Predictors of Deep Behavioural Engagement in Climate Action Among Australian Adults

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Climate change affects all social and ecological systems, and its mitigation will entail billions of humans transforming their relationships with those complex systems. Amid signs that more people are alarmed and taking action to mitigate climate change, a new concept of deep behavioural engagement (DBE) in climate action is presented and explored through a mixed methods study. Australian adults (N=384) were surveyed anonymously online using open- and closed-ended items, with the sample including 111 people who reported practising DBE. Thematic analysis of open-ended items revealed that DBE activities ranged from nonviolent direct action, to teaching climate science, to practising permaculture. Binary logistic regression identified that people who reported higher levels of duty to mitigate climate change for the sake of others, combined with climate anxiety, active hope, and biospheric values, were more likely to practise DBE. Findings are important for understanding the motivations of people who are already doing the kinds of collective activism, career shifts and major lifestyle changes that are needed on a global scale as part of limiting climate change.

Key words: climate change, deep behavioural engagement, climate action, climate anxiety, active hope, Australia.

Climate change is a major concern for most Australians. In 2020, 79% of participants in a large Australian survey agreed that climate change was occurring, 74% were concerned about climate change, and, in the wake of a catastrophic 2019-2020 bushfire season, 82% were worried about bushfires (Quicke & Bennett, 2020). Other research into climate change attitudes has segmented populations into six groups (Leiserowitz et al., 2021). The *Alarmed* are convinced the planet is warming due to human activities and that this is an urgent threat, and they strongly support climate action. The *Concerned* share these views but view climate change as still distant in time and space. The *Cautious* express uncertainty about the reality and seriousness of the threat, while the *Disengaged* have little awareness of the issue. The *Doubtful* say it is not happening or not dangerous, and the *Dismissive* tend to endorse conspiracy theories about climate change (Leiserowitz et al., 2021). Australians were last grouped this way in 2013 (Morrison et al., 2013), but in recent years in the United States (US), the *Alarmed* group has more than doubled (Goldberg et al., 2021). Within that group, the *Active Alarmed* are most likely to be already participating in activism, volunteering, and advocacy to deliver large-scale action (Goldberg et al., 2021).

In its report on the challenge of limiting warming to 1.5 degrees, the Intergovernmental Panel on Climate Change makes it clear that "transformative systemic change" on a planetary scale is needed in order to avoid worst-case-scenario consequences of climate change (de Coninck et al., 2018). This requires massive shifts at the group level, because individual actions have little impact unless combined into collective mobilisation (Fritsche & Masson, 2021). These group-level phenomena are the topic of a growing body of literature on the social psychology of climate change (Mackay et al., 2021).

Nevertheless, there is still a need for psychology to examine individual-level phenomena because individuals' actions are the building blocks of collective mobilisation and

transformative systemic change. The present study is concerned with understanding what motivates individuals to undertake deep behavioural engagement such as climate activism, reorienting their work lives towards climate change efforts, or drastically reducing the carbon intensity of their lifestyle. According to complexity theory, complex systems transform as a result of "myriad small, simple changes, with each element doing its own simple thing while the whole is acquiring increasing complexity and emergent properties" (Hill, 2015, p. 51). Change is a bottom-up process involving disorganisation, a qualitative shift at some critical point, and reorganisation into something new (Hill, 2015). The top-down power of the systems inhibiting climate action does not obviate the need to examine bottom-up processes of individuals acting collectively to transform those systems.

Deep behavioural engagement in climate action (DBE) is a new construct, intended to represent extensive engagement in carbon-reducing activities within one's personal lifestyle, professional life, or through volunteer and advocacy activities. Other than Goldberg and colleagues' (2021) identification of the *Active Alarmed*, there is little previous research on characteristics of people who practice DBE. In the present study, a person's deep behavioural engagement (DBE) is defined as self-reported current action "in a major way" in at least one of the following three areas: engaging in volunteering and/or activism toward mitigating climate change; directing the focus of one's work, study or career toward mitigating climate change; and designing one's personal lifestyle (transport, housing, diet, and/or energy consumption) to reduce one's contribution to climate change. This expansion of the scope of pro-environmental behaviours (PEBs) to emphasise major changes aligns with increased calls in urgency for larger carbon reductions. The aim of the present study is to identify psychological factors that predict DBE among Australian adults through qualitative and quantitative exploratory analyses. In the absence of previous research on DBE, it draws on variables that previous research has found to be linked to PEBs or collective action in response to climate change, and variables that have a theoretical link to DBE. These links are briefly summarised below.

Climate change anxiety has been identified theoretically as a necessary precursor to taking action (Burke, 2017; Lewis et al., 2020). Climate change anxiety has been defined as "heightened emotional, mental or somatic distress in response to dangerous changes in the climate system" (p.22, Climate Psychology Alliance, 2020). When the threat seems terrifying and overwhelming, people who shut down and deny their feelings about it can be paralysed into inaction, while those whose feelings are acknowledged and responded to with compassion may be inspired towards taking action (Cunsolo et al., 2020; Lertzman, 2008). Affective responses, which can include anxiety, have been identified as being among the strongest predictors of climate change mitigation and adaptation behaviour, although research has not yet established causal pathways from affective responses towards either PEB or deeper forms of engagement in climate action (Brosch, 2021).

