

RESEARCH REPORT

Green Personas: How Beliefs and Cognition Motivate “Green” Behavior

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INTRODUCTION & OVERVIEW

Introduction

Climate change is one of the greatest challenges of our lifetimes, disrupting weather patterns, destabilizing ecosystems, and threatening public health. Climate change is driving several downstream impacts to the global economy, including the degradation and loss of raw materials and infrastructure, the disruption of supply chains, greater uncertainty in the price of production and insurance, and harm to the labor force¹. According to the Global Carbon Project, the US is the second largest global carbon dioxide (CO₂) polluter, surpassed only by China, and is the largest CO₂ emitter based on the consumption of goods². Transitioning to a sustainable global economy is more vital than ever to prevent the worst effects of climate change and build economic resilience.

From 2010 to 2022, US adults have increasingly endorsed the beliefs that climate change is happening (57% and 72%, respectively), is human-driven (46% and 56%, respectively), and will affect them personally (23% and 43%, respectively)³. The rapidly growing market of socially and environmentally responsible products and services reflects the shifting American zeitgeist: sustainable products held 17% of the market share in 2021, a 3.3% increase from 2015, and products with carbon footprint labels doubled in sales from \$1.7B in 2020 to \$3.4B in 2021. Not only does this burgeoning sustainability market offer businesses new prospects to grow their consumer base, but it opens up unique opportunities for businesses to improve their social and environmental impacts.

¹ Woetzel, J., Pinner, D., Samandari, H., Engel, H., Krishnan, M., Kampel, C., & Graabak, J. (2020). (rep.). Could climate become the weak link in your supply chain? McKinsey Global Institute. Retrieved May 30, 2023, from <https://www.mckinsey.com/~/media/mckinsey/business%20functions/sustainability/our%20insights/could%20climate%20become%20the%20weak%20link%20in%20your%20supply%20chain/could-climate-become-the-weak-link-in-your-supply-chain-v3.pdf>.

² Global Carbon Atlas. (n.d.). CO₂ emissions | Global Carbon Atlas. <http://www.globalcarbonatlas.org/en/co2-emissions>.

³ Leiserowitz, A., Maibach, E., Rosenthal, S., Kotcher, J., Carman, J., Neyens, L., Myers, T., Goldberg, M., Campbell, E., Lacroix, K., & Marlon, J. (2022). Climate Change in the American Mind, April 2022. Yale University and George Mason University. New Haven, CT: Yale Program on Climate Change Communication.

⁴ Kronthal-Sacco, R., & Whelan, T. (2022). Sustainable Market Share Index. NYU Stern Center for Sustainable Business. Retrieved May 30, 2023, from https://www.stern.nyu.edu/sites/default/files/assets/documents/FINAL%202021%20CSB%20Practice%20Forum%20website_0.pdf.



To better understand environmentally conscious behavior, the Cognitive Sciences team at AnalyticsIQ developed a predictive segmentation system that identifies four eco-conscious consumer profiles (hereafter referred to as Green Personas)⁵. The heart of the Green Personas system is the intersection between consumers' environmental beliefs and attitudes about climate change and their individual cognitive flexibility (the ability to mentally adjust their thoughts, perceptions, and reactions in response to uncertain situations). Our Green Personas segmentation system comprehensively sorts consumers into one of the following four groups:

- **Sustainable Living Spenders (A1s)** who are high in cognitive flexibility and have strong beliefs in climate change.
- **Climate Conscious (A2s)** who are low in cognitive flexibility but have strong beliefs in climate change.
- **Climate Change Skeptics (B1s)** who are high in cognitive flexibility but have weak beliefs in climate change.
- And finally, **Climate Change Deniers (B2s)**, who are low in both cognitive flexibility and belief in climate change. See Figure 1.

