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On the nature of eco-anxiety: How constructive or unconstructive is habitual worry about global warming?

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ABSTRACT

Three studies investigated habitual worry about global warming as an example of 'eco-anxiety'. The key question was whether such worrying is constructive (a motivated pro-environmental response) or unconstructive (a symptom of pathological worry). Pathological worry and worry about global warming were assessed together with two other worry sources, that is, personal issues and the world economy (Study 1) and personal issues and the corona virus (Study 2). In both studies a statistically significant correlation was found between pathological worry and global warming worry. However, this relationship was nonsignificant when controlled for the other two worry sources. Comparisons between Studies 1 and 2 conducted one month before and during the COVID-19 crisis, respectively, as well as between order conditions within Study 2 suggested that global warming worry was unaffected by the COVID-19 context. Study 3 demonstrated that global warming worry was associated with the perception of a proximal as well as a distal threat, and correlated positively with determinants of pro-environmental behaviour, that is, a pro-ecological worldview, pro-environmental values, past pro-environmental behaviour and a 'green' identity. Global warming worry also correlated positively with emotion clusters signifying determination, anxiety, and anger, respectively. The three studies together suggest that while habitual global warming worry may be unconstructive and part of intrapersonal dysfunction for some individuals, for many others it is a constructive adaptive pro-environmental response.

1. Introduction

Global warming is a key aspect of climate change which provides a serious threat to existing ecosystems and is associated with a wide range of consequences, such as adverse weather events, resource depletion, and decreasing biodiversity (e.g., IPCC, 2019). People may respond to such events in a variety of ways and display for instance denial, heightened awareness or distress (e.g., Reser & Swim, 2011; Smith & Leiserowitz, 2012). Central in most responses to global warming is a degree of concern. Although levels of concern have been waxing and waning over time (e.g., Smith & Leiserowitz, 2012), substantial proportions of the world population are very concerned. An opinion poll in the UK conducted in the summer of 2019 revealed that 85% of Britons are 'concerned' about climate change, with the majority (52%) 'very concerned' (Ipsos MORI, 2020a). In polls in 14 countries across the world 71% of respondents think global warming is as serious a crisis as COVID-19 (Ipsos MORI, 2020b).

Environmental concern may take various forms, which differ across individuals, nations and cultures (e.g., Lee, Markowitz, Howe, Ko, & Leiserowitz, 2015; Milfont & Schultz, 2016). For instance, concerns may focus on specific negative consequences of climate change, such as flooding, deforestation or persistent dryness and wind erosion. Exposure to such events may trigger powerful responses, including psychological trauma (e.g., Cianconi, Betrò, & Janiri, 2020; Hayes, Blashki, Wiseman, Burke, & Reifels, 2018). Concern may also relate to general beliefs and values about the environment, such as how individuals or communities identify with their ecosystem, the working and living relationships with the natural world and the personal and cultural identities associated with it (Cunsolo & Ellis, 2018; Dunlap, Van Liere, Mertig, & Jones, 2000; Stern & Dietz, 1994). Such beliefs, together with appraisals of benefits or the necessity of activities, feed into attitudes and behaviour, for instance with respect to the acceptance of technologies, policy measures, or pro-environmental action (e.g., Bamberg & Möser, 2007; Fischhoff, Slovic, Lichtenstein, Read, & Combs, 1978; Gkargkavouzi, Halkos, & Matsiori, 2019; Klöckner, 2013; Milfont, 2012; Poortinga, Steg, & Vlek, 2002; Stern, 2000; van der Linden, 2015a).

Concern about global warming may also manifest as discrete emotions (e.g., Doherty & Clayton, 2011), in particular worry and fear (e.g.,

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Clayton & Karazsia, 2020; Leiserowitz, 2005). Distress caused by climate change is often referred to by the increasingly popular term *eco-anxiety*. Whereas anxiety is usually associated with adverse or pathological psychological conditions, this may not necessarily hold for eco-anxiety and anxiety about global warming; it is possible that eco-anxiety is a constructive and powerful response to the climate crisis.

Recently, Clayton and Karazsia (2020) provided an in-depth analysis of anxiety related to climate change and developed an instrument that assessed a range of possible responses to climate change, including cognitive-emotional and functional impairment. They found among other things that climate change anxiety was relatively strongly related to general anxiety and depression, which suggests that climate change anxiety may pose a threat to mental health. The Clayton and Karazsia (2020) study also picked up signs of adaptive responses, such as behavioural engagement and a sense of environmental identity.

To explore why eco-anxiety might be associated with both adaptive and maladaptive responses, the present studies focus on a key facet of anxiety; worry. Worry describes repetitive affect-laden thoughts and images related to potentially threatening events in the future (e.g., Borkovec, Robinson, Pruzinsky, & DePree, 1983). Worry is predominantly a cognitive process, that is, a form of mental problem solving or self-regulation under conditions of uncertainty, but it also has an affective component in its association with anxiety. A distinction can be made between *constructive* and *unconstructive* worry (e.g., McNeill & Dunlop, 2016; Watkins, 2008). Constructive worry is focused on problem solving by an engagement with the situation that triggers the worry and on taking protective or evasive action (e.g., Davey, Hampton, Farrell, & Davidson, 1992). In finding such solutions, this type of worry should then diminish or discontinue anxiety. In contrast, unconstructive worry (Watkins, 2008) involves generalised and repetitive worry, which is often experienced as intrusive and uncontrollable and is thought to contribute to the manifestation of distressing, anxiety-related pathologies, such as generalised anxiety disorder (e.g., Barlow, 1988; Behar, Alcaine, Zuellig, & Borkovec, 2003; Borkovec et al., 1983; Newman, Llera, Erickson, Przeworski, & Gastonguay, 2013; Wells, 1999). In cases of unconstructive worry any event or situation might trigger worried thoughts and anxiety, although the focus of such worries will depend on the type of pathology. Furthermore, unconstructive worry tends to be associated with unhelpful solutions, such as avoiding situations that trigger worry or engaging in superstitious thinking (Wells, 1999). Unconstructive, repetitive worry thus adds to distress, psychological impairment and negative behavioural consequences rather than leading to helpful solutions.

With respect to worry as a response to climate change, it can be expected that those who are at risk or have been victims of global warming-related disasters, such as flooding, wildfires, or extreme air pollution, are worried and anxious, although they may not always hold climate change responsible (Whitmarsh, 2008). Worries related to natural disasters may be overwhelming and lead to serious mental health problems (e.g., Berry, Bowen, & Kjellstrom, 2010; Fritze, Blashki, Burke, & Wiseman, 2008; Hayes et al., 2018; Reser & Swim, 2011). However, while disaster victims' responses can be attributed to their unfortunate experiences, expressions of worry about climate change or global warming are not always unequivocal. A difficulty in understanding reported worries is that these could arise from multiple sources. Thus, worry about global warming may be an expression of genuine concern about perceived threat or loss (e.g., Cunsolo & Ellis, 2018), but could equally be a manifestation of anxiety-related pathologies. In the latter case, worried thoughts about climate may be generated as by-product of a troublesome intrapersonal context, that is, as one of many anxieties in an individual's personal life, or as a manifestation of a more general tendency to relate to uncertainty and threat through unconstructive worry. While those worries should not be dismissed, they could be seen as a response to adverse personal circumstances, or as part of a more general negative affective and possibly pathological condition, as demonstrated in other domains such as the threat of nuclear war (e.g., Hamilton, Keilin, Knox, & Naginey, 1989).

