Extraversion, Social Interactions, and Well-Being During the COVID-19 Pandemic: Did Extraverts Really Suffer More Than Introverts?

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We embrace the values of openness and transparency in science (Schönbrodt et al., 2015). We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study (Simmons et al., 2012), or refer to project documentations in the OSF. The data and statistical code necessary to reproduce the reported results can be retrieved from https://osf.io/y726z/. The studies' data cleaning procedures, hypotheses, and statistical analyses were preregistered; see https://osf.io/y726z/. We are grateful to the research assistants at York University and Texas State University who helped with conducting the data collection for Study 1, and to Martje Kohlhoff, Tina Nadine Ricken, and Elina Ryvkina who helped with conducting and documenting the data collection for Studies 2 and 3.

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Abstract

A large body of research suggests that extraversion is positively related to well-being. However, it is unclear whether this association can be explained by social participation (i.e., more extraverted individuals engage in social interactions more frequently) or social reactivity (i.e., more extraverted individuals profit more from social interactions) processes. Here, we examined the role of social interactions for the extraversion–well-being relationship during the COVID-19 pandemic, an unprecedented time of reduced social contact. We analyzed data from an international, longitudinal study (Study 1: 10,523 assessments provided by 4,622 participants) and two experience sampling studies (Study 2: 29,536 assessments provided by 293 participants; Study 3: 61,492 assessments provided by 1,381 participants). Preregistered multilevel structural equation models revealed that extraversion was robustly related to well-being, even when social restrictions were in place. Across data sets, we found some support for the social participation hypothesis (i.e., the relationship between extraversion and well-being is mediated by social interactions), but the social reactivity hypothesis (i.e., extraversion moderates the relationship between social interactions and well-being) was not consistently supported. Strikingly, however, exploratory analyses showed that the social reactivity hypothesis was supported for specific facets of extraversion (i.e., sociability) and well-being (i.e., activated positive affect). Moreover, changes in social interaction patterns during the COVID-19 pandemic (e.g., decreases in face-to-face interactions and interactions with friends) were unrelated to extraversion, and more extraverted individuals did not suffer more from these changes. Taken together, these findings underline the robustness of the effects of extraversion on well-being during a societal crisis.

Keywords: extraversion, well-being, social interactions, experience sampling, COVID-19

Extraversion, Social Interactions, and Well-Being During the COVID-19 Pandemic: Did Extraverts Really Suffer More Than Introverts?

Decades of research have shown that extraversion is positively related to well-being (Anglim et al., 2020), but the underlying processes remain unclear. One key domain of processes that could explain the link between extraversion and well-being is the domain of social interactions (Lucas et al., 2008). Specifically, it has been hypothesized that more extraverted individuals may be happier because they interact more on average (social participation), because they enjoy social interactions more (social reactivity), or both.

Recently, the COVID-19 pandemic fundamentally changed people's social lives. To reduce the spread of the virus, individuals all around the world were encouraged to physically distance themselves from others (Hale et al., 2021). Physical distancing provides a unique opportunity to investigate how involuntary reductions in the frequency of social interactions affect the well-being of more extraverted individuals. In particular, it is a widespread conviction amongst laypeople that individuals high in extraversion suffered more from social restrictions in terms of decreased well-being:

Introverts, please put down your book and check on your extrovert friends. They are not okay. (https://twitter.com/vicking02/status/1240059003465498624/photo/1)

This phenomenon could be a result of both social participation and social reactivity processes: More extraverted individuals may have suffered more because they experienced stronger decreases in social participation, because they reacted more negatively to these decreases, or both.

Although these hypotheses may seem plausible, previous studies on this issue have yielded mixed results. For example, Entringer and Gosling (2022) reported that more extraverted individuals experienced stronger increases in loneliness during the pandemic, whereas Folk et al. (2020) found that changes in social connectedness were unrelated to extraversion. Thus, it is currently unknown whether

individuals high in extraversion suffered more from social restrictions and to what extent this effect can be explained by social participation, social reactivity, or both processes.

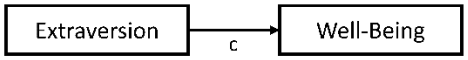
With this research, we aimed to examine the links between extraversion, social interactions, and well-being across three longitudinal studies, which were conducted before, during, and after the first COVID-19-related lockdown in 2020. We used the COVID-19 pandemic as a natural quasi-experimental setting to examine how more extraverted individuals reacted to decreases (beginning of physical distancing regulations) and increases (end of physical distancing regulations) in their opportunities to engage in social interactions. Our study extends previous research in two additional ways. First, we zoomed in on the social situation and compared the effects of different types of social interactions (e.g., face-to-face vs. computer-mediated interactions, interactions with friends vs. family). Second, we zoomed in on the person by examining the effects of three extraversion facets (i.e., sociability, assertiveness, and energy level). Previous research has shown that the relationship between extraversion and well-being likely depends on the specific extraversion facet that is being examined (Margolis et al., 2020), but little research has targeted the underlying mechanisms.

Effects of Extraversion

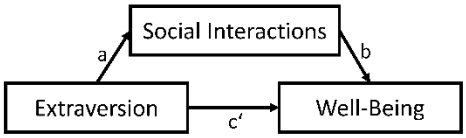
Extraversion is a broad trait domain that subsumes tendencies toward sociability, assertiveness, warmth, positive emotions, activity level, and excitement seeking (Costa & McCrae, 1995; Soto & John, 2017). A large body of research has shown that extraversion is positively related to well-being (Figure 1a; Anglim et al., 2020; Costa & McCrae, 1980; Soto, 2019; Steel et al., 2008), which includes multiple dimensions, such as affective (e.g., positive and negative affect) and cognitive aspects (e.g., life satisfaction; Diener, 1984). Regarding affective aspects, previous research has shown that extraversion is more strongly correlated with activated positive affect (e.g., enthusiastic, excited) than with merely pleasant affect (e.g., happy, pleased; Smillie, DeYoung, et al., 2015).

Figure 1

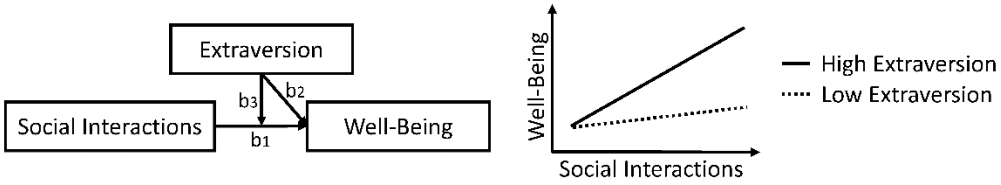
Models Concerning the Effects of Extraversion



(a) Model 1: Main Effect on Well-Being



(b) Model 2: Social Participation



(c) Model 3: Social Reactivity

However, the explanation for the extraversion–well-being relationship is unclear. Initially, it was suggested that the association may be due to conceptual and methodological overlap because the definition and measures of extraversion include aspects of well-being (e.g., positive affect). Indeed, previous research has shown that extraversion facets, such as positive emotions (NEO), social self-esteem and liveliness (HEXACO), or energy level (BFI-2)—which are very similar to well-being scales—are the strongest correlates of well-being (Anglim et al., 2020; Margolis et al., 2020). However, conceptual or methodological overlap cannot fully account for the relationship between extraversion and well-being, as the relationship holds across different measures of extraversion with varying affective content (Lucas & Fujita, 2000). Therefore, research has searched for additional explanations for the extraversion–well-being relationship.

One set of explanations focuses on biological differences that might characterize more extraverted individuals and contribute to differences in well-being (e.g., individual differences in the dopaminergic system; DeYoung, 2013). In addition, individual differences in extraversion may reflect a set of cognitive and affective processes that cause people to experience the world more positively. For instance, people with high extraversion may be more optimistic in general (Sharpe et al., 2011) and may react more strongly to rewards (Lucas & Baird, 2004; Smillie et al., 2012), causing them to experience higher levels of positive affect. Finally, social interactions have been highlighted as one key domain of processes that explain the relationship between extraversion and well-being (Kritzler et al., 2020; Lucas & Diener, 2009; McCrae & Costa, 1991). In the following, we focus on explanations involving social interactions.

A large body of research has shown that extraversion is related to social behaviors (Breil et al., 2019). For instance, more extraverted individuals spend more time engaging in social interactions (both online and offline; Asendorpf & Wilpers, 1998; Harari et al., 2020; Wilson et al., 2015) and tend to have larger social networks (Wagner et al., 2014) and higher quality relationships (Berry et al., 2000; Malouff et al., 2010; Wilson et al., 2015). Two (not mutually exclusive) mechanisms have been suggested to describe the role of social interactions in explaining the relationship between extraversion and well-being: social participation and social reactivity.

Social Participation

The social participation hypothesis posits that the link between extraversion and well-being can be explained by the frequency of social interactions, that is, individuals high in extraversion engage in social interactions more often. Because more extraverted individuals interact more frequently, and social interactions are linked to higher well-being, individuals high in extraversion should experience higher well-being on average (Argyle & Lu, 1990; Lucas et al., 2008; Pavot et al., 1990; Srivastava et

al., 2008). In statistical terms, social interaction frequency should *mediate* the effect of extraversion on well-being (Figure 1b).

There is considerable evidence that more extraverted individuals engage in more social interactions (Asendorpf & Wilpers, 1998; Harari et al., 2020; Wilson et al., 2015) and that social interactions are related to higher well-being (Kroencke et al., 2023; Kushlev et al., 2018; Liu et al., 2019; Sun et al., 2020). However, it is unclear whether social interaction frequency accounts for the relationship between extraversion and well-being. Lucas et al. (2008) tested the social participation hypothesis in two studies using both experience sampling and daily diary methodology. In both studies, social participation (i.e., the frequency of engaging in different types of social activities) explained part of the relationship between extraversion and positive affect. Similarly, in two studies using the Day Reconstruction Method (Oerlemans & Bakker, 2014; Srivastava et al., 2008), the association between extraversion and positive affect was partly mediated by social activities. By contrast, in a longitudinal study of college students, extraversion (measured at the beginning of college) predicted both life satisfaction (at the end of college) and engagement in social activities (throughout college), but social engagement did not mediate the relationship between extraversion and life satisfaction (Harris et al., 2017).

Social Reactivity

Another idea is that the relationship between extraversion and well-being exists because individuals high in extraversion experience greater enjoyment from engaging in social interactions (Diener et al., 1984; Lucas et al., 2008; Pavot et al., 1990; Srivastava et al., 2008). In other words, extraversion is expected to *moderate* the relationship between social interactions and well-being (Figure 1c). Such a moderation effect could explain why more extraverted individuals have higher well-being, even if extraversion is not associated with social interaction frequency. For instance, if extraversion is unrelated to well-being in nonsocial situations but positively related to well-being

during social interactions, more extraverted individuals should have higher well-being on average due to their stronger social reactivity.

The social reactivity hypothesis can be tested in two different ways. First, in line with the description above, most studies have tested the social reactivity hypothesis as a cross-level interaction (i.e., whether more extraverted individuals experience greater increases in momentary well-being after social compared with nonsocial situations). These studies have typically found nonsignificant effects (Kroencke et al., 2023; Lucas et al., 2008; Srivastava et al., 2008; Sun et al., 2020). Second, it is plausible that such cross-level interaction effects accumulate to the between-person level (i.e., that the *between-person* relationship between social interaction frequency and well-being is stronger in more extraverted individuals; for another paper examining between-person interactions, see Kuper et al., 2022). Thus, to be most comprehensive, we tested both cross-level and between-person interaction effects.

In summary, and in line with the social participation hypothesis, there is some evidence that social interaction frequency may be one reason why more extraverted individuals are happier in their everyday lives. By contrast, the social reactivity hypothesis has received less support in previous studies. However, the complex relationships between extraversion, social interactions, and well-being have not been tested comprehensively when social restrictions have been in place.

Effects of Social Restrictions

The COVID-19 pandemic caused countries all around the world to implement physical distancing restrictions (Hale et al., 2021). Physical distancing provides a unique opportunity to examine the relationships between extraversion, social interactions, and well-being for two reasons. First, the physical distancing restrictions could be considered a quasi-experimental manipulation of social interaction frequency, as they reduced opportunities for everyday social interactions. Thus, they provide a quasi-experimental test of how individuals react to systematic variations in their everyday

social interactions and whether these effects are more pronounced in individuals high in extraversion. However, few studies have explicitly examined how (different types of) social interactions changed when social restrictions were in place and how changes in social interactions contributed to changes in well-being in more extraverted individuals.

Second, the COVID-19 pandemic provides a unique opportunity for testing competing perspectives on personality effects during societal challenges. First, it has been argued that personality differences become more accentuated during new and unpredictable contexts due to a lack of clear behavioral norms (Caspi & Moffitt, 1993). This perspective would suggest that the relationships between personality traits and their behavioral and affective correlates in everyday life should become more pronounced during the pandemic. Moreover, according to Trait Activation Theory, the pandemic should activate traits that are particularly relevant in this situation (Tett et al., 2021), including social traits, such as extraversion. Thus, the effects of extraversion on social interactions and well-being should increase during the pandemic. Alternatively, the pandemic could be conceptualized as a strong situation (Mischel, 1977) due to the governmental restrictions, which prohibited and therefore limited the expression of individual differences. Thus, the pandemic should *de*activate traits when they are not as relevant. For instance, the effects of extraversion on well-being and social interaction processes may decrease because of the strong behavioral pressure to avoid social contact with others (Anglim & Horwood, 2021; Krämer et al., 2022).

This latter perspective aligns with the popular idea that more extraverted individuals suffered more—in terms of decreased well-being—during the pandemic. In statistical terms, this idea is best represented by a moderation effect. Specifically, extraversion could moderate the effect of regulation stringency (i.e., how strict current physical distancing regulations are) on well-being, such that the negative effect of regulation stringency would be more pronounced in more extraverted individuals (Figure 2a).

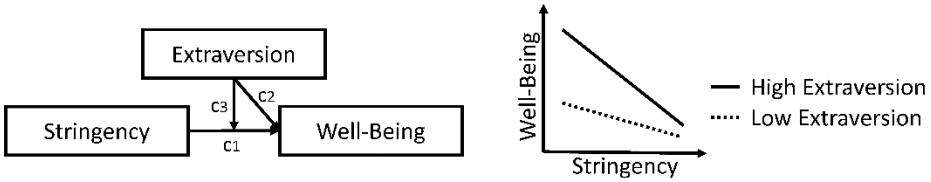
This moderation effect could be explained by social participation, social reactivity, or both processes: First, according to the social participation hypothesis, individuals high in extraversion should have higher baseline levels of social interaction frequency in pre-pandemic times (Lucas et al., 2008). These differences in baseline levels would affect how individuals with higher or lower levels of extraversion would be affected by the physical distancing regulations. Whereas more introverted individuals would reduce their—already infrequent—social interactions a little, more extraverted individuals would experience much larger reductions in social interaction frequency. In statistical terms, extraversion would moderate the effect of regulation stringency on social interactions, such that the negative effect of regulation stringency on social interactions would be stronger for more extraverted individuals (Figure 2b). Moreover, stronger decreases in social participation would explain why more extraverted individuals would experience stronger declines in well-being during the pandemic.

By contrast, according to the social reactivity hypothesis, extraversion should moderate the effect of social interactions on well-being, such that the positive effect of social interactions on well-being would be stronger for more extraverted individuals (Lucas et al., 2008). From this perspective, individuals high in extraversion would suffer more from the reductions because their well-being would be more contingent on their social interactions (Figure 2c).

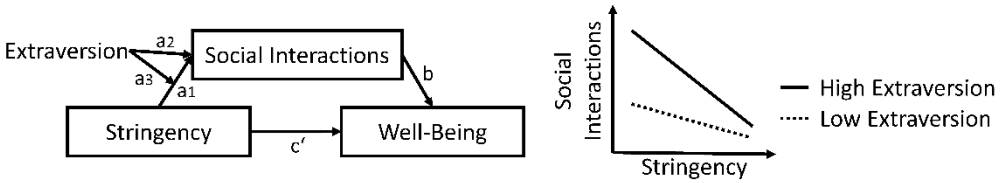
A moderation effect implies that the association between extraversion and well-being should be reduced during the lockdown, not that it should vanish completely. For instance, Anglim and Horwood (2021) found that extraversion was still positively correlated with well-being during the lockdown, but the effect was attenuated. There are two reasons for why this finding seems likely: First, previous studies have shown that social participation only partially mediates the relationship between extraversion and well-being (Lucas et al., 2008; Oerlemans & Bakker, 2014; Srivastava et al., 2008).

Figure 2

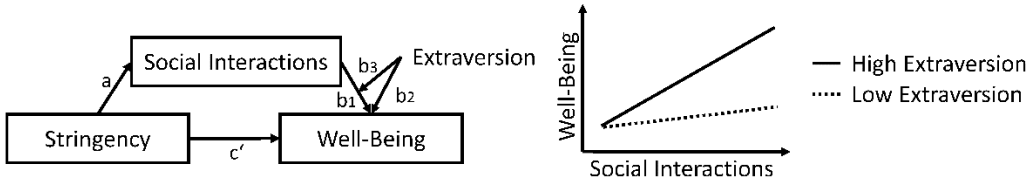
Models Concerning the Effects of Social Restrictions



(a) Model 4: Extraversion as a Moderator of the Regulation Stringency–Well-Being Relationship



(b) Model 5: Social Participation With Regulation Stringency



(c) Model 6: Social Reactivity With Regulation Stringency

Even beyond social participation, extraversion is robustly related to higher well-being in general (Anglim et al., 2020) and lower risk for mental health problems (Kotov et al., 2010). This effect could be due to other affective and cognitive processes that were relatively unaffected by the pandemic (e.g., optimism or reward sensitivity, as noted earlier). Thus, even if individuals high in extraversion could not interact as much as usual during the pandemic, they could still have been happier. Second, extraversion has also been found to be related to higher success in interpersonal situations (Dilchert & Ones, 2009) and more adaptive coping strategies (Carver & Connor-Smith, 2010). These findings suggest that more extraverted individuals may be more skilled at using different forms of contact (e.g.,

computer-mediated communication) and more flexible in adapting to new situations. These resources could have helped them cope better with the situation and maintain comparatively higher levels of social interactions during the pandemic.

One recent study already looked at the relationships between extraversion and changes in one specific indicator of well-being (social connectedness) in one undergraduate sample ($N = 467$) and one community sample ($N = 336$; Folk et al., 2020). The authors reported that declines in social connectedness were small overall and were not related to extraversion after baseline levels were controlled for. On the basis of these findings, the authors concluded that more extraverted individuals did not suffer more during the pandemic. Other studies reported that more extraverted individuals felt more restricted by the physical distancing regulations (Modersitzki et al., 2021) and perceived the situation more negatively (Schmiedeberg & Thönnissen, 2021). Moreover, increases in depressive symptoms and loneliness were stronger for individuals high in extraversion (Entringer & Gosling, 2022; Wijngaards et al., 2020), indicating that more extraverted individuals were more negatively affected by the pandemic. However, previous studies were limited in that they focused on only one indicator of well-being (e.g., social connectedness, depressive symptoms) or general perceptions of the pandemic. How well these results generalize to other well-being indicators—particularly those that are more closely related to extraversion (e.g., activated positive affect)—is currently unclear.

Zooming In On the Social Situation: The Role of Communication Channel and Interaction Partner

The physical distancing regulations during the COVID-19 pandemic affected not only the absolute number of social interactions but also the range of social choices available. In particular, individuals had to restrict face-to-face (FtF) interactions because of the high risk of infection and were encouraged to increase their computer-mediated interactions (e.g., talking on the phone, videoconferencing, texting) in both private and professional contexts. Previous studies have suggested

that FtF interactions are associated with higher well-being than computer-mediated interactions (Kroencke et al., 2023; Petrova & Schulz, 2022). This finding suggests that decreases in the proportion of FtF interactions may be related to lower well-being. Moreover, if more extraverted individuals profit more from FtF interactions than from computer-mediated interactions, they should suffer more from a reduction in FtF interactions.

Moreover, the physical distancing regulations affected the the range of possible interaction partners, as individuals were encouraged to limit their interactions to people from the same household. A large body of research has suggested that the type of interaction partner matters for well-being. For instance, interactions with close ties (e.g., friends) are typically related to higher well-being than interactions with weak ties (e.g., strangers; Venaglia & Lemay, 2017). Moreover, interactions with friends have been associated with higher well-being than interactions with family (Buijs et al., 2022; Hudson et al., 2020; Kahneman et al., 2004; Mueller et al., 2019). On the basis of these results, decreases in the proportion of interactions with friends may be linked to lower well-being. In addition, previous research has suggested that more extraverted individuals profit more from interactions with friends than from interactions with other interaction partners (Buijs et al., 2022). Thus, more extraverted individuals could suffer more from a reduction in interactions with friends than less extraverted individuals.

Zooming In On the Person: The Role of Extraversion Facets

Personality traits are structured hierarchically, with broad domains (i.e., the Big Five) subsuming narrower sub-traits, usually called facets, which may have different correlates on the basis of their theoretical content (Denissen et al., 2020). For instance, the Big Five Inventory-2 (BFI-2) measures three facets of extraversion, namely, sociability, assertiveness, and energy level (Soto & John, 2017). The social participation hypothesis and the idea that more extraverted individuals suffered more during the pandemic due to the restriction of social interactions mainly refers to the facet of

sociability. However, previous cross-sectional studies have reported that positive affect, happiness, and life satisfaction are most closely related to energy level and not to sociability (Margolis et al., 2020), thus implying that the relationship between extraversion and well-being should not be diminished when physical distancing is in place. However, these ideas have not been examined empirically, particularly not in everyday life with experience sampling studies that distinguish between the three facets. The potentially differentiated role of extraversion facets for understanding well-being in everyday life is therefore currently unknown.