The conditions of uncertainty that produce anxiety can also give rise to hope: a belief that a positive future is possible (Verlie, 2019). Research has found that different kinds of hope, driven by different underlying appraisals, have contrasting effects on PEB (Brosch, 2021). Constructive, or active, forms of hope relate to believing that taking action collectively can help mitigate climate change, and have been shown to correlate with PEB, support for climate action policy, and political engagement (Brosch, 2021). False hope, based in denial of the seriousness of the threat of climate change or a focus on positive consequences of climate change, has been reported to have the opposite effect (Marlon et al., 2019; Ojala, 2015). A survey of middle school students in the US found that climate change concern and climate change hope, which was measured with items tapping into both personal active hope and hope about collective action, appeared to be independent antecedents to PEB (Stevenson & Peterson, 2016). Hope and concern could coexist, and contrasted with the negative effects of climate

change despair on PEB (Stevenson & Peterson, 2016). These findings suggest hope is likely to be related to engaging in impactful forms of climate action, and that different forms of hope might have varying impacts on engagement with different forms of climate action.

Given the global and unevenly distributed nature of the threat of climate change and its greater impact on developing countries, there has been some research examining attitudes that would promote global solidarity and cooperation towards mitigation. Studies have found a link between cosmopolitan orientation (the attitudinal and value orientations of people who see themselves as global citizens), and in particular a component called global prosociality, with intentions to engage in PEB (Ito et al., 2020; Leung et al., 2015). Outcome measures were intentions to engage in non-activist behaviours in the private sphere, and frequency of basic PEBs such as turning off lights in unused rooms or taking shorter showers. While it is not yet clear from research whether cosmopolitan orientation is predictive of more impactful environmental behaviours, the collective and community scale of many forms of climate action means that a sense of global prosociality or solidarity has potential theoretical relevance to DBE.

People's values also seem to have a role in their willingness to engage in PEB. Research has examined the role of hedonic values (related to feeling good and reducing effort), egoistic values (related to increasing money and status), altruistic values (related to benefiting others), and biospheric values (related to how their choices affect nature and the environment) (de Groot & Steg, 2008; Steg, 2016, 2018; Steg, Bolderdijk, et al., 2014). Strong endorsement of hedonic or egoistic values is associated with lower PEB, and strong endorsement of altruistic and particularly biospheric values is associated with higher PEB (Steg, 2016). An Australian study ($N = 921$) found that sociocultural influences, namely free-market ideology, prescriptive norms (social pressure to personally take action), and biospheric values, played a role in predicting participants' willingness to engage in climate change mitigation behaviours (Xie et al., 2019). A model that included these factors explained 72% of variance in climate change risk perception, but only 47% of variance in willingness to engage in mitigation behaviours, suggesting other factors prevented concern translating into action (Xie et al., 2019). Reviewing the literature, Bouman and colleagues (2021) noted a collective lack of action on climate change despite widespread endorsement of biospheric values, and suggested that people's non-engagement in climate action may be motivated by protecting other values where there is a value conflict – such as when a pro-environmental action is time consuming and brings hedonic costs.

Some climate psychology research in high-income countries has linked collective inaction to the way the threat has often been seen as distant, abstract, in the future, and uncertain (Jones et al., 2017; McDonald et al., 2015; Spence et al., 2012; Van Lange & Huckelba, 2021). Lower psychological distance (i.e., climate change as close) is generally associated with higher levels of concern. Messaging that makes the consequences of climate change, and instrumental actions individuals can take, seem more concrete and less uncertain, has been used as a way of encouraging climate action (Jones et al., 2017; Van Lange & Huckelba, 2021), though the role of psychological distance in DBE has not yet been explored.

Climate change could be expected to feel closer in time and place when a person has personally experienced its effects. In large Australia-wide surveys conducted in 2010 (N = 3,096) and 2011 (N = 4,347), 45% of respondents reported direct personal experience with climate change, such as in the forms of seasonal changes, extreme weather, environmental degradation, and water scarcity (Bradley & Reser, 2017). Reporting direct personal experience of such events was associated with greater acceptance of climate change as reality, perceived risk, objective knowledge, distress, psychological adaptation, and behavioural engagement, compared to people who did not report such personal experience (Bradley & Reser, 2017). In 2020, 57% of Australians reported they had experienced some form of direct impact from the

2019/2020 Black Summer bushfires; this group was more likely than those who had not been directly impacted to agree with statements such as "This is a wake-up call for the world on the impacts of climate change" and "The current bushfires demonstrate the cost of climate inaction" (Quicke & Bennett, 2020, p. 10).

This kind of psychological "reckoning with reality" has been described as just as crucial as work to mitigate climate change and to adapt to aspects of it that cannot be avoided (Lewis, 2021). As more people report that climate change makes them concerned and alarmed (Goldberg et al., 2021), psychotherapists have observed that all people are in a process of emerging from various degrees of disavowal or denial about climate change (Lewis, 2021). For some, this reckoning brings a sense of duty, or responsibility, to safeguard a safe climate for the sake of future people (Mulgan, 2018). Bateman and O'Connor (2016) argue that a future-oriented feeling of personal responsibility is a vital psychological link between acceptance of climate science and behavioural engagement in climate action. Felt responsibility reflects the extent to which people feel capable of and compelled to take useful action towards a desired result, like the way some bystanders feel a duty to help a person in need (Bateman & O'Connor, 2016). Felt responsibility or duty has been linked to taking action to adapt to climate change (Bateman & O'Connor, 2016; Wang et al., 2018). As such, a sense of duty or responsibility is worth examining in relation to DBE in climate action.

