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No party no joy?—Changes in university students' extraversion, neuroticism, and subjective well-being during two COVID-19 lockdowns

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Abstract

The COVID-19 lockdowns represent a major life event with an immense impact on university students' lives. Findings prior to the pandemic suggest that changes in personality and subjective well-being (SWB) can occur after critical life events or psychological interventions. The present study examined how university students' extraversion, neuroticism, and SWB changed during two COVID-19 lockdowns in Germany. To this end, we conducted a partly preregistered, two-cohort study with four measurement points each from October 2019 to May 2021 ($N_{Study\ 1} = 81–148$, $N_{Study\ 2} = 82–97$). We used both multilevel contrast analyses and multi-group random-intercept cross-lagged panel models to examine within-person changes over time. Levels of life satisfaction, extraversion, and, unexpectedly, neuroticism were lower during both lockdowns. Students' affect improved during the first but deteriorated during the second lockdown, suggesting that similar experiences with the deceleration of daily life were associated with different affective outcomes during the two lockdown periods. Following the introduction or termination of a lockdown, changes in extraversion (neuroticism) were consistently positively (negatively) associated with

changes in SWB. Our results stress the importance of disentangling between- and within-person processes and using pre-COVID baseline levels to examine changes in personality and SWB.

KEYWORDS

COVID-19 lockdown, extraversion, longitudinal changes, neuroticism, random-intercept cross-lagged panel models, subjective well-being

INTRODUCTION

> Initially the lockdown felt "relaxing" as all weekly appointments were cancelled. Then total social isolation. Toward the end, increased listlessness and above all a lack of motivation to do anything about it. Anonymous university student

Around the globe, the COVID-19 pandemic and its accompanying lockdowns have had an enormous impact on people's daily lives. Among other social groups, university students have been severely affected by many restrictions imposed by national governments and additional changes due to a complete reorganization of education: First, in Germany, in-person teaching was abruptly terminated and later changed to online classes; upcoming internships and exams were postponed for an indefinite time (Cao et al., 2020). Second, most student activities outside of teaching could no longer be carried out. Due to the fear of infection and transmission (Bao et al., 2020), many students were socially isolated from their peers and moved back in with their parents in their hometowns (Elmer et al., 2020). Third, the lockdowns also caused a loss of income for many students, as numerous student jobs—such as working in a restaurant, bar, or retail store—were terminated, in the worst-case scenario leading them to drop out of their studies for financial reasons (Zhai & Du, 2020).

We can perhaps best characterize these experiences, which shaped students' everyday lives, as major life events (see Figure 1, for an overview of the lockdown situation in Germany in 2020 and 2021). Major life events are defined as "environmental changes that have a definable beginning point in time and that would be expected to be associated with at least some degree of psychological threat, unpleasantness, or behavioral demands" (Harkness & Monroe, 2016, p. 729). They involve challenges, threats, or obstacles inflicted by physical and social environments (Monroe & Slavich, 2020) that require a behavioral, affective, or cognitive response. Research on personality development has revealed that well-being and aspects of personality, such as neuroticism, extraversion, and conscientiousness, can change within short periods of time following such major life events (e.g., Bleidorn et al., 2018; Luhmann et al., 2012). While these studies have not yet reached consensus on the short-livedness or longevity of these personality changes, no studies so far, to our knowledge, examined how (even) short-term changes in personality enable us to better understand changes in well-being during such major life events.

The rapidly increasing literature on how the COVID-19 pandemic has resulted in behavioral and affective changes across diverse populations (for reviews, see Aknin et al., 2021; Panda et al., 2021; Prati & Mancini, 2021; Xiong et al., 2020) faces several conceptual and methodological challenges. First, as researchers could not anticipate the pandemic, most COVID-19 studies

