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Measuring differences in social touch: Development and validation of the short Touch Experiences and Attitudes Questionnaire (TEAQ-s)

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ABSTRACT

Interpersonal touch is an essential part of human social life, impacting emotional and physical well-being. Variations in touch behavior and perception can be assessed by the *Touch Experiences and Attitudes Questionnaire (TEAQ)*. Although comprehensive, the TEAQ appears lengthy with 57 items, limiting its usability for large surveys. Therefore, we developed a refined and shortened version of 16 items, tested in Germany and France. This manuscript presents three studies. In the first, we created the TEAQ-s ($n = 313$). In the second and third, we validated the TEAQ-s in German ($n = 383$) and French ($n = 327$), respectively. The resulting TEAQ-s showed strong reliability (Cronbach's alpha: 0.86 to 0.87; test-retest correlation: $r = 0.85$) and validity consistent with the original version. Analyses also revealed that being in a relationship, relationship satisfaction, mental health, and body appreciation were positively related to touch experiences and attitudes. A four-factor structure (4 items per scale) was confirmed through factor analysis. Final subscales are *attitude to friendly touch*, *current intimate touch*, *childhood touch*, and *attitude to intimate touch*. We hope that the TEAQ-s serves as a valuable tool for researchers in the field of touch and beyond, offering well-founded items in an efficient format.

1. Introduction

Touch plays a crucial role in human interactions (Gallace & Spence, 2010). Positive effects on stress-buffering, social bonding, and feelings of comfort have been repeatedly reported (Debrot et al., 2013; Ditzen et al., 2019; Packheiser et al., 2024). However, individual touch preferences differ. While one person likes being hugged by a stranger, another finds the same action transgressive. Research has started to understand how factors such as culture (McDaniel & Andersen, 1998; Sorokowska et al., 2021), gender (Russo et al., 2020), context (Sailer et al., 2024), prior experiences (Devine et al., 2020; Trotter, McGlone, et al., 2018), mental health (Triscoli et al., 2019), social anxiety (Wilhelm et al., 2001), or personality traits (Trotter, McGlone, et al., 2018) may influence the perception of social touch. To further extend this research, a valid and efficient instrument for assessing touch attitudes and experiences is key.

Research on touch has led to the development of several self-report questionnaires. Some of them focus on childhood experiences, some on recent experiences, and others on attitudes. The TEAQ (Touch Experiences and Attitudes Questionnaire; Trotter, McGlone, et al., 2018) covers all three aspects. On reviewing existing touch questionnaires, different foci can be distinguished: the Touch Avoidance Measure (TAM; Andersen & Leibowitz, 1978), the TACTYPE questionnaire (Deethardt & Hines, 1984), and the Touch Test (Fromme et al., 1989) represent an early generation of touch questionnaires. They measure negative attitudes to touch, tactile tendencies in different relations, and comfort with different types of touch, respectively. However, due to their strong focus on contrasting same-sex vs. opposite-sex touch interactions, their

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wording and concepts are outdated (e.g., TAM: "When I see two people of the same sex hugging, it revolts me"). Then, there is a group of questionnaires that focuses on childhood touch experiences. The Familial Touch Orientation (FTO; Gladney & Barker, 1979) scale assesses the frequency of positive touch experiences as a child, the Questionnaire on Physical Contact Experience (QPCE; Cochrane, 1990) combines childhood with present touch experiences, and the Tactile Biography Questionnaire (TBQ; Beltrán et al., 2020) expands the perspective over the whole lifespan (childhood, adolescence, adulthood). For evaluating a lack of touch, the Touch Deprivation Scale (Punyanunt-Carter et al., 2009) and the Longing for Interpersonal Touch Picture Questionnaire (LITPQ; Beßler et al., 2020) have been proposed. On the attitude side, the Social Touch Questionnaire (STQ; Wilhelm et al., 2001) is a good choice. The STQ was originally designed to study the relationship between social anxiety and social touch preferences (Wilhelm et al., 2001). Since the STQ primarily addresses social touch attitudes, but not experiences, the TEAQ was developed.

The Touch Experiences and Attitudes Questionnaire (TEAQ; Trotter, McGlone, et al., 2018) is a tool that combines multiple aspects of positive touch in one comprehensive scale. Developed in 2018 in English by Trotter, McGlone, et al., it is one of the most frequently used touch questionnaires. The six original TEAQ subscales which were identified after factor analysis are *friends and family touch* (FFT), *current intimate touch* (CIT), *childhood touch* (ChT), *attitude to intimate touch* (AIT), *attitude to unfamiliar touch* (AUT), and *attitude to self-care* (ASC). Within these, the TEAQ encompasses active and passive perspectives (giving and receiving touch), different types of touch (e.g., hugging, kissing, stroking), and various touch interaction partners (friends, family, intimate and unfamiliar people). Specifically, *friends and family touch* captures a preference for physical contact that is typical with friends and relatives, *current intimate touch* captures touch experiences and behaviors in an intimate setting, *childhood touch* examines positive touch experiences in the childhood, *attitude to intimate touch* assesses individual preferences for touch with a romantic partner or emotionally close one, *attitude to unfamiliar touch* reflects comfort with physical touch from less familiar people, and a*ttitude to self-care* assesses preferences in skin care and self-care procedures. The questionnaire demonstrates convincing results for reliability and validity and receives international attention.

The development of the TEAQ followed a thorough multi-step procedure. Items were generated in discussions with professional psychologists and psychiatrists, leading to 117 items, which were then narrowed down by structural and redundancy criteria to 57 items. Three further studies revealed good internal consistency (Cronbach's alpha: 0.78–0.92) and confirmed a 6-factor structure (Trotter, McGlone, et al., 2018). TEAQ subscale scores correlated with other touch questionnaires such as the STQ, QPCE, and FTO. For example, the STQ showed moderate to strong correlations with all TEAQ subscale except *attitude to self-care*. A total TEAQ score was not proposed at that time. As expected, the *childhood touch* subscale was negatively associated with severity of childhood trauma, particularly emotional neglect. Singles had lower scores in *current intimate touch* and *attitude to intimate touch* than those who were in a relationship or married.

Later, the same pool of 117 items was used by the same leading author to develop a Russian TEAQ version (Trotter, Belovol, et al., 2018). The items were reviewed for cultural appropriateness and narrowed down by participants' comments, item-total correlations, and factor analytical results from 117 to 37 items. Thirty percent of those items were not part of the original TEAQ-57. A further study revealed a 5-factor structure and tested content and criterion validity aspects. The five subscales were: *attitude to friendly touch* (AFT; formerly *friends and family touch*), *attitude to intimate touch* (AIT), *current intimate touch* (CIT), *childhood touch* (ChT), and a*ttitude to self-care* (ASC). The subscale *attitude to unfamiliar touch* from the original version was not included in the TEAQ-37 Rus, as it did not occur in the factor structure. A total TEAQ score was proposed for the first time and correlated positively with personality traits such as extraversion, openness, and agreeableness, as well as emotional intelligence. Participants with higher TEAQ scores rated affective touch such as slow stroking which was shown in videos as more pleasant than those with lower scores.

A few years later, new versions of the questionnaire were developed in different languages and lengths. In 2022, a Mongolian TEAQ with 55 items in a 6-component structure was published (Tumurbaatar et al., 2022). Two items showing weak factor loadings were excluded. The validation study showed a positive correlation with quality-of-life domains and negative associations with depression and anxiety for several TEAQ subscales, especially for *current intimate touch*. In 2023, a Portuguese version with 52 items and a 6-component structure was developed (Pereira et al., 2023). Five items were dropped due to inappropriate values in a multidimensional Rasch analysis. They replicated convergent validity with the STQ and its associations with personality traits. In 2024, a Chinese version consisting of 18 items and three factors was validated in a college student population (Yang et al., 2024). Thirty-nine items were excluded based on participant feedback, item-total correlation, and factor loading. The authors found a positive correlation of the TEAQ total score with well-being, social support, and sense of security. In most TEAQ studies, women scored higher on TEAQ subscales than men (Pereira et al., 2023; Trotter, Belovol, et al., 2018; Trotter, McGlone, et al., 2018; Yang et al., 2024). The impact of age was minimal or insignificant, likely due to the predominance of young adults in the samples studied (Trotter, Belovol, et al., 2018; Trotter, McGlone, et al., 2018). In 2020, the TEAQ was also translated into Spanish and Dutch (Beltrán et al., 2020), but has not been further tested in those languages.