With growing awareness that transformative systemic change is needed in response to the climate emergency, and indications that more people are *Alarmed* and engaging in collective action, the concept of DBE is necessary and warrants further exploration. The present study involves a survey of people residing in Australia to identify some who are undertaking DBE, and the concept of DBE is elaborated with examples from these participants. Using the quantitative data, mean comparisons are used to identify ways in which people who practice DBE differ from people who do not. Finally, logistic regression identifies factors predicting that a person will be deeply behaviourally engaged in climate action. Implications for driving transformative systemic change are discussed.

Theory

Two decades ago, Stern (2000, p. 421) noted that environmentally significant behaviour was "dauntingly complex" and depended on a broad range of causal factors, sometimes in interaction, that seemed to vary greatly across different target behaviours and individuals. For example, value-belief-norm theory was able to predict environmental citizenship, private-sphere behaviour, and policy support, but was a limited predictor of environmental activism (Stern, 2000). Since then, theory-driven research into the antecedents of PEB has continued to be central in climate psychology (Nielsen et al., 2021). The theory of planned behaviour, based in broader social psychology, posits that attitudes, social norms, and perceived behavioural control influence intentional behaviour. While perceived behavioural control is linked to structural constraints, it does not fully account for the cultural and physical context of people's action and inaction (Whitmarsh et al., 2021). Attempts to do so include ABC theory, where behaviour (B) is the result of personal-sphere attitudinal variables (A) interacting with contextual factors (C) (Guagnano et al., 1995). This has led to findings that attitudes predict behaviour more strongly when contextual factors are neutral but have very little association with behaviour in the face of influential contexts, which seem to powerfully compel or prohibit PEB (Stern, 2000).

Psychological factors that predict low-impact behaviours, typically studied in PEB research, have been shown to be less predictive of higher-impact environmental actions (Nielsen et al., 2021). Research into higher-impact behaviours, and characteristics of people who would fit the DBE or *Active Alarmed* categories, has been limited because these behaviours do not necessarily fit the theoretical requirements of PEB scales (Nielsen et al.,

2021). As such, the present study is exploratory and inductive, aiming to understand the proposed phenomenon of DBE and identify whether selected attitudinal variables used in other climate psychology research are predictive of DBE.

Material and Methods

Prior to commencing, all research materials were reviewed and approved by the Queensland University of Technology Ethics Committee (protocol #2000001000).

Participants

Data were collected via a 106-item online survey that was hosted via Qualtrics between 23 January and 30 May 2021. The survey was promoted via a dedicated Facebook page and in Facebook groups focused on climate activism, low-carbon living, and climate advocacy. In addition, the link to the survey was shared via email and LinkedIn messages to professionals working in climate change, including climate scientists and people who had spoken publicly about their commitment to climate action. People were encouraged to share the survey. Adults aged 18 years and over were eligible, and participants could opt into a prize draw of 12 e-gift cards valued at $50.

Criteria for a participant's responses to be included in the present study were that they had given their age as 18 years or older, indicated that they currently resided in Australia, and completed all relevant survey questions. Table 1 presents data collected on the included participants' sociodemographic characteristics.

Table 1

Sociodemographic Characteristics of Participants (N = 384)

Characteristic	n	%
Gender		
Female	272	70.8
Male	109	28.4
Nonbinary	1	0.3
Transgender	1	0.3
Not specified	1	0.3
Parenthood status and intentions		
Parent of one or more children	266	69.3
Not a parent but intend to have children	41	10.7
Not a parent and do not intend to have children	47	12.2
Not a parent and unsure about intention	30	7.8
Education completed		
0-6 years of schooling (primary school)	0	0
7-10 years of schooling	5	1.3
11-12 years of schooling	16	4.2
Vocational or trade certification	43	11.2
University (undergraduate)	146	38.0
University (postgraduate)	174	45.3
Remoteness		
Urban area or city	298	77.6
Town or village (coastal)	26	6.8
Town or village (inland)	43	11.2
Remote/isolated area (coastal)	3	0.8
Remote/isolated area (inland)	16	3.6

Enough money for basics		
Never	5	1.3
Rarely	9	1.6
Sometimes	13	3.4
Most of the time	94	24.5
All of the time	266	69.3
Enough money for extras		
Never	5	1.9
Rarely	19	7.1
Sometimes	71	22.3
Most of the time	155	38.1
All of the time	134	30.6
Work situation		
Working full-time	158	41.1
Working part-time	74	18.2
Working on a casual basis	25	6.5
Studying	36	9.4
Caring responsibilities	18	4.7
Unemployed and looking for work	11	2.9
Unemployed and unable to work	5	1.3
Retired	60	15.6
No response	1	0.3

Note. Participants were on average 46.6 years old (*SD* = 14.0).