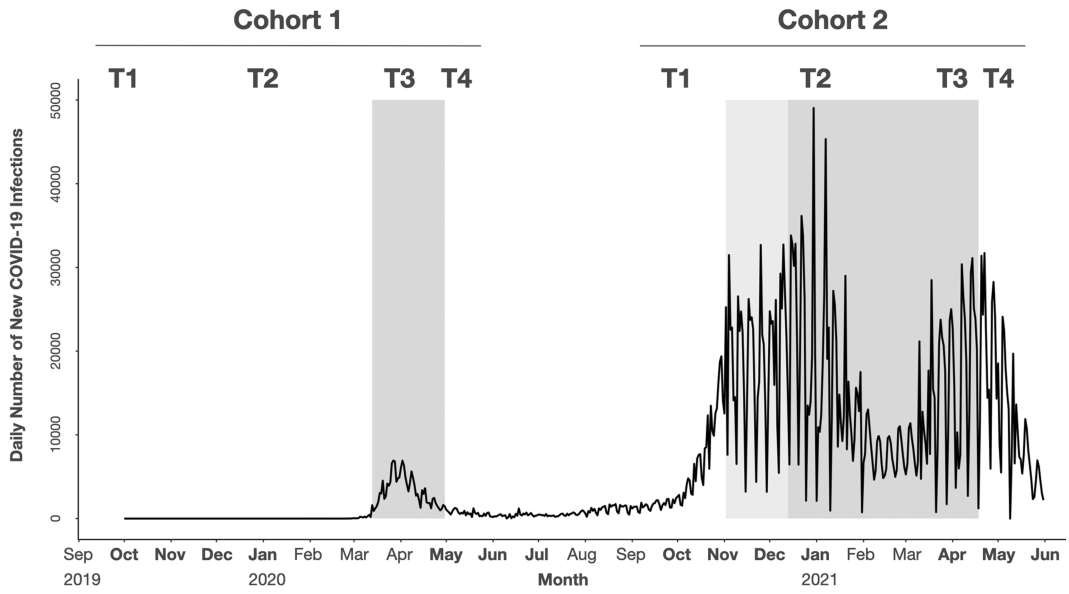

FIGURE 1 Daily number of new COVID-19 infections in Germany is displayed from September 2019 until May 2021. Lockdowns are highlighted in gray; the "partial lockdown" (November and December 2020) is highlighted in light gray. Restrictions in lockdowns included, among others, shutting down social life, banning public gatherings, closing schools and non-essential businesses (e.g., restaurants, bars, and leisure centers), and requiring students and employees to work remotely. The vaccination rollout affected only few students during the period of the study. For more information on the restrictions in Germany, see Kantis et al. (2021). T1 to T4 represent the four measurement points in each survey. All months marked in bold indicate months when teaching took place at the university. With respect to teaching, April was the only month during the study period that was different for the two cohorts: In April 2020, all teaching was canceled, whereas in April 2021, teaching took place online

have been conducted cross-sectionally and without pre-COVID baseline levels (but see, for instance, Folk et al., 2020; Sibley et al., 2020; Zacher & Rudolph, 2021a, 2021b). However, only comparisons with pre-COVID baseline levels can meet the requirements for detecting potential changes in personality or well-being triggered by a major life event (Sheldon & Lucas, 2014). Second, conceptually, researchers are interested in the impact of the pandemic on intra-individual changes (i.e., how people's personality and SWB have deviated from their baseline levels due to the pandemic), but most previous studies have not used designs or modeling approaches that could adequately address this question. Third, the longitudinal studies that have been able to overcome this issue have mostly concerned the early stages of the pandemic (but see Anglim & Horwood, 2021). Little is known about the effects of second-wave lockdowns and potential differences from first-wave lockdowns. We aim to address these challenges with our two-cohort study spanning a time frame of 1.5 years.

THEORETICAL BACKGROUND

Subjective well-being

Subjective well-being (SWB) is a multidimensional measure that includes both cognitive and affective components of well-being (Diener, 1984). Life satisfaction, the cognitive component of

SWB, describes an overall evaluation of one's life, whereas affective well-being refers to a person's emotions, feelings, and moods, that is, the degree to which people experience positive affect (PA) and negative affect (NA).

Following the experience of a negative major life event, decreases in SWB have consistently been reported (e.g., Luhmann et al., 2012). Many researchers (e.g., Holmes et al., 2020), the media (e.g., Meredith, 2020), and international organizations (e.g., WHO, 2020) warned that the lockdowns would have a tremendous negative impact on students' SWB. However, the results of studies that have tested this prediction have not been as clear-cut as initially expected: Some studies have reported that the lockdowns were on average detrimental (e.g., Anglim et al., 2020), negligible (e.g., Aknin et al., 2021), or even conducive (e.g., Recchi et al., 2020) to SWB. Notwithstanding the overall apparently mixed effects on well-being, some data have suggested that the well-being of university students could be particularly affected (Rajkumar, 2020; Zhai & Du, 2020). In addition, the mixed results of previous studies may be a consequence of analytical approaches not taking the stability of the constructs into account, possibly leading to confounding results (Hamaker et al., 2015). Focusing on intraindividual processes, we hypothesized that SWB levels (H*1a*) decreased during the lockdowns compared with the times with no lockdown.

Extraversion and neuroticism

One way to achieve a better understanding of why university students experience changes in their SWB is to examine changes in their personality as well, because the two variables are typically related to each other (e.g., Anglim et al., 2020; Kroencke et al., 2020; Modersitzki et al., 2021). Conceptually, the two of the personality factors—extraversion and neuroticism—show the strongest associations with SWB (e.g., Costa & McCrae, 1980) and may have been particularly susceptible to change during the lockdowns (e.g., Modersitzki et al., 2021; Zacher, Rudolph, 2021b). Individuals scoring high on extraversion are inclined to be sociable and active, yet they are more prone to boredom when they must spend time by themselves. Instead, they take great pleasure in attending social gatherings—activities that were rarely or not at all feasible during the lockdown (e.g., Buecker et al., 2020). Extraversion thus plays a special role during the pandemic, since the lockdowns represent an exogenous event which influences whether and how people can behave extravertly. Individuals scoring high on neuroticism usually have a higher reactivity to stress than average and tend to be less emotionally stable (Barlow et al., 2014). They often experience feelings, such as anxiety, worry, and loneliness, mostly triggered by stressors associated with uncertainty and threat (Kroencke et al., 2020; Lahey, 2009). Viewed through this lens, both COVID-19 lockdowns may represent such an unfamiliar event, triggering feelings of uncertainty and isolation (e.g., Bao et al., 2020; Zhai & Du, 2020).

Whereas recent COVID-19 research has already examined whether personality factors moderate the behaviors (e.g., Folk et al., 2020) and the psychological consequences of the pandemic (e.g., Zacher & Rudolph, 2021b), the extents to which extraversion and neuroticism may have changed during the pandemic have not yet been considered (cf. Sutin et al., 2020). When considering changes in personality, recent studies have suggested that such changes follow major life events (Lüdtke et al., 2011), events that are considered unusual (Headey, 2007), and even relatively short interventions of only a few weeks (Roberts et al., 2017; Stieger et al., 2020). During the lockdowns, students' extraversion levels may

have been lower than usual because students were limited in their ability to engage in extraverted behavior due to the social restrictions. Moreover, many students may have assessed the lockdowns as negative life events due to financial worries and increased stress (Kroencke et al., 2020; Zhai & Du, 2020), which may be reflected in higher neuroticism levels (Lüdtke et al., 2011). Thus, we hypothesized that levels of extraversion (H*1b*) decreased during the lockdowns compared with the times with no lockdown, whereas we expected to find that levels of neuroticism increased (H*1c*).