Taken together, the TEAQ had been translated into six different languages and examined regarding several related constructs. This illustrates a great interest in the questionnaire. However, every prior validation study resulted in a slightly different version in which some items were deleted or a new factor structure was found. We hope to calm down this trend with an in-depth evaluation and development of a robust short version. We believe we can achieve this goal by revising problematic items, refining the model to solely focus on social touch, and significantly shortening the version. Supporting this approach, Trotter, Belovol, et al. (2018) suggested at the end of the TEAQ-Rus article that the creation of a shorter version would be the next step. A short version brings multiple benefits: by reducing cognitive load and completion time, participant compliance and response rates will increase. It would also allow researchers to streamline large-scale studies such as epidemiological surveys and enhance cross-cultural applicability. The new version is expected to remain valid and reliable in assessing social touch attitudes and experiences. Relationships with variables that have been investigated with prior TEAQ versions, such as sex, age, anxiety, depression, relationship status, and the Social Touch Questionnaire, were expected to replicate, while associations with new variables, including need for touch, body appreciation, relationship satisfaction, cohabitation, and the Longing for Interpersonal Touch Picture Questionnaire, were explored. We aimed to validate the new version in two different languages simultaneously, namely German and French, allowing us to test for cross-cultural applicability.

2. Materials and methods

To ensure a well-founded development of the questionnaire, we chose a multistep procedure and conducted three studies. An overview of the entire process is displayed in Fig. 1 and described in more detail in the following paragraphs. Before any data were collected, the original questionnaire and previous versions were reviewed considering face validity and content criteria. After a few adjustments which are described below, we translated the items into German. Thereafter, we tested the translated TEAQ in a sample of 313 participants (first study: *Pre TEAQ*) and examined factor structure, reliability, and validity aspects. Based on these data, we shortened the questionnaire to 16 items (4 items per subscale) and repeated the analyses. To cross-validate the new version in a different German sample (second study: *TEAQ-s Germany*),

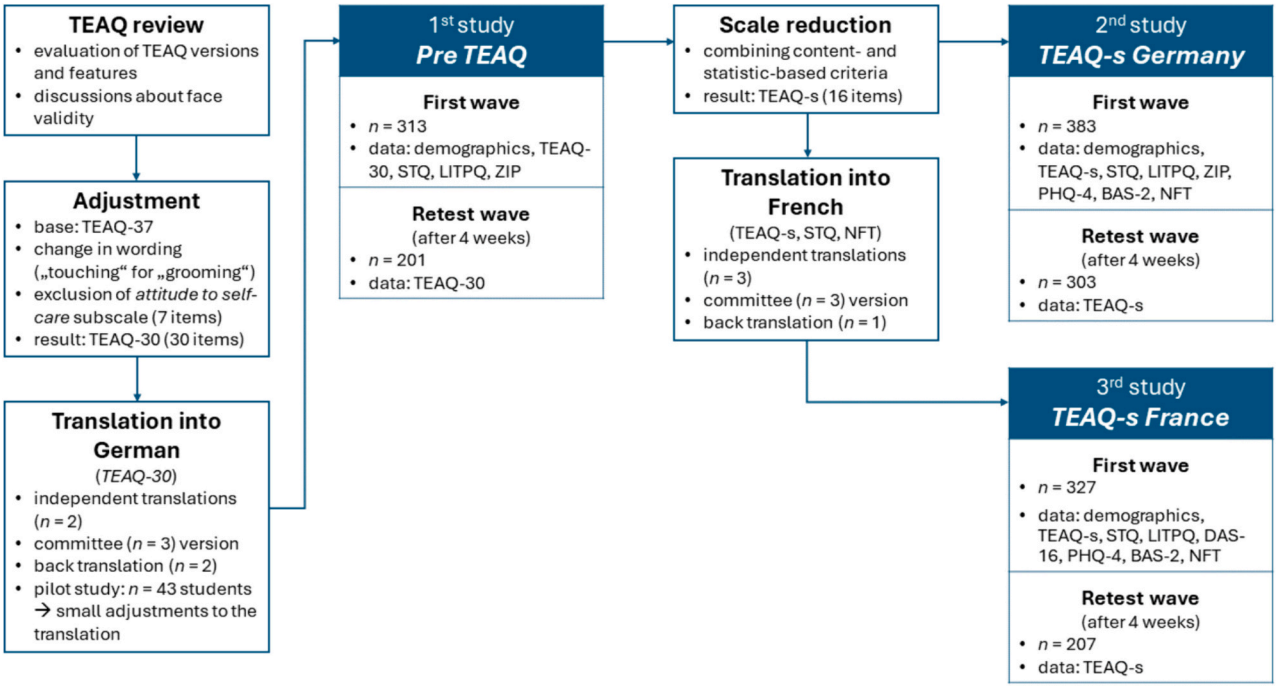

Fig. 1. Overview of the process for developing and validating the TEAQ-s. TEAQ-s = short Touch Experiences and Attitudes Questionnaire, STQ = Social Touch Questionnaire, LITPQ = Longing for Interpersonal Touch Picture Questionnaire, ZIP = Zufriedenheit-in-Paarbeziehungen-Skala (German Relationship Assessment Scale), NFT = Need for Touch Questionnaire, PHQ-4 = Patient Health Questionnaire 4, BAS-2 = Body Appreciation Scale 2, DAS-16 = Dyadic Adjustment Scale 16.

we recruited another 383 participants and tested for the same criteria. In the third study (*TEAQ-s France*), we tested whether psychometric properties remain stable in a different language. The French TEAQ-s was applied to 327 participants. Full versions of the TEAQ-s in German, French, and English can be found in Supplement A together with scoring instructions.

2.1. Development of the TEAQ-s

2.1.1. TEAQ review and adjustment

When reviewing the existing TEAQ versions, we found some crucial points that we wanted to address. First, we needed to select a foundation for our short version. We had the choice between the original British TEAQ and the Russian TEAQ, as both represent independent selections from the original English 117-item pool. Surprisingly, although German and French touch cultures appear closer to British culture, the Russian item selection proved more suitable for our purpose. Unlike the original British version, the TEAQ-Rus selection was based on both participant feedback and statistical criteria. Additionally, the TEAQ-Rus offers a total score that aggregates subscales. It maintained excellent internal consistency (Cronbach's alpha = 0.92) and delivered similar model fit values. Thus, we chose the 37-item TEAQ-Rus as the foundation for the new TEAQ-s.

Second, we focused on assessing social touch only and excluded the subscale *attitude to self-care*. This will refine the model and clarify the meaning of a total TEAQ score. Besides this, we think that items about cosmetic usage may lack relevance for general touch attitudes (e.g., "I like using face masks on my skin") and inherit the risk of gender and cultural biases. Thus, we excluded the 7 items of the subscale *attitude to self-care* and proceeded with the remaining 30-item version. Third, the phrase "grooming" in two of the 30 items (e.g., "I enjoy grooming other people's skin.") confused the authors and translators because it is mainly used for animal behaviors. Thus, we changed the phrase "grooming" to "touching" in both affected items (TEAQ-s: item 2 and item 4). All decisions were made in a consensus discussion among experts and served to improve face validity.

2.1.2. German translation

The translation process of the TEAQ followed a committee direct translation verified by back translation (Harkness & Schoua-Glusberg, 1998). Therefore, two German native speakers proficient in English language translated the items independently from each other and combined the results in a discussion with a third researcher. Following the recommendations for cross-cultural translation by Su and Parham (2002), translating the fundamental meaning was preferred over literal equivalency. For back translation, the resulting items were given to two other German native speakers proficient in English language who spent at least one year in an English-speaking country. The back-translated items were rated for accordance with the original items by the committee and revised until a reasonable fit was achieved. To test the translated items for comprehensiveness, we did a piloting round with $n = 43$ students aged 18–31 years ($M = 20.7$, $SD = 2.66$) prior to the first study. Single items were adjusted based on their feedback. The translated 30-item version (TEAQ-30) was administered to the first sample (study: *Pre TEAQ*).

2.1.3. Scale reduction

We aimed at a questionnaire length that balances time efficiency with validity and reliability. To ensure that every subscale is meaningfully represented and of equal length, we decided on four items per subscale. Equal subscale lengths ensure that every subscale has the same impact on the TEAQ-s sum score. After collecting data in *Pre TEAQ*, the TEAQ-30 was shortened based on multiple criteria. As relying solely on statistical features in scale reduction is highly criticized, we followed the consensus that both qualitative content-oriented and statistics-based features should be considered (Goetz et al., 2013; Stanton et al., 2002). In our manuscript, we roughly followed the recommendations by Goetz et al. (2013): document the validity of the original scale and the objective of its shortening, take the conceptual model into account, preserve content validity, preserve psychometric properties, document the reasons for item selection, and validate the short-form scale in an independent sample. This said, we used an iterative process for combining psychometric properties and content criteria (detailed

reasons of item in/exclusion in Supplement Table B1): (1) exclude items with major concerns (e.g., due to cultural incompatibilities), (2) run CFA and exclude the item with the lowest factor loading per subscale, (3) review the result regarding content criteria (e.g., problems reported in participants' comments, broad feature representation) and methodological criteria (e.g., percentage of reversed items), (4) adjust, if necessary, (5) run CFA again. We repeated the procedure until a satisfactory solution with four items per subscale was found. A cross-validation of the new TEAQ-s was performed with the subsequent studies: *TEAQ-s Germany* and *TEAQ-s France*.