The Present Research

Here, we built on these initial findings using large samples (total $N = 6{,}296$) and longitudinal experience sampling designs. Data for Study 1 (biweekly online surveys) were collected between March and July 2020 across 59 countries worldwide. Given that most participants provided only one assessment, we focused on between-person effects in Study 1. Studies 2 and 3 (experience sampling) both comprised two data collection waves that took place in Germany. Data for Study 2 were collected in January 2020 (before the first nationwide lockdown) and March 2020 (during the first nationwide lockdown). Data for Study 3 were collected in March 2020 (during the first nationwide lockdown) and May 2020 (after the first nationwide lockdown). Thus, Studies 2 and 3 allowed us to compare well-being and social interactions among participants across time (i.e., from before to during the lockdown or during to after the lockdown). Each of these three studies provides comprehensive tests of the social participation and social reactivity hypotheses during social restrictions. Moreover, we used the COVID-19 pandemic as a natural quasi-experimental setting to examine how extraverted individuals reacted to systematic variations in their everyday social interactions. In all analyses, we further explored the role of the social situation (i.e., communication channel and interaction partner) and the facets of extraversion.

Transparency and Openness

We embrace the values of openness and transparency in science (Schönbrodt et al., 2015). We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study (Simmons et al., 2012). The procedures and measures relevant to the present manuscript are described in the main text. A codebook with a full description of all other procedures and measures can be retrieved from https://osf.io/xfh84/ (Study 1) and https://osf.io/6kzx3/ (Studies 2 and 3). The data and statistical code necessary to reproduce the reported results can be retrieved from https://osf.io/y726z/.

All three studies were preregistered; see https://osf.io/y726z/. At the time of the preregistration, the data had already been collected for all three studies. Therefore, we preregistered the data cleaning procedures and the hypotheses and statistical analyses for the present manuscript. Given that some of the data for Study 1 had already been analyzed by one of the coauthors (Richard B. Slatcher), this coauthor was not involved in writing the preregistration.

Study 1

In Study 1, we focused on the between-person relationships between extraversion, social interactions, and well-being when social restrictions were in place.

Method

Participants

The original sample included 5,575 participants. Data from 953 participants were excluded during data cleaning (for more details, see Supplement A), resulting in a final sample of 4,622 participants (78% female; M_{age} = 31.38 years, SD_{age} = 12.31, $Range_{age}$: 16–91) from 59 different countries. The most common countries were Spain (n = 1,315), the United States (n = 1,314), Switzerland (n = 309), Turkey (n = 303), Portugal (n = 228), and Canada (n = 223). Most participants had completed at least some university education (86%) and were either students (41%) or were working full- or part-time (49%). The majority of participants were dating or in a relationship (73%)

and living with at least one other person (85%). Participants were recruited via social media and the project website (https://loveinthetimeofcovid.me/). To be eligible to participate, participants had to be 18 years old. Participation was voluntary, and no compensation was offered for participation.

Procedures

The data were collected as part of a longitudinal study on the effects of the COVID-19 pandemic on social relationships and well-being (https://loveinthetimeofcovid.me/). The study was launched on March 27, 2020, shortly after the World Health Organization had declared a global pandemic. Participants first (T1) completed an online survey on their demographics, personality traits (e.g., extraversion), and experiences since the onset of the pandemic. Subsequently, they were invited via email to complete a biweekly follow-up survey on their experiences during the past 2 weeks (including their well-being and social activities). For the present project, we analyzed the first six waves of data (T1–T6) spanning a total of 3 months. The average participant completed 2.28 surveys (SD = 1.67). Out of the 4,622 participants, 2,361 participants (51%) completed only one survey, 753 participants (16%) completed two surveys, and 1,508 participants (33%) completed at least three surveys. The surveys were available in 11 different languages (English, Spanish, French, Turkish, Italian, German, Indonesian, Dutch, Thai, Portuguese, and Chinese), and data were collected worldwide. The last biweekly survey was completed on July 19, 2020. Note that additional surveys were sent out after that date with increasing time lags (i.e., monthly, every 4 months), but we included only the biweekly surveys for this project. All procedures used in this study were approved by the review board of the University of Georgia.

Measures

Means and standard deviations for all measures can be found in the descriptive statistics table (Table S1) in Supplement A.

Demographic Information. At T1, participants indicated their gender, age, education, and occupation. Moreover, participants reported their relationship status and living situation at all six time points (T1–T6).[1] These variables were included as control variables in additional robustness analyses (see "Robustness Analyses" below). Participants also indicated the country they were currently living in. This information was used to determine the strictness of the COVID-19-related regulations (see below).

Extraversion. At T1, participants completed the BFI-2-XS (Soto & John, 2017). The extraversion subscale begins with the item stem "I am someone who:" and comprises the following three items: "Tends to be quiet" (reverse-coded), "Is dominant, acts as a leader," and "Is full of energy." These items were rated using 5-point rating scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). We aggregated these items by creating a mean per participant. Reliability was acceptable ($\omega = .55$) and in line with other studies that have used this measure (e.g., Soto & John, 2017).

Well-Being. At all six time points (T1–T6), participants were asked about their well-being during the past 2 weeks. Affective well-being was measured with selected items from the PANAS-X (Watson & Clark, 1994). In the present study, we focused on the item "Over the past two weeks, I've felt happy," to which participants indicated their agreement on a 5-point rating scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*). Additional items (i.e., excited, inspired, active) were analyzed as part of the robustness analyses (see below). One item from the Satisfaction with Life Scale (Diener et al., 1985) was administered to assess cognitive well-being. The item read "In the last two weeks, I have been completely satisfied with my life" and was rated using a 7-point rating scale ranging from 1 (*not at all*) to 7 (*completely*).

[1] Please see the codebook on the OSF (https://osf.io/xfh84/) or Supplement A for the exact wording of the questions and response options.

Social Time.[2] At all six time points (T1–T6), participants indicated how often over the past 2 weeks they had spent time with others; separately for FtF (i.e., in-person) interactions with family, friends, and colleagues (3 items) and for online interactions (e.g., videocalls) with family, friends, and colleagues (3 items). All six items were rated using 4-point rating scales ranging from 1 (*never*) to 4 (*every day*). These items were averaged to create a composite measure of social time per time point per participant. To examine the effects of different communication channels, we created two separate composite scores (3 items each) for *in-person* and *online* social time, respectively. To examine the effects of different interaction partners, we created three separate composite scores (2 items each) for social time with *family*, *friends*, and *colleagues*, respectively.

Regulation Stringency. Regulation stringency was not rated by participants but was determined on the basis of objective data from an independent source. Specifically, we looked up the strictness of the COVID-19-related regulations using the Oxford COVID-19 Government Response Tracker (Hale et al., 2021). The tracker collects information on publicly available indicators of government responses to the COVID-19 pandemic that are aggregated into four government response indices (overall government response index, containment and health index, stringency index, economic support index) per country per day. For the present analyses, we used the stringency index, which records the strictness of "containment and closure policies, sometimes referred to as lockdown policies" (Hale et al., 2021, p. 536) per country per day.

The stringency index combines information on the following nine indicators: school closures, workplace closures, cancelation of public events, restrictions on gatherings, closure of public transport, stay at home requirements, restrictions on movement, restrictions on international travel, and presence of public information campaigns. All indicators were scored on ordinal scales (e.g., school closures: 0

[2] This social time variable is a continuous measure of social interactions used only in Study 1. In Studies 2 and 3, the measure of social interactions is dichotomous.

= *no regulations*, 1 = *recommend closing or significant differences compared to non-Covid-19 operations*, 2 = *require closing some levels or categories*, 3 = *require closing all levels*) and then transformed and combined into a single aggregate score ranging from 0 (*no regulations*) to 100 (*total lockdown*) per country per day. Because the surveys referred to the last 2 weeks, we averaged all scores from the respective participant's country over the last 14 days. To ease interpretation, we divided the scores by 100 so that the variable ranged from 0 (*no regulations*) to 1 (*total lockdown*; Wijngaards et al., 2020).

Analytical Strategy

General Analytical Strategy. The data were analyzed with Multilevel Structural Equation Modeling (MSEM) in M*plus* version 8.6 (Muthén & Muthén, 1998-2017). In all three studies, continuous variables were either standardized using the grand mean and grand *SD* (i.e., extraversion and well-being) or centered at the grand mean (i.e., social time [Study 1] and regulation stringency) prior to the analysis. Binary variables (i.e., social interactions [Studies 2 and 3]) were retained on their original scales. As part of the modeling strategy, all time-varying variables (i.e., well-being, social time, social interactions, and regulation stringency) were decomposed into their within- and between-person components as described below. Fully standardized estimates are available in Supplement B. Standardization was done with respect to the level-specific variances, as implemented in M*plus*.

We estimated all models with Bayesian estimation in M*plus*, using the M*plus* defaults for the (uninformative) priors and the Gibbs sampler. Given that the M*plus* default convergence criterion (Potential Scale Reduction [PSR] < 1.05) typically stops too early (Zitzmann & Hecht, 2019), we tested which PSR is needed to achieve acceptable convergence for the most complex models (evaluated on the basis of the effective sample sizes, trace plots, histograms, and autocorrelation plots; Depaoli & van de Schoot, 2017; Zitzmann & Hecht, 2019). On the basis of these pretests, we chose PSR < 1.01 as the stopping rule for our analyses (for more details, see Supplement A). Bayesian credibility intervals and

Bayesian *p*-values allowed us to test the significance of all model parameters, including indirect effects which have nonnormal distributions (Preacher et al., 2011). We used a conservative significance criterion ($p < .005$, one-tailed) due to the large number of statistical tests and the large sample sizes.

Study-Specific Analytical Strategy for Study 1. In Study 1, we focused on between-person effects because more than half of the participants provided only one assessment. That is, the models estimated in Study 1 refer to, for example, the association between extraversion and individuals' within-person *average* well-being across the measured time points. We estimated these person means as latent variables within the MSEM model to obtain more accurate between-person estimates than would be the case with manually computed means (Asparouhov & Muthén, 2019; Lüdtke et al., 2008). We specified six models that reflect the different kinds of associations implied by the theory. We will now briefly describe all the models, focusing on the aspects of the models that are relevant for testing our hypotheses. We provide graphical depictions of all models in Figures 1 (Models 1–3) and 2 (Models 4–6) and formulas for all models in the Appendix (Table A1). Each of the six models was estimated separately for happiness and life satisfaction as the outcome variable, resulting in a total of 12 (6*2) main models.

Effects of Extraversion.

Model 1: Main Effect on Well-Being. We first tested the main effect of extraversion on well-being by regressing the latent person mean for well-being on extraversion (Figure 1a, path *c*, Equation 1b). We expected that extraversion would be positively related to well-being (path $c > 0$).

Model 2: Social Participation. Next, we specified the mediation model depicted in Figure 1b. That is, we regressed the latent person mean for social time on extraversion (path *a*, Equation 2b), and we regressed the latent person mean for well-being on the latent person mean for social time (path *b*) and on extraversion (path *c'*, Equation 3b). The indirect effect was calculated as the product of paths *a* and *b* (Equation 4; Preacher et al., 2011). We expected a positive indirect effect because this would

indicate that the positive effect of extraversion on well-being could (partly) be explained by more extraverted individuals spending more time socializing, which in turn is related to higher well-being.

Model 3: Social Reactivity. In the next analytical step, we specified the moderation model depicted in Figure 1c at the between-person level, using the latent moderated structural equations method (Preacher et al., 2016). That is, we regressed the latent person mean for well-being on the latent person mean for social time (path *b1*), extraversion (path *b2*), and their latent between-person interaction (path *b3*, Equation 5b). We expected a positive interaction effect (path $b3 > 0$), such that the positive effect of social time on well-being would be stronger for more extraverted individuals.

Effects of Social Restrictions.

Model 4: Extraversion as a Moderator of the Regulation Stringency–Well-Being Relationship. To test whether more extraverted individuals suffered more when physical distancing was in place, we specified the moderation model depicted in Figure 2a at the between-person level (Equation 6b). We expected a negative interaction effect (path $c3 < 0$), such that the negative effect of regulation stringency on well-being would be stronger for more extraverted individuals.

Model 5: Social Participation With Regulation Stringency. We next included social time as a mediator of the relationship between regulation stringency and well-being and tested whether extraversion moderated path *a* of the indirect effect (Figure 2b, Equations 7b and 8b; Preacher et al., 2007). We expected a negative interaction effect (path $a3 < 0$), such that the negative effect of regulation stringency on social time would be stronger for more extraverted individuals. In line with Hayes et al. (2015), moderated mediation was tested as the product of paths *a3* and *b* (Equation 9). The product term indicated whether the indirect effect was stronger for more extraverted individuals due to stronger decreases in social participation.

Model 6: Social Reactivity With Regulation Stringency. Finally, we tested whether extraversion moderated path *b* of the indirect effect (Figure 2c, Equations 10b and 11b; Preacher et al.,

2007). We expected a positive interaction effect (path *b3* > 0), such that the positive effect of social time on well-being would be stronger for more extraverted individuals. We calculated the product of paths *a* and *b3* (Equation 12), which indicated whether the indirect effect was stronger for more extraverted individuals due to stronger social reactivity.

Exploratory Analyses: Zooming In On the Social Situation. To zoom in on the social situation, we used specific communication channels (i.e., in-person social time, online social time) and interaction partners (i.e., social time with family, social time with friends, social time with colleagues) as mediators of the relationship between regulation stringency and well-being. We could not zoom in on the person (i.e., examine facets of extraversion) in Study 1, as our measure of extraversion was too short for calculating facets.

Robustness Analyses. We ran four sets of robustness analyses. First, we tested the effects for different well-being adjectives (i.e., excited, inspired, active) to check whether our results depended on the specific type of well-being variable used. Second, we replaced the continuous regulation stringency variable with a dummy variable (i.e., 0 = *no lockdown*, 1 = *lockdown*) to check whether the results held up when we used the originally preregistered approach (see below). We used 70 as a cut-off because the lockdown in Germany was characterized by values higher than 70. However, because this value is somewhat arbitrary, we only present these results as robustness analyses. Third, we reran the main models while controlling for demographic variables (categorical variables were dummy-coded, continuous variables were centered at the grand mean). Finally, as suggested by a reviewer, we reran the main models for the other Big Five traits (i.e., agreeableness, neuroticism, conscientiousness, and openness).

Deviations From the Preregistration. We preregistered Models 1–3 (Figure 1) and Model 4 (Figure 2a). Additionally, we had planned to investigate whether the effect of social time on well-being as well as the moderating effect of extraversion on the social time–well-being relationship changed

during the lockdown. However, during the writing process, we realized that our theoretical questions could be more accurately represented by Models 5 and 6 (Figures 2b and 2c).

Further deviations from the preregistration included the following: First, we had preregistered that we would examine effects on both the between- and within-person level. However, the average number of assessments per participant was so small in Study 1 that estimates of within-person effects would have been very unreliable (Neubauer et al., 2020). We therefore decided to focus on between-person effects in Study 1. We examined the effects on both levels in Studies 2 and 3 where the number of assessments was sufficient. Second, we had preregistered that we would use manual person means for the mediation models and standard multilevel modeling for the moderation models. We later switched to MSEM (including latent person means) because this approach is better suited to estimate the more complex models that extend the preregistration (see above) and yields more accurate results for the preregistered models. Third, we used a continuous instead of a dichotomous lockdown measure (see above). Fourth, we did not calculate an aggregate of happiness and life satisfaction because we decided to present the results for affective and cognitive well-being separately. Fifth, we did not control for time effects (i.e., measurement wave, day of data collection) because the time variables are largely redundant with regulation stringency, and including them would render the effects of regulation stringency uninterpretable. Finally, we used Bayesian credibility intervals instead of bootstrapping to calculate the standard errors of the indirect effects (see above).

Results and Discussion

Descriptive statistics for all focal variables are presented in Table S1 (Supplement A; https://osf.io/y726z/). An overview of the results from the six main models (depicted in Figures 1 and 2) is presented in Table 1 (first and second columns).

Effects of Extraversion

559 **Main Effect on Well-Being.** As expected, extraversion was positively related to happiness and
560 life satisfaction (Table 1, Model 1, path *cb*).

561 **Social Participation.** Our results were in line with the social participation hypothesis (Table 1,
562 Model 2): More extraverted individuals spent more time socializing than more introverted individuals
563 (path *ab*), and individuals who spent more time socializing had higher well-being than those who spent
564 less time socializing (path *bb*). The indirect effect of extraversion on well-being via social time was
565 significant (happiness: $b_{ab} = 0.021$, $p < .001$; life satisfaction: $b_{ab} = 0.016$, $p < .001$), indicating that
566 social participation explained part of the relationship between extraversion and well-being. However,
567 most of the association was direct (i.e., not mediated by social time; happiness: $b_{c'} = 0.132$, $p < .001$;
568 life satisfaction: $b_{c'} = 0.092$, $p < .001$). When we zoomed in on different types of social activities as
569 part of our exploratory analyses, we found that the effect of extraversion on well-being was mediated
570 by the time participants spent socializing in person and online (Table 2, Model 2) as well as by the time
571 they spent socializing with family, friends, and colleagues (except for the effect of extraversion on life
572 satisfaction via social time with friends, as social time with friends was not significantly related to life
573 satisfaction; Table 3, Model 2).

574 **Social Reactivity.** We found no support for the social reactivity hypothesis at the between-
575 person level. As shown in Table 1 (Model 3), extraversion did not moderate the between-person effect
576 of social time on happiness (path *bb3*), indicating that the relationship between social time and
577 happiness was unrelated to participants' extraversion levels. Extraversion moderated the between-
578 person effect of social time on life satisfaction, but the direction of the effect was opposite our
579 theoretical expectations: Among *introverted* individuals (operationalized as individuals whose
580 extraversion level was 1 *SD* below average), social time was more strongly related to life satisfaction
581 (conditional slope of 0.417, $p < .001$) than among extraverted individuals (extraversion level 1 *SD*
582 above average; conditional slope of 0.151, $p = .010$).

Table 1

Overview of Results

Models	Path	Study 1 Happiness	Study 1 Life satisfaction	Study 2 Positive affect	Study 3 Positive affect
Model 1: Main effect on well-being					
Extraversion → well-being	cb	**0.153 [0.119, 0.188], *p* < .001**	**0.109 [0.075, 0.143], *p* < .001**	**0.108 [0.033, 0.181], *p* < .001**	**0.120 [0.081, 0.158], *p* < .001**
Model 2: Social participation					
Extraversion → social interactions[a]	ab	**0.059 [0.044, 0.073], *p* < .001**	**0.059 [0.044, 0.073], *p* < .001**	**0.087 [0.015, 0.159], *p* = .001**	**0.152 [0.109, 0.195], *p* < .001**
Social interactions[a] → well-being	bb	**0.359 [0.239, 0.479], *p* < .001**	**0.280 [0.160, 0.401], *p* < .001**	**0.234 [0.058, 0.409], *p* < .001**	0.074 [0.001, 0.147], *p* = .005
Extraversion → well-being	c'b	**0.132 [0.097, 0.166], *p* < .001**	**0.092 [0.057, 0.128], *p* < .001**	**0.087 [0.011, 0.162], *p* = .002**	**0.109 [0.069, 0.148], *p* < .001**
Indirect effect		**0.021 [0.013, 0.030], *p* < .001**	**0.016 [0.009, 0.025], *p* < .001**	**0.019 [0.002, 0.048], *p* = .001**	0.011 [0.000, 0.024], *p* = .005
Model 3: Social reactivity					
Extraversion × Social Interactions[a] → well-being	bb3	-0.088 [-0.205, 0.031], *p* = .029	**-0.134 [-0.258, -0.016], *p* = .001**	-0.029 [-0.191, 0.130], *p* = .322	0.002 [-0.066, 0.070], *p* = .465
	bw3			0.030 [-0.007, 0.067], *p* = .020	0.015 [-0.008, 0.037], *p* = .039
Model 4: Extraversion as a moderator of the regulation stringency–well-being relationship					
Stringency → well-being	cb1	**-3.256 [-4.705, -1.937], *p* < .001**	**-3.223 [-4.590, -1.878], *p* < .001**	0.224 [-0.173, 0.617], *p* = .076	-0.322 [-1.149, 0.494], *p* = .150
	cw1			0.073 [-0.029, 0.171], *p* = .030	**-0.361 [-0.623, -0.103], *p* < .001**
Extraversion × Stringency → well-being	cb3	-0.261 [-1.539, 1.065], *p* = .312	-0.729 [-2.050, 0.479], *p* = .067	0.038 [-0.365, 0.424], *p* = .408	-0.531 [-1.346, 0.242], *p* = .038
	cw3			-0.023 [-0.122, 0.076], *p* = .258	-0.056 [-0.312, 0.211], *p* = .281
Model 5: Social participation with regulation stringency					
Stringency → social interactions[a]	ab1	0.054 [-0.525, 0.635], *p* = .405	0.076 [-0.495, 0.652], *p* = .369	0.284 [-0.112, 0.678], *p* = .031	-0.839 [-1.750, 0.072], *p* = .009
	aw1			-0.029 [-0.180, 0.123], *p* = .311	-0.166 [-0.513, 0.183], *p* = .107
Social interactions[a] → well-being	bb	**0.366 [0.245, 0.486], *p* < .001**	**0.289 [0.167, 0.412], *p* < .001**	**0.225 [0.052, 0.400], *p* < .001**	**0.075 [0.002, 0.151], *p* = .004**
	bw			**0.168 [0.129, 0.206], *p* < .001**	**0.056 [0.035, 0.078], *p* < .001**
Stringency → well-being	c'b1	**-3.340 [-4.718, -1.999], *p* < .001**	**-3.290 [-4.727, -1.962], *p* < .001**	0.153 [-0.243, 0.553], *p* = .160	-0.275 [-1.087, 0.527], *p* = .188
	c'w1			0.052 [-0.045, 0.150], *p* = .082	**-0.361 [-0.618, -0.101], *p* < .001**
Indirect effect		0.019 [-0.188, 0.255], *p* = .405	0.021 [-0.137, 0.215], *p* = .369	0.060 [-0.025, 0.193], *p* = .032	-0.058 [-0.185, 0.008], *p* = .013
				0.021 [-0.025, 0.071], *p* = .112	0.009 [-0.097, 0.115], *p* = .416
Extraversion × Stringency → social interactions[a]	ab3	0.070 [-0.467, 0.610], *p* = .368	0.102 [-0.448, 0.656], *p* = .316	-0.064 [-0.462, 0.338], *p* = .342	-0.584 [-1.486, 0.320], *p* = .048
	aw3			-0.066 [-0.218, 0.084], *p* = .128	-0.013 [-0.368, 0.335], *p* = .461
Moderated mediation effect		0.025 [-0.173, 0.236], *p* = .368	0.029 [-0.134, 0.205], *p* = .316	-0.013 [-0.124, 0.086], *p* = .342	-0.040 [-0.153, 0.026], *p* = .052
				-0.011 [-0.037, 0.014], *p* = .128	-0.001 [-0.022, 0.020], *p* = .461
Model 6: Social reactivity with regulation stringency					
Extraversion × Social Interactions[a] → well-being	bb3	-0.097 [-0.214, 0.021], *p* = .016	**-0.142 [-0.265, -0.023], *p* = .001**	-0.033 [-0.190, 0.124], *p* = .292	0.003 [-0.067, 0.073], *p* = .452
	bw3			0.031 [-0.008, 0.070], *p* = .021	0.015 [-0.007, 0.037], *p* = .038
Moderated mediation effect		-0.004 [-0.057, 0.040], *p* = .359	-0.005 [-0.071, 0.057], *p* = .383	-0.007 [-0.079, 0.046], *p* = .303	-0.001 [-0.047, 0.041], *p* = .458
				-0.001 [-0.008, 0.005], *p* = .338	-0.002 [-0.012, 0.003], *p* = .134

Note. Unstandardized coefficients with 99% credibility intervals and one tailed *p*-values are presented. Only coefficients that are relevant for testing the hypotheses are shown in the manuscript. Full models can be found in Supplement B. All models were estimated with the Bayesian estimator with uninformative priors. Coefficients that are significant at $p < .005$ are printed in bold.