The interplay of extraversion, neuroticism, and SWB

On an intraindividual level, previous research has suggested that the factors of personality and SWB are interrelated and tend to change in unison (Boyce et al., 2013). That is, prior studies have reported positive correlations between changes in SWB and extraversion and negative correlations between changes in SWB and neuroticism. We built on these findings and hypothesized that when the lockdowns were introduced or lifted (i.e., after a major transition), changes in SWB were positively related to changes in extraversion (H*2a*) and negatively related to changes in neuroticism (H*2b*).

Although previous studies have shown that both extraversion and neuroticism are related to SWB, findings on whether the direction of the relationship is unilateral or reciprocal have been inconsistent. In some studies, changes in personality have preceded changes in SWB (Charles et al., 2001; Griffin et al., 2006), whereas in other studies, changes in SWB have subsequently predicted changes in personality (Specht et al., 2013). One large-scale study with more than 16,000 participants reported a reciprocal influence of personality and SWB over time (Soto, 2015). Thus, we hypothesized that all cross-lagged relationships were positive for extraversion and SWB (H*3a*) and negative for neuroticism and SWB (H*3b*). We further explored whether the directions of these prospective relations, if at all, were unilateral or reciprocal.

METHODS

Participants and procedure

For two consecutive years, we conducted identical studies with two first-year psychology student cohorts at a German university. Figure 1 presents the four nearly equidistant measurement points, which cover the periods October 2019 to May 2020 and October 2020 to May 2021, respectively. The two cohorts were each surveyed at times with and without lockdowns, enabling us to detect changes in personality and SWB and to compare the two cohorts accordingly. The surveys took approximately 10 min to complete and were sent via email to the participants. All students provided informed consent and had the chance to receive (a) research credit, (b) individual feedback reports at the end of the study, or (c) one of five 10€ Amazon gift cards that were raffled to the participants.

The maximum number of students qualifying for participation was limited by the total size of the cohort of enrolled students. The total number of students enrolled in the first cohort was 162. Of these, between 81 (at T4; 98 at T3; 116 at T2) and 148 (at T1) students participated in

the four times of measurement for a total of $k = 443$ ($M = 110.75$) completed surveys. Fifty percent of the participants were between 19 and 23 years old ($M = 21.9$, $SD = 6.0$), and 78.6% of participants were female.[1] None of the students had been infected with or vaccinated against COVID-19. Between T2 and T4, the participation rate ranged from 52.7% to 76.4%.

The total number of students enrolled in the second cohort was 114. Of these, between 82 (at T3; 83 at T2; 85 at T4) and 97 (at T1) students participated in the four times of measurement for a total of $k = 347$ ($M = 86.75$) completed surveys. Fifty percent were between 19 and 21.5 years old ($M = 20.9$, $SD = 4.4$), and 77.8% percent were female. One student (1.2%) had been infected with COVID-19, and, at the last time of measurement, 34 students (39.5%) had been vaccinated at least once. Between T2 and T4, the participation rate ranged from 84.5% to 87.6%.

Measures

Unless otherwise noted, all rating scales were answered on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*very*). In the first two surveys in each cohort, participants were asked to indicate the answer that was generally most likely to apply to them, whereas in the last two surveys, they were asked to aggregate their experiences across the previous week. For the repeated administration of surveys (e.g., in longitudinal designs), short scales offer several advantages over both longer-item scales and single-item measures. They result in a decreased time requirement and less participant fatigue, resulting in smaller proportions of missing data; in contrast to single-item measures, however, they allow an estimation of reliability. Following best practices in multilevel reliability calculation, we computed the composite reliability (omega), the two-level alpha (see the supporting information), and the maximal reliability (H; see the supporting information) at both the within-person and between-person levels (Geldhof et al., 2014).

Subjective well-being

SWB was assessed with items for both the cognitive (life satisfaction) and the affective (PA and NA) components. Life satisfaction was measured with the Life Satisfaction Scale (Diener & Emmons, 1985). The scale consists of five items (e.g., "The conditions of my life are excellent") ranging from 1 (*do not agree at all*) to 7 (*totally agree*) on a 7-point Likert scale.[2] Two items for PA ("good" and "calm") and two items for NA ("dissatisfied" and "restless") were derived from the Multidimensional Mood State Questionnaire (Steyer et al., 1997). The within-person (between-person) omega was .81 (.97) for life satisfaction, .64 (.86) for PA, and .55 (.71) for NA.

Personality

The two personality factors—extraversion ("outgoing," "sociable," and "lively") and neuroticism ("vulnerable," "sensitive," and "capricious") were measured with three items each using a short one-word version of the Big Five Scale (Ostendorf, 1990). The within-person (between-person) omega was .75 (.91) for extraversion and .70 (.91) for neuroticism.

Statistical procedure

All statistical analyses were carried out using *R* 4.0.3 (R Core Team, 2021). The preregistration for the second cohort, from which we did not deviate, the data, R scripts, and all materials, is openly available at our OSF repository (https://osf.io/634va/).