2.1.4. French translation

For the study *TEAQ-s France*, we translated the 16 TEAQ-s items from English to French with the same strategy as the German translation: committee direct translation verified by back translation (Harkness & Schoua-Glusberg, 1998). Please note that due to an error items 2 and 13 were based on similar but not identical English items from the same subscale (Supplement B-VII) which represents a deviation from the German TEAQ-s. In the committee, three native French-speaking researchers proficient in English language translated the questionnaire independently and combined the translations with a native English-speaking researcher proficient in French language. As before, meaning was preferred over literal equivalence. A native bilingual English and French speaking researcher translated the items back. Two members of the committee compared the back translation to the items in English and agreed on correspondence.

2.1.5. Resulting TEAQ-s

The resulting TEAQ-s is a refined and shortened version of the TEAQ consisting of 16 items. As in the original version, responses are given on a 5-point-Likert scale ranging from *1* = "Disagree strongly" to *5* = "Agree strongly". The questionnaire measures social touch experiences and attitudes on four subscales with four items each: *attitude to friendly touch* (AFT), *current intimate touch* (CIT), *childhood touch* (ChT), and *attitude to intimate touch* (AIT). Total scores can range from 16 to 80 with higher scores indicating more positive attitudes and more frequent experiences with social touch.

2.2. Data collection

2.2.1. Samples

In *Pre TEAQ*, a total of 313 participants (78.9 % females, M_{age} = 25.0 years) completed the first survey wave, and of those n = 201 (82.1 % females, M_{age} = 24.8 years; response rate: 64.2 %) completed the retest wave after four weeks. In *TEAQ-s Germany*, n = 383 (81.2 % females, M_{age} = 22.1 years) participated in the first wave and n = 303 (81.5 % females, M_{age} = 22.0 years; response rate: 79.1 %) in the retest wave. In *TEAQ-s France*, n = 327 (82.6 % females, M_{age} = 25.3 years) participated in the first wave and n = 207 (82.1 % females, M_{age} = 25.8 years; response rate: 63.3 %) in the retest wave. For all three studies, the sample size rationale aimed for at least 300 participants in the first wave to achieve an adequate power for factor analyses (Goretzko et al., 2021; Worthington & Whittaker, 2006). Detailed sample characteristics are displayed in Table 1. Subjects were eligible for participation if they were at least 18 years old and proficient in German or French, respectively. Recruiting strategies involved mailing lists, public notes, posts in social networks (e.g., X/Twitter, Facebook, Instagram, LinkedIn, BlueSky), and word of mouth. In *Pre TEAQ* and *TEAQ-s Germany*, which were both conducted in Germany, most participants were recruited through the psychology students' mailing list at the Friedrich-Schiller University Jena. Although we primarily recruited first-year students and studies were conducted about two years apart, we cannot completely rule out a small overlap in the *Pre TEAQ* and *TEAQ-s Germany* samples. For reimbursement, participants received class credit or got the chance to win money in a lottery (2 × 50€, 4 × 25€) in both studies. In the *TEAQ-s France*, they got the chance to win a gift card (2 × 50€, 4 × 25€). The studies were reviewed and formally approved by the local ethical committees, namely the ethical commission of the faculty of social and behavioral sciences at the Friedrich-Schiller University Jena in Germany (registration number: FSV 21/074 & FSV 23/079) and the ethical committee of the Aix-Marseille University in France (reference: 2023-11-09-02; data protection registration number: 0042023–28). All procedures were in accordance with the 1964 Helsinki Declaration and its later amendments. Informed consent was obtained from all participants included in this study.

2.2.2. Study procedures

All presented studies were conducted online via SoSci Survey (Leiner, 2022). *Pre TEAQ* ran from March to June 2022, *TEAQ-s Germany* from December 2023 to April 2024, and *TEAQ-s France* from December 2023 to March 2024. In all three studies, self-report questionnaires were administered at two time points. The first wave contained TEAQ items, questions about demographic data (i.e., sex, age, education level, professional status), and other questionnaires related to touch, namely the STQ and LITPQ. The Social Touch Questionnaire (STQ; Wilhelm et al., 2001, Lapp & Croy, 2021) focuses on social touch attitudes with the three factors *dislike of social touch*, *liking of informal social touch*, and *liking of general social touch*. The Longing for Interpersonal Touch Picture Questionnaire (LITPQ; Beßler et al., 2020) measures *touch wish*, *touch frequency*, and the resulting *touch deprivation* within the last week. If applicable, we also assessed relationship characteristics (i.e., relationship status, type, duration, cohabitation) and *relationship satisfaction* by

Table 1
Sample characteristics of the three studies.

Variable	*Pre TEAQ* (n = 313)		*TEAQ-s Germany* (n = 383)		*TEAQ-s France* (n = 327)	
	n	Percentage	n	Percentage	n	Percentage
Sex						
Female	247	78.9 %	311	81.2 %	270	82.6 %
Male	60	19.2 %	59	15.4 %	52	15.9 %
Other/not reported	6	1.9 %	13	3.4 %	5	1.5 %
Age [years]	M = 25.0	SD = 8.5	M = 22.1	SD = 4.0	M = 25.3	SD = 9.8
Employment status						
University student	211	67.4 %	376	98.2 %	239	73.1 %
Working	59	18.8 %	3	0.8 %	80	24.5 %
Pupil	17	5.4 %	0	0.0 %	0	0.0 %
Other	26	8.3 %	4	1.0 %	8	2.4 %
Relationship status						
Single	141	45.0 %	185	48,3 %	125	38.2 %
In a relationship	172	55.0 %	198	51.7 %	202	61.8 %
Cohabitation						
Living together	85	49.4 %	60	30.3 %	96	47.5 %
Living separately	87	50.6 %	138	69.7 %	106	52.5 %

the ZIP (Zufriedenheit-in-Paarbeziehungen-Skala; Hassebrauck, 1991) in the German studies and *relationship quality* by the Dyadic Adjustment Scale (DAS; Spanier, 1976) in *TEAQ-s France.* The retest wave, after four weeks, repeated the TEAQ items only. The design remained generally the same for all three studies. Only small adjustments were made in the validation studies. In *TEAQ-s Germany* and *TEAQ-s France*, TEAQ-s items were shown instead of the interim TEAQ-30 version, and we added three additional questionnaires to extend our validity measures: Patient Health Questionnaire 4, Body Appreciation Scale 2, and Need for Touch questionnaire. The Patient Health Questionnaire 4 (PHQ-4; Kroenke et al., 2009) consists of a two-item depression measure and a two-item anxiety measure. The Body Appreciation Scale 2 (BAS-2; Avalos et al., 2005, Tylka & Wood-Barcalow, 2015) measures how much an individual accepts and holds favorable opinions about their own body. The Need for Touch questionnaire (NFT; Peck & Childers, 2003) assesses how strongly tactile and haptic information are gathered for purchasing decisions with the two components *autotelic* and *instrumental NFT*. A detailed description of the questionnaires can be found in Supplement B—I.

2.3. Statistical analyses and hypotheses

Statistical analyses were conducted using two programs: IBM SPSS Statistics Version 29.0 (IBM Corp, 2022) for data preparation and R Studio Version 4.3.1 (R Core Team, 2023) for data analysis. We analyzed item characteristics and indicators of reliability and validity for the TEAQ-s. The study design and detailed hypotheses were preregistered on the Open Science Framework (*Pre TEAQ*: https://osf.io/vg8w5; *TEAQ-s Germany & TEAQ-s France*: https://osf.io/qg5he; all data: https://osf.io/rb85w/) and are reviewed here briefly. Please note that the latter also contains hypotheses about additional TEAQ-s modules that we developed to capture self-touch (8 items) and object-touch (8 items) which are not included in this article.

2.3.1. Item characteristics

Mean, standard deviation, item-total-score correlation, item difficulty, and inter-item correlations were used to evaluate single items. Item difficulty expresses the level of agreement with each item on a scale from 0 to 1. It was expected to vary between items and fall in the range between 0.20 and 0.80. Item-total correlations were expected to reveal relations between single items and the total TEAQ-s score and thus exceed the lower limit of $r > 0.30$. Inter-item correlations were expected to not provide redundancy ($r < 0.80$).

2.3.2. Factorial validity

Factor analyses were expected to confirm the 4-factor structure proposed. We used confirmatory factor analysis with the maximum likelihood method (MLM). Indices of model fit were RMSEA (root mean square error of approximation), SRMSR (standardized root mean squared residual), CFI (comparative fit index), and TLI (Tucker-Lewis index). Appropriateness for factor analysis was evaluated by Bartlett's test of sphericity ($p < .05$) and Kaiser-Meyer-Olkin measure of sampling adequacy (KMO > 0.60). Model fit indices indicated good fit if RMSEA $\leq$ 0.06, SRMSR $\leq$ 0.08, CFI $\geq$ 0.95, and TLI $\geq$ 0.95 (Hu & Bentler, 1999). Item loadings on corresponding factors were expected to be good (> 0.70) to acceptable (> 0.30). We calculated both a first-order model with subscales as correlated factors, in line with prior TEAQ versions, and a model with a second-order factor on top that represents the TEAQ-s total score.

