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**Would the Real Loneliness Please Stand Up? The Validity of Loneliness
Measures and the Reliability of Single Items**

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Abstract

Several measures that assess loneliness have been developed for adults. Across three studies, we investigated psychometric features of different versions of the Rasch-Type Loneliness Scale, the UCLA Loneliness Scale, and three single-item measures. In Study 1 ($N = 697$ self-ratings, $N = 282$ informant-ratings of 163 targets) and Study 2 ($N = 1,216$ individuals from 608 couples), we investigated the convergent validity and self-informant agreement of the included measures. Furthermore, we compared the nomological nets of these measures using correlates related to demographic aspects, personality, satisfaction, and network characteristics. In Study 3 ($N = 411$), we estimated a reliability of $r_{xx} > .70$ for three single-item measures of loneliness in a short-term prospective study. Overall, all measures and their nomological nets were highly correlated within and across studies, indicating that the included measures are all reliable and valid. Recommendations for choosing a loneliness measure are discussed.

Keywords: loneliness, Rasch-Type Loneliness Scale, University of California Los Angeles Loneliness Scale, single-item measures, validity, nomological net, self-other agreement

Would the Real Loneliness Please Stand Up? The Validity of Loneliness Measures and the Reliability of Single Items

Humans are social beings, and they rely and depend on each other (Axelrod & Hamilton, 1981; Baumeister & Leary, 1995). Interpersonal relationships are among the most powerful sources for well-being and health (Baumeister & Leary, 1995; Cohen, 2004; Hartup & Stevens, 1997; House et al., 1988). When interpersonal relationships are perceived as deficient regarding quantitative (e.g., network size, number of friends) and/or qualitative aspects (e.g., relationship closeness, trust, intimacy), individuals experience loneliness (Ernst & Cacioppo, 1999; Perlman & Peplau, 1981).

Since its introduction in the scientific literature by Weiss (1973), loneliness has attracted a lot of attention. The large body of literature that has accumulated is very consistent in demonstrating the negative effects of loneliness on health-related outcomes (for reviews, see Cacioppo et al., 2015; Ernst & Cacioppo, 1999; Hawkley & Cacioppo, 2010; Hawkley & Capitanio, 2015; Heinrich & Gullone, 2006; Holt-Lunstad et al., 2015) and interpersonal outcomes (Cacioppo et al., 2017; Lodder et al., 2017; Mund & Johnson, 2021; Mund et al., in press; Spithoven et al., 2018). This consistency is to be highlighted given the multitude of loneliness measures that have been developed over the last decades, including uni- and multidimensional multi-item scales, various abbreviated versions thereof, and a variety of single-item measures. Although issues of validity have been investigated in prior research, these studies are limited in that they (a) have examined either convergent validity between instruments, but not their correlations with external variables (e.g., Cacioppo et al., 2006; Grygiel et al., 2013; Iecovich, 2013; Maes et al., 2017; D. Russell et al., 1980), (b) examined the nomological net of only one or two measures at once (Cacioppo et al., 2006; Shiovitz-Ezra & Ayalon, 2012; Victor et al., 2005), and, when doing so, (c) mostly only considered demographic variables such as age, gender, and education as external correlates of loneliness (Borys & Perlman, 1985; Shiovitz-Ezra & Ayalon, 2012; Victor et al., 2005). Thus, it is unclear whether different loneliness measures for adults tap into different aspects of loneliness or capture a common core.

In the present study, we extend prior work in four ways. First, we simultaneously examine the convergent validity among, and the nomological net of, the most widely-used measures of loneliness in adulthood (Buecker et al., 2020; Maes et al., 2019; Mund, Freuding, et al., 2020; Pinquart & Sörensen, 2001): the Rasch-Type Loneliness Scale and its facets emotional and social loneliness (de Jong Gierveld & Kamphuis, 1985; de Jong Gierveld & van Tilburg, 2006), the University of California Los Angeles Loneliness Scale in its full (D. Russell et al., 1980; D. Russell et al., 1978; D. W. Russell, 1996) and two abbreviated versions (Hawkley et al., 2015; Hays & DiMatteo, 1987), and three single-item measures of loneliness. Second, we examine the convergence between self- and informant-ratings of loneliness to extend the assessment of the validity beyond self-reports (McCrae et al., 2004; Podsakoff et al., 2003). Third, in addition to demographic correlates of loneliness, we investigate the nomological net of the various measures using a wide variety of constructs (e.g., Big Five personality traits, domain and life satisfaction, social support, depressiveness, and shyness) to pinpoint similarities and differences between the selected measures. Fourth, we examine the reliability of three single-item measures to investigate the often-raised criticism that such measures lack reliability (D. Russell, 1982).

To achieve these goals, we conducted three independent studies. Studies 1 and 2 were designed to investigate the validity and agreement between self-ratings of close others and examine the nomological nets of different loneliness measures. In Study 3, we examined the reliability of three single-item measures of loneliness using a procedure developed by Heise (1969) in a study extending over three measurement occasions, each two weeks apart.

Measures of Loneliness

Given its subjective nature (Ernst & Cacioppo, 1999; Perlman & Peplau, 1981), loneliness has most often been assessed using self-reports (Marangoni & Ickes, 1989; D. Russell, 1982). The various self-report measures that have been developed in recent decades primarily differ regarding three aspects (D. Russell, 1982): (a) the dimensionality of the instrument (uni- vs. multidimensional), (b) the number of items

(i.e., single-item measures vs. multi-item scale), and (c) whether the instrument assesses loneliness in a direct or an indirect way.

Unidimensional and Multidimensional Measures

Measurement instruments to assess loneliness can be differentiated according to whether they were developed based on the conceptualization of loneliness as a unidimensional construct or as a construct with multiple interrelated facets. Instruments such as the University of California Los Angeles Loneliness Scale (UCLA-LS; D. Russell et al., 1980; D. Russell et al., 1978; D. W. Russell, 1996) have been designed to assess global loneliness. However, it should be noted that some studies have reported specific facets contained in the UCLA-LS (e.g., Hawkley et al., 2005; Maes et al., 2017). As the intent of the authors of the UCLA-LS was to develop a unidimensional scale (D. Russell et al., 1980; D. Russell et al., 1978; D. Russell, 1982; D. W. Russell, 1996), we will treat the scale as unidimensional in the present study.

Other scales such as the Rasch-Type Loneliness Scale (RTL; de Jong Gierveld & Kamphuis, 1985; de Jong Gierveld & van Tilburg, 2006) have been designed to capture multiple aspects of loneliness such as emotional and social loneliness. Multidimensional approaches offer the opportunity to measure loneliness in a more nuanced fashion and to better understand differential predictors and consequences of those facets. However, when taking the RTL as an example, surprisingly few studies seem to build on its multidimensionality (for meta-analyses, see Buecker et al., 2020; Mund, Freuding, et al., 2020). This might be due to relatively high correlations between the two facets of the RTL (Grygiel et al., 2013; Iecovich, 2013; Mund & Neyer, 2016), possibly indicating that the two facets capture actually the same aspects of loneliness. In the present study, we will examine both global loneliness as measured by the RTL and its facets emotional and social loneliness.

Single Items and Multi-Item Scales

Single-item measures of loneliness have been used frequently (Mund, Freuding, et al., 2020; Pinquart & Sörensen, 2001) and have attested substantial content validity (D. Russell, 1982). However, their usage has been discouraged and criticized for several

reasons (Marangoni & Ickes, 1989; D. Russell, 1982). For example, the validity of single-item measures has been questioned due to possible socially desirable responding and lack of standardization (Marangoni & Ickes, 1989; D. Russell, 1982). That is, there is a plethora of single-item measures of loneliness that differ in wording and response format so that it is not fully clear whether all these measures tap into the same construct. Studies comparing single-item with multi-item measures have found a lower prevalence of loneliness when single items are used (Eccles et al., 2020; Victor et al., 2005; but see Shiovitz-Ezra & Ayalon, 2012, for a contrasting finding). Moreover, it seems that the individuals who are classified as “lonely” based on cut-off scores on multi-item scales are not the same individuals who are classified as “lonely” based on the same cut-off score applied to single-item measures (Eccles et al., 2020; Shiovitz-Ezra & Ayalon, 2012). Apart from prevalence rates, however, the results obtained with single-item measures converge very well with those obtained with multi-item scales with regard to demographic aspects (Shiovitz-Ezra & Ayalon, 2012; von Soest et al., 2020), aspects of mean-level and rank-order stability (Mund, Freuding, et al., 2020; Mund, Lüdtke, et al., 2020), interpersonal dynamics (Mund & Johnson, 2021; Mund et al., in press), personality correlates (Buecker et al., 2020), and health outcomes (Beutel et al., 2017; Eccles et al., 2020), including early mortality (Holt-Lunstad et al., 2015; Shiovitz-Ezra & Ayalon, 2010).

It has also been argued that single items are unreliable and capture more noise than substantial inter-individual differences (Marangoni & Ickes, 1989; D. Russell, 1982). In line with this reasoning, a study employing STARTS models (Kenny & Zautra, 2001) found that single item measures capture more (potentially unreliable) state variance ($\approx 50\%$ state variance) than longer scales such as a 6-item version of the RTLS ($\approx 25\%$ state variance; Mund, Lüdtke, et al., 2020). However, it has been shown for single-item measures of subjective well-being that state variance can contain a substantial amount of reliable variance (Lucas & Donnellan, 2012). Similarly, Robins et al. (2001) demonstrated high reliability of a single-item measure of self-esteem ($r_{xx} = .75$) by applying a procedure introduced by Heise (1969). In this approach, the

reliability of a single-item measure is estimated based on its pattern of autocorrelation across three measurement points. In the present study, we will adopt this approach to estimate the reliability of three single-item measures of loneliness.

Direct and Indirect Measures of Loneliness

In direct measures of loneliness, the respondents are confronted with the target construct insofar as words such as “lonely” are contained in the questions (e.g., “I am lonely”; “How often have you felt very lonely?”). Indirect measures, by contrast, avoid such references to loneliness (D. Russell, 1982). One item from the UCLA-LS, for example, asks participants to indicate “How often do you feel left out?”, and an item from the RTLS asks participants to rate to what extent they agree with the statement “I experience a general sense of emptiness” (indicative of emotional loneliness).

The reasoning for using indirect measures is to disguise the researchers’ interest in loneliness, thereby avoiding the activation of negative stereotypes and socially desirable responding (D. Russell, 1982). Previous studies have shown that gender differences in the prevalence of loneliness can be observed when direct measures are used, with men reporting lower levels of loneliness on average than women (Borys & Perlman, 1985). Those gender differences disappear or even reverse when indirect measures are used (Maes et al., 2019). It should be noted that direct measures of loneliness are often single items, which, necessarily, are unidimensional. By contrast, most multi-item measures are indirect measures of loneliness (for an exception, see Rubenstein & Shaver, 1980), and some of them are multi-dimensional.

Convergent Validity, Self-Informant Agreement, and Nomological Nets

Previous studies comparing different measures of loneliness for adults usually included no more than two measures at once and primarily considered their association with demographic variables (Borys & Perlman, 1985; Cacioppo et al., 2006; Hughes et al., 2004; Iecovich, 2013; Maes et al., 2017; Shiovitz-Ezra & Ayalon, 2012; Victor et al., 2005; von Soest et al., 2020). Regarding aspects of validity, we extend prior research in the present study by (a) considering multiple measures, and their facets, of loneliness for adults, (b) investigating correlations among self-reports and the agreement

between self- and informant-ratings on those measures, and (c) considering a broad range of demographic and psychological variables to investigate similarities and differences in the nomological nets of those measures.

While several studies have investigated psychometric properties of multiple loneliness measures for children and adolescents (Cole et al., 2021; Goossens & Beyers, 2002; Maes et al., 2017), studies on loneliness measures for adults have only compared two measures at once (Borys & Perlman, 1985; Cacioppo et al., 2006; Hughes et al., 2004; Iecovich, 2013; Shiovitz-Ezra & Ayalon, 2012; Victor et al., 2005; von Soest et al., 2020), with a particular focus on the UCLA-LS. However, examining the convergent validity of multiple measures is important to ensure that all those measures capture inter-individual differences in the same construct (Cronbach & Meehl, 1955).

The correlation between self- and informant-reports is an important aspect of construct validity (Connelly & Ones, 2010; McCrae et al., 2004; Podsakoff et al., 2003). If an instrument merely captures noise instead of reliable inter-individual differences, then the correlation with informant-ratings would be low (McCrae, 2015; Podsakoff et al., 2003). Thus, self-informant agreement is indicative of the substance of the measured construct (McCrae et al., 2004). Using a 9-item version of the UCLA-LS, Luhmann et al. (2016) found self-informant agreements for partnered individuals of $r = .37, .43$, and $.66$, when the informants were friends, parents, and partners, respectively. For individuals without a partner, the self-informant agreement with friends amounted to $r = .43$ and to $r = .56$ with parents. Using the 20-item UCLA-LS, Lee and Ko (2018) reported a correlation of $r = .55$ between self-ratings and an aggregated informant-rating of up to three friends in a study with 118 self-(aggregated) informant pairs. Finally, also using the 20-item UCLA-LS, Mearns et al. (2009) reported a correlation of $r = .44$ between self-ratings and ratings by a friend, roommate, or parent in a study with 74 self-informant pairs. Studies investigating the self-informant agreement in adult samples for other measures than the UCLA-LS are lacking to date.

