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Green dreams are made of this: Futures consciousness and proenvironmental engagement

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Abstract

Futures consciousness (FC) refers to the capacity to understand, anticipate and prepare for the future. As a form of future orientation, it encompasses five interrelated dimensions of time perspective, agency beliefs, openness to alternatives, systems perception and concern for others. We present here cross-sectional evidence that FC is related to greater environmental engagement, above and beyond other future orientation constructs. In two pre-registered studies (one convenience student sample and one representative sample; $N = 1041$), we found that respondents with higher futures consciousness reported greater proenvironmental behaviour (consumption behaviour, land stewardship, social environmentalism and environmental citizenship). FC proved a better predictor of proenvironmental behaviour than the Zimbardo Inventory's Future Time Perspective and the Consideration for Future Consequences Scale (Study 1). FC was also related to stronger biospheric values (Study 2). However, it was not significantly related to personal environmental footprint (derived from a 16-item calculator). Strikingly, the environmental footprint was also unrelated to the Proenvironmental Behaviour Scale, which could point to a lack of correspondence between measures of proenvironmental *propensity* and *impact*. We discuss implications for future-thinking research and interventions aiming to improve futures consciousness.

KEYWORDS
biospheric values, carbon footprint, future orientation, future thinking, futures consciousness, proenvironmental behaviour

INTRODUCTION

Climate change, natural resources depletion, biodiversity loss: many environmental issues have in common to be 'future problems'. Although they can be forecasted with some certainty, their full impact will not be witnessed before some time. Nonetheless, it is immediate action that is needed to effectively address these issues (IPCC, 2023). However, it can be difficult to motivate people to act on future problems, notably because of an increased psychological distance (e.g. Keller et al., 2022; but see van Valkengoed et al., 2023). People tend to focus on present issues and only reluctantly discount present outcomes for future ones (Bickel et al., 2015; Sparkman et al., 2021), although there are significant variations among individuals in this regard. This paper aims to examine whether futures consciousness, a recently developed model of future-thinking orientation, influences people's concern for and engagement towards future environmental issues.

We present the results of two studies that tested the relationship between futures consciousness and proenvironmental values and behaviours. Study 1 relied on a convenience sample of university students and endeavoured to compare the predictive power of futures consciousness to that of neighbouring constructs (i.e. future time perspective and consideration for future consequences; see below). Study 2 replicated and prolonged these findings with a larger and representative sample; it also included measures of proenvironmental values and an environmental footprint calculator. Overall, these studies demonstrate the positive role of future consciousness for environmental action. In the following sections, we describe the existing research on future orientation and engagement for the environment before turning to futures consciousness, more specifically, and to the present studies.

Future orientation and environmental engagement

Broadly speaking, future orientation represents the human capacity and tendency to represent what might happen in the future (Szpunar et al., 2014). Studies have illustrated the relevance of future orientation for understanding behaviour and attitudes, both for individual issues (such as health or academic achievement) and collective issues. Among the latter, a large body of evidence pertains to sustainability and the environment: people who express a greater tendency to think about and plan for the future are also more likely to be concerned about environmental issues. For instance, individuals with a strong future orientation were more likely to oppose offshore drilling (Strathman et al., 1994), engage in environmental activism (Joireman et al., 2001), recycle (Lindsay & Strathman, 1997) and use public transportation (Joireman et al., 2004). A meta-analysis of 19 studies similarly showed a strong positive association between future time perspective and environmental attitudes and behaviour (Milfont et al., 2012).

While most of the abovementioned studies have been carried out with relatively small and mostly student samples, evidence from larger population samples also supports the association between future orientation and environmental engagement. Notably, a study on Swiss citizens showed a significant effect of future orientation on adopting various types of environmentally friendly behaviour, such as using energy-saving light bulbs, solar panels or thermal insulation (Bruderer Enzler, 2015). Another study on Israeli citizens showed strong correlations between future orientation and environmental behaviour, concern, attitudes and activism, as well as willingness to sacrifice for the sake of the environment (Carmi & Arnon, 2014).

Several instruments exist that can capture future orientation, and the most commonly used in the literature have been the Zimbardo Time Perspective Inventory (ZTPI, Zimbardo & Boyd, 1999) and the Consideration of Future Consequences Scale (CFC, Strathman et al., 1994). The ZTPI is based on a five-dimensional model that describes the different time orientations that may dominate an individual's thinking: past-negative, past-positive, present-hedonistic, present-fatalistic and future. The future perspective subscale of the ZTPI characterizes individuals with high conscientiousness and a strong goal orientation and tendency for planning (Mohammed & Marhefka, 2020). For its part, CFC was

originally conceived as a unidimensional construct but later developed into a two-factor structure, contrasting one's focus on immediate versus future consequences of their actions (Joireman & King, 2016). The CFC scale characterizes tendencies related to delay discounting, personal convenience, sacrifices and the considered timescale of behaviour outcomes. While the original scale received criticism for low readability (e.g. Bruderer Enzler, 2015), recent adaptations of the scale have focused on simpler items (Chng et al., 2022). Studies investigating future orientation and environmental engagement have most often utilised the CFC scale, the ZTPI coming second. The aforementioned meta-analysis did not identify any differences in effect sizes between the CFC and the ZTPI (Milfont et al., 2012). Yet, some published studies found no association between the ZTPI and proenvironmental behaviour, leading some to suggest that the ZTPI might be more adequate in the context of personal (e.g. health related) than collective behaviour (e.g. environmental; Carmi, 2013).

In summary, a large body of evidence suggests that future orientation is an important driver of proenvironmental engagement. However, questions remain as to whether the existing scales are well fit to the study of collective issues such as the environment. In the following section, we discuss a recently developed model of future thinking, futures consciousness, which might prove promising for studying environmental engagement.

