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Research article

Discovering emotional patterns for climate change and for the COVID-19 pandemic in university students

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ABSTRACT

The global crises of climate change and of the COVID-19 pandemic are straining young peoples' mental health and their mitigation behaviours. We surveyed German-speaking university students aged 18 to 30 years on their negative emotions regarding both crises repeatedly before and during the COVID-19 crisis. Different emotional patterns emerged for climate change and for COVID-19 with negative emotions regarding COVID-19 increasing during the pandemic. We were further able to differentiate between emotional responses associated with impaired wellbeing and those associated with mitigation efforts. Our findings emphasise the need to focus on a mixture of highly inactivating and activating emotions regarding COVID-19 as they are associated with both reduced wellbeing and mitigation behaviours. The findings broaden the understanding of how young adults react to the burden of two global crises and what role negative emotions play.

1. Introduction

When the COVID-19 pandemic emerged, researchers early on focused on the mental health impacts of the pandemic and the measures implemented to limit the spread of the virus. Studies found an increasing prevalence of mental illness with young people being particularly affected [1]. One explanation is an increase in negative emotions during the pandemic [2] which were found to be associated with different psychopathological symptoms [3,4]. However, the COVID-19 pandemic is not the only global crisis humanity is currently facing. Even if greenhouse gas emissions were limited during lockdowns, climate change did not halt [5]. Climate change will particularly affect younger people as they will likely suffer from its impact during their lifetime and might be particularly vulnerable to mental health impacts exacerbated by climate change [6,7]. Regarding mental health effects on people who are not directly exposed to climate change impacts, there is a focus on emotions like anxiety, worry, anger, or grief [8–11]. Simultaneously, negative emotional reactions are deemed a critical factor for climate-friendly behaviour [12,13]. Taken together, negative emotions regarding climate change might constitute healthy and adaptive responses to this threat but might also lead to problematic outcomes [10]. Therefore, there is an increasing focus on differentiating emotions [6,11]. Following Feldman Barrett [14,15], emotions can be differentiated by levels of pleasure and activation. Accordingly, emotions can be experienced as positive or as negative and they can vary in their degree of inducing activity or mobilization. Stanley and colleagues found that the activating negative emotion eco-anger – but not the less activating eco-anxiety and eco-depression – is associated with both better mental health outcomes and more mitigation efforts [11].

As climate change and the COVID-19 pandemic represent global crises with several similarities and presumed mental health impact, especially for young people, studying both simultaneously is one step in understanding emotional reactions to crises and their mental health and behavioural implications. This is especially important since the combination of both crises might increase the burden on mental health in interconnected ways. In this article, we compare emotional reactions regarding COVID-19 and climate change, explore changes over time, and analyse emotional patterns. Due to the novelty of the situation and the research questions, analyses are exploratory. Additionally, we examine effects of negative emotions on wellbeing and mitigation behaviour.

2. Method

This study is based on longitudinal data collected in online surveys. The study was conducted in accordance with the Declaration of Helsinki and approved by the Review Board for Ethical Questions of

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the University of Innsbruck. All participants provided informed consent at the beginning of each survey. Participants were university students recruited via mailing lists of two universities in Innsbruck, Austria, and by contacting students who participated in a previous survey. In total, three surveys during the COVID-19 pandemic are included in this analysis:

- T1 – July 8 to August 29, 2020
- T2 – November 23 to December 21, 2020
- T3 – April 13 to May 13, 2021

The cross-sectional focus of this study is on T3. We further used data from a survey conducted to research effects of climate change on young people's mental health before COVID-19 became a pandemic:

- T0 – December 3, 2019, to January 3, 2020

2.2. Measures

At the beginning of each survey, participants provided information on basic sociodemographic data.

Negative emotions were measured using an eleven-item scale based on a German translation of a scale measuring climate change distress by Searle and Gow [16]. Participants rated the extent they felt each emotion when thinking about climate change or the COVID-19 crisis on a four-point Likert response format (1 *does not apply at all* to 4 *does apply completely or all the time*). Negative emotions associated with climate change were assessed in the surveys T0 and T3. Negative emotions associated with the COVID-19 crisis were assessed in surveys T1 through T3 (see Table 1).