On the other hand, constructive worry about global warming may motivate an individual to take mitigating action (e.g., McNeill & Dunlop, 2016), or engage in behaviours that might have positive consequences for the environment (e.g., making sustainable domestic choices, purchasing an electric car or becoming an environmental activist). While people undoubtedly know that the global warming crisis will not be solved overnight, constructively worrying individuals might have the confidence that one's own and one's community's actions will lead to favourable outcomes, albeit in the future (e.g., Davey, Jubb, & Cameron, 1996). In the case of global warming, worry may thus represent a motivating and energising force associated with pro-environmental attitudes and actions (e.g., Bissing-Olson, Fielding, & Iyer, 2016; Coelho, Pereira, Cruz, Simões, & Barata, 2017; Harth, Leach, & Kessler, 2013; Reser & Swim, 2011; Verplanken & Roy, 2013). Although a degree of anxiety may accompany constructive worries, positive emotions such as interest, hope and optimism can be elicited as well (e.g., Ojala, 2005, 2012a, 2012b; Hoijer, 2010; Smith & Leiserowitz, 2014). These associations thus signify important markers of constructiveness.

In the present studies we focused on *habitual* worry about global warming. The habitual quality refers to the enduring, repetitive and automatic nature of thinking, in this case worry about global warming (e.g., Fritze, et al., 2008; Verplanken, Friborg, Wang, Trafimov, & Woolf, 2007; Watkins, 2008). Whereas an occasional thought or worry cannot be expected to have much impact on emotions or behaviour, the habitual occurrence of worried thoughts (i.e., occurring repetitively and automatically) is likely to be more impactful and add to the effects of what one is worried about. In other words, the habitual quality is what makes worry powerful. Following from the previous, the habitual quality of thinking may thus empower constructive as well as unconstructive thinking. In a constructive frame, habitual thinking may function as a motivator to solve problems or change things for the better (e.g., Hay, McCaul, & Magnan, 2006; Sweeny & Dooley, 2017; Verplanken & Roy, 2013). In an unconstructive frame habitual thinking contributes to negative outcomes such as low self-worth and depression (e.g., Verplanken, Friborg, Wang, Trafimow, & Woolf, 2007) and anxiety (e.g., Meyer, Miller, Metzger, & Borkovec, 1990; Verplanken & Fisher, 2014).

The overall aim of the present studies is thus to investigate the constructive and unconstructive nature of habitual worry about global warming. Studies 1 and 2 were conducted to establish to what extent habitual global warming worry is related to chronic pathological worry and might thus be a form of unconstructive thinking. Study 3 tested whether habitual worry about global warming is a form of constructive thinking. This would be indicated by associations with pro-environmental motivation and action and supporting emotions.

2. Study 1

This study sought to establish the nature of the relationship between habitual worry about global warming and trait pathological worry. Pathological worry may manifest for instance as Generalised Anxiety Disorder (e.g., Behar et al., 2003; Wells, 1999). It implies a baseline level of general worry, which may lead to an array of specific worries, ranging from personal to more general fears about the world and the future. It may also include beliefs about worrying itself, which may exacerbate the persistence of worry (Wells, 1999). In addition to 'global warming' two other potential sources of worry were included; 'personal issues' and 'the world economy'. The former worries are most closely related to pathological worry as these tap into self-referential negative beliefs (e.g., Borkovec et al., 1983). The world economy was chosen as this has a number of risks characteristics in common with global warming, such as being involuntary, uncontrollable, delayed in time, and relatively unknown to exposed individuals (e.g., Fischhoff et al., 1978). The key question in this study was whether global warming worry was associated

with pathological worry when controlled for worry about personal issues and the world economy.

2.1. Method

2.1.1. Participants, design and power analyses

The study comprised 266 participants who completed an online survey and was conducted between 16 January and February 10, 2020. The study was announced as "A study on worry". Participants were recruited from online social science research platforms in the USA and Europe (Social Psychology on the Net, $N = 134$; Social Psychology Network, $N = 21$; SurveyCircle, $N = 94$; PollPool, $N = 13$), while four students were recruited from the first author's social network. Respondents were only retained if they finalised the survey and did not raise suspicions of sloppy or careless responding (e.g., 'straightlining'). There were 194 females, 66 males, while 6 indicated "other" or did not disclose their sex. The mean age was 26 years, $SD = 10$ years. The sample contained 87% students versus 13% non-students. 59% of the participants resided in the USA, 22% in the UK, and 19% elsewhere. Informed consent was obtained from all participants. The study was approved by the authors' departmental ethics committee (reference number 16–249).

Participants were assigned to one of six conditions which systematically varied the order in which assessments of worry were presented with respect to the three sources of worry, that is, global warming, personal issues, and the world economy. Assignment to the conditions was accomplished according to birth month.

The analyses planned for this study comprised independent and dependent samples t-tests and bivariate correlations, respectively. A sensitivity power analysis was conducted for each type of analysis, given the achieved sample size of 266, alpha set at 0.05, accepting a power of 0.80, and two-sided testing. The effect sizes that can reliably be observed are medium for the independent t-tests between males and females ($d > 0.40$), small for dependent t-tests ($d > 0.17$), and small to medium for correlations (absolute $r > 0.17$).

2.1.2. Measures

2.1.2.1. Trait pathological worry. Participants were presented with the 16-item Penn State Worry Questionnaire (PSWQ; Meyer et al., 1990). Sample items are "Many situations make me worry", " I know I should not worry about things, but I just can't help doing it", "I'm always worrying about something", and "When there is nothing more I can do about a concern, I don't worry about it anymore" (reverse-coded). Five-point Likert response scales were provided, which were labelled from "Not at all typical of me" (1) to "Very typical of me" (5). The items were averaged after having been keyed in the same direction. Higher ratings represent higher levels of worry. Cronbach's Alpha was 0.90.

