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Personal experience with Covid-19 is associated with increased environmental concern and pro-environmental behavioral intentions

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ABSTRACT

Climate change attributable to human activities has created a global threat to humanity and the natural world. However, there is a tendency for people to view climate change as a threat primarily affecting those in far-away places and there is reluctance to engage in pro-environmental action, which is often costly. It is therefore crucial to understand the factors that shape willingness to engage in pro-environmental behavior. Existing research suggests that personal experience with the consequences of climate change may increase pro-environmental action, however it is unknown whether personal experiences in other non-environmental domains may have similar effects. The circumstances of the Covid-19 pandemic allowed us to conduct a quasi-natural experiment to examine the effects of personal experience with a different global threat, namely Covid-19, on environmental responses. Across two studies conducted among UK and US participants, we found that personal experience of Covid-19 was associated with pro-environmental behavioral intentions, and that this relationship was mediated by increased environmental concern. We found that personal experience with Covid-19 was associated with stronger self-transcendence values of universalism and benevolence, which played a further mediating role between personal experience with the virus and environmental concern. These findings suggest that personal experience with at least some global threats, even when not directly related to climate change, may increase concern for distant others and also sensitize people to environmental issues and motivate pro-environmental action.

Introduction

Climate change is one of the biggest threats facing humanity today, with the consequences being especially dire for those in developing countries (Akanwa and Joe-Ikechebelu, 2019). Combatting climate change requires urgent global action (Davis et al., 2011), however, such action is sorely lacking, particularly in developed countries such as the US and UK (Ritchie, 2018). It has been argued that this is partly due to the widely held perception of climate change as a threat to people in far-away places (De Guttry et al., 2017; Gifford et al., 2009; Spence et al., 2012; Weinstein and Klein, 1996). As people consider environmental problems as primarily affecting distant others, they tend to feel less responsible for them and less compelled to make sacrifices to mitigate their effects (Uzzell, 2000). It is therefore crucial to identify factors that are associated with willingness to engage in pro-environmental action.

One factor associated with pro-environmental behavior is people's sense that climate change has immediate consequences locally (Spence et al., 2012, but some studies have suggested this factor may have limited influence, e.g., Brügger and Pidgeon, 2018, and for reviews see Maiella et al., 2020; McDonald et al., 2015). A second factor associated with pro-environmental behavior instead involves greater concern for distant others (Stern et al., 1993). Here, we focus on this second factor and specifically suggest that personal experience with Covid-19 might be one such path to increasing concern for distant others and promoting climate change mitigation.

A substantial body of research has found that personal experiences with environmental hazards influence attitudes towards climate change. Personal experience with the impacts of climate change has been found to be associated with increased environmental concern (Akerlof et al., 2013; Bergquist et al., 2019; van der Linden, 2014, 2015) and pro-environmental behaviors (Broomell et al., 2015; Reser et al., 2014). For example, experiencing floods was found to be associated with increased climate change concern (Hamilton-Webb et al., 2017), and willingness to reduce energy consumption (Spence et al., 2011). Similarly, directly experiencing damage caused by landslides and floods was found to be associated with increased risk perceptions about climate related disasters, both locally and globally, but merely living in an affected area was not (Lujala et al., 2015). Personal experience of a severe weather event

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potentially enables people to realize the full severity of climate change that is often otherwise hard to grasp.

However, not everyone experiences, or is aware that they are experiencing, the effects of climate change (Leiserowitz et al., 2017). One line of inquiry, therefore, is exploring whether there are other types of personal experiences that may increase concern about climate change and consequently motivate action to mitigate its effects. There are mixed findings in the literature about whether experiencing one type of hazard increases concern about other hazards (Weinstein, 1989). Some studies suggest that there is a "finite pool of worry", meaning that when concern about one threat increases, concern about other threats decrease, as people have limited emotional resources (Hansen et al., 2004). Accordingly, worry over climate change may actually be reduced after experiencing other threats. Weber (2010) reported a decline in concern over climate change in a US sample following both the terrorist attack of 9/11 and the 2009 financial crisis, providing evidence of the finite pool of worry effect. However, a recent longitudinal study comparing survey data pre-Covid-19 and during Covid-19, found that climate change remained a concern despite the global pandemic, contrary to the finite pool of worry effect (Evensen et al., 2021). These researchers, however, did not examine the effect of *personal experience* with Covid-19 on climate-change concern, and as such a question remains as to whether personally experiencing Covid-19 could *increase* environmental worry and motivate pro-environmental behavior, thus demonstrating a positive spillover effect between experiencing hazards that are not directly related to environmental crises and attitudes towards climate change.