Wellbeing was measured using a German version of the WHO-5 at T3 [17]. Five items were rated on a six-point Likert response format (0 *never* to 5 *all the time*, Cronbach's $\alpha = 0.89$). The scale was formed by using the sum of all items.

Mitigation behaviour was assessed using four items for climate friendly-behaviour and two items for adherence to COVID-19 measures at T3. Frequency of climate-friendly behaviours (e.g., 'I make sure to save electricity') was assessed on a seven-point Likert response format (1 *very rarely* to 7 *very often*). Participants could opt out of answering individual items as not all items applied to every person. Adherence to COVID-19 measures (e.g., 'I independently take measures to counteract the spread of the virus.') was assessed on a five-point Likert response format (1 *does not apply at all* to 5 *does apply completely*). Mean scores were calculated with higher values indicating more frequent mitigation behaviour. Internal consistency was Cronbach's $\alpha = 0.62$ for climate-friendly behaviour and $\alpha = 0.62$ for adherence with COVID-19 measures.

2.3. Sample

Participants were university students aged between 18 and 30 years. Students who did not complete the whole survey or who had missing data in the relevant scales were excluded from the analyses (the opt-out option was not considered missing data). At T0 $N = 574$ students participated, at T1 $N = 430$, at T2 $N = 578$, and at T3 $N = 314$. Age and gender for all data collection points are presented in Table 2. Of all students, $n = 45$ participated in all surveys T1 through T3 which was trackable via an anonymised code that could be entered optionally. Amongst those participants women were more frequent ($n = 36$, 80.0%) than men ($n = 8$, 17.8%). Mean age at T1 was 23.20 years ($SD = 2.92$). As we did not plan to use the data collected before the pandemic in a longitudinal study, we did not include a code to match participants in T0.

Table 1
Measurement of negative emotions.

	T0	T1	T2	T3
COVID-19		x	x	x
Climate change	x			x

2.4. Data analysis

Data was analysed using IBM SPSS Statistics, Version 26.0. To examine differences in emotions regarding the two crises as well as changes over time, we used non-parametrical Wilcoxon-tests, Mann-Whitney U-tests, and Friedman H-tests. To assess the factorial structure of the emotion scales, we used main-axis factor analyses using data of T3. Factors were extracted based on the Eigenvalue > 1. The effects of these emotion scales on wellbeing and mitigation behaviour at T3 were assessed by hierarchical linear regression analyses with forced entry.

Additional details on descriptive data for all tests and subsamples are presented in the appendix for reasons of space and clarity.

3. Results

3.1. Comparing emotions regarding COVID-19 and climate change

Using Wilcoxon-tests, we compared emotions evoked by the two crises at T3. Results are presented in Fig. 1 (see also Table A.1). Participants felt more powerless ($Z = -4.83$, $p < 0.001$, $\eta^2 = 0.074$), depressed ($Z = -5.86$, $p < 0.001$, $\eta^2 = 0.109$), stressed ($Z = -8.84$, $p < 0.001$, $\eta^2 = 0.249$), and tense ($Z = -4.85$, $p < 0.001$, $\eta^2 = 0.075$), when thinking about the COVID-19 pandemic compared to climate change. Climate change evoked feeling worried ($Z = -5.98$, $p < 0.001$, $\eta^2 = 0.114$) and concerned ($Z = -5.97$, $p < 0.001$, $\eta^2 = 0.114$) more strongly. There were no differences in feeling helpless, sad, hopeless, angry, and anxious.

Correlations between emotions regarding climate change and COVID-19 are presented in Table 3 (see also Table A.3). Correlations were small to medium sized with largest associations for anxiety and smallest associations for anger.

