When loneliness dimensions drift apart: Emotional, social and physical loneliness during the COVID-19 lockdown and its associations with age, personality, stress and well-being

Helen Landmann and Anette Rohmann

Department of Psychology, FernUniversität in Hagen, Community Psychology, Hagen, Germany

Previous research differentiated between emotional loneliness (perceived lack of emotional connection with others) and social loneliness (perceived lack of a broader social network). We argue that physical loneliness (perceived lack of physical contact) constitutes a third dimension of loneliness that is particularly relevant in times of physical distancing. We conducted a longitudinal experience sampling study (N = 578) during the first 8 weeks of the COVID-19 lockdown in Germany to test this claim. The results indicate that loneliness has a three-dimensional structure encompassing emotional, social and physical loneliness. Each loneliness dimension explained a unique variance in perceived stress and psychological well-being. However, the three loneliness dimensions differed in their prevalence during the contact restrictions and their associations with age and personality. Physical loneliness was higher during the contact restrictions whereas emotional and social loneliness remained on a normal level. Age was positively associated with social loneliness but negatively associated with physical loneliness. Extraversion was negatively associated with emotional and social loneliness but positively associated with physical loneliness. These findings expand loneliness models, enhance loneliness assessment and improve the prediction of vulnerability to loneliness.

Keywords: Physical distancing; Physical loneliness; Personality; Well-being; Stress.

EMOTIONAL, SOCIAL AND PHYSICAL LONELINESS DURING THE COVID-19 CONTACT RESTRICTIONS

To combat the COVID-19 pandemic, governments across the world implemented measures to reduce residents’ contact to one another (e.g., restrictions on group gatherings, school closures). These measures sought to maintain physical distance between people to slow down the spread of the virus. This led to unique circumstances in which social isolation affected large portions of the world. However, even though physical contact was restricted, it remained possible to communicate with others and share experiences. Scholars have suggested using the term physical distancing rather than social distancing to highlight this maintenance of social connection (Van Bavel et al., 2020). We argue that this unique situation created an experience of loneliness different from our previous understanding of the concept, because the different components of loneliness drifted apart. Specifically, we argue that the concept of physical loneliness is needed—in addition to the well-established dimensions of emotional and social loneliness—to explain psychological reactions to the COVID-19 contact restrictions.

Loneliness is the perception of discrepancy between one’s desired and actual relationships (Buecker et al., 2020). Loneliness can be experienced as severely painful and is associated with increased morbidity and mortality (Hawkley & Cacioppo, 2010), whereas social connection enhances well-being and coping with stress (Jetten et al., 2012). Previous research has revealed two dimensions of loneliness (Buecker et al., 2020): Emotional loneliness can be described as the perceived lack of feeling emotionally connected to others, while social loneliness represents the perceived lack of a broader social network. These two types of loneliness are elicited by different life events. For instance, marital status is more strongly associated with emotional loneliness (Stroebe et al., 1996), whereas group affiliation is more strongly associated with social loneliness (Margelisch et al., 2017).

Correspondence should be addressed to Helen Landmann, Department of Psychology, FernUniversität in Hagen, Community Psychology, 58084 Hagen, Germany. (E-mail: helen.landmann@fernuni-hagen.de)

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Neither emotional nor social loneliness seems to cover the most common reactions to physical contact restrictions. During these restrictions, individuals are not necessarily emotionally lonely because they can feel connected to others and not necessarily socially lonely because their circle of friends and social network may persist. However, physical contact restrictions undermine interpersonal touch and the experience of being part of a crowd. Touch, such as hand-holding, hugging or massage, exhibits a protective function against different forms of stress (Field, 2010) and being part of large crowds at festivals, concerts, or sporting events can induce positive emotions (Novelli et al., 2013). Furthermore, computer-mediated communication exhibits several drawbacks compared to face-to-face interactions, such as impaired development of trust (Wilson et al., 2006). Reduced participation in physical contact (i.e., contact involving the physical presence of others) may induce feelings of a deficit as well. People may miss the physical company of others even if they feel emotionally and socially connected. We call these feelings physical loneliness.

Considering physical loneliness in addition to emotional and social loneliness may improve our understanding of psychological reactions to the COVID-19 lockdown and physical distancing in general. Quarantine usually impairs psychological well-being (Brooks et al., 2020) and scholars observed an increased prevalence of anxiety and depression symptoms during the first weeks of the contact restrictions (Torales et al., 2020). Loneliness is considered to be a major factor influencing these impairments on mental health alongside health and economic concerns. However, research on the effect of social isolation on loneliness during the COVID-19 pandemic is inconsistent so far. Some studies find increased loneliness during the contact restrictions (Van Tilburg et al., 2020), while others find no significant changes in loneliness (Luchetti et al., 2020). Alongside differences by country and study design, different dimensions of loneliness may contribute to these inconsistencies. Van Tilburg et al. (2020) used a scale with a larger proportion of items referring to physical loneliness—which may be especially affected by physical contact restrictions—than Luchetti et al. (2020). However, the proposed three-factor structure of loneliness (emotional, social, physical) as well as the specific predictors and consequences of physical loneliness have not yet been investigated.