The construct validity of the measures investigated in the present work are further examined using a comprehensive nomological net (Cronbach & Meehl, 1955).

Previous studies comparing the nomological nets of loneliness measures for adults (Borys & Perlman, 1985; Cacioppo et al., 2006; Hughes et al., 2004; Iecovich, 2013; Shiovitz-Ezra & Ayalon, 2012; Victor et al., 2005; von Soest et al., 2020) were mostly restricted to a few, mostly demographic aspects. In the present work, we investigated broad nomological nets of the selected loneliness measures including demographic aspects, personality characteristics, domain-specific and life satisfaction, and aspects of social networks. Large differences in the nomological nets across measures would indicate that researchers and practitioners need to choose their measures carefully to make sure that they measure the intended aspects.

The Present Work

In this article, we present a series of three studies. In Study 1, we investigated the validity (convergence, self-other agreement, and nomological nets) of six measures of loneliness in a sample of young adults. In Study 2, we examined the validity of four partly different measures of loneliness than those used in Study 1. Furthermore, data in Study 2 were collected as part of a larger project on partner relationships; accordingly, informants in Study 2 were romantic partners. In Study 3, we investigated the reliability of three single-item measures of loneliness by designing a short-term prospective study with three measurement occasions each two weeks apart. The single studies were not preregistered. Analysis scripts and data used in the analyses are accessible at https://osf.io/7gsfw/?view_only=7e21e28c104549d0a5d9613495322148.

Study 1: Validity of Six Loneliness Measures

Method

Sample

The study was conducted in May 2018 as a cross-sectional online study using the formr survey framework (Arslan et al., 2020). The study was announced on several university mailing lists and on dedicated websites for people interested in psychological studies. The study protocol was approved by the Institutional Review Board of the Friedrich Schiller University Jena (FSV 18/03). A total of 697 German-speaking individuals participated in the self-rating part of the study. Among those, 72.17% were

female. The majority of the participants were students (73.39%), 15.88% of the participants were employed or self-employed, 2.43% were enrolled in non-academic education (e.g., vocational learning, traineeship), and 1% were fulfilling a civil service; 7.30% of the participants were unemployed, unable to work because of ill-health, or not working for other reasons (e.g., retired, parental leave). On average, participants were 26.06 years ($SD = 9.84$, $Mdn: 23$) old, ranging from 18 to 99 years. After completion of the survey, participants received personalized feedback on their personality and well-being and could sign up for a voucher lottery.

Very early in the survey, participants were asked to provide contact details of up to five individuals who could provide ratings of the targets' personality and well-being. Those contacts were then sent an e-mail and asked to fill in a brief questionnaire. In this way, we obtained 282 informant-ratings on 163 targets. On average, the informants were 28.25 years old ($SD = 13.58$, $Mdn = 22$), ranging from 18 to 70 years. Among the informants, 52% were friends of the targets, 23% were kin (e.g., parents, siblings), 18% were the target's romantic partner, 3% were acquaintances, 3% were colleagues, and 1% indicated to be in another relationship with the target. Given the uneven distribution of types of informants, we aggregated the ratings of all informants in the analyses.

Informants were asked to indicate how well they knew the target using a scale ranging from 0 (*not well*) to 10 (*very well*). On average, informants stated to know the targets very well (8.43, $SD = 1.54$, $Mdn = 9$). Upon completion of the survey, informants were offered the option to sign up for a voucher lottery. Informants were also invited to take part in the self-rating. In this way, it was possible that self-raters also served as informants for other targets. Furthermore, it is possible that some individuals provided informant-ratings for more than one person. The primary data used for the analysis are available at

https://osf.io/7gsfw/?view_only=7e21e28c104549d0a5d9613495322148.

Measures

Details on internal consistency, sample items, response formats, descriptive statistics, and zero-order correlations are provided in Supplemental Tables S1 to S3.

Loneliness. The loneliness measures were presented in the self- and the informant-rating parts of the study.

Rasch-Type Loneliness Scale (RTL_S). We used the 11-item version of the RTL_S (de Jong Gierveld & Kamphuis, 1985) to assess global loneliness and the facets emotional and social loneliness. Internal consistency (coefficient ω) was high for self-ratings ($\omega_{Total} = .89, \omega_{Emotional} = .80, \omega_{Social} = .87$) and informant-ratings ($\omega_{Total} = .87, \omega_{Emotional} = .83, \omega_{Social} = .82$). RTL_{S_{Emotional}} and RTL_{S_{Social}} were highly correlated in the self- ($r = .66, p < .001$) and the informant-ratings ($r = .61, p < .001$).

UCLA Loneliness Scale (UCLA-LS_{20Items}). We used the German version of the 20-item UCLA-LS (Döring & Bortz, 1993; D. Russell et al., 1980). Internal consistency was high for self- ($\omega = .94$) and informant-ratings ($\omega = .93$).

3-item version of the UCLA Loneliness Scale (UCLA-LS_{3Items}). We employed a 3-item version of the UCLA-LS that has been developed for use in large panel studies (Hawkey et al., 2015; Luhmann & Hawkey, 2016). Internal consistency was satisfactory in the self- ($\omega = .78$) and the informant-ratings ($\omega = .80$).

Direct single-item measure (SI Direct). As a direct single-item measure of loneliness, we asked the participants to what extent the statement “I feel lonely” applies to them.

Indirect single-item measure (SI Indirect). As indirect single-item measure of loneliness, we asked participants to indicate their agreement with the statement “I feel alone”.

Direct single-item frequency measure (SI Direct_{frequency}). Adapting the SI Direct, we also asked participants about the frequency of loneliness (i.e., “How often do you feel lonely?”).

Correlates of loneliness. All correlates were assessed only in the self-rating part of the study. We examined correlates from the domains of (a) demography, (b) personality, (c) satisfaction, and (d) network characteristics.

Demographic variables. Participants were asked to indicate their age, gender, educational status, and whether they currently have a partner or not.

Personality. The *Big Five personality traits* were assessed using a 15-item version of the Big Five Inventory (Hahn et al., 2012). *Self-esteem* was assessed using a three-item version adapted from the Rosenberg Self-Esteem Scale that has been used previously in a large panel study (Huinink et al., 2011). *Depressiveness* was measured using the 10-item State-Trait Depression Scale (Spaderna et al., 2002). The explicit *affiliation motive* was assessed using four items from the Unified Motive Scales (Schönbrodt & Gerstenberg, 2012). We also assessed *need satisfaction* of the affiliation motive by two items from the Basic Need Satisfaction and Frustration Scale (Chen et al., 2015). A product interaction between both variables was calculated to create an index of *frustration of the affiliation motive*. *Social desirability* was assessed using the 17-item Social Desirability Scale (Stöber, 2001). *Shyness* and *sociability* were assessed using the Shyness and Sociability Scales for adults (Asendorpf & Wilpers, 1998).

Satisfaction. Participants were asked to indicate their overall satisfaction with (a) life, (b) education, (c) leisure, (d) friends and social contacts, (e) family, and (f) partner relationship. These items were taken from larger panel studies (Huinink et al., 2011; Siedler et al., 2008).

Network Characteristics. Using single-item measures, participants were asked to indicate the number of (a) close friends, (b) friends on Facebook, (c) persons with whom the participant would be ready to discuss personal or occupational problems (i.e. *emotional support*), (d) persons who could be contacted for practical help (e.g., when relocating; i.e., *instrumental support*), and (e) persons the participant would ask for advice. Furthermore, participants were asked to indicate the frequency of (f) contact with their closest friend(s) and (g) joint activities with their friends.

Analytic Procedure

Convergent validity, operationalized as the correlation between the six loneliness measures, was assessed separately for self- and informant-ratings. Furthermore, for each measure, we examined the correlation between self- and informant-ratings. Nomological nets of the loneliness measures were examined by calculating the correlations with the external variables (e.g., demography, personality).

To investigate whether the selected loneliness measures differ in their associations with external variables we conducted pairwise model comparisons. In the first step of this approach, we entered all available measures and allowed unrestricted correlations between the loneliness measures and the external variables, resulting in a saturated model. In a next step, we constrained the correlation between two loneliness measures (e.g., $RTLS_{Total}$ and $UCLA-LS_{20Items}$) and a correlate (e.g., shyness) to be equal. We then compared the fit of this constrained model to the unconstrained model via a χ^2 -difference test with 1 degree of freedom. A significant decrease in model fit in this setup indicated that the two loneliness measures differed significantly in their association with the external variable. Due to the large number of pairwise comparisons, we only consider differences significant when the p -value of the χ^2 -difference test was lower than .001. To facilitate the interpretation of the findings, we computed the average absolute correlation ($|\bar{r}|$) for each loneliness measure and each domain (i.e., demography, personality, satisfaction, network characteristics).

To estimate differences in the correlation patterns between self- and informant-ratings as well as between Study 1 and Study 2, we calculated mean absolute deviations between correlation matrices ($|\overline{\Delta r}|$). To examine the similarity of correlation profiles, we calculated the double-entry Intraclass Correlation (ICC_{DE} ; McCrae, 2008). Specifically, ICC_{DE} was calculated to examine the profile similarity of the correlations between self- and informant-ratings as well as the different loneliness measures and the external correlates within and between studies. Furthermore, ICC_{DE} was calculated to compare correlation profiles between Study 1 and Study 2. In all analyses, all variables were treated as manifest variables. All syntax files used in the study are available at https://osf.io/7gsfw/?view_only=7e21e28c104549d0a5d9613495322148.

Results and Discussion

Convergent validity

The intercorrelation between the different measures of loneliness are displayed in Table 1 separately for the self- and aggregated informant-ratings. Overall, the correlations were high for self-ratings ($\bar{r} = .63$) and informant-ratings ($\bar{r} = .66$).

Furthermore, the average difference between the two correlation matrices were small ($|\overline{\Delta r}| = .08$). Finally, the profile similarity between the coefficients in the two matrices was high ($ICC_{DE} = .97$).

Within the self-ratings, the correlations between $RTLS_{social}$ and the three single items were lower than other associations and varied between $r = .43$ and $r = .47$. The $UCLA-LS_{20Items}$ was more strongly correlated with the $RTLS_{Total}$ ($r = .87$) than the $UCLA-LS_{3Items}$ ($r = .73$). Likewise, the $UCLA-LS_{20Items}$ was more strongly correlated with the $RTLS_{Social}$ ($r = .82$) than the $UCLA-LS_{3Items}$ ($r = .57$). Among the informant-ratings, the SI Direct_{frequency} was least strongly associated with all other measures of loneliness ($.34 \leq r \leq .51$).

Taken together, the findings converge with prior research showing high intercorrelations between different measures of loneliness for adults (Iecovich, 2013; D. Russell et al., 1980). Furthermore, we extended prior research by simultaneously examining the convergent validity of multi-item and single-item instruments, and by demonstrating that the high convergence between measures also extends to informant-ratings. Thus, we conclude that all the instruments included in Study 1 are appropriate to assess between-person differences in loneliness from an internal (i.e., self-ratings) as well as an external (i.e., informant-ratings) perspective.

Self-informant agreement

Table 2 displays the correlations between self- and aggregated informant-ratings. Self-informant agreement on the same scale (shown in the diagonal of Table 2) varied across instruments ($.49 \leq r \leq .61$). The highest self-informant agreement was found for the $RTLS_{Total}$ ($r = .61$) and the $UCLA-LS_{20Items}$ ($r = .61$); the lowest agreement was observed for the SI Direct ($r = .49$). Across all measures, the self-informant agreement amounted to $\bar{r} = .51$. This average correlation converges with other studies in which self-informant agreement in loneliness was investigated (Lee & Ko, 2018; Luhmann et al., 2016; Mearns et al., 2009).

To our knowledge, this is the first study that investigated the self-informant agreement on multiple measures of loneliness. The results show that the overall

convergence between self- and informant-ratings is high within and across measures. In fact, the amount of self-informant agreement found in the present and previous studies (Lee & Ko, 2018; Luhmann et al., 2016; Mearns et al., 2009) is similar to self-informant agreement in broader personality characteristics such as the Big Five traits (for a meta-analysis, see Connelly & Ones, 2010).

The nomological nets of loneliness measures

Table 3 displays the correlations between the different loneliness measures and a wide variety of correlates pertaining to demography, personality, satisfaction, and aspects of social networks. All correlations were compared pairwise via a model comparison with one degree of freedom. We will not go into detail on these model comparisons but instead highlight the overall pattern of results. To facilitate the interpretation, we computed scale-wise average absolute correlations ($|\bar{r}|$) for each block of correlates (i.e., demography, personality, satisfaction, network characteristics). Table 4 shows scale-wise profile correlations derived from the correlations in Table 3.