Futures consciousness and environmental engagement

Futures consciousness (FC) refers to the human capacity to understand, anticipate, prepare for and embrace the future (Lalot et al., 2020). A five-dimension model of FC was recently developed based on a literature review of theoretical conceptualizations in the field of futures research (Ahvenharju et al., 2018), which has endeavoured to describe the qualities of future-oriented thinking and behaviour, notably for educational purposes. The field of futures research often considers the temporal perspective as intertwined with other capacities, such as systemic understanding, agency, openness or responsibility. In the same vein, the model of FC builds on the fundamental idea that future thinking is dependent on other factors than a purely temporal perspective. Furthermore, the focus of FC is not only on an individual's personal future but also on the future of everyone globally.

The FC model, therefore, suggests that in order to successfully understand and deal with complex and abstract future dilemmas, an individual needs to mobilize the following five dimensions: (1) *Time Perspective*, to guide orientation and interests towards future events and long-term consequences; (2) *Agency Beliefs*, to increase confidence in one's own ability to influence future outcomes and to take successful action; (3) *Openness to Alternatives*, to strengthen the appreciation and understanding of novel possibilities and potential alternatives to the present that the future may bring; (4) *Systems Perception*, to enhance one's capacity to recognize links, interdependencies and causalities among and between different systems that influence future outcomes; and (5) *Concern for Others*, to highlight the understanding of one's own responsibility in relation to the potentially conflicting interests of others (such as future generations, Ahvenharju, 2022; Ahvenharju et al., 2018, 2021).

Support for this theoretical model was found in the successful development of the Futures Consciousness Scale, a psychometric instrument measuring individual differences in the propensity to mobilize the aforementioned five dimensions (Lalot, Ahvenharju, & Minkkinen, 2021; Lalot et al., 2020). Through hierarchical confirmatory factor analysis, Lalot and colleagues showed that time perspective, agency beliefs, openness to alternatives, systems perception and concern for others were consistently and positively cross-related, and together contributed to the higher-order latent construct of futures consciousness.

Assuming that individuals with high FC are more aware of the future, while also considering systemic connections, novel alternatives and the needs of others beyond the self, then FC should predict all sorts of future-oriented collective behaviours. Studies support this hypothesis: higher FC scores were positively related to (self-reported) altruistic behaviour, engaged citizenship, general interest in politics and frequency of voting (Lalot, Ahvenharju, & Minkkinen, 2021; Lalot et al., 2020), as well as

compassion for others and engagement in collective action during the COVID-19 pandemic (Lalot, Abrams, et al., 2021).

Crucially for our present purpose, FC also positively relates to proenvironmental behaviour (PEB). Specifically, Lalot et al. (2020) observed positive correlations between FC scores and the General Ecological Behaviour Scale (GEB; Kaiser & Wilson, 2004) in two samples. It is also noteworthy that in these studies, environmental behaviour was positively associated with each subdimension of FC taken separately as well as with the global score of FC, but this latter association was greater than that of any of the subdimensions – speaking of the relevance of the global construct of FC above and beyond pure time perspective.

This initial evidence is encouraging but also limited in scope. Notably, it relied on relatively small and non-representative samples. It also utilized only one instrument to assess PEB, focusing on consumption behaviours. Finally, past studies have not assessed the incremental validity of the FC scale above and beyond other time-related constructs that have been shown to relate to PEB (e.g. the ZTPI or CFC scale). The present research aims to pursue this effort to further examine how FC might relate to proenvironmental views and behaviour, in comparison with other future-thinking scales.

The present research

We conducted two cross-sectional surveys to further our understanding of future orientation and proenvironmental engagement. Study 1 relied on a convenience sample of university students ($N = 241$). The first aim was to provide a test of the relationship between FC and different forms of self-reported PEB going above consumption/conservation lifestyle (i.e. land stewardship, social environmentalism and environmental citizenship). Second, the study aimed to test the incremental validity of the FC scale above and beyond the Consideration for Future Consequences Scale (Joireman et al., 2012) and the Zimbardo Time Perspective Inventory (Zimbardo & Boyd, 1999).

Study 2 extended these findings in two respects: (1) by relying on a larger and representative sample ($N = 800$), and (2) by broadening the measures of environmental views to also consider environmental values and environmental footprint. The study thus included a measure of biospheric values, that is, a value orientation 'that emphasises the intrinsic value of nature' (de Groot & Steg, 2008, p. 333). Biospheric values have been found to positively relate to environmental intentions and actions (van der Werff et al., 2013, 2014), potentially through the creation of a self-nature connection (Martin & Czellar, 2017). They are often studied in conjunction with altruistic and egoistical values, which may also drive PEB but for different motives (i.e. for the sake of other people or one's own benefit, respectively). While FC has been found to correlate with other stable traits and goal-driven orientation (Lalot et al., 2020), to the best of our knowledge the relationship between FC and values has never been formally tested – a gap this study will address.

Finally, we decided to include an environmental footprint calculator to reflect recent (and less recent) findings that self-reported measures of PEB may not be related to actual consumer behaviour (e.g. Koller et al., 2023; Lange & Dewitte, 2019, 2021) and that individuals who are more concerned about the environment might ironically have a larger environmental impact than others due to covarying factors such as their socioeconomic status (Nielsen et al., 2022; Nielsen, Nicholas, et al., 2021). With the environmental footprint calculator, participants are asked to report their actual behaviour – rather than their views or intentions – from which we can derive an objective indicator of environmental impact. Furthermore, the calculator questions focus on objective reporting (e.g. size of one's house and number of people living in it, in combination with the type of heating system used), which may be less prone to distorted recall and socially desirable reporting than other self-reported scales.

Both studies were pre-registered and hypotheses are spelled out below. Data, code for analyses and materials are publicly available on the OSF: https://osf.io/zxwnp/.