Measures

Demographic and Contextual Questions

The survey asked participants to indicate their gender, age, country of residence, and country of birth. They were also asked about the remoteness of their location, the amount of education they had completed, and their employment situation, with answer options as listed in Table 1. Participants were asked whether they were parents and whether they intended to become parents, and to estimate financial security were asked "How often do you feel that you have enough money to cover your basic needs (such as food, housing and clothing)?" and "How often do you feel that you have enough money to cover extra expenses, like special occasions or treats?", with responses on a 5-point Likert scale from "Never" to "All of the time".

Participants' level of general life stress was measured using the Short-form Perceived Stress Scale (SFPSS), which consists of four items on a five-point scale from "Never" to "Very often". An example is "In the last month, how often have you felt you were unable to control the important things in your life?" The scale is a shortened version of the 14-item Perceived Stress Scale (Cohen et al., 1983), which has demonstrated reliability and validity across settings and in multiple languages, and has been confirmed as having acceptable psychometric properties (Warttig et al., 2013). The higher a respondent's score, the greater their perception that demands on them are higher than their ability to cope, and scores can be compared to population norms. A general life stress measure was included to be able to differentiate from stress and anxiety specific to climate change. In the present study, the SFPSS was found to have good reliability ($\alpha = .801$).

Climate Change Anxiety (CC Anxiety)

Participants' level of cognitive-emotional impairment and functional impairment due to anxiety about climate change was measured using the CC anxiety scale, which consists of 13 items on a 5-point Likert scale from "Never" to "Almost always" (Clayton & Karazsia, 2020). Examples are "I find myself crying because of climate change" and "My concerns about climate change interfere with my ability to get work or school assignments done". The CC anxiety scale was developed and validated in two samples of US adults, recruited online (Clayton & Karazsia, 2020), and has been widely cited. In the present study, the CC anxiety scale was found to have high reliability ($\alpha = .914$).

Psychological Distance of Climate Change (PDCC)

Participants' perception of the psychological distance of climate change was assessed using a measure consisting of four components: geographic distance (four items), temporal distance (four items), social distance (two items), and uncertainty (six items) (Jones et al., 2017). Example items include "The worst effects of climate change will be felt by countries far from where I live", and "Climate change is likely to have a big impact on people like me". Responses are on a 5-point Likert scale from "Strongly disagree" to "Strongly agree". Low total mean scores indicate a perception that climate change is geographically, temporally and socially close and imminent to the participant, and that there is little uncertainty that it is occurring. In the present study, the total PDCC scale was found to have acceptable reliability ($\alpha = .779$).

Psychological Sense of Global Community (PSGC)

The extent of participants' sense of global community or solidarity was assessed using the global subscale of the Psychological Sense of Community scale, which consists of five items on a 7-point Likert scale from "Strongly disagree" to "Strongly agree" (Malsch, 2005). Examples are "People all over the world have a shared fate", and "People's actions can affect others in the world, whether directly or indirectly". Higher scores indicate a greater sense of being connected to people all over the world. In the present study, the scale was found to have acceptable reliability ($\alpha = .754$).

Climate Change Hope (CC Hope)

Participants' sense of hope about climate change was measured using the CC Hope scale, including three subscales: collective-sphere willpower and waypower (CW), personal-sphere willpower and waypower (PW), and lack of willpower and waypower (LW, reverse coded), all measured on a 7-point Likert scale from "Strongly disagree" to "Strongly agree"(Li & Monroe, 2018). The PW subscale had the strongest theoretical link to DBE, because it was about active steps a person was willing to take to address climate change, whereas the CW subscale was about trusting that the problem would be solved, and the LW subscale was about a sense of defeat, but reverse coded. Acceptable reliability was found for the CC Hope scale ($\alpha = .835$), and the CW ($\alpha = .762$), PW ($\alpha = .706$), and LW ($\alpha = .714$) subscales.

Values

To measure participants' alignment with hedonic, egoistic, altruistic and biospheric values, they were asked to rate the importance of 16 different values as guiding principles in their lives on a 9-point scale from "Opposed to my principles" to "Extremely important". Following Steg, Perlaviciute and colleagues (2014), a short version of a value scale with the addition of three items measuring hedonic values was used. The hedonic ($\alpha = .753$), egoistic

(α = .817), altruistic (α = .791) and biospheric (α = .877) values scales all demonstrated acceptable reliability in the present study.

Observation of Climate Change (Observed CC)

To gauge the extent to which participants had personally noticed the effects of climate change in their own local area, they were asked the extent of their agreement or disagreement, on a 5-point Likert scale from "Strongly disagree" to "Strongly agree", with the following six items: "I have observed sea levels rising, higher tides, decreased beaches/soil erosion etc, in my country"; "My country is experiencing more frequent/severe bush fires"; "My country is experiencing more frequent/severe droughts"; "I have observed changes in wildlife (e.g., fewer fish in rivers/oceans, more/fewer wild animals in my area)"; "My country is experiencing more frequent cyclones/severe storms"; and "I have observed decreased food and fresh water supply in my area". An average score was created where higher scores represented greater overall exposure.

Reckoning with Reality

To gauge participants' level of reckoning with the seriousness of the climate change threat, and whether this had affected their reproductive intentions, they were asked the extent of their agreement or disagreement, on a 7-point Likert scale from "Strongly disagree" to "Strongly agree", with the following three items: "Climate change has influenced my thinking about whether to have children or how many children to have" (Whether Children); "Climate change is a global emergency, caused by human activity, that threatens the extinction of human life" (Emergency); and "I have a duty to help mitigate climate change for the sake of others, including future generations" (Duty). Higher scores indicate greater agreement with the statement, with each item analysed independently.

