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National Differences in Age and Future-Oriented Indicators Relate to Environmental Performance

Stylianos Syropoulos [1,2,*], Kyle Fiore Law [3] and Liane Young [1]

[1] Department of Psychology and Neuroscience, Boston College, Boston, MA 02467, USA; younglw@bc.edu
[2] The Schiller Institute for Integrated Science and Society, Boston College, Boston, MA 02467, USA
[3] Department of Psychology, University at Albany, State University of New York, Albany, NY 12222, USA; kflaw@albany.edu
* Correspondence: syropoul@bc.edu

Abstract: Environmental concerns inherently involve an intergenerational aspect, where today's decisions can have far-reaching effects on future generations. Numerous national characteristics can forecast a nation's commitment to investing in environmental sustainability. This study expands on previous research and offers evidence in support of Gott's principle, which states that citizens may use their country's age to forecast its remaining lifespan. Specifically, we show that a nation's age positively relates to intergenerational solidarity—a country's willingness to sacrifice for future generations. Furthermore, country age and other future-oriented variables, such as a country's Long-Term Orientation and ability to overcome temporal discounting, are linked to sustainability-related indicators, indicating that countries concerned about the future also exhibit greater concern for the environment. These findings reinforce the value of framing a country as a long-standing entity and implementing intergenerational framing interventions to motivate pro-environmental engagement.

Keywords: cross-country differences; Long-Term Orientation; temporal discounting; intergenerational solidarity; climate change; Gott's principle

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1. Introduction

Environmental challenges already exert a profound impact on populations around the globe [1–5] and continue to mount towards a widespread and worsening crisis, ultimately threatening the long-term well-being of future generations [6–8]. Complicating efforts to mitigate such challenges, substantial national variation exists in climate change performance, environmental health, and ecosystem vitality, as well as levels of concern regarding climate-related threats [9–11]. Notably, there exists a well-established trend for wealthier nations to score more highly across metrics of environmental performance compared to poorer nations [12–14]; after all, environmental protection can be an incredibly costly and resource-demanding endeavor [15–17]. Nevertheless, national differences in wealth cannot account for the full breadth of disparities in environmental outcomes across nations, and, in recent years, investigations into additional factors have gained significant attention. Indeed, understanding what drives national environmental performance can shed light on factors that can be targeted to increase it. In this vein, Hershfield and colleagues [11] revealed an intriguing phenomenon: older countries tend to exhibit higher levels of environmental concern and performance than younger ones. These researchers propose that this phenomenon may be attributed to a nation's longer history, which could instill a sense that the country will also have a longer future. As a result, this perspective could potentially foster a heightened focus on future-oriented decision making and, consequently, greater pro-environmental engagement. While this finding enhances our understanding of how cross-national factors relate to environmental performance, it prompts us to ask: What accounts for the effect of country age on international variation in pro-environmentalism?

That is, what are the core constructs that might vary alongside a country's age to help explain its association with environmental attitudes and performance?

In the pursuit of a more comprehensive understanding, this study proposes a framework that builds upon the findings from Hershfield and Colleagues [11], offering a more precise approach to predicting and explaining national disparities in pro-environmental outcomes. Whereas the age of a nation may play a role in environmental outcomes, we hypothesize that other critical factors more closely associated with an expansive intertemporal national perspective could exert an influence above and beyond that of a country's age alone. Specifically, the present research has three objectives. First, we look to replicate the findings from Hershfield and colleagues [11] in a larger sample of countries and with additional environmental outcomes. Second, we set out to examine additional predictors related to national intergenerational perspective, namely a country's Long-Term Orientation (LTO), level of intergenerational solidarity (ISI), and tendency to overcome temporal discounting (OTD). Finally, by controlling for the same set of covariates included in the research by Hershfield and colleagues [11], while integrating additional predictors alongside national age, we wish to assess the relative explanatory power of factor. By exploring the interplay of these dynamics, we aim to deepen our comprehension of the variables that shape a nation's pro-environmental performance and attitudes.

1.1. The Relationship between a Country's Age and Environmental Concern and Performance

The approach Hershfield and his colleagues [11] applied to examining national disparities in environmental performance was founded on Gott's theory [18,19], which posits that people tend to estimate an entity's current position within its lifespan as being near the midpoint. Accordingly, if a nation has existed for longer, then it is likely that its existence will continue for longer in the future. In an age where extinction and existential threats to humanity's future are increasing, this principle serves as a reminder of the longevity of nations. Applied to the context of pro-environmental behavior, the authors hypothesized that citizens of older nations, with longer pasts, would estimate that their nations would also have longer futures with less-uncertain endpoints. In turn, this temporal perspective would inspire motivation to engage in protective actions, such as supporting pro-environmental public policies, for the sake of safeguarding their country's future against climate-related threats [20–22]. Indeed, they found that older countries do show a greater environmental performance, as measured by Yale's Environmental Performance Index [9], which assesses the environmental health of a nation across 40 performance indicators (e.g., air quality, waste management, and biodiversity). Furthermore, they found that a country's age also tracked positively with national differences in concern about climate change [23]. Although this research serves as a valuable foundation for assessing the cumulative impact of macro- (such as country age) and individual-level factors (such as climate concern) on a nation's overall effectiveness in countering global warming and climate change, numerous inquiries are left unresolved [11]. Below, we draw upon other existing research and emerging insights to formulate a more comprehensive understanding of the relationship between a country's age and its environmental attitudes and performance, suggesting additional factors worthy of consideration in the complex dynamics of these relationships.