2.3.3. Indicators of reliability

Internal consistency was expected to be high for the total score (Cronbach's alpha > 0.80) and appropriate for the four subscales (Cronbach's alpha > 0.70). Split-half reliability was expected to be high for the total score (Guttman's lambda 6 > 0.80). Retest reliability was expected to be moderate for the total score and subscales ($r > 0.60$).

2.3.4. Indicators of convergent and discriminant validity

We expected significant ($p < .05$) and meaningful ($r > 0.30$), but not overlapping ($r < 0.80$) correlations between TEAQ-s scores and other touch questionnaires. This should relate to the following associations: TEAQ-s and STQ total scores, the TEAQ-s subscale *current intimate touch* and *touch frequency* according to the LITPQ as well as *relationship satisfaction*, the TEAQ-s subscales *attitude to friendly touch* and *attitude to intimate touch* with *touch wish* according to the LITPQ.

2.3.5. Indicators of criterion validity

TEAQ-s subscale and total scores were expected to reflect the sociodemographic characteristics of the participants. Scores in the TEAQ-s subscale *current intimate touch* were expected to be higher when subjects are in a relationship compared to single, and when subjects are cohabiting with their partner compared to living without their partner. The correlation of TEAQ-s total scores and age or education level was expected to be little ($r < 0.10$) to insignificant ($p > .05$).

2.3.6. Validity check by study comparison

We planned to check for data plausibility by comparing the TEAQ-s total and subscale sum scores of the three studies. We expected insignificant to small differences in favor for the French sample. Tests for measurement invariance evaluated whether the TEAQ-s maintains its factorial structure consistently across different study samples.

2.3.7. Missing values

Missing values were imputed on the item level by predictive mean matching (PPM) in SPSS. In our studies, percentages were quite low as missing values did only occur in the BAS-2 (0 % to 0.61 % per item) and the LITPQ (0.26 % to 3.36 % per item).

2.3.8. P-value correction for multiple comparisons

As we conducted more correlational analyses than initially hypothesized, we applied Bonferroni correction to adjust the *p*-value according to the number of correlations or comparisons in each study. Specifically, the *p*-value for correlations was corrected by factor 55 in *Pre TEAQ*, 90 in *TEAQ-s Germany*, and 100 in *TEAQ-s France*. Additionally, we adjusted *p*-values to correct for multiple comparisons in the *t*-tests by factor 11 in each study, by 15 in the study comparison, and by 5 in the ANOVAs.

3. Results

3.1. Item characteristics

Item characteristics of the TEAQ-s from the three studies are displayed in Table 2. In *Pre TEAQ*, only the 16 items we selected for the TEAQ-s are presented (TEAQ-30 results in Supplement B-II). In all three studies, all TEAQ-s items met the criteria of item-total correlation $r >$ 0.30 indicating that the items are good indicators of the measured trait. Regarding inter-item correlation, most items demonstrated non-redundancy ($r < 0.80$). However, minor weaknesses were evident in item 10 (“There was a lot of physical affection during my childhood.”) which showed an overlap with other items of the same subscale *childhood touch* (item 9 in *Pre TEAQ* or item 12 in *TEAQ-s Germany* and *TEAQ-s France,* Supplement Tables B2, B4, B5). Regarding item difficulty, most items fell within the acceptable range (0.20 to 0.80). Exceptions were found in the *attitude to intimate touch* subscale ($diff_{AIT}$: 0.76 to 0.91) which presented with high agreement rates across studies and in single items from *childhood touch* in one study ($diff_{ChT}$: 0.76 to 0.81 in *TEAQ-s Germany*). Taken together, item characteristics were predominantly convincing with slight weaknesses in *attitude to intimate touch* and *childhood touch*.

3.2. Factor analyses

The factorability was given with Bartlett's test of sphericity ($p < .05$)

Table 2
Item wording and item characteristics of the TEAQ-s.

	English item	*Pre TEAQ*				*TEAQ-s Germany*				*TEAQ-s France*			
		M	*SD*	*Diff*	Item-total *r*	*M*	*SD*	*Diff*	Item-total *r*	*M*	*SD*	*Diff*	Item-total *r*
Attitude to friendly touch (AFT)													
1	I dislike people being very physically affectionate towards me. (*)	3.15	1.15	0.63	0.52	3.31	1.12	0.66	0.55	3.03	1.19	0.61	0.58
2	I enjoy having my skin *touched* by other people.	3.11	1.07	0.62	0.62	3.28	1.06	0.66	0.55	3.18	1.16	0.64	0.62
3	Physical contact with other people is important to me.	3.56	1.07	0.71	0.65	3.74	1.07	0.75	0.63	3.17	1.14	0.63	0.54
4	I enjoy *touching* other people's skin.	2.97	1.15	0.59	0.59	3.30	1.10	0.66	0.56	2.49	1.18	0.50	0.57
Current intimate touch (CIT)													
5	Most days I get a hug or a kiss.	3.18	1.43	0.64	0.55	3.47	1.38	0.69	0.52	3.27	1.58	0.65	0.53
6	I often share a romantic kiss.	3.04	1.42	0.61	0.55	3.19	1.48	0.64	0.47	3.03	1.46	0.61	0.59
7	I often hold hands with someone I am fond of.	3.10	1.51	0.62	0.56	3.37	1.46	0.67	0.52	3.34	1.43	0.67	0.60
8	I often have my skin stroked.	2.87	1.38	0.57	0.56	3.09	1.40	0.62	0.59	2.85	1.42	0.57	0.62
Childhood touch (ChT)													
9	As a child my parents would tuck me up in bed every night and give me a hug and a kiss goodnight.	3.87	1.27	0.77	0.55	4.06	1.12	0.81	0.51	3.64	1.37	0.73	0.45
10	There was a lot of physical affection during my childhood.	3.65	1.22	0.73	0.63	3.82	1.13	0.76	0.62	3.44	1.36	0.69	0.53
11	As a child my parents always comforted me when I was upset.	3.86	1.19	0.77	0.45	4.00	1.04	0.80	0.46	3.21	1.35	0.64	0.36
12	My parents regularly cuddled me as a child.	3.78	1.19	0.76	0.56	3.95	1.14	0.79	0.59	3.49	1.38	0.70	0.54
Attitude to intimate touch (AIT)													
13	I enjoy the feeling of my skin against someone else's if I know them intimately.	3.81	1.02	0.76	0.53	4.14	1.01	0.83	0.70	4.10	1.16	0.82	0.58
14	I enjoy being cuddled by someone I am fond of.	4.38	0.85	0.88	0.61	4.49	0.85	0.90	0.68	4.28	0.99	0.86	0.65
15	Kissing is a great way of expressing physical attraction.	4.28	0.95	0.86	0.51	4.21	1.03	0.84	0.58	4.08	1.00	0.82	0.46
16	Hugging someone is a good way of consoling them.	4.26	0.86	0.85	0.58	4.57	0.68	0.91	0.48	4.39	0.92	0.88	0.43

Note. All items are answered on a 5-point Likert scale with the endpoints *1* = "Disagree strongly" and *5* = "Agree strongly". *Diff* stands for item difficulty, (*) means reversed scoring, *italics* in items indicate adjusted wording. Item-total correlation *r* is corrected for item overlap and scale reliability. Item characteristics of the interim version TEAQ-30 are displayed in Supplement Table B1. The English, French, and German versions of the TEAQ-s with instructions of scoring can be found in Supplement A-I and A-II.

and Kaiser-Meyer-Olkin measure of sampling adequacy (KMO > 0.60) in all three studies. When first performing a confirmatory factor analysis (MLM, scaled model) on the interim TEAQ-30 version, the results were poor with $X^2(399) = 1360.5$, $p < .001$, RMSEA = 0.088 [0.083–0.092], CFI = 0.805, TLI = 0.787, SRMR = 0.079. After scale reduction, the fit indices for the TEAQ-s were much better with $X^2(98) = 194.4$, $p < .001$, RMSEA = 0.056 [0.045–0.067], CFI = 0.958, TLI = 0.949, SRMR = 0.049. Thus, almost all model fit indices for TEAQ-s met the criteria by Hu and Bentler (1999) for a good fit (RMSEA ≤0.06, CFI ≥ 0.95, TLI ≥ 0.95, and SRMSR ≤0.08) in *Pre TEAQ*. As required, all factor loadings were larger than 0.30 ranging between 0.56 and 0.93 (Supplement Fig. B2). In the validation studies *TEAQ-s Germany* and *TEAQ-s France*, the model fit indices were partially met and revealed a good to satisfactory fit, which appeared better or comparable to prior TEAQ versions (Table 3). Again, all factor loadings were larger than 0.30 ranging between 0.55 and 0.93 in *TEAQ-s Germany* (Fig. 2) and between 0.47 and 0.94 in *TEAQ-s France* (Supplement Fig. B3). We also calculated a confirmatory factor analysis for a second-order model with a total score on top of the subscales (Fig. 3), yielding similar fit indices like the first-order model (*TEAQ-s Germany:* $X^2(100) = 241.2$, $p < .001$, RMSEA = 0.061 [0.052–0.070], CFI = 0.943, TLI = 0.932, SRMR = 0.053). Comparing both models showed no significant difference in fit ($X^2(2) = 1.9$, $p = .395$), as it was the case in the other two studies (Supplement Fig. B4, B5). Following the parsimony rule, when two models show similar fit, the simpler model is preferred. In this case, the second-order model wins as it has a higher number of degrees of freedom (*df*).