Forms of DBE

The key outcome variable of interest was DBE in climate action, in any of three distinct spheres of life: volunteering or activism; work, study or career; and personal lifestyle. These forms of DBE were measured with a single purpose-designed item each: "I engage in volunteering and/or activism toward mitigating climate change"; "I direct the focus of my work, study or career towards mitigating climate change"; and "I design my personal lifestyle (transport, housing, diet, and/or energy consumption) to reduce my contribution to climate change". For each item, participants were asked to choose from the following answer options: "I currently do this in a major way", "I currently do this to some extent", "I do not do this but want to", "I do not do this but I am open to it", "I did this in the past", and "I have no intention to do this". Presence of DBE in climate action was operationalised as the presence of the answer "I currently do this in a major way" in response to one or more of the DBE items (n = 111). Participants who did not answer "I currently do this in a major way" to any of the three items were categorised as non-DBE (n = 273).

For each of the forms of DBE (volunteering/activism, work/study/career, and personal lifestyle), participants who responded with any option other than "I have no intention to do this" were asked to briefly describe their activity in this area, including current, past, or intended actions, by typing into a text box. For the three forms of DBE, 331 participants, 300 participants, and 366 participants, respectively, gave responses that led to them being invited to describe their activity, and participants took up the invitation to do so in about 65% of cases.

Analytic Strategy

Six hundred and fourteen individuals commenced the survey, 480 reached the end, 96 were filtered out due to not meeting the study's eligibility criteria for age and country of

residence, and 384 were included in the data analysis. IBM SPSS Statistics 27 was used for quantitative data analysis, which began with descriptive statistics, including examination of histograms, scatterplots and boxplots. A missing values analysis on the dataset (N = 384) showed that no variable had missing data for more than 1.8% of the sample. Little's MCAR test supported the null hypothesis that data were missing completely at random, X^2 = 3018.903, df = 3566, p = 1.000. Expectation maximization imputation was used to manage missing data (Grace-Martin, 2014).

The outcome variable for the primary research question was presence of DBE in climate action (1 = DBE, 0 = no DBE). Independent variables where there was a statistically significant mean difference between the DBE and non-DBE groups were considered potential predictors, and their bivariate relationship with DBE was tested using unadjusted (crude) odds ratios. After confirming that the assumptions for binary logistic regression were met, the predictors (PDCC, PSGC, CC anxiety, altruistic values, biospheric values, PW, Observed CC, Emergency, and Duty) were entered into a binary logistic regression to examine their relationship with DBE while controlling for the other predictors.

Results

Forms of DBE Reported by Participants

The participants who responded with "in a major way" to any of the three DBE items gave a range of examples of ways in which they were contributing to climate change action. Many indicated a high level of commitment, such as a leadership role, dedication of most of their career to climate work, or climate change as their primary focus in work or life. A summary is presented in Table 2.

Table 2

Deep Behavioural Engagement (DBE) Activities Reported by Participants

Sphere of activity	Examples
I engage in volunteering and/or activism towards mitigating climate change (in a major way) n = 47 (12.2%)	Activism, e.g., with Extinction Rebellion, Stop Adani, Lock the Gate alliance Volunteering for the Australian Greens political party, local sustainability groups, and climate action groups Nonviolent direct action, such as blocking coal trains Attended multiple demonstrations or protests Volunteering in organisations involving native tree seedlings, revegetation, community compost Climate change awareness photography Working in climate change action and advocacy Creating and running climate action groups Supporting people with climate emotions
I direct the focus of my work, study or career towards mitigating climate change (in a major way) n = 47 (12.2%)	Teaching preschool, school and university students about environmental issues including climate change Doing paid or unpaid work in climate advocacy organisations Working in human rights charities to help people affected by climate change Studying or practising permaculture or regenerative agriculture Organising climate-focused election campaigns Advancing legislative proposals for climate action Studying environmental science in various forms Working in renewable energy, recycling, sustainability, environmental science, environmental management, climate communication, local adaptation, disaster preparedness, environmental campaigning, climate change impact research, and climate psychology research
I design my personal lifestyle (transport, housing, diet, and/or	Walking and bicycling for transport, using public transport Limiting car journeys, electric car use, living car-free

energy consumption) to reduce my contribution to climate change (in a major way) *n* = 77 (20.1%)	□ Reducing or eliminating plane travel □ Reducing or eliminating consumption of beef, all meat, or all animal products □ Growing own food, making own clothes and bread □ Installing solar power, solar hot water and home batteries □ Making energy efficient home modifications □ Recycling, composting, off grid living, living in a small home □ Choosing not to have children □ Planting trees □ Buying produce directly from farms □ Buying second-hand clothes, reducing consumption in general □ Financially supporting climate advocacy organizations

Descriptive Statistics

Chi-square tests indicated no significant differences between the DBE and non-DBE groups based on gender (female, male, or nonbinary/transgender/not specified; X^2 (2, N = 384) = .05, p = .977), their current work situation (full-time, part-time, casual, studying, caring, unemployed and looking for work, unable to work, or retired; X^2 (7, N = 384) = 9.06, p = .248), or educational attainment (0-6 years of schooling, 7-10 years of schooling, 11-12 years of schooling, vocational or trade certification, undergraduate degree or postgraduate degree; X^2 (4, N = 384) = 3.91, p = .419). A chi-square test indicated that the groups differed on whether climate change had influenced their reproduction decisions, X^2 (6, N = 384) = 62.51, p < .001. Post-hoc tests using a Bonferroni adjusted alpha level of .007 per test (.05/7, for 7 tests) (Geert van den Berg, 2021) showed that the DBE group was significantly more likely than the non-DBE group to "strongly agree" that climate change had influenced their thinking about whether to have children or how many children to have, and the non-DBE group was significantly more likely to "strongly disagree" with this statement.