587 [a] In Study 1, social time was the measure of social interactions.

Table 2

Exploratory Analyses: Zooming In On the Communication Channel (Study 1)

Models	Path	Happiness		Life satisfaction	
		In person	Online	In person	Online
Model 2: Social participation					
Extraversion → social time	ab	**0.022 [0.003, 0.041], *p* = .001**	**0.095 [0.071, 0.118], *p* < .001**	**0.022 [0.003, 0.041], *p* = .001**	**0.095 [0.071, 0.118], *p* < .001**
Social time → well-being	bb	**0.267 [0.173, 0.361], *p* < .001**	**0.110 [0.035, 0.186], *p* < .001**	**0.195 [0.100, 0.290], *p* < .001**	**0.095 [0.019, 0.171], *p* = .001**
Extraversion → well-being	c'b	**0.147 [0.113, 0.181], *p* < .001**	**0.143 [0.108, 0.177], *p* < .001**	**0.104 [0.070, 0.140], *p* < .001**	**0.100 [0.064, 0.136], *p* < .001**
Indirect effect		**0.006 [0.001, 0.012], *p* = .001**	**0.010 [0.003, 0.019], *p* < .001**	**0.004 [0.001, 0.009], *p* = .001**	**0.009 [0.002, 0.017], *p* = .001**
Model 3: Social reactivity					
Extraversion × Social Time → well-being	bb3	-0.055 [-0.146, 0.036], *p* = .060	-0.039 [-0.112, 0.037], *p* = .088	-0.065 [-0.163, 0.034], *p* = .045	-0.063 [-0.140, 0.013], *p* = .014
Model 5: Social participation with regulation stringency					
Stringency → social time	ab1	**-1.686 [-2.453, -0.944], *p* < .001**	**1.904 [0.962, 2.876], *p* < .001**	**-1.673 [-2.428, -0.949], *p* < .001**	**1.928 [1.016, 2.930], *p* < .001**
Social time → well-being	bb	**0.216 [0.119, 0.314], *p* < .001**	**0.160 [0.080, 0.239], *p* < .001**	**0.142 [0.043, 0.242], *p* < .001**	**0.147 [0.066, 0.227], *p* < .001**
Stringency → well-being	c'b1	**-2.868 [-4.263, -1.502], *p* < .001**	**-3.607 [-5.037, -2.211], *p* < .001**	**-2.919 [-4.362, -1.567], *p* < .001**	**-3.575 [-5.076, -2.206], *p* < .001**
Indirect effect		**-0.359 [-0.611, -0.177], *p* < .001**	**0.299 [0.112, 0.586], *p* < .001**	**-0.232 [-0.447, -0.071], *p* < .001**	**0.279 [0.097, 0.562], *p* < .001**
Extraversion × Stringency → social time	ab3	-0.459 [-1.161, 0.247], *p* = .045	0.680 [-0.173, 1.553], *p* = .018	-0.431 [-1.124, 0.271], *p* = .056	0.707 [-0.148, 1.576], *p* = .017
Moderated mediation effect		-0.096 [-0.279, 0.053], *p* = .045	0.105 [-0.027, 0.286], *p* = .018	-0.057 [-0.193, 0.040], *p* = .056	0.100 [-0.021, 0.277], *p* = .017
Model 6: Social reactivity with regulation stringency					
Extraversion × Social Time → well-being	bb3	-0.061 [-0.156, 0.034], *p* = .047	-0.042 [-0.117, 0.032], *p* = .073	-0.070 [-0.168, 0.025], *p* = .028	-0.069 [-0.147, 0.006], *p* = .009
Moderated mediation effect		0.061 [-0.036, 0.182], *p* = .047	-0.049 [-0.158, 0.041], *p* = .073	0.073 [-0.027, 0.202], *p* = .028	-0.080 [-0.200, 0.007], *p* = .009

Note. Unstandardized coefficients with 99% credibility intervals and one tailed *p*-values are presented. Only coefficients that are relevant for testing the hypotheses are shown in the manuscript. Full models can be found in Supplement B. All models were estimated with the Bayesian estimator with uninformative priors. Coefficients that are significant at $p < .005$ are printed in bold.

Table 3

Exploratory Analyses: Zooming In On the Interaction Partner (Study 1)

Models	Path	Happiness		
		Family	Friends	Colleagues
Model 2: Social participation				
Extraversion → social time	ab	**0.065 [0.039, 0.093], *p* < .001**	**0.068 [0.049, 0.088], *p* < .001**	**0.041 [0.021, 0.062], *p* < .001**
Social time → well-being	bb	**0.147 [0.081, 0.213], *p* < .001**	**0.169 [0.074, 0.261], *p* < .001**	**0.145 [0.062, 0.228], *p* < .001**
Extraversion → well-being	c'b	**0.143 [0.109, 0.177], *p* < .001**	**0.142 [0.107, 0.176], *p* < .001**	**0.147 [0.112, 0.181], *p* < .001**
Indirect effect		**0.009 [0.005, 0.016], *p* < .001**	**0.011 [0.005, 0.019], *p* < .001**	**0.006 [0.002, 0.011], *p* < .001**
Model 3: Social reactivity				
Extraversion × Social Time → well-being	bb3	-0.033 [-0.097, 0.032], *p* = .102	-0.073 [-0.160, 0.017], *p* = .017	0.000 [-0.083, 0.081], *p* = .498
Model 5: Social participation with regulation stringency				
Stringency → social time	ab1	**1.911 [0.878, 2.971], *p* < .001**	**-1.040 [-1.818, -0.281], *p* < .001**	-0.752 [-1.580, 0.073], *p* = .010
Social time → well-being	bb	**0.185 [0.117, 0.253], *p* < .001**	**0.138 [0.042, 0.232], *p* < .001**	**0.125 [0.041, 0.210], *p* < .001**
Stringency → well-being	c'b1	**-3.656 [-5.071, -2.284], *p* < .001**	**-3.140 [-4.522, -1.791], *p* < .001**	**-3.170 [-4.578, -1.835], *p* < .001**
Indirect effect		**0.349 [0.138, 0.652], *p* < .001**	**-0.137 [-0.302, -0.030], *p* < .001**	-0.089 [-0.227, 0.009], *p* = .010
Extraversion × Stringency → social time	ab3	0.020 [-0.955, 1.025], *p* = .479	0.059 [-0.687, 0.797], *p* = .418	0.036 [-0.761, 0.826], *p* = .453
Moderated mediation effect		0.004 [-0.181, 0.196], *p* = .479	0.008 [-0.103, 0.127], *p* = .418	0.004 [-0.105, 0.119], *p* = .453
Model 6: Social reactivity with regulation stringency				
Extraversion × Social Time → well-being	bb3	-0.037 [-0.102, 0.028], *p* = .072	-0.075 [-0.167, 0.016], *p* = .017	-0.001 [-0.085, 0.081], *p* = .485
Moderated mediation effect		-0.046 [-0.148, 0.037], *p* = .072	0.045 [-0.010, 0.137], *p* = .017	0.000 [-0.051, 0.054], *p* = .484
			Life satisfaction	
		Family	Friends	Colleagues
Model 2: Social participation				
Extraversion → social time	ab	**0.066 [0.039, 0.092], *p* < .001**	**0.069 [0.049, 0.088], *p* < .001**	**0.041 [0.020, 0.061], *p* < .001**
Social time → well-being	bb	**0.128 [0.061, 0.195], *p* < .001**	-0.010 [-0.105, 0.085], *p* = .389	**0.211 [0.127, 0.296], *p* < .001**
Extraversion → well-being	c'b	**0.100 [0.065, 0.136], *p* < .001**	**0.110 [0.074, 0.146], *p* < .001**	**0.100 [0.065, 0.134], *p* < .001**
Indirect effect		**0.008 [0.004, 0.015], *p* < .001**	-0.001 [-0.007, 0.006], *p* = .389	**0.009 [0.004, 0.015], *p* < .001**
Model 3: Social reactivity				
Extraversion × Social Time → well-being	bb3	-0.038 [-0.105, 0.029], *p* = .071	-0.086 [-0.182, 0.009], *p* = .009	-0.039 [-0.123, 0.045], *p* = .118
Model 5: Social participation with regulation stringency				
Stringency → social time	ab1	**1.918 [0.915, 2.983], *p* < .001**	**-1.012 [-1.799, -0.252], *p* < .001**	-0.735 [-1.540, 0.064], *p* = .009
Social time → well-being	bb	**0.165 [0.095, 0.235], *p* < .001**	-0.040 [-0.136, 0.057], *p* = .143	**0.193 [0.108, 0.277], *p* < .001**
Stringency → well-being	c'b1	**-3.565 [-5.031, -2.209], *p* < .001**	**-3.240 [-4.671, -1.905], *p* < .001**	**-3.087 [-4.445, -1.739], *p* < .001**
Indirect effect		**0.312 [0.121, 0.596], *p* < .001**	0.037 [-0.055, 0.182], *p* = .143	-0.138 [-0.316, 0.013], *p* = .009
Extraversion × Stringency → social time	ab3	0.008 [-0.988, 1.011], *p* = .492	0.092 [-0.674, 0.866], *p* = .376	0.107 [-0.684, 0.920], *p* = .365
Moderated mediation effect		0.001 [-0.168, 0.179], *p* = .492	-0.001 [-0.063, 0.048], *p* = .417	0.020 [-0.137, 0.190], *p* = .365

Model 6: Social reactivity with regulation stringency				
Extraversion × Social Time → well-being	bb3	-0.047 [-0.114, 0.020], p = .033	-0.089 [-0.185, 0.003], p = .006	-0.040 [-0.123, 0.043], p = .106
Moderated mediation effect		-0.057 [-0.163, 0.024], p = .033	0.056 [-0.002, 0.158], p = .007	0.016 [-0.022, 0.081], p = .114

Note. Unstandardized coefficients with 99% credibility intervals and one tailed p-values are presented. Only coefficients that are relevant for testing the hypotheses are shown in the manuscript. Full models can be found in Supplement B. All models were estimated with the Bayesian estimator with uninformative priors. Coefficients that are significant at $p < .005$ are printed in bold.

Our exploratory analyses showed that extraversion did not moderate reactivity to any of the more specific social activities (Tables 2 and 3, Model 3, path *bb3*).

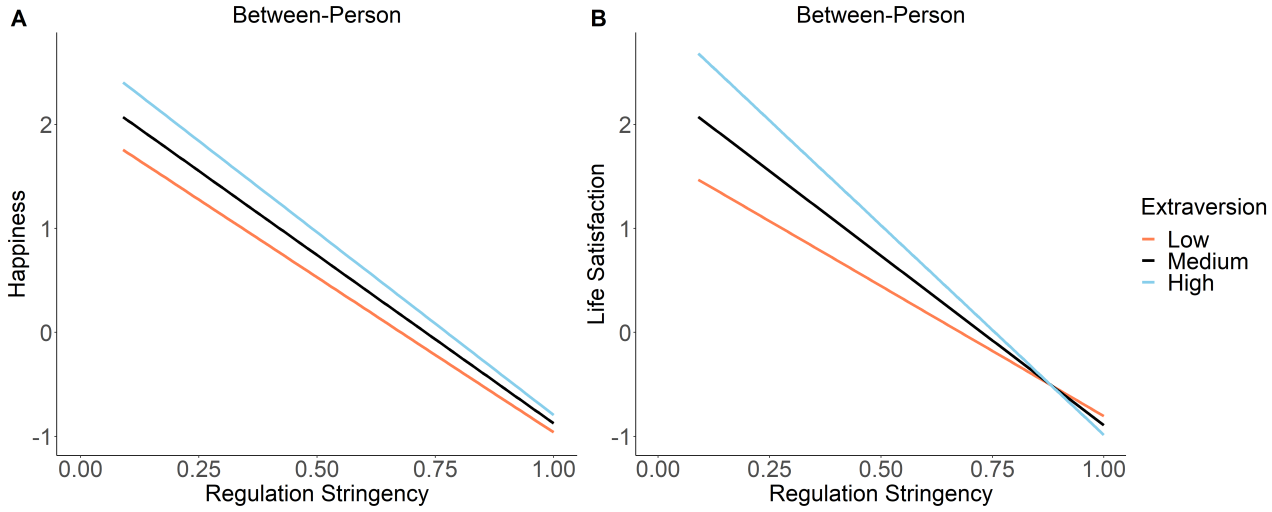
Effects of Social Restrictions

Quasi-Experimental Manipulation Check. In Study 1, the within-person means of regulation stringency ranged from 14.83 to 99.26 (M = 75.28). We first focused on the effects of regulation stringency on social time (i.e., path *ab1* in Model 5). These analyses can be understood as kind of a manipulation check in the quasi-natural experiment. Overall, social time was unrelated to regulation stringency at the between-person level (Table 1, Model 5, path *ab1*), suggesting that individuals who participated in periods with higher average regulation stringency did not socialize less than individuals who participated in periods with lower average regulation stringency. However, when zooming in on different types of social activities (i.e., different communication channels and interaction partners), we observed a more coherent result pattern that was in line with the physical distancing regulations: Regulation stringency had negative effects on in-person social time and social time with friends but positive effects on online social time and social time with family (Tables 2 and 3, Model 5, path *ab1*).

Extraversion as a Moderator of the Regulation Stringency–Well-Being Relationship. Next, we tested whether extraversion moderated the between-person effect of regulation stringency on well-being (Table 1, Model 4). Regulation stringency was negatively related to happiness and life satisfaction at the between-person level (path *cb1*), indicating that individuals who participated in periods with higher average regulation stringency reported lower well-being than those who participated in periods with lower average regulation stringency. However, extraversion did not moderate the between-person effect of regulation stringency on happiness and life satisfaction (path *cb3*). As shown in Figure 3, the relationship between regulation stringency and well-being was unrelated to extraversion and was therefore similar for more extraverted and more introverted individuals.

Figure 3

Happiness and Life Satisfaction as a Function of Regulation Stringency and Extraversion (Study 1)



Note. Between-person effects of regulation stringency on (a) happiness and (b) life satisfaction for three different levels of extraversion (Low = 1 *SD* below the mean, Medium = average, High = 1 *SD* above the mean).

Social Participation With Regulation Stringency. Next, we investigated whether the between-person relationship between regulation stringency and well-being was mediated by reduced social time and whether extraversion moderated path *a* of this effect (Table 1, Model 5). Because our aggregated measure of social time was unrelated to regulation stringency (path *ab1*), social time could not mediate the effect of regulation stringency on well-being. Moreover, extraversion did not moderate the between-person effect of regulation stringency on social time (path *ab3*), indicating that regulation stringency was unrelated to social time for all levels of extraversion.

When zooming in on different types of social activities, we found that these associations varied by communication channels (Table 2, Model 5) and by interaction partners (Table 3, Model 5). First, individuals who participated in periods with higher average regulation stringency spent comparatively less time socializing in person and more time socializing online (path *ab1*). Because both in-person and

online social time were related to higher happiness and higher life satisfaction (path *bb*), we observed two opposing indirect effects: a negative indirect effect of regulation stringency on well-being via in-person social time and a positive indirect effect of regulation stringency on well-being via online social time. In a similar vein, individuals who participated in periods with higher average regulation stringency spent comparatively less time socializing with friends and thus experienced lower happiness (negative indirect effect), but they also spent comparatively more time socializing with family and thus experienced higher happiness and higher life satisfaction (positive indirect effects). However, extraversion did not moderate the between-person effects of regulation stringency on time spent socializing in person or time spent socializing with friends (path *ab3*). Therefore, the indirect effects described above were not related to extraversion (no moderated mediation effects).

Social Reactivity With Regulation Stringency. As explained above, social time was less strongly linked to life satisfaction among more extraverted individuals compared with more introverted individuals. However, this moderation effect did not affect the link between regulation stringency and life satisfaction because regulation stringency was not related to social time (Table 1, Model 6). We observed no other significant effects (Tables 2 and 3, Model 6).

Robustness Analyses

To examine the robustness of the results (see Supplement B), we first tested the effects of three different well-being adjectives (excited, inspired, and active). We found robust social participation effects for all three adjectives but no social reactivity effects. Regarding the effects of regulation stringency, individuals who participated in periods with higher average regulation stringency felt more excited, but they did not feel more or less inspired or active than individuals who participated in periods with lower average regulations stringency. None of these effects were moderated by extraversion. Using a dummy variable instead of the continuous regulation stringency variable or controlling for demographic variables did not change any of the conclusions. Analyses involving the

other Big Five traits (see Supplement A) showed that social interaction frequency partially explained the links between the other Big Five traits (i.e., agreeableness, neuroticism, and conscientiousness) and well-being, but these indirect effects were much smaller than those observed for extraversion. Moreover, the other Big Five traits did not moderate reactivity to the physical distancing regulations.

Summary

The results of Study 1 underline the role of extraversion for well-being and provide high-powered evidence for the robustness of this association even during times when physical distancing was in place. Moreover, we found support for the social participation hypothesis, as part of the relationship between extraversion and well-being was mediated by social time. However, we did not find any support for the social reactivity hypothesis. For life satisfaction, we even observed the opposite effect, such that the relationship between social time and life satisfaction was *less* pronounced in more extraverted individuals compared with more introverted individuals.

We found a negative effect of regulation stringency on well-being for both well-being indicators we assessed: happiness and life satisfaction. However, the negative effect of regulation stringency on well-being was equally strong for participants at all levels of extraversion. Regarding the role of social interactions, the relationship between regulation stringency and well-being was not mediated by reduced social time *overall*. When zooming in on communication channels and interaction partners, however, we found that regulation stringency was negatively related to social activities that were restricted (e.g., in-person social time, social time with friends) but positively related to social activities that were not affected by the physical distancing measures (e.g., online social time, social time with family). These associations resulted in opposing effects on well-being: Individuals who participated in periods with higher average regulation stringency had comparatively less in-person contact and were therefore less happy and less satisfied, but they also had comparatively more online interactions that compensated for the lack of personal contact in terms of their well-being. Similarly,

individuals who participated in periods with higher average regulation stringency spent comparatively less time socializing with friends, which was related to lower well-being, but comparatively more time socializing with family, which was associated with higher well-being. However, the differences in communication channels and interaction partners between individuals who participated in periods with higher versus lower average regulation stringency were similar for individuals at all levels of extraversion and not differentially related to well-being.