2.1.2.2. Habitual worry. After responding to the PSWQ, assessments of habitual worry were obtained concerning the three topics; global warming, personal issues, and the world economy, respectively. The order in which these topics were presented was counterbalanced as determined by the six conditions. The worry measures were obtained using the paradigm established by Verplanken et al. (2007), which capitalises on the thinking process underlying worry. This paradigm decomposes habitual thinking into *content* and *process*. Content comprises the worrying cognitions which one may have (the 'what' of thinking; e.g., "mass animal extinction"). The repetitive and habitual nature of those thoughts constitutes a process element (the 'how' of thinking; i.e., occurring frequently and automatically). For each topic, participants were thus first asked to list up to ten worrying thoughts they sometimes might have about the topic at hand. This was followed by the Habit Index of Negative Thinking (HINT; Verplanken et al., 2007). The HINT consists of 12 items following the stem "Having worrying thoughts about global warming/personal issues/the world economy is something … ". Sample items are "I do frequently", "I do automatically", "I do unintentionally", and "I find hard not to do". Five-point Likert response scales were provided, which were labelled from "Disagree strongly" (1) to "Agree strongly" (5). The items were averaged. Higher ratings represent a stronger habit. Cronbach's Alphas for global warming, personal issues, and the world economy worries were all 0.96.

2.2. Results and discussion

Statistically significant sex differences emerged for trait pathological worry and habitual worry about personal issues. Women scored higher than men on trait pathological worry, M-women = 3.69, M-men = 3.13, $t(258) = 5.26$, $p < .001$, $d = 0.65$, and worry about personal issues; M-women = 3.86, M-men = 3.26, $t(258) = 4.42$, $p < .001$, $d = 0.55$. No significant sex differences were present for worry about global warming or the world economy, $t(258) = 1.08$, $d = 0.13$ and $t(258) = 0.19$, $d = 0.02$, respectively. Age correlated significantly and negatively with trait pathological worry, $r = -0.16$, $p < .01$. No significant correlations emerged between age and any of the worry measures, $r = 0.03$, $r = -0.01$, and $r = 0.05$, for global warming, personal issues, and the world economy, respectively.

The mean numbers of worries generated in the thought-listing tasks were 3.66 ($SD = 2.85$), 4.95 ($SD = 2.89$), and 2.95 ($SD = 2.78$), for global warming, personal issues, and the world economy, respectively. These differed statistically significantly, $t(265) = 7.32$, $p < .001$, $d = 0.45$, $t(265) = 10.52$, $p < .001$, $d = 0.65$, and $t(265) = 4.62$, $p < .001$, $d = 0.28$, for the contrasts between global warming-personal issues, the world economy-personal issues, and global warming-the world economy, respectively.

In order to investigate the *content* of global warming worries these were subjected to a content analysis. The analytic procedure followed guidelines from Smith (2000) and was based on an inductive approach. An initial set of themes was established by AD on the basis of a subset of thought protocols and was used by a second coder (EM) to code the same participants independently. The interrater reliability as indicated by Cohen's κ was 0.91. After discussion of discrepancies and refinement, the final coding scheme consisted of 17 categories. All protocols of Studies 1, 2 and 3 were then coded independently by the two coders. Table 1 contains an overview of the percentages of global warming worries in the ten most prevalent themes, which cover 82% of all thoughts generated across the three studies. The percentages of Study 1 are found in the first column. Catastrophic consequences for human and

Table 1
Worries about global warming (Studies 1–3).

Worry theme	Study 1	Study 2	Study 3	Total
Loss of human and animal life	18%	16%	14%	16%
Destruction of natural habitats	13%	11%	11%	12%
egative societal effects and breakdown of civilisation	9%	10%	12%	11%
Significant changes to weather and seasons	9%	5%	10%	8%
Negative impacts on self and significant others	7%	10%	6%	7%
Changes to oceans and other bodies of water	7%	4%	7%	6%
Irreversibility and uncertainty of timing	5%	8%	5%	6%
Negative impacts on humanity[a]	6%	6%	5%	6%
Negative actions by other people	4%	7%	5%	5%
Consumerism and associated pollution	6%	5%	5%	5%

Note: The total amount of worries generated were 961 (Study 1), 1,046 (Study 2), and 1,380 (Study 3). The table covers 82% of the total amount of generated worries and the ten most prevalent themes.

[a] This category included negative impacts on humanity except loss of life, which was covered by "Loss of human and animal life". It mostly concerned issues related to quality of life.

animal life, natural habitats, society and weather were the four most prevalent themes, followed by personal and family consequences.

In Table 2 means, standard deviations and correlations are presented for trait pathological worry and the habitual worry measures in the three domains. The highest level of worry was about personal issues, which differed statistically significantly from habitual worry about global warming and the economy, $t(265) = 12.43$, $p < .001$, $d = 0.76$, and $t(265) = 10.36$, $p < .001$, $d = 0.64$, respectively, while global warming worry did not differ significantly from worry about the world economy, $t(265) = -0.10$, $d = 0.01$.

Medium-size correlations were present between trait pathological worry and habitual worry about global warming and the world economy, and a large-size correlation between trait pathological worry and habitual worry about personal issues. In order to establish unique variances shared by pathological worry and global warming worry, a partial correlation was calculated controlling for the other two sources of worry, that is, personal issues and the world economy. The correlation between pathological worry and global warming worry thus dropped from 0.30 to a nonsignificant partial correlation of 0.06. On the other hand, the partial correlation between pathological worry and worry about the world economy remained statistically significant when controlled for worry about personal issues and global warming, r-partial $= 0.26$, $p < .001$. Similarly and unsurprisingly, the partial correlation between pathological worry and worry about personal issues remained statistically significant when controlled for worry about global warming and the world economy, r-partial $= 0.64$, $p < .001$. These results thus suggest that global warming worry did not share unique variance with pathological worry in the presence of the other worry sources. In the general discussion we will review possible models that might account for these results.

3. Study 2

Study 2 was a replication of Study 1 conducted two months after Study 2, that is, during the COVID-19 crisis. The study firstly provided a test of the robustness of the key findings in Study 1. It also provided an opportunity to test whether the measure of worry about global warming was affected by the COVID-19 context. The assumption was that if worry about global warming is a constructive expression of a pro-environmental attitude and a motivation towards pro-environmental action, it should be less context-sensitive than an unconstructive form of worry, in which case the COVID-19 crisis as a more immediate threat might overshadow and diminish worry about global warming. Apart from the timing of the study, the COVID-19 context was further brought into the study by replacing 'worry about the world economy' by 'worry about the corona virus'. In terms of Fischhoff et al.'s (1978) risk profiles, the COVID-19 threat can be characterised as involuntary, relatively uncontrollable and unknown to exposed individuals, but, contrary to 'the world economy' in Study 1, a potentially direct personal threat.

Table 2
Means, standard deviations, and correlations (Study 1).

		1	2	3	4
1.	Trait pathological worry (1–5)	–	0.30***	0.67***	0.29***
2.	Habitual worrying about global warming (1–5)		–	0.39***	0.46***
3.	Habitual worrying about personal issues (1–5)			–	0.16**
4.	Habitual worrying about the world economy (1–5)				–
Mean		3.55	2.85	3.72	2.85
Standard deviation		0.79	.07	1.00	1.10

Note: $N = 266$. ** $= p < .01$; *** $= p < .001$.

