Emotion

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Age Differences in Hedonic Adaptation to Societal Restrictions? Positive and Negative Affect Trajectories During the First Wave of the COVID-19 Pandemic in 33 Nations

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We examined age group differences in hedonic adaptation trajectories of positive and negative affect (PA/NA) at different arousal levels during the severe societal restrictions that governments implemented to contain the first wave of the COVID-19 pandemic (March to June 2020). Data from 10,509 participants from 33 countries and 12 weekly assessments were used (67% women, aged 18 to 85+, on average 318 participants per country (*SD* = 434) and 5.6 assessments (*SD* = 2.5) per participant). Multilevel models (level 1: assessments, level 2: participants, level 3: countries) were fit to examine trajectories of low to high arousal PA and NA during the phase of tightening societal restrictions, the phase of stable peak restrictions, and the phase of easing restrictions separately. During the entire study period mean levels of PA were lower in emerging and young adults (aged 18–44) than older adults, whereas mean NA levels were higher. During peak societal restrictions, participants reported increasingly more PA, especially high-arousal emotions (*d* = .36 per month vs. .19 unaroused). NA levels decreased over time, especially high-arousal emotions (*d* = .35 vs. .14 p/month). These hedonic adaptation trajectories were largely similar across age groups. Nevertheless, up to 30% of the participants increased in NA and up to 6% decreased in PA, against the general trend, demonstrating substantial individual differences in emotional adaptation. Finally, heterogeneity in the effects of time on affect was larger on the individual level than the country level. Emotional recovery trajectories during the first lockdown in the COVID-19 pandemic were virtually similar across age groups in 33 countries, across valence and arousal levels, suggesting age advantages in emotional well-being remain restricted to mean-level differences rather than emotion dynamics.

Keywords: COVID-19, lockdown, resilience, well-being

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Over the spring of 2020, the coronavirus SARS-CoV-2 rushed around the globe, and most governments responded with severe societal restrictions in an attempt to contain this pandemic. The forced adaptation of people's lives to these restrictions during this period caused much emotional distress (e.g., Pancani et al., 2020; Ramírez-Ortiz et al., 2020), such as loneliness among young and older adults, due to physical and social distancing (Losada-Baltar et al., 2020; Luchetti et al., 2020), and hampered emotional well-being (Torales et al., 2020). The present study examined how participants adapted to this stable period of imposed societal restrictions over the spring of 2020, and whether lifespan differences in such hedonic adaptation patterns could be observed.

Humans are able to adapt to even the most marked changes and adversities (e.g., Bonanno et al., 2011; Neria et al., 2008), and *hedonic adaptation* describes accommodation of emotional responses over time (Frederick & Loewenstein, 1999; Ormel et al., 2017). Essential

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Our cherished Elisabeth H. Bos passed away before we finished this article.

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to the idea of hedonic adaptation is that it occurs only in response to constant or repeated stimuli. In this sense, hedonic adaptation is functional (Frederick & Loewenstein, 1999; Frijda, 1988; Lucas, 2007a). Hedonic adaptation is a cardinal feature of a healthy emotion system because it enables us to disengage our attention away from contextual continuities and toward novel events and changing contexts (Frederick & Loewenstein, 1999; Lucas, 2007a). Most people eventually refocus their minds' eye on their daily hassles, uplifts, and experiences, which allows their distress to fade into the psychological background (Kahneman & Thaler, 2006; Lyubomirsky, 2011), and to become part of our biographical narrative (McAdams, 2019). Hedonic adaptation processes are evident in the short duration of each particular emotion episode (<72 hr, see Kim-Prieto et al., 2005; Verduyn and Lavrijsen, 2015), and unfold over weeks when we adapt to major emotional experiences such as childbirth, divorce, unemployment, and natural disasters (Bonanno et al., 2011; Frederick & Loewenstein, 1999; Neria et al., 2011).

Hedonic adaptation to negative events such as persistent societal restrictions or lockdown is likely to be evident in both a decrease in negative affect and an increase in positive affect over time. Negative emotions have an alarm function (Baumeister et al., 2001; Rozin & Royzman, 2001), whereas positive emotions signal safety and the fulfillment of primary needs (Tugade, 2010) and help to down-regulate the sympathetic arousal (e.g., heart rate) that comes with negative stress (Fredrickson et al., 2000). Adaptation patterns of emotions may differ based on their arousal level. Theory assumes that adaptation evolved as a means to reduce high-arousal (Lyubomirsky, 2011), as high-arousal emotions are more compelling and "costly" than low-arousal ones, and therefore adaptation of high-arousal emotions may be stronger compared with low-arousal emotions. On the other hand, low-arousal positive emotions support individuals in dealing with stressors and maintaining levels of functioning in the contexts of stress (Fredrickson et al., 2000; McManus et al., 2019), which could also lead to a downregulation of high-arousal negative emotions.

Hedonic adaptation processes are influenced by a host of complex factors, from event characteristics and individual differences to various social indicators and resources (Mancini et al., 2011; Zautra et al., 2008). During the COVID-19 pandemic, *age* might have been one of the most salient predictors of individual differences, if only because older individuals (65+ years old) were objectively a thousand times more likely to die from COVID-19 than emerging adults (Williamson et al., 2020; Wu et al., 2020). Consequently, older people may have been more vigilant because the virus was a threat to their health, and such continued attention can forestall hedonic adaptation (Lyubomirsky, 2011). Paradoxically, during the first wave of the coronavirus, older adults have been found to report less subjective threat than younger adults (Klaiber et al., 2021; although not in all studies, see Carstensen et al., 2020), in line with evidence that older adults are generally less affected by major life events (Aldwin, 2010; Diehl et al., 2014) and disasters (Jeronimus et al., 2019; Norris et al., 2002; Norris & Wind, 2009) than younger adults are, and more resilient to postdisaster distress, depression, and posttraumatic symptoms (Norris et al., 2002).

Older adults typically report equal or more positive emotions and lower levels of negative emotions than younger adults do (e.g., Carstensen & DeLiema, 2018; Carstensen et al., 2011; Mather & Ponzio, 2015), although the strength of age effects on positive emotions differs based on arousal level (Kessler & Staudinger, 2009). Socioemotional selectivity theory (SST; Carstensen et al., 1999) explains age differences in affect through a changing perception of time as individuals age. Older adults experience a limited time horizon, which motivates them to focus on present-oriented goals that bestow *immediate* hedonic reward, such as spending time with family. In contrast, during young adulthood and up until middle age, people often have larger social networks and goals related to exploration and learning, which are particularly enabled by high-arousal positive emotions such as enthusiasm and excitement (Izard, 1977). During middle age, for example, these larger social networks may help to buffer the stressors that come with having young children (Byron, 2005). A complementary approach to the SST is given by the Stress and Vulnerability Integration model (SAVI; Charles, 2010), which focuses on differences in emotion regulation. The SAVI model posits that, with age, people more frequently and effectively use emotion regulation strategies to de-escalate or avoid negative events. However, older adults are also more vulnerable physiologically, and age-related benefits in emotion regulation may be offset when stressors are chronic and unavoidable and overtax their physiological reserves (Charles, 2010; Sliwinski & Scott, 2013).

Higher emotional well-being could benefit hedonic adaptation processes among older adults via, for example, positive affect–induced increased flexibility in thoughts and problem solving, or a reduced physiological impact of negative emotions (Fredrickson, 2001; Fredrickson et al., 2000; Tugade et al., 2004). This suggests that older adults may have adapted more readily to the emotional impact of forementioned societal restrictions. On the other hand, the heightened risk of COVID-19 among this age group could have amplified the negative emotional impact of the first infection wave, which would then predict slower adaptation with age. Additionally, in line with the SAVI model, emotion regulation benefits could have dissipated, especially because the COVID-19 threat was both enduring and difficult to avoid. This leads to the contrasting expectation that hedonic adaptation would not be faster among older adults.

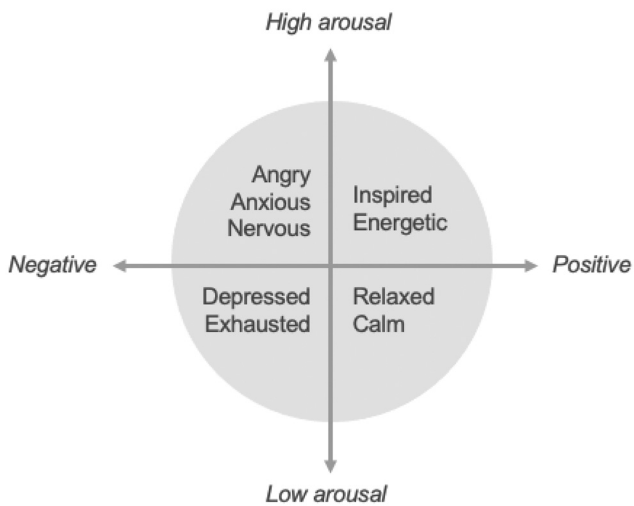
To solve this riddle, we examined trajectories of positive and negative affect during the first wave of the COVID-19 pandemic in four typically distinguished age groups (Arnett, 2000; Erikson, 1968) using 12 weekly measures. Weekly measurements cover the time dimension on which hedonic recovery processes typically unfold. We distinguish between emotional valence (positive/negative) and arousal dimension (low/high, see Figure 1) of emotional experiences during three phases of societal restrictions in 33 countries; the phase of stable peak societal restrictions (henceforth referred to as *phase 2*), the phase of tightening of restrictions (*phase 1*), and the phase of easing of restrictions (*phase 3*, see Figure 2). Societal restrictions were not effectuated and/or tightened or eased simultaneously in each country, and these three phases were therefore aligned using start- and end-dates of the phase of peak restrictions in each country. Random effects models were used to examine individual and country-level heterogeneity in these processes.