Demography. All measures were only modestly related with demographic aspects. Average absolute correlations ranged from $|\bar{r}| = .06$ for the UCLA-LS_{3Items} to $|\bar{r}| = .13$ for the UCLA-LS_{20Items} and the RTLS_{Social}. The UCLA-LS_{3Items} was the only scale that was not significantly correlated with any of the demographic variables.

Personality. The correlations as displayed in Table 3 converged well with previous studies on loneliness and the Big Five (Buecker et al., 2020), self-esteem (Levin & Stokes, 1986), and depression (Cacioppo et al., 2006). The average absolute correlations ranged from $|\bar{r}| = .20$ for the three single-item measures to $|\bar{r}| = .36$ for the UCLA-LS_{20Items}. These differences held also when computing $|\bar{r}|$ for disattenuated correlations (RTLS_{Total} = .41, RTLS_{Emotional} = .39, RTLS_{Social} = .39, UCLA_{20Items} = .45, UCLA_{3Items} = .41, SI Direct = .29, SI Indirect = .27, and SI Direct_{frequency} = .29—for the single-items, we used the reliability estimated in Study 3 as correction).

These differences were probably due to substantially lower correlations between the single items and personality aspects such as openness, agreeableness,

conscientiousness, sociability, and need frustration. Furthermore, the correlations suggested that the UCLA-LS_{20Items} was more strongly related to aspects associated with extraversion (i.e., sociability, shyness, affiliation motive) than other instruments.

Satisfaction with domains of life. The average absolute correlations between loneliness measures and domains of satisfaction ranged from $|\bar{r}| = .38$ for the SI Direct_{frequency} to $|\bar{r}| = .47$ for the RTLS_{Total} and the UCLA-LS_{20Items}. The RTLS_{Total}, RTLS_{Emotional}, and the UCLA-LS_{20Items} stood out in this regard with average absolute correlations between $|\bar{r}| = .45$ and $|\bar{r}| = .47$, whereas all other measures varied on a somewhat lower level with $.38 \leq |\bar{r}| \leq .40$. The largest differences between measures emerged for the association with satisfaction with friends and social contacts. Single-item measures were less strongly associated with this aspect ($.43 \leq |\bar{r}| \leq .47$), than the multi-item instruments ($.55 \leq |\bar{r}| \leq .66$).

Network characteristics. Across all measures, loneliness was associated with smaller friendship and support networks. All measures were uncorrelated with the self-reported number of friends on Facebook. The average absolute correlations ranged from $|\bar{r}| = .13$ for the SI Direct_{frequency} to $|\bar{r}| = .31$ for the RTLS_{Social} and the UCLA-LS_{20Items}. Thus, as with the personality correlates, the UCLA-LS_{20Items} seems to tap into aspects related to sociability and support. The average absolute correlations with network characteristics were particularly low for the single items ($|\bar{r}| = .13, .14, .16$ for the SI Direct_{frequency}, SI Direct, and SI Indirect, respectively) and was somewhat higher for the UCLA-LS_{3Items} ($|\bar{r}| = .20$) and the RTLS_{Emotional} ($|\bar{r}| = .22$). Except for the number of friends providing instrumental support and advice, the single items were markedly less strongly correlated with network characteristics than the other instruments; these differences were particularly strong with regard to the frequency of contact with friends. In this case, the single items were not significantly correlated with this variable, whereas the multi-item scales were.

Profile similarity. The correlation between the profiles of the loneliness measures and the correlates examined in Study 1 are displayed in Table 4. On average, the profiles of the scales were very similar to each other, indicating that their

nomological nets overlap to a large extent. Nevertheless, it might be noted that the profile correlation between the single items and the $RTLS_{Total}$ ($.87 \leq ICC_{DE} \leq .89$), $RTLS_{Social}$ ($.82 \leq ICC_{DE} \leq .87$), and $UCLA-LS_{20Items}$ ($.80 \leq ICC_{DE} \leq .84$) were relatively low. By contrast, the profile correlations were substantially higher with the $RTLS_{Emotional}$ ($ICC_{DE} = .94$) and the $UCLA-LS_{3Items}$ ($.92 \leq ICC_{DE} \leq .93$). Likewise, the profile of the $UCLA-LS_{3Items}$ was less strongly correlated with the profile of the $RTLS_{Social}$ ($ICC_{DE} = .92$) and the $UCLA-LS_{20Items}$ ($ICC_{DE} = .93$) than with the $RTLS_{Emotional}$ ($ICC_{DE} = .98$). By contrast, and resembling the findings presented in Table 3, the profile of the $UCLA-LS_{20Items}$ was closely related to the $RTLS_{Social}$ ($ICC_{DE} = .97$).

Summary and Conclusion

Overall, the results of Study 1 show that (a) all measures of loneliness are highly correlated in the self- and the informant-reports, (b) self-informant agreement was high for all measures, and (c) all measures have a similar nomological net. These findings suggest that all measures tap into the same underlying latent construct and that there are no strong qualitative differences between the measures. It should be noted, though, that the nomological net of the single-item measures and—to a lesser extent—of the $UCLA-LS_{3Items}$ overlapped less strongly with related phenomena pertaining to personality (e.g., extraversion, sociability) and social networks (e.g., contact frequency). It could be argued that these measures provide purer assessments of loneliness. However, it could also be argued that these lower correlations are due to the lower reliability of these measures (Marangoni & Ickes, 1989; D. Russell, 1982). Indeed, the $UCLA-LS_{3Items}$ had a lower internal consistency in the present study ($\omega = .78$) than the $UCLA-LS_{20Items}$ ($\omega = .94$) and the $RTLS_{Total}$ ($\omega = .89$).

Study 2: Validity of Four Loneliness Measures

Method

Sample

The data used in Study 2 were taken from a larger online study on personality and partner relationships (Mund & Drewke, 2020). The study protocol was approved by

the Institutional Review Board of the Friedrich Schiller University Jena (FSV 18/47). The larger study combines features of longitudinal and diary methods in that couples are asked every three months about aspects of their own and their partner's personality, evaluations of the partner relationship, and aspects related to partner perception and communication patterns. In addition, participants are invited in February and March each year to participate in a diary period extending over 28 days in total, separated by a three-week break after the first 14 days. Participants were recruited via advertisements on social media platforms, several university mailing lists, and online forums visited by people interested in research participation (Mund & Drewke, 2020).

In the present study, we use data from the first five longitudinal waves. These waves were conducted in January 2020, April 2020, July 2020, October 2020, and January 2021, respectively. We included data of couples when they participated for the first time. That is, for the purpose of the present study, we did not build on the longitudinal nature of the study, but on its dyadic nature and the large sample size. Accordingly, when a couple participated more than once, we only used data from the first time both partners provided data. This first-time participation could have been anytime during the five waves. In this way, we included data from 1,216 individuals (608 mixed-sex couples). Of those 608 couples, 136 entered the study in January 2020, 48 new couples entered in April 2020, 141 new couples entered in July 2020, 219 new couples entered in October 2020, and 64 new couples entered in January 2021.

Despite couples entering the study at different measurement occasions, Analyses of Variance indicated no mean level differences across waves for the UCLA-LS_{8Items} ($F_{4,1208} = 1.07, p = .37$), UCLA-LS_{3Items} ($F_{4,1207} = 1.29, p = .27$), or the SI Direct ($F_{3,753} = 1.87, p = .13$). There was a small difference, however, for the RTLS_{Total} ($F_{4,1193} = 3.61, p = .006$). Post-hoc Tukey tests revealed that the mean of the RTLS_{Total} was significantly higher in October 2020 compared to April 2020 ($\Delta = 0.26, p = .013$). All other pairwise comparisons, however, were not statistically significant ($.075 \leq p \leq .999$). This difference in the RTLS_{Total} is attributable to differences between waves in the RTLS_{Social} ($F_{4,1193} = 3.37, p = .009$). Tukey post-hoc tests

indicated that social loneliness was higher in October 2020 than in January 2020 ($\Delta = 0.18, p = .036$) and April 2020 ($\Delta = 0.27, p = .030$). All other pairwise comparisons were not statistically significant ($.299 \leq p \leq .998$). No difference between waves was observed for $RTLS_{Emotional}$ ($F_{4,1193} = 2.19, p = .068$). In sum, the few observed differences were small in size and inconsistent across loneliness measures. Accordingly, we decided to proceed with the analyses using this pooled data set.

On average, participants were 26.69 years old ($SD = 4.86$) and had been engaged in their current relationship for 40.85 months on average ($SD = 40.91, Mdn = 28$), with a range from two weeks to 44 years. The majority of couples lived in a non-institutionalized relationship (81.25%), 11.35% were married. The remaining participants indicated other relationship forms (e.g., in registered partnership) or preferred not to answer the question. A minority of participants (5.83%) reported to have children. Of those, 81.25% reported to have one child, 11.35% reported to have two children, and 7.40% reported to have three or more children. As highest educational degree, 0.08% of participants reported to have finished primary school, 0.99% reported to have achieved a secondary school diploma, 6.71% have achieved a high school diploma, 6.13% have achieved an entrance qualification for a University of Applied Sciences (Fachabitur), 36.87% have earned a University entrance qualification (Abitur), 47.97% have earned a diploma from a University or a University of Applied Sciences, and 1.24% have completed a PhD. The remaining 0.01% of participants indicated “other” degrees or preferred not to answer this question. A subset of the data without any personal information (age, gender, etc.) is available from https://osf.io/7gsfw/?view_only=7e21e28c104549d0a5d9613495322148.

Measures

Details on internal consistency, sample items, response formats, descriptive statistics, and zero-order correlations are provided in Supplemental Tables S4 to S6.

Loneliness. For all loneliness measures, we obtained a self-rating and a partner-rating. That is, each participant rated and was rated by their partner on each loneliness measure.

Rasch-Type Loneliness Scale (RTLIS). In Study 2, we used the 6-item version of the RTLIS (de Jong Gierveld & van Tilburg, 2006), which also allows to differentiate between emotional and social loneliness. The correlation between the two facets was less strong than in Study 1 for both the self- ($r = .46, p < .001$). and the partner-rating ($r = .47, p < .001$). Internal consistency was high for the full scale and its facets in the self-rating ($\omega_{Total} = .78, \omega_{Emotional} = .68, \omega_{Social} = .83$) as well as in the partner-rating ($\omega_{Total} = .79, \omega_{Emotional} = .66, \omega_{Social} = .85$).

UCLA Loneliness Scale (UCLA-LS_{8Items}). We used the German version of the 8-item UCLA-LS (Hays & DiMatteo, 1987). Internal consistency was high for self- ($\omega = .80$) and partner-ratings ($\omega = .81$).

3-item version of the UCLA Loneliness Scale (UCLA-LS_{3Items}). As in Study 1, we employed a 3-item version of the UCLA-LS as proposed by Hawkey et al. (2015). Internal consistency was satisfactory in the self- ($\omega = .77$) and the informant-ratings ($\omega = .81$).

Direct single-item measure (SI Direct). As a direct single-item measure of loneliness, we used the same measure as employed in Study 1. Self-ratings of this item were collected in January 2020, April 2020, July 2020, and January 2021, but not in October 2020. The partner-ratings were collected at all measurement occasions.

Correlates of loneliness. As in Study 1, we used variables from several domains to examine the nomological net of the loneliness measures. Specifically, we used correlates from the domains of (a) demography, (b) personality, and (c) satisfaction.

Demographic variables. Participants were asked to indicate their age, gender, educational status, and their relationship duration.

Personality. The *Big Five* were assessed using a 15-item version of the Big Five Inventory Version 2 (Rammstedt et al., 2020; Soto & John, 2017). *Self-esteem* was assessed using the 10-item Rosenberg Self-Esteem Scale (von Collani & Herzberg, 2003). *Depressiveness* was measured using the five negatively-worded items from the State-Trait Depression Scale (Spaderna et al., 2002). The explicit *affiliation motive* was assessed using two items from the Unified Motive Scales (Schönbrodt & Gerstenberg,

2012). *Shyness* and *sociability* were assessed using the Shyness and Sociability Scales for adults (Asendorpf & Wilpers, 1998). Sociability was only assessed at the first three measurement waves (January, April, July 2020, respectively).

Satisfaction. Participants were asked to indicate their overall satisfaction with (a) life, (b) education, (c) leisure, (d) friends and social contacts, and (e) family using single items (Huinink et al., 2011; Siedler et al., 2008). *Relationship satisfaction* was assessed with the 7-item Relationship Assessment Scale (Hendrick, 1988; Sander & Böcker, 1993).