3.1. Method

3.1.1. Participants, design and power analyses

The study comprised 293 participants who completed an online survey between 16 March and April 10, 2020. The study was announced as "A study on worry". Participants were recruited from online social science research platforms in the USA and Europe (Social Psychology on the Net, $N = 106$; Social Psychology Network, $N = 42$; SurveyCircle, $N = 96$), students at the authors' university, $N = 22$, and the authors' social networks, $N = 27$. Respondents were only retained if they finalised the survey and did not raise suspicions of sloppy or careless responding. There were 214 females, 76 males, while 3 indicated "other" or did not disclose their sex. The mean age was 27 years, $SD = 13$ years. The sample contained 83% students versus 17% non-students. 34% of the participants resided in the USA, 33% in the UK, and 32% elsewhere. Informed consent was obtained from all participants. The study was approved by the authors' departmental ethics committee as an amendment to Study 1. The order of the assessments of the three sources of worry was systematically varied as was done in Study 1.

The analyses planned for this study comprised independent and dependent samples t-tests, bivariate correlations, and a chi-square test, respectively. A sensitivity power analysis was conducted for each type of analysis, given the achieved sample size of 293 and the total of 559 for Studies 1 and 2 combined (see 3.2.2.), alpha set at 0.05, accepting a power of 0.80, and two-sided testing. The effect sizes that can reliably be observed are medium for the independent t-tests between males and females ($d > 0.38$), small for the independent t-tests reported in 3.2.2. ($d > 0.24$), small for dependent t-tests ($d > 0.17$), small to medium for correlations (abs $r > 0.16$), and small for the chi-square comparisons reported in 3.2.2. (Cramer's $V > 0.12$).

3.1.2. Measures

The measures were identical to those of Study 1, with the exception that "worry about the world economy" was replaced by "worry about the corona virus". Cronbach's Alphas for trait pathological worry, and the assessments of global warming, personal issues, and the corona virus worries were 0.91, 0.93, 0,93, and 0.90, respectively.

3.2. Results and discussion

3.2.1. Replication of study 1

Women scored statistically significantly higher than men on trait pathological worry, M-women $= 3.52$, M-men $= 3.03$, $t(288) = 4.86$, $p < .001$, $d = 0.57$, habitual worry about global warming, M-women $= 2.93$, M-men $= 2.70$, $t(288) = 2.00$, $p < .05$, $d = 0.23$, personal issues, M-women $= 3.90$, M-men $= 3.58$, $t(288) = 2.89$, $p < .001$, $d = 0.34$, and the corona virus, M-women $= 3.58$, M-men $= 3.18$, $t(288) = 3.99$, $p < .001$, $d = 0.47$. Age correlated significantly and negatively with trait pathological worry, $r = -0.17$, $p < .003$, and habitual worry about personal issues, $r = -0.14$, $p < .02$. No significant correlations emerged between age and habitual worry about global warming, $r = -0.01$, or the corona virus $r = 0.00$.

The mean numbers of worries generated in the thought-listing tasks were 3.79 ($SD = 2.43$), 3.78 ($SD = 2.43$), and 3.78 ($SD = 2.44$), for worry about global warming, personal issues, and the corona virus, respectively. None of these differed statistically significantly, $t(292) = 0.82$, $d = 0.05$, $t(292) = 1.00$, $d = 0.06$, and $t(292) = 0.45$, $d = 0.03$, for contrasts between global warming-personal issues, the corona virus-personal issues, and global warming-the corona virus, respectively. The middle column in Table 1 displays the percentages of global warming worries in the ten most prevalent themes in this study. As can be seen, the pattern strongly resembles the one in Study 1.

In Table 3 means, standard deviations and correlations are presented for trait pathological worry and habitual worry in the three domains. The highest levels of worry were about personal issues, which differed statistically significantly from worry about global warming and the

Table 3
Means, standard deviations, and correlations (Study 2).

		1	2	3	4
1.	Trait pathological worry (1–5)	–	0.35***	0.66***	0.53***
2.	Habitual worrying about global warming (1–5)		–	0.43***	0.38***
3.	Habitual worrying about personal issues (1–5)			–	0.62***
4.	Habitual worrying about the corona virus (1–5)				–
Mean		3.39	2.88	3.81	3.48
Standard deviation		0.80	0.89	0.82	0.79

Note: $N = 293$. *** $= p < .001$.

corona virus, $t(292) = 17.51$, $p < .001$, $d = 1.02$, and $t(292) = 8.29$, $p < .001$, $d = 0.48$, respectively, while worry about global warming also differed significantly from worry about the corona virus, $t(292) = 10.92$, $p < .001$, $d = 0.64$.

Medium-size correlations were found between trait pathological worry and worry about global warming and the corona virus, and a large-size correlation between trait pathological worry and habitual worry about personal issues. Similarly to Study 1, the partial correlation between pathological worry and global warming worry dropped from 0.35 to a nonsignificant 0.08 when controlled for the other two sources of worry, that is, personal issues and the corona virus. The partial correlation between pathological worry and worry about the corona virus remained statistically significant when controlled for worry about personal issues and global warming, *r*-partial $= 0.18$, $p < .002$, while the partial correlation between pathological worry and worry about personal issues remained statistically significant when controlled for worry about global warming and the corona virus, *r*-partial $= 0.48$, $p < .001$. Thus, also in this study global warming worry did not share unique variance with pathological worry when controlled for the other worry sources.

3.2.2. Worry about global warming and the COVID-19 context

In order to investigate whether worry about global warming was influenced by the COVID-19 context, two tests were conducted. The first was a comparison of the worry measures obtained in Study 1, which was conducted a month before the COVID-19 crisis started in the UK, and the present Study 2, which was conducted two months later during the crisis. The two samples were comparable with respect to sex, age, and the student versus non-student distribution, which was exemplified by nonsignificant test statistics, $X^2(1550) = 0.05$, Cramer's $V = 0.01$, and $X^2(1559) = 2.53$, Cramer's $V = 0.06$, respectively. Participants in Study 1 scored slightly higher on pathological worry, *M*-Study 1 $= 3.55$, *M*-Study 2 $= 3.39$, $t(557) = 2.41$, $p < .02$, $d = 0.20$, although the effect size was small. The samples differed with respect to participants' location; Study 1 contained relatively more participants from the USA than the present study, $X^2(2559) = 34.94$, $p < .001$, Cramer's $V = 0.25$. The measures of habitual worry about global warming did not differ statistically significantly between the two samples, *M*-Study 1 $= 2.85$, *M*-Study 2 $= 2.88$, $t(557) = 0.37$, $d = 0.03$.