1.2. How Much Does Age Matter? Exploring Additional Factors That May Help to Account for National Differences in Environmental Performance

Building upon the foundation laid by Hershfield and colleagues [11], we extend our analysis beyond the scope considered in their research. In addition to investigating the influence of country age, we examine the impact of a country's standing on each of the factors listed across a range of environmental metrics.

1.2.1. Long-Term Orientation (LTO)

With its roots in Confucian philosophy, LTO represents one of the five primary dimensions proposed by Hofstede on which cultures tend to vary [24–27]. Broadly speaking,

countries with cultures scoring higher on this dimension show a robust pragmatic orientation towards a forward-thinking perspective and prioritize innovative solutions to present challenges. These countries and cultures show an inclination towards perseverance in the face of adversity and greater willingness to sacrifice in the present for the sake of promoting a brighter future. On the other hand, countries with cultures scoring lower on this dimension tend to honor more traditional solutions to present challenges and show greater resistance to change. Countries worldwide are regularly assessed and indexed based on their Long-Term Orientation (LTO) scores, with countries such as Germany and China being among the highest scorers, countries such as Egypt and Iran being among the lowest scorers, and the United States scoring in between [24,28,29]. A country's LTO is a strong predictor of technological innovation [30], national performance in education [31], ethical values [32], and corporate social responsibility [33].

However, much of the research on LTO has taken place in an organizational setting [28, 33–35], and no existing large-scale cross-national study has comprehensively investigated whether national differences in LTO predict national differences in environmental performance. Nonetheless, issues pertaining to climate change and global warming pose challenges not only for the current generation, but for future generations as well [4,17,36–38], which offers reason to suspect that LTO may predict differences in national environmental outcomes. In support of this possibility, at the individual level, future-oriented mindsets similar to LTO (e.g., longtermism beliefs and responsibility for future generations) predict a host of pro-environmental attitudes and behaviors [39–42]. Furthermore, future-oriented planning and thrift, central elements of LTO, are also necessary ingredients in combatting climate threats [43–45]. Finally, there is some evidence that LTO within nations supports attitudes in line with climate protection, such as heightened risk perceptions related to climate change [46]. On the basis of these various findings, we hypothesize that nations with higher scores on LTO, those that look towards the future and show a greater willingness to implement innovative solutions to pressing challenges, will show greater environmental performance and climate concern across numerous metrics above and beyond merely country age.

1.2.2. Intergenerational Solidarity (ISI)

Intergenerational solidarity refers to the mutual support, cooperation, and shared responsibility that exists among different generations within a society or family [47–50]. It signifies a sense of connection and unity between individuals from various age groups, particularly between older and younger generations. This solidarity involves recognizing the needs, interests, and well-being of both current and future generations and working together to address common challenges and concerns. Recently, McQuilkin and colleagues [47] developed the Intergenerational Solidarity Index (ISI)—a metric to assess global variations in intergenerational solidarity, specifically defined as the willingness of a nation to make sacrifices in the present to promote well-being for future generations. Utilizing this comprehensive index, which encompasses nine distinct indicators, the researchers meticulously quantified intergenerational solidarity (ISI) in 120 countries across the globe. The resulting ratings offer a nuanced assessment of the degree to which each nation fosters and embodies intergenerational solidarity within its societal fabric. This multifaceted approach enables a more thorough examination of the intricate dynamics that underpin ISI on a global scale, shedding light on its potential influence on various aspects of societal well-being and policy development.

In light of this framework, we hypothesize that a nation's level of intergenerational solidarity will correlate positively with its environmental performance and climate concerns above and beyond merely its age. Specifically, we propose that strong intergenerational bonds can foster a culture of responsibility towards future generations. Put differently, a culture rooted in intergenerational solidarity may motivate national efforts to prioritize environmentally sustainable policies and practices, acknowledging the critical role of a healthy environment for the well-being of future generations. In this context, the well-being

of future generations becomes inextricably linked to environmental stewardship, motivating nations to address environmental challenges effectively and cultivate heightened climate concerns.

1.2.3. Overcoming Temporal Discounting (OTD)

Temporal discounting, also known as time discounting, delay discounting, or temporal discount rate, is a cognitive bias or decision-making phenomenon where individuals tend to place lower value on rewards or outcomes that are delayed in time compared to those available immediately [51–58]. In essence, it reflects a tendency to prioritize immediate gratification over larger, but delayed, rewards. This concept is fundamental in behavioral economics and psychology, as it helps explain why people often make choices that may not be in their long-term best interest, favoring short-term gains instead [59–62]. Substantial evidence suggests that temporal discounting can significantly impact various aspects of decision making, from financial choices to health behaviors and environmental actions. Indeed, at an individual level, those who exhibit lower levels of temporal discounting tend to display certain beneficial characteristics. They are more inclined to invest in both their own and others' long-term well-being [60], demonstrating increased prosocial behavior [55,63]. Importantly, individuals with reduced temporal discounting tendencies often exhibit greater care for the environment [64–66]. This is because they are more likely to make choices that prioritize long-term environmental sustainability over short-term gains, contributing to a more eco-conscious and responsible approach to environmental stewardship [60,65].