Results and Discussion

Convergent validity

The intercorrelation between the loneliness measures used in Study 2 are displayed in Table 5 separately for self- (below the diagonal) and partner-ratings (above the diagonal). For the self-ratings, intercorrelations were high $\bar{r} = .59$ and comparable to Study 1 ($\bar{r} = .63$). The average correlation for the partner-ratings was lower ($\bar{r} = .47$) than the average correlation in the self-ratings of Study 2 and the informant-ratings in Study 1 ($\bar{r} = .66$). This relatively lower convergence seems to be due to the partner-rated SI Direct. For this item, the correlation with the other measures was weak, ranging from $r = .07$ with partner-rated $RTLS_{Social}$ to $r = .15$ with partner-ratings on the $UCLA-LS_{8Items}$. Without the SI Direct, the average correlation in the partner-ratings increased to $\bar{r} = .60$ —a value which is comparable to self-ratings in Study 2 and informant-ratings in Study 1.

The average difference between the self- and partner-ratings in Study 2 was $|\overline{\Delta r}| = .19$. Without the SI Direct, the two correlation matrices were nearly identical ($|\overline{\Delta r}| = .03$). Similarly, the profile correlation between self- and partner-ratings amounted to $ICC_{DE} = .67$ for all measures and increased to $ICC_{DE} = .99$ when SI Direct was left out.

Finally, we compared the average differences and profile correlations between Study 1 and Study 2 separately for the self- and informant-ratings for the measures included in both studies (i.e., $RTLS_{11Items/6Items}$ and facets, $UCLA-LS_{20Items/8Items}$,

UCLA-LS_{3Items}, SI Direct). The absolute difference in the self-ratings between Study 1 and Study 2 amounted to $|\overline{\Delta r}| = .16$. For the informant-ratings, $|\overline{\Delta r}|$ amounted to .31 when SI Direct was included and to .22 when SI Direct was left out. For both the self- and the informant-ratings, thus, the average differences in the intercorrelation were modest. With regard to the profile correlations between Study 1 and Study 2, ICC_{DE} amounted to .86 for the self-ratings, indicating a very high similarity of the profiles across studies despite the fact that we used different measures in Study 2. For the informant-ratings, the profile similarity amounted to $ICC_{DE} = .65$ and was even higher ($ICC_{DE} = .83$) when the SI Direct was excluded.

Taken together, the results regarding the convergent validity of different loneliness measures obtained in Study 2 converged very well with the results observed in Study 1. Across the two studies, the correlation profiles were very similar and the differences in the average correlations were small to moderate. Unlike Study 1, the SI Direct turned out to be somewhat problematic in the partner-rating of Study 2 in the sense that it showed only modest correlations with the other partner-rated loneliness measures. One possible explanation for this finding is that the SI Direct forced individuals to explicitly rate their partners as “lonely”, which might threaten the self-concept of the rating partner. In Study 1, such effects might have been removed through the aggregation of the informant-ratings across multiple raters.

Self-informant agreement

The agreement between self- and partner-ratings are displayed in Table 6. The diagonal shows the agreement on the same instrument, ranging between $r = .22$ for the SI Direct to $r = .55$ for the UCLA-LS_{8Items}. Apart from the SI Direct, however, the correlations in the diagonal are close to each other with $.42 \leq r \leq .55$. With the exception of RTL_{Social}, the agreement between self-rated SI Direct and the partner-rated measures are almost twice as high ($.42 \leq r \leq .44$) as the correlation with partner-rated SI Direct ($r = .22$). Across all measures, self-informant agreement amounted to $\bar{r} = .39$ with and to $\bar{r} = .43$ without the SI Direct, respectively. These coefficients were lower than the average correlation observed in Study 1 ($\bar{r} = .51$). It

should be noted, though, that we employed shorter measures of the UCLA-LS and the RTLS in Study 2 that evinced a weaker internal consistency. When correcting for attenuation, the self-informant agreement for the UCLA-LS_{8Items}, for example, increased to $\hat{r} = .68$, which is very similar to a corrected self-informant agreement for the UCLA-LS_{20Items} in Study 1 ($\hat{r} = .65$).

Comparing self-informant agreement between Study 1 and Study 2, we found a weak profile correlation of $ICC_{DE} = .16$. However, the average difference between the matrices is only small ($|\overline{\Delta r}| = .11$). Thus, small shifts in the profiles might have led to the low profile similarity, whereas the actual coefficients do not differ much between Study 1 and Study 2.

The nomological nets of loneliness measures

The correlations between the different measures of loneliness and external correlates are displayed in Table 7. As in Study 1, we focus on the average absolute correlations ($|\bar{r}|$) when discussing the results. Table 7 additionally contains the results of pairwise model tests with one degree of freedom for each scale and each correlate. The similarity between the correlation profiles of the different loneliness measures with external correlates is displayed in Table 8.

Demography. The absolute average correlations varied only slightly between the loneliness measures with $.04 \leq |\bar{r}| \leq .10$. In many cases, the correlations between the demographic aspects and the loneliness measures were not statistically significant.

Personality. Compared to Study 1, the absolute average correlations in Study 2 were substantially lower ranging from $|\bar{r}| = .22$ for RTLS_{Social} to $|\bar{r}| = .32$ for UCLA-LS_{8Items}. When calculating disattenuated correlations, the $|\bar{r}|$ were very close to those observed in Study 1 (RTLS_{Total} = .39 vs. .41, RTLS_{Emotional} = .39 vs. .39, RTLS_{Social} = .32 vs. .39, UCLA_{8Items} = .45 vs. .45, UCLA_{3Items} = .37 vs. .41, and SI Direct = .37 vs. .27), indicating that the lower correlations found in Study 2 might be attributed to the lower internal consistency of the abbreviated measures.

As in Study 1, the UCLA-LS_{8Items} showed the highest associations with aspects related to sociability (i.e., extraversion, sociability, shyness, affiliation) and, thus, was

similar in this regard to the $RTLS_{Social}$. By contrast, other scales such as the $UCLA_{3Items}$ or the SI Direct were less strongly or even not significantly associated with aspects of sociability.

Satisfaction. On average, there were no strong differences between the loneliness measures with $.27 \leq |\bar{r}| \leq .35$. The strongest differences between the measures emerged for satisfaction with friends and social contacts. In this domain, the $RTLS_{Total}$, $RTLS_{Social}$, and the $UCLA-LS_{8Items}$ showed quite strong associations, whereas the association with the remaining measures was lower.

Profile similarity between measures. The profile similarities for Study 2 are displayed in Table 8. The profiles of the different loneliness measures varied between $.77 \leq ICC_{DE} \leq .99$. The highest similarity was found between the SI Direct and the $UCLA-LS_{3Items}$ and the lowest between $RTLS_{Emotional}$ and $RTLS_{Social}$. Similarly, the profile correlations between $RTLS_{Social}$ and SI Direct (.84) and $UCLA-LS_{3Items}$ (.79) were lower than the profile similarities between other measures.

Comparing the profiles of the measures that were used in both studies (i.e., $RTLS$ and facets, $UCLA-LS_{20Items/8Items}$, $UCLA-LS_{3Items}$, SI Direct) with regard to the correlates that were used in both studies yielded a high profile similarity. Specifically, the profile similarity between the nomological nets in Study 1 and Study 2 was high for the $RTLS_{Total}$ ($ICC_{DE} = .92$), $RTLS_{Emotional}$ ($ICC_{DE} = .89$), $RTLS_{Social}$ ($ICC_{DE} = .87$), $UCLA-LS_{20Items/8Items}$ ($ICC_{DE} = .88$), $UCLA-LS_{3Items}$ ($ICC_{DE} = .91$), and SI Direct ($ICC_{DE} = .91$). Thus, we conclude that the nomological nets of these popular measures are largely invariant across samples and studies.

Summary and Conclusion

The results of Study 2 compared well with the results obtained in Study 1. We found a similar pattern of convergent validity among different loneliness measures in the self-ratings and, with the exception of SI Direct, also in the partner-ratings of loneliness. Moreover, we found a very high similarity between the profiles of different loneliness measures and external correlates across the two studies. Although Study 2 cannot be considered a direct replication of Study 1, the similarity between the results

indicates that the findings are robust. Thus, Study 2 further corroborates that all included measures are valid and reliable measures of loneliness in adults.

Study 3: Reliability of Single-Item Measures

In Studies 1 and 2, we found that the nomological nets of single-item measures of loneliness overlap less with phenomena related to extraversion and sociability. As mentioned in the previous discussions, this finding might either point to “purer” nomological nets or to a lack of validity of the single items—because of low reliability, their correlation with other constructs might be reduced.

Two previous studies have used STARTS models (Kenny & Zautra, 2001) on single-item measures of loneliness (Mund, Lüdtke, et al., 2020; Zhong et al., 2016). In this way, Zhong et al. (2016) estimated a reliability of $r_{xx} = .595$ for a SI Direct, whereas the results reported by Mund, Lüdtke, et al. (2020) imply a reliability of different single item measures in the range between $.455 \leq r_{xx} \leq .524$. An alternative to STARTS models is a procedure proposed by Heise (1969). In this approach, the reliability of single-item measures is estimated based on their autocorrelations over three evenly spaced measurement occasions. In Study 3, we adopted this approach and examined the reliability of three single-item measures of loneliness.

Method

Sample

In 2019, we recruited a sample of 411 individuals via the service provider Prolific (www.prolific.com; for an overview, see Palan & Schitter, 2018). As the study only involved self-rating, no ethical approval was necessary. On average, participants were 30.06 years old ($SD = 9.23$), ranging from 18 to 63 ($Mdn = 28$). Almost half of the sample (47.7%) were women. Regarding employment status, 46% and 25% of the sample reported to work full-time or part-time, respectively, 7.2% reported not to be in paid work (e.g., homemaker, disabled, retired). The remaining $\approx 12\%$ of individuals reported to be currently job seeking, about to start a new job, or “other” status. Most participants were of German (76%) or Austrian (14%) nationality. The Prolific score (possible range from 0 to 100) of the participants, resembling the quality and validity of

their responses based on previous studies they participated in, was high (mean = 99.57, $SD = 1.22$, $Mdn = 100$, range from 87 to 100).

Two weeks after the first assessment (T1), all participants were reinvited to participate a second time (T2). Of the initial 411 individuals, 278 (67%) participated again. Another two weeks later (i.e., 4 weeks after the initial assessment), all participants were invited to the third survey (T3) and 276 individuals (67% compared to T1) provided the necessary data. For estimating the reliability of the single items, we conducted an analysis based on all available data and, separately, for the panel sample of 276 individuals who participated in all three assessment points. The data used for the key analyses are available from

https://osf.io/7gsfw/?view_only=7e21e28c104549d0a5d9613495322148.

Measures

Loneliness. As measures of loneliness, we included the three single items also included in Study 1. That is, we included the SI Direct, SI Indirect, and the SI Direct_{frequency}.

Correlates. The three single-item measures of loneliness were interspersed with other measures. We included the three-item measure of *self-esteem* developed for large panel studies (Huinink et al., 2011) that was also used in the present Study 1. Furthermore, participants rated the frequency of being *tense*, *joyful*, *sad*, and *happy*. We will consider self-esteem in the following analyses, but the emotion ratings were merely used as fillers and will not be considered further.

Analytic Strategy

The procedure described by Heise (1969, Formula 9) requires three autocorrelations among the items measuring loneliness: The correlation between T1 and T2 (r_{12}), T1 and T3 (r_{13}), and T2 and T3 (r_{23}). Based on these three correlations, reliability is estimated as $r_{xx} = \frac{r_{12} \times r_{23}}{r_{13}}$. We applied this formula separately to all three single-item measures. Moreover, we applied the formula to the point estimate of the observed correlations and additionally to the lower and upper bound of the 95% confidence interval of the observed correlations.

Results and Discussion

Before estimating the reliability of the single-item measures, we investigated their correlation with the brief self-esteem measure. The correlation between self-esteem and SI Direct ($r_{T1} = -.55, r_{T2} = -.51, r_{T3} = -.51$), SI Indirect ($r_{T1} = -.53, r_{T2} = -.53, r_{T3} = -.45$), and SI Direct_{frequency} ($r_{T1} = -.51, r_{T2} = -.52, r_{T3} = -.45$) converged well with the coefficients observed in the present Studies 1 and 2 and in previous studies (Levin & Stokes, 1986).

Table 9 displays the reliability of the single-item measures of loneliness for the full and the panel sample. The highest reliability was estimated for the SI Indirect, followed by the SI Direct_{frequency}. The reliability of the SI Direct was somewhat lower, but still above typically used cut-offs of .70. Thus, these three single-item measures have a reliability that can at least be considered adequate. The often-cited notion that single items are unreliable appears questionable against the backdrop of the results of this analysis. Furthermore, the reliability estimated in the current study is similar to reliability estimates for single-items of self-esteem ($r_{xx} = .75$ using the Heise approach; Robins et al., 2001) and life satisfaction (average r_{xx} across four independent studies = .72 using bivariate STARTS models; Lucas & Donnellan, 2012). Thus, loneliness in adults can be reliably captured by single-item measures. This finding is particularly important when financial or time-related constraints do not allow researchers to include multi-item measures of loneliness.