Table 3
Comparison of fit indices from different TEAQ studies and versions after confirmatory factor analysis.

Study & version	Items	Factors	X^2/df	RMSEA	CFI	TLI	SRMR
Current studies							
TEAQ-s Germany	16	4	2.441	0.061	0.943	0.931	0.052
TEAQ-s France	16	4	2.564	0.069	0.938	0.924	0.054
Pre TEAQ	16	4	1.984	0.056	0.958	0.949	0.049
	30	4	3.410	0.088	0.805	0.787	0.079
Prior studies*							
Original TEAQ	57	6		0.069	0.805	0.796	0.071
Russian TEAQ	37	5	3.809	0.071	0.817	0.803	
Mongolian TEAQ	55	6	2.083	0.073	0.692	0.677	
Portuguese TEAQ	52	6	2.78	0.07	0.78		
Chinese TEAQ	18	3	6.028	0.084	0.900	0.884	

Note. Criteria by Hu and Bentler (1999) for a good fit are: root mean square error of approximation (RMSEA) ≤ 0.06, comparative fit index (CFI) ≥ 0.95, Tucker-Lewis index (TLI) ≥ 0.95, and standardized root mean squared residual (SRMSR) ≤ 0.08. All models presented significant chi-square (X^2) values ($p < .001$). *This table presents non-adjusted fit indices for all versions. However, due to the high number of items in prior versions, authors additionally used parceled or otherwise adjusted models which improved the fit indices (e.g., original TEAQ: RMSEA = 0.055, CFI = 0.974, TLI = 0.967 and SRMR = 0.034).

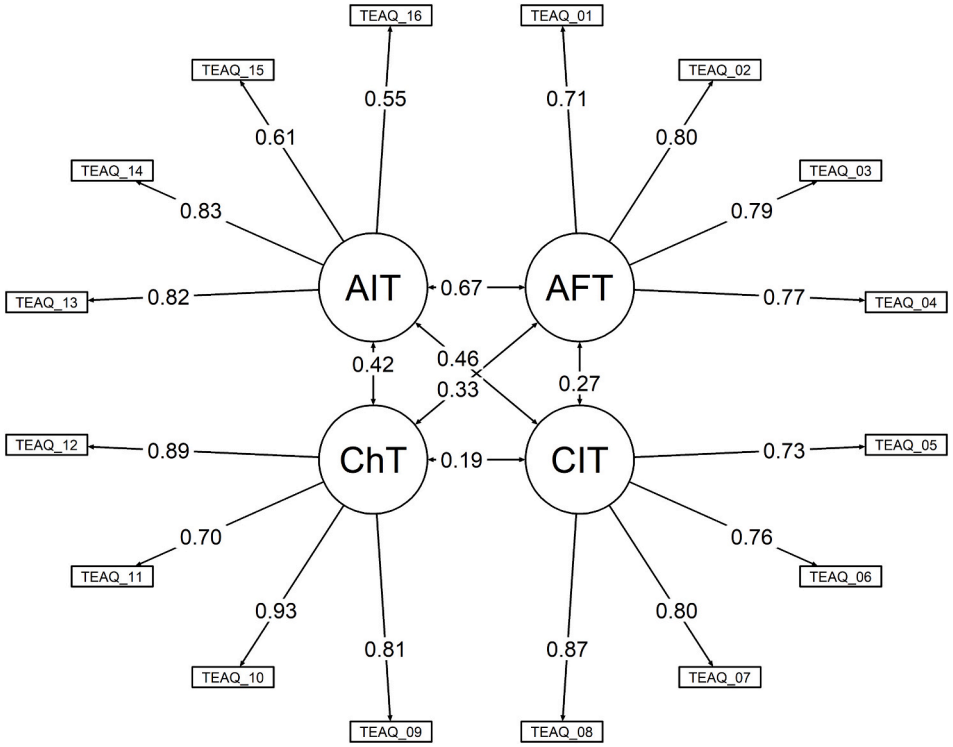

Fig. 2. CFA path diagram for TEAQ-s from study *TEAQ-s Germany*. Rectangles indicate measured variables (items) and circles indicate latent constructs (corresponding to TEAQ-s subscales). Numbers between circles and rectangles represent factor loadings. Numbers between two circles represent correlations between the latent constructs *attitude to intimate touch* (AIT), *attitude to friendly touch* (AFT), *childhood touch* (ChT), and *current intimate touch* (CIT).

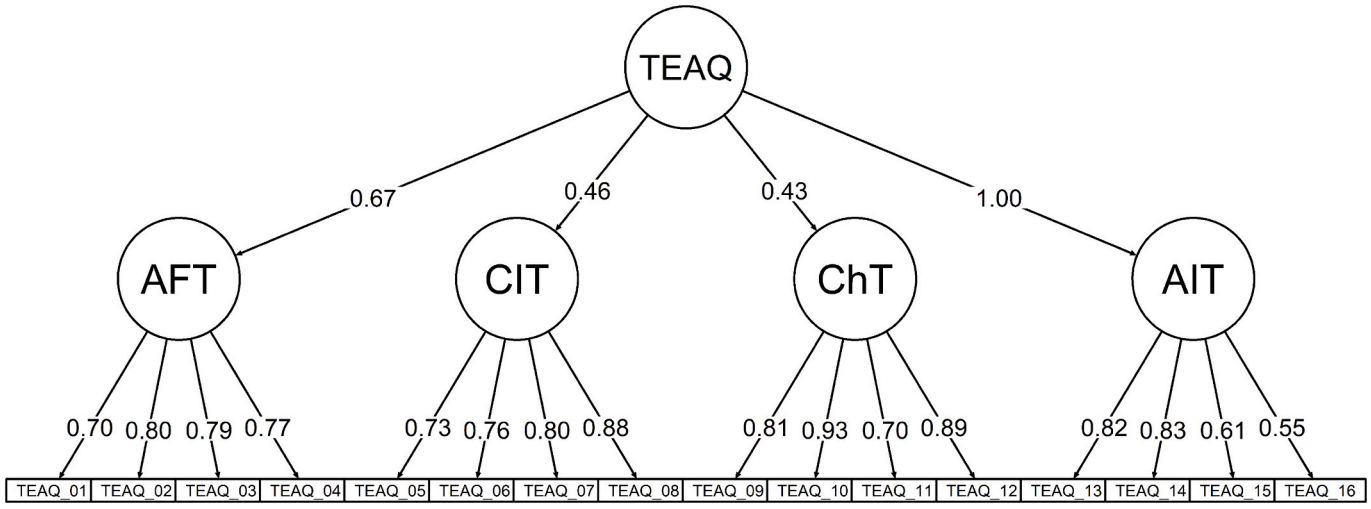

Fig. 3. CFA path diagram of the second-order TEAQ-s model from study *TEAQ-s Germany*. Rectangles indicate measured variables (items) and circles indicate latent constructs (corresponding to TEAQ-s subscales and the total score). Numbers between circles and rectangles represent factor loadings. Numbers between two circles represent correlations between the latent constructs *attitude to intimate touch* (AIT), *attitude to friendly touch* (AFT), *childhood touch* (ChT), *current intimate touch* (CIT) and the total TEAQ.

3.3. Indicators of reliability

Indicators of reliability for the TEAQ-s are shown in Table 4. Internal consistency of the selected 16 items was high with Cronbach's alpha $\geq$ 0.86 for the total scores and $\geq$ 0.72 for the subscales in the three conducted studies. Split-half reliability was also high with Gutman's lambda 6 $\geq$ 0.91 for the total scores and mainly good with $\geq$ 0.68 for the subscales. Test-retest reliability was excellent with r = 0.85 for the total scores and good with $\geq$ 0.67 for the subscales (Table 4). Taken together, the TEAQ-s met all reliability requirements that were set in the preregistration for the three studies. Overall, reliability indicators appeared highest for *childhood touch* and lowest for *attitude to intimate touch*.

3.4. Construct validity

For the sake of clarity, the following results will focus on the *TEAQ-s Germany* which was the largest validation study. Validity results of *Pre TEAQ* and *TEAQ-s France* are briefly mentioned and presented in detail in Supplement B-IV and B—V.

Table 4
Indicators of reliability for total TEAQ-s scores and subscales in the three studies.