Our hypothesis posits that national differences in temporal discounting rates will serve as a robust predictor of environmental performance, going beyond the influence of a nation's age. This proposition builds upon recent research conducted by Ruggeri and colleagues [51], who thoughtfully adapted and administered a temporal discounting task to a large, diverse sample of individuals spanning 61 nations across the globe, finding that national tendencies to prefer larger delayed rewards correlate negatively with metrics assessing income inequality. The publicly available dataset resulting from their work offers a unique opportunity to investigate the interplay between national discounting rates and a spectrum of outcomes, including those closely linked to environmental performance. By incorporating their data into our present analyses, we aim to uncover whether a nation's propensity for temporal discounting plays a pivotal role in shaping its environmental behaviors and outcomes, independent of country age.

1.3. The Present Studies

Prior research by Hershfield and colleagues [11] highlighted that differences in a nation's age can influence national levels of environmental performance and concern and speculated that this is because the age of a country can be reflective of a variety of future-oriented constructs. In their results, older countries showed markedly elevated environmental concern and performance. In this study, we delve deeper into this phenomenon, suggesting that explicitly integrating national variation in intertemporal perspective into models assessing differences in pro-environmental outcomes among nations may provide superior predictive capabilities compared to solely considering a nation's age. While the age of a nation might play a role, other factors, such as a country's Long-Term Orientation (LTO), intergenerational solidarity (ISI), and propensity to overcome temporal discounting (OTD), could be even more influential in determining environmental behaviors and outcomes. To investigate this hypothesis, our analysis framework controls for the same variables as Hershfield and colleagues [11], including a country's age, its GDP (expressed in millions of USD), and an aggregated measure of six World Governance Indicators (WGIs).

However, expanding on this established work, we additionally explore these relationships across several environmental metrics. These include the Environmental Performance Index (EPI), a decade-long change in EPI (EPI Change), the Ecological Threat Index (ETI), Greenhouse Gas (GHG) Emissions, and public sentiment, specifically the percentage of the

population identified as alarmed or concerned as per the international Six Americas Super Short Survey (SASSY) conducted by the Yale Program for Climate Change Communication (YPCCC). Furthermore, our study has two additional contributions. First, it replicates the findings of Hershfield and colleagues [11] in a larger sample, with additional outcomes. Second, by incorporating measures of national intertemporal perspective directly into our models, it seeks to validate whether a nation's age indeed correlates with hypothesized factors underpinning a national capacity to plan for the future.

Thus, building on a previous investigation [11], which found that national differences in country age predict differences in environmental concern and performance, we theorized that, on top of a country's age, it is a country's Long-Term Orientation (LTO), intergenerational solidarity (ISI), and tendency to overcome temporal discounting (OTD) that predict differences in environmental performance. Stated differently, we hypothesized that LTO (H1), OTD (H2), and ISI (H3) predict an increased environmental performance. We examined these associations for the following outcomes: the Environmental Performance Index (EPI; H1a–H3a), changes in the EPI over 10 years (H1b–H3b), the Ecological Threat Index (ETI; H1c–H3c), Greenhouse Gas Emissions (GHG; H1d–H3d), and the percentage of the population that is alarmed (H1e–H3e) and concerned (H1f–H3f) based on the international SASSY survey from the Yale Program for Climate Change Communication (YPCCC).

All data and code for the investigation are available on the Open Science Framework (OSF), https://osf.io/zrqwt/?view_only=8ad2487e5aeb47fa9706c36fae68e147 (accessed on 25 December 2023). The preregistration for this study is available on AsPredicted, https://aspredicted.org/ZRC_QP6 (accessed on 25 December 2023).

2. Materials and Methods

2.1. Dataset

Country-level data were collated by the research team from publicly available datasets. The collated dataset encompasses information from 204 countries pertinent to our research objectives. Specifically, 61 countries provided scores for the temporal discounting predictor, OTD; 101 countries for the LTO index; and 118 countries for the ISI. In our sensitivity analyses, using an alpha of 0.05, using a power of 0.80, and accounting for four predictors (the primary predictor in each model, the age of the country, GDP, and the WGI average), we established that we can discern effect sizes (represented as eta square) as small as 0.117, 0.073, and 0.063, corresponding to the respective sample sizes, from the smallest to the largest.

2.2. Materials

The following metrics were collated from the various publicly available datasets described below. For each metric, we utilized the most recent data available at the time of analysis. We organized the metrics from our collated dataset into categories based on their use as predictors, outcomes, or covariates in the present investigation.

2.2.1. Predictors

National age: To calculate the age of each nation, its year of establishment was subtracted from the present year, 2023. Information on national age was sourced from the CIA Factbook page [67] and Wikipedia.org [68]. Age was measured in years.

Long-Term Orientation (LTO): The LTO index [24] was employed to measure the extent to which nations exhibit a progressive or future-oriented, rather than historical or more traditional, perspective [25]. We obtained data pertaining to LTO from The Cultural Factor Group's "Country Comparison Tool" website [69], which indexes nation-level data on cultural dimensions deriving from research articles published in peer-reviewed journals, https://www.hofstede-insights.com/country-comparison-tool (accessed on 15 November 2023). Scores ranged from 0 to 100.

Intergenerational Solidarity Index (ISI): The ISI was employed to measure the extent to which nations invest in or sacrifice for the sake of forthcoming generations [47]. This index

represents the average of 12 sub-indicators [47]. Nation-level data pertaining to ISI were obtained from article in which the scale was developed [47]. Scores ranged from 0 to 100.