General Discussion

In the present studies, we examined the psychometric features of several measures of loneliness—the perception of one’s relationships as deficient regarding the quantitative and/or qualitative aspects (Ernst & Cacioppo, 1999; Perlman & Peplau, 1981). We included versions of the RTLS, UCLA-LS, and different single-item measures because those are among the most popular and widely-used measures of loneliness in adulthood (Buecker et al., 2020; Maes et al., 2019; Mund, Freuding, et al., 2020; Pinquart & Sörensen, 2001). At the same time, these measures represent broader operationalizations of loneliness: The RTLS represents an indirect multidimensional

approach, whereas the UCLA-LS represents an indirect unidimensional approach to loneliness. The included single-item measures are necessarily unidimensional, but represent both direct and indirect approaches. The present study largely extends previous research by (a) focusing on several loneliness measures at once, (b) using self- and informant-ratings to assess loneliness, (c) examining and comparing broad nomological nets, and (d) paying attention to the validity and reliability of different versions of single-item measures. The results presented in this article offer many vantage points for discussion, including (a) the similarities and differences between measures of loneliness, (b) the debate around the use of single items, and (c) recommendations for future research.

Similarities and Differences Between Loneliness Measures

In Study 1 and Study 2, we investigated the convergent validity of different measures of loneliness, self-informant agreement, and the nomological nets of these measures. The results indicate that all measures included in the present study are useful measures of loneliness. All measures show high convergent validity in the self- and informant-reports. Furthermore, the nomological nets of all measures were very similar to each other as indicated by high profile correlations. However, it should be noted that consistent across Study 1 and 2, the UCLA-LS, in its 20-item as well as in its 8-item version, was more strongly related to affiliative aspects like sociability and extraversion than the other measures, even after controlling for unreliability in the other instruments. Likewise, $RTLS_{Social}$ was more strongly related to sociability, extraversion (Studies 1 and 2), and network characteristics such as the frequency of joint activities with friends (Study 1). By contrast, $RTLS_{Emotional}$ was more strongly related to variables like neuroticism and self-esteem. Thus, the findings for the RTLS support the idea that, despite the high intercorrelation between its facets, it allows to differentiate between emotional and social aspects of loneliness (Green et al., 2001; van Baarsen et al., 2001). The correlation between the RTLS and UCLA-LS with personality and network characteristics demonstrates that the indirect approach taken by both instruments might come along with a less clear separation of loneliness from related

constructs (Buecker et al., 2020). As we will discuss below, this approach might have consequences for specific research questions.

Consistent with prior research (Lee & Ko, 2018; Luhmann et al., 2016; Mearns et al., 2009), self-informant agreement within and across measures was generally high and similar to self-informant agreement in broader personality characteristics (Connelly & Ones, 2010). This finding indicates that loneliness is can be perceived by others. From a psychometric perspective, this supports the notion that the measures selected in the present article capture reliable inter-individual differences that are, to a large extent, validated by informants (McCrae et al., 2004; Podsakoff et al., 2003). From an applied perspective, this finding might also indicate that close others can accurately evaluate a person's loneliness. Thus, campaigns to tackle loneliness might also benefit from equipping close others with the knowledge of how to help and support lonely individuals in their environment in addition to encouraging lonely people to seek help proactively.

It should be noted that the informant-ratings in the present and previous studies (Lee & Ko, 2018; Luhmann et al., 2016; Mearns et al., 2009) were obtained from close others such as partners, friends, or parents. Loneliness might be less well observable for less close informants, such as teachers or casual acquaintances (Geukens et al., 2021). Unlike extraversion, for example, which can be judged accurately even after a few seconds of interaction (Back & Nestler, 2016; Connelly & Ones, 2010; Vazire, 2010), loneliness is a rather internal state that might not manifest readily in specific observable behaviors (see also Vazire, 2010). Instead, loneliness might express itself in the content of interactions, for example by a specific emotional tone present in repeated conversations, or specific language patterns (Mehl et al., 2017; for findings on neuroticism, see Tackman et al., 2020) or interaction patterns (Tsai & Reis, 2009).

Debate Around Single-Item Measures

The practice of measuring loneliness via single items has been controversial (Marangoni & Ickes, 1989; D. Russell et al., 1980). However, single-item measures are highly prevalent in research on loneliness (Mund, Freuding, et al., 2020; Pinquart & Sörensen, 2001) and frequently used in large-scale studies due to financial and

time-related constraints.

In Study 1 and Study 2, we demonstrated that different versions of single-item measures correlate highly with each other and with multi-item scales. Furthermore, we demonstrated that the nomological nets of single items are consistent across different formulations and with the nomological nets of the established RTLS and UCLA-LS. In Study 3, we also demonstrated that single items are reliable measures. Thus, the results of the present studies indicate that single-item measures are not deficient or invalid measures of loneliness per se. Consequently, we argue that single-item measures of loneliness have their place as robust and trustworthy measures in research on loneliness (for a similar point regarding single-item measures of life satisfaction, see Cheung & Lucas, 2014; Lucas & Donnellan, 2012).

Recommendations for Future Research

Broadly speaking, when it comes to measuring the core of loneliness, we proclaim the well-known Dodo Verdict that “everybody has won, so all shall have prizes”. Put differently, we believe that the phenomenon of loneliness in adulthood can be measured robustly, validly, and reliably by any of the measures investigated in this article.

A more nuanced view is necessary within specific research contexts. For example, in studies designed to investigate the behavioral correlates and/or the observability of loneliness, researchers need to take care that any observed effects are not due to other factors. For example, most studies that have examined self-informant agreement in loneliness have used the UCLA-LS (Lee & Ko, 2018; Luhmann et al., 2016; Mearns et al., 2009). Given the results presented in the current studies, the high self-informant agreement found in these studies might be attributable, to some extent, to informants having actually observed the target’s extraversion or sociability, which are well observable even for raters who are unacquainted with the target (Back & Nestler, 2016; Connelly & Ones, 2010). As another example, the similarity in loneliness between romantic partners has been found to be moderate ($r = .27$) using the UCLA-LS_{8Items} (Mund et al., in press), but to be near zero ($r = .08$) in a study using a single item (Mund & Johnson, 2021). By contrast, the effects of loneliness on later relationship

satisfaction were similar in both studies.

The general recommendation that can be taken from the present findings is that loneliness measures should be selected with a particular regard to the research question. Some of the existing measures (e.g., RTLS, UCLA-LS) might need to be adjusted statistically to rule out confounding with overlapping constructs (e.g., extraversion). Furthermore, some measures might not work well when informant-ratings are to be collected, as was the case for the SI Direct in the present Study 2; in such cases, indirect measures might be better suited. Ideally, researchers should include multiple measures whenever possible to cross-check the results. The nomological nets presented in the current study might help to spot potential sources of disagreement between measures in existing and future research.

Limitations

The findings presented in this article should be evaluated against the backdrop of some limitations. First, recruitment of the participants was conducted via the Internet and, thus, was prone to self-selection. Overall, the samples were composed of mostly young and highly educated female adults. Hence, it is unclear whether the results can be generalized to samples from other age groups, other educational or cultural backgrounds, or with chronic health conditions.

Second, we investigated a selection of measurement instruments that are frequently used in contemporary research on loneliness in adulthood (Buecker et al., 2020; Maes et al., 2019; Mund, Freuding, et al., 2020; Pinquart & Sörensen, 2001). However, other loneliness measures are also available. Some of those measures have been developed for samples of children or adolescents (Maes et al., 2015; Maes et al., 2017; Marcoen et al., 1987), and some have been developed with a broad multidimensional and relationship-specific perspective (DiTommaso & Spinner, 1993; Hoza et al., 2000; Maes et al., 2015; Pollet et al., 2018). We hope that the nomological nets presented in the current study might serve as a foundation for further investigating the construct validity of those measures.

Third, although we investigated comprehensive nomological nets of the different

loneliness measures, several important correlates were not considered. These include, first and foremost, health behaviors (Eccles et al., 2020; Shankar et al., 2011), but also other phenomena such as externalizing problems (e.g., hostility; Luhmann et al., 2015; Segel-Karpas & Ayalon, 2020) or social media usage (Nowland et al., 2018).

Fourth, we used the included scales as intended by their original authors. That is, we used the RTLS as a multi-dimensional measure including the facets emotional and social loneliness (de Jong Gierveld & Kamphuis, 1985; de Jong Gierveld & van Tilburg, 2006) and the UCLA-LS as a unidimensional measure (D. Russell, 1982). Several studies have shown that the factor structure of these scales might be more complex (Grygiel et al., 2013; Hawkey et al., 2005; Iecovich, 2013; Maes et al., 2017). The question of the most appropriate factor structure of the included scales was beyond the scope of the present work, but would be a worthwhile endeavor for future research. For example, by a simultaneous factor analysis over multiple scales (Cramer & Barry, 1999; Goossens & Beyers, 2002; Maes et al., 2017), it might be possible to develop new scales reliably capturing the core of loneliness and its related facets.

Conclusion

Across three studies, we investigated aspects of the validity and reliability of different loneliness measures—including several versions of established scales such as the Rasch-Type Loneliness Scale and the University of California Los Angeles Loneliness Scale, but also different versions of single-item measures. Overall, the results indicate that all measures are highly correlated in self- as well as informant-ratings. Furthermore, we found substantial self-informant agreement on all measures. The nomological nets of the included measures were shown to be consistent within and across studies. Finally, we have shown that single-item measures of loneliness possess adequate reliability. Taken together, the findings of the present studies provide rich evidence for the validity of popular loneliness measures, thereby providing a nuanced picture of each measure's nomological net. Thus, the present study might guide further research in selecting an appropriate loneliness measure and at the same time provides a solid foundation for future research on the validity of other loneliness measures.

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Table 1*Study 1: Convergent Validity of Loneliness in Self- and Informant-Rating*

Scale	Rasch-Type Loneliness Scale			UCLA Loneliness Scale		Single Items		
	Total	Emotional	Social	20 Items	3 Items	direct	indirect	direct frequency
RTLS _{Total}		.95	.89	.85	.76	.67	.68	.43
RTLS _{Emotional}	.93		.72	.80	.75	.72	.70	.44
RTLS _{Social}	.89	.66		.77	.65	.49	.53	.34
UCLA-LS _{20Items}	.87	.77	.82		.70	.58	.64	.41
UCLA-LS _{3Items}	.73	.75	.57	.73		.61	.65	.39
SI Direct	.61	.66	.43	.57	.59		.74	.48
SI Indirect	.62	.64	.47	.59	.56	.70		.51
SI Direct _{frequency}	.66	.71	.46	.63	.66	.81	.67	

Note. Self-rating ($N = 657\text{--}679$) is below the diagonal, informant-rating ($N = 160$) above the diagonal. All correlations are statistically significant at $p < .001$. RTLS: Rasch-Type Loneliness Scale. UCLA-LS: University of Los Angeles California Loneliness Scale. SI: Single Item.

Table 2

Study 1: Self-Informant Agreement of the Different Loneliness Measures

	Rasch-Type Loneliness Scale			UCLA Loneliness Scale		Single Items		
	I-Total	I-Emotional	I-Social	I-20 Items	I-3 Items	I-Direct	I-Indirect	I-Direct Frequency
S-RTLS _{Total}	.61							
S-RTLS _{Emotional}	.56	.57						
S-RTLS _{Social}	.58	.56	.52					
S-UCLA-LS _{20Items}	.59	.57	.51	.61				
S-UCLA-LS _{3Items}	.48	.47	.41	.44	.57			
S-SI Direct	.46	.47	.36	.39	.43	.49		
S-SI Indirect	.51	.52	.39	.42	.50	.51	.55	
S-SI Direct _{Frequency}	.43	.44	.34	.41	.39	.48	.51	.53

Note. N = 159–160 pairs between self- and aggregated informant-ratings. S: Self-Rating; I: Informant-Rating. All correlations are statistically significant at $p < .001$. RTLS: Rasch-Type Loneliness Scale. UCLA-LS: University of Los Angeles California Loneliness Scale. SI: Single Item.