	TEAQ-s	*Attitude to friendly touch*	*Current intimate touch*	*Childhood touch*	*Attitude to intimate touch*
Cronbach's alpha					
Pre TEAQ	0.87	0.85	0.89	0.91	0.76
TEAQ-s Germany	0.87	0.85	0.87	0.90	0.78
TEAQ-s France	0.86	0.85	0.85	0.90	0.72
Gutman's lambda 6					
Pre TEAQ	0.92	0.82	0.86	0.89	0.73
TEAQ-s Germany	0.92	0.81	0.85	0.88	0.76
TEAQ-s France	0.91	0.82	0.82	0.89	0.68
Retest reliability					
Pre TEAQ	0.85	0.82	0.87	0.89	0.67
TEAQ-s Germany	0.85	0.77	0.86	0.84	0.68
TEAQ-s France	0.85	0.82	0.87	0.87	0.69

3.4.1. TEAQ-s subscales

The TEAQ-s subscales correlated weakly to strongly with each other suggesting mainly associated but not overlapping measurements (Table 5). The highest correlation was found between the two TEAQ-s attitude subscales *attitude to friendly touch* and *attitude to intimate touch* ($r = 0.55$, $p_{corr} < 0.001$). The weakest correlation was found between the experience subscales *current intimate touch* and *childhood touch* ($r = 0.15$, $p_{corr} = 0.253$) which was not significant after Bonferroni *p*-value correction. Results for subscale correlations were comparable in *Pre TEAQ* (Supplement Table B6) and *TEAQ-s France* (Supplement Table B7). Additionally, we applied the heterotrait-monotrait ratio (HTMT; Henseler et al., 2015) to assess discriminant validity. All HTMT values in the three studies were below the threshold value of 0.85 (ranging from 0.13 to 0.71; Supplement Table B12), indicating discriminant validity for the four TEAQ-s subscales.

3.4.2. Touch questionnaires

Regarding other touch questionnaires, we could see associated but not overlapping measurement tools, confirming our hypotheses (Table 5). The STQ and TEAQ-s total scores presented with a large correlation ($r = 0.66$, $p_{corr} < 0.001$). Regarding STQ subscales, the association was strongest for *liking of general touch* and the two TEAQ-s attitude scales ($r_{LGT,AFT} = 0.77$, $p_{corr} < 0.001$; $r_{LGT,AIT} = 0.65$, $p_{corr} < 0.001$) suggesting similar concepts. We also confirmed our hypotheses about the LITPQ. Due to the skewness of the LITPQ data, we calculated Spearman's ρ instead of Pearson's *r*. As predicted, *touch frequency* according to the LITPQ was strongly correlated with the experience scale *current intimate touch* ($\rho = 0.64$, $p_{corr} < 0.001$). As we hypothesized, *touch wish* according to the LITPQ showed significant, medium-sized correlations with the two TEAQ-s attitude subscales ($\rho_{AFT} = 0.31$, $p_{corr} < 0.001$; $\rho_{AIT} = 0.44$, $p_{corr} < 0.001$). Again, results were similar in *Pre TEAQ* (Supplement Table B6) and *TEAQ-s France* (Supplement Table B7).

3.4.3. Other questionnaires

In correspondence with our hypothesis, relationship satisfaction (ZIP) correlated significantly with *current intimate touch* measured by the TEAQ-s ($r = 0.33$, $p_{corr} < 0.001$) which means that more intimate touch was experienced in more satisfied couples. This was similar in *Pre TEAQ* (Supplement Table B6) and in *TEAQ-s France* for relationship quality (Supplement Table B7). We also took an explorative look on the questionnaires about mental health, body appreciation, and need for touch. Mental health issues according to the PHQ-4 were negatively correlated with the TEAQ-s ($r = -0.30$, $p_{corr} < 0.001$) which was reflected in both *anxiety* ($r = -0.29$, $p_{corr} < 0.001$) and *depression* scores ($r = -0.24$, p_{corr}

Table 5
Correlations from study *TEAQ-s Germany* between of the TEAQ-s total score and subscales with other questionnaires and age to evaluate discriminant and convergent validity.

	TEAQ-s	*Attitude to friendly touch*	*Current intimate touch*	*Childhood touch*	*Attitude to intimate touch*
TEAQ-s					
Attitude to friendly touch	**0.70**				
Current intimate touch	**0.71**	**0.23**			
Childhood touch	**0.63**	**0.28**	0.15		
Attitude to intimate touch	**0.79**	**0.55**	**0.44**	**0.35**	
STQ	**0.66**	**0.67**	**0.35**	**0.39**	**0.51**
Dislike of social touch	**0.37**	**0.43**	**0.19**	**0.23**	**0.22**
Liking of social touch	**0.59**	**0.42**	**0.33**	**0.50**	**0.42**
Liking of general touch	**0.70**	**0.77**	**0.36**	**0.28**	**0.65**
LITPQ					
Touch frequency	**0.53**	**0.23**	**0.64**	**0.20**	**0.36**
Touch wish	**0.51**	**0.31**	**0.52**	0.15	**0.44**
Touch deprivation	−0.01	0.14	−0.13	−0.06	0.12
Relationship satisfaction (ZIP)	0.23	0.09	**0.33**	0.06	0.23
Mental health issues (PHQ-4)	**−0.30**	**−0.20**	**−0.18**	**−0.25**	**−0.19**
Depression	**−0.24**	**−0.19**	−0.16	−0.18	−0.16
Anxiety	**−0.29**	**−0.18**	−0.17	**−0.27**	**−0.19**
Body appreciation (BAS-2)	**0.29**	**0.26**	**0.18**	**0.20**	**0.20**
Need for touch (NFT)	0.03	0.04	0.03	−0.02	0.04
Autotelic	0.04	0.09	0.04	−0.04	0.03
Instrumental	0.01	−0.02	0.01	0.01	0.04
Age	−0.01	0.08	0.00	−0.06	−0.07

Note. Significant correlations are printed bold ($p_{corr} < 0.05$). *P*-values were adjusted according to Bonferroni (corrected by factor 90). Correlation coefficients are Spearman's ρ for the LITPQ and Pearson's *r* for the rest. Results from *Pre TEAQ* and *TEAQ-s France* studies are displayed in Supplement Tables B6 and B7. TEAQ-s = short Touch Experiences and Attitudes Questionnaire, STQ = Social Touch Questionnaire, LITPQ = Longing for Interpersonal Touch Picture Questionnaire, ZIP = Zufriedenheit-in-Paarbeziehungen-Skala (German Relationship Assessment Scale), PHQ-4 = Patient Health Questionnaire 4, BAS-2 = Body Appreciation Scale 2, NFT = Need for Touch Questionnaire.

< 0.001) indicating that individuals with less touch experiences and less positive attitudes have more depressive and anxious symptoms. The TEAQ-s was positively associated with *body appreciation* assessed with the BAS-2 ($r = 0.29$, $p_{corr} < 0.001$) indicating that positive beliefs about one's body relate to positive attitudes about affective touch and more frequent touch experiences. Surprisingly, there was no correlation between TEAQ-s and *need for touch* ($r = 0.03$, $p_{corr} = 1$) or any of the NFT subscales ($r \leq 0.09$, $p_{corr} = 1$) which suggests that social touch measured by the TEAQ-s and object touch measured by NFT are rather unrelated constructs. Again, the results were confirmed in *TEAQ-s France*, except for the relation to *mental health issues* ($r = -0.02$, $p_{corr} = 1$, Supplement Table B7). *Pre TEAQ* did not include PHQ-4, BAS-2, or NFT questionnaires.

3.5. Criterion validity

3.5.1. Relationship status

As we hypothesized, couples and singles showed differences in the intimate touch scales. In *TEAQ-s Germany*, individuals in a relationship reported more *current intimate touch* ($M = 16.4$, $SD = 3.2$) than singles ($M = 9.6$, $SD = 3.7$), $t(367) = 19.21$, $p_{corr} < 0.001$, $d = 1.97$, and slightly more positive *attitudes to intimate touch* ($M = 17.9$, $SD = 2.4$) than singles ($M = 16.9$, $SD = 3.1$), $t(343) = 3.70$, $p_{corr} = 0.003$, $d = 0.38$. No difference between the two groups was observed in the subscales unrelated to intimate touch such as *attitude to friendly touch*, $t(375) = -0.81$, $p_{corr} = 1$, $d = -0.08$, or *childhood touch*, $t(379) = -0.38$, $p_{corr} = 1$, $d = -0.04$ (Fig. 4, Supplement Table B10). These results were replicated in the other two studies (Supplement Tables B8, B9).

3.5.2. Sex

Neither the total score, $t(86) = 0.58$, $p_{corr} = 1$, $d = 0.08$, nor any of the subscales revealed sex differences, AFT: $t(79) = -0.97$, $p_{corr} = 1$, $d = -0.14$; CIT: $t(79) = 0.61$, $p_{corr} = 1$, $d = 0.09$; ChT: $t(78) = 1.71$, $p_{corr} = 1$, $d = 0.25$; AIT: $t(86) = -0.24$, $p_{corr} = 1$, $d = -0.03$ (Fig. 4) in the *TEAQ-s Germany* study. The same was true for *Pre TEAQ* and *TEAQ-s France* (Supplement Tables B8, B9).