STUDY 1: INCREMENTAL VALIDITY OF THE FUTURES CONSCIOUSNESS SCALE

We pre-registered the study design, materials, hypotheses, sample size and rules for exclusion on AsPredicted: https://aspredicted.org/e7vb9.pdf. Sample size was determined based on a power analysis. Specifically, and relying on Lalot et al. (2020), we expect a correlation between FC and PEB of around 0.30. Schönbrodt and Perugini (2013) suggest that correlations of 0.30 stabilize at $N = 212$ for a width of the corridor of stability $w = 0.10$ (power $= 0.80$). To allow for exclusions, we therefore aimed to recruit at least $N = 220$ participants. We made the following hypotheses:

> **H1.** Futures consciousness is positively related to self-reported proenvironmental behaviour (PEB).

> **H2.** Futures consciousness relates to PEB above and beyond related future-thinking constructs (i.e. Zimbardo Time Perspective Inventory – future orientation, and Consideration for Future Consequences).

Methods

Participants and procedure

Participants were students in a Swiss university invited to complete a questionnaire in exchange for course credits or a small monetary compensation. They completed the survey on individual computers in the lab (1–6 participants at the time). Two hundred forty-two participants completed the study but one person failed the attention check embedded in the questionnaire and was excluded from analyses, as pre-registered. The final sample was therefore $N = 241$ (including 177 women, 57 men, 3 non-binary or other and 4 undisclosed; $M_{age} = 23.16$, $SD = 4.89$). Participants first completed the three scales measuring future orientation (i.e. Futures Consciousness Scale, Consideration for Future Consequences Scale and Zimbardo Time Perspective Inventory) in a randomized order. This was followed by a proenvironmental behaviour inventory. They finally indicated demographics and were thanked, debriefed and remunerated.

Materials

Futures consciousness scale

Participants completed the 20-item Revised Futures Consciousness Scale (Lalot, Ahvenharju, & Minkkinen, 2021) in German, with four items measuring each dimension of time perspective (e.g. 'I consider how things might be in the future, and try to influence those things with my day-to-day behaviour'), agency beliefs (e.g. 'I believe I can succeed at most any endeavour to which I set my mind'), openness to alternatives (e.g. 'I am often on the lookout for new ideas'), systems thinking (e.g. 'I think that all the Earth's systems, from the climate to the economy, are interconnected') and concern for others (e.g. 'When they are in need, I want to help people all over the world'; 5-point Likert scale, $1 = $ *Not at all like me*, $5 = $ *Very much like me*). A confirmatory factor analysis (CFA) showed that the data fit the theoretical structure of the scale well (i.e. five subdimensions contributing to the higher-order factor of futures consciousness), $\chi^2(165) = 257$, $\chi^2/df = 1.56$, CFI $= 0.913$, RMSEA $= 0.048$, 90% CI [0.036, 0.059], SRMR $= 0.071$. As in previous work using the FC scale, we aggregated all items into a single index of futures consciousness ($\alpha = .70$, $\omega_T = 0.77$, $M = 3.84$, $SD = 0.39$).

Zimbardo time perspective inventory

We used the German translation of the Zimbardo Time Perspective Inventory (Zimbardo & Boyd, 1999) validated by Reuschenbach et al. (2013), and more specifically the 13 items forming the subscale of future time perspective (e.g. 'I believe that a person's day should be planned ahead each morning'; 5-point Likert scale, 1 = *Very uncharacteristic of me*, 5 = *Very characteristic of me*). Answers were aggregated in a mean score of future time perspective ($\alpha = .73$, $M = 3.70$, $SD = 0.49$).

Consideration for future consequences

We relied on the German translation of the Two-Factor Consideration for Future Consequences Scale (Joireman et al., 2012) by Kübel and Wittmann (2020). The two-factor scale includes seven items measuring concern with immediate consequences (CFC-Immediate, e.g. 'I only act to satisfy immediate concerns, figuring the future will take care of itself') and seven items measuring concern with future consequences (CFC-Future, e.g. 'When I make a decision, I think about how it might affect me in the future'; 5-point Likert scale, 1 = *Very uncharacteristic of me*, 5 = *Very characteristic of me*). As recommended, we treated them as separate subscales (CFC-Immediate: $\alpha = .77$, $M = 2.40$, $SD = 0.66$; CFC-Future: $\alpha = .69$, $M = 3.78$, $SD = 0.55$).

Self-reported proenvironmental behaviour

Self-reported PEB were measured with the 13-item scale developed by Larson et al. (2015). The scale measures the frequency of adoption of PEB in four different domains: conservation lifestyle behaviours (3 items, e.g. 'Actively save water or energy at home'), land stewardship (3 items, e.g. 'Volunteer to improve wildlife habitat in your community'), social environmentalism (3 items, e.g. 'Work with others to address an environmental problem or issue') and environmental citizenship (4 items, e.g. 'Vote to support a policy/ regulation that affects the local environment'; 5-point Likert scale, 1 = *Never*, 5 = *Very often or always*). We submitted all items to an exploratory factor analysis. After removing one item that did not load with all others, the analysis recommended a single factor solution (all loadings >0.30). We therefore aggregated the 12 remaining items into a single score of self-reported PEB ($\alpha = .83$, $\omega_T = 0.86$, $M = 2.57$, SD = 0.59).[1]

Results

Code for analyses is reported in supplementary file (ESM1) available on the OSF alongside the data: https://osf.io/zxwnp/.

H1: Zero-order correlations

We first investigated zero-order correlations between future-thinking scores and PEB (see Table 1). Supporting our first hypothesis, FC was significantly and positively related to PEB, $r(239) = .36$, $p < .001$. PEB also showed a positive correlation with CFC-Future scores, $r(239) = .18$, $p = .005$, while the correlation with CFC-Immediate scores was negative, $r(239) = -.19$, $p = .003$. ZTPI-Future scores, however, showed a non-significant correlation, $r(239) = .00$, $p = .99$.