3.2. Changes during the COVID-19 crisis

Using only the subsample of students who participated in all three surveys during the COVID-19 crisis, we assessed changes in their emotional reactions during the pandemic. There were significant increases in feeling depressed ($\chi^2(2) = 12.39$, $p = 0.002$, $\eta^2 = 0.275$), hopeless ($\chi^2(2) = 28.97$, $p < 0.001$, $\eta^2 = 0.644$), and helpless ($\chi^2(2) = 17.53$, $p < 0.001$, $\eta^2 = 0.390$) in this subsample (see Fig. 2). The remaining emotions did not reach the Bonferroni-corrected significance level of $p < .004$, although generally negative emotions trended towards increasing (see Table A.4).

Table 2
Age and gender of participants of all surveys.

	Gender			Age			
	female	male	non-binary	Min	Max	M	SD
T0	402 (70.0%)	167 (29.1)	5 (0.9%)	18	30	22.92	2.85
T1	332 (77.2%)	95 (22.1%)	3 (0.7%)	18	30	23.07	2.68
T2	409 (70.8%)	167 (28.9%)	2 (0.3%)	18	30	22.48	2.86
T3	230 (73.2%)	83 (26.4%)	1 (0.3%)	18	30	23.09	2.79

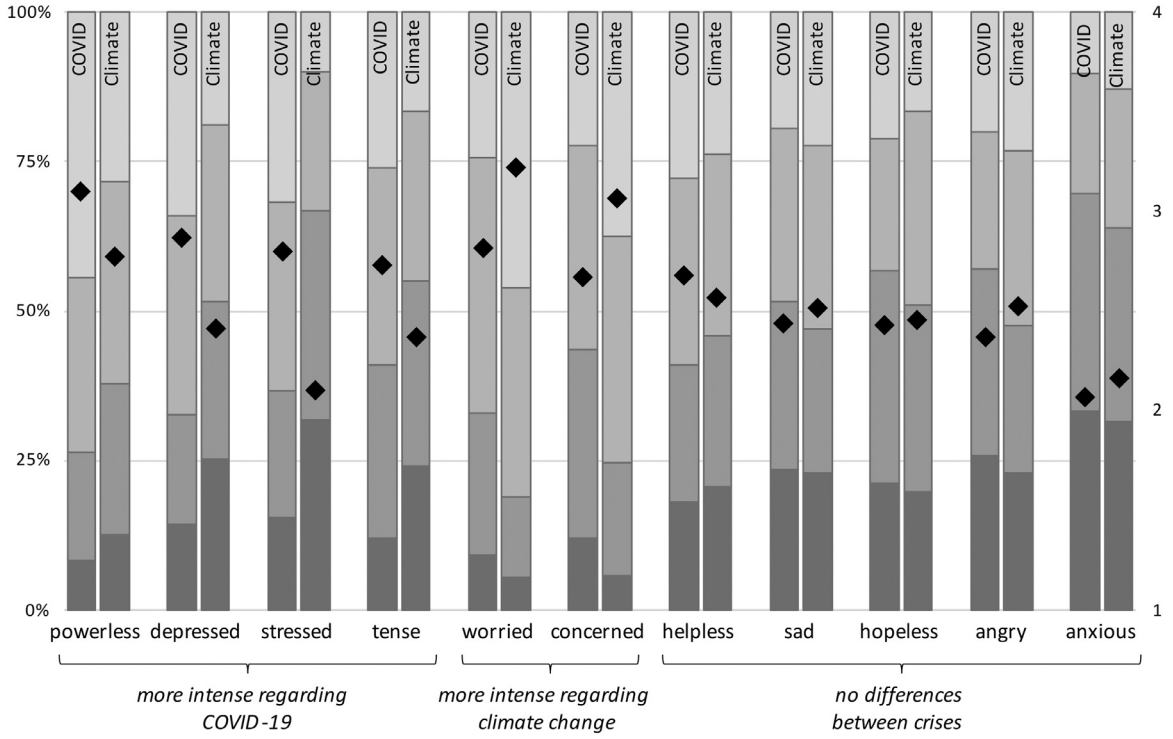

Fig. 1. Emotional reactions towards COVID-19 and climate change. For each emotion left bar = COVID-19, right bar = climate change. Stacked columns indicate the percentage (left axis) of participants who indicated "does not apply at all" = dark grey at the bottom to "does apply completely or all the time" = light grey at the top; Black squares indicate the mean on a scale of 1 to 4 (right axis). *N* = 314; data collection T3.