Overcoming temporal discounting (OTD): National averages for overcoming temporal discounting were obtained from the publicly available data associated with research conducted by Ruggeri and colleagues [51]. Temporal discounting refers to an individual's tendency to prefer smaller, more immediate rewards to larger, delayed rewards. In the original research, discounting scores for each country were computed using a 20-point scale, ranging from 0 (always prefers delayed rewards) to 19 (always prefers immediate rewards). OTD was calculated by reverse coding these discounting scores, with higher scores representing a greater tendency to overcome the tendency to discount the value of future rewards.

2.2.2. Outcomes

Environmental Performance Index (EPI) and EPI Change: Scores from 2022 and 10-year change metrics pertaining to 177 nations' environmental performance were sourced from the Yale EPI platform [9], https://epi.yale.edu/ (accessed on 15 November 2023). The EPI averages across 40 performance indicators to gauge each nation's overall success in mitigating the effects of global warming and climate change, with higher scores corresponding to a greater environmental performance. Scores ranged from 0 to 100.

Greenhouse Gas (GHG) Emissions: Data from 2021 on GHG emissions for 169 nations, as measured by the metric tons of carbon dioxide emissions (MtCO2e) in a given year, were accessed from the Climate Watch website [1], https://www.climatewatchdata.org/ghg-emissions?end_year=2021&source=GCP&start_year=1960 (accessed on 15 November 2023).

Ecological Threat Index (ETI): The ETI was developed by the Institute for Economics and Peace [70]. The ETI consolidates five qualitative indicators to assess the influence of ecological threat on a nation. Annual report scores from 2021 for 202 nations were obtained from the Vision of Humanity website, https://www.visionofhumanity.org/maps/ecological-threat-report/#/ (accessed on 15 November 2023). Scores ranged from 1 to 5.

Public Climate Perception: Data from 2023 on the percentage of people in 105 nations expressing either alarm or concern regarding climate change were obtained from the international SASSY (Six Americas Super Short Survey, Yay!), which was conducted and published by the Yale Program on Climate Change Communications (YPCCC [23]), https://climatecommunication.yale.edu/publications/global-warmings-six-americas-age-race-ethnicity-gender/ (accessed on 15 November 2023).

2.2.3. Covariates

Gross Domestic Product (GDP): GDP figures for 194 nations, represented in millions of USD, were sourced from the World Bank website [71]. GDP assesses the average dollar value of goods and services produced within a country's economy in a given year.

Worldwide Governance Indicators (WGIs): The average of standardized scores from six world governance indices assessing voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption were used to account for global variability in governance across 199 nations (a = 0.96). This decision was made to mirror the analyses of Hershfield and colleagues [11]. Standardized WGI scores, like GDP, were obtained from the World Bank [71] and ranged from −2.05 (representing a score 2.05 standard deviations below the mean) to 1.76 (representing a score 1.76 standard deviations below the mean).

3. Results

3.1. Analytical Plan

We preregistered that we would examine the relationships between a country's Long-Term Orientation (LTO), intergenerational solidarity (ISI), and tendency to overcome temporal discounting (OTD) with each of the outcomes listed above, using 18 separate linear regression models, controlling for the factors of national age, GDP (in millions of USD), and

the average of the six World Governance Indicators (WGIs) in each model. The controls we preregistered align with those utilized by Hershfield and colleagues [11] and account for the substantial variance in most outcomes (see Table 1 for bivariate relationships between each variable and Figure 1 for a visual depiction of the bivariate relationships between predictors and outcomes). We also preregistered that, to enhance the robustness of our findings, a secondary set of models would be estimated to account for the non-independence of nations [72]. Specifically, we specified that we would integrate both a geographic proximity matrix and a linguistic proximity matrix into multilevel Bayesian regressions models to control for geographical and cultural phylogenetic similarities between nations. However, practical limitations in computing power barred us from running these additional models.

Table 1. Bivariate correlations between all outcomes (EPI, EPI Change, ETI, GHG, alarmed, and concerned), predictors (OTD, LTO, ISI, and age), and covariates (GDP, WGI, and age).

	EPI	EPI Change	ETI	GHG	Alarmed	Concerned	OTD	LTO	ISI	GDP	WGI
EPI	—										
EPI Change	0.582 ***	—									
ETI	−0.597 ***	−0.426 ***	—								
GHG	−0.108	0.099	−0.037	—							
Alarmed	−0.360 ***	−0.240 *	0.388 ***	0.049	—						
Concerned	0.679 ***	0.361 ***	−0.541 ***	0.040	−0.456 ***	—					
OTD	0.602 ***	0.239	−0.365 **	−0.093	−0.239	0.622 ***	—				
LTO	0.323 **	0.199	−0.413 ***	0.221 *	−0.226 *	0.577 ***	0.367 **	—			
ISI	0.523 ***	0.264 **	−0.298 **	0.154	−0.156	0.582 ***	0.580 ***	0.387 ***	—		
GDP	0.056	0.086	−0.071	0.951 ***	−0.046	0.089	−0.195	0.116	0.160	—	
WGI	0.719 ***	0.341 ***	−0.573 ***	0.011	−0.175	0.647 ***	0.705 ***	0.328 ***	0.526 ***	0.137	—
Age	0.328 ***	0.221 **	−0.289 ***	0.016	0.005	0.219 *	0.222	−0.096	0.259 **	0.075	0.275 ***