H2: Hierarchical regressions

We then turned to a hierarchical regression model to assess the incremental validity of FC above and beyond ZTPI and CFC. The first model included CFC-I, CFC-F and ZTPI as multiple predictors,

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[1]In their original development of this PEB scale, Larson and colleagues identified four separate domains of PEB. Here, in contrast, the factor analysis suggests that the items are better represented by a unidimensional structure. A key difference between the two studies is the population sampled: Larson and colleagues focused on 'nature-based recreationists' (hunters, birdwatchers and landowners) while we sampled a student population (Study 1) or the general population (Study 2). It is possible that people who spend more time in nature for leisure activities start making psychological distinctions between categories of PEB which other people do not.

TABLE 1 Study 1: Correlations among Futures Consciousness, Zimbardo Time Perspective Inventory (Future), Considerations for Future Consequences (Immediate and Future) and Self-Reported Proenvironmental Behaviour.

Pearson's correlations	ZPTI	CFC-I	CFC-F	PEB
FC	0.29***	−0.29***	0.42***	0.36***
ZTPI		−0.41***	0.50***	0.00
CFC-I			−0.51***	−0.19**
CFC-F				0.18**
PEB				−

**p < .01, ***p < .001.

Abbreviations: CFC-F, consideration for future consequences – future; CFC-I, consideration for future consequences – immediate; FC, Futures consciousness; PEB, proenvironmental behaviour; ZTPI, Zimbardo Time Perspective Inventory – Future.

TABLE 2 Study 1: Hierarchical Multiple Regressions Testing the Relationships among Considerations for Future Consequences (Immediate and Future), Zimbardo Time Perspective Inventory (Future), Futures Consciousness and Self-Reported Proenvironmental Behaviour.

	Model 1					Model 2				
	b (SE)	95% CI	t-test	p-value	β	b (SE)	95% CI	t-test	p-value	β
Intercept	2.91 (0.467)	-	6.23	< .001	-	1.46 (0.524)	-	2.78	.006	-
CFC-I	−0.15 (0.066)	[−0.29, −0.03]	−2.21	.028	−.17	−0.12 (0.063)	[−0.25, −0.01]	−1.89	.059	−.14
CFC-F	0.18 (0.083)	[0.01, 0.33]	2.19	.029	.17	0.06 (0.082)	[−0.10, 0.22]	0.77	.44	.06
ZTPI	−0.18 (0.088)	[−0.32, 0.02]	−2.08	.039	−.15	−0.22 (0.084)	[−0.35, −0.01]	−2.63	.009	−.19
FC						0.52 (0.099)	[0.14, 0.53]	5.19	<.001	.34
Summary	$F(3, 237) = 5.31, p = .001, R^2_{adj} = .051$					$F(4, 236) = 11.16, p < .001, R^2_{adj} = .145$				
	Model comparison: $F(1, 236) = 26.96, p < .001, \Delta R^2_{adj} = .094$									

Note: Dependent measure: proenvironmental behaviour.

Abbreviations: CFC-F, consideration for future consequences – future; CFC-I, Consideration for future consequences – immediate; FC, futures consciousness; ZTPI, Zimbardo Time Perspective Inventory – future.

while FC was added in a second step (Table 2). In the first model and consistent with the zero-order correlations, CFC-F was positively related to PEB while CFC-I was negatively related to it. ZTPI scores showed a negative effect, indicating that the unique variance covered by ZTPI beyond CFC was actually related to *fewer* PEB. Explained variance in this first model was rather little ($R^2_{adj} = .051$).

When introducing FC in the second model, the effects of CFC-I and -F became non-significant, while the negative effect of ZTPI remained. Supporting our second hypothesis, FC was significantly related to PEB and explained substantially larger variance ($R^2_{adj} = .145$, $\Delta R^2_{adj} = .094$).

Exploratory: Correlations with the five dimensions of futures consciousness

The theoretical foundations of futures consciousness assume that its five dimensions form a coherent whole and that futures consciousness is best apprehended as the aggregate of these dimensions. Yet, when it comes to the correlates of futures consciousness, it remains possible that some dimensions drive correlations more than others. In the present case, one could argue that PEB is in fact only related to some of the dimensions of FC, something that would remain hidden behind the overall correlation

with the global FC score. To probe for such effects, in follow-up exploratory analyses we looked at the correlations between PEB and each of the dimensions of FC. Results revealed four significant correlations out of five. Specifically, PEB was positively correlated to time perspective, $r(239) = .16$, $p = .012$, openness to alternatives, $r(239) = .26$, $p < .001$, systems perception, $r(239) = .41$, $p < .001$, and concern for others, $r(239) = .28$, $p < .001$. Only the correlation with agency beliefs was non-significant, $r(239) = -.06$, $p = .39$.

Discussion

This first study provided evidence for the hypothesized positive relationship between futures consciousness and proenvironmental behaviour. Importantly, it demonstrated the incremental validity of the FC scale above and beyond other future-thinking-related constructs, namely, the Zimbardo Time Perspective Inventory and the Consideration for Future Consequences Scale. FC, ZTPI and CFC were all significantly inter-correlated, speaking of the convergent validity of these scales. More specifically, the FC scale correlated strongly with CFC-F ($r = .42$), suggesting that the two tap into a relatively similar conceptualization of future thinking. The correlation with CFC-I was more modest ($r = -.29$) which speaks to the notion that concern for the present is not the mere opposite of concern for the future but something qualitatively different (Joireman & King, 2016). The correlation with ZTPI was similarly modest ($r = .29$) and may indicate divergence in the exact form of future thinking that both scales capture (see below).