In Studies 2 and 3, our goal was to (a) examine within-person effects in addition to between-person effects and (b) examine facets of extraversion. To this end, we conducted two experience sampling studies, one with undergraduate students (Study 2) and one in the general population (Study 3). Both studies comprised two data collection waves, lasting 2 weeks each and covering different phases of the pandemic. Specifically, the data for Study 2 were collected *before* (starting on January 13, 2020) and *during* (starting on March 16, 2020) the first nationwide lockdown in Germany. The data for Study 3 were collected *during* (starting on March 18, 2020) and *after* (starting on May 13, 2020) the first nationwide lockdown in Germany.[3] Our samples were larger than a typical ESM study in psychological research (e.g., 136.6 participants in an average ESM study, cf. Wrzus & Neubauer, 2022; here: 293 [Study 2] and 1,381 [Study 3] participants in our ESM studies), so that we had exceptionally high power to detect small effects (Arend & Schäfer, 2019).

Study 2

Whereas Study 1 referred only to the relationship between extraversion and well-being during periods with comparatively high regulation stringency, Study 2 allowed us to examine the association

[3] We report the results for the student sample and for the sample from the general population separately because (a) the samples had very different demographic characteristics (e.g., in terms of the distributions of age and occupational status) and (b) the data sets were collected during different phases of the pandemic (*before* and *during* the lockdown vs. *during* and *after* the lockdown, respectively). The differences in demographic composition and pandemic phases may result in divergent effects, which would have been obscured if we had collapsed across samples. During the analyses, we also ran models on a pooled data set, which included data from both studies (see the Robustness Analyses section in Study 3). However, the models in the pooled data set were very sensitive to changes in model specifications (probably due to the divergent results across samples; see the Results sections), which lowered our confidence in the pooled results.

between extraversion and well-being in times of no (*before* the lockdown) and high (*during* the lockdown) restrictions. Moreover, we examined both between- and within-person effects and additionally compared the effects of different facets of extraversion.

Method

Participants

Participants in Study 2 were 293 undergraduate students at a German university. A total of 281 individuals (79% female; M_{age} = 22.87 years, SD_{age} = 7.01 years) participated in the first data collection wave (*before* the lockdown), and 192 individuals (80% female; M_{age} = 21.84 years, SD_{age} = 5.43 years) participated in the second data collection wave (*during* the lockdown). Of these, 180 individuals participated in both waves (i.e., *before* and *during* the lockdown). Most participants (78%) studied psychology and were in their first (37%), third (33%), or fifth (20%) semester.

Participants were recruited via posters and flyers at the university and via online advertisements. They received three different types of compensation. First, participants could earn class credit in exchange for their participation (proportional to the number of ESM surveys they completed). Second, they were offered two different types of monetary compensation. In the first data collection wave (*before* the lockdown), participants were entered into a lottery to win one of 25 Amazon gift cards (50 Euros each). In the second data collection wave (*during* the lockdown), participants were paid 10 Euros if they completed 1 week of ESM data collection and 30 Euros if they completed at least 80% of all the ESM surveys. Lastly, all participants received feedback on their affective well-being on the basis of their ESM survey responses.

Procedures

The first data collection wave began in January 2020 when the pandemic had not yet reached Germany. The study was programmed in formR (version v0.18.3; Arslan et al., 2020) and conducted online. Upon clicking on the link to the study, participants first provided informed consent and

completed several trait questionnaires (e.g., demographic information, personality traits). At the end of the initial online survey, participants chose their daily personal start and end times and entered their email address.

During the 14-day ESM phase, which began the next day in the morning, participants were prompted via email to complete six short ESM surveys per day. Each survey first asked participants whether they had engaged in a social interaction (> 5 min) since the last assessment. Depending on their answer, participants were presented with several questions about either (if *yes*) their most recent social interaction or (if *no*) their most recent individual activity. Each survey included questions about the context in which the interaction or activity occurred and about participants' emotional states directly following the interaction or activity (completion time ~ 2 min). The surveys were sent at random times between participants' daily personal start and end times, with the restriction that a survey could not be sent within 40 min of the previous survey. If participants did not react to the initial email, they were reminded once after 20 min. The surveys became unavailable 45 min after the reminder. The morning after the ESM phase ended, participants once again provided information about their personality traits.

In mid-March, a range of nationwide restrictions were announced in Germany, encompassing the closure of many nonessential stores and facilities (Bundesregierung, 2020). On March 16, the day when the restrictions came into effect, all students were invited via email to participate a second time. The procedures were essentially the same (including an initial online survey, a 14-day ESM phase, and a final online survey), except for the administration of additional COVID-19-related trait questionnaires (e.g., risk perceptions, behavioral changes, policy evaluations), which are not part of the present manuscript. All procedures used in this study were approved by the review board of the University of Münster.

Data Cleaning

As part of the data cleaning procedure, we removed partial reports and surveys that were completed too close to each other (< 40 min between two consecutive ESM surveys) or during the night due to technical errors. We also excluded all participants who completed fewer than 10 valid ESM surveys ($N = 34$) and all participants who did not provide extraversion scores ($N = 1$). After data cleaning, the average participant completed 101 surveys in total.

Trait Measures

Means and standard deviations for all measures can be found in the descriptive statistics table (Table S2) in Supplement A.

Demographic Information. In the initial online survey, participants reported on a range of demographic variables, including their age and gender.[4]

Extraversion. Extraversion was measured with the Interpersonal Adjective List (IAL; Jacobs & Scholl, 2005). The questionnaire comprises a list of 64 adjectives. The scales Gregarious-Extraverted (outgoing, communicative, open-minded, sociable, charming, courageous, interested, loyal) and Aloof-Introverted (unsociable, withdrawn, solitary, reserved, reclusive, distant, rigid, uninterested; reverse-coded) were averaged as an index of sociability. The scales Assured-Dominant (assertive, self-assured, self-confident, persuasive, offensively-minded, dominant, straightforward, proud) and Unassured-Submissive (shy, unconfident, quiet, hesitant, unobtrusive, submissive, conflict-avoidant, influenceable; reverse-coded) were averaged as an index of assertiveness. Participants indicated their agreement with the adjectives on 5-point rating scales ranging from 1 (*do not agree*) to 5 (*agree very much*). The IAL was administered at three time points (at the beginning of the first data collection wave, end of the first data collection wave, and end of the second data collection wave). We first created a mean per time point per participant. The average reliability for the three trait assessments was

[4] Please see the codebook on the OSF (https://osf.io/6kzx3/) or Supplement A for the exact wording of the questions and response options.

high (ω = .93). We then averaged across all available time points for every participant to obtain the most reliable estimate.

State Measures

Positive Affect. The dependent variable was assessed as part of the ESM surveys. Both versions of the ESM survey (i.e., social interaction and individual activity) comprised 14 items relating to participants' emotional states. The item stem read either "How did you feel directly after the interaction?" or "How did you feel directly after the activity?" Two items were averaged to indicate positive affect: enthusiastic and pleased. *Enthusiastic* was rated using a 6-point rating scale ranging from 1 (*do not agree at all*) to 6 (*agree completely*). *Pleased* was rated using a slider ranging from 0 to 100. The two variables were standardized and then averaged per time point per participant.

Social Interaction. Participants first indicated whether they had engaged in a social interaction (> 5 min) since the last assessment. This item was dummy coded to indicate the presence (1) vs. absence (0) of social interactions. If answered affirmatively, participants next provided information on several characteristics of the social context.

Communication Channel. The item for communication channel read: "The interaction evaluated here took place as follows:" and the answer options were 1 (*directly/face-to-face*) or 2 (*via phone/chat*).

Interaction Partner. Participants indicated what role their interaction partner had in relation to themselves for up to five different interaction partners. If participants interacted with more than five people, they were asked to refer to the five people with whom they interacted most via 11 response options. These response options were collapsed into five categories: family (*my child*, *parent*, *sibling*, *other relatives*), friends (*friend/acquaintance*), partner (*partner*), work contacts (*supervisor*, *my employee*, *co-worker*, *customer/client/patient*), and others (*other persons*).

Regulation Stringency. We used the same stringency index as described in Study 1. For every survey, we determined the stringency value on the day on which the survey was completed in Germany.

Analytical Strategy

Study-Specific Analytical Strategy for Study 2. In Study 2, we estimated the same six models as in Study 1 (see Figures 1 and 2, for formulas, see Table A1 in the Appendix) but included both between- and within-person effects, which is admissible for these data due to the larger number of assessments per person. Thus, in addition to modeling individuals' within-person *average* well-being across the measured time points, we also modeled momentary fluctuations in well-being at specific time points. In all the models that included moderation effects, we estimated between-person interactions (as in Study 1) and cross-level interactions (e.g., the effect of extraversion on people's within-person associations between social interactions and well-being), using the random coefficient prediction method (Preacher et al., 2016). Similarly, in the (moderated) mediation models, we estimated between- and within-person indirect effects as well as between- and within-person moderated mediation effects (Preacher et al., 2007, 2011).

As recommended by Asparouhov and Muthén (2019), we used latent centering for the binary social interaction variable. Specifically, we assumed a continuous latent variable M_{ti}^{*} that translated into the observed values of M_{ti} via a threshold mechanism. We then used the latent between- and within-person components of M_{ti}^{*} as predictor and outcome variables in multilevel logistic regressions. Because we estimated all the relationships on the continuous scale of the latent variable M_{ti}^{*}, the indirect effects could be derived by using the same formulas that apply to continuous variables (Muthén et al., 2017).

Exploratory Analyses: Zooming In On the Social Situation and the Person. As part of our exploratory analyses, we zoomed in on different types of social interactions. To this end, we replaced

the binary social interaction variable with (a) one of two dummy-coded variables that reflected FtF interactions versus no social interaction and computer-mediated interactions versus no social interaction, respectively, and (b) one of five dummy-coded variables that reflected interactions with one of five interaction partners (family, friends, partner, work contacts, others) versus no social interaction, respectively. The effects of different communication channels and interaction partners were estimated in separate models (i.e., two models for communication channel, five models for interaction partner) to ensure that the reference category in the multilevel probit regression (path *a*) was the same as in the multilevel linear regression (path *b*). Path *a* reflected whether the frequency of social interactions occurring in physical versus digital contexts or with a given partner increased or decreased as the regulations became stricter. Path *b* indicated whether interacting in physical versus digital contexts or with a given partner was beneficial for well-being compared with no social interaction. Because we used the same reference category in all models, we could compare the strengths of effects across models. We also explored the effects of different extraversion facets (i.e., sociability, assertiveness).

Robustness Analyses. Similar to Study 1, we ran several robustness analyses. We (a) tested the effects for both well-being adjectives (i.e., enthusiasm, pleasure) separately, (b) replaced the continuous regulation stringency variable with a dummy variable (i.e., 0 = *no lockdown*, 1 = *lockdown*), and (c) added control variables to the main models. Specifically, we controlled for demographic variables (gender was dummy-coded, age was centered at the grand mean) and the effect of weekday (0) versus weekend (1) to capture time trends in the data. In addition, we reran the main models among participants who participated twice (i.e., both before and during the lockdown) to check whether a variance restriction in regulation stringency (among participants who participated only once) might have biased the estimates. Finally, as suggested by a reviewer, we also reran the main models for other Big Five traits (i.e., agreeableness and neuroticism).

Deviations From the Preregistration. In addition to the deviations described for Study 1, we decided to run analyses on one combined data set for the student sample (Study 2) and one combined data set for the sample from the general population (Study 3), instead of analyzing the subsamples that were collected before and during or during and after the lockdown separately. Combining the data sets collected during different phases of the pandemic allowed us to obtain statistical estimates for the effects of regulation stringency (instead of descriptively comparing the sizes of the coefficients). Because we used the continuous regulation stringency variable, we could analyze all the available data and did not have to create separate data sets with data collected before and during the lockdown, respectively.

Results and Discussion

Descriptive statistics for all focal variables are presented in Table S2 (Supplement A; https://osf.io/y726z/). An overview of the results from the six main models (depicted in Figures 1 and 2) is presented in Table 1 (third column).

Effects of Extraversion

Main Effect on Well-Being. Extraversion (and its facet sociability) were positively associated with positive affect (Tables 1 and S4, Model 1, path *cb*).

Social Participation. In line with the social participation hypothesis, the relationship between extraversion and positive affect was mediated by social interactions (Table 1, Model 2), suggesting that more extraverted individuals felt better than more introverted individuals in part because they interacted more often. However, similar to Study 1, the indirect effect of extraversion on positive affect via social interactions (b_{ab} = 0.019, p = .001) was small compared with the direct effect ($b_{c'}$ = 0.087, p = .002). When zooming in on different facets of extraversion and different types of social interactions, we found that the social participation hypothesis was supported only for sociability but not for

assertiveness (Table S4, Model 2) and only for FtF interactions but not for computer-mediated interactions (Table 4, Model 2).

Social Reactivity. Contrary to the social reactivity hypothesis, extraversion moderated neither the between- nor the within-person effect of social interactions on positive affect (Table 1, Model 3, paths *bb3* and *bw3*) when we considered a broad extraversion measure. When zooming in on different facets of extraversion, however, we found that sociability moderated the within-person effect of social interactions on positive affect (Table S4, Model 3, path *bw3*), such that more sociable individuals profited more from social interactions than more introverted individuals. In addition, more extraverted individuals profited more from interactions with friends than more introverted individuals (Table 4, Model 3, path *bw3*).

Table 4

Exploratory Analyses: Zooming In On the Communication Channel and Interaction Partner (Study 2)

Models	Path	Face-to-face	Computer-mediated	Family	Friends
Model 2: Social participation					
Extraversion → social interactions	ab	**0.105 [0.024, 0.186], *p* < .001**	0.068 [-0.031, 0.166], *p* = .038	0.061 [-0.059, 0.181], *p* = .093	**0.108 [0.016, 0.201], *p* = .001**
Social interactions → well-being	bb	**0.243 [0.090, 0.398], *p* < .001**	0.062 [-0.089, 0.215], *p* = .146	**0.151 [0.041, 0.262], *p* < .001**	0.097 [-0.049, 0.244], *p* = .042
Extraversion → well-being	c'b	0.077 [0.001, 0.153], *p* = .005	**0.089 [0.007, 0.170], *p* = .003**	0.071 [-0.007, 0.149], *p* = .009	**0.099 [0.019, 0.178], *p* = .001**
Indirect effect		**0.025 [0.005, 0.057], *p* < .001**	0.003 [-0.008, 0.022], *p* = .174	0.009 [-0.010, 0.033], *p* = .093	0.010 [-0.006, 0.034], *p* = .043
Model 3: Social reactivity					
Extraversion × Social Interactions → well-being	bb3	-0.055 [-0.199, 0.085], *p* = .158	0.059 [-0.091, 0.208], *p* = .149	-0.041 [-0.146, 0.068], *p* = .162	-0.016 [-0.136, 0.109], *p* = .375
	bw3	0.034 [-0.005, 0.072], *p* = .013	0.028 [-0.030, 0.093], *p* = .105	0.030 [-0.021, 0.080], *p* = .063	**0.048 [0.009, 0.090], *p* = .002**
Model 5: Social participation with regulation stringency					
Stringency → social interactions	ab1	0.178 [-0.277, 0.634], *p* = .156	**0.733 [0.215, 1.253], *p* < .001**	**1.289 [0.685, 1.897], *p* < .001**	-0.399 [-0.914, 0.116], *p* = .023
	aw1	-0.157 [-0.343, 0.024], *p* = .013	**0.394 [0.197, 0.589], *p* < .001**	**0.632 [0.389, 0.877], *p* < .001**	**-0.791 [-0.993, -0.597], *p* < .001**
Social interactions → well-being	bb	**0.237 [0.086, 0.389], *p* < .001**	0.040 [-0.117, 0.196], *p* = .254	**0.145 [0.029, 0.260], *p* = .001**	0.137 [-0.006, 0.285], *p* = .007
	bw	**0.161 [0.122, 0.201], *p* < .001**	**0.182 [0.126, 0.237], *p* < .001**	**0.102 [0.049, 0.154], *p* < .001**	**0.262 [0.222, 0.301], *p* < .001**
Stringency → well-being	c'b1	0.118 [-0.286, 0.518], *p* = .224	**0.435 [0.007, 0.863], *p* = .004**	0.069 [-0.358, 0.493], *p* = .338	0.425 [-0.004, 0.852], *p* = .005
	c'w1	0.055 [-0.047, 0.156], *p* = .082	**0.258 [0.138, 0.377], *p* < .001**	**0.181 [0.063, 0.297], *p* < .001**	**0.330 [0.211, 0.450], *p* < .001**
Indirect effect		0.040 [-0.069, 0.175], *p* = .156	0.027 [-0.094, 0.168], *p* = .254	**0.182 [0.035, 0.387], *p* = .001**	-0.050 [-0.180, 0.017], *p* = .030
		0.003 [-0.054, 0.060], *p* = .451	**0.086 [0.010, 0.168], *p* = .002**	0.035 [-0.060, 0.129], *p* = .168	**-0.181 [-0.259, -0.111], *p* < .001**
Extraversion × Stringency → social interactions	ab3	-0.133 [-0.593, 0.325], *p* = .225	0.062 [-0.476, 0.594], *p* = .381	0.102 [-0.520, 0.722], *p* = .335	-0.225 [-0.751, 0.298], *p* = .134
	aw3	-0.037 [-0.220, 0.147], *p* = .301	-0.034 [-0.231, 0.161], *p* = .326	-0.076 [-0.321, 0.169], *p* = .211	0.026 [-0.179, 0.231], *p* = .372
Moderated mediation effect		-0.029 [-0.161, 0.082], *p* = .225	0.001 [-0.046, 0.061], *p* = .442	0.013 [-0.085, 0.125], *p* = .336	-0.027 [-0.141, 0.047], *p* = .139
		-0.006 [-0.036, 0.024], *p* = .301	-0.006 [-0.044, 0.030], *p* = .326	-0.007 [-0.036, 0.018], *p* = .211	0.007 [-0.047, 0.061], *p* = .372
Model 6: Social reactivity with regulation stringency					
Extraversion × Social Interactions → well-being	bb3	-0.051 [-0.192, 0.088], *p* = .173	0.049 [-0.092, 0.191], *p* = .180	-0.044 [-0.148, 0.059], *p* = .138	-0.008 [-0.132, 0.113], *p* = .434
	bw3	0.033 [-0.006, 0.072], *p* = .014	0.030 [-0.030, 0.096], *p* = .106	0.028 [-0.024, 0.080], *p* = .081	**0.044 [0.003, 0.087], *p* = .003**
Moderated mediation effect		-0.006 [-0.071, 0.029], *p* = .268	0.033 [-0.070, 0.164], *p* = .181	-0.054 [-0.205, 0.078], *p* = .138	0.002 [-0.059, 0.071], *p* = .437
		-0.005 [-0.017, 0.001], *p* = .027	0.011 [-0.012, 0.042], *p* = .106	0.017 [-0.015, 0.055], *p* = .081	**-0.034 [-0.072, -0.003], *p* = .003**

Models	Path	Partner	Work contacts	Others
Model 2: Social participation				
Extraversion → social interactions	ab	0.250 [-0.024, 0.535], *p* = .010	**0.142 [0.032, 0.252], *p* < .001**	0.057 [-0.040, 0.154], *p* = .064
Social interactions → well-being	bb	**0.073 [0.019, 0.129], *p* < .001**	0.053 [-0.097, 0.204], *p* = .178	-0.003 [-0.200, 0.195], *p* = .482
Extraversion → well-being	c'b	0.073 [-0.007, 0.154], *p* = .009	0.066 [-0.016, 0.150], *p* = .019	0.077 [-0.004, 0.157], *p* = .007
Indirect effect		0.017 [-0.002, 0.048], *p* = .010	0.007 [-0.016, 0.034], *p* = .178	0.000 [-0.018, 0.017], *p* = .486
Model 3: Social reactivity				
Extraversion × Social Interactions → well-being	bb3	0.007 [-0.043, 0.055], *p* = .350	-0.013 [-0.157, 0.130], *p* = .406	0.104 [-0.119, 0.329], *p* = .112
	bw3	0.009 [-0.052, 0.077], *p* = .347	0.070 [-0.008, 0.139], *p* = .009	0.066 [-0.016, 0.144], *p* = .017
Model 5: Social participation with regulation stringency				

Stringency → social interactions	ab1	-0.361 [-5.591, 4.693], p = .364	**-0.938 [-1.565, -0.326], p < .001**	-0.083 [-0.653, 0.479], p = .352
	aw1	0.188 [-0.170, 0.527], p = .081	**-0.746 [-1.039, -0.467], p < .001**	**-0.380 [-0.621, -0.150], p < .001**
Social interactions → well-being	bb	**0.018 [0.003, 0.130], p < .001**	0.084 [-0.071, 0.239], p = .081	0.074 [-0.134, 0.286], p = .180
	bw	**0.184 [0.118, 0.245], p < .001**	**0.100 [0.032, 0.166], p < .001**	**0.134 [0.051, 0.212], p < .001**
Stringency → well-being	c'b1	0.437 [0.004, 0.841], p = .005	0.347 [-0.105, 0.796], p = .024	0.322 [-0.108, 0.751], p = .026
	c'w1	**0.186 [0.059, 0.314], p < .001**	**0.335 [0.192, 0.479], p < .001**	**0.342 [0.199, 0.489], p < .001**
Indirect effect		-0.010 [-0.179, 0.108], p = .364	-0.074 [-0.263, 0.070], p = .081	-0.002 [-0.094, 0.071], p = .418
		0.114 [0.004, 0.237], p = .004	-0.019 [-0.142, 0.104], p = .336	-0.027 [-0.145, 0.090], p = .275
Extraversion × Stringency → social interactions	ab3	0.681 [-4.536, 5.678], p = .273	0.229 [-0.400, 0.865], p = .173	-0.099 [-0.681, 0.498], p = .330
	aw3	-0.011 [-0.347, 0.330], p = .466	-0.085 [-0.373, 0.200], p = .219	-0.034 [-0.260, 0.189], p = .344
Moderated mediation effect		0.020 [-0.077, 0.217], p = .273	0.013 [-0.049, 0.123], p = .227	-0.004 [-0.111, 0.062], p = .371
		-0.002 [-0.066, 0.062], p = .466	-0.008 [-0.043, 0.022], p = .219	-0.004 [-0.038, 0.028], p = .344
Model 6: Social reactivity with regulation stringency				
Extraversion × Social Interactions → well-being	bb3	0.010 [-0.043, 0.061], p = .313	-0.020 [-0.171, 0.120], p = .357	0.067 [-0.144, 0.283], p = .206
	bw3	0.023 [-0.045, 0.101], p = .200	0.047 [-0.031, 0.123], p = .064	0.015 [-0.069, 0.097], p = .323
Moderated mediation effect		0.000 [-0.044, 0.043], p = .494	0.016 [-0.113, 0.168], p = .357	-0.001 [-0.087, 0.067], p = .429
		0.003 [-0.012, 0.029], p = .244	-0.034 [-0.099, 0.024], p = .064	-0.005 [-0.040, 0.029], p = .323

Note. Unstandardized coefficients with 99% credibility intervals and one tailed p-values are presented. Only coefficients that are relevant for testing the hypotheses are shown in the manuscript. Full models can be found in Supplement B. All models were estimated with the Bayesian estimator with uninformative priors. Coefficients that are significant at $p < .005$ are printed in bold.