Table 3*Study 1: Nomological Net of Different Measures of Loneliness (Self-Reports)*

Variable	Rasch-Type Loneliness Scale ^a			UCLA Loneliness Scale		Single Items		
	Total	Emotional	Social	20 Items	3 Items	direct	indirect	direct frequency
<i>Demography</i>								
Age	.05 _a	-.03 _{b,c}	.13 _d	.08 _{a,d}	-.05 _{b,c}	-.09 _{b,c}	.00 _{a,c,d}	-.10 _b
Gender ^c	-.10 _{a,c}	-.04 _b	-.15 _{b,c}	-.15 _c	-.03 _{a,b}	-.04 _{a,b,c}	-.10 _{a,b,c}	-.03 _{a,b}
Education	-.12 _a	-.10 _b	-.11 _b	-.11 _{a,b}	-.06 _{a,b}	-.11 _{a,b}	-.10 _{a,b}	-.11 _{a,b}
Partnered	-.19 _{a,c}	-.21 _b	-.13 _{b,c}	-.18 _{a,b,c}	-.10 _c	-.25 _{a,b}	-.24 _{a,b}	-.23 _{a,b}
<i>Average Absolute Correlation^b</i>	.11	.10	.13	.13	.06	.12	.11	.12
<i>Personality</i>								
Neuroticism	.29 _{a,c}	.34 _b	.18 _c	.24 _c	.37 _{a,b}	.21 _c	.19 _c	.26 _{b,c}
Extraversion	-.34 _{a,d}	-.30 _{c,e}	-.33 _{c,e}	-.46 _b	-.33 _{a,e}	-.19 _{d,f}	-.20 _{c,f}	-.20 _{c,f}
Openness	-.15 _{a,d}	-.08 _b	-.20 _{c,d}	-.20 _d	-.11 _{a,b,c,d}	-.07 _{a,b,c}	-.07 _{b,c}	-.03 _b
Agreeableness	-.23 _{a,e}	-.17 _{c,d}	-.27 _d	-.29 _{a,d}	-.16 _{c,d,e}	-.10 _{b,c}	-.13 _{c,e}	-.08 _{b,c}
Conscientiousness	-.21 _a	-.18 _b	-.21 _b	-.22 _{a,b}	-.17 _{a,b}	-.18 _{a,b}	-.15 _{a,b}	-.16 _{a,b}
Shyness	.34 _{a,d}	.33 _{b,c,e}	.28 _{c,f}	.39 _{a,b}	.39 _{a,b,c}	.25 _{d,e,f}	.24 _{d,f}	.27 _{d,f}
Sociability	-.30 _a	-.19 _c	-.37 _d	-.42 _d	-.20 _c	-.06 _b	-.13 _{b,c}	-.06 _b
Self-Esteem	-.53 _a	-.53 _b	-.42 _c	-.49 _{a,b}	-.53 _{a,b,c}	-.47 _{a,b,c}	-.46 _{a,c}	-.50 _{a,b,c}
Affiliation Motive	-.25 _a	-.11 _c	-.36 _d	-.40 _{b,d}	-.09 _{c,e}	-.04 _{c,e}	-.11 _c	.00 _e
Unsatisfied Needs	.57 _a	.49 _{c,d}	.48 _{d,e}	.57 _{a,c}	.55 _{a,c,d}	.38 _{b,e}	.33 _b	.37 _{b,e}

Table 3 (continued)

Variable	Rasch-Type Loneliness Scale ^a			UCLA Loneliness Scale		Single Items		
	Total	Emotional	Social	20 Items	3 Items	direct	indirect	direct frequency
Frustrated Affiliation Motive	-.06 _a	-.01 _b	-.10 _b	-.10 _{a,b}	-.01 _{a,b}	-.06 _{a,b}	-.07 _{a,b}	.00 _{a,b}
Depressiveness	.62 _a	.61 _{c,d}	.52 _{b,d}	.64 _{a,c}	.58 _{a,b,c,d}	.49 _b	.48 _{b,e}	.56 _{a,d,e}
Social Desirability	-.05 _a	-.05 _b	-.05 _b	-.04 _{a,b}	-.05 _{a,b}	-.03 _{a,b}	-.01 _{a,b}	-.02 _{a,b}
<i>Average Absolute Correlation^b</i>	.32	.27	.30	.36	.29	.20	.20	.20
<i>Satisfaction with Domains of Life</i>								
Life	-.53 _a	-.51 _b	-.45 _b	-.53 _{a,b}	-.43 _{a,b}	-.49 _{a,b}	-.53 _{a,b}	-.49 _{a,b}
Education	-.36 _a	-.34 _b	-.32 _b	-.36 _{a,b}	-.33 _{a,b}	-.32 _{a,b}	-.30 _{a,b}	-.33 _{a,b}
Leisure	-.45 _a	-.41 _b	-.40 _b	-.48 _{a,b}	-.38 _{a,b}	-.38 _{a,b}	-.40 _{a,b}	-.35 _{a,b}
Friends	-.66 _a	-.64 _c	-.55 _{c,d}	-.64 _{a,c}	-.60 _{a,c,e}	-.47 _{b,d,e}	-.47 _{b,d,e}	-.43 _{b,d}
Family	-.42 _a	-.37 _b	-.41 _b	-.44 _{a,b}	-.37 _{a,b}	-.39 _{a,b}	-.35 _{a,b}	-.35 _{a,b}
Partner Relationship	-.34 _a	-.36 _c	-.26 _{c,d}	-.32 _{a,c,d}	-.21 _{b,d,e}	-.33 _{a,c,e}	-.34 _{a,c,e}	-.30 _{a,c,e}
<i>Average Absolute Correlation^b</i>	.47	.45	.40	.47	.39	.40	.40	.38
<i>Network Characteristics</i>								
<i>Number of Friends (Providing)...</i>								
Overall	-.32 _{a,d}	-.25 _{b,c,e}	-.35 _{c,e}	-.36 _{a,b,c}	-.24 _{b,c,d}	-.16 _{a,d,e}	-.17 _{a,d,e}	-.16 _{d,e}
on Facebook	-.04 _a	-.01 _b	-.07 _b	-.08 _{a,b}	-.03 _{a,b}	-.05 _{a,b}	-.05 _{a,b}	-.03 _{a,b}
Help with Problems	-.38 _{a,d}	-.29 _b	-.42 _c	-.37 _{a,c}	-.23 _{b,d}	-.19 _{a,b,d}	-.20 _{a,b,d}	-.17 _d
Instrumental Support	-.37 _a	-.31 _{b,c}	-.36 _b	-.35 _{a,b}	-.27 _{a,b}	-.22 _{a,c}	-.26 _{a,b}	-.21 _{a,c}
Advice	-.22 _a	-.18 _b	-.23 _b	-.24 _{a,b}	-.16 _{a,b}	-.17 _{a,b}	-.19 _{a,b}	-.19 _{a,b}

Table 3 (continued)

Variable	Rasch-Type Loneliness Scale ^a			UCLA Loneliness Scale		Single Items		
	Total	Emotional	Social	20 Items	3 Items	direct	indirect	direct frequency
<i>Frequency of...</i>								
Contact	-.22 _{a,e}	-.15 _{b,d}	-.27 _{b,c}	-.27 _{a,c}	-.13 _{d,e}	-.02 _{e,f}	-.08 _{a,d,f}	-.02 _{b,e,f}
Joint Activities	-.41 _{a,d}	-.34 _c	-.42 _c	-.45 _a	-.31 _{b,c,d}	-.17 _{b,d}	-.15 _b	-.12 _b
<i>Average Absolute Correlation^b</i>	.28	.22	.31	.31	.20	.14	.16	.13

Note. ^aDue to the high correlation between the total score on the RTLS and its subfacets emotional and social loneliness, we ran different batches of models. In one batch, we compared the correlations between the full RTLS and all other scales, in the second batch, we compared the correlations between the emotional and social loneliness facets with all other scales. Hence, we could not test whether correlations differ between the full RTLS and its subfacets. ^bAverage correlations were calculated based on the absolute z -transformed correlations. After averaging, z -scores were re-transformed to r . ^cGender was coded as 1 = female and 0 = male/other. Different subscripts indicate a significantly different ($p < .001$) correlation as judged by the results of a χ^2 -difference test with 1 degree of freedom. Italicized correlations have a p -value $\geq .01$.

Table 4

Study 1: Profile Correlations Between Different Loneliness Measures

Scale	Rasch-Type Loneliness Scale			UCLA Loneliness Scale		Single Items		
	Total	Emotional	Social	20 Items	3 Items	direct	indirect	direct frequency
RTLS _{Total}								
RTLS _{Emotional}	.98							
RTLS _{Social}	.97	.93						
UCLA-LS _{20Items}	.98	.94	.97					
UCLA-LS _{3Items}	.96	.98	.92	.93				
SI Direct	.88	.94	.84	.82	.93			
SI Indirect	.89	.94	.87	.84	.92	.99		
SI Direct _{frequency}	.87	.94	.82	.80	.93	.99	.98	

Note. Table shows the correlations of the profiles of different loneliness scales with regard to the correlates displayed in Table 3.

Profile correlations are based on z -scores and were calculated using the double-entry ICC. RTLS: Rasch-Type Loneliness Scale.

UCLA-LS: University of Los Angeles California Loneliness Scale. SI: Single Item.

Table 5

Study 2: Convergent Validity of Loneliness in Self- and Informant-Rating

Scale	Rasch-Type Loneliness Scale			UCLA Loneliness Scale		
	Total	Emotional	Social	8 Items	3 Items	SI Direct
RTLS _{Total}		.85	.86	.74	.67	.12
RTLS _{Emotional}	.86		.47	.61	.69	.13
RTLS _{Social}	.84	.46		.65	.45	.07
UCLA-LS _{8Items}	.71	.63	.58		.74	.15
UCLA-LS _{3Items}	.65	.69	.42	.76		.12
SI Direct	.66	.66	.45	.67	.66	

Note. Self-rating ($N = 757-1,212$) is below the diagonal, informant-rating ($N = 1,181-1,196$) above the diagonal. Italicized correlations have a p -value $\geq .001$. RTLS: Rasch-Type Loneliness Scale.

UCLA-LS: University of Los Angeles California Loneliness Scale. SI: Single Item.

Table 6

Study 2: Self-Informant Agreement of the Different Loneliness Measures

	Rasch-Type Loneliness Scale			UCLA Loneliness Scale		
	I-Total	I-Emotional	I-Social	I-8 Items	I-3 Items	I-SI Direct
S-RTLS _{Total}	.53					
S-RTLS _{Emotional}	.47	.49				
S-RTLS _{Social}	.43	.32	.42			
S-UCLA-LS _{8Items}	.48	.42	.41	.55		
S-UCLA-LS _{3Items}	.43	.45	.30	.45	.48	
S-SI Direct	.42	.44	.26	.42	.44	.22

Note. N = 742–1,196 pairs self- and partner-ratings. S: Self-Rating; I: Informant-Rating. All correlations are statistically significant at $p < .001$. RTLS: Rasch-Type Loneliness Scale. UCLA-LS: University of Los Angeles California Loneliness Scale. SI: Single Item.

Table 7*Study 2: Nomological Nets of Different Measures of Loneliness (Self-Reports)*

Variable	Rasch-Type Loneliness Scale ^a			UCLA Loneliness Scale		
	Total	Emotional	Social	8 Items	3 Items	SI Direct
<i>Demography</i>						
Age	-.07 _a	-.15 _b	.04 _c	-.07 _{a,b,c}	-.15 _{a,b}	-.07 _{a,b,c}
Gender ^c	-.01 _a	.06 _c	-.09 _d	.05 _{a,c}	.17 _b	.12 _{b,c}
Education	-.13 _a	-.10 _b	-.11 _b	-.01 _b	-.01 _b	-.04 _{a,b}
Relationship Duration	-.06 _a	-.10 _b	.01 _b	-.01 _{a,b}	-.06 _{a,b}	-.03 _{a,b}
<i>Average Absolute Correlation^b</i>	.07	.10	.06	.04	.10	.06
<i>Personality</i>						
Neuroticism	.46 _{a,d}	.54 _b	.22 _c	.41 _a	.53 _{b,d}	.49 _{a,b}
Extraversion	-.17 _a	-.09 _c	-.20 _{c,d}	-.30 _{b,d}	-.17 _{a,c}	-.15 _{a,c}
Openness	.05 _a	.10 _b	-.02 _b	.04 _{a,b}	.07 _{a,b}	.08 _{a,b}
Agreeableness	-.22 _{a,f}	-.14 _{c,e}	-.24 _{c,d}	-.27 _{a,d}	-.09 _{b,e}	-.16 _{b,c,f}
Conscientiousness	-.20 _a	-.19 _b	-.15 _b	-.15 _{a,b}	-.18 _{a,b}	-.15 _{a,b}
Shyness	.23 _a	.23 _c	.16 _c	.36 _b	.28 _{a,b,c}	.23 _{a,c}
Sociability	-.14 _a	-.01 _c	-.24 _b	-.30 _b	-.05 _{a,c}	-.08 _{a,c}

Table 7 (continued)

Variable	Rasch-Type Loneliness Scale ^a			UCLA Loneliness Scale		
	Total	Emotional	Social	8 Items	3 Items	SI Direct
Self-Esteem	−.54 _a	−.55 _b	−.36 _c	−.48 _{a,b}	−.51 _{a,b}	−.52 _{a,b}
Affiliation Motive	−.12 _a	.05 _c	−.26 _b	−.24 _b	.01 _c	−.05 _{a,c}
Depressiveness	.56 _a	.60 _b	.33 _c	.55 _{a,b}	.58 _{a,b}	.58 _{a,b}
<i>Average Absolute Correlation^b</i>	.28	.27	.22	.32	.26	.26
<i>Satisfaction with Domains of Life</i>						
Life	−.39 _a	−.35 _b	−.30 _b	−.34 _{a,b}	−.27 _b	−.31 _{a,b}
Education	−.31 _a	−.30 _b	−.21 _b	−.23 _{a,b}	−.23 _{a,b}	−.25 _{a,b}
Leisure	−.32 _a	−.29 _b	−.25 _b	−.33 _{a,b}	−.29 _{a,b}	−.30 _{a,b}
Friends	−.50 _{a,c}	−.39 _{b,d}	−.45 _b	−.48 _{a,b}	−.39 _{c,d,e}	−.42 _{a,b,e}
Family	−.29 _a	−.25 _b	−.23 _b	−.23 _{a,b}	−.22 _{a,b}	−.24 _{a,b}
Partner Relationship	−.28 _a	−.27 _b	−.21 _b	−.24 _{a,b}	−.23 _{a,b}	−.29 _{a,b}
<i>Average Absolute Correlation^b</i>	.35	.31	.28	.31	.27	.30

Table 7 (continued)

Variable	Rasch-Type Loneliness Scale ^a			UCLA Loneliness Scale		
	Total	Emotional	Social	8 Items	3 Items	SI Direct

Note. ^aDue to the high correlation between the total score on the RTLS and its subfacets emotional and social loneliness, we ran different batches of models. In one batch, we compared the correlations between the full RTLS and all other scales, in the second batch, we compared the correlations between the emotional and social loneliness facets with all other scales. Hence, we could not test whether correlations differ between the full RTLS and its subfacets. ^bAverage correlations were calculated based on the absolute *z*-transformed correlations. After averaging, *z*-scores were re-transformed to *r*. ^cGender was coded as 1 = female and 0 = male/other. Different subscripts indicate a significantly different ($p < .001$) correlation as judged by the results of a χ^2 -difference test with 1 degree of freedom. Italicized correlations have a *p*-value $\geq .01$.