3.5.3. Cohabitation

As expected, there was a difference in *current intimate touch* between couples that lived together ($M = 17.7$, $SD = 2.2$) and those living separately ($M = 15.9$, $SD = 3.5$) in *TEAQ-s German*, $t(173) = 4.60$, $p_{corr} < 0.001$, $d = 0.65$. However, this was not replicated in the two other studies (Supplement Tables B8, B9).

3.5.4. Age and education

In accordance with our hypothesis, age did not significantly correlate with TEAQ-s total scores in the age range of our sample ($r = -0.01$, $p_{corr} = 1$) which was confirmed in the two other studies (Supplement Tables B6 and B7). Regarding subscales, there was one significant correlation in the three studies, namely with *childhood touch* in *Pre TEAQ* ($r = -0.26$, $p_{corr} < 0.001$) which means that younger people reported more favorable touch experiences in their childhood. Due to the low variance in educational level in our samples, we did not test the hypothesis about education.

3.6. Study comparison

We compared TEAQ-s total and subscale scores across the three studies and observed differences ranging from insignificant to moderate (Supplement B-VIII). The TEAQ-s total, $F(2,1020) = 19.08$, $p_{corr} < 0.001$, and three of the four subscales, namely *attitude to friendly touch*, $F(2,1020) = 19.76$, $p_{corr} < 0.001$, *childhood touch*, $F(2,1020) = 20.19$, $p_{corr} < 0.001$, and *attitude to intimate touch*, $F(2,1020) = 5.74$, $p_{corr} = 0.017$, showed significant variation. The subscale *current intimate touch* did not show any differences across the three studies, $F(2,1020) = 3.45$, $p_{corr} = 0.160$. Contrary to our hypothesis that predicted highest values in the French sample, the participants in *TEAQ-s Germany* ($M = 60.0$, $SD = 10.6$) reported greater affinity for touch ($M = 55.0$, $SD = 11.0$), $t(672) = 6.05$, $p_{corr} < 0.001$, $d = 0.46$. On average, the responses in *TEAQ-s Germany* were 0.3 points higher per item. Specifically, *attitude to friendly touch*, $t(673) = 6.23$, $p_{corr} < 0.001$, $d = -0.47$, and *childhood touch* scores, $t(625) = 6.17$, $p_{corr} < 0.001$, $d = -0.47$, were higher in the German compared to the French validation study. However, these differences do not appear to be language specific, as similar variations were

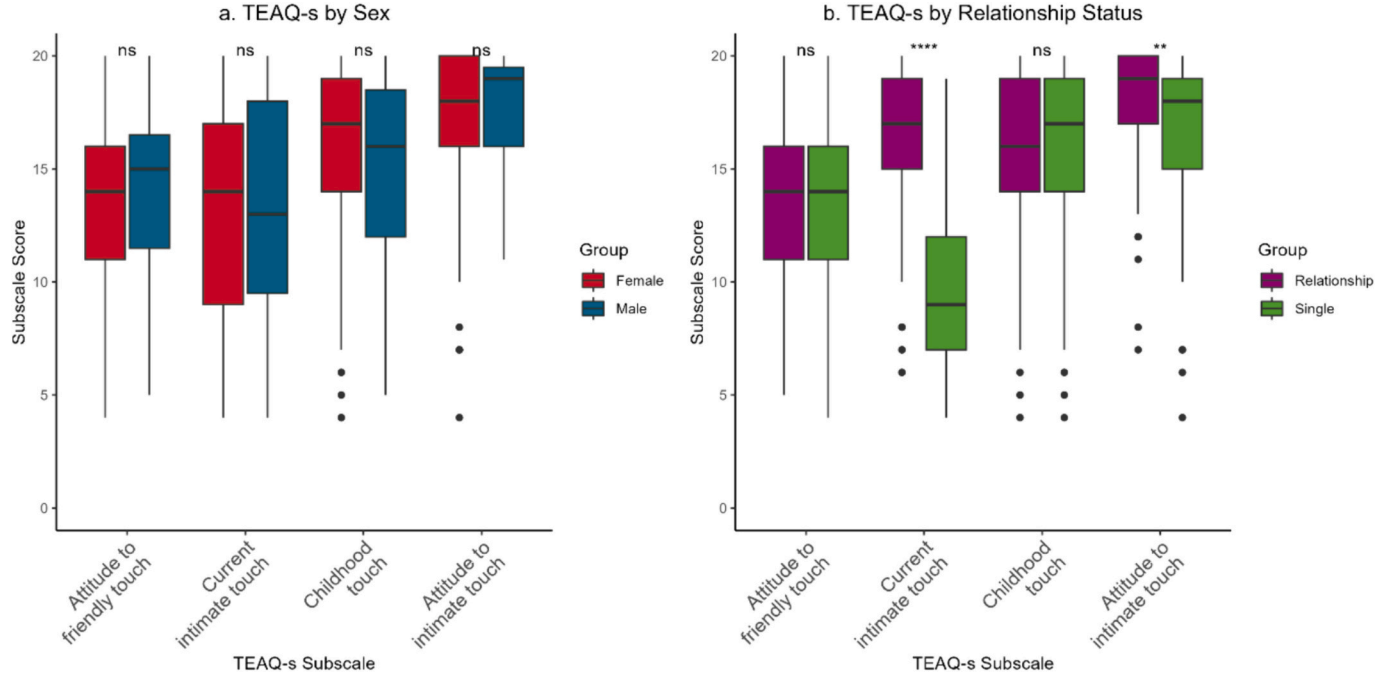

Fig. 4. TEAQ-s scores by (a) sex and (b) relationship status in *TEAQ-s Germany*. Stars mark statistical significance (****: $p_{corr} < 0.0001$, ***: $p_{corr} < 0.001$, **: $p_{corr} < 0.01$, *: $p_{corr} < 0.05$, ns: $p_{corr} > 0.05$). (a) TEAQ-s subscale scores did not differ with sex. (b) Singles showed lower scores in the intimate touch subscales than subjects in a relationship, no differences in the other subscales were found.

found between *Pre-TEAQ* and *TEAQ-s Germany* (e.g., TEAQ-s total: $t(656) = 3.79$, $p_{corr} = 0.002$, $d = 0.29$), both conducted in German. Given that our samples were not representative of the respective populations, cultural interpretations should be made with caution. We also tested for measurement invariance. Metric invariance across samples was not supported, neither by the first-order, $X^2(24) = 56.3$, $p < .001$, nor by the second-order model, $X^2(30) = 70.1$, $p < .001$ (Supplement Table B11).

4. Discussion

The objective of the present investigation was to design a refined and shortened version of the TEAQ that preserves characteristics of validity and reliability, while enhancing its efficiency. We developed the TEAQ-s in a multi-step procedure and tested it in Germany and France. The TEAQ-s, with 16 items, is considerably shorter than the original 57-item TEAQ, the Russian 37-item TEAQ which we used as a base, or subsequent versions. Overall, the questionnaire demonstrates convincing results in terms of item characteristics, reliability, and validity. At the subscale level, a four-factor structure was confirmed, consisting of two touch attitude subscales – *attitude to friendly touch* and *attitude to intimate touch* – and two experience-based subscales – *childhood touch* and *current intimate touch*. Additionally, a second-order factor connecting these subscales was supported. Two prior subscales, *attitude to self-care* and *attitude to unfamiliar touch,* were not included in the TEAQ-s. *Attitude to unfamiliar touch* had been omitted in previous TEAQ studies (Trotter, Belovol, et al., 2018; Yang et al., 2024), and *attitude to self-care* was excluded to focus solely on social touch.

The remaining subscales cover a broad spectrum within the social touch area. *Attitude to friendly touch* does not only focus on touch with friends and family as in prior versions but has a wider scope now and captures general preferences for physical contact with others. *Attitude to intimate touch* specifically focuses on preferences for touch with a romantic partner or with other emotionally close individuals. These two attitude subscales exhibit strong associations, suggesting that preferences in different touch domains are interrelated. This view is supported by other touch questionnaires (e.g. STQ, Wilhelm et al., 2001; TBQ, Beltrán et al., 2020). The subscale *current intimate touch* captures actual touch behaviors and experiences with a romantic partner or with other close individuals. *Current intimate touch* shows a moderate to high correlation with *attitude to intimate touch.* This supports the notion that abstract internal states such as attitudes influence actual behavior, and vice versa, which has been frequently proposed in the touch literature (e.g., Jakubiak & Feeney, 2016). The last subscale, *childhood touch,* examines positive touch experiences during childhood, primarily with the parents. It is also moderately associated with *attitude to intimate touch* and weakly with the other subscales. This implies that childhood touch experiences continue to influence thinking about touch in adulthood, although their impact on actual touch behaviors, as measured by the *current intimate touch* subscale, is minimal. The connection between childhood experiences and adult attitudes aligns with developmental psychology theories emphasizing early life experiences shaping later beliefs (e.g., attachment theory by Bowlby, 1978, or social learning theory by Bandura, 1977).