Note: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

3.2. Conceptual Replication of Hershfield and Colleagues [11]

We started by estimating regression analyses for each outcome, including only age as a predictor, while controlling for GDP and WGI in an attempt to replicate the findings from Hershfield et al. [11] (see Table 2). Replicating the effects found in the original research, we found that, above and beyond GDP and WGI, greater national age significantly predicted greater environmental performance (EPI) and positive EPI Change over the course of a decade. Moreover, we built upon these earlier findings by unveiling a previously unexplored link between a higher national age and reduced scores on the Ecological Threat Index (ETI). Nonetheless, national age was not a significant predictor of Greenhouse Gas (GHG) Emissions or the percentage of citizens who reported being either alarmed or concerned about global warming. Notably, contrary to the arguments made by Hershfield and colleagues [11], a country's age had nonsignificant or weak and positive correlations with OTD and the ISI, and a nonsignificant negative association with LTO.

3.3. Do Cross-National Differences in LTO, ISI, and OTD Account for Cross-National Variation in Environmental Outcomes above and beyond National Age?

Next, we examined whether the inclusion of additional predictors, such as a country's Long-Term Orientation (LTO), intergenerational solidarity (ISI), or tendency to overcome temporal discounting (OTD), helped to account for variance between the national age and each outcome. In a non-preregistered analysis, we first conducted an exploratory analysis examining the connections between the three predictor variables and each outcome, using 18 linear regression models, including national age as a covariate, while excluding GDP and WGI (see Table 3). In each model, adding a predictor alongside age led to an increase in R-Squared compared to the zero-order relationship between age and each respective outcome.

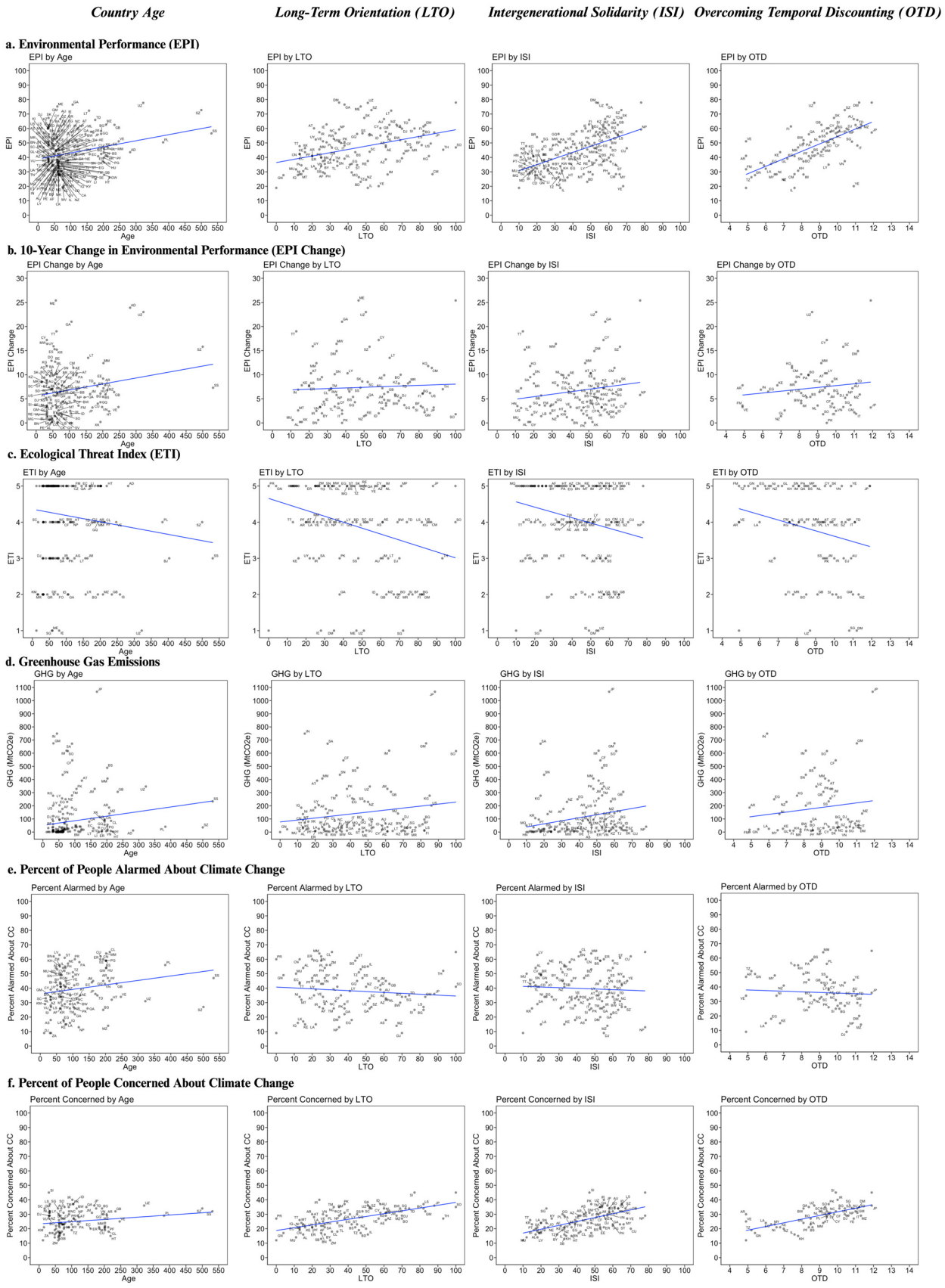

Figure 1. Scatterplots depicting the bivariate relationships between all outcomes (EPI, EPI Change, ETI, GHG, alarmed, and concerned) and predictors (OTD, LTO, ISI, and age).