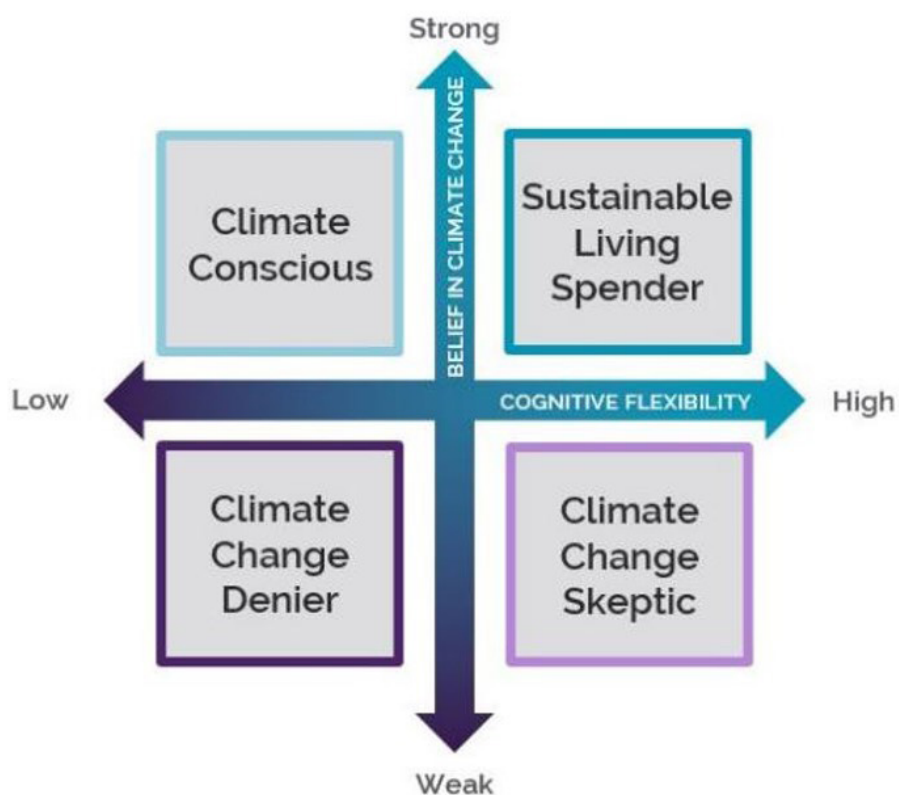


Figure 1. The above figure illustrates the Green Personas segmentation system, which comprehensively sorts respondents into one of the four following groups: sustainable living spenders (A1s), climate conscious (A2s), climate change skeptics (B1s), and climate change deniers (B2s).

⁵ Cavrak, S. (2020). The Cognitive Psychology Behind Eco-Consumerism. AnalyticsIQ.com.

During the development of the Green Personas, Cavrak⁵ predicted that cognitive flexibility and belief in climate change would each independently and positively predict pro-environmental behaviors (PEBs). Moreover, the researcher also predicted an interactive relationship such that belief in climate change would moderate the central relationship between cognitive flexibility and PEBs. In other words, PEBs would be higher for people with high cognitive flexibility, regardless of their strength of belief in climate change due to the cognitive demand required to shift one's focus from short-term, personal convenience to longer-term, environmental benefit. However, among those with low cognitive flexibility, strong belief in climate change would lead to higher PEBs than those with weak (or no) belief in climate change.

Instead, Cavrak found only partial support for the original hypothesis. Although high cognitive flexibility and strong belief in climate change (independently and collectively) predicted greater PEBs, the data also revealed that if you have a strong belief that climate change is real, regardless of your personal cognitive flexibility, then you are significantly more likely to engage in PEBs relative to those with low beliefs and greater cognitive resources. These data are consistent with a similar exploration conducted by Langenbach and colleagues⁶, and jointly support the notion that one's personal environmental beliefs have a greater influence on their day-to-day eco-choices and lifestyle than cognitive infrastructure alone⁵. If this pattern holds, then it stands to reason that this motivational framework could also predict other environmentally related experiences, beyond behavior.

The Current Research

The goal of the current research is two-fold: first, we aim to replicate the original Green Persona segmentation system from 2020 and its predictive relationship to PEBs. Second, we intend to explore

the breadth of the Green Personas' predictive power across other eco-related attitudes (e.g., climate change emotions), perceptions (e.g., connectedness to nature) and behaviors (e.g., time spent in nature).



⁵ Cavrak, S. (2020). The Cognitive Psychology Behind Eco-Consumerism. AnalyticsIQ.com.

⁶ Langenbach, Berger, Baumgartner & Knoch (2019). Cognitive Resources Moderate the Relationship Between Pro-Environmental Behavior and Green Behavior. *Environment and Behavior*, 1-17. doi: 10.1177/0013916519843127.