There is some work indicating that experiencing a threat can indirectly motivate behaviors to mitigate other closely related, but different, threats. For example, Demski et al. (2017) found that experiencing floods was associated with increased behavioral intentions related to heatwaves, as climate change concern and saliency of environmental issues, more generally, increased. Similarly, Whitmarsh (2008) found that experiencing air pollution was related to increased environmental behaviors, including those not directly related to improving air quality, as environmental values became more salient. While these personal experiences and behavioral intentions are both in the environmental domain, these findings raise the possibility that under certain conditions experiencing a hazard even in a non-environmental domain could affect environmental attitudes.

We hypothesized that personal experience with Covid-19, a pandemic that has directly affected hundreds of millions of individuals in over 200 countries, may be associated with positive environmental engagement. Recent work has noted similarities between Covid-19 and climate change and suggests that lessons learned from the Covid-19 crisis, such as the importance of global cooperation, could help tackle climate change (Klenert et al., 2020; Manzanedo and Manning, 2020). Moreover, there is work theorizing that psychological processes instigated by experiencing Covid-19 could motivate pro-environmental behavior. For example, Reese et al., (2020), suggests that the global threat of Covid-19 may increase concern for humanity, and this in turn could increase support for environmental action, although this remains to be empirically tested.

However, there is recent empirical work indicating that prosocial values potentially related to pro-environmentalism may have become more prominent in response to the Covid-19 pandemic (Evers et al., 2021; Greenfield et al., 2021). While people's values tend to be relatively stable, values can shift as a result of major changes in external circumstances and in the face of new threats (Bardi et al., 2009; Greenfield, 2016; Sortheix et al., 2019). Studies have found that the Covid-19 crisis encouraged a shift towards values of collectivism, and reduced materialism, in the United States (Evers et al., 2021; Greenfield et al., 2021). Two big-data studies revealed that there were significantly more searches for words relating to collectivism (such as "share," "help," and "give") on Google, Twitter, internet forums and blogs, in the 70 days after Covid-19 was declared a national emergency in the US, compared with the 70 days prior to this declaration, indicating strengthened prosocial values (Evers et al., 2021). Similarly, other recent research suggests that in the face of loss and suffering in the context of Covid-19, endorsing self-transcendence values that emphasize concern for others' welfare and humankind and nature, can give meaning and purpose to people beyond their immediate plight (Walsh, 2020). Experiencing a survival threat on a mass scale, like Covid-19, may heighten people's awareness of others' suffering, including those beyond one's immediate environment, and increase concern regarding their wellbeing.

Increased concern for others, as a consequence of experiencing Covid-19, may in turn lead people to care more about climate change, which poses a massive threat to humanity. Indeed, research shows that self-transcendence values, which stand in contrast to the pursuit of one's individualistic interests, have motivational properties and can energize prosocial costly behavior (Schwartz, 2010, 2012). Self-transcendence values are specifically associated with willingness to help those in developing countries (Ma and Lee, 2012). A large of body research has also demonstrated that these values play a powerful and positive role in shaping engagement with environmental issues and behavior (Corner et al., 2014; Nordlund and Garvill, 2002). While Covid-19 and climate change belong to distinct domains, they are both global issue that fundamentally relate to the welfare of humanity. Personally experiencing the negative effects of Covid-19, and being part of shared global pain, might sensitize people to the suffering of distant others and lead to greater concern with the climate emergency.

Current research

We conducted two studies in different social contexts examining whether the experience of Covid-19 was associated with pro-environmental behavioural intentions. The Institutional Review Board of IDC Herzliya, the School of Psychology approved the study and all participants consented to participate in the study. In Study 1, we tested whether heightened environmental concern may help explain an increase in pro-environmental intentions, and examined both personal and collective experience. In Study 2, we aimed to replicate our findings and further test the mechanism. Study 1 was conducted with UK participants and Study 2 with US participants, to test generalizability. The UK and US are among two of the countries worst affected by Covid-19 (WHO, 2020). Moreover, research suggests that among both publics, climate change is considered to be a distant threat (Lorenzoni et al., 2006). Thus, our question was relevant to, and important in, both contexts. At the same time, there is greater climate change skepticism among the US public (YouGov, 2019), making these distinct contexts in which to test our question. Data for both studies is available at: https://osf.io/wt4hf/?view_only=2a07d3b74f504798a03e053bc97e24ef