Method

Procedure

The PsyCorona study was launched in March 2020 to examine virus and lockdown-related behavior, cognition, emotion, and

Figure 1
Emotions in PsyCorona Organized by Valence (Negative-Positive) and Arousal (Low-High) as Key Dimensions of the Affect Circumplex



motivation (Agostini et al., 2022; Leander, 2020). The research was approved by the Ethics Committees of the University of Groningen (PSY1920-S-0390) and New York University Abu Dhabi (HRPP-2020-42). Although the PsyCorona project was not preregistered, research and analysis proposals for the gathered data were reviewed by an internal review board. The research proposal and analytic plan for the current study can be found on OSF at https://osf.io/wxzcq/?view_only=1330063e10924e60b7df4cf124344fe5 (Reitsema, 2022). Participants were recruited for an initial cross-sectional survey through convenience sampling and paid panels. When participants completed the cross-sectional survey, they were invited to join the longitudinal study in which participants received weekly questionnaires to examine changes over time. Because participants joined the study on a rolling basis, the number of surveys following the cross-sectional study for each participant depended on their initial date of enrollment. In this study, we examined data from the cross-sectional survey and from 11 longitudinal assessments between March 2020 and June 2020 (see overview in Supplemental Table S1).

Participants

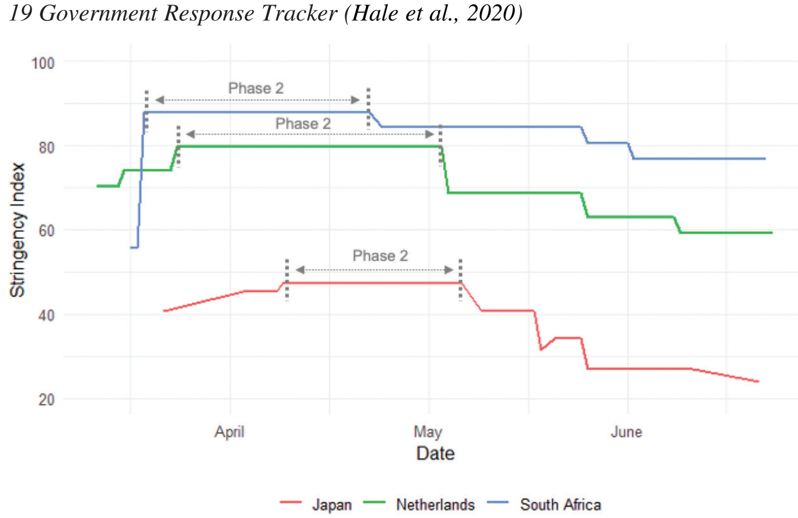
In total, 61,385 individuals participated in the cross-sectional survey, and approximately 4,000 individuals participated in each of the 11 longitudinal assessments. For the current analyses, participants were included if they were residents of the country they were living in at the time of assessment (228 missing), had provided information on their age (360 missing), gender (328 missing), and education (426 missing), and participated in the cross-sectional survey and subsequently in at least two longitudinal assessments (13,464 participants). Additionally, we restricted ourselves to countries with a minimum number of 20 participants to allow for robust analyses of country-level random effects (excluding 51 countries). The final sample at baseline comprised 10,509 participants (67% women, 32% men, 1% third or no gender, aged 18 to 85+) from 33 different countries, with a mean number of 318 (*SD* = 434) participants per country and 5.58 assessments per participant (*SD* = 2.5). All descriptive statistics are provided in Table 1.

Materials

Affect

We used nine emotion items to cover the valence and arousal dimensions of the affect circumplex model by Russell (1980; see

Figure 2
Example of the Peak Phase of Societal Restrictions in Three Countries Between March and July 2020, as Indexed by the Stringency Index of the Oxford COVID-19 Government Response Tracker (Hale et al., 2020)



Note. See Method section for details. See the online article for the color version of this figure.

Table 1
Descriptive Statistics

Measure	Wave 1	2	3	4	5	6	7	8	9	10	11	12
N	10,509	1,093	4,156	4,417	6,112	5,981	5,624	4,655	4,733	4,287	3,721	4,370
$N_{\text{per country}}$ (M, SD)	318 (434)	68.3 (133)	134 (304)	138 (288)	191 (236)	187 (204)	176 (194)	141 (148)	144 (166)	134 (150)	114 (127)	127 (156)
♀ (%)	67	70	72	73	65	66	65	65	65	65	65	68
♂ (%)	32	29	27	26	34	34	35	34	34	34	34	32
⚥ (%)	1	1	1	1	1	0	0	1	1	1	1	0
N_{age}												
18–24	1,365	162	712	811	807	715	602	478	466	401	330	377
25–44	3,886	545	1,960	2,008	2,194	2,069	1,835	1,428	1,457	1,325	1,064	1,199
45–64	3,675	340	1,217	1,297	2,134	2,173	2,154	1,838	1,838	1,676	1,468	1,553
65+	1,583	46	268	307	983	1,026	1,037	918	977	879	800	690
$NA_{\text{high arousal}}$ (M, SD)	2.4 (1.0)	2.4 (1.0)	2.3 (0.9)	2.3 (1.0)	2.2 (1.0)	2.2 (1.0)	2.2 (1.0)	2.1 (1.0)	2.1 (1.0)	2.1 (1.0)	2.1 (1.0)	2.1 (1.0)
$NA_{\text{low arousal}}$ (M, SD)	2.2 (1.0)	2.2 (1.0)	2.3 (1.0)	2.3 (1.0)	2.2 (1.0)	2.2 (1.0)	2.2 (1.0)	2.1 (1.0)	2.1 (1.0)	2.1 (1.0)	2.1 (1.0)	2.1 (1.0)
$PA_{\text{high arousal}}$ (M, SD)	2.4 (1.0)	2.3 (0.9)	2.5 (0.9)	2.5 (0.9)	2.5 (1.0)	2.6 (1.0)	2.6 (1.0)	2.7 (1.0)	2.7 (1.0)	2.7 (1.0)	2.7 (1.0)	2.7 (1.0)
$PA_{\text{low arousal}}$ (M, SD)	2.8 (1.0)	2.8 (1.0)	2.9 (1.0)	3.0 (1.0)	3.0 (1.0)	3.0 (1.0)	3.0 (1.0)	3.0 (1.0)	3.1 (1.0)	3.0 (1.0)	3.0 (1.0)	3.0 (1.0)
Stringency (M, SD)	79.4 (10.9)	76.1 (7.5)	80.2 (8.7)	80.7 (8.7)	81.6 (9.1)	80.6 (9.0)	76.9 (9.5)	73.8 (9.8)	71.4 (9.1)	68.7 (9.3)	63.3 (13.0)	62.0 (13.6)
Stringency (range)	20.4–100.0	38.9–100.0	45.4–100.0	47.2–100.0	43.5–100.0	40.7–96.3	40.7–96.3	39.8–96.3	31.5–96.3	24.1–91.7	24.1–89.8	24.1–89.8

Note. Data were derived from participants from 33 countries who completed on average 5.58 assessments (SD = 2.5). N = number of participants; N_{age} = number of participants in each age group; $N_{\text{per country}}$ = number of participants per country (mean and SD); NA = negative affect; PA = positive affect. ♀ = proportion women, ♂ = proportion men, ⚥ = proportion third/no gender.

Figure 1). High-arousal negative affect (NA) was measured with the items anger, anxiety, and nervousness. Low-arousal NA was measured with depression and exhaustion. High-arousal positive affect (PA) was measured with the emotions energetic and inspired. Low-arousal PA was measured with being calm and relaxed. All these items were assessed at every wave except anger, which was not assessed at baseline. Participants indicated how they felt in the past week using a scale ranging from 0 (*never*) to 7 (*always*). The translations of these items can be found in Supplemental Table S19.

The fit of the four-factor structure of the circumplex model to the data (i.e., low- and high-arousal PA and NA) was checked in a multilevel confirmatory factor analysis, and compared against the fit of a two-factor structure (PA versus NA) using the Lavaan package in R (Rosseel, 2012). The four-factor model showed a better fit (robust confirmatory fit index [CFI] = .98, robust root mean square error of approximation [RMSEA] = .031, 90% CI [.029, .032]) compared with the two-factor model (robust CFI = .92, robust RMSEA = .057, 90% CI 9.056, .058]), which indicates that arousal should be accounted for, next to valence. All items of the four-factor model had standardized factor loadings above .40 (see Supplemental Tables S2A–S2C).

Societal Restrictions Stringency Index

The severity of societal restrictions on any given date in a participant's country of residence was operationalized using the stringency index of the Oxford Government Response Tracker (Hale et al., 2020; also see formula in Supplement A in the online supplemental materials). The stringency index quantifies the strictness of societal restrictions taken by governments worldwide from no restriction (0) to complete lockdown (100), using a composite of 18 indicators of "containment and closure" (eight indicators), "economic response" (four), "health systems" (five), and "miscellaneous" (one). Each indicator was coded on an ordinal scale to reflect the severity of the measures. This stringency index as a combination of indicators was deemed to best capture the severity of the societal restrictions that were applied in each nation.

Demographic Characteristics

Additional variables that were included in this study are participants' age, gender, education level, the country they were currently residing, and whether they were a registered citizen in this country. Age was assessed using a categorical response variable with eight categories based on the U.S. Census Bureau (2019) segmentation (18–24; 25–34; 35–44; 45–54; 55–64; 65–75; 75–84; 85^{+} years of age). Gender was measured using three categories (women, men, or other/unknown/unwilling to say). Education was measured using seven categories (Primary education; General secondary education; Vocational education; Higher education; bachelor's degree; master's degree; PhD degree).