METHODS AND PARTICIPATION

Methods

In May 2023, the Cognitive Sciences team at AnalyticsIQ conducted a large nationwide survey of US adults that assessed cognitive flexibility, as well as beliefs, attitudes, experiences, and behaviors related to the environment and climate change. All survey respondents first completed an informed consent and then self-reported various demographic characteristics (i.e., age, gender, race, level of education, political orientation⁷, religiosity⁸, geographic region⁹). Next, they responded to key cognitive and environmental assessments (see Assessments section below), and finally they were compensated for their time¹⁰. Overall, the sample was representative of the national distributions¹¹ for age¹², gender¹³, and race¹⁴.

⁷ Respondents rated their political orientation on a 5-point Likert scale (1 = very liberal, 5 = very conservative).

⁸ Religiosity was calculated as the average frequency of engaging in religious behaviors (e.g., praying / meditating, attending church services, reading scripture), all rated on a 7-point Likert scale (0 = never, 6 = everyday).

⁹ To determine geographic region, respondents optionally provided their state and zip code and were then assigned to one of the four US Census regions (Northeast, South, Midwest, or West).

¹⁰ Median survey duration was 10.28 minutes.

¹¹ US Census information was accessed via data.census.gov.

¹² Ages ranged from 18-99 years, with a median age of 44 years. Age Generation groups were created from self-reported age (in years) as follows: Gen Z = 18-26 years (13%), Millennials = 27-42 years (34%), Gen X = 43-58 years (22%), and Baby Boomers = 59 years and older (31%).

¹³ The sample's gender distribution was as follows: males (49%) and females (51%).

¹⁴ The sample's racial distribution was as follows: Black (13%), Asian or Pacific Islander (7%), white (62%), Latino/a/x (17%), Native American (1%), and multi-racial (1%).



Assessments

- To measure cognitive flexibility, we utilized 9 items from the Cognitive Control and Flexibility Questionnaire (CCFQ) measure¹⁵ rating the strength of agreement to statements (e.g., “I approach situations from multiple angles,” “I weigh out my options before choosing how to take action,” and “I manage my thoughts or feelings by reframing the situation”) on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree)¹⁶. Scores were calculated as the average of responses to all items.
- To measure belief in climate change, we utilized an 11-item assessment (adapted from the original Green Personas development study⁵) rating the strength of agreement to statements (e.g., “there is an urgent climate crisis,” “I’m concerned for the health of the planet for future generations”) on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Scores were calculated as an average of responses to all items.
- To measure PEBs, we included 12 statements assessing the frequency of engaging in PEBs (e.g., “I usually recycle items rather than throw them away”, “I choose to walk or cycle instead of using my car when I can”¹⁷) on a 5-point Likert scale (1 = never true, 5 = always true). Scores were calculated as an average of responses to all items.
- To measure emotional reactions to climate change, respondents rated the strength with which they experience emotions (e.g., anxiety, anger) when they think about climate change on a 5-point Likert scale (0 = not at all, 4 = a great deal). Scores were calculated as an average of responses to all emotion items, and higher values reflect more negative emotions regarding climate change.
- To assess connectedness to nature, we employed the 8-item Connectedness to Nature Scale¹⁸ rating the strength of agreement to each statement (e.g., “I often feel a sense of connection and oneness with the natural world around me”) on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Scores were calculated as an average of responses to all items.
- To measure time in nature, we developed a novel assessment with questions about how often respondents spend time in nature on a 7-point Likert scale (0 = never, 6 = a few times a week), the number of peers with whom respondents spend time in nature, whether they have a nature-based job, and the importance of seeking out people who enjoy nature on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Composite Time in Nature scores were then calculated.