Table 3
Correlations between COVID-19 and climate change emotions.

worried	tense	concerned	anxious	depressed	hopeless	powerless	sad	helpless	stressed	angry
.25**	.24**	.26**	.40**	.22**	.28**	.34**	.24**	.33**	.30**	.17*

Note. *N* = 314; data collection T3; * $p < 0.01$, ** $p < 0.001$.

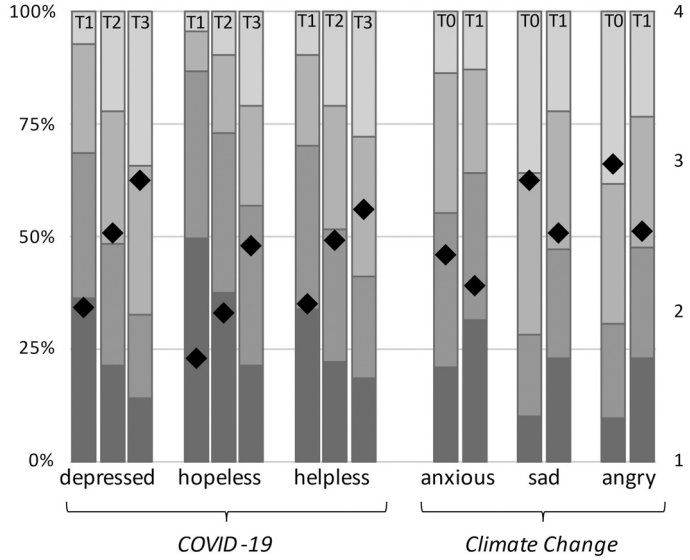

Fig. 2. Crisis specific emotions that changed significantly between data collections. Stacked columns indicate the percentage (left axis) of participants who indicated "does not apply at all" = dark grey at the bottom to "does apply completely or all the time" = light grey at the top; Black squares indicate the mean on a scale of 1 to 4 (right axis). T0 *N* = 574, T1 *N* = 430, T2 *N* = 578, T3 *N* = 314.

Table 4
Factorial structure of COVID-19 emotions.

	despair	concern
depressed	**.85**	−0.12
hopeless	**.73**	.01
helpless	**.72**	.11
powerless	**.66**	.07
sad	**.65**	.09
stressed	**.60**	.17
tense	**.58**	.20
angry	**.55**	−0.10
worried	−0.05	**.86**
concerned	.05	**.79**
anxious	.17	**.57**

Note. N = 314; data collection T3; pattern matrix after direct oblimin rotation with Kaiser-normalization.

Using Mann-Whitney U-tests, we examined differences in climate change associated emotions before and during the COVID-19 pandemic. There were significant changes in some of the emotions. Students felt less sad (U = 73,666.00, Z = −4.70, $p < .001$, η^2 = 0.023), anxious (U = 79,489.50, Z = −3.03, p = 0.002, η^2 = 0.010), and angry (U = 69,133.00, Z = −5.98, $p < 0.001$, η^2 = 0.037) about climate change during the COVID-19 pandemic compared to before (see Fig. 2). There were no differences in the other emotions evoked by climate change (all $p > 0.004$, see Table A.5).

3.3. Factorial structure of negative emotions

Data at T3 was used to analyse the factorial structures of both emotion scales. For emotions regarding COVID-19 two factors were extracted (KMO = 0.90, $\chi^2(55)$ = 1716.08, $p < 0.001$). The factors were named 'despair' (eight items) and 'concern' (three items). Both had a satisfactory reliability of Cronbach's α = 0.89 for despair and α = 0.81 for concern. Mean for despair was M = 2.68 (SD = 0.77), mean for concern was M = 2.52 (SD = 0.81). The pattern matrix is presented in Table 4.