Data Preparation

We excluded participants with missing information on age, gender, education, and country of residence or citizenship. The eight age categories were combined into broader age groups to simplify our already complex model and because of an unequal distribution of respondents, especially in the upper two categories (i.e., 75–84 and 85+). Four age groups were defined according to Erikson's developmental life stage theory (Erikson, 1968) and Arnett's (2000) theory of emerging adulthood: Emerging adults (aged 18–24), Young adults (aged 25–44), Middle-aged (aged 45–64), and Older adults (65+). The results of secondary analyses in which age categories were not collapsed can be found in the online supplemental materials (Supplemental Tables S16–S18). These results differed from the primary analyses mostly in terms of a change in significance level (i.e., 26 of 140 estimated coefficients; i.e., results that were significant in the primary analyses lost this status when considering the separate age-groups). This was likely attributable to power issues resulting from fewer participants in the older age groups.

For each country, we obtained the first day on which the highest level of societal restrictions was reached across the entire study period, and the first day on which restrictions started to ease. A dummy variable *Phase* was created to indicate whether an assessment occurred during the phase of tightening societal restrictions in the participant's country of residence (phase 1, coded 0), during the phase of severest restrictions (phase 2, coded 1), and during the phase of easing restrictions (phase 3, coded 2). We created an additional continuous time variable *Days* to indicate the number of days during each of the three phases, thus each phase started anew at day 1. After the first wave of the COVID-19 pandemic, several countries tightened restrictions again after an initial reduction in severity (i.e., after the easing phase). These observations ($N = 583$) were excluded from the analyses to accurately capture only emotional responses during the first wave of the pandemic.

Missing Data Imputation

Missing data on the emotion items were imputed using a multilevel factorial analysis package missMDA in R (Josse & Husson, 2016). Four within-person and four between-person factors were used to impute the missing scores, following the data structure we identified in the multilevel confirmatory analysis (outlined above). Imputation was confined to assessments where at least one emotion item was answered ($N = 10{,}765$ assessments), leaving those assessment waves missing where no emotion ratings were provided ($N = 53{,}293$ assessments).

Analyses

Analyses were performed in two steps. Our prime interest was in potential age differences in hedonic adaptation during a period of peak societal restrictions, a question that presumes that emotions fluctuate with changes in restrictions. Therefore, we first established the association between the severity of societal restrictions in each country on a given date and our affect measures, before we set out to examine age differences. To test the impact of the restrictions, we compared this association between phase 1 (i.e., during tightening of restrictions), phase 2 (stable peak restrictions), and phase 3 (easing of restrictions). Our analysis showed that the severity of societal restrictions was indeed related to affect and that the direction of this effect differed across the three phases. We therefore could proceed by examining age differences in trajectories of positive and negative affect using growth curve models for each phase using multilevel regression analysis. In both the first and second step of the analysis, we fitted hierarchical three-level models (level 1: assessments, level 2: participants, level 3: countries) using the package nlme in R (Version 3.1–150, Pinheiro et al., 2021).

Step 1: Association Between Societal Restriction Severity and Affect

First, we examined whether there was an association between the severity of the societal restrictions and the four affect measures (low- and high-arousal PA and NA). To this end, we used the stringency index (country-mean centered) at the time of assessment *t* of person *i*'s country of residence *j* as a level-1 predictor of affect. We included the dummy variable *Phase* to indicate the phase of societal restrictions and the interaction between these predictors (Stringency × Phase) as level-1 predictors. The following level-1 model was specified: $\text{Affect}_{\text{tij}} = \pi_{0ij} + \pi_{1ij}(\text{Stringency}_{tij}) + \pi_{2ij}(\text{Phase}_{tij}) + \pi_{3ij}(\text{Stringency}_{tij} \times \text{Phase}_{tij}) + e_{tij}$. For each of the four affect measures, we fit multiple models to estimate all possible combinations of random intercepts and random slopes for stringency index at levels 2 and 3, and with various covariance structures for the random effects as well as for the level-1 residuals.

Step 2: Growth Curve Modeling

As the second analysis step, we estimated linear growth curve trajectories for each of the four affect measures and age-related differences therein. Affect trajectories were estimated separately for phases 2 and 3. Most countries reached their highest level of restrictions already after only two assessment waves, preventing us from estimating trajectories in phase 1. Therefore, in phase 1, only age group differences in mean affect were estimated.

In the growth curve models for phases 2 and 3, the number of days in the current phase (level-1 predictor *Days*) and age (as a categorical level-2 predictor) were included. Age-related differences in hedonic adaptation were estimated using the interaction between *Days* and *Age*, in a model specified as: $\text{Affect}_{\text{tij}} = \pi_{0ij} + \pi_{1ij}(\text{Days}_{tij}) + \pi_{2ij}(\text{Age}_{ij}) + \pi_{3ij}(\text{Days}_{tij}{*}\text{Age}_{tij}) + e_{tij}$. All growth curve models were adjusted for gender (men = reference category) and education level (level-2 covariates). The full equations of the final models can be found in Supplement B in the online supplemental materials. To assess individual differences in trajectories, we extracted Empirical Bayes predictions of individual slopes for *Days* from the final models for phases 2 and 3.

We estimated the models for phase 2 and 3 in a stepwise fashion by first including the main effects and subsequently also the interaction effect. As the results of the main effects did not meaningfully change after including the interaction effect, we report only the results of the full models. We additionally examined our models without the covariates gender and education, and the results of these can be found in Supplemental Tables S13–S15. Finally, we examined the presence of a quadratic trend for *Days*, by mean-centering (to reduce multicollinearity) and squaring this variable and including it in the models for phases 2 and 3. The results of these latter models, which had a lower fit than the linear models, are documented in Supplemental Table S4.

Interpretation of Effects

The models with the lowest Bayesian Information Criterion (BIC, Schwarz, 1978) scores were deemed the best fitting (Raudenbush & Bryk, 2002). An alpha level of .05 was used as the significance level of fixed effects. Effect sizes were calculated based on the average intraindividual standard deviation (*ISD*) of each affect measure, which measures an individual's average dispersion in affect over time (Wang & Maxwell, 2015; Wang et al., 2019). The ISD allows us to interpret the magnitude of age-group differences in mean affect and affective change over time in terms of the average individual dispersion in affect. For the main effect of *Age*, the effect size then reflects age differences in affect in terms of an average *ISD* (i.e., coefficient/*ISD*). For the main effect of *Days* and the interaction between *Days* and *Age*, the effect size reflects the change in affect over a period of four weeks in terms of an average *ISD* (i.e., coefficient × 28/average *ISD*).

Results

Descriptive Characteristics

The number of participants was highest for the baseline survey (N = 10,509). Participation was lower in the longitudinal part of the study but remained relatively stable with around 4,000 participants each wave (see Table 1). Across all assessment waves, approximately two thirds of the sample were women, and there were fewer emerging adults (aged 18–24) and older adults (65+) compared with young (25–44) and middle-aged adults (45–64). The stringency index across countries showed a slight increase until assessment wave 5, followed by a decline in measures, while the range across countries decreased and subsequently increased again.

Step 1: Association Between Societal Restriction Severity and Affect

The best-fitting model for each of the four outcome measures included random intercepts for participants (level 2) and countries (level 3), and random slopes for stringency on both levels, as well as an independent covariance structure for the random effects at both levels, and a first-order autoregressive level-1 covariance structure (see Table 2, and Supplement B for the full specifications of the models). The main effects for Phase suggest that high-arousal NA was highest during phase 1 (reference category, represented by the intercept) and lower during phases 2 and 3 (see Table 2). Levels of low-arousal NA did not differ across the three phases. *M* PA levels were lowest in phase 1 and higher during phases 2 and 3, independent of arousal levels. Combined, these results suggest that mean affect levels were more positive and less negative in phase 2 and 3 compared with phase 1.

Stringency (country-mean centered) showed a weak negative association with high-arousal NA during phase 1 (main effect of Stringency, $B = -.004$), but this association was positive during phase 2 and 3 (significant interaction effects Stringency × Phase). No associations between stringency and low-arousal NA were found (see Table 2). The results for PA largely mirrored those for NA, with a weak positive association between stringency and PA during phase 1 (main effect of Stringency, high-arousal PA: B = .008, and low-arousal PA: B = .005) and a negative association during phase 2 and 3 (significant interaction effects Stringency × Phase).

These results suggest that the severity of societal restrictions was related to affect, although the direction of this effect differed across the three phases. Saliently, restriction severity was associated with higher PA and lower high-arousal NA during phase 1 (tightening of restrictions), but with lower PA and higher high-arousal NA during phases 2 (peak restrictions) and 3 (easing of restrictions). The regression coefficients for these associations were small, in part because these estimated affect differences were expressed per 1-point increase in stringency (scale ranging from 0 to 100). Nonetheless, these results provide a first indication of hedonic adaptation effects during the first wave of the COVID-19 pandemic. We therefore proceeded to examine hedonic adaptation and age differences therein in more detail using growth curve analyses.

Step 2: Growth Curve Modeling

Age-group differences in affect trajectories were estimated with linear growth curve models for each of the four affect measures during

Table 2

Fixed and Random Effects in Final Models Predicting Affect From Societal Restriction Severity

	Negative affect		Positive affect	
Fixed effects	High-arousal Coef. (*SE*)	Low-arousal Coef. (*SE*)	High-arousal Coef. (*SE*)	Low-arousal Coef. (*SE*)
Intercept	2.468*** (0.042)	2.238*** (0.041)	2.451*** (0.045)	2.828** (0.040)
Stringency	−0.004** (0.002)	0.003 (0.002)	0.008*** (0.002)	0.005** (0.018)
Phase 2	−0.208*** (0.018)	−0.006 (0.020)	0.150*** (0.021)	0.167*** (0.019)
Phase 3	−0.214*** (0.014)	0.007 (0.015)	0.222*** (0.015)	0.163*** (0.015)
Stringency × Phase 2	0.013*** (0.002)	0.001 (0.002)	−0.015*** (0.003)	−0.010*** (0.002)
Stringency × Phase 3	0.007*** (0.002)	−0.002 (0.002)	−0.014*** (0.002)	−0.005*** (0.002)
Random effects	Variance	Variance	Variance	Variance
Level 1 residuals	0.353	0.395	0.393	0.411
Level 2 intercept	0.534	0.598	0.481	0.525
Stringency	0.000	0.000	0.000	0.000
Level 3 intercept	0.048	0.045	0.056	0.042
Stringency	0.000	0.000	0.000	0.000
Level 1 AR	0.338	0.288	0.273	0.257

Note. Models were based on 59,037 assessments, 10,509 participants, and 33 countries. AR = autocorrelation; Coef. = coefficient; Level 1 = assessments; Level 2 = participants; Level 3 = countries; Phase = a categorical variable indicating phase of societal restrictions (reference category Phase 1 = during tightening of restrictions); Phase 2 = during peak restrictions; Phase 3 = during easing of restrictions; Stringency = stringency index.
** $p < .01$. *** $p < .001$.

phases 2 and 3 separately. During phase 1, only age differences in mean levels of affect were estimated (see Method section).