From the more technical perspective, various quality criteria of the TEAQ-s have been evaluated. Reliability of the TEAQ-s was high, with good results for internal consistency and test-retest correlation. High values of Cronbach's alpha and split-half reliability indicated an internally consistent structure of the TEAQ-s. Compared to prior versions, Cronbach's alpha for the TEAQ-s total score (*TEAQ-s Germany*: 0.87*, TEAQ-s France*: 0.86) was slightly lower than for the longer versions (e.g., Russian TEAQ: 0.92, Trotter, Belovol, et al., 2018; Mongolian TEAQ: 0.93, Tumurbaatar et al., 2022), which is typical when scales contain less items (Tavakol & Dennick, 2011). However, alpha was still at a good level (Nunnally & Bernstein, 1994). Regarding retest reliability, it was the first time a TEAQ version has been assessed in this regard. The convincing test-retest correlation of 0.85 in all three studies showed that the measured attitude and experience levels were stable over the four-week period. Taken together, these promising results indicate that total TEAQ-s scores are measured reliably.

Factor analyses generally supported the four-factor structure proposed. Model fit was best when we reduced the scale and recalculated the model with the selected items only. With the new data of *TEAQ-s Germany* and *TEAQ-s France*, the model fit was slightly weaker, but nevertheless satisfactory (Coughlan et al., 2008). The factor structure was not identical across the three study samples, as metric invariance was not supported, indicating deviations in factor loadings between samples. Fit indices were still higher than for prior TEAQ versions. Besides having a more suitable model, this may be driven by the fact that prior TEAQ versions were longer. The high item-to-factor ratio was the reason why some authors calculated parceled models (original TEAQ; Trotter, McGlone, et al., 2018; Portuguese TEAQ; Pereira et al., 2023) or modified the model in other ways (Russian TEAQ; Trotter, Belovol, et al., 2018; Chinese TEAQ; Yang et al., 2024) which resulted in more comparable fit indices. Interestingly, a second-order model proposing a common construct behind the individual TEAQ-s subscales showed comparable fit indices to the first-order model and was preferred because it is the simpler model. This is the first time a second-order model has been documented for the TEAQ. Our results support using a total TEAQ-s score and reinforces our decision to focus the questionnaire exclusively on social touch. It could be subject to future investigations exploring the exact meaning of the second-order TEAQ-s construct. For now, we propose the term "*social touch orientation*". Linking the subscales, *social touch orientation* is shaped by early life experiences (*childhood touch*), expressed through touch preferences in various social contexts (*attitude to friendly touch*, *attitude to intimate touch*), and manifests in actual touch behaviors and touch-seeking tendencies (*current intimate touch*).

Item characteristics mainly fulfilled the criteria that we set. The TEAQ-s contains items that measure aspects of the same latent variable (item-total correlations) and that can differentiate between different levels of touch attitudes and experiences (item difficulty). In general, the TEAQ-s demonstrates high agreement rates, especially in the *attitude to intimate touch* subscale. On the one hand, this might be critical as it is harder to differentiate between people and capture subtle nuances in variability. On the other hand, interpersonal touch – especially in an intimate setting – is something that most people like and enjoy (Cruciani et al., 2021; Debrot et al., 2013; Packheiser et al., 2024), which makes the response patterns plausible. Although the *attitude to intimate touch* subscale difficulty levels were above the set criterion, a differentiation between couples and singles was possible using this subscale.

Validity measures showed plausible correlations and distinctions. The TEAQ-s was strongly, but not redundantly, correlated with the STQ ($r = 0.66$), an association that was shown with other TEAQ versions of the same magnitude (e.g., original TEAQ; Trotter, McGlone, et al., 2018; Portuguese TEAQ; Pereira et al., 2023). Correlating the TEAQ-s to the LITPQ was also consistent with the questionnaire concepts. *Touch frequency* (LITPQ) was strongly correlated with *current intimate touch* (TEAQ-s), which is plausible, as both subscales measure recent touch behaviors but in different ways. Positive *attitudes to intimate touch* and to *friendly touch* (TEAQ-s) also manifested in numerically higher *touch wishes* (LITPQ).

The TEAQ-s was not only associated with touch questionnaires, but also with other constructs. For example, higher TEAQ-s values were related to higher body appreciation and mental health, both indices of psychological well-being. This corresponds to a multivariate meta-analysis reporting significant mental health benefits of touch interventions (Packheiser et al., 2024). Interestingly, the TEAQ-s was not correlated with the Need for Touch scale. This could indicate that social touch preferences may be rather distinct from object touch preferences. This distinction aligns with the neurobiological proposal of two dimensions of touch – object touch as a more discriminative function mediated by A-beta mechanoreceptive afferents and social touch as a

more affective experience reinforced by mechanosensitive low-threshold C-fibers (C-tactile afferents or CTs; McGlone et al., 2014).

Interpersonal touch also plays a key role in romantic relationships. As in the original TEAQ (Trotter, McGlone, et al., 2018), this was reflected in higher scores in the intimate touch subscales, namely *current intimate touch* and *attitude to intimate touch,* when compared to singles. Additionally, more *current intimate touch* was associated with higher relationship satisfaction. A finding that is supported by previous studies outside the TEAQ literature investigating touch frequency and indicators of relationship quality (Jakubiak, 2022; Sorokowska et al., 2023). Touch from a partner often induces feelings of pleasantness (Kreuder et al., 2017), closeness, and security (Debrot et al., 2013), reflected in a parasympathetic calming response including reduced heart rate (Triscoli, Croy, Olausson, & Sailer, 2017) and increased heart rate variability (Triscoli, Croy, Steudte-Schmiedgen, et al., 2017). These positive effects may contribute to the high prevalence of intimate touch in close relationships.

We did not find differences regarding sex. Prior versions of the TEAQ have shown sex differences favoring women in some subscales (e.g., Trotter, McGlone, et al., 2018), but these findings have not been consistent (e.g., Tumurbaatar et al., 2022). Effects were interpreted to mean that females experience more positive touch in both childhood and adulthood (see Takeuchi et al., 2010; Trotter, McGlone, et al., 2018) or that they perceive affective touch as more pleasant than men (Russo et al., 2020). In the broader touch literature, the picture is not clear either. In some studies, quantitative differences were reported (e.g., friend and child touch: Sorokowska et al., 2021; touch comfort: Webb & Peck, 2015), in others not (e.g., touch frequency and wish: Beßler et al., 2020; STQ: Lapp & Croy, 2021; negative touch experiences: Beltrán et al., 2020; partner touch: Sorokowska et al., 2021). Inconsistencies might stem from different sample characteristics including cultural differences or measured touch domains. Although various theories have been proposed to explain possible sex differences in touch – sociological (e.g., men touch females as an expression of higher status and power; Henley, 1973), evolutionary (e.g., females are more involved as caregivers; Russo et al., 2020), and hormonal (less testosterone in females enhances tactile sensitivity; Russo et al., 2020) – it remains common ground that giving and receiving affective touch is a universal human need.

Our studies have strengths and weakness. On the one hand, we strengthened methodological quality by preregistering our hypotheses and study procedures, we tested the TEAQ-s in two different languages, and we considered both content validity and statistical measures during the questionnaire development. On the other hand, interpretations are limited by the characteristics of our samples. We included primarily young adult, white, female university students that may bias our results in a more touch friendly direction. It also restricts the interpretation of the nonsignificant age effect, as the age range was limited. Studies including elderly people and more diverse backgrounds may shed more light on group differences. Additionally, we collected only retrospective self-report data, and not behavioral data, which inherits certain biases (e.g., social desirability, recall biases). Both aspects can be addressed in future investigations.

Nevertheless, assessing touch is important. As one of our earliest senses (Fulkerson, 2014), touch shapes our perception of the world and connects us with other humans before any word is spoken. Over lifetime, individuals have diverse experiences and form different preferences for social touch. The TEAQ-s is a questionnaire that is able to capture some of these differences. Our study has also shown that these attitudes and experiences are not only pertinent to touch domains itself but are also related to the way we perceive our body, to our mental health and in leading satisfactory romantic relationships. While this study did not explore causal relationships, it may contribute to reliable and consistent touch research.

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CRediT authorship contribution statement

Yvonne Friedrich: Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Conceptualization. **Sophia Faresse:** Writing – review & editing, Investigation. **Celine Henning:** Writing – review & editing, Investigation. **Paula D. Trotter:** Writing – review & editing. **Rochelle Ackerley:** Writing – review & editing, Supervision, Funding acquisition. **Ilona Croy:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization.

Declaration of competing interest

None.

Data availability

The data and code is shared on OSF https://osf.io/rb85w/

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Appendix A. Supplementary data

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