Turning to the scales' relationship with environmental behaviour, CFC and FC were also both significantly correlated with PEB. However, when directly compared in a multiple regression model, results suggest that FC is a more precise correlate of PEB than CFC is, explaining more variance. The ZTPI scores produced unexpected results (a non-significant zero-order correlation and a negative effect in the multiple regression model), which are in contrast with some earlier studies comparing the effects of CFC and ZTPI on environmental engagement (see Milfont et al., 2012). Upon further examination, it seems that many items of the ZTPI-future scale pertain to organizational skills or even conscientiousness rather than future thinking strictly speaking (e.g. 'I make lists of things to do', 'I meet my obligations to friends and authorities on time'; for similar considerations, see Mohammed & Marhefka, 2020; Worrell et al., 2016) – which may also explain the relatively lower correlation with the FC scale. It may be that these other dimensions captured by the scale are actually negatively related to PEB, an effect that appears once the future thinking dimension is captured by the CFC or the FC scale in the multiple regression model.

More important to our present purpose, exploratory analyses showed that proenvironmental behaviour was positively related to (most) all dimensions of FC, including time perspective, openness to alternatives, systems perception and concern for others, which is consistent with previous findings reported by Lalot et al. (2020). Only agency beliefs showed a non-significant correlation, a finding to which we turn again in the general discussion in light of the findings of Study 2.

STUDY 2: SELF-REPORTED PEB, BIOSPHERIC VALUES AND ENVIRONMENTAL FOOTPRINT

Study 2 aimed to extend the previous study, replicating the findings in a larger and representative sample. It also included further measures of environmental views (i.e. biospheric values and an environmental footprint calculator). This study was pre-registered: https://aspredicted.org/9k8g6.pdf, and our pre-registered hypotheses were as follows:

H1. Futures consciousness (FC) is positively related to biospheric values.

H2. FC is positively related to self-reported environmental behaviour.

H3. We could additionally expect that FC is related to lower environmental footprint. However, recent findings suggest that high-income and high-agency individuals might have a greater personal impact on the environment even though they express higher environmental concern (e.g. Nielsen et al., 2022; Nielsen, Nicholas, et al., 2021). Because of the interconnections among FC, income and agency, it is therefore possible that FC is in fact related to *higher* environmental footprint. We will consider this hypothesis in an exploratory manner.

Method

Participants and procedure

We aimed to recruit a representative sample of the population of Finland, with quotas set to match demographics by gender, age group and region. The target sample size was determined by available funding ($N = 800$). An independent polling company collected the data and was directly responsible for data exclusion. Low-quality responses (more than 10% missing values, or unrealistically quick completion time) were removed, with slots reopening to new participants on a rolling basis. The final sample included 800 participants (384 men, 411 women, 4 non-binary or other and 1 undisclosed) with a mean age of 46.78 years ($SD = 16.13$). Sensitivity power analysis showed this sample would allow detecting an effect as small as Cohen's $d = 0.02$ in a multiple linear regression with 80% power (alpha = .05). The study took the form of an online questionnaire including measures of futures consciousness, biospheric values, proenvironmental behaviour and an environmental footprint calculator as well as demographics.[2]

Materials

Futures consciousness
Participants completed the 20-item Revised Futures Consciousness Scale (Lalot, Ahvenharju, & Minkkinen, 2021) in Finnish (5-point Likert scale, $1 = $ *Not at all like me,* $5 = $ *Very much like me*). Similar to Study 1, a CFA confirmed that the data fit the theoretical structure of the scale well (i.e. five subdimensions contributing to the higher-order factor of futures consciousness), $\chi^2(165) = 745$, $\chi^2/\text{df} = 4.52$, CFI $= 0.910$, RMSEA $= 0.068$, 90% CI [0.063, 0.073], SRMR $= 0.057$ (the complete output is reported in Appendix S1, ESM2). We aggregated all items into a single index of futures consciousness ($\alpha = .90$, $\omega_T = 0.92$, $M = 3.35$, $SD = 0.61$).

Biospheric values
Four items (translated from de Groot & Steg, 2008) measured the importance of biospheric values 'as a guiding principle in life' (e.g. 'Protecting the environment: preserving nature'). Although not core to our hypotheses, we also measured egoistic (e.g. 'Wealth: material possessions, money') and altruistic values (e.g. 'Equality: equal opportunity for all'; four items each) to be able to contrast between the different sets of values (9-point Likert scale, $1 = $ *Opposed to my values*, $2 = $ *Not important*, $9 = $ *Extremely important*). We aggregated each set into one indicator (biospheric: $\alpha = .93$, $M = 6.87$, $SD = 1.78$; altruistic: $\alpha = .90$, $M = 6.99$, $SD = 1.72$; egoistic: $\alpha = .84$, $M = 4.07$, $SD = 1.65$).

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[2]As indicated in the pre-registration, the questionnaire also included a measure of transformational leadership, which pertains to a different set of hypotheses.

Self-reported proenvironmental behaviour

We utilized the same proenvironmental behaviour inventory as in Study 1 (Larson et al., 2015) with minor adaptations. Specifically, given the inclusion in the present study of an environmental footprint calculator focusing on lifestyle and consumption behaviour, we removed the conservation lifestyle behaviour items to avoid redundancy. We also tentatively developed one additional item for the land stewardship subscale; however, this item was later removed from analysis (see below). We therefore tested 11 items (land stewardship: 3 items, social environmentalism: 4 items and environmental citizenship: 4 items; 5-point Likert scale, 1 = *Never*, 5 = *Very often or always*). As in Study 1, we submitted all items to an exploratory factor analysis. After removing one item that did not load with all others, the analysis recommended a single factor solution (all loadings >0.48). We therefore aggregated the 10 remaining items into a single score of self-reported PEB ($\alpha = .89$, $M = 2.38$, $SD = 0.80$).

