

Conflict of interest The authors declares that they have no conflict of interest or competing interests.

Consent to Participate Written informed consent was obtained from all participants before the experiment.

Consent for Publication Written informed consent was obtained from all participants before the experiment.

Ethical Approval The study has received ethical approval from the Psychology Ethics Committee at the University of Aberdeen (PEC/3710/2017/9).

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