For climate change, two factors were extracted (KMO = 0.92, $\chi^2(55)$ = 1823.48, $p < 0.001$). The pattern differed from COVID-19 emotions. Eight items were combined into the scale 'distress'. The remaining three items referred to the factor 'hopelessness'. Internal consistency was Cronbach's α = 0.90 for distress and α = 0.83 for hopelessness. Mean for distress was M = 2.55 (SD = 0.76), mean for hopelessness was M = 2.60 (SD = 0.88). The pattern matrix is presented in Table 5.

3.4. Effects of emotions on wellbeing

Correlation analyses indicated negative associations of negative emotions and wellbeing. The more intense negative emotions were, the lower was students' wellbeing (see Table 6). Emotions correlated positively. There were no effects of gender and age on wellbeing, but women reported more negative emotions than did men.

Table 5
Factorial structure of climate change emotions.

	distress	hopelessness
tense	**.93**	−0.20
stressed	**.76**	−0.07
anxious	**.70**	.06
concerned	**.68**	.05
worried	**.59**	.17
depressed	**.58**	.28
angry	**.57**	.14
sad	**.56**	.21
powerless	−0.06	**.85**
helpless	.16	**.71**
hopeless	.18	**.60**

Note. N = 314; data collection T3; pattern matrix after oblimin rotation with Kaiser-normalization.

Table 6
Correlations at T3.

		1	2	3	4	5	6
1	Wellbeing	–					
2	Gender (male)	.04					
3	Age	.10	.04				
4	COVID-19 despair	−0.57**	−0.22**	−0.06			
5	COVID-19 concern	−0.35**	−0.15*	.05	.60**		
6	Climate change distress	−0.13*	−0.20**	−0.01	.30**	.37**	
7	Climate change hopelessness	−0.20**	−0.17*	.01	.38**	.31**	.65**

Note. N = 314, N = 313 for gender; data collection T3; gender 0 = female, 1 = male; *$p < .05$, ** $p < .002$.

We tested effects of the emotional reactions on wellbeing separately for each crisis. COVID-19 associated emotions explained 33% of variance of wellbeing ($F(2, 311) = 76.05$, $p < 0.001$, $R^2 = 0.33$). Despair had strong negative effects ($B = -4.06$, $\beta = -0.57$, $p < .001$). There was no effect of COVID-19 concern ($B = -0.05$, $\beta = -0.01$, $p = 0.903$). Negative emotions associated with climate change also had significant effects on wellbeing ($F(2, 311) = 6.49$, $p = 0.002$, $R^2 = 0.04$). There were significant effects of hopelessness ($B = -1.24$, $\beta = -0.20$, $p = 0.008$), but not of distress ($B = -0.04$, $\beta = -0.01$, $p = 0.945$).

Using multiple linear regression analysis, effects of all emotion scales on students' wellbeing were analysed simultaneously (see Table 7). The model improved predictability of wellbeing significantly compared to the mean ($F(4, 309) = 38.08$, $p < 0.001$, $R^2 = 0.33$). When all emotions were included, the only significant predictor for wellbeing was despair associated with COVID-19 ($\beta = -0.57$, $p < .001$).

3.5. Effects on behaviour

Negative emotions were further tested for their effects on mitigation behaviour. Climate change distress ($\beta = 0.21$, $p = 0.004$) but not hopelessness was associated with increased climate-friendly behaviour ($F(2, 311) = 6.52$, $p = 0.002$, $R^2 = 0.04$; see Table 8, Model 1). When adding COVID-19 emotions into the model, despair about the pandemic was associated with reduced climate-friendly behaviour ($\beta = -0.15$, $p = 0.037$; $F(4, 309) = 4.38$, $p = 0.002$, $R^2 = 0.05$; see Table 8, Model 2). However, $\Delta F(2, 309) = 2.19$ ($p = 0.114$) was not significant.