Environmental footprint calculator

Sixteen items measured participants' lifestyle and its impact in terms of environmental footprint. The items were taken from the Sitra Lifestyle Test (https://lifestyletest.sitra.fi/), which provided the carbon footprint equivalent for each answer. We assessed environmental footprint related to housing (4 items, e.g. 'What is the primary form of heating in your home?'), transportation (5 items, e.g. 'How many hours have you flown in the last year?'), dietary habits (4 items, e.g. 'How often do you eat beef (steaks, cutlets) or hard cheese?') and consumption habits (3 items, e.g. 'How would you describe your shopping habits for goods and clothes?'). The final result was expressed in kg of CO_2 per person and per year ($M = 10{,}027$ kg, $SD = 3912$).

Demographics

Participants reported their gender and age, as well as level of education (10 levels, ranging from primary school to post-graduate university degree; $M = 5.89$, $SD = 2.22$). In addition, two questions measured income: (1) objective monthly income before tax and (2) subjective perception of income as adequate (1 = *Get by just fine,* 5 = *Have to compromise for almost everything*). Answers were strongly correlated, $r(707) = -.53$, $p < .001$, so we aggregated them into a single score after rescaling and reverse coding the second item (10-point scale; $M = 4.72$, $SD = 2.26$). Two questions measured political orientation: (1) as a left–right continuum and (2) as a liberal-conservative continuum. Answers were strongly correlated, $r(789) = .38$, $p < .001$, so we aggregated them into a single score (11-point scale; $M = 5.99$, $SD = 2.19$).

Results

Code for analyses is reported in supplementary file ESM3, available on the OSF alongside data: https://osf.io/zxwnp/. A correlation matrix of all measured variables and demographics is reported in Appendix S1 (ESM4).

H1: Futures consciousness and biospheric values

As pre-registered, we conducted hierarchical linear regressions (with and without demographics) to assess the relationships between FC and the variables of interest. The first analysis revealed the expected positive relationship between FC and biospheric values, regardless of whether demographics were included in the analysis (Table 3). An additional analysis (non-preregistered) was run as a robustness check; it ensured that the relationship hold when taking into account the other types of values (altruistic and egoistic; see Appendix S1, ESM5).

TABLE 3 Hierarchical Linear Regressions Testing the Relationship Between Futures Consciousness and Biospheric Values.

	Model 1					Model 2				
	b (SE)	95% CI	t-test	p-value	β	b (SE)	95% CI	t-test	p-value	β
Intercept	1.67 (0.30)	[1.07, 2.25]	5.53	<.001	-	1.87 (0.36)	[1.17, 2.56]	5.25	<.001	-
Futures consciousness	1.55 (0.09)	[1.37, 1.72]	17.54	<.001	.53	1.57 (0.09)	[1.39, 1.73]	18.11	<.001	.54
Gender						0.26 (0.05)	[0.15, 0.35]	4.96	<.001	.14
Age						0.02 (0.003)	[0.01, 0.02]	6.16	<.001	.18
Education						−0.05 (0.03)	[−0.10, −0.003]	−2.10	.036	−.07
Income						−0.05 (0.03)	[−0.09, −0.001]	−1.99	.047	−.06
Political orientation						−0.11 (0.02)	[−0.15, −0.05]	−4.43	<.001	−.13
Model summary	$F(1, 796) = 307.50, p < .001$					$F(6, 783) = 72.44, p < .001, \Delta R^2_{adj} = .074$				
Explained variance	$R^2_{adj} = .278$					$R^2_{adj} = .352, \Delta R^2_{adj} = .074$				

H2: Futures consciousness and self-reported proenvironmental behaviour

We then turned to self-reported PEB. The hierarchical linear regression supported our pre-registered hypothesis and showed a strong positive link between FC and PEB (Table 4). As robustness check, we conducted another analysis (non-preregistered) controlling for the effect of values on PEB. This showed a sustained positive relationship above and beyond values (see Appendix S1, ESM6).

H3: Futures consciousness and environmental footprint

We finally assessed the link between FC and environmental footprint, with a similar hierarchical linear regression (Table 5). In this case, however, the link was not significant. Only demographics played a role, most importantly, income which was positively related to environmental footprint. There were also smaller effects of age (older respondents reported a lower footprint) and political orientation (more right-wing/conservative respondents reported a higher footprint). Overall, the model explained much less variance for environmental footprint than it could for self-reported PEB and biospheric values.

In additional analyses (non-preregistered), we also examined the relationships between FC and demographics on different facets of environmental footprint (housing, transportation, dietary habits and consumption habits; see details in Appendix S1, ESM7). FC was not related to any of the environmental footprint scores. Crucially, self-reported PEB was related negatively to footprint from dietary habits only (i.e. greater PEB was related to a lower environmental footprint). It was not significantly related to footprints from housing or transportation, and its relationship to consumption habits was even positive (i.e. greater PEB related to *higher* environmental footprint).

Exploratory: Correlations with the five dimensions of futures consciousness

In a final follow-up exploratory analysis and similar to Study 1, we explored the correlations between each of the dimensions of FC and biospheric values, self-reported PEB and environmental footprint. Results (see Table 6) revealed that each dimension of FC was significantly and positively related to biospheric values as well as self-reported PEB. There was no significant correlation with environmental footprint except for a positive relationship with agency beliefs, suggesting that greater agency corresponds with *higher* environmental footprint.

GENERAL DISCUSSION

Aims and findings of the present research

A growing literature has identified a positive effect of future orientation – that is, the human capacity and tendency to represent what might happen in the future (Szpunar et al., 2014) – on engagement towards the environment (e.g. Bruderer Enzler, 2015; Milfont et al., 2012; Milfont & Demarque, 2015; Strathman et al., 1994). However, some questions remain regarding the scales commonly used to assess future orientation. The present paper builds on the relatively new construct of futures consciousness (FC) based on a model of future orientation highlighting the intertwined relationships of five subdimensions (time perspective, agency beliefs, openness to alternatives, systems perception and concern for others; Ahvenharju, 2022; Ahvenharju et al., 2018, 2021). We aimed to test whether individual differences in FC would translate into differences in proenvironmental views and actions. Theoretically, higher FC should lead to greater engagement in long-term, future-oriented, collective behaviour (Lalot et al., 2020). We, therefore, expected positive relationships among FC, biospheric values and proenvironmental behaviour (PEB).