Phase 1: Tightening Restrictions

During phase 1, high-arousal NA was lower in middle-aged adults (aged 45–64, $B = -.366$) and older adults (65+, $B = -.637$), but not in young adults, compared with emerging adults (the reference category, aged 18–24, $B = 2.588$, see Figure 3 and Table 3). Similarly, low-arousal NA was also lower among middle-aged ($B = -.425$) and older adults ($B = -.722$) than among emerging adults. There were no differences in high-arousal PA between emerging adults and any of the other age groups (all $ps > .05$), although low-arousal PA was lower in young adults ($B = -.158$) but higher in older adults ($B = .224$) compared with emerging adults ($B = 2.938$, see Figure 3 and Table 3).

Phase 2: Peak Societal Restrictions

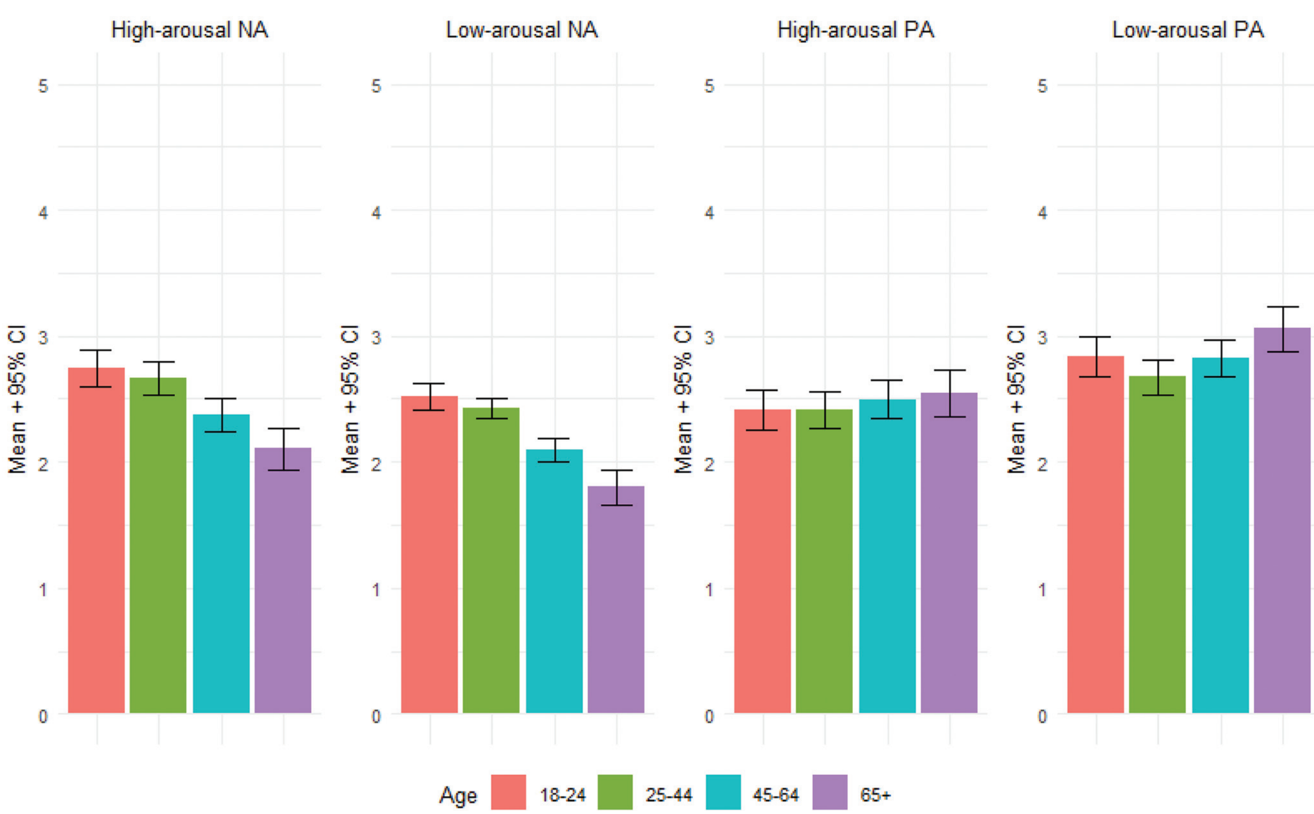
All age groups except young adults reported lower high-arousal NA compared with emerging adults (main effect of *Age*, see Table 4) whereas low-arousal NA was lower in all age groups (all $ps < .01$). There was a significant main effect of *Days* on high-arousal NA but no significant *Days* × *Age* interaction effects. In other words, high-arousal NA decreased in emerging adults with ∼.33 *SD* over 4 weeks (*Days*, $B = -.005$, Figure 4 and Table 4), and this rate seemed similar in the older age groups. Similarly, there was a significant main effect of *Days* on low-arousal NA, although this was small with ∼.14 *SD* per 4 weeks ($B = -.002$; see Figure 4 and Table 4). This decrease was not present in the other age groups, as the significant *Days* × *Age* interaction effects canceled out this decrease for young adults ($B = .002$) and older adults ($B = .003$).

A main effect of *Age* was also found for high-arousal PA, although only middle-aged adults reported increased high-arousal PA compared with emerging adults ($B = .074$). Low-arousal PA, in contrast, was *lower* in middle-aged adults ($B = -.132$) and in young adults ($B = -.196$) compared with emerging adults (reference category). Over time, high-arousal PA increased among emerging adults with ∼.36 *SD* over 4 weeks (main effect of *Days*, $B = .006$), whereas this increase was slower in the other age groups (*Days* × *Age* interactions, see Figure 4 and Table 4). In contrast, low-arousal PA increased *faster* over time in all other age groups compared with emerging adults (main effect of *Days* and *Days* × *Age* interactions, Figure 4 and Table 4).

Random Effects (Phase 2)

During phase 2, the random effects captured differences in mean emotional intensity on both the participant- and country-level, although differences between participants were more pronounced than differences between countries. For example, on the participant-level, high-arousal NA varied with ∼1.46 points around the grand mean (in 95% of the participants, or twice the *SD* of .73) whereas high-arousal NA varied with ∼.42 points around the grand mean on the country-level (in 95% of the countries, or twice the *SD* of .21).

Figure 3
Predicted Mean Affect Scores per Age Group During Phase 1 (Tightening of Restrictions)



Note. NA = negative affect; PA = positive affect. See the online article for the color version of this figure.

Table 3
Multilevel Model Results of High- and Low-Arousal NA and PA Predicted by Age and Days During Phase 1 (Tightening of Restrictions)

	High-arousal NA		Low-arousal NA		High-arousal PA		Low-arousal PA	
Fixed effects	Coef. (*SE*)	ES	Coef. (*SE*)	ES	Coef. (*SE*)	ES	Coef. (*SE*)	ES
Intercept	2.588*** (0.096)	5.54	2.450*** (0.082)	5.14	2.346*** (0.101)	5.01	2.938*** (0.102)	5.79
Gender (♀)	0.235*** (0.036)	0.50	0.231*** (0.037)	0.47	−0.152*** (0.036)	−0.32	−0.274*** (0.037)	−0.54
Gender (⚥)	0.234 (0.224)	0.50	0.397 (0.232)	0.82	0.202 (0.223)	0.43	−0.385 (0.232)	−0.76
Education	−0.002 (0.013)	0.00	−0.029* (0.014)	−0.06	0.037** (0.013)	0.08	0.018 (0.014)	0.03
Young (25−44)	−0.077 (0.050)	−0.16	−0.093 (0.052)	−0.19	−0.005 (0.050)	0.00	−0.158** (0.052)	−0.31
Middle-aged (45−64)	−0.366*** (0.053)	−0.78	−0.425*** (0.055)	−0.87	0.082 (0.053)	0.17	−0.005 (0.055)	−0.01
Older (65+)	−0.637*** (0.075)	−1.36	−0.722*** (0.077)	−1.48	0.131 (0.075)	0.28	0.224** (0.079)	0.44
Random effects	Variance		Variance		Variance		Variance	
Level 1 residuals	0.346		0.423		0.360		0.431	
Level 2 intercept	0.473		0.475		0.454		0.467	
Days								
Correlation[a]								
Level 3 intercept	0.065		0.013		0.086		0.078	
Days								
Correlation[a]								
Level 1 AR								

Note. Models were based on 4,177 assessments, 2,762 participants, and 26 countries. Results of models estimated without the covariates Gender and Education can be found in Supplemental Table S13. NA = negative affect; PA = positive affect; AR = autocorrelation; Coef. = coefficient; ES = effect size (see Method section); Level 1 = assessments; Level 2 = participants; Level 3 = countries; Var. = variance. Age group reference category is Emerging adults (18–24). Gender reference category is men.
[a] Correlation between random intercept and slope (if estimated).
* $p < .05$. ** $p < .01$. *** $p < .001$.