Table 2. Regression results for outcomes, with age as the primary predictor, controlling for GDP and WGI covariates.

	β	Lower 95% C.I.	Upper 95% C.I.	*p*	β	Lower 95% C.I.	Upper 95% C.I.	*p*
		EPI				**EPI Change**		
Age	**0.200**	**0.100**	**0.300**	**<0.001**	**0.190**	**0.000**	**0.380**	**0.048**
Model R^2	0.560				0.130			
		GHG				**ETI**		
Age	−0.080	−0.200	0.040	0.412	**−0.130**	**−0.220**	**−0.040**	**0.003**
Model R^2	0.920				0.350			
		Alarmed				**Concerned**		
Age	0.100	−0.220	0.420	0.531	0.000	−0.100	0.100	0.935
Model R^2	0.070				0.420			

Note: Bolded relationships are significant.

Table 3. Exploratory linear regressions for each outcome with age and each predictor, without controlling for GDP and WGI. Δ R^2 values denote the additional variance in each outcome explained by integrating each predictor alongside age.

	β	95% C.I. Lower	95% C.I. Upper	p	β	95% C.I. Lower	95% C.I. Upper	p
		EPI				**EPI Change**		
Model 1								
LTO	**0.420**	**0.250**	**0.590**	**0.016**	**0.220**	**0.050**	**0.390**	**0.013**
Age	**0.500**	**0.340**	**0.660**	**<0.001**	**0.250**	**0.100**	**0.400**	**0.001**
Model R^2	0.260				0.090			
Δ R^2	0.152				0.041			
Model 2								
ISI	**0.490**	**0.310**	**0.670**	**<0.001**	**0.190**	**0.010**	**0.370**	**0.040**
Age	**0.350**	**0.220**	**0.480**	**<0.001**	**0.240**	**0.100**	**0.380**	**<0.001**
Model R^2	0.340				0.110			
Δ R^2	0.232				0.061			
Model 3								
OTD	**0.620**	**0.390**	**0.850**	**<0.001**	0.160	−0.030	0.350	0.096
Age	**0.320**	**0.150**	**0.490**	**<0.001**	**0.210**	**0.060**	**0.360**	**0.006**
Model R^2	0.440				0.120			
Δ R^2	0.332				0.071			
		GHG				**ETI**		
Model 1								
LTO	0.300	−0.190	0.790	0.226	**−0.470**	**−0.650**	**−0.290**	**<0.001**
Age	0.010	−0.070	0.090	0.899	**−0.360**	**−0.500**	**−0.220**	**<0.001**
Model R^2	0.050				0.260			
Δ R^2	0.050				0.176			
Model 2								
ISI	0.200	−0.110	0.510	0.490	**−0.240**	**−0.400**	**−0.080**	**0.005**
Age	−0.070	−0.180	0.040	0.211	**−0.270**	**−0.460**	**−0.080**	**0.007**
Model R^2	0.030				0.130			
Δ R^2	0.030				0.046			
Model 3								
OTD	−0.160	−0.510	0.190	0.386	**−0.320**	**−0.550**	**−0.090**	**0.007**
Age	−0.020	−0.080	0.040	0.508	**−0.260**	**−0.430**	**−0.090**	**0.005**
Model R^2	0.010				0.200			
Δ R^2	0.010				0.116			

Table 3. *Cont.*

	β	95% C.I. Lower	95% C.I. Upper	p	β	95% C.I. Lower	95% C.I. Upper	p
	Alarmed				**Concerned**			
Model 1								
LTO	**−0.240**	**−0.460**	**−0.020**	**0.040**	**0.610**	**0.450**	**0.770**	**<0.001**
Age	−0.030	−0.280	0.220	0.823	**0.250**	**0.150**	**0.350**	**<0.001**
Model R^2	0.050				0.390			
Δ R^2	0.050				0.342			
Model 2								
ISI	−0.160	−0.380	0.060	0.157	**0.600**	**0.420**	**0.780**	**<0.001**
Age	0.000	−0.290	0.290	0.994	0.100	−0.030	0.230	0.127
Model R^2	0.020				0.350			
Δ R^2	0.020				0.302			
Model 3								
OTD	−0.220	−0.470	0.030	0.091	**0.560**	**0.360**	**0.760**	**<0.001**
Age	0.000	−0.220	0.220	0.997	0.060	−0.050	0.170	0.296
Model R^2	0.060				0.390			
Δ R^2	0.060				0.342			

Note: Bolded relationships are significant.

In our preregistered primary analysis, for each outcome, we estimated three distinct regression models, each incorporating one of the additional predictors alongside national age, this time consistently controlling for GDP and WGI, which show strong relationships with the outcomes (see Table 4). In these models, we found that, above and beyond national age, GDP, and WGI, a greater national LTO significantly predicted a greater environmental performance (EPI), lower impact of ecological threat on a nation (ETI), and heightened national sentiments of concern about global warming. Furthermore, greater national ISI predicted greater climate-related concern. Nonetheless, national tendencies towards OTD did not significantly predict any of the outcomes.