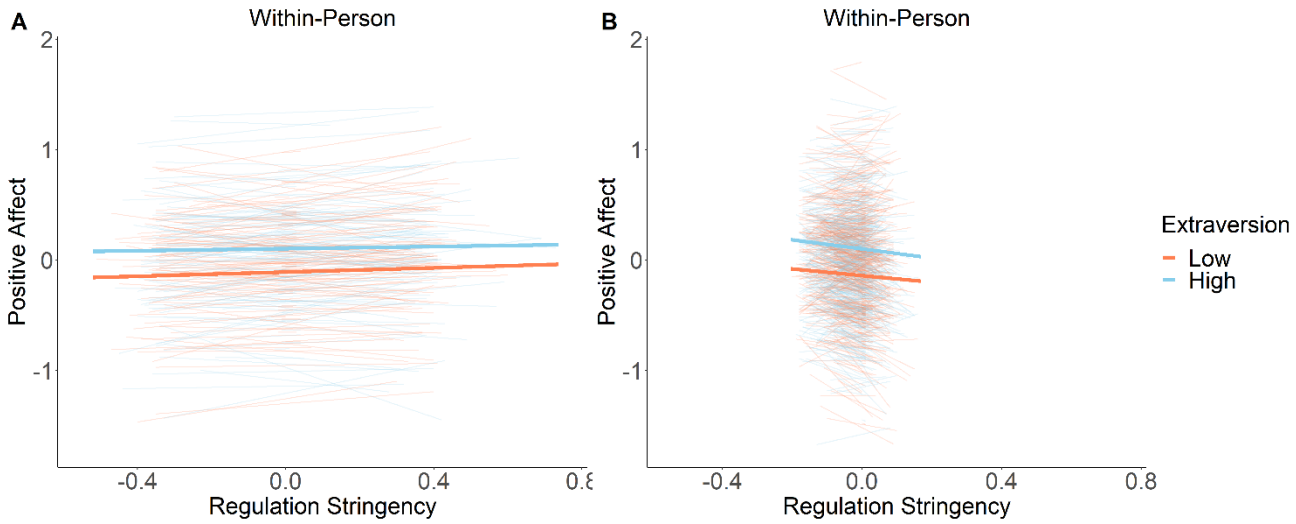
Effects of Social Restrictions

Quasi-Experimental Manipulation Check. In Study 2, the within-person means of regulation stringency ranged from 0 to 76.85 (M = 29.95). The average person-specific Level 1 stringency variable ranged from -22.88 to 26.36. As a quasi-experimental manipulation check, we first examined the effects of regulation stringency on social interactions. As in Study 1, regulation stringency was unrelated to social interactions when different types of social interactions were combined (within and between persons; Table 1, Model 5, paths *ab1* and *aw1*). However, we observed a changed socialization pattern when we zoomed in on the specific types of social interactions: Regulation stringency had negative effects on interactions with work contacts (within and between persons) as well as interactions with friends and other interaction partners (only within persons) but positive effects on computer-mediated interactions and interactions with family (within and between persons; Table 4, Model 5, paths *ab1* and *aw1*).

Extraversion as a Moderator of the Regulation Stringency–Well-Being Relationship. In Study 2, regulation stringency was not related to positive affect (Table 1, Model 4). At the between-person level, individuals who participated in periods with higher average regulation stringency did not report less positive affect than those who participated in periods with lower average regulation stringency (path *cb1*). At the within-person level, positive affect did not decrease as the regulations became stricter (path *cw1*). Moreover, extraversion (and its facets) moderated neither the between- nor the within-person effect of regulation stringency on positive affect (Tables 1 and S4, Model 4, paths *cb3* and *cw3*). As shown in Figure 4 (Panel a), we observed large variability in person-specific slopes, but this variability was not significantly related to extraversion.

Figure 4

Within-Person Changes in Positive Affect as a Function of Regulation Stringency and Extraversion (Studies 2 and 3)



Note. Within-person effect of regulation stringency on positive affect in (a) Study 2 and (b) Study 3. Each line represents data from one participant. Lines are colored according to participants' extraversion levels (based on a median split). The solid blue (light gray) line depicts the predicted slope for participants with an extraversion score 1 *SD* above the mean; the solid orange (dark gray) line refers to extraversion 1 *SD* below the mean.

Social Participation With Regulation Stringency. Next, we investigated whether the relationship between regulation stringency and positive affect was mediated by reduced social interactions and whether extraversion (and its facets) moderated path *a* of this effect (Tables 1 and S4, Model 5). As in Study 1, social interactions were not related to regulation stringency (paths *ab1* and *aw1*) and therefore could not mediate the effect of regulation stringency on positive affect. Moreover, extraversion (and its facets) moderated neither the between- nor the within-person effect of regulation stringency on social interactions (paths *ab3* and *aw3*), indicating that more extraverted individuals did not experience stronger (or weaker) reductions in social participation than more introverted individuals.

We also examined whether COVID-19-related changes in communication channels and interaction partners were associated with changes in positive affect (Table 4, Model 5). The pattern was similar to the one observed in Study 1. At the within-person level, interactions with friends decreased on days with higher regulation stringency, which was related to lower positive affect on these days (negative indirect effect). At the same time, computer-mediated interactions and interactions with romantic partners increased, which was related to higher positive affect (positive indirect effects). At the between-person level, individuals who participated in periods with higher average regulation stringency spent comparatively more time with family, which was related to higher well-being levels (positive indirect effect). As in Study 1, the social changes were unrelated to extraversion and thus similar for individuals with high and low extraversion (paths *ab3* and *aw3*). As a result, the indirect effects described above were not moderated by extraversion (no moderated mediation effects).

Social Reactivity With Regulation Stringency. Comparatively stronger social reactivity in more sociable individuals did not lead to stronger decreases in positive affect during the COVID-19 pandemic because the effect of regulation stringency on social interactions was not significant (Table S4, Model 6). However, when zooming in on interaction partners, we found that, compared with more introverted individuals, more extraverted individuals' stronger reactivity to interactions with friends was related to stronger decreases in positive affect during the pandemic (Table 4, Model 6).

Robustness Analyses

To check for the robustness of the results (see Supplement B), we first repeated the analyses for the two well-being adjectives (enthusiastic, pleased) separately. Whereas social participation effects were similar for the two adjectives, social reactivity effects were supported only for enthusiasm but not for pleasure. Specifically, extraversion significantly moderated the within-person effect of social interactions on enthusiasm, such that more extraverted individuals felt comparatively more enthusiastic after social interactions. However, extraversion did not moderate the between- or within-person effect

of social interactions on pleasure. When we used a dichotomous lockdown variable instead of the continuous stringency index, the results did not change substantially. When we included control variables or analyzed a subset of the most compliant participants, the social participation effect was no longer significant. Other Big Five traits (i.e., agreeableness and neuroticism) were also related to well-being, but these associations could not be explained by social interactions (see Supplement A). Moreover, similar to Study 1, these traits did not moderate the effect of regulation stringency on well-being.

Summary

In Study 2, we again found a positive relationship between extraversion and well-being during the pandemic, particularly for the facet of sociability. Moreover, our results supported the social participation hypothesis: More extraverted individuals engaged in social interactions more frequently than more introverted individuals, which was related to higher levels of positive affect. This effect was particularly strong for individuals with high sociability and for FtF interactions. The social reactivity hypothesis was not supported for broad measures of extraversion, social interactions, or positive affect. However, we found significant social reactivity effects at the within-person level for (a) the sociability facet, (b) interactions with friends, and (c) a measure of activated positive affect (enthusiastic) instead of merely pleasurable affect.

As opposed to Study 1, we found no effect of regulation stringency on well-being, meaning that well-being did not decrease (or increase) as the regulations became stricter. Moreover, this effect was not related to extraversion, suggesting that more extraverted individuals did not suffer more. As in Study 1, we observed changes in communication channels and interaction partners, which had opposing effects on well-being. Specifically, at the within-person level, interactions with friends decreased, which was related to lower positive affect, whereas computer-mediated interactions and interactions with romantic partners increased, which was related to higher positive affect. In addition,

individuals who participated in periods with higher regulation stringency had more interactions with family, which was related to higher well-being levels. However, the social changes associated with the pandemic were unrelated to extraversion and were therefore similar for individuals with high and low extraversion. Moreover, more extraverted individuals did not react more strongly to these changes than more introverted individuals, except for the lack of interactions with friends.

Study 3

In Study 3, we aimed to test whether our findings generalized to a sample from the general population and to different phases of the pandemic (i.e., *during* and *after* the lockdown).

Method

Participants

Participants were 1,381 individuals from the general population. A total of 990 individuals (79% female; M_{age} = 35.83 years, SD_{age} = 13.38 years) participated in the first data collection wave (*during* the lockdown), and 660 individuals (83% female; M_{age} = 42.00 years, SD_{age} = 12.54 years) participated in the second data collection wave (*after* the lockdown). Of these, 269 individuals participated in both waves (i.e., during and after the lockdown). The sample was highly educated and professionally active: Most participants held a university degree (51%) or German Abitur (32%) and were either working (59%) or studying at a university (26%).

Participants were recruited via a press release by the University of Münster and online advertisements. As in Study 2, all participants received feedback on their affective well-being to compensate them for their time.

Procedures

Similar to Study 2, each of the two data collection waves in Study 3 consisted of an initial online survey, a 14-day ESM phase, and a final online survey. Compared with Study 2, some questionnaires were different (see below). Moreover, the two studies differed in which phases of the

pandemic they covered: Whereas Study 2 covered periods *before* and *during* the lockdown, Study 3 comprised data collection waves that took place *during* and *after* the lockdown. Specifically, the first data collection wave for Study 3 began on March 18, shortly after the announcement of the first nationwide regulations in Germany. The second data collection wave for Study 3 began in mid-May, when the restrictions were first loosened, and the number of daily new infections had decreased markedly. Besides the changes in questionnaires and pandemic phases, the procedures were identical to the ones followed in Study 2. All procedures used in this study were approved by the review board of the University of Münster.

Data Cleaning

We applied the same data cleaning steps as in Study 2. A total of 905 participants were removed because they completed fewer than 10 surveys. After data cleaning, the average participant completed 45 surveys in total.

Trait Measures

Means and standard deviations for all measures can be found in the descriptive statistics table (Table S3) in Supplement A.

Demographic Information. In addition to age and gender, participants indicated their occupational and educational status. Moreover, we asked for participants' relationship status and living situation,[5] as this information might be particularly relevant during the COVID-19 pandemic. Note that some participants provided demographic information twice (e.g., in the initial online surveys of both data collection waves). We considered only the first assessment for each person.

Extraversion. Extraversion was measured with the German version of the BFI-2-S (Rammstedt et al., 2020). The extraversion subscale comprises a total of six items with the item stem "I am

[5] Please see the codebook on the OSF (https://osf.io/6kzx3/) or Supplement A for the exact wording of the questions and response options.

someone who." Two items tap into the facets of sociability ("tends to be quiet" [reverse-coded]; "is outgoing, sociable"), assertiveness ("is dominant, acts as a leader"; "prefers to have others take charge" [reverse-coded]), and energy level ("is full of energy"; "is less active than other people" [reverse-coded]), respectively. The items were rated using 5-point rating scales ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). The BFI-2-S was administered at the beginning and end of the first and second data collection waves, respectively. As in Study 2, we first created a mean per time point per participant. The average reliability for the four trait assessments was good ($\omega = .73$). We again averaged across all available assessments for every participant to obtain the most reliable estimate.

State Measures

All state measures were the same as in Study 2. This regards the item wordings as well as the response formats.

Analytical Strategy

Study-Specific Analytical Strategy for Study 3. We ran the same models as in Study 2. Given the broader extraversion measure applied in Study 3, we could examine the effects of three facets (i.e., sociability, assertiveness, energy level) instead of just the two (sociability, assertiveness) from Study 2.

Robustness Analyses. We conducted the same robustness analyses as in Study 2 and extended them by adding more control variables (i.e., educational status, occupational status, relationship status, living situation) and Big Five traits (i.e., conscientiousness and openness). Finally, as described above, we estimated the main models in a pooled data set that contained data from Studies 2 and 3.

Results and Discussion

Descriptive statistics for all focal variables are presented in Table S3 (Supplement A; https://osf.io/y726z/). An overview of the results from the six main models (depicted in Figures 1 and 2) is presented in Table 1 (fourth column).

Effects of Extraversion

Main Effect on Well-Being. As depicted in Tables 1 and S4 (Model 1), extraversion (and its facets) were positively related to positive affect (path *cb*).

Social Participation. In Study 3, the social participation effect just failed to reach significance (Table 1, Model 2; $b_{ab} = 0.011$, $p = .005$; $b_{c'} = 0.109$, $p < .001$). When zooming in on the different facets of extraversion (Table S4, Model 2) and different types of social interactions (Table 5, Model 2), we found that social participation effects were (a) significant only for sociability and assertiveness but not for energy level and (b) significant only for FtF interactions and interactions with friends but not for other types of interactions.

Social Reactivity. Extraversion moderated neither the between- nor the within-person effects of (any types of) social interactions on positive affect (Tables 1 and 5, Model 3, paths *bb3* and *bw3*). However, similar to Study 2, sociability moderated the within-person effect of social interactions on positive affect (Table S4, Model 3, path *bw3*), indicating that more sociable individuals benefitted more from social interactions than more introverted individuals.

Table 5

Exploratory Analyses: Zooming In On the Communication Channel and Interaction Partner (Study 3)

Models	Path	Face-to-face	Computer-mediated	Family	Friends
Model 2: Social participation					
Extraversion → social interactions	ab	**0.164 [0.111, 0.216], *p* < .001**	**0.177 [0.124, 0.232], *p* < .001**	**0.167 [0.092, 0.242], *p* < .001**	**0.208 [0.149, 0.267], *p* < .001**
Social interactions → well-being	bb	**0.078 [0.018, 0.139], *p* < .001**	0.004 [-0.068, 0.076], *p* = .449	0.043 [-0.003, 0.088], *p* = .009	**0.122 [0.054, 0.192], *p* < .001**
Extraversion → well-being	c'b	**0.103 [0.063, 0.144], *p* < .001**	**0.119 [0.076, 0.162], *p* < .001**	**0.105 [0.064, 0.147], *p* < .001**	**0.112 [0.068, 0.155], *p* < .001**
Indirect effect		**0.013 [0.003, 0.025], *p* < .001**	0.001 [-0.012, 0.014], *p* = .449	0.007 [-0.001, 0.017], *p* = .009	**0.025 [0.011, 0.043], *p* < .001**
Model 3: Social reactivity					
Extraversion × Social Interactions → well-being	bb3	-0.002 [-0.060, 0.057], *p* = .463	0.030 [-0.040, 0.100], *p* = .133	0.007 [-0.039, 0.049], *p* = .345	0.027 [-0.045, 0.097], *p* = .167
	bw3	0.009 [-0.014, 0.032], *p* = .147	0.027 [-0.001, 0.055], *p* = .006	0.018 [-0.012, 0.049], *p* = .059	0.013 [-0.019, 0.044], *p* = .143
Model 5: Social participation with regulation stringency					
Stringency → social interactions	ab1	**-1.597 [-2.706, -0.496], *p* < .001**	1.132 [-0.028, 2.299], *p* = .006	-0.890 [-2.420, 0.645], *p* = .068	-1.022 [-2.278, 0.234], *p* = .018
	aw1	**-0.538 [-0.937, -0.135], *p* < .001**	**0.725 [0.224, 1.236], *p* < .001**	-0.023 [-0.506, 0.466], *p* = .451	-0.353 [-0.852, 0.146], *p* = .034
Social interactions → well-being	bb	**0.076 [0.015, 0.137], *p* = .001**	0.005 [-0.068, 0.080], *p* = .425	0.043 [-0.003, 0.090], *p* = .008	**0.163 [0.090, 0.235], *p* < .001**
	bw	**0.062 [0.039, 0.085], *p* < .001**	**0.051 [0.023, 0.078], *p* < .001**	**0.058 [0.029, 0.087], *p* < .001**	**0.203 [0.171, 0.235], *p* < .001**
Stringency → well-being	c'b1	-0.371 [-1.199, 0.463], *p* = .127	0.301 [-0.598, 1.197], *p* = .194	-0.146 [-1.029, 0.736], *p* = .334	-0.004 [-0.924, 0.921], *p* = .495
	c'w1	**-0.344 [-0.626, -0.062], *p* = .001**	-0.174 [-0.506, 0.152], *p* = .084	-0.203 [-0.524, 0.118], *p* = .051	-0.110 [-0.467, 0.253], *p* = .217
Indirect effect		**-0.117 [-0.279, -0.018], *p* = .001**	0.005 [-0.096, 0.114], *p* = .426	-0.034 [-0.145, 0.031], *p* = .075	-0.162 [-0.410, 0.037], *p* = .018
		-0.012 [-0.144, 0.121], *p* = .409	0.071 [-0.094, 0.240], *p* = .135	-0.026 [-0.194, 0.143], *p* = .347	-0.021 [-0.233, 0.198], *p* = .401
Extraversion × Stringency → social interactions	ab3	-0.664 [-1.765, 0.418], *p* = .058	-0.477 [-1.642, 0.674], *p* = .142	**-1.688 [-3.268, -0.138], *p* = .003**	**-1.492 [-2.718, -0.280], *p* = .001**
	aw3	0.010 [-0.398, 0.417], *p* = .474	0.025 [-0.488, 0.546], *p* = .450	0.100 [-0.402, 0.609], *p* = .305	-0.077 [-0.586, 0.423], *p* = .347
Moderated mediation effect		-0.047 [-0.169, 0.034], *p* = .058	-0.001 [-0.071, 0.059], *p* = .448	-0.068 [-0.207, 0.007], *p* = .011	**-0.237 [-0.501, -0.042], *p* = .001**
		0.001 [-0.026, 0.027], *p* = .474	0.001 [-0.027, 0.030], *p* = .450	0.006 [-0.025, 0.039], *p* = .305	-0.016 [-0.120, 0.087], *p* = .347
Model 6: Social reactivity with regulation stringency					
Extraversion × Social Interactions → well-being	bb3	-0.004 [-0.064, 0.055], *p* = .425	0.033 [-0.034, 0.101], *p* = .101	0.009 [-0.036, 0.053], *p* = .309	0.026 [-0.045, 0.098], *p* = .173
	bw3	0.010 [-0.014, 0.033], *p* = .143	**0.029 [0.000, 0.057], *p* = .004**	0.019 [-0.012, 0.050], *p* = .057	0.016 [-0.015, 0.049], *p* = .093
Moderated mediation effect		0.004 [-0.066, 0.077], *p* = .425	0.036 [-0.043, 0.147], *p* = .101	-0.002 [-0.049, 0.029], *p* = .375	-0.010 [-0.093, 0.034], *p* = .218
		-0.005 [-0.022, 0.008], *p* = .143	0.020 [0.000, 0.053], *p* = .005	0.000 [-0.015, 0.013], *p* = .444	-0.005 [-0.027, 0.007], *p* = .121

Models	Path	Partner	Work contacts	Others
Model 2: Social participation				
Extraversion → social interactions	ab	**0.305 [0.186, 0.424], *p* < .001**	**0.185 [0.105, 0.267], *p* < .001**	**0.110 [0.044, 0.176], *p* < .001**
Social interactions → well-being	bb	0.028 [-0.002, 0.058], *p* = .007	-0.003 [-0.049, 0.043], *p* = .431	0.028 [-0.044, 0.101], *p* = .155
Extraversion → well-being	c'b	**0.094 [0.052, 0.136], *p* < .001**	**0.110 [0.067, 0.152], *p* < .001**	**0.103 [0.059, 0.147], *p* < .001**
Indirect effect		0.008 [0.000, 0.020], *p* = .007	-0.001 [-0.010, 0.009], *p* = .431	0.003 [-0.005, 0.013], *p* = .155
Model 3: Social reactivity				
Extraversion × Social Interactions → well-being	bb3	-0.005 [-0.035, 0.024], *p* = .316	0.015 [-0.032, 0.061], *p* = .206	0.065 [-0.014, 0.145], *p* = .017
	bw3	-0.019 [-0.054, 0.017], *p* = .089	0.025 [-0.013, 0.062], *p* = .044	0.011 [-0.030, 0.051], *p* = .244
Model 5: Social participation with regulation stringency				