**THE PRESENT RESEARCH**

To address these gaps, we investigated the structure of loneliness and its potential predictors and outcomes during the first 8 weeks of the German COVID-19 contact restrictions with a longitudinal experience sampling study. During this period (March 16–May 10, 2020), a series of political measures were introduced gradually in Germany. Schools were closed in the first week and most did not open up again before the end of the study. Public life was severely restricted (e.g., only takeaway orders from restaurants, closure of bars, clubs and numerous shops) from the first until the sixth week. Travel bans and upper limits on the number of individuals who were allowed to meet in public were introduced in the second week of the lockdown. From the sixth week on, masks were compulsory in shops and public transport.

The first aim of the study was to test the proposed three-factor structure of loneliness (emotional, social, physical). We employed the De Jong Gierveld Loneliness Scale (De Jong Gierveld & Van Tilburg, 2006), which is frequently used in research on loneliness. Previous research identified a two-dimensional structure for this scale encompassing emotional and social loneliness (De Jong Gierveld & Van Tilburg, 2010; Hyland et al., 2019). We argue that this two-factor structure may not persist during physical distancing. The scale does include items reflecting physical loneliness, although they are usually treated as part of the emotional loneliness subscale. We expected to find a three-factor structure for loneliness, with physical loneliness explaining unique variance in the loneliness items in addition to emotional and social loneliness.

The second aim of the present research was to investigate predictors of the loneliness dimensions. Personality traits predict a considerable amount of variance in subjective loneliness (see Buecker et al., 2020, for a recent meta-analysis): Loneliness is positively associated with neuroticism and negatively with extraversion, agreeableness, conscientiousness and openness (though the latter association is less stable). Neurotic individuals tend to avoid contact with others and hence are more prone to loneliness. Conversely, extraverted individuals enjoy social interactions, agreeable individuals are motivated to maintain positive interactions, conscientious individuals are more reliable, and individuals who are open to experience have more opportunities for contact (Buecker et al., 2020). We explored whether these personality traits differentially predict the three loneliness dimensions.

Finally, we investigated the consequences of loneliness during the contact restrictions. Loneliness typically impairs psychological well-being and increases perceived stress (Hawkley & Cacioppo, 2010; Jetten et al., 2012). Well-being (optimal psychological functioning and experience) comprises both hedonic elements (pleasure and happiness) and eudaimonic elements (the experience of meaningfulness; Ryan & Deci, 2001). Stress (i.e., perceived imbalance between demands and resources) can manifest as worries but also as perceived overload due to external demands (Kocalevent et al., 2007). We explored how positive affect (hedonic well-being), positive functioning and satisfaction with relationships (eudaimonic well-being), as well as different aspects of stress are associated with the three loneliness dimensions.
METHODS

A total of 578 members of the community in Germany participated in the study, 49 of whom dropped out after the baseline questionnaire. The remaining 529 participants (407 women, 113 men, nine other) were between 18 and 72 years of age ($M_{age} = 34.3, SD_{age} = 10.5$). The vast majority (92.6%) were students at the FernUniversität in Hagen, which is a distance learning university with a diverse student body with regard to age, family and employment status. Most participants were working full-time (28.9%), part-time (34.2%), or as freelancers (10.2%). Most participants lived together with at least one other person (68.1%), 132 participants (25.0%) were parents and 71 participants (13.4%) indicated that they are at high-risk for severe illness in the case of a COVID-19 infection. Only a few participants (between 5.8% and 8.5%) were under quarantine while they participated in the study. The study was conducted during the first 8 weeks of contact restrictions in Germany. Each participant was enrolled in the study for 4 weeks. They began by completing a 40-minute baseline questionnaire. Subsequently, they completed four 25-minute weekly questionnaires. Invitations for the weekly questionnaires were sent each Sunday morning with the request to respond within 1 day. After 4 weeks, participants received the final 40-minute questionnaire. A total of 188 participants started the weekly diary in the first week, 92 in the second week, 78 in the third week, 85 in the fourth week and 86 in the fifth week of the contact restrictions. Participants responded to questions regarding subjective loneliness, psychological well-being and perceived stress on a weekly basis. Personality traits were assessed in the final questionnaire. Participants indicated to what extent they agreed with each item on scales ranging from 1 (not at all) to 7 (completely). An overview of all measures is provided in Supporting Information (Figure S1). Further publications using the dataset are in preparation (Landmann & Rohmann, 2021).