Multilevel contrast analyses

Given the clustered nature of the data in each sample (times of measurement nested in participants), we first computed the intraclass correlations (ICC) to examine the degree to which the variance could be split into within-person and between-person variance. As all variables varied substantially within and between persons (see the supporting information for the ICCs), we used the *lme4* package (Bates et al., 2014) to estimate random intercept models with fixed slopes. Multilevel models take different levels of analysis into account (level 2 = participants, level 1 = measurement points) and thus allow for residual components at each of these levels (Diez-Roux, 2000). To examine H*1a* to H*1c*, we specified a priori contrasts with the *emmeans* package (Lenth, 2020). Specifically, we tested differences in the measured variables during the lockdowns compared with before and after the lockdowns. That is, in the first cohort, we compared T1, T2, and T4 (no lockdown) with T3 (lockdown), resulting in a contrast of 1, 1, −3, 1. In the second cohort, we compared T1 and T4 (no lockdown) with T2 and T3 (lockdown), resulting in a contrast of 1, −1, −1, 1.[3]

Random-intercept cross-lagged panel models

First introduced by Hamaker et al. (2015), the random-intercept cross-lagged panel model (RI-CLPM) decomposes the observed scores into a time-invariant between-person part ("trait-like") and a time-variant within-person part ("state-like" deviations from the trait). As such, the RI-CLPM surpasses the traditional cross-lagged panel model (CLPM), which does not take the stability of constructs into account, possibly leading to confounding results between trait and state aspects (Hamaker et al., 2015). Instead, we were able to overcome the difficulties of having estimates that were potentially biased by the stability of our constructs and were able to analyze pure intraindividual change.

We used the *lavaan* package (Rosseel, 2012) and a full information maximum likelihood estimator (FIML) with robust standard errors to estimate six multiple-group RI-CLPMs (one for each combination of personality and SWB) that were grouped by cohort (see Figure 2). The four repeated measures of a set of two variables (e.g., neuroticism and NA) can be presented as within-person latent factors, referring to intrapersonal deviations from the expected person-specific scores, and a latent intercept factor for each variable, accounting for the trait-like stability of the variables. We estimated the within-time correlations to examine H*2a* and H*2b* and the cross-lagged effects to examine H*3a* and H*3b*.

Model fit was evaluated via multiple fit indices (Hu & Bentler, 1999): the χ^2 goodness-of-fit statistic, the comparative fit index (CFI) $\geq$ .95, the root mean square error of approximation (RMSEA) $\leq$ .08, and the standardized root mean square residual (SRMR) $\leq$ .08. To test for differences in model fit, we concluded that the models did not differ when ΔCFI $\leq$ .01 and ΔRMSEA $\leq$ .015 or ΔSRMR $\leq$ .03 (Chen, 2007). We further considered ΔMcDonald's NCI, following the recommendations of Kang et al. (2016).

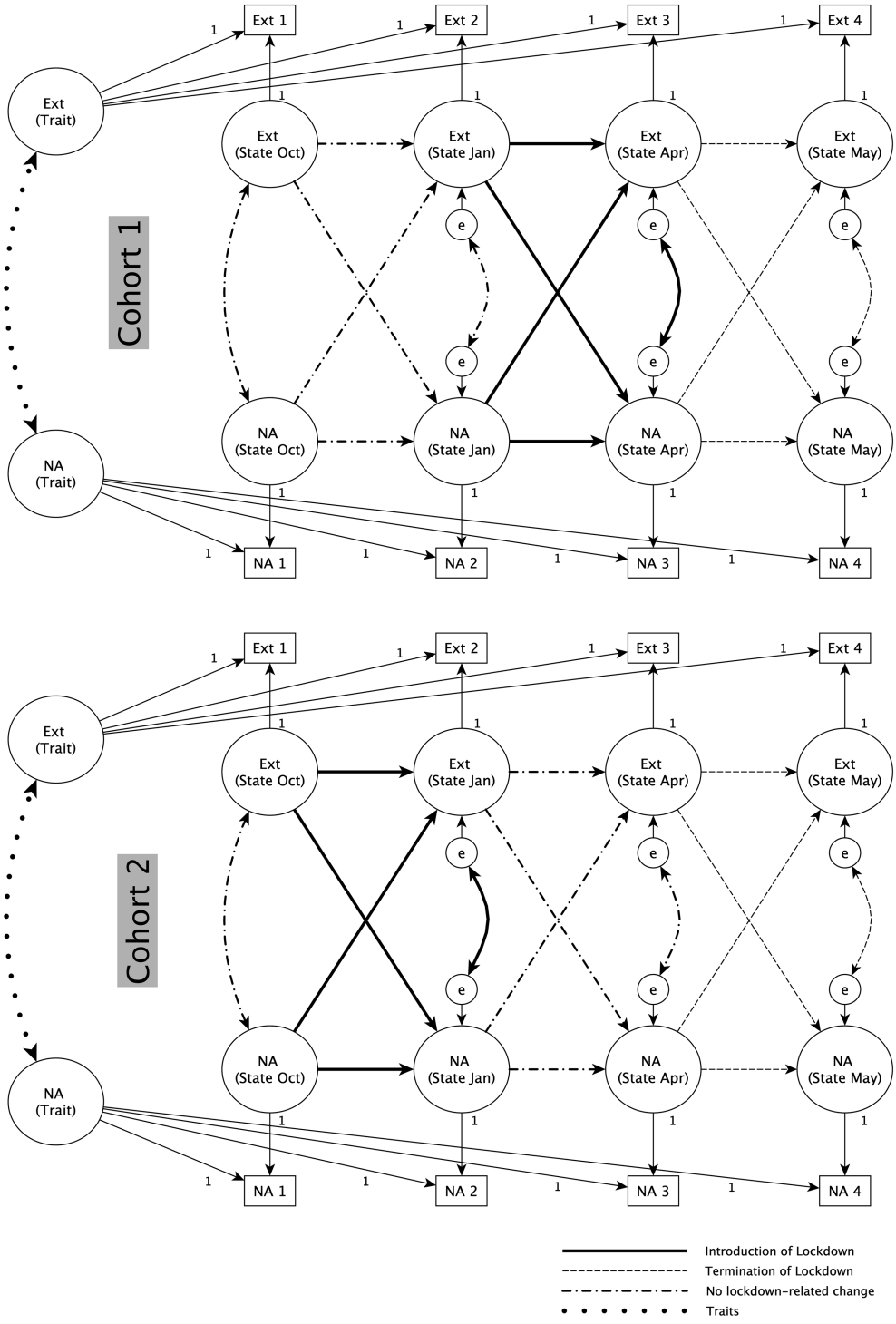

FIGURE 2 A two-cohort RI-CLPM depicting the relationship between extraversion and NA across four measurement points. Theoretical constraints are highlighted by different types of lines. Details about the computation can be found in Hamaker et al. (2015)