Postestimation Bayesian predictions of the random intercepts showed that mean high-arousal NA intensity ranged from 2.01 to 2.85 across countries and mean low-arousal NA intensity was slightly higher, although the range was comparable (2.29 to 3.18, Supplemental Table S6). Low-arousal PA random intercepts were also generally lower than high-arousal PA across countries (range 1.64 to 2.82 vs. 2.59 to 3.46, see Supplemental Table S6).

There were also significant random effects for *Days* at both the country- and participant-level for high-arousal NA and low-arousal PA, but only at the participant-level for low-arousal NA and high-arousal PA (see Table 4). Empirical Bayes prediction of individual growth curve parameters showed that around 5% of participants increased in high-arousal NA during phase 2 (Figure 5A and Supplemental Table S3) while approximately a third of participants increased in low-arousal NA (Figure 5B and Supplemental Table S3). A small minority of participants (2.76%, Figure 6A and Supplemental Table S3) decreased in high-arousal PA which was also found for low-arousal PA (6.13%, Figure 6B and Supplemental Table S3). Between-country differences in the effect of time (*Days*) were observed, but minimal, and only for high-arousal NA and low-arousal PA. For example, the Bayesian postestimation predictions of the random slopes of *Days* for high-arousal NA during peak restrictions ranged from −.012 to −.001 (see Supplemental Table S6).

Phase 3: Easing Restrictions

In phase 3, the age differences in mean levels of high-arousal NA remained (main effect of *Age*, see Table 5). The decrease in high-arousal NA of the previous phase stabilized during this phase in emerging adults (main effect of *Days*), but this decrease continued in middle-aged adults (*Days* × *Age* interaction, Figure 7, Table 5). Age-group differences in mean levels of low-arousal NA were also present during this phase, but no differences in effects over time between emerging adults and the older age groups were observed (no main effect of *Age* and no *Days* × *Age* interactions).

Age-group differences in mean levels of high- as well as low-arousal PA were small; only the levels reported by older adults were slightly higher than those of emerging adults. The increase in high-arousal PA over time among emerging adults continued during this period (main effect of *Days*, $B = .003$, $d = .17$ *SD* per month), but this rate of increase was similar in the other age groups (no *Days* × *Age* interactions, see Table 5 and Figure 7). There was no change over time in low-arousal PA among emerging adults (no main effect of *Days*), but a small increase in the other age groups (*Days* × *Age* interactions, Figure 7 and Table 5).

Random Effects (Phase 3)

Significant random effects for *Days* on the participant level were observed for all outcome measures. Significant random effects for *Days* on the country level were only observed for low-arousal PA (see Table 5). We therefore only discuss the random effects on the participant level. The proportion of individuals experiencing an increase in high-arousal NA was larger during this phase compared with the previous phase (13.74%, Figure 8A and Supplemental Table S3), and an increase was also observed in a substantial proportion of individuals for low-arousal NA (35.34%, Figure 8B and Supplemental Table S3). The proportion of participants experiencing a decrease in high-arousal PA was still small (3.32% Figure 9A and Supplemental Table S3), but for low-arousal PA the proportion increased sixfold compared with the previous phase (36.45%, see Figure 9B and Supplemental Table S3).

Trajectories of Single Emotions

To bolster our understanding of the results, we estimated linear growth curve models for each of the nine single emotions (anger,

Table 4

Multilevel Model Results of High- and Low-Arousal NA and PA Predicted by Age and Days During Phase 2 (Peak Restrictions)

	High-arousal NA		Low-arousal NA		High-arousal PA		Low-arousal PA	
Fixed effects	Coef. (*SE*)	ES	Coef. (*SE*)	ES	Coef. (*SE*)	ES	Coef. (*SE*)	ES
Intercept	2.507*** (0.057)	5.49	2.509*** (0.048)	5.28	2.324*** (0.059)	4.75	2.988*** (0.059)	5.92
Gender (♀)	0.186*** (0.019)	0.41	0.215*** (0.020)	0.45	−0.166*** (0.018)	−0.34	−0.270*** (0.019)	−0.53
Gender (⚥)	0.467*** (0.012)	1.03	0.683*** (0.125)		−0.074 (0.117)	−0.15	−0.465*** (0.122)	−0.92
Education	−0.012* (0.006)	−0.03	−0.021** (0.006)	−0.04	0.052*** (0.006)	0.11	0.031*** (0.006)	0.06
Young (25−44)	0.004 (0.036)	0.01	−0.157*** (0.037)	−0.32	−0.005 (0.035)	−0.01	−0.196*** (0.036)	−0.39
Middle-aged (45−64)	−0.221*** (0.037)	−0.49	−0.420*** (0.038)	−0.88	0.074* (0.036)	0.15	−0.132*** (0.037)	−0.26
Older (65+)	−0.494*** (0.045)	−1.08	−0.763*** (0.046)	−1.60	0.086 (0.043)	0.18	0.055 (0.045)	0.11
Days	−0.005*** (0.001)	−0.33	−0.002* (0.001)	−0.14	0.006*** (0.001)	0.36	0.003* (0.001)	0.19
Days × YA	−0.002 (0.001)	−0.11	0.002* (0.001)	0.12	−0.002* (0.001)	−0.13	0.002* (0.001)	0.14
Days × MA	−0.001 (0.001)	−0.08	0.002 (0.001)	0.09	−0.003*** (0.001)	−0.19	0.003** (0.001)	0.17
Days × OA	−0.0,006 (0.001)	−0.04	0.003* (0.001)	0.15	−0.003* (0.001)	−0.14	0.003* (0.001)	0.17
Random effects	Variance		Variance		Variance		Variance	
Level 1 residuals	0.310		0.355		0.350		0.370	
Level 2 intercept	0.536		0.602		0.462		0.505	
Days	6.601×10^{-5}		5.020×10^{-5}		3.874×10^{-5}		3.245×10^{-5}	
Correlation[a]	−0.19		−0.232					
Level 3 intercept	0.043		0.014		0.054		0.049	
Days	1.392×10^{-5}						2.255×10^{-5}	
Correlation[a]								
Level 1 AR	0.262		0.224		0.214		0.218	

Note. Models were based on 29,779 assessments, 9,260 participants, and 33 countries. Results of models estimated without the covariates Gender and Education can be found in Supplemental Table S14. NA = negative affect; PA = positive affect; AR = autocorrelation; Coef. = coefficient; Days = number of days during phase 2; ES = effect size (see Method section); Level 1 = assessments; Level 2 = participants; Level 3 = countries; Var. = variance; YA = young adults; MA = middle-aged adults; OA = older adults (reference is Emerging adults [18–24]. Gender reference category is men.

[a] Correlation between random intercept and slope (if estimated).

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

anxiety, nervousness, depression, exhaustion, energetic, inspired, calm, and relaxed), and compared the results of each emotion model (e.g., anger) with the results of the model of the composite affect construct (e.g., high-arousal NA), as outlined in Supplemental Tables S7–S12. The growth curve trajectories of single emotions were generally similar to the trajectories of the broader affect construct during each of the three phases of stringency; most of the differences pertained the significance level (i.e., 39/234 = 17% of the estimated coefficients), whereas a minority concerned differences in the direction of effect (i.e., 15/234 = 6%).

The most notable differences were found in the models of anger and anxiety, two of the three high-arousal NA emotions. Whereas high-arousal NA among young adults did not differ from emerging adults (main effect of Age), anger was slightly lower among this age group ($B = -.07$). Additionally, the interactions between *Days* and *Age* for anger and anxiety differed from those observed for high-arousal NA (see Table S9). This indicates that these emotions changed with age in ways that became obfuscated in the composite affect model. Specifically, although there were no age differences in the rate in which the composite high-arousal NA score decreased during phase 2, the anger component decreased more slowly among middle-aged and older adults compared with emerging adults (the reference group). The anxiety component, on the other hand, decreased *faster* among these age groups compared with emerging adults.