Mean comparisons for continuous variables are shown in Table 3. The DBE and non-DBE groups did not differ significantly in age, perceived stress, or egoistic values. Mean comparisons revealed the DBE group reported significantly higher anxiety about climate change (CC anxiety), sense of global solidarity (PSGC), hedonic, altruistic and biospheric values, and personal active hope in climate action (PW) than the non-DBE group. The DBE group scored higher on both CC Hope and its PW subscale, but PW had a larger effect size; this was expected because of its closer theoretical fit with active hope. As such, PW, rather than CC Hope, was used as a measure of hope in subsequent analyses. The DBE group was significantly more likely than the non-DBE group to report higher agreement with the framing of climate change as an emergency, and greater sense of duty to mitigate it. The DBE group scored significantly lower on PDCC, indicating that they perceived climate change as more imminent, geographically and socially close, and certain, compared to the non-DBE group.

Table 3

Descriptive Statistics for DBE (n = 111) and Non-DBE (n = 273) Groups.

Variable	DBE		Non-DBE		*t*(*df*)	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
Age (years)	48.2	13.9	45.9	14.0	1.45 (206)	.149	0.16
Enough money for basics (1-5 scale, never to always)	4.66	0.65	4.56	0.78	-1.25 (243)	.214	-0.13
Enough money for extras (1-5 scale, never to always)	4.05	0.88	4.01	0.94	-0.39 (216)	.697	-0.04
SFPSS (1-5 scale, never to very often)	2.51	0.66	2.39	0.76	1.47 (233)	.143	-0.16
CC anxiety	2.12	0.64	1.60	0.58	7.55 (187)	< .001	0.89
PDCC	2.01	0.35	2.33	0.51	-7.05 (292)	< .001	-0.68
PSGC	5.84	0.80	5.29	1.07	5.40 (270)	< .001	0.54
PW	6.12	0.73	5.46	0.90	7.54 (251)	< .001	0.78
CC Hope	5.58	0.79	5.28	0.84	3.26 (217)	.001	0.36
Hedonic values	6.35	1.14	6.62	1.19	-2.06 (213)	.041	-0.23
Egoistic values	4.70	1.39	4.77	1.41	-0.45 (207)	.651	-0.05
Altruistic values	8.04	1.00	7.75	1.12	2.44 (228)	.015	0.26
Biospheric values	8.43	0.80	7.74	1.10	6.81 (279)	< .001	0.67
Observed CC	4.26	0.52	3.83	0.83	6.02 (317)	< .001	0.56
Emergency (1-7 scale, strongly disagree to strongly agree)	6.75	0.64	5.76	1.70	3.23 (217)	.001	0.67
Duty (1-7 scale, strongly disagree to strongly agree)	6.89	0.41	6.07	1.36	9.04 (360)	< .001	0.71

Note. t tests assume unequal variance. SFPSS = Short-form Perceived Stress Scale; CC anxiety = Climate Change Anxiety; PDCC = Psychological Distance of Climate Change; PSGC = Psychological Sense of Global Community; PW = Personal-sphere willpower and waypower; CC Hope = Climate Change Hope; Observed CC = Observed Climate Change; DBE = Deep Behavioural Engagement in Climate Action.

Pearson product-moment correlations between predictor variables were analysed. As shown in Table 4, the highest correlations were between Duty, Emergency, PDCC, and Observed CC. The r = .77 correlation between Duty and Emergency was relatively high, however no variables in the analysis had a tolerance value of less than .10, a commonly used cut-off point for identifying multicollinearity (Pallant, 2020).

Table 4

*Pearson Product-Moment Correlations Between Predictor Variables (*n = *382).*

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. CC anxiety	—											
2. PDCC	−.40**	—										
3. PSGC	.28**	−.44**	—									
4. SFPSS	.36**	−.20**	.07	—								
5. Hedonic	−.15**	.04	-.01	-.06	—							
6. Egoistic	−.00	−.00	.02	.04	.38**	—						
7. Altruistic	.13**	−.30**	.39**	−.09*	.26**	.13*	—					
8. Biospheric	.32**	-.35**	.32**	.12**	.11*	-.07	.52**	—				
9. PW	.29**	-.46**	.42**	.07	-.03	.03	.32**	.36**	—			
10. Emergency	.44**	-.69**	.43**	.18**	-.04	-.02	.37**	.40**	.48**	—		
11. Duty	.41**	-.69**	.48**	.12*	-.10	-.08	.31**	.39**	.58**	.77**	—	
12. Observed CC	.41**	-.68**	.40**	.21**	-.05	-.04	.37**	.39**	.46**	.69**	.67**	—

Note. CC anxiety = Climate Change Anxiety; PDCC = Psychological Distance of Climate Change; PSGC = Psychological Sense of Global Community; SFPSS = Short-Form Perceived Stress Scale; PW = personal-sphere willpower and waypower; Observed CC = observed climate change. n = 382 due to two participants not completing the PW scale. $^{*}p < .05$. $^{**}p < .01$ (2-tailed).