Study 1

Study 1 was conducted at the end of May 2020, following the peak of the first wave of the pandemic in the UK. We examined the association between experiencing the Covid-19 crisis on environmental engagement in two ways. We tested: (1) whether individual differences in personal experience with Covid-19 were associated with greater environmental concern and pro-environmental intentions, and (2) whether experimentally making salient the collective experience of Covid-19 and its similarities with climate change (versus not mentioning it) increased pro-environmental intentions.

Participants

We conducted two power analyses using G*Power 3.1 (Faul et al., 2009) to ensure that our study would be sufficiently powered to detect medium sized effects for our two main questions. The first analysis based on a correlational research design to test our hypothesis that personal experience with Covid-19 would be associated with pro-environmental outcomes, showed that to detect a medium effect size (r = .3) with

Table 1
Means, standard deviations, and correlations for Study 1.

Variable	*M*	*SD*	1	2	3	4	5	6	7
1. Covid-19 experience	3.62	3.88							
2. Environmental concern	5.86	0.97	0.97						
3. Pro-environmental behavioral intentions	5.50	0.93	0.93	.52**					
4. Gender (+ Woman)	1.78	0.42	-.16†	-.07	.07				
5. Age	33.72	15.75	.11	-.13	-.09	-.31**			
6. Political Ideology (+ Right)	3.16	1.25	.03	-.38**	-.24**	.04	.26**		
7. Education	4.28	1.36	-.02	.09	.24**	-.04	.23**	-.04	
8. SES	4.70	1.34	.04	-.03	-.01	-.13	.31**	.16	.25**

Table 2
Means, standard deviations, and correlations for Study 2.

Variable	*M*	*SD*	1	2	3	4	5	6	7	8
1. Covid-19 experience	2.14	2.55								
2. Environmental concern	5.53	1.51	1.51							
3. Pro-environmental behavioral intentions	4.75	1.39	.16	.46**						
4. Self-transcendence values	5.64	1.15	.20*	.39**	.31**					
5. Gender (+Woman)	1.83	0.98	.13	.04	-.12	.13				
6. Age	33.70	12.22	-.04	-.08	-.10	-.06	.06			
7. political ideology (+Right)	3.22	1.65	-.03	-.45**	-.38**	-.20*	-.06	.13		
8. Education	3.78	1.65	.06	.07	.15	.04	.12	.11	-.13	
9. SES	3.69	1.36	.10	.02	.08	-.03	-.06	-.12	.05	.25**

Note. M and *SD* are used to represent mean and standard deviation, respectively.
* indicates $p < .05$;
** indicates $p < .01$.

a power of .8 and alpha of .05, a minimum of 84 participants were required. A second power analysis based on the experimental design showed that 128 participants were needed to detect a medium-sized effect (d=.50), with a power of .8 and alpha of .05.

Participants were recruited on social media. One-hundred and fifty-eight participants began the study. After dropping participants who failed to answer two attention-check questions correctly, 138 remained (Men=30, Women=106, missing=2).

Procedure

Participants were randomly assigned to one of two conditions. In both conditions, participants read an opinion piece that warned about the threat of climate change. In the experimental condition, the article emphasized the collective experience of Covid-19 by explicitly highlighting how the crisis could help society deal with climate change (e.g., by increasing awareness about the important of preventative action). In the control condition, there was no mention of Covid-19. To reduce the likelihood of demand characteristics, we told participants that the study was about the effects of viewing colors on information processing (texts and cover story details are presented in supplementary materials). After reading the respective article, participants answered a survey.

Measures

Participants reported their gender, age, education level, social and economic status (SES), and political ideology. As in related work examining the relationship between personal experiences of climate change and environmental attitudes (Myers et al., 2013; Lujala et al., 2015), we controlled for socio-demographic variables in the analyses, however zero-order correlations for both studies are also presented in Tables 1 and 2. Response options for the measures were on a 1–7 scale unless stated.