Discussion

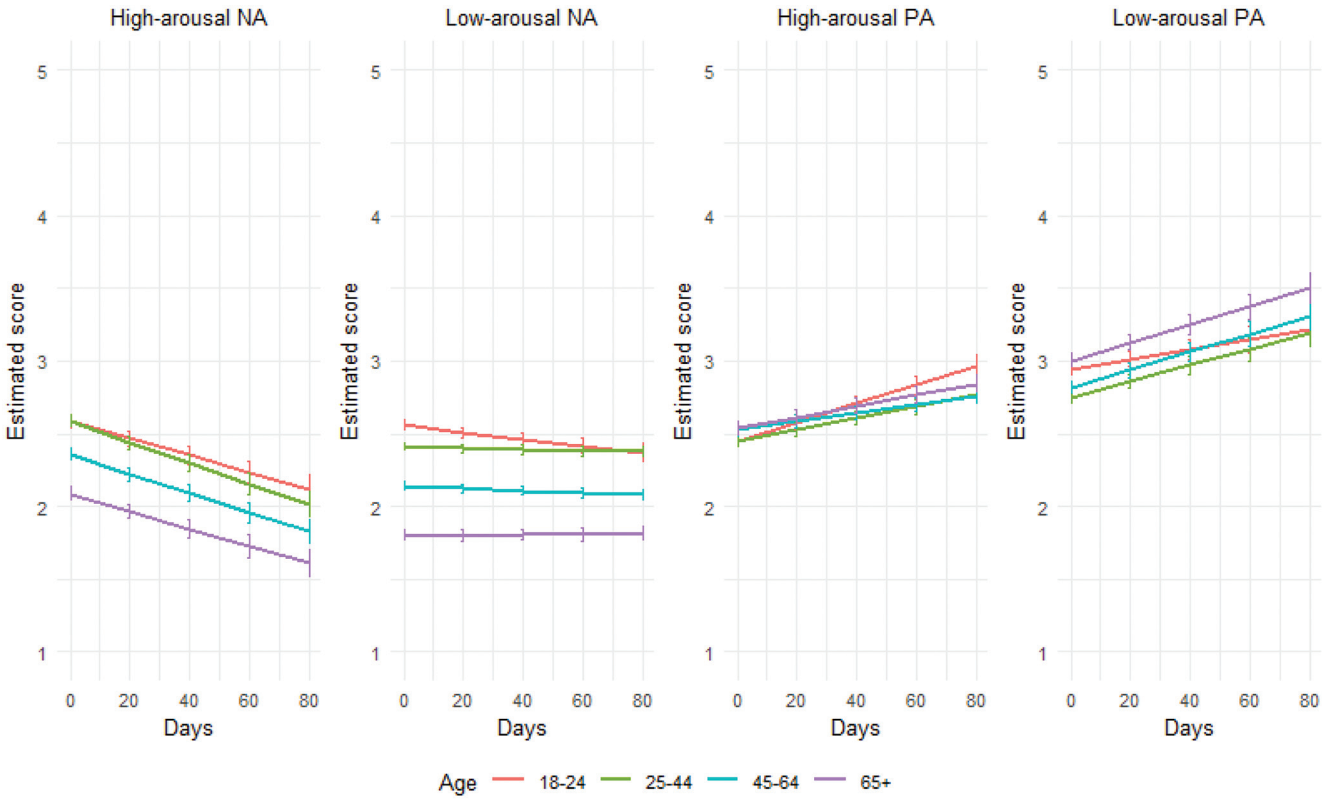
We examined age group differences in hedonic adaptation trajectories during societal restrictions to contain the first wave of the COVID-19 pandemic (March to June 2020) across 33 countries. In doing so, we distinguished between trajectories of positive and negative affect (PA/NA) at high- and low-arousal levels. Our models provided five key observations. *First*, older adults reported higher levels of low-arousal PA and lower NA than emerging adults, suggesting the age-graded positivity effect persisted during the pandemic. *Second,* hedonic adaptation during the phase of stable peak restrictions was evident in a small increase in PA, most prominently in high-arousal PA ($d = .36$ per month) but also in low-arousal PA ($d = .19$ p/m). NA decreased over time, especially high-arousal NA ($d = .35$) while low-arousal NA decreased more slowly ($d = .14$ p/m). Evidently, most adaptation occurred high in the emotional arousal spectrum. *Third*, the rate of hedonic adaptation in older age groups does not appear to differ from that in the youngest age group, suggesting that age-advantages in emotional well-being are confined to mean-level differences rather than emotion dynamics. *Fourth*, during periods of peak restrictions, about ∼5% to 30% of the participants continued to increase in NA and ∼3% to 6% decreased in PA (in emotions at low and high arousal levels), demonstrating substantial individual differences in adaptation. *Fifth*, individual heterogeneity was generally more pronounced at the individual than at the country level. These five observations are now discussed in more detail below.

Lifespan Differences in Emotional Well-Being

During the first wave of the COVID-19 pandemic, older adults reported higher low-arousal PA and lower NA than emerging adults. In general, these differences in emotional well-being increased incrementally from the youngest to the oldest age group. To facilitate

Figure 4

Predicted Growth Curve Trajectories of Affect During Phase 2 (Peak Societal Restrictions)



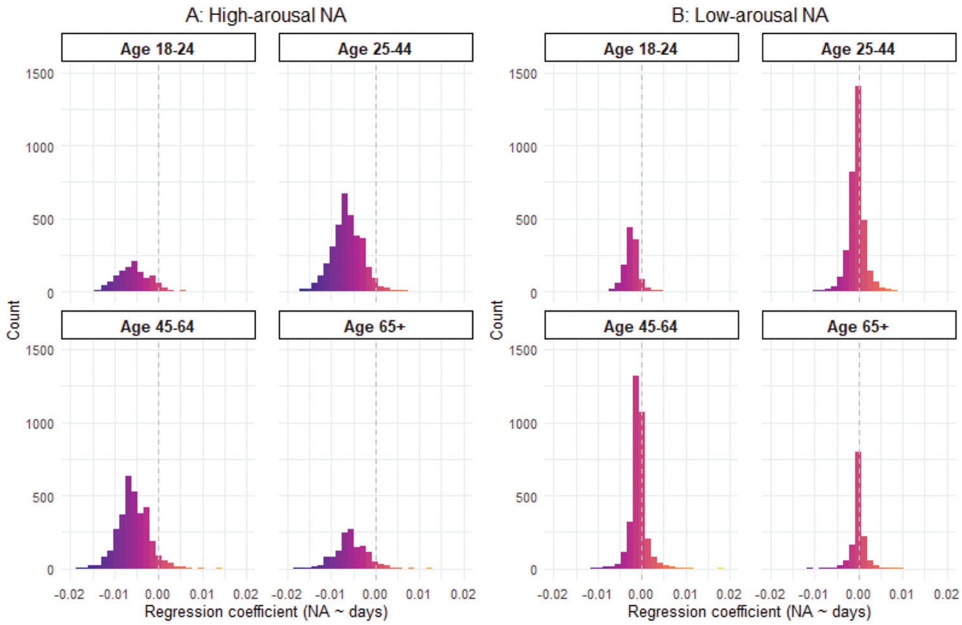
Note. NA = negative affect; PA = positive affect. See the online article for the color version of this figure.

interpretation of our analysis, we collapsed ten age categories into four: emerging (18–24), young (25–44), middle-aged (45–64), and older (65+) adults. These are arguably broad age ranges but reflect recent conceptualizations of distinct developmental periods in adulthood (e.g., Infurna et al., 2020; Mehta et al., 2020). Nevertheless, we observed similar patterns of results in secondary analysis in which these age categories were not collapsed (see Supplemental Tables S16–S18).

Higher emotional well-being among older people has often been reported (e.g., Carstensen et al., 2011), also during the COVID-19 pandemic (Carstensen et al., 2020; Klaiber et al., 2021). However, a recent study reported that the relative difference in emotional well-being between younger and older adults decreased during the pandemic (Sun & Sauter, 2021). The age-graded advantage in emotion processing is explained by socioemotional selectivity theory (SST) as a motivational shift in the type of goals that people prioritize as their time horizon decreases with age (e.g., Carstensen, 2006; Carstensen et al., 1999; Mather & Ponzio, 2015). Existing and emotionally close relationships become more important for emotional well-being, whereas younger adults typically prioritize a broadening of their social network to learn and experience new things. The Strength and Vulnerability Integration (SAVI) model, on the other hand, states that people become more skilled in avoiding or de-escalating negative experiences with age (Charles, 2010). This age-graded advantage may be attenuated, however, in the context of chronic or unavoidable stressors: physiological vulnerabilities make regulating high levels of emotional arousal more difficult among older adults (Charles, 2010).

In our study, there was no evidence that age advantages in emotional well-being dissipated during the first peak of the COVID-19 pandemic. Our findings are therefore in line with the view that age differences in the prioritization of goals (SST) persist during stressful situations (Carstensen et al., 2020). Arguably, societal restrictions during the pandemic might have thwarted this goal fulfillment in different ways across the age groups, and therefore impacted emotional well-being differently. Recent work indeed shows that young adults reported larger changes in their daily life patterns due to pandemic-related circumstances than older adults, and felt more restricted and stressed (Birditt et al., 2021; Charles et al., 2021). This age group also reported a substantially larger increase in mental health symptoms (Dopmeijer et al., 2021; Kwong et al., 2021). However, parents of (young) children, which are often adults in middle-age, have also been found to be more stressed than adults without children (Adams et al., 2021). Nevertheless, without a pre–COVID-19 baseline measurement, we could not examine whether the age-graded advantage in emotional well-being actually remained stable during the pandemic. A reduction such as reported by Sun and Sauter (2021) would be in line with the predictions of the SAVI model. Arguably, some people could minimize their stress exposure during the pandemic, and older adults indeed proved more avoidant of media coverage of COVID-19 than younger adults (Deng et al., 2020). In sum, whereas our study revealed an apparent age advantage in emotional well-being (in terms of mean intensity scores), the underlying mechanisms for the existence and persistence of this advantage remain unclear.

Figure 5
Variability in (A) High- and (B) Low-Arousal NA Trajectories During Phase 2

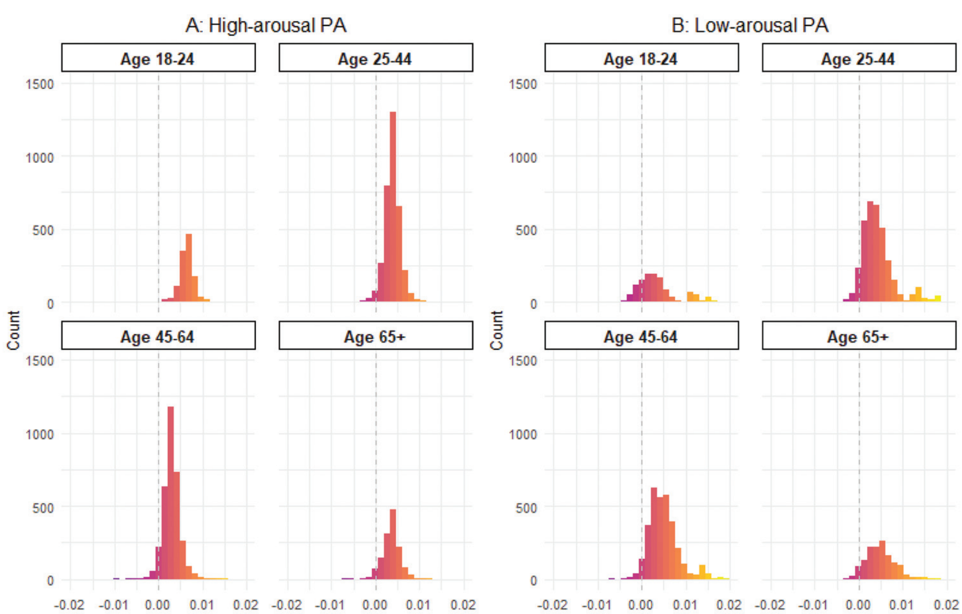


Note. NA = negative affect. See the online article for the color version of this figure.