Loneliness was assessed with the De Jong Gierveld Loneliness Scale (DJGLS; 11 items; De Jong Gierveld & Van Tilburg, 2006). The items of the De Jong Gierveld Loneliness Scale as well as the previously proposed two-dimensional structure and newly proposed three-dimensional structure are shown in the Supporting Information (Table S1). Emotional loneliness (e.g., I miss having a really close friend; 4 items; $\alpha$ between .84 and .90), social loneliness (e.g., There is always someone I can talk to about my day-to-day problems; 5 items, $\alpha$ between .71 and .77) and physical loneliness (e.g., I miss having people around; 2 items, $\alpha$ between .80 and .84) created reliable scales.

Psychological well-being was assessed with the Warwick–Edinburgh Mental Well-Being Scale (WEMWBS; 14 items; Tennant et al., 2007; German translation by Lang & Bachinger, 2017). The scale covers aspects of positive affect (e.g., I’ve been feeling relaxed; $\alpha$ between .92 and .93), positive functioning (e.g., I’ve been dealing with problems well; $\alpha$ between .82 and .87) and satisfying relationships (e.g., I’ve been feeling loved; $\alpha$ between .68 and .81).

Perceived stress was assessed with the German version of the Perceived Stress Questionnaire (PSQ-20; 20 items; Fliege et al., 2005; Levenstein et al., 1993). The scale covers worries (e.g., I am afraid for the future; $\alpha$ between .89 and .91), tension (e.g., I feel tense; $\alpha$ between .88 and .90), lack of joy (e.g., I feel light-hearted (reverse coded); $\alpha$ between .83 and .88) and demands (e.g., I have too many things to do; $\alpha$ between .87 and .88).

Personality traits were assessed with the HEXACO scales (60 items; Ashton & Lee, 2009). These scales encompass honesty (being sincere and honest; $\alpha$ = .76), emotionality (being sentimental and anxious; $\alpha$ = .77), extraversion (being outgoing and sociable; $\alpha$ = .79), agreeableness (being patient and tolerant), conscientiousness (being organised and disciplined; $\alpha$ = .76) and openness to experience (being unconventional and creative; $\alpha$ = .68). The HEXACO scales for extraversion, conscientiousness and openness correspond to the respective Big-5 scales. The HEXACO scales for honesty, emotionality and agreeableness share variance with the Big-5 scales for agreeableness and neuroticism (Ashton & Lee, 2009).

The current research was conducted in accordance with the APA Code of Conduct and the Declaration of Helsinki. The local ethical review board Ethikkommission der Fakultät für Psychologie der FernUniversität in Hagen approved the study. Informed consent was obtained from all participants. We report all data exclusions, all manipulations and all measures in the study. Anonymized data and syntaxes are stored in an OSF project (https://osf.io/r6mk3).

RESULTS

A total of 49 participants with more than 10% missing values were excluded from the analyses. The remaining missing values (32 items for age, 6 for personality, 11 for loneliness, 11 for well-being and 11 for stress exhibited missing values) were replaced with the scale means. We used Mplus robust maximum likelihood estimation (MLR) for the multi-level analyses.

Dimensions of loneliness

To investigate the factor structure of the loneliness items, we conducted multilevel confirmatory factor analysis following the procedure proposed by Geldhof et al. (2014). We expected that three correlated factors representing emotional, social and physical loneliness (Model 3) would explain the variance in the loneliness
items better than a single-factor representing global loneliness (Model 1) and two correlated factors representing emotional and social loneliness (Model 2). In the two-factor model, items were allocated to emotional and social loneliness according to the loneliness structure proposed by De Jong Gierveld and Van Tilburg (2006). In the three-factor model, this allocation was maintained, with the exception that the physical loneliness items were allocated to a third factor for “physical loneliness” (see Table S1).

As shown in Table 1, the three-factor model exhibits better model fit than the single-factor model (Model 3 vs. Model 1): ΔRMSEA = .040, ΔSRMR_{within} = .038, ΔSRMR_{between} = .084, ΔCFI = .277, ΔTLI = .336, ΔAIC = 1169, ΔBIC = 1136) and the two-factor model representing emotional and social loneliness (Model 3 vs. Model 2): ΔRMSEA = .037, ΔSRMR_{within} = .030, ΔSRMR_{between} = .082, ΔCFI = .246, ΔTLI = .308, ΔAIC = 821, ΔBIC = 799). The two-factor model provides only a small improvement in model fit compared to the single-factor model (Model 2 vs. Model 1): ΔRMSEA = .003, ΔSRMR_{within} = .008, ΔSRMR_{between} = .002, ΔCFI = .031, ΔTLI = .028, ΔAIC = 348, ΔBIC = 337). Hence, neither emotional and social loneliness nor global loneliness can sufficiently explain the variance in the loneliness statements. Additionally considering physical loneliness explained unique variance in the loneliness statements, supporting the proposed three-dimensional structure of loneliness.