Personal experience with Covid-19. To capture the extent of personal experience with Covid-19, participants were asked the following three questions: "Do you think you had COVID-19?"; "Did one or more of your relatives or close friends have COVID-19?"; and "Do you know anyone else (not a close other) who became unwell due to COVID-19?" Response options were "I don't think so" or "I don't know" (coded as 0); "Yes, with mild symptoms" (coded as 1); "Yes, with bad symptoms" (coded as 2) and "Yes, with serious symptoms" (coded as 3). As personally having Covid-19 should affect someone the most, followed by a relative or close friend having Covid-19, followed by simply knowing someone who had it, we weighted responses accordingly to create a personal experience score: (3*self) + (2*close other) + (1*distant other). Our conceptualization of personal experience considered both the severity of harm experienced and whether the harm was experienced directly or vicariously, as both are key aspects of experience (Weinstein, 1989).

Environmental concern. Participants responded to two items: "To what extent are you concerned about global warming?" and "To what extent is global warming a threat? (α=.69).

Pro-environmental behavioral intentions. Ten items measured participants self-reported likelihood of engaging in pro-environmental behavioral intentions (e.g. "How likely are you to contribute financially to environmental organizations" and "How likely are you to read about environmental issues" α=.85) based on the Willingness to Sacrifice for the Environment scale (Davis et al., 2011) and the General Ecological Behavior scale (Kaiser et al., 2003). For full measures see supplementary materials.[1]

Results and discussion

Means, standard deviations, and zero-order correlations are presented in Table 1. Twenty-two participants (16%) reported having had Covid-19; 62 participants had a relative or close friend who had Covid-19 (45%); 91 knew someone who had Covid-19 (66%); and 41 participants (30%) had no known experience with the virus.

In order to test the relationship between personal experience with Covid-19 and environmental concern and behavioral intentions, we ran regression analyses using participants' personal experience with Covid-19 as the predicting variable and environmental concern and behavioral intentions as the outcome variables, respectively, while controlling for demographics. We found that personal experience with Covid-19 was

[1] Both studies included exploratory measures, which are all listed in supplementary materials. Though there are additional significant correlations between personal experience and other variables, here we focus on the variables that are relevant to our a-priori hypothesized model.

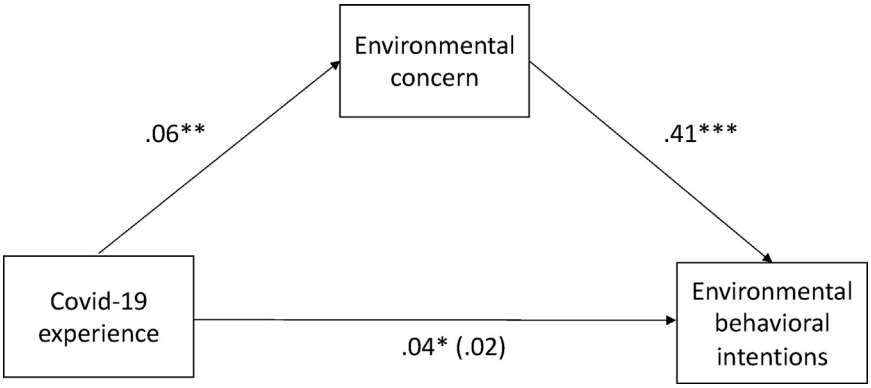

Fig. 1. Results of the mediation model assessing the effects of Covid-19 experience – environmental concern – pro-environmental behavioral intentions with standardized path coefficients (Study 1). $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

associated with increased environmental concern (*Beta* = 0.24, $t = 2.84$, *CI* [.20, .28], $p = .005$) and pro-environmental behavioral intentions (*Beta* = 0.19, $t = 2.22$, *CI*[.155, .234], $p = .028$).

To test the mediating role of environmental concern on intentions, we used Hayes' PROCESS (Hayes, 2013) bootstrapping command with 5,000 iterations (model 4). The relative total effect of experiencing Covid-19 on behavioral intentions was reduced after concern was introduced into the model. The relative indirect effect of personal experience with Covid-19 on behavior intentions through concern was significant [indirect effect = .024, *SE*=.01, 95% *CI* [.006, .047] (See Fig. 1). This suggests that heightened environmental concern may help explain the relationship between experiencing Covid-19 and pro-environmental behavioral intentions.