Table 8

Study 2: Profile Correlations Between Different Loneliness Measures

Scale	Rasch-Type Loneliness Scale			UCLA Loneliness Scale		
	Total	Emotional	Social	8 Items	3 Items	SI Direct
RTLS _{Total}						
RTLS _{Emotional}	.97					
RTLS _{Social}	.88	.77				
UCLA-LS _{8Items}	.96	.91	.90			
UCLA-LS _{3Items}	.95	.98	.79	.93		
SI Direct	.98	.98	.84	.95	.99	

Note. Table shows the correlations of the profiles of different loneliness scales with regard to the correlates displayed in Table 7. Profile correlations are based on *z*-scores and were calculated using the double-entry ICC. RTLS: Rasch-Type Loneliness Scale. UCLA-LS: University of Los Angeles California Loneliness Scale. SI: Single Item.

Table 9*Study 3: Reliability of Single-Item Measures*

Scale	Full (N = 411)			Panel (N = 276)			Correlations at T1 ^a		
	r_{xx}	LB	UB	r_{xx}	LB	UB	1	2	3
1 SI Direct	.71	.65	.76	.74	.66	.77		.79	.82
2 SI Indirect	.82	.77	.85	.85	.81	.88	.80		.72
3 SI Direct _{frequency}	.77	.71	.81	.80	.74	.84	.81	.74	

Note. ^aCorrelations in the Full Sample are displayed below the diagonal, correlations in the Panel Sample are displayed above the diagonal. SI: Single Item. r_{xx} : reliability as estimated by Formula 9 presented in Heise (1969). LB: lower bound of the 95% confidence interval of the estimated reliability. UB: upper bound of the 95% confidence interval of the estimated reliability.

Supplemental Material

Would the Real Loneliness Please Stand Up? The
Validity of Loneliness Measures and the Reliability
of Single Items

Study 1

Table S1

Overview of the Measures Used in Study 1

Construct	Source	Sample Item	Scale Range	# Items	Coefficient ω	
					Self	Informant
<i>Demographic Characteristics</i>						
Age		“How old are you?”	18–100 in 1-year steps			
Gender		“Please indicate your gender”	1 (male), 2 (female), 3 (other), 4 (not saying); for the analysis reported in the mansucript, the variable was recoded as 1 (female) and 0 (not female, incl. male and other)			
Education		“Please select your highest educational degree”	1 (no degree), 2 (Grundschule — Primary School), 3 (Hauptschule — secondary modern school qualification), 4 (Realschule — secondary school certificate), 5 (Fachhochschulreife — entrance qualification for a university of applied sciences), 6 (Abitur — university entrance qualification), 7 (Hochschulstudium — university degree, e.g., B.Sc., M.Sc.), 8 (Promotion — PhD)			
Partnered		“Are you involved in a partner relationship?”	1 (<i>yes</i>), 0 (<i>no</i>)			

Table S1 (continued)

Construct	Source	Sample Item	Scale Range	# Items	Coefficient ω	
					Self	Informant
<i>Loneliness</i>						
Rasch-Type Loneliness Scale (RTLS _{Total})	de Jong Gierveld and Kamphuis (1985)		1 (<i>does not apply</i>) to 5 (<i>fully applies</i>)	11	.89	.87
Emotional Loneliness (RTLS _{Emotional})	de Jong Gierveld and Kamphuis (1985)	“I experience a general sense of emptiness”	1 (<i>does not apply</i>) to 5 (<i>fully applies</i>)	6	.80	.83
Social Loneliness (RTLS _{Social})	de Jong Gierveld and Kamphuis (1985)	“There are plenty of people I can rely on when I have problems”, reverse scored	1 (<i>does not apply</i>) to 5 (<i>fully applies</i>)	5	.87	.82
UCLA Loneliness Scale (UCLA-LS _{20Items})	Döring and Bortz (1993)	“Nobody really knows me”	1 (<i>completely false</i>) to 5 (<i>completely true</i>)	20	.94	.93
3-Item UCLA Loneliness Scale (UCLA-LS _{3Items})	Hawkley et al. (2015)	“How often do you have the feeling to be left out”; “How often do you have the feeling to be isolated”; “How often do you have the feeling to lack companionship”	1 (<i>never</i>) to 5 (<i>very often</i>)	3	.78	.80
Direct Single Item (SI Direct)		“I feel lonely”	1 (<i>does not at all apply</i>) to 5 (<i>does fully apply</i>)	1		
Indirect Single Item (SI Indirect)	Döring and Bortz (1993)	“I feel alone”	1 (<i>does not at all apply</i>) to 5 (<i>does fully apply</i>)	1		
Direct Single Item Frequency (SI Direct _{Frequency})		“How often do you feel lonely”	1 (<i>never</i>) to 5 (<i>always</i>)	1		
<i>Personality</i>						
Neuroticism	Hahn et al. (2012)	“I see myself as someone who worries a lot”	1 (<i>do not agree at all</i>) to 7 (<i>fully agree</i>)	3	.76	
Extraversion	Hahn et al. (2012)	“I see myself as someone who is communicative”	1 (<i>do not agree at all</i>) to 7 (<i>fully agree</i>)	3	.84	

Table S1 (continued)

Construct	Source	Sample Item	Scale Range	# Items	Coefficient ω	
					Self	Informant
Openness	Hahn et al. (2012)	“I see myself as someone who is original”	1 (<i>do not agree at all</i>) to 7 (<i>fully agree</i>)	3	.68	
Agreeableness	Hahn et al. (2012)	“I see myself as someone who has a forgiving nature”	1 (<i>do not agree at all</i>) to 7 (<i>fully agree</i>)	3	.54	
Conscientiousness	Hahn et al. (2012)	“I see myself as someone who does things effectively”	1 (<i>do not agree at all</i>) to 7 (<i>fully agree</i>)	3	.71	
Self-Esteem	German Family Panel	“I like myself just the way I am”	1 (<i>do not agree at all</i>) to 5 (<i>fully agree</i>)	3	.80	
Depressiveness	Spaderna et al. (2002)	“In general, how often do you feel sad”	1 (<i>almost never</i>) to 4 (<i>almost always</i>)	10	.91	
Affiliation Motive	Schönbrodt and Gerstenberg (2012)	“How important is it for you to be in the company of friends?”	1 (<i>not important</i>) to 6 (<i>very important</i>)	4	.73	
Need Satisfaction	Chen et al. (2015)	“In general, people are friendly with me”, reverse scored	1 (<i>does not apply</i>) to 5 (<i>applies fully</i>)	2	.66	
Social Desirability	Stöber (2001)	“In traffic I am always polite and considerate of others”	true/false	17	.71	
Shyness	Asendorpf and Wilpers (1998)	“I feel inhibited when I am with other people”	1 (<i>does not apply</i>) to 5 (<i>applies fully</i>)	5	.76	
Sociability	Asendorpf and Wilpers (1998)	“I really like to talk to other people”	1 (<i>does not apply</i>) to 5 (<i>applies fully</i>)	5	.79	
<i>Satisfaction</i>						
Life	Siedler et al. (2008)	“In general, how satisfied are you with your life”	0 (<i>very dissatisfied</i>) to 10 (<i>very satisfied</i>)	1		
Education	Siedler et al. (2008)	“In general, how satisfied are you with your education and work life”	0 (<i>very dissatisfied</i>) to 10 (<i>very satisfied</i>)	1		

Table S1 (continued)

Construct	Source	Sample Item	Scale Range	# Items	Coefficient ω	
					Self	Informant
Leisure	Siedler et al. (2008)	“In general, how satisfied are you with your leisure”	0 (<i>very dissatisfied</i>) to 10 (<i>very satisfied</i>)	1		
Friends	Siedler et al. (2008)	“In general, how satisfied are you with your friends and social contacts”	0 (<i>very dissatisfied</i>) to 10 (<i>very satisfied</i>)	1		
Family	Siedler et al. (2008)	“In general, how satisfied are you with your family relationships”	0 (<i>very dissatisfied</i>) to 10 (<i>very satisfied</i>)	1		
Relationship	Siedler et al. (2008)	“In general, how satisfied are you with your partner relationship”	0 (<i>very dissatisfied</i>) to 10 (<i>very satisfied</i>)	1		
<i>Network Characteristics</i>						
# close friends				1		
# friends on Facebook				1		
# persons to discuss problems with				1		
# persons to contact for practical help				1		
# persons to ask for advice				1		
Contact frequency with closest friend				1		
						<i>once a year (1), every few months (2), once a month (3), two to three times per month (4), once a week (5), several times a week (6), daily (7)</i>

Table S1 (continued)

Construct	Source	Sample Item	Scale Range	# Items	Coefficient ω	
					Self	Informant
Frequency of joint activities with friends			<i>once a year (1), every few months (2), once a month (3), two to three times per month (4), once a week (5), several times a week (6), daily (7)</i>	1		

Note. Informant-ratings were only collected for the loneliness measures.

Table S2*Descriptive Statistics*

Measure	Self-Rating			Informant-Rating ^a		
	M	SD	Md	M	SD	Md
<i>Loneliness</i>						
RTLS _{Total}	2.36	0.85	2.27	2.10	0.73	2.02
RTLS _{Emotional}	2.47	0.93	2.33	2.24	0.86	2.17
RTLS _{Social}	2.22	0.94	2.00	1.94	0.69	1.80
UCLA _{20Items}	2.07	0.73	1.90	1.76	0.60	1.57
UCLA _{3Items}	2.60	0.85	2.67	2.27	0.76	2.17
SI Direct	2.69	1.31	2.00	2.39	1.21	2.00
SI Indirect	2.77	1.25	2.00	2.49	1.21	2.00
SI Direct _{Frequency}	2.60	0.95	3.00	2.43	0.79	2.42
<i>Personality</i>						
Neuroticism	4.38	1.42	4.67			
Extraversion	4.42	1.45	4.67			
Openness	4.99	1.22	5.00			
Agreeableness	5.31	1.01	5.33			
Conscientiousness	5.00	1.17	5.00			
Shyness	2.85	0.71	2.80			
Sociability	3.06	0.79	3.20			
Self-Esteem	3.49	0.98	3.67			
Affiliation Motive	4.66	0.87	4.75			
Need Frustration	2.00	0.79	2.00			
Motive×Need	−0.16	0.79	0.00			
Depressiveness	2.01	0.60	1.90			
Social Desirability	1.45	0.18	1.47			
<i>Satisfaction with...</i>						
Life	6.60	2.06	7.00			
Education	6.47	2.46	7.00			
Leisure	6.57	2.23	7.00			
Friends	6.71	2.36	7.00			
Family	7.28	2.48	8.00			
Partner Relationship	8.00	1.99	8.00			
<i>Network Characteristics</i>						
<i>Number of Friends (Providing)...</i>						
Overall	5.35	4.10	4.00			
on Facebook	270.84	210.93	201.50			
Help with Problems	6.82	5.92	5.00			
Instrumental Support	10.07	8.29	8.00			
Advice	9.07	11.00	6.00			
<i>Frequency of...</i>						
Contact	5.53	1.33	6.00			
Joint Activities	4.15	1.52	4.00			

Note. ^aInformant-ratings were only collected for the loneliness measures. RTLS: Rasch-Type Loneliness Scale. UCLA-LS: University of Los Angeles California Loneliness Scale. SI: Single Item.