Hedonic Adaptation?

In this study we examined change in PA and NA over time and age group differences in these trajectories. We observed increases in PA and decreases in NA over several weeks during a period of stable societal restrictions, indicative of hedonic adaptation (Frederick & Loewenstein, 1999; Lyubomirsky, 2011). The known shift toward a more positive emotional balance with advancing age (e.g., Reed et al., 2014), most markedly higher PA and lower NA intensity, could arguably benefit older adults via the reduced physiological impact of negative emotions, and more flexible thoughts and problem solving (Fredrickson, 2001;

Figure 6
Variability in (A) High- and (B) Low-Arousal PA Trajectories During Phase 2



Note. PA = positive affect. See the online article for the color version of this figure.

Table 5
Multilevel Model Results of High- and Low-Arousal NA and PA Predicted by Age and Days During Phase 3 (Easing Restrictions)

	High-arousal NA		Low-arousal NA		High-arousal PA		Low-arousal PA	
Fixed effects	Coef. (*SE*)	ES	Coef. (*SE*)	ES	Coef. (*SE*)	ES	Coef. (*SE*)	ES
Intercept	2.496*** (0.058)	5.93	2.445*** (0.058)	5.34	2.473*** (0.064)	5.05	3.023*** (0.061)	6.12
Gender (♀)	0.119*** (0.021)	0.28	0.172*** (0.022)	0.38	−0.194*** (0.022)	−0.40	−0.253*** (0.022)	−0.51
Gender (⚥)	0.258 (0.172)	0.61	0.270 (0.179)	0.59	−0.05 (0.175)	−0.11	−0.245 (0.176)	−0.50
Education	−0.017* (0.007)	−0.04	−0.018** (0.007)	−0.04	0.050*** (0.007)	0.10	0.029*** (0.007)	0.06
Young adults (25−44)	−0.103* (0.040)	−0.25	−0.113** (0.042)	−0.25	0.059 (0.040)	0.12	−0.063 (0.041)	−0.13
Middle-aged (45−64)	−0.326*** (0.040)	−0.77	−0.371*** (0.041)	−0.81	0.063 (0.040)	0.12	0.013 (0.040)	0.03
Older (65+)	−0.615*** (0.046)	−1.46	−0.714*** (0.047)	−1.56	0.091* (0.046)	0.19	0.194*** (0.046)	0.39
Days	−0.001 (0.001)	−0.09	0.0,005 (0.001)	0.03	0.003** (0.001)	0.17	−0.002 (0.001)	−0.12
Days × YA	−0.002 (0.001)	−0.11	−0.001 (0.001)	−0.07	0.001 (0.001)	0.04	0.003* (0.001)	0.17
Days × MA	−0.002* (0.001)	−0.15	−0.001 (0.001)	−0.06	0.001 (0.001)	0.07	0.004** (0.001)	0.22
Days × OA	−0.002 (0.001)	−0.12	−0.002 (0.001)	−0.10	0.002 (0.001)	0.10	0.005*** (0.001)	0.28
Random effects	Variance		Variance		Variance		Variance	
Level 1 residuals	0.274		0.331		0.347		0.361	
Level 2 intercept	0.601		0.604		0.518		0.530	
Days	9.048×10^{-5}		7.074×10^{-5}		5.037×10^{-5}		4.129×10^{-5}	
Correlation[a]	−0.31		−0.205					
Level 3 intercept	0.038		0.031		0.060		0.045	
Days							5.244×10^{-5}	
Correlation[a]								
Level 1 AR	0.196		0.185		0.184		0.161	

Note. All models were based on 25,081 assessments, 7,069 participants, and 32 countries. Results of models estimated without the covariates Gender and Education can be found in Supplemental Table S15. NA = negative affect; PA = positive affect; AR = autocorrelation; Coef. = coefficient; Days = number of days during phase 3; ES = effect size (see Method section); Level 1 = assessments; Level 2 = participants; Level 3 = countries; YA = young adults; MA = middle-aged adults; OA = older adults (reference is Emerging adults [18–24]). Gender reference category is men.
[a] Correlation between random intercept and slope (if estimated).
* $p < .05$. ** $p < .01$. *** $p < .001$.

Fredrickson et al., 2000; Tugade et al., 2004). However, our models indicated that differences between emerging adults and older age groups in the rate of hedonic adaptation processes were minimal. This suggests that the flexibility of our emotional system and its capacity to monitor contextual changes and novelty therefore functions fairly similarly along the lifespan.

Taking a closer look at single emotions versus composite high- and low-arousal PA and NA, however, revealed that the adaptation patterns of anger and anxiety differed slightly among older age groups compared with emerging adults. Whereas anxiety decreased faster among middle-aged and older adults, anger showed the opposite pattern. This is surprising given that young adults reported feeling more restricted in pursuing their daily life goals during the COVID-19 pandemic (Birditt et al., 2021; Charles et al., 2021), and anger is typically elicited by the appraisal that one's goals are intentionally blocked (Frijda et al., 1989; Lazarus, 1991). Aside from anxiety and anger, there were minimal age differences in the rate of hedonic adaptation of the other studied single emotions.

The rate of emotional adaptation was about twice as large for high-arousal emotions than low-arousal emotions (across all age groups), independent of emotional valence. This is in line with theories that suggest that adaptation evolved as a means to reduce ("costly") high-arousal (Fredrickson et al., 2000; Lyubomirsky, 2011). Arousal energizes the body and motivates active interaction with the environment, whereas low arousal emotions reflect passive compliance (Harmon-Jones et al., 2013, 2016). During the COVID-19 pandemic, there were only limited possibilities for people to actively change their living situation; even if one felt angry about the societal restrictions, it was most convenient to comply. In such a situation that requires compliance over active engagement with one's environment, the behavioral tendencies connected to high-arousal negative emotions are no longer useful, leading to a regulatory decrease in their intensity (Gross, 2015). Finally, the diverging rate of adaptation of high- versus low-arousal emotions might also reflect that high-arousal emotions were experienced more frequently in general (Scherer et al., 2004), or that we remember these high-arousal experiences better (Kensinger & Schacter, 2016; Panksepp & Biven, 2012).

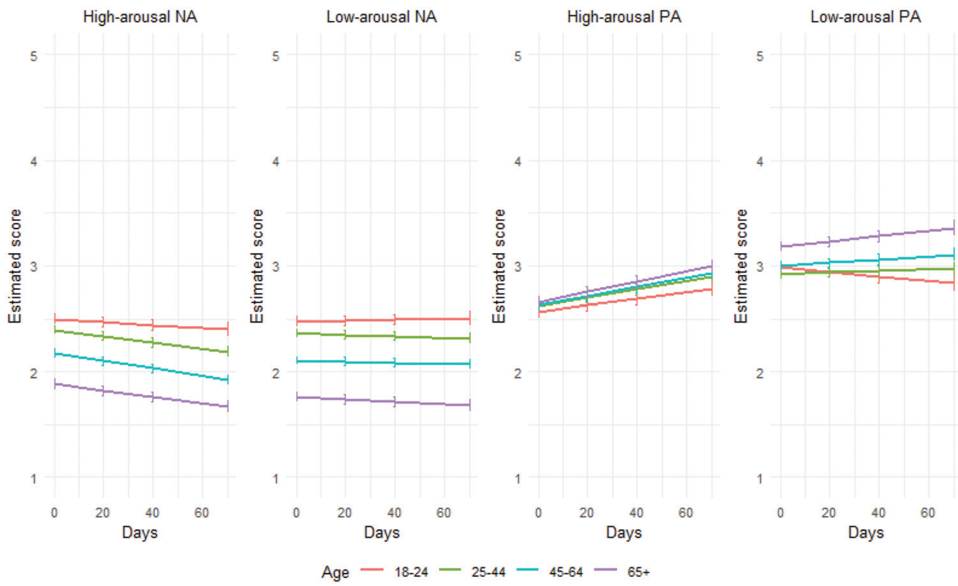
One speculative interpretation of our results would be that arousal levels remained fairly stable during the period of peak societal restrictions but were interpreted more positively over time, in line with the theory of constructed emotion (Barrett, 2017). In other words, people increasingly constructed their experiential components into more positive emotions and perceptions of their reality, shifting from NA ($d = -.35$ p/m) to PA ($d = .36$ p/m) over time. Future studies with more refined data and experiments may test this application of the theory of constructed emotions which suggests that qualitative changes in emotional experiences occurred, versus the competing idea that emotional recovery became hard-coded into our biology because it was key to ancestral survival (Panksepp & Biven, 2012), and would therefore remain fairly stable with advancing age.

Individual Differences in Hedonic Adaptation

Most participants reported more PA and less NA the longer the extreme societal restrictions were in place in their countries.

Figure 7

Predicted Growth Curve Trajectories of Affect During Phase 3 (Easing Restrictions)

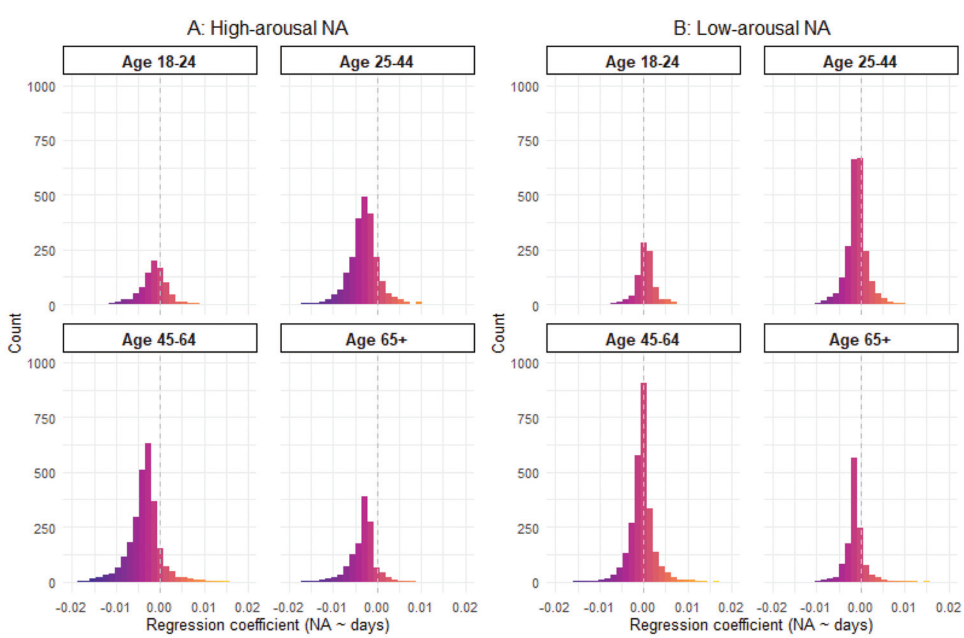


Note. See the online article for the color version of this figure.