Stringency → social interactions	ab1	-1.534 [-3.960, 0.902], p = .052	**-3.262 [-4.967, -1.582], p < .001**	**-4.489 [-5.879, -3.124], p < .001**
	aw1	-0.070 [-0.600, 0.475], p = .366	-0.347 [-1.006, 0.345], p = .093	**-1.038 [-1.600, -0.462], p < .001**
Social interactions → well-being	bb	**0.033 [0.004, 0.063], p = .002**	-0.008 [-0.055, 0.040], p = .335	0.049 [-0.034, 0.133], p = .064
	bw	**0.052 [0.017, 0.087], p < .001**	-0.003 [-0.039, 0.034], p = .405	**0.049 [0.009, 0.089], p = .001**
Stringency → well-being	c'b1	-0.024 [-0.922, 0.872], p = .471	-0.166 [-1.086, 0.751], p = .320	0.321 [-0.724, 1.390], p = .215
	c'w1	-0.336 [-0.679, 0.000], p = .005	-0.154 [-0.504, 0.200], p = .130	-0.137 [-0.520, 0.252], p = .182
Indirect effect		-0.047 [-0.173, 0.031], p = .053	0.024 [-0.138, 0.199], p = .335	-0.218 [-0.630, 0.156], p = .064
		0.049 [-0.150, 0.247], p = .259	0.002 [-0.248, 0.254], p = .492	-0.047 [-0.263, 0.178], p = .293
Extraversion × Stringency → social interactions	ab3	0.665 [-1.801, 3.143], p = .243	-0.444 [-2.118, 1.244], p = .246	-1.046 [-2.391, 0.279], p = .021
	aw3	-0.073 [-0.626, 0.488], p = .368	0.206 [-0.475, 0.881], p = .216	-0.143 [-0.723, 0.438], p = .261
Moderated mediation effect		0.019 [-0.067, 0.133], p = .244	0.001 [-0.042, 0.064], p = .416	-0.044 [-0.211, 0.042], p = .082
		-0.004 [-0.038, 0.028], p = .368	0.000 [-0.019, 0.015], p = .441	-0.006 [-0.043, 0.025], p = .261
Model 6: Social reactivity with regulation stringency				
Extraversion × Social Interactions → well-being	bb3	-0.004 [-0.034, 0.025], p = .349	0.018 [-0.028, 0.065], p = .152	0.073 [-0.005, 0.150], p = .008
	bw3	-0.016 [-0.052, 0.021], p = .137	0.024 [-0.013, 0.061], p = .047	0.011 [-0.031, 0.053], p = .248
Moderated mediation effect		0.002 [-0.038, 0.055], p = .381	-0.042 [-0.176, 0.069], p = .152	-0.237 [-0.530, 0.017], p = .008
		0.000 [-0.012, 0.017], p = .395	-0.007 [-0.041, 0.010], p = .118	-0.011 [-0.061, 0.033], p = .248

Note. Unstandardized coefficients with 99% credibility intervals and one tailed p-values are presented. Only coefficients that are relevant for testing the hypotheses are shown in the manuscript. Full models can be found in Supplement B. All models were estimated with the Bayesian estimator with uninformative priors. Coefficients that are significant at $p < .005$ are printed in bold.

Effects of Social Restrictions

Quasi-Experimental Manipulation Check. In Study 3, the within-person means of regulation stringency ranged from 56.61 to 76.85 (M = 69.03). The average person-specific range of the Level 1 stringency variable was from -7.08 to 3.37. As in Study 2, we observed no effect of regulation stringency on social interactions when we combined the different types of social interactions (within and between persons; Table 1, Model 5, paths *ab1* and *aw1*). In addition, we replicated the more nuanced effects on different types of social interactions that occurred in Studies 1 and 2: Regulation stringency had negative effects on FtF interactions and interactions with other interaction partners (within and between persons) as well as interactions with work contacts (only between persons) but positive effects on computer-mediated interactions (only within persons; Table 5, Model 5, paths *ab1* and *aw1*).

Extraversion as a Moderator of the Regulation Stringency–Well-Being Relationship. In Study 3, regulation stringency was negatively related to positive affect at the within-person level (Table 1, Model 4, path *cw1*), suggesting that positive affect increased as the restrictions were relaxed. However, regulation stringency was not related to positive affect at the between-person level (path *cb1*), indicating that individuals who participated in periods with lower average regulation stringency did not report more positive affect than those who participated in periods with higher average regulation stringency. As in Studies 1 and 2, extraversion (and its facets) moderated neither the between- nor the within-person effect of regulation stringency on positive affect (Tables 1 and S4, Model 4, paths *cb3* and *cw3*). As shown in Figure 4 (Panel b), the negative relationship between regulation stringency and positive affect was unrelated to extraversion and was thus similar for individuals with different levels of extraversion.

Social Participation With Regulation Stringency. When we combined the different types of interactions, social interactions did not mediate the relationship between regulation stringency and

well-being (Table 1, Model 5, no indirect effect). Moreover, more extraverted individuals did not experience stronger decreases in social participation than their more introverted counterparts (paths *ab3* and *aw3*), both when we used a general measure (Table 1) and when we used narrower facets (Table S4).

When zooming in on the social situation (Table 5, Model 5), we found that individuals who experienced higher regulation stringency on average tended to have comparatively fewer FtF interactions which was related to lower levels of positive affect (negative indirect effect). Moreover, we found significant moderation effects at the between-person level for interactions with family and friends (Table 5, Model 5, path *ab3*). However, the moderated mediation effect was significant only for interactions with friends, suggesting that the negative indirect effect of regulation stringency on well-being via social interactions with friends was stronger for more extraverted individuals.

Social Reactivity With Regulation Stringency. As in Study 2, stronger social reactivity in more sociable individuals did not lead to stronger decreases in positive affect in these individuals because the effect of regulation stringency on social interactions was not significant (Table S4, Model 6). Moreover, our exploratory analyses showed that more extraverted individuals profited comparatively more from computer-mediated interactions (Table 5, Model 6, path *bw3*), but the moderated mediation effect just failed to reach significance.

Robustness Analyses

In our robustness analyses (Supplements A and B), we found that the negative between-person effect of regulation stringency on pleasure (but not on enthusiasm) was more pronounced in more extraverted individuals than in more introverted individuals. The results did not change substantially when we used a dichotomous lockdown variable instead of the continuous stringency index, included control variables, or analyzed a subset of the most compliant participants. As in Study 1, social interactions were relevant for explaining links between other Big Five traits (i.e., agreeableness and

neuroticism) and well-being, but these indirect effects were much smaller than those observed for extraversion (see Supplement A). In addition, agreeableness moderated the within-person effect of social interactions on well-being. However, this effect was observed only in Study 3 and could not be replicated in the other two studies. None of the other Big Five traits moderated the effect of regulation stringency on well-being.

Summary

As in Studies 1 and 2, extraversion was related to higher well-being. This effect could not be explained by social interactions when we used broad measures. However, we did find significant effects when zooming in on the facets of extraversion and more specific types of social interactions: Social participation effects emerged for the sociability and assertiveness facets as well as for FtF interactions and interactions with friends. Moreover, we observed significant social reactivity effects at the within-person level for the sociability facet.

Regarding the effects of social restrictions, we found a negative effect of regulation stringency on positive affect at the within-person level, indicating that positive affect increased as the regulations were relaxed. However, this effect was not moderated by extraversion. Similar to Studies 1 and 2, we observed effects of regulation stringency on specific types of social interactions, which partly affected well-being. In particular, the lower frequency of FtF interactions among individuals who participated in periods with higher average regulation stringency was related to lower well-being levels in these participants. However, extraversion was mostly unrelated to changes in social interaction patterns and reactivity to these changes when we analyzed all types of social interactions together. A more differentiated inspection revealed that extraversion moderated the between-person effect of regulation stringency on interactions with friends, which was related to lower well-being levels.

Meta-Analysis

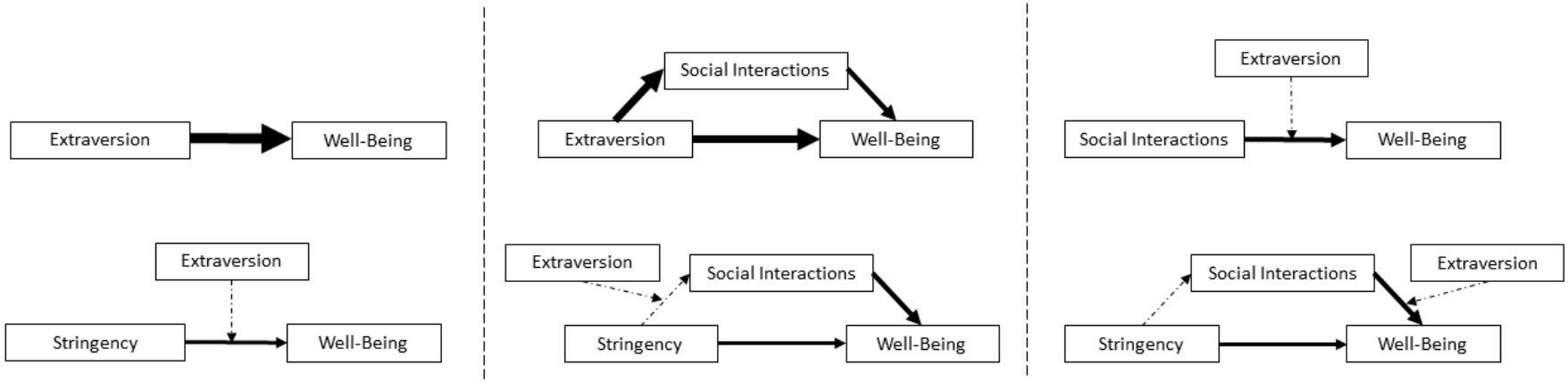
We integrated the standardized effects from all three (between-person effects) or two (within-person effects) studies using a fixed-effects meta-analysis with the package metafor (Viechtbauer, 2010) in R (R Core Team, 2021). Figure 5 shows an overview of the results. Across all three studies, extraversion was consistently related to higher well-being levels (β_{cb} = .208, p < .001). In line with the social participation hypothesis, we found a small indirect effect of extraversion on well-being via social interactions (β_{ab} = .027, p < .001), but most of the association was direct ($\beta_{c\prime}$ = .181, p < .001). The social reactivity hypothesis was not supported at the between-person level and just failed to reach significance at the within-person level (β_{bw3} = .081, p = .005) when we considered broad measures of extraversion and well-being. However, we observed the theoretically expected social reactivity effects for specific facets of extraversion (i.e., sociability; β_{bw3} = .143, p < .001) and well-being (i.e., activated positive affect; β_{bw3} = .117, p < .001) at the within-person level.

We observed a small negative effect of regulation stringency on well-being at the between-person level (β_{cb1} = -.095, p < .001), but this effect was inconsistent across studies and was not moderated by extraversion. This finding indicates that individuals with high extraversion did not suffer more during the pandemic. Moreover, the overall frequency of social interactions did not change during the pandemic and therefore did not mediate the effect of regulation stringency on well-being. However, the types of social interactions changed: FtF interactions (β_{ab1} = -.129, β_{aw1} = -.033) and interactions with friends (β_{ab1} = -.010, β_{aw1} = -.084), work contacts (β_{ab1} = -.131, β_{aw1} = -.064), and other interaction partners (β_{ab1} = -.291, β_{aw1} = -.070) decreased, whereas online interactions (β_{ab1} = .147, β_{aw1} = .060) and interactions with family (β_{ab1} = .097, β_{aw1} = .038) increased (all ps < .001). These changes triggered opposing mediation pathways: At the within-person level, COVID-19-related restrictions led to lower well-being because they went along with fewer interactions with friends (negative indirect effect). However, this effect was partially compensated for because the restrictions also led to an increase in online interactions (positive indirect effect). Moreover, at the between-person

level, individuals who participated in periods with higher average regulation stringency had fewer FtF interactions and interactions with friends, which was related to lower well-being levels (negative indirect effects). However, there was no evidence for the expected social participation or social reactivity processes during the COVID-19 pandemic: More extraverted individuals did not experience stronger decreases in social participation during the pandemic, nor did they suffer more from the social changes.

Figure 5

Overview of Findings



Note. The figure is based on a fixed-effects meta-analysis of the standardized estimates from the individual studies (for Study 1, the outcome was happiness, for Studies 2 and 3, the outcome was positive affect). The strength of the arrows indicates the sizes of the effects (< .10, .10–.15, .15–.20, > .20). All effects reflect between-person effects. Nonsignificant effects are depicted with dashed arrows.

General Discussion

For decades, it has been assumed that social interactions play a vital role in explaining the link between extraversion and well-being (Diener et al., 1984; Lucas et al., 2008; Srivastava et al., 2008). Here, we provide evidence from large samples (total $N = 6{,}296$) during an unprecedented time of reduced social contact to further clarify the relationships between extraversion, social interactions, and well-being. First, we found some evidence for the social participation hypothesis in that the relationship between extraversion and well-being was partly mediated by social interactions but no consistent evidence for the social reactivity hypothesis in that extraversion did not moderate the relationship between social interactions and well-being when broad measures of extraversion and well-being were considered. However, in line with theoretical expectations (see below), significant social reactivity effects emerged for specific facets of extraversion and well-being (i.e., the sociability facet and measures of activated positive affect). Second, we showed that, despite the social participation and social reactivity effects, individuals with comparatively higher extraversion did not react differently to involuntary reductions in social interaction frequency and therefore did not suffer more. Below, we discuss our findings with regard to theories about extraversion and well-being, effects of the COVID-19 pandemic on well-being and social interaction processes, and personality effects during societal challenges.

Revisiting the Social Participation and Social Reactivity Hypotheses

Owing to our large samples, our analyses had a high power to test the social participation and social reactivity hypotheses and thereby offer new insights into the empirical evidence for them. First, in line with the social participation hypothesis, we found a small indirect effect of extraversion on well-being via social interaction frequency, but most of the association was direct. This finding is in line with previous research that found partial mediation effects (Lucas et al., 2008; Oerlemans & Bakker, 2014; Srivastava et al., 2008). Thus, even though social interaction frequency may be involved in the

link between extraversion and well-being, there must be additional processes that explain why more extraverted individuals experience higher well-being on average (see below).

Second, we found no consistent evidence for the social reactivity hypothesis for broad measures of extraversion and well-being and even opposing effects at the between-person level. Specifically, in Study 1, the between-person relationship between social time and life satisfaction was stronger in more *introverted* individuals. Interestingly, similar patterns have been reported in other studies. For example, in Kuper et al. (2022), the between-person relationship of social leisure activities (i.e., evening socializing and talking to close others) with subjective well-being (i.e., happiness and life satisfaction) was more pronounced in more introverted individuals. Along with the main effects of extraversion on social interaction frequency, these findings resemble a pattern of diminishing returns, such that higher social interaction frequencies among more extraverted individuals are associated with diminishing well-being benefits (Ren et al., 2022). Note, however, that the between-person interaction was significant only in Study 1. Moreover, it was limited to cognitive aspects of well-being (i.e., life satisfaction) and did not generalize to affective well-being in our study. As such, future studies should test the robustness of this finding across different samples and aspects of well-being.

When zooming in on within-person relationships in Studies 2 and 3, we found that social reactivity effects may be specific to lower-level facets of extraversion and well-being. These findings were in line with theoretical expectations: First, in both studies, social reactivity effects were present for the sociability facet but not for the assertiveness or energy level facets. The sociability facet captures individual differences in the tendency to seek out social activities (Soto & John, 2017). Thus, it is conceptually most closely related to the enjoyment of social interactions. Second, in the meta-analysis, social reactivity effects emerged only for activated positive affect but not for merely pleasant affect. This finding is in line with previous studies that have shown that extraversion reflects positive activation rather than pleasant valence (Smillie, DeYoung, et al., 2015). Taken together, these results

underline (a) the need to disentangle between- from within-person effects and (b) the need to consider lower-level facets of extraversion and well-being to comprehensively understand affective reactivity processes in daily life (Mõttus, 2016; Smillie et al., 2012).

Theories About Extraversion and Well-Being

If social interactions are not the (only) reason for the extraversion–well-being relationship, what other mechanisms might be at play? First, the link between extraversion and well-being might not be explained (only) by higher social interaction quantity but also by better social interaction *quality* in individuals with high extraversion (Smillie, Wilt, et al., 2015). For instance, in Harris et al. (2017), the association between extraversion and subjective well-being was mediated by feelings of social belonging and social connection (i.e., higher relationship satisfaction). Similarly, Sun et al. (2017) found that the association between extraversion and well-being was mediated by perceived social contribution (i.e., the perception of having a positive impact on other people). These findings suggest that indirect effects of extraversion on well-being via social interactions may be larger when the qualitative experience of these interactions is considered. Similarly, more extraverted individuals may react more strongly to specific qualitative aspects of social interactions (e.g., Sun et al., 2020).

Second, in line with instrumental models, the relationship between extraversion and well-being may be (partly) mediated by additional activities and experiences. Previous research has shown that more extraverted individuals tend to engage in numerous activities that are associated with higher well-being. For instance, more extraverted individuals tend to exercise more (Kroencke et al., 2019; Rhodes & Smith, 2006; Wilson & Dishman, 2015), engage in more cultural activities, and go on more vacations (Kuper et al., 2022) than more introverted individuals. If all these activities jointly contribute to higher well-being in more extraverted individuals, the effect of every single activity (e.g., social interactions) is likely to be small, and only partial mediation effects can be expected. Similarly, more extraverted individuals may profit comparatively more from other activities beyond social interactions,

such as physical activity (Chan et al., 2018). However, such moderation effects are often small in size and inconsistent across studies (Kuper et al., 2022).

Finally, the link between extraversion and well-being may be due to neurobiological factors. In particular, extraversion has been linked to individual differences in the dopaminergic system, which is thought to regulate reward processing (Depue & Collins, 1999; DeYoung, 2013; Gray, 1987; Wacker & Smillie, 2015). Specifically, dopamine is thought to regulate the motivation to seek out rewards and the corresponding feelings of "wanting" or "craving" (Berridge, 2007). Given that many rewards in our everyday lives are social, the social reactivity effects for activated positive affect reported in our study are in line with neurobiological reward-processing theories of extraversion (Smillie et al., 2012).

Effects of the COVID-19 Pandemic on Well-Being and Social Interaction Processes

Previous studies on the link between the COVID-19 pandemic and well-being have yielded mixed results. Whereas some studies reported no decreases in well-being during the first COVID-19-related lockdown in Germany (e.g., Entringer & Gosling, 2022), other studies found that well-being declined during this period (e.g., Zacher & Rudolph, 2021). A meta-analysis reported that, whereas mental health symptoms (e.g., depression, anxiety) increased during the first lockdowns in 2020, positive psychological functioning (including satisfaction with life and positive affect) did not change significantly, but there was considerable between-study heterogeneity (Prati & Mancini, 2021). Similarly, in our studies, results varied across samples, as we observed small negative effects in the samples from the general population in Studies 1 and 3 but no effect in the student sample in Study 2. Our pattern of findings suggests that students may have been less affected by the first nationwide lockdowns in 2020 than other populations. This interpretation is in line with a large-scale German daily diary study that showed that increases in loneliness during this time were stronger for older participants (Buecker et al., 2020). However, potential differences between subgroups from the population may have changed over the course of the pandemic (see below).

The small effects we observed in our studies could also be due to factors other than the regulations. In Studies 2 and 3, well-being increased from January to March and then again from March to May. These increases may be due to a seasonal effect (Feddersen et al., 2016). Moreover, during the first data collection phase in January, students were preparing for their exams in February. As such, performance pressure might have dampened their positive affect compared with the postexam phase in March—a phase without classes between semesters in which students typically do not meet regularly based on their schedule. Importantly, if pandemic-related decreases in well-being can be masked by other everyday phenomena (e.g., weather or exams), the effects on well-being must be very small compared with the effects of other everyday life experiences. Thus, we found no evidence for the drastic decreases in well-being that were expected.

When zooming in on the underlying social interaction processes, we found that social interactions changed in line with the physical distancing regulations. Specifically, interactions with a high risk of infection that were targeted by the regulations (i.e., FtF interactions and interactions with individuals from different households, e.g., friends, work contacts, or other interaction partners) decreased with higher regulation stringency. At the same time, unavoidable interactions or those with a lower risk of infection (i.e., computer-mediated interactions and interactions with individuals from the same household, e.g., family members) increased. These changes in social interaction patterns are in line with another recent study that found that in-person interactions increased from April 2020 (during the lockdown) to June 2020 (after the lockdown) in Germany, whereas online interactions decreased (Krämer et al., 2022). Similarly, previous studies reported that the number of work contacts decreased dramatically during the COVID-19 pandemic, whereas the number of home contacts remained relatively stable (Tomori et al., 2021). Our mediation analyses showed that these changes were adaptive for well-being. For instance, whereas negative effects of regulation stringency on FtF

interactions and interactions with friends were related to lower well-being, positive effects on computer-mediated interactions had a buffering effect on well-being.