To test our second goal, namely, whether explicitly making salient the collective experience of Covid-19 and its relevance for climate change mitigation (vs. no mention of Covid-19) can increase environmental concern and pro-environmental intentions, we conducted an ANCOVA. We found no significant or trending difference between conditions in environmental concern ($F(1, 120) = .03$, $p = .873$, Experimental: $M = 5.90$, $SE = .12$, Control: $M = 5.88$, $SE = .11$) nor in behavioral intentions ($F(1, 120) = .10$, $p = .748$, Experimental: $M = 5.53$, $SE = .12$, Control: $M = 5.48$, $SE = .12$). There was also no difference in Covid-19 experience between conditions, nor an interaction between condition and personal experience with Covid-19.

This study provided initial evidence that personal experience with Covid-19 is associated with pro-environmental behavioral intentions and that this relationship is mediated by increased environmental concern. Interestingly, we found that making salient the collective experience of Covid-19 and its lessons for climate change did not influence environmental responses. This could be because personal experience is more powerful than exposure to the collective experience or explicit argument about its lessons, as research findings indeed suggest (Myers, et al., 2013). As previously mentioned, one study looking at the effect of experiencing climate related disasters on environmental attitudes, found that simply living in an area where a disaster occurred did not change environmental attitudes, but personally suffering as a result of the disaster did increase environmental concern (Lujala et al., 2015). Alternatively, the null results could stem from Covid-19 being salient for all participants across conditions, as data was collected just after the peak of the pandemic, possibly attenuating the effect of the manipulation. As such, the null results of the experiment should be interpreted with caution. In Study 2, we set out to test the replicability and generalizability of the association between personal experience with Covid-19 and environmental concern and pro-environmental intentions in a different context.

Study 2

We ran Study 2 at the end of July 2020 in the US, during the peak of the second wave of the pandemic. Our first goal was to replicate the association between personal experience and Covid-19 that we found in Study 1. Our second goal was to test whether the effect of Covid-19 experience on environmental concern and intentions, may be due to the strengthening of self-transcendence values in the face of human suffering. In line with theoretical work suggesting that the global threat of the pandemic may increase identification with humanity (Reese et al., 2020), we considered that personal experience with Covid-19 may activate self-transcendence values related to care and concern for others. Self-transcendence values direct people's attention to the needs of others, including strangers, and motivate prosocial behavior (Schwartz, 2010). Moreover, several studies have found that these values are associated with environmental concern and action (Howell and Allen, 2017; Lucas, 2018; Schultz et al., 2005) and they therefore may act as a bridge between experiencing Covid-19 and climate-change concern. To test whether the effect of experiencing Covid-19 is correlated with self-transcendence values, rather than values in general, we also tested whether conservative values that emphasize security, tradition, and conformity were strengthened by Covid-19 experience. We did not expect that these values would be related to Covid-19 experience.

As a further indication of this mechanism, we tested whether personal experience with Covid-19 specifically affects responses to global threats to humanity (e.g. environmental threat) or increases sensitivity to threats in general. To this end, we tested the effect of personal experience with Covid-19 on two additional issues that could be viewed as constituting a threat - immigration and road-traffic accidents.

Participants

We conducted a power analysis for a correlational study design that would enable us to have sufficient power to detect an association between Covid-19 experience and our outcome variables. We used G*Power and found that to obtain a small effect size, like that found in Study 1 ($r = .25$), with an alpha of .05 and a power of .8, 123 participants were required. We collected data from 145 US-based participants on Prolific. After screening eight participants who failed to answer both attention-check questions correctly, 137 remained (Men=78, Women=55, Other=3 (1 missing)).

Measures

We used the same measure of personal experience with Covid-19 as in Study 1. We also measured participants gender, age, education level, SES, and political ideology, to control for these variables.

Environmental Concern. As in Study 1, participants rated their level of concern and threat regarding global warming (α=.91).

Self-transcendence values. This comprised two items measuring universalism and benevolence from the short Schwartz values scale (Lindeman and Verkasalo, 2005). Specifically, participants were asked to rate the importance of universalism (defined as broad-mindedness, beauty of nature and arts, social justice, a world at peace, equality,

wisdom, unity with nature, environmental protection) and benevolence (defined as helpfulness, honesty, forgiveness, loyalty, responsibility) as life-guiding principles (α=.65).

Conservative values. This comprised three items measuring tradition (defined as respect for tradition, humbleness, accepting one's portion in life, devotion, modesty), security (defined as national security, family security, social order, cleanliness, reciprocation of favors, and conformity (defined as obedience, honoring parents and elders, self-discipline, politeness) from the short Schwartz values scale (Lindeman and Verkasalo, 2005) (α=.80).