The second test was conducted between order conditions in the present study, which were counterbalanced in the sample. While the sources of worry were not disclosed in the announcement and instruction, participants in three conditions answered the survey questions about global warming *before* they were confronted with the issue of the corona virus, while participants in the three other conditions answered the questions about global warming *after* having responded to those about the corona virus. The measure of habitual worry about global warming did not differ statistically significantly between these two subsamples, *M*-global warming first $= 2.91$, *M*-corona virus first $= 2.84$, $t(291) = 0.75$, $d = 0.04$.

Thus, both tests suggested that the measures of habitual worry about global warming were unaffected by the COVID-19 context. The resemblance of the content of the worries as shown in Table 1 adds further support to this conclusion. The results thus provide support for the hypothesis that worry about global warming is a manifestation of a relatively strong and motivated response.

4. Study 3

In this study we investigated correlates of habitual worry about global warming. The hypothesis tested in this study was that global warming worry is constructive. An auxiliary assumption was that 'constructive' in this context implies a motivation to hold pro-environmental views and act accordingly. We tested three clusters of constructs that may correlate with habitual worry about global warming and cover basic domains; perception (e.g., Trope & Liberman, 2010); thinking and its relation to behaviour (e.g., Stern, 2000); feeling (e.g., Watson & Tellegen, 1985). We thus assessed perceptions of global warming as psychologically proximal or distal, determinants of pro-environmental behaviour and environmentalism, and emotions associated with global warming.

Psychological distance refers to how objects, events or phenomena are framed or perceived as being proximal or distant in terms of time, geography, interpersonal distance, and likelihood of occurrence (Trope & Liberman, 2010). Psychological distance may have an impact on how relevant people think global warming is for them and thus how worried they are. Whereas many people perceive environmental threats that are not immediately visible or imminent as psychologically distant (e.g., Gifford, 2011; Lee et al., 2015; Leiserowitz, 2005; Spence, Poortinga, & Pidgeon, 2012; Uzzell, 2000; Whitmarsh, 2008), the more frequent weather-related disasters such as flooding and wildfires may 'bring global warming home', and thus lead to higher degrees of worry (e.g., Brügger, Morton, & Dessai, 2016; McDonald, Chai, & Newell, 2015; Spence, Poortinga, Butler, & Pidgeon, 2011). Psychological distance was thus included as a measure of personal relevance of global warming.

The second cluster of correlates included constructs that have traditionally been found to be *determinants of pro-environmental behaviour and environmentalism*; endorsing a pro-ecological worldview, pro-environmental values and past pro-environmental behaviour (e.g., Bamberg & Möser, 2007; Brick & Lai, 2018; Cheung, Luke, & Maio, 2014; Klöckner, 2013; Stern, 2000). In addition, we measured the presence of a 'green' self-identity. This concerns the way individuals describe themselves, in this case as someone who labels themselves as pro-environmental or 'green' (e.g., Udall, de Groot, de Jong, & Shankar, 2020; Whitmarsh & O'Neill, 2010). Positive correlations between these determinants and global warming worry would testify such worry as an adaptive and constructive response.

Finally, a range of *emotions* were assessed with respect to global warming. Unsurprisingly, observations of negative emotions have been found associated with global warming, in particular anxiety and fear (e.g., Clayton & Karazsia, 2020; Doherty & Clayton, 2011; Leiserowitz, 2005; Ojala, 2012a; Smith & Leiserowitz, 2014; Spence & Pidgeon, 2010; Stevenson, Lashley, Chitwood, Peterson, & Moorman, 2015; Sundblad, Biel, & Gärling, 2007, 2014), guilt (e.g., Bamberg & Möser, 2007; Ferguson & Branscombe, 2010), sadness or grief (e.g., Cunsolo & Ellis, 2018; Schwartz & Loewenstein, 2017), and anger (e.g. Cunsolo Willox, Harper, Ford, Landman, Houle, & Edge, 2012; Ojala, 2005). However, positive emotions associated with global warming have been reported as well, such as interest, hope and optimism (Hoijer, 2010; Ojala, 2005, 2012a, 2012b; Smith & Leiserowitz, 2014). As worry is inherently linked to a degree of apprehension or anxiety, habitual worry about global warming was expected to correlate with negative emotions. For some individuals, in particular those with high levels of pathological worry, these emotions may be unconstructive, that is, making up part of a wider condition dominated by negative affect. However, for others negative emotions related to global warming may function as an adaptive response, for instance by instigating pro-environmental action. A constructive nature of global warming worry would further be indicated

by associations with positive emotions such as feeling determined, inspired or interested as well as by positive correlations between negative emotions and determinants of pro-environmental behaviour.

The three clusters of assessments related to perception, thinking and feeling, as well as the constructs within each of these clusters, can be expected to be intercorrelated. This will become evident by inspecting correlations. In order to disentangle which constructs uniquely account for variance in habitual global warming worry while controlling for the presence of the other constructs, a multiple regression was conducted.

4.1. Method

4.1.1. Participants, design and power analyses

The study comprised 306 participants who completed an online survey between 24 September and December 13, 2018.[1] The study was announced as "A study on climate change". Respondents were only retained if they finalised the survey and did not raise suspicions of sloppy or careless responding. Participants were recruited from online social science research platforms in the USA and Europe (Social Psychology on the Net, $N = 65$; Social Psychology Network, $N = 72$; SurveyCircle, $N = 78$; SurveyTandem, $N = 10$; PollPool, $N = 11$), a community panel, $N = 20$, students at the authors' university, $N = 31$, and the first author's social networks, $N = 19$. There were 208 females, 93 males, while 5 indicated "other" or did not disclose their sex. The mean age was 26 years, $SD = 11$ years. The sample contained 83% students versus 17% non-students. 42% of the participants resided in the USA, 29% in the UK, and 29% elsewhere. Informed consent was obtained from all participants. The study was approved by the authors' departmental ethics committee (reference number 18–015).

The analyses planned for this study comprised independent samples t-tests, bivariate correlations and a multiple regression with nine predictors, respectively. A sensitivity power analysis was conducted for each type of analysis, given the achieved sample size of 306, alpha set at 0.05, accepting a power of 0.80, and two-sided testing. The effect sizes that can reliably be observed are small to medium for the t-tests ($d > 0.35$), small to medium for correlations (abs $r > 0.16$), and small for the total R^2 in a multiple regression ($f^2 > 0.05$).

4.1.2. Measures

4.1.2.1. Habitual worrying about global warming. The procedure to assess habitual worry about global warming was identical to the one used in Study 1. That is, participants were first asked to list worries they may have about global warming, followed by the Habit Index of Negative Thinking focused on the listed worries (Verplanken et al., 2007). Cronbach's Alpha was 0.89.