Logistic regression predicting DBE

Logistic regression analysis assessed the combined effect of nine independent variables (CC anxiety, PDCC, PSGC, PW, altruistic values, biospheric values, Observed CC, Emergency, and Duty) on the odds that participants would exhibit DBE. The full model containing all predictors was statistically significant, X^2 (9) = 114.02, $p < .001$, indicating that the model was able to distinguish between participants who did and did not exhibit DBE. The full model correctly classified 76.7% of cases (sensitivity 50.5%, specificity 87.5%). The model explained 36.8% (Nagelkerke R^2) of the variance in DBE. As shown in Table 5, only four of the independent variables made a unique statistically significant contribution to the model (CC anxiety, biospheric values, PW, and Duty). The strongest predictors were CC anxiety and Duty: each one-unit increase in anxiety or in duty more than doubled the odds of exhibiting DBE.

Table 5

Logistic Regression Predicting Likelihood of Deep Behavioural Engagement in Climate Action.

Variable	B	SE	Wald	*p*	Exp(B)	95% CI	
						LL	*UL*
CC Anxiety	0.77	0.22	11.90	.001	2.16	1.39	3.33
PDCC	-0.65	0.42	2.34	.126	0.52	0.23	1.20
PSGC	0.13	0.17	0.64	.424	1.14	0.83	1.58
PW	0.65	0.21	9.97	.002	1.92	1.28	2.87
Altruistic values	-0.20	0.17	1.44	.231	0.82	0.59	1.14
Biospheric values	0.42	0.18	5.34	.021	1.52	1.07	2.17
Observed CC	-0.15	0.28	0.30	.582	0.86	0.50	1.48
Emergency	0.23	0.21	1.21	.272	1.26	0.84	1.90
Duty	0.72	0.36	3.87	.049	2.05	1.00	4.18
Constant	-13.01	3.00	18.85	< .001	0.00		
Full model: X^2 (9) = 114.02, $p < .001$, Nagelkerke $R^2 = .368$							

Note. df = 1. Hosmer and Lemeshow Test of goodness of fit was non-significant. *N* = 382. SE = standard error; Exp (B) = odds ratio; CI = confidence interval; *LL* = lower limit; *UL* = upper limit. CC Anxiety = Climate Change Anxiety; PDCC = Psychological Distance of Climate Change; PSGC = Psychological Sense of Global Community; PW = Personal-sphere willpower and waypower; Observed CC = Observed Climate Change.

Discussion

This study proposed a new construct called deep behavioural engagement (DBE) in climate action, referring to self-reported climate change mitigation activities in either volunteering and/or activism, work, study or career, or personal lifestyle, that a person reports currently doing in a major way. This exploratory, mixed methods study surveyed a non-random convenience sample of Australian adults to find examples of DBE, thematically analysed activities perceived to exemplify DBE, identified ways in which people practising DBE differed from other people in the sample, and identified several factors that predicted whether a person would practise DBE.

Results showed that the reported DBE activities of adults in Australia in the volunteering and activism sphere included involvement in nonviolent direct action, creating and running climate action groups, promoting the election of pro-climate-action candidates, and supporting people in their emotional responses to climate change. In the work, study and career sphere, DBE activities included spending decades working in climate advocacy or human rights organisations, teaching students about climate change, organising climate-focused election campaigns, advancing legislative proposals for climate action, and working in

various areas of science, research, energy, adaptation, and psychology around climate change. In terms of personal lifestyle changes, DBE participants reported impactful activities such as reducing or eliminating car journeys, plane travel, or consumption of animal products; growing their own food, making their own clothes, and composting; small homes, solar power, and living off the grid; and choosing not to have children. The broad range of DBE activities reported by participants demonstrates that there are many ways people can contribute towards climate action, and that despite barriers, people are capable of deep commitments to these efforts. These findings have potential to inform development of scales to measure deep behavioural engagement in climate action across different spheres of activity.

Descriptive statistics revealed that people in the sample who were practising DBE did not differ significantly from people who were not practising DBE on any of the demographic variables measured: age, gender, current work situation, educational attainment, or parenthood status and intentions. This shows that in this sample DBE was not unique or specific to one or more subgroups of the population in terms of demographic characteristics. It was also notable that although DBE participants experienced significantly more climate change anxiety, they did not have higher or lower general life stress than non-DBE participants. This supports the premise that climate change anxiety is specific to the climate reality, can be differentiated from other forms of psychological distress, and while associated (r = .36) it is distinct to feeling overwhelmed by life in general.