RESULTS

Mean-level changes in SWB and personality

Table 1 presents the means and standard deviations of the study variables. In line with H*1a*, levels of life satisfaction were significantly lower during the lockdowns in both the first ($b = 1.13$, 95% CI [0.70, 1.56], $p < .001$) and second ($b = 0.71$, 95% CI [0.33, 1.08], $p < .001$) cohort. The difference in life satisfaction scores during the lockdowns compared with times without a lockdown were −0.57 and −0.24 on the 5-point Likert scale.

For PA and NA, the results for the two cohorts were mixed and only partly supported our hypotheses. Levels of PA were significantly higher during the first lockdown ($b = -0.71$, 95% CI [−1.19, −0.23], $p = .004$) but significantly lower during the second lockdown compared with the times before and after the lockdown ($b = 0.60$, 95% CI [0.33, 0.88], $p < .001$). The average deviations in PA during the lockdowns were +0.24 and −0.20 on the 5-point Likert scale compared with the times without a lockdown. Levels of NA were nonsignificantly lower during the first lockdown ($b = -0.18$, 95% CI [−0.72, −0.36], $p = .509$) but significantly higher during the second lockdown compared with the times before and after the lockdown ($b = 0.42$, 95% CI [0.10, 0.73], $p = .010$). The average deviations in NA during the lockdowns were −0.06 and +0.14 on the 5-point Likert scale compared with the times without a lockdown. Thus, H*1a* was partially supported.[4]

In line with H*1b*, levels of extraversion were significantly lower during the lockdowns in both the first ($b = 1.06$, 95% CI [0.70, 1.43], $p < .001$) and second ($b = 0.72$, 95% CI [0.42, 1.02], $p < .001$) cohort. The average deviations in extraversion during the lockdowns were −0.35 and −0.24 on the 5-point Likert scale compared with the times without a lockdown. Thus, H*1b* was supported. Contrary to H*1c*, levels of neuroticism were significantly lower during the lockdown in the first cohort ($b = -0.72$, 95% CI [−1.16, −0.28], $p = .001$). In the second cohort, neuroticism was nonsignificantly lower during the lockdown ($b = -0.13$, 95% CI [−0.44, 0.18], $p = .412$). The average deviations in neuroticism during the lockdowns were −0.24 and −0.06 on the 5-point Likert scale compared with the times without a lockdown. Thus, H*1c* was not supported.

TABLE 1 Descriptive statistics for the two cohorts

	Cohort 1				Cohort 2			
	October 19	**January 20**	**April 20**	**May 20**	**October 20**	**January 21**	**April 21**	**May 21**
Ext	**3.64** (0.73)	**3.55** (0.72)	**3.15** (0.82)	**3.35** (0.79)	**3.56** (0.81)	**3.14** (0.92)	**3.37** (1.11)	**3.64** (0.81)
Neu	**3.43** (0.83)	**3.49** (0.81)	**3.08** (0.96)	**3.00** (1.06)	**3.45** (0.83)	**3.23** (0.97)	**3.17** (1.13)	**2.83** (0.93)
LS	**5.23** (1.23)	/	**4.48** (1.22)	**4.83** (1.20)	**5.39** (0.99)	**5.11** (0.90)	**4.58** (1.17)	**4.99** (1.26)
PA	**3.31** (0.91)	**3.29** (0.89)	**3.52** (0.85)	**3.31** (0.85)	**3.46** (0.68)	**3.28** (0.68)	**2.98** (0.89)	**3.41** (0.86)
NA	**2.85** (0.99)	**2.76** (1.02)	**2.68** (0.99)	**2.65** (1.03)	**2.46** (0.81)	**2.72** (0.89)	**2.98** (0.97)	**2.80** (1.00)

Note: Means and standard deviations are displayed for all study variables. The COVID-19 lockdown periods are presented in gray. Life satisfaction was not measured at T2 in Cohort 1.

Abbreviations: Ext = extraversion; LS, life satisfaction; NA, negative affect; Neu, neuroticism; PA, positive affect.

Intraindividual changes in SWB and personality

For all six RI-CLPMs, the lagged regression coefficients and (residual) (co)variances were first allowed to differ across the two cohorts. In a next step, we constrained the parameters of the two cohorts to be equal (Mulder & Hamaker, 2020). These constraints resulted in a significantly worse fit for the extraversion models—indicating that there was a moderation effect by cohort—but not for the neuroticism models, for which the intraindividual processes could be restricted to equality across cohorts. We also imposed constraints based on theoretical considerations (e.g., restricting all parameters from no lockdown to lockdown to be equal in the two cohorts; see Figure 2), as we expected that intraindividual changes might be more strongly affected by such exogenous influences than by the timing of the surveys. These theoretical constraints resulted in a significantly worse fit for the neuroticism RI-CLPMs but not for the extraversion RI-CLPMs, for which the intraindividual processes could be restricted to equality across cohorts with regard to COVID-19-related events. Thus, we selected the models with time constraints for the neuroticism RI-CLPMs and the models with theoretical constraints for the extraversion RI-CLPMs, which all had good model fit (see Tables 2 and 3 for the unstandardized