4.1.2.2. Psychological distance. Sixteen items were included representing the spatial, temporal, social, and uncertainty facets of psychological distance (Spence et al., 2012). Five-point Likert response scales were provided, which were labelled from "Disagree strongly" (1) to "Agree strongly" (5). All items were keyed such that high scores indicated a strong psychological impact. The items were factor-analysed using a Varimax rotation, which resulted in three factors based on the eigenvalue >1.00 criterion and a visual inspection of the pattern of eigenvalues ('scree test'), which together accounted for 53% of the variance. The first factor accounted for 28% of the variance. It was labelled "Proximal consequences" and referred to expecting consequences of global warming being geographically and temporally proximal. The six highest loading items were "Global warming is likely to have a big impact on people like me", "We are experiencing the consequences of global warming at this very moment", "I will be personally affected by global warming", "Global warming affects the region I live in as much as other places", "My local area is affected by the effects of global warming", "Global warming is already happening". The second factor accounted for 14% of the variance and was labelled "Scepticism". The four highest loading items were "The seriousness of climate change is somewhat exaggerated", "I am uncertain that climate change is really happening", "If global warming is real, its effects will only be felt in the distant future", and "The real effects of global warming will not become problematic during my lifetime". The third factor accounted for 11% of the variance. It was labelled "Distal consequences" and referred to expecting consequences of global warming being geographically distant. The three highest loading items were "Other countries are more vulnerable to negative effects of global warming than we are", "Developing countries will suffer most of global warming", and "Although global warming is real, it is particularly problematic for distant parts of the world". The remaining three of the sixteen items had factor loadings <0.50 and loaded on more than one factor. In order to identify the unique contribution of each factor, participants' factors scores were used to represent the three psychological distance clusters, which due to the orthogonal rotation were thus uncorrelated.

4.1.2.3. Pro-ecological worldview. Participants were presented with the 15-item New Ecological Paradigm Scale (Dunlap, Liere, Mertig, & Jones, 2000). This scale consists of beliefs related to how humans relate to nature and the environment and thus assesses endorsement of an environmentally conscious worldview (e.g., Dunlap, 2008). Sample items are "We are approaching the limit of the number of people the Earth can support", "Humans are seriously abusing the environment", "The balance of nature is strong enough to cope with the impact of modern industrial nations" (reverse-coded), "Humans were meant to rule over the rest of nature" (reverse-coded). Five-point Likert response scales were provided, which were labelled from "Disagree strongly" (1) to "Agree strongly" (5). The items were averaged. Higher ratings represent endorsing a pro-ecological worldview. Cronbach's Alpha = 0.79.

4.1.2.4. Pro-environmental values. Participants were presented with four items representing pro-environmental values (De Groot & Steg, 2008); "Protecting the environment: preserving nature and natural resources", "Respecting the Earth: harmony with nature and other species", "Preventing pollution: protecting natural resources", "Unity with nature: fitting into nature". Participants were asked to rate the extent to which the values were "a guiding principle in your life". Seven-point Likert response scales were provided, which were labelled from "Not at all important" (1) to "Of supreme importance" (7). The items were averaged. Higher ratings represent higher levels of importance. Cronbach's Alpha was 0.91.

4.1.2.5. . Past pro-environmental behaviour. A self-report index of sixteen behaviours was used to assess past pro-environmental behaviour, for example "Take a used or reusable shopping bag with me when shopping", "Make sure not to waste gas or electricity while cooking", "Donate to an environmental organisation", "Buy locally produced products". Five-point Likert response scales were provided, which were labelled from "Never" (1), "Sometimes" (2), "Every now and then" (3), "Often" (4), "All the time" (5). The items were averaged. Higher ratings represent more frequently performed behaviours. Cronbach's Alpha was 0.88.

4.1.2.6. Green self-identity. Eight items were used to assess the degree to which participants have adopted a 'green' self-identity. The set included the four items that made up the pro-environmental self-identity scale (Whitmarsh & O'Neill, 2010). Two items did not show sufficient item-total correlations. The remaining six items were taken as an assessment of a 'green' self-identity; "I consider myself as a 'green'

[1] Note that the data for this study were collected before those of Studies 1 and 2.

person"; "Taking care of the global warming is a core value for me", "Being concerned about the environment is part of my identity", "I think of myself as an environmentally concerned consumer", "When I think of 'who I am', being concerned about the environment is an important part of it", "I would be happy if people would see me as a 'green' person". Five-point Likert response scales were provided, which were labelled from "Disagree strongly" (1) to "Agree strongly" (5). The items were averaged. Higher ratings represent a stronger green self-identity. Cronbach's Alpha was 0.91.

4.1.2.7. Emotions. Participants were presented with 10 positive and 10 negative emotions, which were taken from the Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988). They were asked to indicate "how much these apply to you when you think of global warming". Five-point Likert response scales were provided, which were labelled from "Disagree strongly" (1) to "Agree strongly" (5). The items were factor-analysed using a Varimax rotation, which resulted in three factors based on the eigenvalue >1.00 criterion and a visual inspection of the pattern of eigenvalues ('scree test'), which together accounted for 64% of the variance. The first factor accounted for 48% of the variance and contained eight emotions; determined, active, attentive, passionate, alert, interested, inspired, strong. The scale was labelled "Determined". The second factor accounted for 9% of the variance and contained seven emotions; afraid, nervous, scared, upset, guilty, ashamed, distressed. As anxiety-related emotions dominated, the scale was labelled "Anxious". The third factor accounted for 7% of the variance and contained five emotions; hostile, jittery, irritable, vigorous, zealous. The scale was labelled "Angry". In order to identify the unique contribution of each factor, participants' factors scores were used to represent the three emotion clusters, which due to the orthogonal rotation were thus uncorrelated.

4.2. Results and discussion

Women scored higher than men on endorsing a pro-ecological worldview, *M*-women = 3.80, *M*-men = 3.61, $t(298) = 3.18$, $p < .002$, $d = 0.37$, values, *M*-women = 5.59, *M*-men = 5.26, $t(293) = 2.22$, $p < .03$, $d = 0.26$, and past pro-environmental behaviour, *M*-women = 3.52, *M*-men = 3.29, $t(299) = 2.64$, $p < .009$, $d = 0.31$, as well as on anxious emotions, *M*-women = 0.13, *M*-men = −0.30, $t(299) = 3.52$, $p < .001$, $d = 0.41$. No significant sex differences emerged for any of the other study variables, thus including habitual worry about global warming. Age correlated positively with a pro-ecological worldview, $r = 0.26$, $p < .001$, weakly positively with past pro-environmental behaviour, $r = 0.16$, $p < .005$ and green self-identity $r = 0.12$, $p < .04$, respectively, and weakly negatively with scepticism, $r = -0.11$, $p < .05$ and anxious emotions, $r = -0.17$, $p < .004$. No significant correlations emerged for any of the other study variables, thus including habitual worry about global warming.

The mean number of worries about global warming generated in the thought-listing task was 4.64 (*SD* = 2.90). The third column in Table 1 displays the percentages of global warming worries in the ten most prevalent themes in this study, which is consistent with those found in Studies 1 and 2.