Pro-environmental behavioral intentions. We measured this with four items similar to those used in Study 1. We selected items that could be adapted to measure behavioral intentions related to road-traffic accidents and immigration, so that there was consistency in how we measured intentions to mitigate these threats. Participants rated the likelihood that they would (1) talk with friends about problems related to the environment, (2) contribute financially to environmental organizations, (3) read about environmental issues, and (4) sign a petition calling for politicians to take action on environmental issues in the near future (α=.82).

Concern about road-traffic accidents. Participants rated their level of concern and threat regarding global warming (α=.76).

Behavioral intentions to reduce car accidents. This was a four-item measure that we adapted from the pro-environmental behavioral intentions measure (e.g., "How likely would you be to sign a petition calling for politicians to take action to *improve road safety*?") (α=.87). (All items are presented in supplementary materials).

Immigration concern. Participants rated their level of concern and threat regarding immigration to the US (α=.90).

Behavioral intentions to restrict immigration. This was a four-item measure also adapted from the pro-environmental behavioral intentions measure (e.g., "How likely would you be to sign a petition calling for politicians to take action to *restrict immigration*?") (α=.86).

Results and discussion

Means, standard deviations, and zero-order correlations for main variables are presented in Table 2. Eight participants (6%) reported having had Covid-19; 45 participants (33%) had a relative or close friend who had Covid-19; 69 knew someone who had Covid-19 (50%); and 51 participants (38%) had no know experience with the virus.

We ran regression analyses using personal experience with Covid-19 as the predicting variable and environmental concern and behavioral intentions as the outcome variables, respectively, while controlling for socio-demographics. We again found that personal experience with Covid-19 was associated with increased environmental concern (*Beta* = 0.16, t = 2.06, *CI* [.0.070, .256], p = .041) and pro-environmental behavioral intentions (*Beta* = 0.17, t = 2.09, *CI* [.079, .253], p = .039).

Environmental concern mediated the relationship between experience and pro-environmental intentions, replicating our results. The relative indirect effect of Covid-19 experience on behavioral intentions through concern was significant (indirect effect = .03 *SE*=.01, 95% *CI*[.004, .060]).

We then tested the effect of Covid-19 experience on our additional hypothesized mediator – self-transcendence values. A regression analysis revealed that experiencing Covid-19 strengthened self-transcendence values (*Beta* = 0.18, t = 2.08, *CI* [.102, .256], p = .039), but not conservative values (p = .472), suggesting that personal experience with Covid-19, specifically increases universal concern for humanity and not values more broadly. Next, we tested whether self-transcendence values further explained the relationship between Covid-19 experience and environmental concern, and in turn, pro-environmental behavioral intentions by using Hayes' PROCESS (model 6). Mediation analysis revealed that the effect of personal experience with Covid-19 on behavioral intentions was reduced after the two mediators (self-transcendence values and environmental concern) were included in the model, and the indirect effect of Covid-19 experience on global warming behavioral intentions was significant (effect = 0.008, SE = 0.005, 95% *CI*[0.001,.020]) (See Fig. 2).

We tested the effect of Covid-19 experience on attitudes relating to road-traffic accidents and immigration. Regression analyses, controlling for demographic variables, revealed that experience with Covid-19 did not have a significant effect on concern related to immigration *Beta* = .003, t = .034, *CI* [-.086, .091], p = .973), nor on behavioral intentions to restrict immigration, *Beta* = -.065, t = -.764, *CI* [-.171, .041], p = .446). Similarly, experience with Covid-19 did not have a significant effect on concern related to car accidents *Beta* = .062, t = .706, *CI* [-.024, .196], p = .482), nor on behavioral intentions aimed at reducing car accidents, *Beta* = .078, t = .900, *CI* [-.030, .187], p = .370). These effects remained non-significant when we did not control for socio-demographic variables. The lack of association between Covid-19 experience and concern or intentions related to these other threats, suggests that the effect of Covid-19 experience on climate change concern and pro-environmental intentions is likely not a function of heightened threat perception in generalIn Study 2, we found that experiencing Covid-19 was associated with pro-environmental behavioral intentions and in both studies this relationship was mediated by environmental concern, replicating the results of Study 1. Results of this study also provide support for a model in which increased self-transcendence values play a role in mediating the relationship between Covid-19 experience and environmental engagement.