A minority showed opposing affect trajectories. Marked individual differences in response to significant life events have been previously reported (Lucas, 2007a, 2007b; Luhmann et al., 2012; Specht et al., 2011), also in the context of an epidemic (e.g., SARS, Bonanno et al., 2008). For these individuals, extreme societal restrictions including physical distancing, stay-at-home orders, gathering bans, and (nonessential) business closures may have created challenges that exceeded their coping resources. Previous studies of hedonic adaptation after disasters and trauma indicate that about 70% of people manage to recover within several weeks (Bonanno et al., 2011; Norris & Wind, 2009), but a minority of people may never recover, and change in their personality

Figure 8

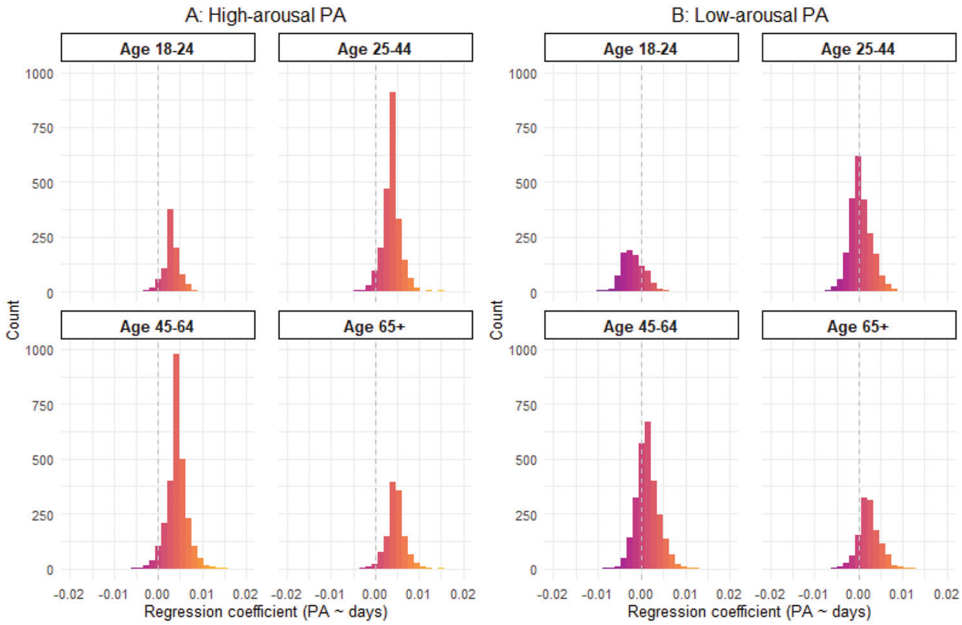
Variability in (A) High- and (B) Low-Arousal NA Trajectories During Phase 3



Note. NA = negative affect. See the online article for the color version of this figure.

Figure 9

Variability in (A) High- and (B) Low-Arousal PA Trajectories During Phase 3



Note. PA = positive affect. See the online article for the color version of this figure.

and well-being (Ormel et al., 2017) and/or develop mental health problems (Goldmann & Galea, 2014; Norris & Wind, 2009). This minority of individuals should not be overlooked in national and international policies.

We examined the period of stable peak restrictions in 33 countries, irrespective of the exact start- and end-date of this phase in each country, to examine hedonic adaptation. Emotional experiences and expressions are grounded in and bound by the cultural context in which they occur (Mesquita et al., 2016), but country differences in mean affect and rate of hedonic adaptation were minimal (compared with differences between individuals); country-level heterogeneity in hedonic adaptation was evident in low-arousal PA and high-arousal NA only, which may also indicate differences in population composition (e.g., age, resources). Moreover, low-arousal PA (approach) and high-arousal NA (avoidance) stimuli are most easily processed and show direct connections to tendencies (cq. "valence-arousal conflict theory" by Robinson, 2004), thus it could be functional. Our results suggest that hedonic adaptation is a universal phenomenon but future research examining this topic may better account for construct and measurement equivalence across cultures. Moreover, future work could also explore individual and contextual differences in interactions between arousal and valence (see Kuppens et al., 2013).

Strengths and Limitations

A key strength of this study was this unique dataset of experiences collected during the unfolding COVID-19 pandemic, which allows us to compare emotional experiences in individuals that experienced a similar societal shock. This natural experiment can be considered the most severe public health emergency and psychosocial shock event since the second world war (Jeronimus, 2020). We measured emotion trajectories and distinguished between differences in valence and arousal, which provided novel insights into age group differences in hedonic adaptation processes.

One limitation of the PsyCorona project is that it was not preregistered. We rapidly launched the project early 2020 and adapted our questionnaire on a rolling basis to address themes that were relevant at the moment (e.g., vaccine developments). Additionally, we therefore lack a pre-COVID-19 baseline assessment of emotions. This means that we do not know whether observed age-differences in emotions were already present before the pandemic. Additionally, we could not test whether individuals' emotions were close to their pre–COVID-19 levels at the end of the period of peak restrictions, or whether they were still significantly less positive and more negative than before. In other words, it remains unknown whether hedonic adaptation was (nearly) complete.

Second, we did not examine the occurrence of concurrent life events, although this would also have resulted in additional difficulties (e.g., was divorce driven by the pandemic?). Indeed, COVID-19 may have been more challenging for some individuals than for others, and some also experienced other life challenges, such as major illness or divorce. Any of such circumstances could impact emotional well-being and/or thwart hedonic adaptation to social restrictions. Note, however, that the emotional adaptation trajectories ran largely in parallel, whether it was young adults or middle-aged adults (who often have children which required homeschooling and for whom family and work responsibilities collided) and older adults (who experienced heightened objective risk positions), more in line with biological than psychosocial interpretations.

Regarding the design of the study, the weekly assessments allowed us to track a large number of individuals over time with an acceptable number of participants dropping out over the course of the study. Nevertheless, measuring emotions once per week is subject to memory biases, and resulted in our study in snapshots of emotion processes that in reality unfold over hours and days, and which are ideally assessed using ambulatory methods and much more frequent assessments (Shiffman et al., 2008). Additionally, the range of emotions we measured was balanced in terms of arousal and valence but limited in number (see Figure 1). It would be interesting to cover a more diverse set of emotions, such as social or moral emotions (e.g., shame, guilt, pride) and emotions like frustration, stress, disgust, fear, and loneliness. Some of the measured emotions may not have been representative of what young and older adults experience most frequently. Young adults report both higher pleasantness and unpleasantness during emotional arousal, whereas older adults typically find low arousal experiences most pleasant (Keil & Freund, 2009). Consequently, young adults are more likely to report aroused positive emotions such as feeling energetic and inspired than older adults, but not more low arousal emotions such as content or calm (see meta-analysis by Pinquart, 2001), and older adults are likely to experience more awe and tenderness (items that we did not measure), and perhaps more attachment related emotions. Furthermore, it remains unclear when which emotions are adaptive for whom, as this may differ between people and across contexts; for example, while for some lockdown could result in more quality time with family and positive affect, others may experience negative (moral) emotions that facilitate social living (e.g., Tangney et al., 2007). Recent work identified more positive emotions during lockdown as indicative of resilience and adaptability to stress (e.g., Israelashvili, 2021).

Finally, there are indications that the first COVID-19 wave may have been experienced differently than subsequent waves (Jeronimus, 2020; Krautter et al., 2022); there was a sense of solidarity (a "rally around the flag" effect) when the pandemic was new, much remained unknown, and most adults still thought the pandemic would last a relatively short time. During subsequent waves, the negative emotions may have been more prominent due to the continuing uncertainty over the pandemic's duration, its economic challenges, and eroding social networks (e.g., Krautter et al., 2022), and more and more diverse empirical data remains required. Studies have indeed started to report deteriorating mental health and an increased number of suicides during the second wave as compared with the first (Canadian Mental Health Association, 2021; Tanaka & Okamoto, 2021) and deteriorating mental health over 2021.

Conclusion

In this article we have examined emotion trajectories over 12 weeks in the spring of 2020 in 33 countries, a period of severe societal restrictions in response to the first wave of the COVID-19 pandemic. Hedonic adaptation processes were evident in increases in positive affect and decreases in negative affect over time. Our key observation is that these adaptation trajectories were similar across age groups (aged 18–85+), despite marked differences in context (e.g., daily rhythm, housing, home schooling) and relative risk position during the coronavirus pandemic. A subgroup of participants showed the opposite trajectories of emotional change, which indicates that there were marked individual differences in hedonic adaptation. Some countries showed salient differences in these affect trajectories, but most heterogeneity occurred between individuals, with up to 30% of the participants increasing in NA and up to 6% decreasing in PA, against the general trend. This study indicates that hedonic adaptation trajectories during stable contextual stress seem age-independent, and it follows that the positivity effect that underlies higher emotional well-being with age is largely restricted to mean-level differences in emotional experiences (which we also observed) and does not necessarily extend to dynamic emotional adaptation processes during periods of stress.

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