Adherence with COVID-19 measures was predicted by higher levels of concern ($\beta = 0.22$, $p = 0.001$) and lower levels of despair ($\beta = -0.16$, $p = 0.020$) regarding COVID-19 ($F(2, 311) = 5.28$, $p = 0.006$, $R^2 = 0.03$; see Table 9, Model 1). Adding climate change emotions did not significantly improve the model ($\Delta F(2, 309) = 0.90$, $p = 0.409$; see Table 9, Model 2) and climate change emotions did not predict COVID-19 mitigating behaviour.

4. Discussion

In this study, we examined negative emotions regarding the two crises COVID-19 pandemic and climate change. Distinctive patterns of negative emotions emerged for either crisis and different emotions

Table 7
Regression analysis predicting wellbeing by crises associated emotions.

	B	SE	β	p
(constant)	21.75	1.14		< 0.001
COVID-19 despair	**−4.08**	**0.43**	**−0.57**	**< 0.001**
COVID-19 concern	−0.14	0.41	−0.02	.728
Climate change distress	0.38	0.46	.05	.415
Climate change hopelessness	−0.08	0.40	−0.01	.843

Note. N = 314; data collection T3; significant effects printed bold.

Table 8
Effects of negative emotions on climate friendly behaviour.

	Model 1				Model 2			
	B	*SE*	*β*	*p*	*B*	*SE*	*β*	*p*
(constant)	4.97	0.21		< 0.001	5.17	0.26		< 0.001
Climate change distress	**0.30**	**0.10**	**.21**	**.004**	**0.28**	**0.10**	**.20**	**.007**
Climate change hopelessness	−0.03	0.09	−0.02	.766	0.02	0.09	.02	.834
COVID-19 despair					**−0.21**	**0.10**	**−0.15**	**.037**
COVID-19 concern					0.11	0.09	.08	.259
ΔR^2			.04				.01	
F			6.52	.002			4.38	.002

Note. $N = 314$, data collection T3; significant effects printed bold.

were more pronounced. These differences represent the effects of the crises on peoples' lives: COVID-19 severely affects everyday lives and poses an immediate health threat. Climate change poses a threat as well, but it is more abstract and does not yet directly affect peoples' lives in the survey regions [18].

The severe impact of the COVID-19 pandemic on peoples' lives might have caused an urge to act against the crisis. However, people might not have felt like they were actively and effectively contributing to crisis mitigation during social distancing as first lockdowns have not sustainably eased the pandemic. Consequently, emotions like powerlessness and hopelessness were prevalent and increased as the pandemic prolonged. This resulted in a mixture of strongly activating and inactivating emotions which points to reduced emotion differentiation. Emotion differentiation is characterised by the ability to identify discrete emotions [19]. Being able to clearly differentiate between emotions beyond their valence is important for emotion regulation and adequate responses [19,20] which might explain both reduced mental health and reduced mitigation behaviours. The second factor we identified was made up of activating emotions like concern and worry. These emotions did not have mental health impacts and were associated with increased mitigation efforts which imply adaptive reactions to the COVID-19 crisis. Concern, worry, and anxiety appeared to represent an adaptive response to climate change as well, as these emotions were associated with increased mitigation efforts. In contrast, the inactivating emotions of hopelessness, powerlessness, and helplessness were associated with decreased wellbeing, which resembles results for COVID-19. Hopelessness has been suggested to obstruct emotion regulation [21] and to contribute to depression [22,23]. Therefore, motivating action against crisis to support hope and a positive perspective might be one pathway of protecting mental health while mitigating the crises.