Further analyses with aspects of Covid-19 experience

Our measure of Covid-19 experience integrates two dimensions of experience with the virus - severity and proximity. We conducted further analyses testing the association between each of these two aspects separately and environmental variables, in order to provide empirical support for the weighted measure that we used, which takes both into account.

Severity

We first tested the relationship between severity of Covid-19 experience and environmental variables. We calculated severity of experience by summing the severity of illness experienced by the self, a close other, and a distant other, which were each measured on a scale of 0 (no illness) - 4 (serious illness). We then ran the regressions models with this non-weighted measure of experience as the predictor and obtained the same pattern of results.

Study 1. We found that personal experience with Covid-19 was associated with increased environmental concern (*Beta* = .24, t = 2.87, p = .005) and pro-environmental behavioral intentions (*Beta* = .20, t = 2.29, p = .024).

Study 2. We found that personal experience with Covid-19 was significantly associated with self-transcendence values (*Beta* = .19, t = 2.18, p = .031) and marginally associated with increased environmental concern (*Beta* = 0.15, t = 1.91, p = .058), self-transcendence values (*Beta* = .19, t = 2.18, p = .031) and pro-environmental behavioral intentions *Beta* = .15, t = 1.93, p = .055).

Overall, this suggests that *severity of experience with Covid-19* is positively associated with environmental outcomes.

Proximity

We next tested whether proximity to Covid-19-experience was associated with environmental intentions and concern. We did this by transforming experience into an ordinal variable. Participants were placed in one of four conditions, each representing a different level of proximity: (1) knows no one who had Covid-19; (2) an acquaintance had Covid-19; (3) a close friend or relative had Covid-19; (4) they personally had Covid-19. With this condition as the IV, we ran two ANCOVAs, first with

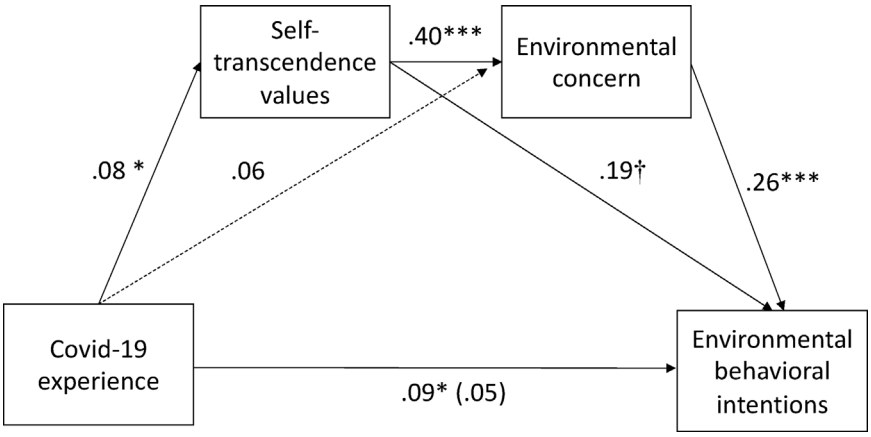

Fig. 2. Results of the serial mediation model assessing the effects of Covid-19 experience – transcendence values – environmental concern – pro-environmental behavioral intentions with standardized path coefficients (Study 2). † $p < 0.08$; $^{*}p < 0.05$; $^{***}p < 0.001$.

environmental concern as the DV and, second, with pro-environmental intentions as the DV. The overall ANCOVAs were significant suggesting differences between groups. Post-hoc tests mainly revealed significant or trending differences between groups, all in the expected direction (details and results are presented in supplementary materials), suggesting that the *proximity of experience with Covid-19* is positively associated with environmental outcomes.

General discussion

Climate change caused by human activity poses an enormous threat to humanity and the natural world (Cook et al., 2013). It is, thus, important to understand the factors that shape environmental concern and behavioral intentions (Weber, 2010). The unfortunate circumstances of the pandemic allowed us to conduct a quasi-natural experiment to examine the effects of personal experience of Covid-19 on environmental responses. Across two studies, each conducted in different contexts, our findings suggested that personal experience of Covid-19 was associated with more pro-environmental behavioral intentions through increased environmental concern. We further found support for a model suggesting that personal experience of Covid-19 strengthens self-transcendence values of universalism and benevolence, and that these values play a role in explaining the effect of experiencing Covid-19 on environmental responses. Due to the quasi-experimental nature of the study and consequently the absence of random assignment, determination of causality is limited.