Emotional loneliness was positively associated with social loneliness (within: R = .58, p < .001; between: R = .79, p < .001) and with physical loneliness (within: R = .37, p < .001; between: R = .31, p < .001), but social and physical loneliness were insignificantly or even negatively associated (within: R = .01, p = .922; between: R = -.13, p = .021). Hence, physical loneliness shares only limited variance with emotional and social loneliness.

### Loneliness, well-being and stress across the study period

The prevalence of physical loneliness differed strongly from that of emotional and social loneliness. Means and 95% confidence intervals are shown in Figure 1a. Emotional and social loneliness were relatively stable during the 8 weeks of the study. Emotional loneliness was centred around 31% of the maximum possible score (M = 2.88; SD = 1.45) and social loneliness was centred around 24% of the maximum possible score (M = 2.45; SD = 1.29). Loneliness is typically centred on 17–31% of the maximum possible score depending on participants’ age (Mund et al., 2020). Hence, the intensity of emotional and social loneliness was comparable to loneliness before the COVID-19 pandemic. However, physical loneliness was significantly more intense (M = 4.85; SD = 1.77), at 64% of the maximum possible score. Furthermore, physical loneliness increased significantly during the first 3 weeks of the contact restrictions and then steadily decreased (see Figure 1a and Table S2). This indicates that participants experienced more physical loneliness than emotional or social loneliness during the COVID-19 contact restrictions.

The aspects of psychological well-being also differed in terms of their trajectories during the COVID-19 contact restrictions. Positive affect (M = 4.69; SD = 1.33), positive functioning (M = 5.17; SD = 1.25) and satisfying relationships (M = 4.94; SD = 1.24) were centred around 70, 70 and 66% of the maximum possible scores, respectively. This scale is usually centred around 72% of the maximum possible score (CI95 [71; 73]; Lang & Bachinger, 2017). As shown in Figure 1b and Table S2, positive affect was significantly reduced during the first 2 weeks of the COVID-19 contact restrictions but then returned to a normal level. By contrast, positive functioning and satisfying relationships were stable during the 8 weeks of the study (see Figure 1b and Table S2). This indicates that the contact restrictions impaired hedonic well-being (positive affect) but less so eudaimonic well-being (positive functioning and satisfying relationships).

The different types of stress also exhibited different patterns during the COVID-19 contact restrictions.
Figure 1. (a) Subjective loneliness, (b) psychological well-being and (c) perceived stress (means and 95% confidence intervals) during the COVID-19 lockdown. [Colour figure can be viewed at wileyonlinelibrary.com]
TABLE 2
Multilevel regression analysis of loneliness on personality traits

|                      | Emotional loneliness | Social loneliness | Physical loneliness |
|----------------------|----------------------|-------------------|---------------------|
| Age                  | −.08                 | .11**             | −.19***             |
| Gender               | .02                  | .01               | .00                 |
| Living alone         | .06                  | .06               | .01                 |
| Having kids          | .03                  | .08               | −.08                |
| HEXACO honesty       | −.15***              | −.14***           | .00                 |
| HEXACO emotionality  | .14***               | −.08              | .26***              |
| HEXACO extraversion  | −.46***              | −.54***           | .20***              |
| HEXACO agreeableness | −.11                 | −.09              | .01                 |
| HEXACO conscientiousness | .00             | .02               | −.02                |
| HEXACO openness      | .05                  | .01               | −.04                |
| R²                   | .31***               | .34***            | .14***              |

Notes: Standardised regression coefficients are shown; gender was coded with 1 (male) and 0 (female); living alone and having kids was coded with 1 (yes) and 0 (no); *p < .05; **p < .01; ***p < .001; N = 480.

Worries (M = 3.21; SD = 1.48), tension (M = 3.44; SD = 1.45), lack of joy (M = 3.60; SD = 1.28) and demands (M = 3.11; SD = 1.47) were centred around 37, 41, 43 and 35% of the maximum possible scores, respectively. These items are usually centred around 33% of the maximum possible score (CI95 [32; 34]; Kocalevent et al., 2007). As shown in Figure 1c and Table S2, lack of joy was significantly elevated during the first 2 weeks of the contact restrictions but decreased in the third week to a normal level. By contrast, overload due to demands was significantly reduced in the first 2 weeks but then increased continuously (see Figure 1c and Table S2).