Personality Effects During Societal Challenges

As described in the Introduction, predictions about personality effects during societal challenges can be made on the basis of two theoretical arguments. On the one hand, the COVID-19 pandemic could be conceptualized as a weak situation that allowed for and to some extent provoked the expression of individual differences due to the ambiguity of novel situations and the lack of clear behavioral norms (Caspi & Moffitt, 1993). This perspective suggests that extraversion's relationships with well-being and social interaction frequency should have *increased* during the pandemic. On the other hand, the pandemic could be conceptualized as a strong situation that should prohibit the expression of individual differences (Mischel, 1977) due to the governmental restrictions. Thus, extraversion's relationships with well-being and social interaction frequency should have *decreased* during the pandemic. The fact that the COVID-19 pandemic could be categorized as either a weak or a strong situation supports the observation that the situational strength hypothesis can be applied flexibly and is therefore difficult to falsify (Cooper & Withey, 2009).

In our studies, we found that extraversion's relationships with well-being and social interaction frequency neither increased nor decreased with more stringent regulations. Thus, none of the theoretical arguments described above were supported by our data. This finding is in line with other research that has failed to support the strong situation hypothesis (Cooper & Withey, 2009). Instead, we found that the effects of personality on social interactions and well-being were robust even in the face of societal challenges, suggesting that most individuals quickly adapted to the new situation in accordance with their personality traits.

Limitations and Future Research

Our study has several limitations that point to fruitful directions for future research. First, even though the number of participants was very large, future studies should increase the number of assessments within participants. For instance, in Study 1, more than half of the participants provided only one assessment, which made it impossible for us to estimate within-person effects.

Second, some measures in Study 1 were relatively short (e.g., only three items for measuring extraversion, single items for affective and cognitive well-being). These shorter measures were chosen intentionally to reduce participant fatigue and increase retention (Bolger et al., 2003). Moreover, previous research has shown that these measures have sufficient reliability and validity to capture our key constructs of interest (Cheung & Lucas, 2014; Lucas & Donnellan, 2012; Rammstedt et al., 2020; Soto & John, 2017), and we observed the expected correlations with the theoretically relevant variables in our data. Future research could improve the measurement of key constructs by using longer measures with even better psychometric properties.

Third, as explained above, the physical distancing regulations coincided with other temporal phenomena, such as seasonal effects or the end of the exam period. With the designs we applied, we could not fully control for these additional environmental influences. As such, it is unclear whether the effects reported in the present study could be completely attributed to the regulations. Future studies should aim to further isolate the effects of the regulations to determine their unique effects.

Fourth, the data were collected in the early phases of the pandemic, for example, around the first of several waves of COVID-19 in Germany. Thus, our results refer only to short-term consequences of the pandemic-related restrictions. Future studies should focus on long(er)-term effects to determine whether the effects become more (or less) pronounced over time.

Fifth, we relied exclusively on self-reports. Previous research has shown that self-reports are a valid method for assessing highly subjective information, such as well-being (Kuppens et al., 2022). Other methodological approaches might be worth exploring, particularly when it comes to the

assessment of social interactions. In addition to using ESM self-reports, future studies should include ESM reports by interaction partners (e.g., Breil et al., 2019, 2022; Geukes et al., 2019) as well as more objective measures of social contact, such as call, text, or app usage logs (Harari et al., 2020). These studies could also consider theoretically derived qualitative features of social interactions and how they are related to extraversion (Back, 2021).

Seventh, future studies might incorporate and model in greater detail the social networks that participants are embedded in. In the current set of studies, we captured various forms of social interaction partners and communication channels from the perspective of individual participants. However, participants' social behaviors and adjustment to social and societal challenges can also be driven by the structure of their social networks and the social norms of the groups they are part of. Future studies might analyze these social network dynamics more closely to understand how extraversion is linked to well-being within larger social networks, such as student cohorts, work groups, or families (e.g., van Zalk et al., 2020). Such designs also call for more complex statistical techniques that allow the network structure and social influences within this network to be modeled (e.g., Meijerink-Bosman et al., 2022; Nestler et al., 2017; Snijders et al., 2010; Stadtfeld & Block, 2017).

Eighth, whereas the hypotheses tested in the present manuscript (i.e., the social participation and social reactivity hypotheses) refer to the effects of *increased* socialization (i.e., social engagement), the physical distancing regulations led a period of *decreased* socialization (i.e., social isolation). We assumed that social engagement and social isolation reflect two ends of the same continuum, but it is also possible that they are qualitatively different phenomena. Therefore, future studies should manipulate social engagement and social isolation separately to identify their shared and unique effects.

Finally, generalizability may be limited in our studies. Whereas we moved beyond student populations in Studies 1 and 3, participants were primarily highly educated in all studies. Moreover,

Study 2 mostly consisted of college students, who are rather overrepresented in psychological research. In addition, because participation was voluntary, we might have missed the people who suffered the most. To draw more robust conclusions about the general population, future studies should aim to increase representativeness.

Conclusions

In the present paper, we provided a comprehensive examination of the extraversion–well-being relationship across diverse samples, methods, and contexts. Our findings underline the robustness of the effects of extraversion on well-being during a societal crisis. Moreover, we provide new insights into social participation and social reactivity processes: First, we found some support for the social participation hypothesis—but not the social reactivity hypothesis—when considering broad measures of extraversion, social interactions, and well-being. Second, theoretically expected social reactivity effects emerged for specific facets of extraversion (i.e., sociability) and well-being (i.e., activated positive affect). Our research highlights the potential of differentiating between different facets of extraversion and well-being when investigating their dynamic interplay with social interactions.

References

Anglim, J., & Horwood, S. (2021). Effect of the COVID-19 pandemic and big five personality on subjective and psychological well-being. *Social Psychological and Personality Science*, *12*(8), 1527–1537. https://doi.org/10.1177/1948550620983047

Anglim, J., Horwood, S., Smillie, L. D., Marrero, R. J., & Wood, J. K. (2020). Predicting psychological and subjective well-being from personality: A meta-analysis. *Psychological Bulletin*, *146*(4), 279–323. https://doi.org/10.1037/bul0000226

Arend, M. G., & Schäfer, T. (2019). Statistical power in two-level models: A tutorial based on Monte Carlo simulation. *Psychological Methods, 24*(1), 1–19. https://doi.org/10.1037/met0000195

Argyle, M., & Lu, L. (1990). The happiness of extraverts. *Personality and Individual Differences*, *11*(10), 1011–1017. https://doi.org/10.1016/0191-8869(90)90128-E

Arslan, R. C., Walther, M. P., & Tata, C. S. (2020). formr: A study framework allowing for automated feedback generation and complex longitudinal experience-sampling studies using R. *Behavior Research Methods, 52*, 376–387. https://doi.org/10.3758/s13428-019-01236-y

Asendorpf, J. B., & Wilpers, S. (1998). Personality effects on social relationships. *Journal of Personality and Social Psychology*, *74*(6), 1531–1544. https://doi.org/10.1037/0022-3514.74.6.1531

Asparouhov, T., & Muthén, B. (2019). Latent variable centering of predictors and mediators in multilevel and time-series models. *Structural Equation Modeling: A Multidisciplinary Journal, 26*(1), 119–142. https://doi.org/10.1080/10705511.2018.1511375

Back, M. D. (2021). Social interaction processes and personality. In J. Rauthmann (Ed.), *The handbook of personality dynamics and processes* (pp. 183–226): Elsevier.

1391 Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as
1392 a fundamental human motivation. *Psychological Bulletin*, *117*(3), 497–529.
1393 https://doi.org/10.1037/0033-2909.117.3.497
1394 Berridge, K. C. (2007). The debate over dopamine's role in reward: the case for incentive salience.
1395 *Psychopharmacology, 191*(3), 391-431. https://doi.org/10.1007/s00213-006-0578-x
1396 Berry, D. S., Willingham, J. K., & Thayer, C. A. (2000). Affect and personality as predictors of conflict
1397 and closeness in young adults' friendships. *Journal of Research in Personality*, *34*(1), 84–107.
1398 https://doi.org/10.1006/jrpe.1999.2271
1399 Bolger, N., Davis, A., & Rafaeli, E. (2003). Diary methods: Capturing life as it is lived. *Annual Review*
1400 *of Psychology, 54*(1), 579-616. https://doi.org/10.1146/annurev.psych.54.101601.145030
1401 Breil, S. M., Geukes, K., Wilson, R. E., Nestler, S., Vazire, S., & Back, M. D. (2019). Zooming into
1402 real-life extraversion – how personality and situation shape sociability in social interactions.
1403 *Collabra: Psychology*, *5*(1), Article 7. https://doi.org/10.1525/collabra.170
1404 Breil, S. M., Schweppe, P. C., Geukes, K., Biesanz, J. C., Quintus, M., Wagner, J., Wrzus, C., Nestler,
1405 S., & Back, M. D. (2022). The incremental validity of average states: A replication and
1406 extension of Finnigan and Vazire (2018). *Journal of Personality and Social Psychology, 123*(3),
1407 e23–e37. https://doi.org/10.1037/pspp0000408
1408 Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J.
1409 (2020). The psychological impact of quarantine and how to reduce it: rapid review of the
1410 evidence. *The Lancet*, *395*(10227), 912–920. https://doi.org/10.1016/S0140-6736(20)30460-8
1411 Buecker, S., Horstmann, K. T., Krasko, J., Kritzler, S., Terwiel, S., Kaiser, T., & Luhmann, M. (2020).
1412 Changes in daily loneliness for German residents during the first four weeks of the COVID-19
1413 pandemic. *Social Science & Medicine, 265*, Article 113541.
1414 https://doi.org/10.1016/j.socscimed.2020.113541

Buijs, V. L., Jeronimus, B. F., Lodder, G. M. A., Riediger, M., Luong, G., & Wrzus, C. (2022). Interdependencies between family and friends in daily life: Personality differences and associations with affective well-being across the lifespan. *European Journal of Personality*. Advance online publication. https://doi.org/10.1177/08902070211072745

Bundesregierung (2020). *Pressekonferenz von Bundeskanzlerin Merkel zu Maßnahmen der Bundesregierung im Zusammenhang mit dem Coronavirus.* https://www.bundesregierung.de/breg-de/aktuelles/pressekonferenz-von-bundeskanzlerinmerkel-zu-massnahmender-bundesregierung-im-zusammenhang-mit-dem-coronavirus-1731022

Carver, C. S., & Connor-Smith, J. (2010). Personality and coping. *Annual Review of Psychology*, *61*, 679–704. https://doi.org/10.1146/annurev.psych.093008.100352

Caspi, A., & Moffitt, T. E. (1993). When do individual differences matter? A paradoxical theory of personality coherence. *Psychological Inquiry*, *4*(4), 247–271. https://doi.org/10.1207/s15327965pli0404_1

Chan, B. C. L., Luciano, M., & Lee, B. (2018). Interaction of physical activity and personality in the subjective wellbeing of older adults in Hong Kong and the United Kingdom. *Behavioral Sciences*, *8*(8), Article 71. https://doi.org/10.3390/bs8080071

Cheung, F., & Lucas, R. E. (2014). Assessing the validity of single-item life satisfaction measures: Results from three large samples. *Quality of Life Research, 23*(10), 2809–2818. https://doi.org/10.1007/s11136-014-0726-4

Cooper, W. H., & Withey, M. J. (2009). The strong situation hypothesis. *Personality and Social Psychology Review*, *13*(1), 62–72. https://doi.org/10.1177/1088868308329378

1437 Costa, P. T., & McCrae, R. R. (1980). Influence of extraversion and neuroticism on subjective well-
1438 being: Happy and unhappy people. *Journal of Personality and Social Psychology*, *38*(4), 668–
1439 678. https://doi.org/10.1037/0022-3514.38.4.668
1440 Costa, P. T., & McCrae, R. R. (1995). Domains and facets: Hierarchical personality assessment using
1441 the Revised NEO Personality Inventory. *Journal of Personality Assessment, 64*(1), 21–50.
1442 http://dx.doi.org/10.1207/s15327752jpa6401_2
1443 Denissen, J. J. A., Geenen, R., Soto, C. J., John, O. P., & van Aken, M. A. G. (2020). The Big Five
1444 Inventory-2: Replication of psychometric properties in a Dutch adaptation and first evidence for
1445 the discriminant predictive validity of the facet scales. *Journal of Personality Assessment*,
1446 *102*(3), 309–324. https://doi.org/10.1080/00223891.2018.1539004
1447 Depaoli, S., & van de Schoot, R. (2017). Improving transparency and replication in Bayesian statistics:
1448 The WAMBS-Checklist. *Psychological Methods, 22*(2), 240–261.
1449 https://doi.org/10.1037/met0000065
1450 Depue, R. A., & Collins, P. F. (1999). Neurobiology of the structure of personality: Dopamine,
1451 facilitation of incentive motivation, and extraversion. *Behavioral and Brain Sciences*, *22*(3),
1452 491-517. https://doi.org/10.1017/S0140525X99002046
1453 DeYoung, C. G. (2013). The neuromodulator of exploration: A unifying theory of the role of dopamine
1454 in personality. *Frontiers in Human Neuroscience*, *7*, Article 762.
1455 https://doi.org/10.3389/fnhum.2013.00762
1456 Diener, E. (1984). Subjective well-being. *Psychological Bulletin*, *95*(3), 542–575.
1457 https://doi.org/10.1037/0033-2909.95.3.542
1458 Diener, E., Larsen, R. J., & Emmons, R. A. (1984). Person × situation interactions: Choice of situations
1459 and congruence response models. *Journal of Personality and Social Psychology*, *47*(3), 580–
1460 592. https://doi.org/10.1037/0022-3514.47.3.580

Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction with Life Scale. *Journal of Personality Assessment, 49*(1), 71-75. https://doi.org/10.1207/s15327752jpa4901_13

Dilchert, S., & Ones, D. S. (2009). Assessment center dimensions: Individual differences correlates and meta-analytic incremental validity. *International Journal of Selection and Assessment*, *17*(3), 254–270. https://doi.org/10.1111/j.1468-2389.2009.00468.x

Entringer, T. M., & Gosling, S. D. (2022). Loneliness during a nationwide lockdown and the moderating effect of extroversion. *Social Psychological and Personality Science*, *13*(3), 769–780. https://doi.org/10.1177/19485506211037871

Feddersen, J., Metcalfe, R., & Wooden, M. (2016). Subjective wellbeing: Why weather matters. *Journal of the Royal Statistical Society: Series A (Statistics in Society), 179*(1), 203-228. https://doi.org/10.1111/rssa.12118

Folk, D., Okabe-Miyamoto, K., Dunn, E., & Lyubomirsky, S. (2020). Did social connection decline during the first wave of COVID-19? The role of extraversion. *Collabra: Psychology*, *6*(1), Article 37. https://doi.org/10.1525/collabra.365

Geukes, K., Breil, S. M., Hutteman, R., Nestler, S., Küfner, A. C. P., & Back, M. D. (2019). Explaining the longitudinal interplay of personality and social relationships in the laboratory and in the field: The PILS and the CONNECT study. *PloS One*, *14*(1), Article e0210424. https://doi.org/10.1371/journal.pone.0210424

Gray, J. A. (1987). *The psychology of fear and stress.* Cambridge University Press.

Hale, T., Angrist, N., Goldszmidt, R., Kira, B., Petherick, A., Phillips, T., Webster, S., Cameron-Blake, E., Hallas, L., Majumdar, S., & Tatlow, H. (2021). A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). *Nature Human Behaviour, 5*(4), 529-538. https://doi.org/10.1038/s41562-021-01079-8

Harari, G. M., Müller, S. R., Stachl, C., Wang, R., Wang, W., Bühner, M., Rentfrow, P. J., Campbell, A. T., & Gosling, S. D. (2020). Sensing sociability: Individual differences in young adults' conversation, calling, texting, and app use behaviors in daily life. *Journal of Personality and Social Psychology*, *119*(1), 204–228. https://doi.org/10.1037/pspp0000245

Harris, K., English, T., Harms, P. D., Gross, J. J., & Jackson, J. J. (2017). Why are extraverts more satisfied? Personality, social experiences, and subjective well–being in college. *European Journal of Personality*, *31*(2), 170–186. https://doi.org/10.1002/per.2101

Hayes, A. F. (2015). An index and test of linear moderated mediation. *Multivariate Behavioral Research, 50*(1), 1-22. https://doi.org/10.1080/00273171.2014.962683

Hudson, N. W., Lucas, R. E., & Donnellan, M. B. (2020). Are we happier with others? An investigation of the links between spending time with others and subjective well-being. *Journal of Personality and Social Psychology*, *119*(3), 672–694. https://doi.org/10.1037/pspp0000290

Jacobs, I., & Scholl, W. (2005). Interpersonale Adjektivliste (IAL). Die empirische Umsetzung theoretischer Circumplex-Eigenschaften für die Messung interpersonaler Stile. *Diagnostica, 51*(3), 145-155. https://doi.org/10.1026/0012-1924.51.3.145

Kahneman, D., Krueger, A. B., Schkade, D. A., Schwarz, N., & Stone, A. A. (2004). A survey method for characterizing daily life experience: The day reconstruction method. *Science*, *306*(5702), 1776–1780. https://doi.org/10.1126/science.1103572

Kotov, R., Gamez, W., Schmidt, F., & Watson, D. (2010). Linking "big" personality traits to anxiety, depressive, and substance use disorders: A meta-analysis. *Psychological Bulletin*, *136*(5), 768–821. https://doi.org/10.1037/a0020327

Krämer, M. D., Roos, Y., Richter, D., & Wrzus, C. (2022). Resuming social contact after months of contact restrictions: Social traits moderate associations between changes in social contact and

well-being. *Journal of Research in Personality*, *98*, Article 104223. https://doi.org/10.1016/j.jrp.2022.104223

Kritzler, S., Krasko, J., & Luhmann, M. (2020). Inside the happy personality: Personality states, situation experience, and state affect mediate the relation between personality and affect. *Journal of Research in Personality*, *85*, Article 103929. https://doi.org/10.1016/j.jrp.2020.103929

Kroencke, L., Harari, G. M., Back, M. D., & Wagner, J. (2023). Well-being in social interactions: Examining personality-situation dynamics in face-to-face and computer-mediated communication. *Journal of Personality and Social Psychology, 124*(2), 437–460. https://doi.org/10.1037/pspp0000422

Kroencke, L., Harari, G. M., Katana, M., & Gosling, S. D. (2019). Personality trait predictors and mental well-being correlates of exercise frequency across the academic semester. *Social Science & Medicine*, *236*, Article 112400. https://doi.org/10.1016/j.socscimed.2019.112400

Kuper, N., Kroencke, L., Harari, G. M., & Denissen, J. J. A. (2022). Who benefits from which activity? On the relations between personality traits, leisure activities, and well-being. *Journal of Personality and Social Psychology.*

Kuppens, P., Dejonckheere, E., Kalokerinos, E. K., & Koval, P. (2022). Some recommendations on the use of daily life methods in affective science. *Affective Science, 3*(2), 505-515. https://doi.org/10.1007/s42761-022-00101-0

Kushlev, K., Heintzelman, S. J., Oishi, S., & Diener, E. (2018). The declining marginal utility of social time for subjective well-being. *Journal of Research in Personality*, *74*, 124–140. https://doi.org/10.1016/j.jrp.2018.04.004

Liu, H., Xie, Q. W., & Lou, V. W. Q. (2019). Everyday social interactions and intra-individual variability in affect: A systematic review and meta-analysis of ecological momentary

assessment studies. *Motivation and Emotion*, *43*(2), 339–353. https://doi.org/10.1007/s11031-018-9735-x

Lucas, R. E., & Baird, B. M. (2004). Extraversion and Emotional Reactivity. *Journal of Personality and Social Psychology, 86*(3), 473–485. https://doi.org/10.1037/0022-3514.86.3.473

Lucas, R. E., & Diener, E. (2009). Personality and subjective well-being. In E. Diener (Ed.), *The science of well-being: The collected works of Ed Diener* (pp. 75–102). Springer Science + Business Media.

Lucas, R. E., & Donnellan, M. B. (2012). Estimating the reliability of single-item life satisfaction measures: Results from four national panel studies. *Social Indicators Research, 105*, 323–331. https://doi.org/10.1007/s11205-011-9783-z

Lucas, R. E., & Fujita, F. (2000). Factors influencing the relation between extraversion and pleasant affect. *Journal of Personality and Social Psychology, 79*(6), 1039–1056. https://doi.org/10.1037/0022-3514.79.6.1039

Lucas, R. E., Le, K., & Dyrenforth, P. S. (2008). Explaining the extraversion/positive affect relation: Sociability cannot account for extraverts' greater happiness. *Journal of Personality*, *76*(3), 385–414. https://doi.org/10.1111/j.1467-6494.2008.00490.x

Lüdtke, O., Marsh, H. W., Robitzsch, A., Trautwein, U., Asparouhov, T., & Muthén, B. (2008). The multilevel latent covariate model: A new, more reliable approach to group-level effects in contextual studies. *Psychological Methods, 13*(3), 203–229. https://doi.org/10.1037/a0012869

Malouff, J. M., Thorsteinsson, E. B., Schutte, N. S., Bhullar, N., & Rooke, S. E. (2010). The Five-Factor Model of personality and relationship satisfaction of intimate partners: A meta-analysis. *Journal of Research in Personality*, *44*(1), 124–127. https://doi.org/10.1016/j.jrp.2009.09.004

Margolis, S., Stapley, A. L., & Lyubomirsky, S. (2020). The association between Extraversion and well-being is limited to one facet. *Journal of Personality*, *88*(3), 478–484. https://doi.org/10.1111/jopy.12504

McCrae, R. R., & Costa, P. T. (1991). Adding Liebe und Arbeit: The full five-factor model and well-being. *Personality and Social Psychology Bulletin*, *17*(2), 227–232. https://doi.org/10.1177/014616729101700217

Meijerink-Bosman, M., Back, M., Geukes, K., Leenders, R., & Mulder, J. (2022). Discovering trends of social interaction behavior over time: An introduction to relational event modeling. *Behavior Research Methods.* Advance online publication. https://doi.org/10.3758/s13428-022-01821-8

Mischel, W. (1977). The interaction of person and situation. In D. Magnusson & N. S. Endler (Eds.), *Personality at the cross-roads: Current issues in interactional psychology* (pp. 333-352). Lawrence Erlbaum.