We identified a psychological process underlying the positive spillover effect between experience of Covid-19 and climate change concern, namely, the strengthening of self-transcendence values of universalism and benevolence. Our finding that experiencing Covid-19 bolsters self-transcendence values adds to a body of research demonstrating that existential threat can shift people away from materialistic concerns, towards prosocial values (Cozzolino et al., 2004; Evers et al., 2021; Naveh-Kedem and Sverdlik, 2019) and altruistic behavior (Jonas et al., 2002). One reason for this may be that becoming personally aware of death leads people to adopt values that imbue life with meaning and a higher purpose. Death awareness may lead people to become more mindful of their existence and more compelled to leave a positive mark on the world (Becker, 1973). Endorsing prosocial values can thus be viewed as a coping mechanism that helps people adapt to the changing circumstances of a new major threat (Walsh, 2020). A second reason could be that having Covid-19, or personally knowing someone who had it, involves experiencing the materialization of a global threat. This personal experience may heighten awareness of looming global threats, foster concern for humanity, in turn increasing people's commitment to preventing future global disasters, such as climate change.

The present work provides evidence that the effects of personally experiencing some threats may sensitize people to other threats in different domains. Previous work has mainly shown that when non-environmental threats (e.g., terrorism, economic) become more dominant, climate change concern reduces, illustrating the "finite pool of worry" effect (Hansen, 2004). Our results shed light on an alternative, spillover, effect that may occur when certain global threats are personally experienced, resulting in an *increase* in climate change concern and pro-environmental intentions. However, we found no significant relationship between Covid-19 experience and approaches to other supposed threats, namely immigration and road-traffic accidents, suggesting that spillover effects may be contingent on the types of threats one experiences.

To fully understand people's approach to climate change and the environment, we may want to consider their various life experiences, including those that are not directly related to the environment. There is a need for future work to further pinpoint and categorize the types of personal experiences that reduce or increase concern about climate change and motivation for mitigating action. It is possible that the negative relationship that has been observed between certain personal experiences and climate change engagement (Hansen, 2004), are due to the specific values these experiences activate. For example, it may be that the negative relationship between terrorism threat and climate change concern is partly due to the activation of traditional and security values. Indeed, there is work showing that terrorism threat increases traditional and security values (Verkasalo et al., 2006), and other work linking these values to reduced climate change concern (Lucas, 2018). However, to the best of our knowledge, the role of values in the relationship between terrorism threat and reduced environmental concern has not been empirically explored. While existing work has established that values, particular self-transcendence values, are strongly predictive of attitudes about climate change (Corner et al., 2014; Graham and Abrahamse, 2017), future work is merited to test the broad significance of unique values as mechanisms for both the positive and negative effects of personal experiences on climate change engagement.

Our findings could inform psychological interventions to promote environmental behavior. Although in many cases personal experiences cannot be directly manipulated (as is the case with Covid-19), there may be other ways to utilize their effects. While we found that exposure to information linking Covid-19 with environmental threat did not influence environmental attitudes, it is possible that exposure to people's experiences vicariously would be more impactful. Recent work suggests that hearing personal stories detailing the destructive effects of climate change increases environmental concern (Gustafson et al., 2020). Exposure to stories of experiences with Covid-19, and perhaps other global threats, may also be a powerful way to evoke stronger responses to climate change. An intervention that involves exposing people to others' personal experiences could potentially reach large and diverse audiences via written stories, radio, and television, and would not be contingent on personal suffering. Such an intervention that focuses on increasing global concern, could also avoid potential drawbacks that have sometimes been found to be associated with attempts to reduce

the psychological distance of climate change, namely, fear and avoidance (McDonald et al., 2015).

The Covid-19 pandemic is a public health and human tragedy that has thrown the world into turmoil (Zamir and Halperin, 2020). Our research suggests that one positive outcome of the pandemic may be greater concern for others and for the environment. Personally experiencing Covid-19 may have been a wakeup call, leading people to focus on what is important beyond the self (Walsh, 2020), motivating them to minimize suffering for humanity and the natural world in the future.

Declaration of Competing Interest

none.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.cresp.2021.100031.

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