Table 4. Regression models for outcomes with national age, LTO, ISI, and OTD, controlling for GDP and WGI covariates. Δ R^2 values denote the additional variance in each outcome that is explained by integrating each predictor alongside age.

	β	95% C.I. Lower	95% C.I. Upper	p	β	95% C.I. Lower	95% C.I. Upper	p
	EPI				**EPI Change**			
Model 1								
LTO	**0.190**	**0.040**	**0.340**	**0.015**	0.100	−0.100	0.300	0.322
Age	**0.180**	**0.090**	**0.270**	**<0.001**	0.110	−0.050	0.270	0.194
Model R^2	0.660				0.180			
Δ R^2	0.100				0.050			
Model 2								
ISI	0.130	−0.020	0.280	0.110	0.010	−0.200	0.220	0.900
Age	**0.170**	**0.080**	**0.260**	**<0.001**	**0.150**	**0.020**	**0.280**	**0.034**
Model R^2	0.670				0.220			
Δ R^2	0.110				0.090			

Table 4. *Cont.*

	β	95% C.I. Lower	95% C.I. Upper	p	β	95% C.I. Lower	95% C.I. Upper	p
Model 3								
OTD	0.080	−0.240	0.400	0.642	−0.110	−0.220	0.440	0.532
Age	**0.180**	**0.080**	**0.280**	**<0.001**	**0.190**	**0.050**	**0.330**	**0.010**
Model R^2	0.640				0.140			
Δ R^2	0.080				0.010			
			GHG				**ETI**	
Model 1								
LTO	−0.030	−0.090	0.030	0.328	**−0.330**	**−0.540**	**−0.120**	**0.003**
Age	−0.050	−0.180	0.080	0.412	−0.190	−0.390	0.010	0.066
Model R^2	0.930				0.390			
Δ R^2	0.010				0.040			
Model 2								
ISI	−0.040	−0.090	0.010	0.111	0.060	−0.100	0.220	0.470
Age	−0.050	−0.170	0.070	0.417	−0.120	−0.320	0.080	0.232
Model R^2	0.930				0.390			
Δ R^2	0.010				0.040			
Model 3								
OTD	−0.080	−0.280	0.120	0.413	0.010	−0.320	0.340	0.969
Age	−0.020	−0.150	0.110	0.738	−0.170	−0.370	0.030	0.100
Model R^2	0.930				0.290			
Δ R^2	0.010				−0.060			
			Alarmed				**Concerned**	
Model 1								
LTO	−0.200	−0.410	0.010	0.074	**0.440**	**0.260**	**0.620**	**<0.001**
Age	0.050	−0.250	0.350	0.758	0.070	−0.020	0.160	0.113
Model R^2	0.090				0.550			
Δ R^2	0.020				0.130			
Model 2								
ISI	0.030	−0.200	0.260	0.801	**0.340**	**0.170**	**0.510**	**<0.001**
Age	0.090	−0.200	0.380	0.532	−0.020	−0.130	0.090	0.671
Model R^2	0.140				0.530			
Δ R^2	0.070				0.110			
Model 3								
OTD	0.070	−0.300	0.440	0.697	0.260	−0.060	0.580	0.113
Age	0.060	−0.200	0.630	0.630	−0.020	−0.110	0.070	0.756
Model R^2	0.130				0.480			
Δ R^2	0.060				0.060			

Note: Bolded relationships are significant.

Although national age continued to be a significant predictor for EPI with each added predictor variable, its relationship with EPI Change became nonsignificant when LTO was factored into the model. Similarly, the relationship between the national age and ETI became nonsignificant with the introduction of any other predictors. Important to note is that, in any model where a predictor other than national age significantly accounted for variance in the outcome, the model's *R-Squared* was higher than that of the model including only national age and the covariates GDP and WGI as predictors.

In sum, these findings indicate that, while a country's age has a positive relationship with its environmental performance (both EPI and EPI Change), Long-Term Orientation (LTO) plays a crucial role in EPI as well, even when accounting for the country's age, GDP,

and variations in governance. Critically, the findings also suggest that, while national age loses its predictive power regarding the impact of ecological threat on a nation (ETI), LTO emerges as a meaningful and influential determinant. Moreover, while national age does not appear to influence varying national sentiments about global warming, both LTO and ISI notably do.

4. Discussion

Extant investigations have highlighted substantial cross-national variability in environmental performance [9,10]. Evidence from Hershfield and colleagues [11] denotes that a country's age, reflecting the amount of time elapsed since establishing sovereignty, holds predictive and explanatory power over such outcomes. Rooted in Gott's principle [18], the hypothesis presented in the original paper suggests that a country's age serves as an indicator for subjective perceptions of how far into the future the country is expected to exist. In this manner, the longer a country's past, the longer its future will be. Put differently, a country's age can act as a proxy for a country's connection to future generations. Consequently, by increasing a sense of responsibility to protect future people, national age might promote more constructive performance on key pro-environmental indicators. Inquiries related to cultivating a sense of connection with future generations and assessing our capacity to positively shape the future have gained prominence in contemporary philosophical discourse, especially within and surrounding the emerging field of ethical philosophy known as longtermism [6,7,17]. Pivotally, evidence from emerging lines of inquiry into the psychological antecedents and consequences of holding longtermism beliefs supports a connection between a sense of connection to future generations and pro-environmental engagement at the individual level [39,40,73].