Modersitzki, N., Le Phan, V., Kuper, N., & Rauthmann, J. F. (2021). Who is impacted? Personality predicts individual differences in psychological consequences of the COVID-19 pandemic in Germany. *Social Psychological and Personality Science*, *12*(6), 1110–1130. https://doi.org/10.1177/1948550620952576

Mõttus, R. (2016). Towards more rigorous personality trait–outcome research. *European Journal of Personality, 30*(4), 292-303. https://doi.org/10.1002/per.2041

Mueller, S., Ram, N., Conroy, D. E., Pincus, A. L., Gerstorf, D., & Wagner, J. (2019). Happy like a fish in water? The role of personality–situation fit for momentary happiness in social interactions across the adult lifespan. *European Journal of Personality*, *33*(3), 298–316. https://doi.org/10.1002/per.2198

Muthén, B. O., Muthén, L. K., & Asparouhov, T. (2017). *Regression and mediation analysis using Mplus.* Los Angeles, CA: Muthén & Muthén.

Muthén, L. K., & Muthén, B. O. (1998–2017). *Mplus user's guide* (8th ed.). Los Angeles, CA: Muthén & Muthén.

Nestler, S., Geukes, K., Hutteman, R., & Back, M. D. (2017). Tackling longitudinal round-robin data: A social relations growth model. *Psychometrika*, *82*(4), 1162–1181. https://doi.org/10.1007/s11336-016-9546-5

Neubauer, A. B., Voelkle, M. C., Voss, A., & Mertens, U. K. (2020). Estimating reliability of within-person couplings in a multilevel framework. *Journal of Personality Assessment, 102*(1), 10-21. https://doi.org/10.1080/00223891.2018.1521418

Oerlemans, W. G., & Bakker, A. B. (2014). Why extraverts are happier: A day reconstruction study. *Journal of Research in Personality*, *50*, 11–22. https://doi.org/10.1016/j.jrp.2014.02.001

Pavot, W., Diener, E., & Fujita, F. (1990). Extraversion and happiness. *Personality and Individual Differences*, *11*(12), 1299–1306. https://doi.org/10.1016/0191-8869(90)90157-M

Petrova, K., & Schulz, M. S. (2022). Emotional experiences in technology-mediated and in-person interactions: An experience-sampling study. *Cognition & Emotion, 36*(4), 750-757. https://doi.org/10.1080/02699931.2022.2043244

Prati, G., & Mancini, A. D. (2021). The psychological impact of COVID-19 pandemic lockdowns: A review and meta-analysis of longitudinal studies and natural experiments. *Psychological Medicine*, *51*(2), 201–211. https://doi.org/10.1017/S0033291721000015

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research, 42*(1), 185-227. https://doi.org/10.1080/00273170701341316

Preacher, K. J., Zhang, Z., & Zyphur, M. J. (2011). Alternative methods for assessing mediation in multilevel data: The advantages of multilevel SEM. *Structural Equation Modeling, 18*(2), 161-182. https://doi.org/10.1080/10705511.2011.557329

Preacher, K. J., Zhang, Z., & Zyphur, M. J. (2016). Multilevel structural equation models for assessing moderation within and across levels of analysis. *Psychological Methods, 21*(2), 189–205. https://doi.org/10.1037/met0000052

Rammstedt, B., Danner, D., Soto, C. J., & John, O. P. (2020). Validation of the short and extra-short forms of the Big Five Inventory-2 (BFI-2) and their German adaptations. *European Journal of Psychological Assessment, 36*(1), 149–161. https://doi.org/10.1027/1015-5759/a000481

R Core Team (2021). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/

Ren, D., Stavrova, O., & Loh, W. W. (2022). Nonlinear effect of social interaction quantity on psychological well-being: Diminishing returns or inverted U? *Journal of Personality and Social Psychology, 122*(6), 1056–1074. https://doi.org/10.1037/pspi0000373

Rhodes, R. E., & Smith, N. E. I. (2006). Personality correlates of physical activity: A review and meta-analysis. *British Journal of Sports Medicine*, *40*(12), 958–965. https://doi.org/10.1136/bjsm.2006.028860

Schmiedeberg, C., & Thönnissen, C. (2021). Positive and negative perceptions of the COVID-19 pandemic: Does personality play a role? *Social Science & Medicine*, *276*, Article 113859. https://doi.org/10.1016/j.socscimed.2021.113859

Schönbrodt, F. D., Maier, M., Heene, M., & Zehetleitner, M. (2015). *Voluntary commitment to research transparency.* Retrieved from http://www.researchtransparency.org

Sharpe, J. P., Martin, N. R., & Roth, K. A. (2011). Optimism and the Big Five factors of personality: Beyond neuroticism and extraversion. *Personality and Individual Differences, 51*(8), 946-951. https://doi.org/10.1016/j.paid.2011.07.033

Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2012). *A 21 word solution.* Retrieved from http://dx.doi.org/10.2139/ssrn.2160588

Smillie, L. D., Cooper, A. J., Wilt, J., & Revelle, W. (2012). Do extraverts get more bang for the buck? Refining the affective-reactivity hypothesis of extraversion. *Journal of Personality and Social Psychology*, *103*(2), 306–326. https://doi.org/10.1037/a0028372

Smillie, L. D., DeYoung, C. G., & Hall, P. J. (2015). Clarifying the relation between extraversion and positive affect. *Journal of Personality*, *83*(5), 564–574. https://doi.org/10.1111/jopy.12138

Smillie, L. D., Wilt, J., Kabbani, R., Garratt, C., & Revelle, W. (2015). Quality of social experience explains the relation between extraversion and positive affect. *Emotion*, *15*(3), 339–349. https://doi.org/10.1037/emo0000047

Snijders, T. A., van de Bunt, G. G., & Steglich, C. E. (2010). Introduction to stochastic actor-based models for network dynamics. *Social Networks*, *32*(1), 44–60. https://doi.org/10.1016/j.socnet.2009.02.004

Soto, C. J. (2019). How replicable are links between personality traits and consequential life outcomes? The life outcomes of personality replication project. *Psychological Science*, *30*(5), 711–727. https://doi.org/10.1177/0956797619831612

Soto, C. J., & John, O. P. (2017). Short and extra-short forms of the Big Five Inventory–2: The BFI-2-S and BFI-2-XS. *Journal of Research in Personality*, *68*, 69–81. https://doi.org/10.1016/j.jrp.2017.02.004

Srivastava, S., Angelo, K. M., & Vallereux, S. R. (2008). Extraversion and positive affect: A day reconstruction study of person–environment transactions. *Journal of Research in Personality*, *42*(6), 1613–1618. https://doi.org/10.1016/j.jrp.2008.05.002

Stadtfeld, C., & Block, P. (2017). Interactions, actors, and time: Dynamic network actor models for relational events. *Sociological Science*, *4*, 318–352. https://doi.org/10.15195/v4.a14

Steel, P., Schmidt, J., & Shultz, J. (2008). Refining the relationship between personality and subjective well-being. *Psychological Bulletin*, *134*(1), 138–161. https://doi.org/10.1037/0033-2909.134.1.138

Sun, J., Harris, K., & Vazire, S. (2020). Is well-being associated with the quantity and quality of social interactions? *Journal of Personality and Social Psychology*, *119*(6), 1478–1496. https://doi.org/10.1037/pspp0000272

Sun, J., Stevenson, K., Kabbani, R., Richardson, B., & Smillie, L. D. (2017). The pleasure of making a difference: Perceived social contribution explains the relation between extraverted behavior and positive affect. *Emotion*, *17*(5), 794–810. https://doi.org/10.1037/emo0000273

Tett, R. P., Toich, M. J., & Ozkum, S. B. (2021). Trait activation theory: A review of the literature and applications to five lines of personality dynamics research. *Annual Review of Organizational Psychology and Organizational Behavior*, *8*(1), 199–233. https://doi.org/10.1146/annurev-orgpsych-012420-062228

Tomori, D. V., Rübsamen, N., Berger, T., Scholz, S., Walde, J., Wittenberg, I., Lange, B., Kuhlmann, A., Horn, J., Mikolajczyk, R., Jaeger, V. K., & Karch, A. (2021). Individual social contact data and population mobility data as early markers of SARS-CoV-2 transmission dynamics during the first wave in Germany—an analysis based on the COVIMOD study. *BMC Medicine, 19*, 271. https://doi.org/10.1186/s12916-021-02139-6

van Zalk, M. H. W., Nestler, S., Geukes, K., Hutteman, R., & Back, M. D. (2020). The codevelopment of extraversion and friendships: Bonding and behavioral interaction mechanisms in friendship networks. *Journal of Personality and Social Psychology*, *118*(6), 1269–1290. https://doi.org/10.1037/pspp0000253

Venaglia, R. B., & Lemay, E. P. (2017). Hedonic benefits of close and distant interaction partners: The mediating roles of social approval and authenticity. *Personality and Social Psychology Bulletin*, *43*(9), 1255–1267. https://doi.org/10.1177/0146167217711917

Viechtbauer, W. (2010). Conducting meta-analyses in R with the metafor package. *Journal of Statistical Software*, *36*(3), 1–48. https://doi.org/10.18637/jss.v036.i03

Wacker, J., & Smillie, L. D. (2015). Trait extraversion and dopamine function. *Social and Personality Psychology Compass*, *9*(6), 225–238. https://doi.org/10.1111/spc3.12175

Wagner, J., Lüdtke, O., Roberts, B. W., & Trautwein, U. (2014). Who belongs to me? Social relationship and personality characteristics in the transition to young adulthood. *European Journal of Personality*, *28*(6), 586–603. https://doi.org/10.1002/per.1974

Watson, D., & Clark, L. A. (1994). *The PANAS-X: Manual for the Positive and Negative Affect Schedule-Expanded Form.* Ames: The University of Iowa.

Wijngaards, I., Sisouw de Zilwa, S. C. M., & Burger, M. J. (2020). Extraversion moderates the relationship between the stringency of COVID-19 protective measures and depressive symptoms. *Frontiers in Psychology*, *11*, Article 568907. https://doi.org/10.3389/fpsyg.2020.568907

Wilson, K. E., & Dishman, R. K. (2015). Personality and physical activity: A systematic review and meta-analysis. *Personality and Individual Differences*, *72*, 230–242. https://doi.org/10.1016/j.paid.2014.08.023

Wilson, R. E., Harris, K., & Vazire, S. (2015). Personality and friendship satisfaction in daily life: Do everyday social interactions account for individual differences in friendship satisfaction? *European Journal of Personality*, *29*(2), 173–186. https://doi.org/10.1002/per.1996

Wrzus, C., & Neubauer, A. B. (2022). Ecological momentary assessment: A meta-analysis on designs, samples, and compliance across research fields. *Assessment.* Advance online publication. https://doi.org/10.1177/10731911211067538

Zacher, H., & Rudolph, C. W. (2021). Individual differences and changes in subjective wellbeing during the early stages of the COVID-19 pandemic. *The American Psychologist*, *76*(1), 50–62. https://doi.org/10.1037/amp0000702

Zettler, I., Schild, C., Lilleholt, L., Kroencke, L., Utesch, T., Moshagen, M., Böhm, R., Back, M. D., & Geukes, K. (2022). The role of personality in COVID-19-related perceptions, evaluations, and behaviors: Findings across five samples, nine traits, and 17 criteria. *Social Psychological and Personality Science*, *13*(1), 299–310. https://doi.org/10.1177/19485506211001680

Zitzmann, S., & Hecht, M. (2019). Going beyond convergence in Bayesian estimation: Why precision matters too and how to assess it. *Structural Equation Modeling: A Multidisciplinary Journal, 26*(4), 646-661. https://doi.org/10.1080/10705511.2018.1545232

Appendix

Table A1

Overview of Research Models and Equations

	Study 1	Studies 2 and 3
	Latent decomposition $S_{ti} = S_{w,ti} + S_{b,i}$ $M_{ti} = M_{w,ti} + M_{b,i}$ $Y_{ti} = Y_{w,ti} + Y_{b,i}$	Latent decomposition $S_{ti} = S_{w,ti} + S_{b,i}$ $M^*_{ti} = M^*_{w,ti} + M^*_{b,i}$ $M_{ti} = 0, \quad M^*_{ti} < \tau$ $M_{ti} = 1, \quad M^*_{ti} \geq \tau$ $Y_{ti} = Y_{w,ti} + Y_{b,i}$
Model 1	Path c Within-person level: $Y_{ti} = \beta_{y0i} + e_{yti}$ (1a) Between-person level: $\beta_{y0i} = \gamma_{y00} + \gamma_{cb}E_i + u_{y0i}$ (1b) Main effect Between-person level: γ_{cb}	Path c Within-person level: $Y_{ti} = \beta_{y0i} + e_{yti}$ (13a) Between-person level: $\beta_{y0i} = \gamma_{y00} + \gamma_{cb}E_i + u_{y0i}$ (13b) Main effect Between-person level: γ_{cb}
Model 2	Path a Within-person level: $M_{ti} = \beta_{m0i} + e_{mti}$ (2a) Between-person level: $\beta_{m0i} = \gamma_{m00} + \gamma_{ab}E_i + u_{m0i}$ (2b)	Path a Within-person level: $P(M_{ti} = 1) = \Phi(\beta_{m0i})$ (14a) Between-person level: $\beta_{m0i} = \gamma_{m00} + \gamma_{ab}E_i + u_{m0i}$ (14b)

	Paths b and c’ Within-person level: $Y_{ti} = \beta_{y0i} + e_{yti}$ (3a) Between-person level: $\beta_{y0i} = \gamma_{y00} + \gamma_{bb}M_{b,i} + \gamma_{c'b}E_i + u_{y0i}$ (3b)	Paths b and c’ Within-person level: $Y_{ti} = \beta_{y0i} + e_{yti}$ (15a) Between-person level: $\beta_{y0i} = \gamma_{y00} + \gamma_{bb}M^*_{b,i} + \gamma_{c'b}E_i + u_{y0i}$ (15b)
	Indirect effect Between-person level: $\gamma_{ab} * \gamma_{bb}$ (4)	Indirect effect Between-person level: $\gamma_{ab} * \gamma_{bb}$ (16)
Model 3	Paths b1, b2, and b3 Within-person level: $Y_{ti} = \beta_{y0i} + e_{yti}$ (5a) Between-person level: $\beta_{y0i} = \gamma_{y00} + \gamma_{bb1}M_{b,i} + \gamma_{bb2}E_i + \gamma_{bb3}E_iM_{b,i} + u_{y0i}$ (5b)	Paths b1, b2, and b3 Within-person level: $Y_{ti} = \beta_{y0i} + \beta_{bw1i}M^*_{w,ti} + e_{yti}$ (17a) Between-person level: $\beta_{y0i} = \gamma_{y00} + \gamma_{bb1}M^*_{b,i} + \gamma_{bb2}E_i + \gamma_{bb3}E_iM^*_{b,i} + u_{y0i}$ (17b) $\beta_{bw1i} = \gamma_{bw1} + \gamma_{bw3}E_i + u_{y1i}$ (17c)
	Moderation effect Between-person interaction: γ_{bb3}	Moderation effect Cross-level interaction: γ_{bw3} Between-person interaction: γ_{bb3}
Model 4	Paths c1, c2, and c3 Within-person level: $Y_{ti} = \beta_{y0i} + e_{yti}$ (6a) Between-person level: $\beta_{y0i} = \gamma_{y00} + \gamma_{cb1}S_{b,i} + \gamma_{cb2}E_i + \gamma_{cb3}E_iS_{b,i} + u_{y0i}$ (6b)	Paths c1, c2, and c3 Within-person level: $Y_{ti} = \beta_{y0i} + \beta_{cw1i}S_{w,ti} + e_{yti}$ (18a) Between-person level: $\beta_{y0i} = \gamma_{y00} + \gamma_{cb1}S_{b,i} + \gamma_{cb2}E_i + \gamma_{cb3}E_iS_{b,i} + u_{y0i}$ (18b) $\beta_{cw1i} = \gamma_{cw1} + \gamma_{cw3}E_i + u_{y1i}$ (18c)
	Moderation effect	Moderation effect

	Between-person interaction: γ_{cb3}	Cross-level interaction: γ_{cw3} Between-person interaction: γ_{cb3}
Model 5	<u>Path a</u> Within-person level: $M_{ti} = \beta_{m0i} + e_{mti}$ (7a) Between-person level: $\beta_{m0i} = \gamma_{m00} + \gamma_{ab1}S_{b,i} + \gamma_{ab2}E_i + \gamma_{ab3}E_iS_{b,i} + u_{m0i}$ (7b)	<u>Path a</u> Within-person level: $P(M_{ti} = 1) = \Phi(\beta_{m0i} + \beta_{aw1i}S_{w,ti})$ (19a) Between-person level: $\beta_{m0i} = \gamma_{m00} + \gamma_{ab1}S_{b,i} + y_{ab2}E_i + \gamma_{ab3}E_iS_{b,i} + u_{m0i}$ (19b) $\beta_{aw1i} = \gamma_{aw1} + y_{aw3}E_i + u_{m1i}$ (19c)
	<u>Paths b and c'</u> Within-person level: $Y_{ti} = \beta_{y0i} + e_{yti}$ (8a) Between-person level: $\beta_{y0i} = \gamma_{y00} + \gamma_{bb}M_{b,i} + \gamma_{c'b1}S_{b,i} + \gamma_{c'b2}E_i + \gamma_{c'b3}E_iS_{b,i} + u_{y0i}$ (8b)	<u>Paths b and c'</u> Within-person level: $Y_{ti} = \beta_{y0i} + \beta_{bwi}M^*_{w,ti} + \beta_{c'w1i}S_{w,ti} + e_{yti}$ (20a) Between-person level: $\beta_{y0i} = \gamma_{y00} + \gamma_{bb}M^*_{b,i} + \gamma_{c'b1}S_{b,i} + y_{c'b2}E_i + \gamma_{c'b3}E_iS_{b,i} + u_{y0i}$ (20b) $\beta_{bwi} = \gamma_{bw} + u_{y1i}$ (20c) $\beta_{c'w1i} = \gamma_{c'w1} + y_{c'w3}E_i + u_{y2i}$ (20d)
	<u>Moderated mediation effect</u> Between-person level: $\gamma_{ab3} * \gamma_{bb}$ (9)	<u>Moderated mediation effect</u> Within-person level: $\gamma_{aw3} * \gamma_{bw}$ (21a) Between-person level: $\gamma_{ab3} * \gamma_{bb}$ (21b)
Model 6	<u>Path a</u> Within-person level: $M_{ti} = \beta_{m0i} + e_{mti}$ (10a) Between-person level:	<u>Path a</u> Within-person level: $P(M_{ti} = 1) = \Phi(\beta_{m0i} + \beta_{awi}S_{w,ti})$ (22a) Between-person level:

$\beta_{m0i} = \gamma_{m00} + \gamma_{ab}S_{b,i} + u_{m0i}$ (10b)

Paths b and c'
Within-person level:
$Y_{ti} = \beta_{y0i} + e_{yti}$ (11a)
Between-person level:
$\beta_{y0i} = \gamma_{y00} + \gamma_{bb1}M_{b,i} + \gamma_{bb2}E_i + \gamma_{bb3}E_iM_{b,i} + \gamma_{c'b}S_{b,i} + u_{y0i}$ (11b)

Moderated mediation effect

Between-person level:
$\gamma_{ab} * \gamma_{bb3}$ (12)

$\beta_{m0i} = \gamma_{m00} + \gamma_{ab}S_{b,i} + u_{m0i}$ (22b)
$\beta_{awi} = \gamma_{aw} + u_{m1i}$ (22c)

Paths b and c'
Within-person level:
$Y_{ti} = \beta_{y0i} + \beta_{bw1i}M^*_{w,ti} + \beta_{c'wi}S_{w,ti} + e_{yti}$ (23a)
Between-person level:
$\beta_{y0i} = \gamma_{y00} + \gamma_{bb1}M^*_{b,i} + \gamma_{bb2}E_i + \gamma_{bb3}E_iM^*_{b,i} + \gamma_{c'b}S_{b,i} + u_{y0i}$ (23b)
$\beta_{bw1i} = \gamma_{bw1} + \gamma_{bw3}E_i + u_{y1i}$ (23c)
$\beta_{c'wi} = \gamma_{c'w} + u_{y2i}$ (23d)

Moderated mediation effect
Within-person level:
$\gamma_{aw} * \gamma_{bw3}$ (24a)
Between-person level:
$\gamma_{ab} * \gamma_{bb3}$ (24b)

Note. We use the following notation: Y = well-being (Study 1: happiness or life satisfaction, Studies 2 and 3: positive affect), M = social activities (Study 1: social time, Studies 2 and 3: social interactions), S = regulation stringency, E = extraversion, e = residual variance on Level 1, u = residual variance on Level 2. Latent between-person components carry the suffix *b*, and latent within-person components carry the suffix *w*. The suffix *t* is used to denote time, and the suffix *i* is used to denote individuals.