Dimensions of loneliness and personality

To investigate the association between the loneliness dimensions and personality traits, a multilevel regression analysis was conducted. We specified a model with age, dummy-coded gender (male vs. female), living alone (yes vs. no), having kids (yes vs. no) and the six HEXACO personality traits as predictors (varying between subjects) as well as emotional, social and physical loneliness as dependent variables (varying within and between subjects). Correlations between the three loneliness dimensions were not restricted. The results of the regression analysis are shown in Table 2. Correlations among the loneliness and personality scales are reported in Table S3.

Emotional, social and physical loneliness were predicted by participants’ age and personality (see Table 2). Older participants reported a greater lack of social networks (social loneliness) than younger participants, but younger participants missed the company of others more (physical loneliness). Participants’ gender, whether they lived alone and whether they had kids did not significantly predict subjective loneliness. By contrast, personality traits predicted a considerable amount of the variance in loneliness. Extraversion (M = 3.43; SD = 0.66) was negatively associated with emotional and social loneliness but positively associated with physical loneliness. More extraverted individuals missed having people around more than less extraverted individuals, yet experienced less of a deficit concerning their emotional connections with others and their social networks. By contrast, high emotionality (M = 3.24; SD = 0.66) was positively associated with emotional and physical loneliness but not significantly associated with social loneliness. Sensitive and anxious participants missed the physical presence of others more than less emotional individuals and—in contrast to extraverts—also felt lonelier than others. Honesty (M = 3.78; SD = 0.68) and agreeableness (M = 3.18; SD = 0.59) were negatively associated with emotional and social loneliness but not significantly associated with physical loneliness. Finally, conscientiousness (M = 3.74; SD = 0.60) and openness to experience (M = 3.78; SD = 0.62) were not significantly associated with the loneliness scales.

Taken together, the predictors of loneliness depended on the dimension of loneliness under consideration. Extraversion, honesty and agreeableness protected against emotional and social loneliness, while emotionality was a risk factor for feeling emotionally lonely and older age for experiencing social loneliness. By contrast, younger and more extraverted individuals were particularly vulnerable to physical loneliness.

Associations between loneliness, well-being and stress

To investigate how the loneliness dimensions are associated with psychological well-being and perceived stress, multilevel regression analyses were conducted. We specified one model with the subscales of psychological well-being (i.e., positive affect, positive functioning and satisfying relationships) as correlated dependent variables and another model with the subscales of perceived stress (i.e., worries, tension, lack of joy and demands) as correlated dependent variables. Emotional, social and physical loneliness were specified as predictors in both models. Both the predictors and dependent variables varied within and between subjects. The results are shown in Table 3.

All types of loneliness predicted low well-being and high stress. However, the strength of these associations was contingent on the dimension of loneliness and the type of well-being or stress under consideration. For instance, emotional loneliness explained differences in well-being and stress between participants particularly well—with the exception of stressful demands (see Table 3). In other words, whether someone experienced high or low levels of well-being and stress on average during the 4 weeks of study participation depended on his or her tendency to experience a lack of connection with others. Furthermore, social loneliness predicted differences in participants’ perception of stressful demands.

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and their satisfaction with relationships particularly well. This suggests that large social networks enhanced coping with multiple demands.

Notably, physical loneliness predicted a small but unique variance in almost all well-being and stress subscales (see Table 3). Missing the physical company of others reduced good feelings (positive affect; lack of joy), the ability to cope with problems (positive functioning) and the experience of being loved (satisfying relationships), but increased concerns (worries). These associations between physical loneliness and the well-being and stress scales were mostly small but significant. Hence, physical loneliness explains small differences in well-being and stress between and within individuals over time above and beyond emotional and social loneliness.

**DISCUSSION**

The present research investigated the structure of loneliness during the COVID-19 contact restrictions with a longitudinal experience sampling study. The results suggest a three-dimensional structure of loneliness encompassing emotional, social and physical loneliness. Each loneliness dimension explained unique variance in psychological well-being and stress. However, the loneliness dimensions differed in their prevalence during the contact restrictions and their association with age and personality, suggesting that they drifted apart during the contact restrictions. These findings can improve loneliness models as well as loneliness assessment and help to predict vulnerability to loneliness.