In Table 4 means, standard deviations and correlations of the study variables are presented. Habitual worry about global warming correlated moderately strongly and positively with the expectation of proximal consequences and weakly positively with the expectation of distal consequences, while there was no significant correlation with scepticism. Relatively strong and positive correlations were present between habitual worry about global warming, a pro-ecological worldview, pro-environmental values, past pro-environmental behaviour and a green self-identity. Finally, relatively strong and positive correlations were present between habitual worry about global warming and the determined, anxious, and angry emotion clusters. Note that the anxious emotions not only correlated positively with global warming worry, but also with a pro-ecological worldview, pro-environmental values, past pro-environmental behaviour and green self-identity, thus indicating a constructive form of worry.

In order to identify which constructs uniquely accounted for variance in habitual worry about global warming, the latter was regressed on the set of correlates in a multiple regression, where all constructs related to psychological distance, determinants of pro-environmental behaviour, and emotions were entered simultaneously. As scepticism did not correlate statistically significantly with global warming worry this scale was not included in the regression equation. There were no indications of multicollinearity as variance inflation factors varied between 1.04 and 3.27. The results are presented in Table 5. The three emotion factors as well as a green self-identity obtained significant regression weights. This suggests that while all constructs included in the analysis correlated significantly with global warming worry, the three emotion factors and self-identity were the most important when controlled for all other variables.

Taken together, the results thus suggest that global warming worry was associated with the perception of global warming both as a distant and a proximal threat and was associated with anxiety. Habitual worry about global warming was also associated with positive emotions, a pro-ecological worldview, pro-environmental values, past pro-environmental behaviour and a green self-identity, thus strongly suggesting a constructive nature. In the presence of all determinants, the three emotion factors and a green self-identity were the constructs that showed a unique relationship with habitual worry about global warming.

Table 4
Bivariate correlations (Study 3).

		1	2	3	4	5	6	7	8	9	10	11
1.	Habitual global warming worry (1–5)	–	0.27***	−0.07	0.23***	0.26***	0.45***	0.39***	0.56***	0.44***	0.39	0.24***
2.	Proximal consequences[a]		–	0.00	0.00	0.28**	0.30***	0.20***	0.26***	0.30***	0.28***	0.00
3.	Scepticism[a]			–	0.00	−0.49***	−0.18***	−0.14*	−0.15**	−0.14*	−0.21***	0.29***
4.	Distal consequences[a]				–	0.07	0.09	0.14*	0.23***	0.08	0.18**	0.11
5.	Pro-ecological worldview (1–5)					–	0.36***	0.16**	0.26***	0.14*	0.33***	−0.12
6.	Pro-environmental values (1–7)						–	0.51***	0.71***	0.47***	0.33***	0.07
7.	Past pro-environmental behaviour (1–5)							–	0.69***	0.41***	0.21***	0.04
8.	Green self-identity (1–5)								–	0.57***	0.27***	0.11
9.	Emotions: Determined[a]									–	0.00	0.00
10.	Emotions: Anxious[a]										–	0.00
11.	Emotions: Angry[a]											–
Mean		3.11	0.00	0.00	0.00	3.75	5.49	3.45	3.45	0.00	0.00	0.00
Standard deviation		0.72	1.00	1.00	1.00	0.51	1.19	0.68	0.83	1.00	1.00	1.00

Note: $N = 306$; * = $p < .05$; ** = $p < .01$; *** = $p < .001$.
[a] Factor scores from a Varimax-rotated factor analysis.

Table 5
Regressing habitual worry about global warming on nine correlates (Study 3).

	b	SE b	95% CI b	β	t	f^2
Proximal consequences	0.02	0.03	(-0.05; 0.08)	0.02	0.44	0.00
Distal consequences	0.05	0.03	(-0.01; 0.12)	0.07	1.64	0.00
Pro-ecological worldview	0.11	0.07	(-0.03; 0.24)	0.08	1.60	0.00
Pro-environmental values	−0.01	0.04	(-0.08; 0.07)	−0.01	−0.19	0.00
Past pro-environmental behaviour	0.00	0.06	(-0.12; 0.12)	0.00	0.01	0.00
Green self-identity	0.24	0.07	(0.11; 0.37)	0.28	3.60***	0.02
Emotions: Determined	0.19	0.04	(0.11; 0.27)	0.26	4.74***	0.04
Emotions: Anxious	0.20	0.04	(0.13; 0.27)	0.27	5.53***	0.06
Emotions: Angry	0.15	0.03	(0.09; 0.21)	0.21	4.84***	0.04

Note: $N = 306$. $R^2 = 0.46$. * = $p < .05$; *** = $p < .001$.

5. General discussion

The objective of the present studies was to investigate a specific aspect of eco-anxiety, that is, habitual worry about global warming. The main question was whether worry about global warming is constructive or unconstructive. Watkins (2008) argued that repetitive worried thinking may have consequences that are constructive, for instance adopting adaptive behaviours in the prospect of danger, or unconstructive, for instance negative affect and impairment of cognitive functioning. Furthermore, unconstructive worry tends to be associated with cognitive and behavioural avoidance rather than engagement with relevant issues (Wells, 1999). In Studies 1 and 2, medium-size correlations were found between habitual worry about global warming and trait pathological worry. However, in both studies this correlation was nonsignificant when controlled for worries about personal issues. Study 3 assessed how participants perceive, think, behave and feel with respect to the environment and how these assessments related to habitual worry about global warming. It was found that global warming worry was associated with the perception that this problem affects distant places as well as one's own location or region, which signifies it as a personally relevant problem. This was also confirmed by the content analysis of global warming worries. Global warming worry was positively associated with determinants of pro-environmental behaviour. Finally, global warming worry was associated with three clusters of emotions; feelings of determination, anxiety and anger, respectively. These associations were positive (thus including the positive emotions) and, as we used factor scores on orthogonal factors, independent from each other. The feelings of determination was the strongest factor in the factor analysis. Also, the negative emotions associated with global warming worry correlated positively with the determinants of pro-environmental behaviour. Taken together, the three studies produced signs of an unconstructive nature of global warming worry (i.e., correlation with pathological worry; negative emotions), as well as a constructive nature (i.e., no significant relation with pathology when controlled for other worries; correlations with pro-environmental views and positive emotions).