TABLE 2 Unstandardized coefficients of the RI-CLPMs between extraversion and SWB

	No change in the situation *b* **[95% CI]** SE (*p*)	**No lockdown → lockdown** *b* **[95% CI]** SE (*p*)	**Lockdown → no lockdown** *b* **[95% CI]** SE (*p*)
RI-CLPM between Ext and PA			
Ext ∼∼ PA	0.01 [−0.05, 0.07] 0.03 (.796)	**0.13 [0.04, 0.23]** **0.05 (.005)**	**0.14[0.07, 0.21]** **0.04 (< .001)**
Ext → PA	−0.03 [−0.22, 0.15] 0.09 (.728)	−0.15 [−0.35, 0.04] 0.10 (.118)	−0.04 [−0.20, 0.13] 0.08 (.667)
PA → Ext	**−0.11 [−0.22, −0.01]** **0.05 (.035)**	0.06 [−0.13, 0.24] 0.09 (.534)	0.00 [−0.14, 0.15] 0.08 (.955)
RI-CLPM between Ext and NA			
Ext ∼∼ NA	0.01 [−0.04, 0.06] 0.03 (.795)	**−0.18 [−0.31, −0.05]** **0.07 (.007)**	**−0.16 [−0.25, −0.07]** **0.05 (.001)**
Ext → NA	0.13 [−0.05, 0.30] 0.09 (.167)	0.09 [−0.14, 0.31] 0.12 (.463)	−0.07 [−0.21, 0.07] 0.07 (.339)
NA → Ext	0.03 [−0.06, 0.13] 0.05 (.479)	−0.01 [−0.18, 0.17] 0.09 (.948)	−0.01 [−0.14, 0.12] 0.07 (.880)
RI-CLPM between Ext and LS			
Ext ∼∼ LS		**0.30 [0.14, 0.45]** **0.08 (< .001)**	**0.18 [0.08, 0.29]** **0.05 (.001)**
Ext → LS		−0.13 [−0.46, 0.19] 0.17 (.426)	−0.07 [−0.33, 0.19] 0.13 (.598)
LS → Ext		0.03 [−0.09, 0.14] 0.06 (.633)	0.06 [−0.08, 0.20] 0.07 (.428)

Note: Statistically significant coefficients are printed in bold. A ∼∼ B = within-time correlation. A → B = cross-lagged effect. Abbreviations: *b*, unstandardized coefficients; CI, confidence interval; Ext, extraversion; *p*, *p* value; LS, life satisfaction; NA, negative affect; PA, positive affect; SE, standard error.

TABLE 3 Unstandardized coefficients of the RI-CLPMs between neuroticism and SWB

	t1: October	→ t2: January	→ t3: April	→ t4: May
	b **[95% CI]** **SE (*p*)**	***b*** **[95% CI]** **SE (*p*)**	***b*** **[95% CI]** **SE (*p*)**	***b*** **[95% CI]** **SE (*p*)**
RI-CLPM between Neu and PA				
Neu ∼∼ PA	−0.03 [−0.11, 0.04] 0.04 (.399)	−0.03 [−0.10, 0.04] 0.04 (.435)	**−0.22 [−0.33, −0.10] 0.06 (< .001)**	**−0.18 [−0.27, −0.09] 0.05 (< .001)**
Neu → PA		0.03 [−0.12, 0.18] 0.08 (.673)	−0.05 [−0.22, 0.12] 0.09 (.533)	0.08 [−0.06, 0.23] 0.07 (.260)
PA → Neu		−0.06 [−0.20, 0.09] 0.07 (.429)	0.05 [−0.14, 0.25] 0.10 (.602)	−0.07 [−0.25, 0.11] 0.09 (.445)
RI-CLPM between Neu and NA				
Neu ∼∼ NA	0 [−0.02, 0.21] 0.04 (.933)	0.10 [−0.02, 0.21] 0.06 (.092)	**0.26 [0.13, 0.38] 0.06 (< .001)**	**0.18 [0.08, 0.27] 0.05 (< .001)**
Neu → NA		−0.03 [−0.23, 0.17] 0.10 (.783)	0.13 [−0.05, 0.31] 0.09 (.169)	−0.06 [−0.23, 0.11] 0.09 (.515)
NA → Neu		−0.02 [−0.15, 0.12] 0.07 (.812)	0.04 [−0.11, 0.20] 0.08 (.565)	0.07 [−0.09, 0.23] 0.08 (.393)
RI-CLPM between Neu and LS				
Neu ∼∼ LS	−0.04 [−0.17, 0.08] 0.06 (.482)		**−0.29 [−0.44, −0.14] 0.08 (< .001)**	**−0.30 [−0.44, −0.16] 0.07 (< .001)**
Neu → LS			0.04 [−0.23, 0.30] 0.13 (.778)	0.06 [−0.13, 0.25] 0.10 (.536)
LS → Neu			0.02 [−0.12, 0.15] 0.07 (.790)	−0.06 [−0.21, 0.07] 0.07 (.341)

Note: Statistically significant coefficients are printed in bold. A ∼∼ B = within-time correlation. A → B = cross-lagged effect. Abbreviations: *b*, unstandardized coefficients; CI, confidence interval; Ext, extraversion; *p*, *p* value; LS, life satisfaction; NA, negative affect; Neu, neuroticism; PA, positive affect; SE, standard error.

coefficients).[5] We report the model fit indices, the auto-regressive effects, and the relationships between the intercepts in the supporting information.