**Physical loneliness as a third dimension in addition to emotional and social loneliness**

Previous research differentiated between emotional loneliness (i.e., experienced lack of feeling connected) and social loneliness (i.e., experienced lack of social networks; Buecker et al., 2020). The present research suggests adding a third dimension: physical loneliness, which can be described as the experienced lack of physical contact. Variance in loneliness during the first 8 weeks of the COVID-19 contact restrictions in Germany was not sufficiently explained by emotional and social loneliness nor by global loneliness. Physical loneliness explained unique variance in participants’ loneliness statements, thus, supporting the three-dimensional structure of loneliness.

Each loneliness dimension explained a unique variance in psychological well-being and perceived stress during the COVID-19 contact restrictions. However, physical loneliness differed from emotional and social loneliness in many respects. Physical loneliness was significantly higher than emotional and social loneliness during the contact restrictions, suggesting that the COVID-19 protection measures specifically affected this dimension of loneliness. In particular, the implemented policies during the lockdown that required people to keep physical distance likely influenced especially physical loneliness. Moreover, the associations between loneliness, age and personality depended on the type of loneliness considered, indicating that vulnerability to loneliness differs across loneliness dimensions. Hence, physical loneliness is a prevalent dimension of loneliness that adds to emotional and social loneliness.

Loneliness research should make particular efforts to consider these three dimensions when investigating loneliness during contact restrictions. Importantly, the frequently used Van Gierveld Loneliness Scale (DJGLS; De Jong Gierveld & Van Tilburg, 2006) and University of California Los Angeles Loneliness Scale (UCLA; Russell, 1996) include items reflecting physical loneliness as part of global loneliness or the emotional loneliness subscale. Applying these scales during contact restrictions without differentiating between the three loneliness subscales would underestimate the vulnerability to physical loneliness.
dimensions means ignoring relevant variance. Importantly, physical loneliness was higher than social and emotional loneliness. Hence, compiling all three loneliness dimensions into a total score during periods of contact restrictions means overestimating the emotional and social aspects of loneliness but underestimating physical loneliness. Moreover, physical loneliness and social loneliness did not correlate (within participants) or correlated negatively (between participants). This implies that social and physical loneliness can change independently over time and that individuals are differentially prone to social and physical loneliness. Thus, differentially considering all three dimensions of loneliness can improve loneliness research in general.

**Personality and loneliness**

Extraverted and younger individuals are typically less vulnerable to loneliness (Buecker et al., 2020). In line with this, extraverted individuals felt less lonely than others (emotional loneliness) and extraverted as well as younger individuals experienced less of a deficit in their social networks (social loneliness) during the first weeks of the COVID-19 contact restrictions. However, the associations between age, personality traits and physical loneliness differed fundamentally from this pattern. Extraverted and younger individuals missed the company of others (physical loneliness) more than less extraverted and older participants. This may have been due to impaired opportunities to regulate social contact during the contact restrictions. Extraverts are particularly good at engaging in social interactions (Buecker et al., 2020), which usually allows them to satisfy their need for company. However, during the COVID-19 contact restrictions, this form of regulation was not possible. These restricted opportunities for regulation, in turn, may explain extraverts’ increased vulnerability to physical loneliness.

**Loneliness, well-being and stress during the COVID-19 contact restrictions**

Loneliness has been established as a significant predictor of well-being and stress (Hawkley & Cacioppo, 2010; Jetten et al., 2012). In line with this, all three loneliness dimensions were associated with reduced well-being and increased stress. However, the present research also suggests that this association is complex. At the beginning of the contact restrictions, hedonic well-being (positive affect) was reduced and most aspects of stress (worries, tension and lack of joy) were increased. This indicates that worries about the pandemic and concerns about one’s own health or that of friends and relatives impaired affective well-being. However, these well-being dimensions increased and stress dimensions decreased between the second and the third week of contact restrictions. Hence, the impaired well-being and increased worries did not last long. These temporal trends may indicate that adaptation to the new, unfamiliar and unexpected situation of contact restrictions initially leads to an observable increase in stress and decrease in positive affect, which return to normal after habituation to the new situation and also probabilistically the development of specific coping mechanisms.

Only physical loneliness was unusually high throughout the entire study. Hence, a large amount of the variance in physical loneliness did not directly affect well-being and stress. This indicates some resilience against the detrimental effects of physical loneliness, at least in the weeks covered by the present study. Furthermore, eudaimonic well-being (positive functioning and satisfying relationships) was not reduced during the contact restrictions, nor were emotional and social loneliness increased, and the experience of stressful external demands was remarkably low during the initial weeks. Reduced demands, social connection through mediated communication and perceived meaning in life may have protected against severe impairments in well-being.

**Limitations and future research**

We identified relevant differences between emotional, social and physical loneliness as well as some resilience to the negative consequences of the latter during the COVID-19 contact restrictions in Germany. However, we observed the first 8 weeks of the contact restrictions only. Detrimental effects of physical loneliness may occur with a greater time lag. Furthermore, it is not clear whether the results generalise to situations with different or no contact restrictions. Future research can address this issue by reanalysing existing studies and comparing the three loneliness dimensions across nations with different levels of contact restrictions.