Our investigation directly contributes to these arguments. First and foremost, it replicates the findings of the original paper by Hershfield and colleagues [11] in a larger sample with a more robust battery of national pro-environmental indicators. In doing so, it bolsters the validity of the arguments put forth in this earlier research. Furthermore, it underscores that the results obtained by Hershfield and colleagues are not simply the byproducts of idiosyncrasies associated with the particular countries examined in their research or the specific outcomes observed in a given year. Second, from a theoretical perspective, our findings are the first to link a country's age with various measures of future-oriented concern.

The results we present indicate a mixed level of support for arguments put forth in earlier research [11] suggesting that a country's age could serve as an accurate indicator of pro-future attitudes, particularly in the context of a nation's ability to overcome temporal discounting and exhibit a Long-Term Orientation. It is worth noting, however, that the magnitude of the positive relationship we observed between a country's age and propensity to overcome temporal discounting, despite being nonsignificant, was not negligible either ($r^2 = 0.05$). Consequently, a future investigation with greater power to detect small effect sizes may reveal a significant effect. Although Hershfield and colleagues' hypothesized relationship between national age and a country's intertemporal perspective lacked empirical support with respect to Long-Term Orientation and discounting tendencies, it does find some support in the significant correlation we observed between a country's age and the level of intergenerational solidarity within its culture.

Importantly, the variables treated as predictors in the current studies, namely LTO, OTD, and ISI, did overlap considerably with one another. This suggests that, as constructs that capture a future-oriented capacity, they display convergent validity and, thus, potential utility for use in country-level analyses. Furthermore, in models that included each of the three future-oriented predictors, the results suggested that, even after controlling for age, each of these predictors held a considerable explanatory capacity, being positively—or negatively in the case of ecological threat—associated with most outcomes. In the final series of models including additional covariates, although most results were

rendered nonsignificant—which we attribute to the strong association between the World Governance Indicators and each outcome (see Table 1)—several associations still persisted.

Overall, these arguments contribute to the existing and growing body of literature calling for intergenerationally framed approaches for addressing climate change as potentially fruitful avenues for motivating pro-environmental engagement [39,40,74–76]. Policymakers and key stakeholders interested in harnessing these associations and existing evidence to promote environmental concern should be encouraged by these findings. However, it is important to take note of concerns about how an emphasis on the future could be perceived as a movement against the present [77,78]. Further research is needed on the fine balance between calls for protecting the future and arguments for protecting nature and people of the present; however, preliminary evidence suggests that those who are concerned about the distant future also tend to express concern for issues and people living in the present to a greater degree [65].

These findings are not without limitations. First, we were unable to conduct analyses controlling for geographic and cultural similarities among nations, despite our original preregistered intention. Specifically, practical limitations, namely our lack of access to technology with enough computing power to afford the estimation of these models, prevented us from running them. We expect that accounting for such similarities, however, would only potentially weaken observed associations, without changing their direction. Future research should seek to replicate these findings, as well as other findings focusing on national-level predictors of environmental performance, accounting for geographic and cultural similarities [72]. A second noteworthy limitation is that these findings speak exclusively to national-level phenomena. This approach prevents us from drawing any conclusions about individual-level psychological processes. Nonetheless, as noted earlier, there is considerable evidence for the effectiveness of intergenerationally related constructs and interventions in shaping pro-climate outcomes (for a large-scale experiment, see [79]). Future work should replicate these findings with a human-subjects sample. In addition, future research should not only utilize a correlational design but also employ a longitudinal design, which would examine these variables in a reciprocal manner, and/or an experimental design, which would afford causal arguments. These designs would also help overcome some additional issues, which are the product of the secondary analysis of existing data, namely the collinearity between different indicators and the relatively small sample size for specific analyses. Another useful future investigation could examine whether these country-level indicators (LTO, OTD, and ISI) moderate the effects of person-level, future, and intergenerational predictors of pro-environmental concern. Importantly, it is worth acknowledging that, even though we attempted to include data from as many countries as possible, we were limited to countries for which data were collected. Thus, in the case of the overcoming temporal discounting analysis, we were limited to the countries for which data were collected by [51], limiting the generalizability of our results. Furthermore, and perhaps more broadly, a comprehensive review and examination of all different future-oriented traits and characteristics is needed to better define their conceptual overlap, helping researchers to improve their understanding of how each could (or could not) contribute to pro-environmental engagement.

5. Conclusions

In conclusion, we view the current study as a comprehensive re-examination and innovative expansion of previous research into the fundamental drivers of pro-environmental engagement on a national scale [11]. In support of Gott's principle, these results provide substantial support for the notion that a nation's age is predictive of its intergenerational solidarity. Moreover, the present findings underscore the centrality of a country's age, Long-Term Orientation, and level of intergenerational solidarity as predictors of national indicators of pro-environmental engagement, suggesting that the temporal perspective of a nation may be critical to how effectively it manages risks associated with climate change. Leveraging the insights from the current study, future research should look to

develop interventions that emphasize intergenerational and pro-future values to enhance environmental concern and engagement on a societal level.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/su16010276/s1, Table S1. Analyses regressing concern for nature on age in combination with each predictor, while controlling for GDP and WGI.

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