TABLE 4   Hierarchical Linear Regressions Testing the Relationship between Futures Consciousness and Self-Reported Proenvironmental Behaviour.

	Model 1					Model 2				
	b (*SE*)	95% CI	*t*-test	*p*-value	*β*	*b* (*SE*)	95% CI	*t*-test	*p*-value	*β*
Intercept	0.29 (0.14)	[0.01, 0.56]	2.09	.037	-	0.56 (0.17)	[0.22, 0.89]	3.26	.001	-
Futures consciousness	0.62 (0.04)	[0.54, 0.70]	15.18	<.001	.47	0.59 (0.04)	[0.50, 0.66]	14.05	<.001	.45
Gender						0.03 (0.03)	[−0.01, 0.08]	1.36	.17	.04
Age						−0.002 (0.002)	[−0.004, .001]	−1.13	.26	−.04
Education						0.002 (0.01)	[−0.02, 0.02]	0.18	.86	.01
Income						0.04 (0.01)	[0.01, 0.06]	3.16	.002	.11
Political orientation						−0.04 (0.01)	[−0.06, −0.02]	−3.90	<.001	−.12
Model summary	$F(1, 798) = 230.30, p < .001$					$F(6, 785) = 44.10, p < .001$				
Explained variance	$R^2_{adj} = .223$					$R^2_{adj} = .246$, $\Delta R^2_{adj} = .023$				

TABLE 5 Hierarchical Linear Regressions Testing the Effect of Futures Consciousness on Environmental Footprint.

	Model 1					Model 2				
	b (SE)	95% CI	t-test	p-value	β	b (SE)	95% CI	t-test	p-value	β
Intercept	8.93 (0.78)	[7.40, 10.45]	11.51	<.001	-	7.11 (0.89)	[5.37, 8.85]	8.03	<.001	-
Futures consciousness	0.33 (0.23)	[−0.11, 0.77]	1.44	.15	.05	−0.07 (0.22)	[−0.49, 0.35]	−0.33	.74	−.01
Gender						−0.14 (0.13)	[−0.39, 0.11]	−1.06	.29	−.04
Age						−0.02 (0.01)	[−0.03, −0.004]	−2.52	.012	−.08
Education						0.07 (0.06)	[−0.05, 0.19]	1.05	.29	.04
Income						0.55 (0.06)	[0.42, 0.67]	8.77	<.001	.33
Political orientation						0.18 (0.06)	[0.06, 0.29]	3.01	.003	.10
Model summary	$F(1, 798) = 2.07, p = .15$					$F(6, 785) = 20.64, p < .001$				
Explained variance	$R^2_{adj} = .001$					$R^2_{adj} = .130, \Delta R^2_{adj} = .129$				

TABLE 6 Study 2: Correlations Between Biospheric Values, Self-Reported Proenvironmental Behaviour, Environmental Footprint and Each Dimension of Futures Consciousness.

Pearson's correlations	Biospheric values	Self-reported PEB	Environmental footprint
Time Perspective	0.33***	0.39***	0.05
Agency Beliefs	0.24***	0.28***	0.17***
Openness to Alternatives	0.36***	0.34***	0.00
Systems Perception	0.57***	0.41***	−0.03
Concern for Others	0.55***	0.41***	−0.01

***$p < .001$.

Two pre-registered studies provided strong support for these hypotheses. Specifically, FC was positively related to different forms of PEB (pertaining to consumption lifestyle, Study 1; but also land stewardship, social environmentalism and environmental citizenship, Studies 1–2) as well as biospheric values (Study 2). A range of additional analyses were conducted as robustness checks and found the link with FC to remain stable despite the inclusion of covariates such as demographics and other sets of values. FC also proved a better predictor of PEB than neighbouring constructs (consideration for future consequences and Zimbardo Time Perspective Inventory; Study 1), showing its incremental validity.

PEB were also positively and significantly related to each of the subdimensions of FC. This finding confirms the relevance of each of the subdimensions in isolation. However, considering them together as a global score showed an even stronger correlation than most of its isolated components, which highlights the importance of apprehending future orientation as a broader construct encompassing further facets of cognitions and perceptions than a mere time perspective (Ahvenharju et al., 2021), especially in the context of collective behaviour such as environmental engagement (Carmi, 2013). Even if time perspective may predict personal or health-related behaviour well, it seems that behaviour that requires the understanding of impacts within a larger societal scope also stipulates openness to alternatives, systemic understanding and concern for others.

One dimension, agency beliefs, showed slightly less stable links with PEB. The correlation was significant in our Finnish representative sample (Study 2) but non-significant in our first sample of Swiss university students (Study 1). This might suggest that the role of agency beliefs is developmental and only fully expresses itself at a less young adult age. Indeed, research suggests that both primary control capacity (i.e. greater access to resources, independence and self-direction) and compensatory secondary control (increasing cognitive and self-regulatory competence) increase from early adulthood to midlife (Heckhausen et al., 2019). Interindividual differences in agency might also be more visible as age increases. In the present data, agency beliefs were indeed more homogeneous in the student sample, with lower variance (despite the smaller sample size) than the representative sample. Therefore, the role of agency beliefs might have been attenuated in the younger student sample of Study 1. As an alternative explanation, we cannot rule out cross-cultural differences in agency, either in terms of mean level or of its role in directing future-oriented behaviour. For example, one cross-cultural study of general self-efficacy (Scholz et al., 2002) found that Finns had slightly lower self-efficacy than other neighbouring European countries (including Germany, the closest proxy to our sample of German-speaking Swiss in Study 1). Future comparative studies across ages and countries would need to test these speculations further.