We used the well-established and frequently used De Jong Gierveld Loneliness Scale (De Jong Gierveld & Van Tilburg, 2006) to investigate the structure of loneliness. This scale includes items that map onto each of the three loneliness dimensions. However, all emotional loneliness items in this scale are framed positively, whereas all social loneliness items are framed negatively, and physical loneliness is covered by just two items. The development of a loneliness scale that covers emotional, social and physical loneliness in a more balanced and detailed way appears to be another task for future research.

**CONCLUSION**

Scholars emphasise the fact that it is possible to feel lonely in a crowd and to feel connected while physically alone (Luchetti et al., 2020). The present findings suggest extending this thesis. It is also possible to feel connected...
and simultaneously miss the physical presence of others. This feeling of physical loneliness is associated with reduced well-being and increased stress but differs from emotional and social loneliness with regard to its prevalence during contact restrictions and its association with personality and age. Hence, our understanding of psychological reactions to contact restrictions can be improved by considering physical loneliness.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Figure S1. Questionnaires of the longitudinal experience sampling study
Table S1. Detailed results of the multilevel confirmatory factor analyses
Table S2. Loneliness, well-being and stress across the study period (means and 95% confidence intervals)
Table S3. Correlations between loneliness, demographic variables and personality traits

REFERENCES

Ashton, M. C., & Lee, K. (2009). The HEXACO–60: A short measure of the major dimensions of personality. *Journal of Personality Assessment, 91*(4), 340–345. https://doi.org/10.1080/00223890902935878

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *Lancet, 395*(10227), 912–920. 10.1016/S0140-6736(20)30460-8.

Buecker, S., Maes, M., Denissen, J. J., & Luhmann, M. (2020). Loneliness and the big five personality traits: A meta-analysis. *European Journal of Personality, 34*(1), 8–28. https://doi.org/10.1002/per.2229

De Jong Gierveld, J., & Van Tilburg, T. (2006). A 6-item scale for overall, emotional, and social loneliness: Confirmatory tests on survey data. *Research on Aging, 28*(5), 582–598. https://doi.org/10.1177/0164027506289723

De Jong Gierveld, J., & Van Tilburg, T. (2006). The De Jong Gierveld short scales for emotional and social loneliness: Tested on data from 7 countries in the UN generations and gender surveys. *European Journal of Ageing, 3*(2), 121–130. https://doi.org/10.1007/s10433-010-0144-6

Field, T. (2010). Touch for socioemotional and physical well-being: A review. *Developmental Review, 30*(4), 367–383. https://doi.org/10.1016/j.dr.2011.01.001

Fliege, H., Rose, M., Arck, P., Walter, O. B., Kocalevent, R. D., Weber, C., & Klapp, B. F. (2005). The perceived stress questionnaire (PSQ) reconsidered: Validation and reference values from different clinical and healthy adult samples. *Psychosomatic Medicine, 67*(1), 78–88. https://doi.org/10.1097/01.psy.0000151491.80178.78

Geldhof, G. J., Preacher, K. J., & Zyphur, M. J. (2014). Reliability estimation in a multilevel confirmatory factor analysis framework. *Psychological Methods, 19*(1), 72–91. https://doi.org/10.1037/a0032138

Hawkley, L. C., & Cacioppo, J. T. (2010). Loneliness matters: A theoretical and empirical review of consequences and mechanisms. *Annals of Behavioral Medicine, 40*(2), 218–227. https://doi.org/10.1007/s12160-010-9210-8

Hyland, P., Shevlin, M., Cloitre, M., Karatzias, T., Vallières, F., McGinty, G., Fox, R., & Power, J. M. (2019). Quality not quantity: Loneliness subtypes, psychological trauma, and mental health in the US adult population. *Social Psychiatry & Psychiatric Epidemiology, 54*(9), 1089–1099. https://doi.org/10.1007/s00127-018-1597-8

Jetten, J., Haslam, C., & Haslam, S. A. (2012). The social cure: Identity, health and well-being. Psychology Press.