Other than for COVID-19, emotions regarding climate change were more clearly differentiated into activating and inactivating factors. One reason might be the longer presence of the climate crisis than the pandemic that allows a more nuanced emotional reaction. Supporting this assumption, factorial structures were stable over time and samples [16]. Still, the results illustrate the dominant nature of the COVID-19 pandemic in young adults' lives as the pandemic also made climate change mitigation behaviours more difficult. For example, protests were not possible and public transport was avoided. Accordingly, some activating emotions regarding climate change decreased during the pandemic. As people were unable to actively fight the pandemic or climate change during the COVID-19 crisis, decreased activating emotions when action was not possible might be adaptive. Other reasons for decreased climate change concern or mitigation efforts during the pandemic might be economic strains [24] or a finite pool of worries [25]. However, the decrease in emotions should be interpreted with caution as other studies report no decreases in climate change concern or climate-relevant behaviour [26,27]. The differences might be due to different operationalizations or different times of surveys during the COVID-19 pandemic.

While there was a negative effect of inactivating climate change emotions on wellbeing, the effect was small and rendered non-significant when adding COVID-19 emotions to the model. The results do not suggest that negative emotions regarding climate change have effects on wellbeing beyond the effects of other stressors like COVID-19. This is in line with findings from Verplanken and colleagues [28] and suggests that the associations between negative climate change emotions and mental health are based on a general tendency to experience negative emotions in some people which increases vulnerability to psychological strains. For most people, negative emotions seem to be appropriate regarding the threat and are not associated with mental health. However, this missing link between climate change emotions and wellbeing should not dismiss concerns about potential mental health impacts of eco-anxiety and other emotions. Even if there were no effects on a statistical level, there might be individuals in whom concerns about climate change cause mental health strains. Additionally, as climate change progresses, effects on mental health can also be expected to increase.

4.1. Strengths and limitations

This study focused on a comparison of negative emotions regarding climate change and COVID-19. A strength of the study is the longitudinal time frame that allowed to assess changes over time. However, when interpreting the results of this study, its limitations should be considered: First, we focused on a homogenous sample of German-speaking university students and results cannot be generalised to other groups. Second, we compared emotions regarding climate change before and during the COVID-19 pandemic using two

Table 9
Effects of negative emotions on adherence with COVID-19 measures.

	Model 1				Model 2			
	B	*SE*	*β*	*p*	*B*	*SE*	*β*	*p*
(constant)	3.67	0.20		< 0.001	3.74	0.23		< 0.001
COVID-19 despair	**−0.20**	**0.08**	**−0.16**	**.020**	−0.17	0.09	−0.14	.056
COVID-19 concern	**0.26**	**0.08**	**.22**	**.001**	**0.26**	**0.08**	**.23**	**.002**
Climate change distress					0.04	0.09	.04	.649
Climate change hopelessness					−0.10	0.08	−0.10	.203
ΔR^2			.03				.01	
F			5.28	.006			3.08	.016

Note. $N = 314$, data collection T3; significant effects printed bold.

different cross-sectional samples. Third, the results concerning mitigation behaviours should be interpreted with caution as internal consistencies of both scales are relatively low, they relied on self-reported behaviour, they were not directly comparable due to the different levels of abstraction, and there were issues concerning the normality of residuals in the analyses. Additionally, we focused on negative emotions and did not consider effects of positive emotions. The approach of measuring negative emotions using individual emotion words cannot be equated with studies that conceptualise, for example, eco-anxiety or climate change concern as multidimensional constructs (e.g., [8,9,29]). Also, the scale cannot be considered comprehensive for the whole spectrum of possible emotions. Recent efforts in creating taxonomies of climate change emotions [30] will further enhance research.

Conclusion

Young people were feeling increasingly depressed, helpless, and hopeless during the COVID-19 pandemic. The strong impact COVID-19 had on students' everyday lives dominated their wellbeing and climate change moved to the background. Comparing emotions evoked by both crises enabled discrimination between emotions that induced behavioural changes without impacting mental health on the one hand, and emotions that impacted mental health on the other hand. Our results further highlight the importance of psychosocial support for young people suffering from the threat of two global crises.

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Declaration of Competing Interest

The authors declare that they have no competing financial or non-financial interests to disclose that could appear to have influenced the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi: 10.1016/j.joclim.2022.100125.

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