Table S3

Zero-Order Correlations

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
<i>Personality</i>																											
1 Neuroticism																											
2 Extraversion	-.21																										
3 Openness	-.04	.32																									
4 Agreeableness	-.03	.07	.15																								
5 Conscientiousness	-.11	.12	.12	.19																							
6 Shyness	.35	-.68	-.26	-.07	-.15																						
7 Sociability	-.13	.55	.18	.31	.10	-.34																					
8 Self-Esteem	-.48	.30	.17	.16	.27	-.37	.21																				
9 Affiliation Motive	.03	.34	.15	.28	.16	-.12	.56	.11																			
10 Need Frustration	.28	-.33	-.11	-.29	-.11	.33	-.32	-.48	-.23																		
11 Motive×Need	-.08	.10	.05	.11	.06	-.07	.12	.12	.24	-.12																	
12 Depressiveness	.57	-.32	-.13	-.23	-.28	.36	-.28	-.72	-.19	.48	-.15																
13 Social Desirability	-.10	-.09	.02	.36	.24	.01	.10	.07	.13	-.03	.06	-.12															
<i>Satisfaction with...</i>																											
14 Life	-.33	.25	.16	.15	.23	-.28	.23	.64	.22	-.39	.17	-.69	.02														
15 Education	-.24	.16	.08	.10	.26	-.21	.16	.43	.10	-.26	.10	-.52	.05	.60													
16 Leisure	-.25	.16	.06	.11	.16	-.15	.10	.42	.16	-.29	.10	-.48	.05	.56	.37												
17 Friends	-.21	.32	.13	.20	.12	-.29	.26	.41	.31	-.46	.14	-.45	.00	.56	.31	.56											
18 Family	-.11	.15	.05	.20	.18	-.11	.21	.35	.29	-.29	.15	-.43	.08	.51	.31	.39	.49										
19 Partner Relationship	-.03	.01	.01	.09	.15	.05	.06	.22	.23	-.11	.17	-.30	.08	.48	.19	.25	.33	.31									
<i>Network Characteristics</i>																											
<i>Number of Friends (Providing)...</i>																											
20 Overall	-.07	.24	.13	.15	-.02	-.16	.30	.07	.26	-.22	.06	-.14	.01	.12	.02	.09	.28	.15	.02								
21 on Facebook	-.01	.28	.09	.04	.02	-.17	.22	.03	.18	-.08	.07	-.02	-.03	.07	.01	-.08	.07	.09	.02	.21							
22 Help with Problems	-.09	.19	.14	.15	.05	-.17	.25	.13	.21	-.25	.03	-.19	-.05	.26	.08	.17	.31	.24	-.08	.37	.09						
23 Instrumental Support	-.17	.26	.15	.17	.03	-.21	.29	.18	.23	-.26	.05	-.27	.04	.22	.13	.17	.25	.25	.07	.38	.12	.51					
24 Advice	-.04	.14	.05	.09	.01	-.07	.17	.07	.09	-.12	.03	-.16	-.03	.17	.08	.08	.17	.17	.01	.30	.13	.47	.48				
<i>Frequency of...</i>																											
25 Contact	.01	.20	.11	.12	.01	-.08	.21	.03	.23	-.13	.06	-.10	-.04	.02	.01	.09	.22	.08	.02	.21	.07	.13	.15	.09			
26 Joint Activities	-.11	.28	.17	.13	.04	-.15	.37	.16	.39	-.27	.12	-.22	-.01	.19	.12	.23	.38	.22	.10	.34	.21	.27	.35	.15	.52		

Study 2

Table S4

Overview of the Measures Used in Study 2

Construct	Source	Sample Item	Scale Range	# Items	Coefficient ω	
					Self	Informant
<i>Demographic Characteristics</i>						
Age		“Please indicate your birth year”	Due to the high frequency of measurement occasions every three months, we decided to ask for birth year so that participants were not required to indicate their age every three months. Instead, we calculated age by subtracting the year of data collection (e.g., 2020 for Wave 1) from the indicated birth year			
Gender		“Please indicate your gender”	1 (male), 2 (female), 3 (diverse); for the analysis reported in the manuscript, the variable was recoded as 1 (female) and 0 (not female, incl. male and diverse)			

Table S4 (continued)

Construct	Source	Sample Item	Scale Range	# Items	Coefficient ω	
					Self	Informant
Education		“Please select your highest educational degree”	1 (no degree), 2 (Grundschule — Primary School), 3 (Hauptschule — secondary modern school qualification), 4 (Realschule — secondary school certificate), 5 (Fachhochschulreife — entrance qualification for a university of applied sciences), 6 (Abitur — university entrance qualification), 7 (Hochschulstudium — university degree, e.g., B.Sc., M.Sc.), 8 (Promotion — PhD)			
Relationship Duration		“How long have you been involved in the relationship with your current partner?”	participants could enter a number in a numeric field and select whether they refer to weeks, months, or years; for the analysis reported in the manuscript, we transformed relationship duration to years			
<i>Loneliness</i> Rasch-Type Loneliness Scale (RTLS _{Total})	de Jong Gierveld and van Tilburg (2006)		1 (<i>does not apply</i>) to 5 (<i>fully applies</i>)	6	.78	.79

Table S4 (continued)

Construct	Source	Sample Item	Scale Range	# Items	Coefficient ω	
					Self	Informant
Emotional Loneliness (RTLS _{Emotional})	de Jong Gierveld and van Tilburg (2006)	“I experience a general sense of emptiness”	1 (<i>does not apply</i>) to 5 (<i>fully applies</i>)	3	.68	.66
Social Loneliness (RTLS _{Social})	de Jong Gierveld and van Tilburg (2006)	“There are plenty of people I can rely on when I have problems”, reverse scored	1 (<i>does not apply</i>) to 5 (<i>fully applies</i>)	3	.83	.85
UCLA Loneliness Scale (UCLA-LS _{8Items})	Döring and Bortz (1993)	“People have a hard time getting close to me”	1 (<i>completely false</i>) to 5 (<i>completely true</i>)	8	.80	.81
3-Item UCLA Loneliness Scale (UCLA-LS _{3Items})	Hawkley et al. (2015)	“How often do you have the feeling to be left out”; “How often do you have the feeling to be isolated”; “How often do you have the feeling to lack companionship”	1 (<i>never</i>) to 5 (<i>very often</i>)	3	.77	.81
Direct Single Item (SI Direct) ^a		“I feel lonely”	1 (<i>does not at all apply</i>) to 5 (<i>does fully apply</i>)	1		
<i>Personality</i>						
Neuroticism	Rammstedt et al. (2020)	“I worry a lot”	1 (<i>do not agree at all</i>) to 5 (<i>fully agree</i>)	3	.74	
Extraversion	Rammstedt et al. (2020)	“I tend to take the lead”	1 (<i>do not agree at all</i>) to 5 (<i>fully agree</i>)	3	.52	
Openness	Rammstedt et al. (2020)	“I can get excited about art, music and literature”	1 (<i>do not agree at all</i>) to 5 (<i>fully agree</i>)	3	.41	
Agreeableness	Rammstedt et al. (2020)	“I am compassionate, have a soft heart. ”	1 (<i>do not agree at all</i>) to 5 (<i>fully agree</i>)	3	.50	
Conscientiousness	Rammstedt et al. (2020)	“I see myself as someone who does things effectively”	1 (<i>do not agree at all</i>) to 5 (<i>fully agree</i>)	3	.641	
Self-Esteem	von Collani and Herzberg (2003)	“I like myself just the way I am”	1 (<i>do not agree at all</i>) to 5 (<i>fully agree</i>)	10	.92	

Table S4 (continued)

Construct	Source	Sample Item	Scale Range	# Items	Coefficient ω	
					Self	Informant
Depressiveness	Spaderna et al. (2002)	“In general, how often do you feel sad”	1 (<i>almost never</i>) to 4 (<i>almost always</i>)	5	.87	
Affiliation Motive	Schönbrodt and Gerstenberg (2012)	“How important is it for you to be in the company of friends?”	1 (<i>not important</i>) to 6 (<i>very important</i>)	2	.68	
Shyness	Asendorpf and Wilpers (1998)	“I feel inhibited when I am with other people”	1 (<i>does not apply</i>) to 5 (<i>applies fully</i>)	5	.74	
Sociability ^b	Asendorpf and Wilpers (1998)	“I really like to talk to other people”	1 (<i>does not apply</i>) to 5 (<i>applies fully</i>)	5	.68	
<i>Satisfaction</i>						
Life	Siedler et al. (2008)	“In general, how satisfied are you with your life”	0 (<i>very dissatisfied</i>) to 10 (<i>very satisfied</i>)	1		
Education	Siedler et al. (2008)	“In general, how satisfied are you with your education and work life”	0 (<i>very dissatisfied</i>) to 10 (<i>very satisfied</i>)	1		
Leisure	Siedler et al. (2008)	“In general, how satisfied are you with your leisure”	0 (<i>very dissatisfied</i>) to 10 (<i>very satisfied</i>)	1		
Friends	Siedler et al. (2008)	“In general, how satisfied are you with your friends and social contacts”	0 (<i>very dissatisfied</i>) to 10 (<i>very satisfied</i>)	1		
Family	Siedler et al. (2008)	“In general, how satisfied are you with your family relationships”	0 (<i>very dissatisfied</i>) to 10 (<i>very satisfied</i>)	1		
Relationship	Sander and Böcker (1993)	“In general, how satisfied are you with your partner relationship”	0 (<i>very dissatisfied</i>) to 5 (<i>very satisfied</i>)	7	.81	

Note. Informant-rating were only collected for the loneliness measures. ^aSelf-ratings of the single-item were not collected in Wave 4 (October 2020). ^bSociability was only assessed at Waves 1 through 3 (i.e., January 2020 until July 2020).

Table S5

Descriptive Statistics

Measure	Self-Rating			Informant-Rating ^a		
	M	SD	Md	M	SD	Md
<i>Loneliness</i>						
RTLS _{Total}	2.07	0.72	2.00	2.30	0.76	2.17
RTLS _{Emotional}	2.21	0.87	2.00	2.39	0.87	2.33
RTLS _{Social}	1.93	0.82	2.00	2.21	0.90	2.00
UCLA _{8Items}	1.98	0.60	1.88	2.13	0.67	2.00
UCLA _{3Items}	2.22	0.74	2.00	2.32	0.79	2.33
SI Direct	1.69	0.89	1.00	1.99	1.02	2.00
<i>Personality</i>						
Neuroticism	2.88	0.90	2.67			
Extraversion	3.10	0.70	3.00			
Openness	3.78	0.68	3.67			
Agreeableness	3.67	0.72	3.67			
Conscientiousness	3.36	0.77	3.33			
Shyness	2.82	0.63	2.80			
Sociability	3.09	0.68	3.20			
Self-Esteem	3.31	0.81	3.50			
Affiliation Motive	4.05	0.95	4.00			
Depressiveness	1.81	0.57	1.80			
<i>Satisfaction with...</i>						
Life	7.16	2.10	8.00			
Education	6.49	2.73	7.00			
Leisure	6.58	2.49	7.00			
Friends	7.14	2.39	8.00			
Family	7.34	2.61	8.00			
Partner Relationship	4.43	0.47	4.57			

Note. ^aInformant-ratings were only collected for the loneliness measures. RTLS: Rasch-Type Loneliness Scale. UCLA-LS: University of Los Angeles California Loneliness Scale. SI: Single Item.

Table S6

Zero-Order Correlations

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<i>Personality</i>																
1 Neuroticism																
2 Extraversion	-.14															
3 Openness	.01	.14														
4 Agreeableness	-.11	-.02	.10													
5 Conscientiousness	-.15	.21	-.03	.10												
6 Shyness	.25	-.53	-.13	-.06	-.10											
7 Sociability	-.08	.34	.04	.25	.03	-.29										
8 Self-Esteem	-.63	.24	.06	.14	.24	-.29	.11									
9 Affiliation Motive	-.08	.37	.04	.24	.08	-.22	.66	.13								
10 Depressiveness	.70	-.24	.08	-.15	-.18	.27	-.17	-.66	-.16							
<i>Satisfaction with...</i>																
11 Life	-.36	.19	.02	.17	.15	-.19	.09	.48	.11	-.45						
12 Education	-.33	.16	.01	.11	.19	-.14	.08	.42	.13	-.40	.61					
13 Leisure	-.30	.17	.05	.05	.09	-.16	.07	.31	.09	-.35	.54	.39				
14 Friends	-.25	.20	.02	.10	.10	-.22	.08	.31	.17	-.34	.56	.34	.62			
15 Family	-.22	.11	-.05	.13	.06	-.11	.09	.24	.08	-.29	.46	.29	.37	.44		
16 Partner Relationship	-.16	.04	.05	.13	.10	-.06	-.02	.21	.00	-.26	.26	.09	.15	.25	.16	

Study 3

Table S7

Descriptive Statistics

Measure	Time 1			Time 2			Time 3		
	M	SD	Md	M	SD	Md	M	SD	Md
SI Direct	2.57	1.24	2.00	2.42	1.23	2.00	2.41	1.20	2.00
SI Indirect	2.60	1.23	2.00	2.50	1.21	2.00	2.52	1.20	2.00
SI Direct _{Frequency}	2.59	1.00	3.00	2.59	1.01	3.00	2.57	0.99	3.00

Note. SI: Single Item

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