In sum, the present findings support a previous investigation by Lalot et al. (2020) who similarly observed a positive association between FC and the General Ecological Behaviour Scale (Kaiser & Wilson, 2004). Furthermore, they extend past findings in several respects: we draw here from a larger and representative sample (Study 2), which allows us to effectively account for demographic factors. Second, we investigate different types of PEB and not just consumption habits (Studies 1–2). This is also the first investigation – as far as we are aware – of the link between FC and values (Study 2). Finally, we were able to demonstrate the incremental validity of the FC scale above and beyond CFC and ZTPI

(Study 1). Thus, results support the idea that people who report higher futures consciousness are also more concerned and involved with the environment.

What about the environmental footprint measure?

Results pertaining to the environmental footprint calculator, as a measure of respondents' impact on the environment (Study 2), stand in contrast to the other variables. The environmental footprint was not related to FC; strikingly, it was also hardly related to self-reported PEB. A first interpretation could be that FC cannot predict 'real' consumption behaviour and that the findings pertaining to values and self-reported PEB might be the mere expression of social desirability and a self-reporting bias (Koller et al., 2023; Lange, 2023). However, this would not explain why the environmental footprint measure was not tainted by similar biases.

Alternatively, we argue that the environmental footprint calculator taps into a different set of behaviours than the self-reported PEB scale (explaining the absence of relationship between the two measures). In recent years, researchers have highlighted key differences underlying specific types of PEB (for a review, see, e.g. Lange & Dewitte, 2019), including the setting in which they take place (e.g. the household vs. public places, Maki & Rothman, 2017), the personal cost of behaviour (in personal time and money; see Rau et al., 2022), accessibility of eco-friendly alternatives and whether PEB represent a personal or a collective effort, including collective action to support large-scale policies and systemic action (Chater & Loewenstein, 2022). The footprint calculator mostly considers personal consumption behaviours that represent a clear trade-off between personal interests (and costs) and the environment; it is also by nature a measure of environmental *impact*. The PEB scale, in contrast, included societal and systemic actions such as being involved in an environmental organization and volunteering for nature conservation activities – actions for which the individual/environment trade-off might be less clear. By assessing and combining a number of different behaviours, the PEB scale is also by nature a measure of *proenvironmental propensity*. As such, a couple of recent studies have identified only weak correlations between PEB scales and footprint calculators or even positive ones (Bleys et al., 2017; Huddart Kennedy et al., 2015; Moser & Kleinhückelkotten, 2017; Nielsen et al., 2022), as was the case for one dimension of the calculator in the present research. Recent work similarly found only limited overlap between carbon footprint and behavioural tasks (i.e. the 'carbon emission task' and the 'work for environmental protection task', Bosshard et al., 2024).

It was also striking that higher income (objectively measured) was related to both higher self-reported PEB and a more damaging environmental footprint – with a similar picture emerging for (subjective) agency beliefs. This reflects other recent findings that high-income individuals, who also enjoy greater agency thanks to their better access to resources, are both more concerned about the environment and the ones with a greater environmental impact due to their general lifestyle (e.g. Bleys et al., 2017; Moser & Kleinhückelkotten, 2017; Nielsen et al., 2022; Nielsen, Cologna, et al., 2021).

As such, we join others in calling for research to focus on high-impact or consequential behaviours (Lange & Dewitte, 2019; Nielsen, Cologna, et al., 2021; Rau et al., 2022; Steg & Vlek, 2009), especially among those who are already convinced about the necessity of proenvironmental action but fail to translate these convictions into impact. Closer to our present purpose, future work will also need to pinpoint which specific types of PEB people with higher futures consciousness are more likely to engage in and how this may or may not translate into impact.

Limitations, future directions and conclusions

The present research has some limitations that future research will need to address. Namely, the cross-sectional design limits a causal interpretation of findings. It would be interesting for future work to develop manipulations that can temporarily increase futures consciousness, in order to assess causal

effects on environmental engagement. As highlighted above, more work is also needed to better understand why the environmental footprint measure was unrelated to FC and whether there are specific types of environmental behaviour that would be most likely for people with higher futures consciousness, for example, behaviour that requires systemic action or understanding of large-scale complex policies. Other paradigms such as lab experiments (see e.g. Berger & Wyss, 2021; Bosshard et al., 2024; Lange, 2023; Lange & Dewitte, 2021) or more exhaustive measures of different types of PEB would be useful in this respect.

Finally, interventions could be designed to teach and increase FC, with the ultimate goal of indirectly encouraging future-oriented behaviour. Several interventions exist that tap into one of the five dimensions of FC specifically, for example, learning to engage in episodic future thinking (Altgassen et al., 2015) or improving critical thinking (King & Kitchener, 1994). We believe, however, that it would be particularly useful to design more holistic interventions that can increase all five dimensions at the same time. Such interventions are currently used in the field of futures research and futures education (see, e.g. Bol & de Wolf, 2023), although research into their impacts is scarce. We believe the present studies provide useful insights that can inspire future research.

AUTHOR CONTRIBUTIONS

Fanny Lalot: Conceptualization; methodology; validation; formal analysis; investigation; data curation; writing – original draft. **Sanna Ahvenharju:** Conceptualization; methodology; investigation; writing – original draft. **Outi Uusitalo:** Conceptualization; methodology; investigation; writing – review and editing; funding acquisition; project administration.

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DATA AVAILABILITY STATEMENT

Studies were pre-registered (Study 1: https://aspredicted.org/e7vb9.pdf; Study 2: https://aspredicted.org/9k8g6.pdf; Data and code: https://osf.io/zxwnp/). Data and code for analyses are publicly available on the OSF: https://osf.io/zxwnp.

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