What model would best explain the results of the three studies and what can we conclude with respect to the constructive or unconstructive nature of global warming worry? As for Studies 1 and 2, we review three scenarios, while bearing in mind that the correlational design of the studies prevents from drawing causal conclusions. The first scenario is that while pathological worry is closely associated with worrying about personal issues, those who suffer from this condition are likely to have worries about other issues as well if and when these are activated, which may thus include global warming. In this scenario worry about global warming is thus unconstructive for those who are high on pathological worry - a minority of the population, while not necessarily so for others for whom such worry may indeed be constructive and lead to pro-environmental attitudes and for some to action. A second scenario is that global warming worries are considered as personal worries by those high on pathological worry and would thus qualify as unconstructive. If this scenario holds, global warming worries should appear in participants' thought listings of worries about personal issues. However, this is not the case; an ad-hoc inspection of the personal worries listed in the worry assessment tasks of Studies 1 and 2 revealed that only 7 from the total of 559 participants mentioned global warming or global warming-related worries as personal issues worries, and only 7% of worries about global warming were self-referential concerns. Finally, as a third scenario, it is possible that all types of worries share a common (unmeasured) component, such as negative affect, which would then explain the correlations between them. Furthermore, the habitual worry measures probably shared some common measurement error due to the use of a similar instrument. In this scenario the relationship between pathological worry and global warming worry is spurious, and leaves the status of global warming worry undetermined, but *not* necessarily unconstructive. Of the three scenarios, the first seems the most convincing to us, and is supported by the findings of the content analysis, the second scenario seems the least likely, while the third scenario cannot be ruled out.

Study 3 provided a demonstration of worry about global warming as a constructive form of thinking. Firstly, global warming worry was associated with a threat that is perceived to be both proximal and distal. The sizable associations of worry about global warming with positive ('determined') as well as angry emotions, a pro-ecological worldview, values and behaviour, and the presence of a 'green' self-identity strongly supported the thesis that habitual worry about global warming can be a constructive response. The importance of the emotional component was apparent as all three emotion clusters were strongly and independently associated with habitual worry. Whereas this may be unsurprising for anxious and to some extent for angry emotions, a key finding was the positive association of determined emotions and worry. Equally important were the positive correlations between anxious and angry emotions and the pro-environmental variables. The positive emotions thus point at an intrinsic motivation to engage with the issue of global warming and 'to do the right thing' (e.g., Taufik, Bolderdijk, & Steg, 2015; van der Linden, 2015b). This thus constitutes a convincing argument for a constructive rather than unconstructive nature of worry about global warming, as theory would predict the latter if global warming worry would have been associated with an avoidance of engagement with these issues (e.g., Wells, 1999). Negative feelings such as anxiety and anger observed in relation to global warming worry may well have an adaptive function too. For instance, Ojala (2012a) applied a model of stress and coping developed by Folkman (2008) to investigate how children cope with anxiety related to climate change. A key concept in this model is 'meaning-focused coping', which refers to strategies to generate positive feelings and reappraisals related to sources of stress. The present findings fit such an interpretation and may thus explain how negative and positive emotions work in tandem in coping with global warming worry. This strategy is particularly useful in the context of threats that are not immediately controllable, such as indeed global warming (e.g., Coelho et al., 2017; Ojala, 2012a, 2012b; Panno, Carrus, Maricchiolo, & Mannetti, 2015).

The relationship between global warming worry and a 'green' self-identity is also significant in this context, as embracing climate change concern as part of one's self-concept is an important marker of the constructive nature of global warming worry. Considering oneself as 'green' may feature as a cognitive/affective 'hub' in driving pro-environmental aspirations and behaviour and may become part of what a person may consider as their 'true self' (e.g., Strohminger, Knobe, & Newman, 2017; Verplanken & Holland, 2002; Verplanken & Sui,

2019). The observation that global warming worry seemed unaffected by the COVID-19 crisis is important in this respect as this suggests that this concern is genuine and not context-dependent. Global warming worry thus has features of a strong attitude which increases the likelihood an individual will act upon (e.g., Holland, Verplanken, & van Knippenberg, 2002; Petty & Krosnick, 1995).

The different affective, cognitive and self-related responses to the threat of global warming may be part of self-regulation processes leading to behaviour (e.g., Hagger, Koch, Chatzisarantis, & Orbell, 2017; Leventhal, Diefenbach, & Leventhal, 1992). However, the exact dynamics in the relationships between global warming worry and associated emotions, a pro-ecological worldview, values, pro-environmental behaviour and self-identity are still to be established. It is not unreasonable to suggest that causal flows are bi-directional (e.g., van der Linden, 2014). For instance, a 'green' self-identity may be the result of sustained pro-environmental behaviour, but equally may instigate such behaviour. In both cases a 'green' self-identity can be expected to be associated with pro-environmental values, while constructive worry may provide 'motivational fuel' for these relations (e.g., van der Linden, 2015b).

This work has limitations. Firstly, the studies were conducted amongst convenience samples with high proportions of students and females. Considering the fact that pro-environmental self-identity is associated with demographic variables such as age, sex, location and education (e.g., Whitmarsh & O'Neill, 2010), this may have to be taken into account when interpreting our results. In particular, our samples may have had relatively strong pro-environmental views. Future research should explore eco-anxiety and related constructs amongst wider populations. Another limitation is the use of cross-sectional designs, which prevents drawing conclusions about the causal nature of habitual worry about global warming and the constructs assessed in the present studies. Future research could explore experimental designs to assess climate change worry when cognitive and behavioural variables are manipulated (e.g., Spence & Pidgeon, 2010), and longitudinal models to monitor these relations over a longer time-period.

6. Conclusion

Climate change may involve threat and loss, thus potentially generating anxiety and grief. However, it also triggers positive emotions and adaptive responses, suggesting it is a complex construct. While for some individuals global warming worry is unconstructive and associated with intrapersonal dysfunction, for others it is a constructive response embedded in a 'green' self-identity. For the latter individuals, global warming worries can be characterised as "macro worries", that is, worries that are focused on large entities such as society or the wider world and correlate with self-transcendence values such as universalism and benevolence (e.g., Schwartz, Sagiv, & Boehnke, 2000). That notwithstanding, for those who are directly affected by disasters such as hurricanes, flooding and wildfires, global warming may have turned into personally very relevant worries.

The emotional correlates of global warming worry are likely to play an important role in activating people. They also remind us that the severity of consequences of global warming is why most people are concerned in the first place (e.g., Sjöberg, 2006); this is where global policy needs to focus on. And this concern seems resilient; our findings suggest that the COVID-19 crisis, which elicited strong and salient worries, did not affect the level of worry about global warming. As a matter of fact, recent findings suggest that during the COVID-19 crisis concern about global warming in the UK has in fact *in*creased (Centre for Climate Change and Social Transformations, 2020). We hope that the next generation will look back upon us and be proud that those who genuinely and habitually worried about global warming were able to remain engaged with this threat and converted those worries into constructive and effective action.

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CRediT authorship contribution statement

Bas Verplanken: Conceptualization, Formal analysis, Writing - original draft, was responsible for the data collection. **Elizabeth Marks:** Writing - review & editing, collaborated in theoretical positioning, the interpretation of the results. **Alexandru I. Dobromir:** Formal analysis, Writing - review & editing, was responsible for the content analysis, The authors wish to thank Greg Maio and Ian Walker for helpful comments on an earlier draft.

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