While other research linked strong endorsement of egoistic or hedonic values to lower PEB (Steg, Perlaviciute, et al., 2014), in the present study there was a significant difference between the DBE and non-DBE groups on endorsement of hedonic values but not egoistic values, with the DBE group scoring lower on hedonic values. Consistent with PEB research, the DBE group was significantly more likely to strongly endorse altruistic and biospheric values, and to have a sense of global solidarity (higher scores on PSGC). Promotion of these values and attitudes could be part of the cultural change entailed in a transformation towards a zero-emissions world. Also, consistent with PEB research (e.g., Jones et al., 2017), those who viewed climate change as proximal, immediate, and certain (i.e., lower scores on PDCC) were more likely to engage in DBE. This is important because psychological distance can be reduced through message framing (Jones et al., 2017) and might already be reducing as the consequences of climate change become more personally relevant to people, such as Australians affected by bushfires and flooding. The DBE group scored higher on the PW form of climate change hope, representing an active form of hope. In line with theory, there were signs that the DBE group had been "reckoning with reality" more than the non-DBE group: DBE participants were significantly more likely to strongly agree that climate change had influenced their reproductive decisions, and significantly more likely to endorse the Emergency and Duty statements.

The logistic regression model predicting the presence or absence of DBE was able to correctly classify more than three quarters of cases. In this model, climate change anxiety and a sense of duty towards others, including future generations, emerged as the strongest predictors of DBE. The personal-sphere willpower and waypower subscale (PW) on the climate change hope scale, which is similar to an active form of hope, and biospheric values, involving appreciation of and connection to nature, also made uniquely significant contributions to the model after controlling for other variables. This indicates that what is different about people who practise DBE is a combination of a strong sense of duty for the sake of others, greater anxiety about climate change, a sense of constructive or active hope about responding to the emergency, and a stronger endorsement of goals to care about nature and the environment. Climate change anxiety and active hope are two distinct components co-occurring in some concerned and alarmed individuals and arising from similar conditions (Stevenson & Peterson, 2016; Verlie, 2019). Future research and climate change communication could focus on ways

of instilling a sense of duty, promoting active hope and protecting people from despair, and fostering cultural discourse that prioritises biospheric values.

Limitations

The present study was based on a non-random sample of adults residing in Australia. The sample was predominantly comprised of women, people living in urban areas, and those with a very high level of education (45.3% of participants with postgraduate-level education). Participants were also relatively affluent, with 69.3% saying they had enough money for basic items "all of the time" and 68.7% saying they had enough money for extra items either most of the time or all the time. This relative homogeneity of the sample makes it unsurprising that no significant differences were identified on demographic variables. It also means that the results cannot be assumed to generalise to the broader Australian adult population, nor to samples in other parts of the world. Given concerns that climate psychology research has been focused on the attitudes and experiences of relatively privileged people in affluent countries, it is unfortunate that recruitment for this study did not manage to counteract that trend. However, given this subgroup is also likely to represent higher carbon emitters, there is likely benefit in targeting this subgroup. Additionally, participants self-selected into the study and tended to find out about the study through environment-related Facebook groups or via people in their networks. These recruitment methods assisted in accessing a usefully high number of people who were practising DBE, at the expense of representativeness.

This research provides a preliminary understanding of the concept of DBE. It is important to note that the quantitative analyses rely on people self-identify as engaging "in a major way" within their lives in the three domains in pro-environmental ways. There is likely variability in how people conceptualise what constitutes minor versus major behaviours. The qualitative data provide further examples of how participants conceptualised these behaviours, however, further research is required for more detailed analysis and operationalisation of the concept.

Conclusions

This study is among the first to examine a phenomenon that has here been termed deep behavioural engagement in climate action, or DBE. The findings show that a portion of Australians practice DBE, and that they do so in a myriad of ways as activists, volunteers, educators, students, workers, leaders, householders, and citizens. The findings provide insights into the ways in which people practising DBE may differ from others. The most important predictors of DBE – climate change anxiety, duty, active hope, and biospheric values – are not characteristics that are fixed or only found in certain parts of the community. As people continue the process of emerging from degrees of disavowal or denial about climate change (Lewis, 2021), there is potential for a large portion of the community to take on these DBE-facilitating attitudes and affective stances, and commit to climate action.

The finding that climate change anxiety is a strong predictor of DBE, and the possibility of more people experiencing this as part of a shift towards more widespread DBE, might seem a dismaying outcome, especially to psychologists. However, it is worth noting how different climate change anxiety is from other forms of anxiety: it is about real threats, and treatment involves transforming the fear into effective action (Lewis et al., 2020). At the same time as humanity works to mitigate climate change and adapt communities towards greater resilience, it may be equally essential to experience the feelings associated with reckoning with this new reality. Verlie (2019, p. 751) calls for affective adaptation, in which people learn to "live with climate change", enduring the pain of letting go of the world they have known, and working to envision and create alternatives.

The other key predictors of DBE – a strong sense of duty about preserving a safe climate for the sake of others, an active form of hope, and biospheric values – have potential to be influenced through climate change communication. Messages that support and amplify these attitudes may have a role to play in growing the proportion of citizens who are *Concerned* and *Alarmed* about climate change and encouraging them to commit to action. In the face of powerful macrosystemic barriers, including the way the global economic system and government priorities are based on continued growth, expansion, extraction, and pollution, changing course away from the current trajectory will require many more people to deeply engage and collectively mobilise in climate action. Additional research, policy change, and collective action is required to avoid potential worst-case scenario outcomes in the coming years and decades.

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Acknowledgements

We are grateful to Cara Philp for collaborating with us in the development of the online survey used in this research and thank all participants for their time in completing the survey.

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