H*2a* and H*2b* predicted positive correlations between changes in extraversion and SWB and negative correlations between changes in neuroticism and SWB. In the RI-CLPMs, the within-time correlations indicate the correlated change that could not be explained by the two variables at the previous measurement point but instead by exogenous influences. In line with H*2a*, the within-time correlations between extraversion and SWB were positive and significant at the time points that followed the introduction (i.e., April 20 and January 21) or termination of a lockdown (i.e., May 20 and May 21). In line with H*2b*, the within-time correlations between neuroticism and SWB were negative and significant for the last two surveys in each cohort (i.e., April 20, May 20, April 21, and May 21). Thus, H*2a* and H*2b* were supported.

H*3a* and H*3b* predicted that the cross-lagged relationships in the RI-CLPMs would be positive for extraversion and SWB and negative for neuroticism and SWB. The cross-lagged parameters show the extent to which two variables prospectively predict each other at subsequent times of measurement while controlling for the autoregressive effects. Our data suggest that almost no cross-lagged relationships in the six RI-CLPMs were statistically significant. Most

coefficients had very small effect sizes, and their sign was not consistent with the expected direction. Thus, H*3a* and H*3b* were not supported.

DISCUSSION

The COVID-19 pandemic and the associated restrictions and lockdowns had an immense impact on public life (e.g., Holmes et al., 2020). The current research was aimed at developing a deeper understanding of whether and how extraversion, neuroticism, and SWB changed and were related to one another during two lockdowns. Using data from two cohorts spanning 1.5 years, we studied changes within university students before, during, and after two COVID-19 lockdowns.

Changes in subjective well-being

Both cohorts indicated lower levels of SWB during the lockdowns, with greater declines in cognitive (i.e., life satisfaction) than affective SWB. Students' affect decreased in the second lockdown but—contrary to our hypotheses—increased during the first lockdown. Exploratory analyses revealed that the two relaxation items (but not the pleasantness items) were elevated during the first lockdown, suggesting that the first lockdown had a rather relaxing effect on students. The dissociation between affective and cognitive SWB during the first lockdown can be explained by the idea that students' lives on the whole did not correspond with what they wanted for themselves, thus resulting in a lower rating of life satisfaction. However, as all exams, lectures, and many other duties were canceled during the acute phase of the first (but not the second) lockdown (see Figure 1), this might have resulted in a calmer and more laid-back mood for students. For instance, in a response to the last survey of the first cohort (after the first lockdown had been lifted), one student stated that the forced pandemic pause had slowed down her life so that she had been able to better understand her personal perception of time and had felt less rushed. It also allowed students to spend time on things that they would normally not get around to doing in everyday life. Hence, even though it was globally stressful, the first (but not the second) lockdown might have led to a relaxing time-out, at least for university students.

Changes in extraversion

As hypothesized, students assessed themselves as less "sociable" and "outgoing" during both lockdowns. One reason for the changes in extraversion levels could be that during a lockdown, many students, when recalling and aggregating past events and experiences, observed less extraverted behavior in themselves or felt restricted in their pursuit of such behavior. Indeed, one student from the second cohort commented on the last survey that he was "now even more introverted and socially incompetent than before." However, levels of extraversion increased again each time a lockdown was lifted, promoting more extraverted behavior again and allowing students to move back toward their baseline levels. This is in line with trait–state theory (Steyer et al., 1999), suggesting that some aspects of personality can change quickly, whereas others are more malleable and thus prone to bottom-up changes (see, e.g., Wrzus & Roberts, 2017).

Changes in neuroticism

Contrary to our expectations, levels of neuroticism declined over time in *both* cohorts. On the basis of the assumption that most university students assessed the lockdowns as generally negative, this finding is surprising because previous research has established an increase in neuroticism after the experience of negative life events (e.g., Specht et al., 2011). Interestingly, a recent study that tested pre-post differences in the Big Five between February 2020 and late March 2020 also found a small decrease in neuroticism levels (Sutin et al., 2020). In our study, the students may have assessed the pandemic as a generally negative event (supported by the lower rating of life satisfaction); on average, however, they might not have experienced too many negative consequences in their own lives. Therefore, they might not have felt an increased sense of stress as reported by others (e.g., Kroencke et al., 2020). Furthermore, our T1 surveys were distributed at the time when the students were just starting their university education. Even though previous studies reported an increase in stress over the course of a university semester (e.g., due to upcoming exams; Pitt et al., 2018), the start of university education may represent a particularly stressful life event (Friedlander et al., 2007), potentially more stressful than the pandemic. As students got more used to their new environment, they may have experienced a decline in neuroticism levels over time (Lüdtke et al., 2011). If this reasoning is correct, the lockdowns might not have added considerable additional stress on top of the stress evoked by starting university education.

The association of well-being and personality

Following adjustments in COVID-19 restrictions, we consistently found positive correlations between changes in extraversion and SWB and negative correlations between changes in neuroticism and SWB. That is, when students deviated from their person-specific average scores in personality, these changes were associated with changes in their SWB. Practically speaking, being less extraverted than usual—which was likely elicited by the social restrictions of the lockdowns—tended to go along with lower levels of SWB. Likewise, declines in SWB were related to changes that moved in the direction of higher neuroticism values, thus providing new evidence that SWB and aspects of personality are closely intertwined and tend to change in unison, in line with previous studies (e.g., Boyce et al., 2013). Interestingly, the changes were only weakly predicted by autoregressive effects and not at all by cross-lagged effects but instead almost exclusively by external influences, such as the introduction or the termination of a lockdown. In other words, the lockdown was such a powerful event that it had a greater effect in predicting students' deviations from their person-specific trait scores than the previous times of measurement. These findings provide more evidence that, even though the changes in extraversion were rather short-term, they were associated with changes in SWB. We argue that the association of extraversion and SWB at the within-person level demonstrates that the changes in SWB are triggered not only as a result of insecurity and anxiety (cf. Kroencke et al., 2020; Zhai & Du, 2020) but also by the social restrictions in daily life. When trying to understand changes in SWB, these transient changes in personality should therefore be considered.