Kocalevent, R. D., Levenstein, S., Fliege, H., Schmid, G., Hinz, A., Brähler, E., & Klapp, B. F. (2007). Contribution to the construct validity of the perceived stress questionnaire from a population-based survey. *Journal of Psychosomatic Research, 63*(1), 71–81. https://doi.org/10.1016/j.jpsychores.2007.02.010

Landmann, H. & Rohmann, A. (2021). Sense of connectedness, contact, and well-being during the COVID-19 pandemic. Manuscript under Review

Lang, G., & Bachinger, A. (2017). Validation of the German Warwick-Edinburgh mental well-being scale (WEMWBS) in a community-based sample of adults in Austria: A bifactor modelling approach. *Journal of Public Health, 25*(2), 135–146. https://doi.org/10.1016/S1038-0166-0778-8

Levenstein, S., Prantera, C., Varvo, V., Scribano, M. L., Berto, E., Luzi, C., & Andreoli, A. (1993). Development of the perceived stress questionnaire: A new tool for psychosomatic research. *Journal of Psychosomatic Research, 37*(1), 19–32. https://doi.org/10.1016/0022-3999(93)90120-5

Luchetti, M., Lee, J. H., Aschwanden, D., Sesker, A., Strickhouser, J. E., Terracciano, A., & Sutin, A. R. (2020). The trajectory of loneliness in response to COVID-19. *American Psychologist, 75*(7), 897–908. https://doi.org/10.1037/amp0000690

Margelisch, K., Schnewind, K. A., Violette, J., & Perrig-Chiello, P. (2017). Marital stability, satisfaction and well-being in old age: Variability and continuity in long-term continuously married older persons. *Aging & Mental Health, 21*(4), 389–398. https://doi.org/10.1080/13607863.2015.1102197

Mund, M., Freuding, M. M., Möbius, K., Horn, N., & Neyer, F. J. (2020). The stability and change of loneliness across the life span: A meta-analysis of longitudinal studies. *Personality and Social Psychology Review, 24*(1), 24–52. https://doi.org/10.1177/1088868319850738

Novelli, D., Drury, J., Reicher, S., & Stott, C. (2013). Crowdedness mediates the effect of social identification on positive emotion in a crowd: A survey of two crowd events. *PLoS One, 8*(11), e78983. https://doi.org/10.1371/journal.pone.0078983

Russell, D. W. (1996). UCLA loneliness scale version 3: Reliability, validity, and factor structure. *Journal of Personality and Social Psychology, 66*(1), 20–40. https://doi.org/10.1207/s15327752jps6601

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Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology, 52*, 141–166. https://doi.org/10.1146/annurev.psych.52.1.141

Stroebe, W., Stroebe, M., Abakoumkin, G., & Schut, H. (1996). The role of loneliness and social support in adjustment to loss: A test of attachment versus stress theory. *Journal of Personality and Social Psychology, 70*(6), 1241–1249. https://doi.org/10.1037/0022-3514.70.6.1241

Tennant, R., Hiller, L., Fishwick, R., Platt, S., Joseph, S., Weich, S., Parkinson, J., Secker, J., & Stewart-Brown, S. (2007). The Warwick-Edinburgh mental well-being scale (WEMWBS): Development and UK validation. *Health and Quality of Life Outcomes, 5*(1), 63. https://doi.org/10.1186/1477-7525-5-63

Torales, J., O’Higgins, M., Castaldelli-Maia, J. M., & Vetruglio, A. (2020). The outbreak of COVID-19 coronavirus and its impact on global mental health. *International Journal of Social Psychiatry, 66*(4), 317–320. https://doi.org/10.1177/0020764020915212

Van Bavel, J. J., Boggio, P., Capraro, V., Cichocka, A., Cikara, M., Crockett, M., Crum AJ, Douglas KM, Druckman JN, Drury J, Dube O, Ellemers N, Finkel EI, Fowler JH, Gelfand M, Han S, Haslam SA, Jetten J, Kitayama S, Mobbs D, Napper LE, Packer DJ, Pennycook G, Peters E, Petty RE, Rand DG, Reicher SD, Schnall S, Shariff A, Skitka LJ, Smith SS, Sunstein CR, Tabri N, Tucker JA, Linden SV, Lange PV, Weeden KA, Wohl MJA, Zaki J, Zion SR, Willer R (2020). Using social and behavioural science to support COVID-19 pandemic response. *Nature Human Behavior, 4*, 460–471. https://doi.org/10.1038/s41562-020-0884-z

Van Tilburg, T. G., Steinmetz, S., Stolte, E., van der Roest, H., & de Vries, D. H. (2020). Loneliness and mental health during the COVID-19 pandemic: A study among Dutch older adults. *The Journals of Gerontology: Series B*, gbaa111. https://doi.org/10.1093/geronb/gbaa111

Wilson, J. M., Straus, S. G., & McEvily, B. (2006). All in due time: The development of trust in computer-mediated and face-to-face teams. *Organizational Behavior and Human Decision Processes, 99*(1), 16–33. https://doi.org/10.1016/j.obhdp.2005.08.001