Note that on the level of changes in mean values, we found that when a lockdown was introduced, SWB significantly decreased on average in both cohorts, and neuroticism scores significantly decreased in the first cohort. Together, these findings nicely illustrate the value of our statistical approach: Mean changes on the level of the sample (i.e., lower neuroticism and SWB

scores) are not necessarily aligned with changes at the intraindividual level (i.e., negative changes in neuroticism corresponded with positive changes in SWB). Analyses that are capable of disentangling and elucidating processes on both between- and within-person levels allow for a deeper understanding of the psychological processes under investigation than analyses that are restricted to only one of these levels.

Strengths, limitations, and future research

The current research has several strengths and limitations. First, the two lockdowns were introduced at different times of the year, ruling out a common confounding of measurement timing in longitudinal studies and therefore providing evidence that the accompanying changes in the examined constructs were driven by the introduction and cessation of each lockdown, respectively. Second, the two waves of data collection before the onset of COVID-19 in the first cohort represent a major strength of this study (Sheldon & Lucas, 2014). Many COVID-19 studies did not have the chance to include a baseline measurement because the onset of the pandemic had been unforeseen. This strength notwithstanding, the maximum number of students qualifying for participation was relatively small because it was limited by the total size of the cohort of enrolled students (which was not under our control). Therefore, we tried to make the incentives for participation particularly attractive so that compliance would be high. Third, personality and affect were assessed with few items only. Short scales are often used in longitudinal studies to keep the participant burden low. While the reliabilities were excellent for life satisfaction and acceptable for personality, the reliabilities for PA and NA were partly below the conventional .70 threshold. One reason for this low reliability may lie in the observation that in hindsight, the four items would have been better summarized as pleasantness and relaxation instead of PA and NA (as we did in our exploratory analyses).

Finally, our sample consisted only of university students in Germany, the majority of whom were female and emerging adults. Examining changes in students' personality and well-being is crucial during the COVID-19 pandemic because they may be particularly susceptible to changes in SWB (e.g., Rajkumar, 2020) since their personality is still developing and is more malleable (Borghuis et al., 2017; Soto et al., 2011). However, it is unclear whether the effects reported here generalize to other age groups and countries. Recent studies reported higher levels of stress and anxiety during the COVID-19 pandemic among older samples (e.g., de Quervain et al., 2020; Zacher, Rudolph, 2021a). Moreover, there is a lot of variability in how people behave and adapt in response to COVID-19 lockdowns. A valuable endeavor for future research, and especially with regard to future lockdowns, would be to study changes (i) in more diverse samples, (ii) in relation to the frequency and the type of social interactions, and (iii) to explore moderators of potentially occurring changes.

CONCLUSION

The current two-cohort study sought to expand our understanding of how aspects of personality and SWB were connected during the occurrence of a severe health crisis. By covering the time from October 2019 before the first-wave lockdown to the end of the second-wave lockdown in May 2021, we found that university students experienced interrelated short-term changes in their SWB and personality, but these changes were limited to the duration of each lockdown. Acknowledging and targeting these short-term changes (and interindividual differences

therein) may offer a new pathway to understanding and eliciting longer term personality change (Wrzus & Roberts, 2017).

The present study further contributes to the emerging COVID-19 literature on mental health, with the aim of increasing awareness and deepening our understanding of the effects of the current health emergency. From a practical point of view, considering the interplay of personality and SWB appears to be crucial to promote better management of the pandemic and its effect on mental health. For instance, consultants may want to encourage students to maintain extraverted behavior remotely during social restrictions (e.g., by making use of virtual meeting spaces) or helping them to value the deceleration of everyday life. University students, while not the most vulnerable to infection from the Coronavirus, were nonetheless strongly affected by the imposed societal restrictions. Reassuringly, on average, our samples recovered from the changes in their personality and SWB after the ends of both lockdowns.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

ETHICS STATEMENT

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed Consent: Informed consent was obtained from all individual participants involved in the study.

DATA AVAILABILITY STATEMENT

The preregistration for the second cohort, the data, R scripts, and all materials is openly available at our OSF repository (https://osf.io/634va/).

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ENDNOTES

[1] A third choice (i.e., *nonbinary/other*) was available but was not selected by anyone.

[2] Please note that life satisfaction was not measured at the second time of measurement in the first cohort (January 20).

[3] In the Supplemental Materials, we report additional contrast analyses in which we compared differences in the periods before and after each lockdown. We further examined whether the effect of the pandemic in general (i.e., April 2020 to April 2021) was greater than the effects of the lockdowns. In contrast to previous studies (cf. Folk et al., 2020; Sibley et al., 2020), we did not find evidence for this exploratory hypothesis.

[4] By further examining the conflicting results for PA and NA in the two cohorts, we identified opposing trends between the items relating to relaxation ("calm," "restless") and pleasantness ("good," "dissatisfied") in the first lockdown. Whereas we found that both the relaxation and pleasantness levels were significantly lower during the second lockdown ($b = 0.35$, 95% CI [0.05, 0.65], $p = .023$ and $b = 0.67$, 95% CI [0.37; 0.97], $p < .001$), the levels of relaxation were significantly higher ($b = -1.26$, 95% CI [−1.79, −0.74], $p < .001$) and the levels of pleasantness were nonsignificantly lower ($b = 0.37$, 95% CI [−0.17, 0.90], $p = .177$) during the first lockdown.

[5] We did not constrain our coefficients to be equal across the timepoints because this procedure is not recommended for study designs that include statistically significant transitions during some but not all intervals (Orth et al., 2021).

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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