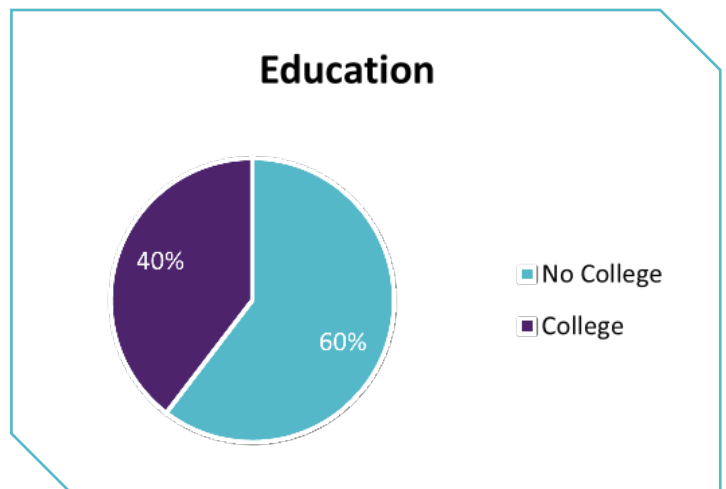
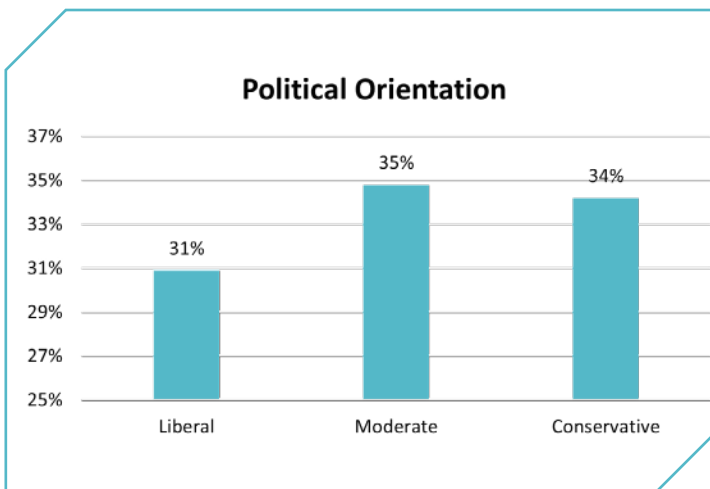
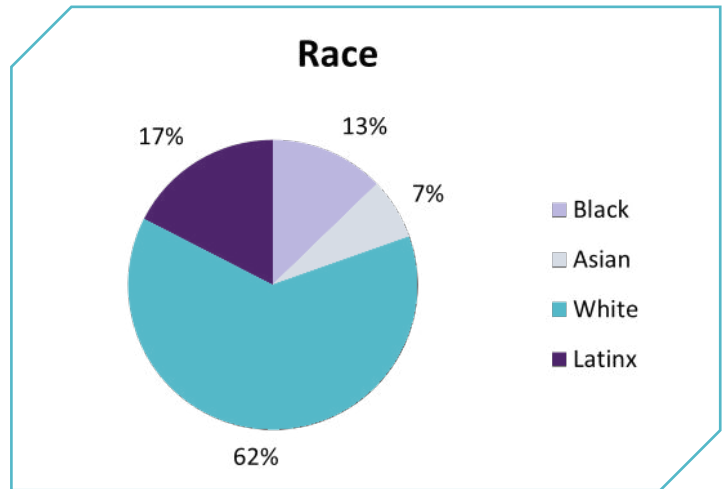
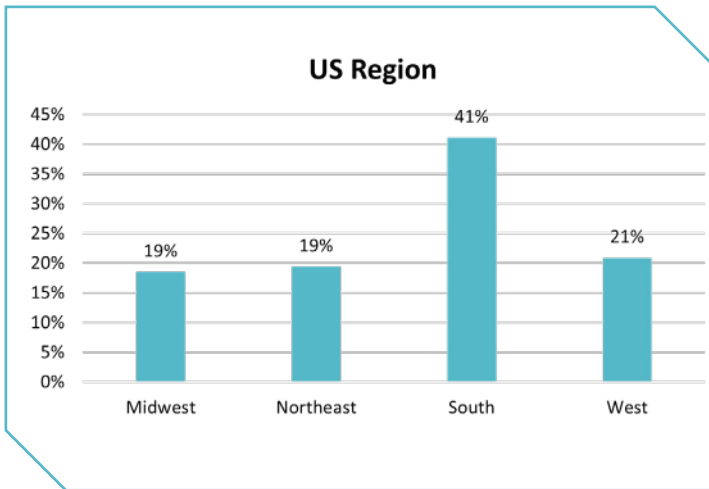
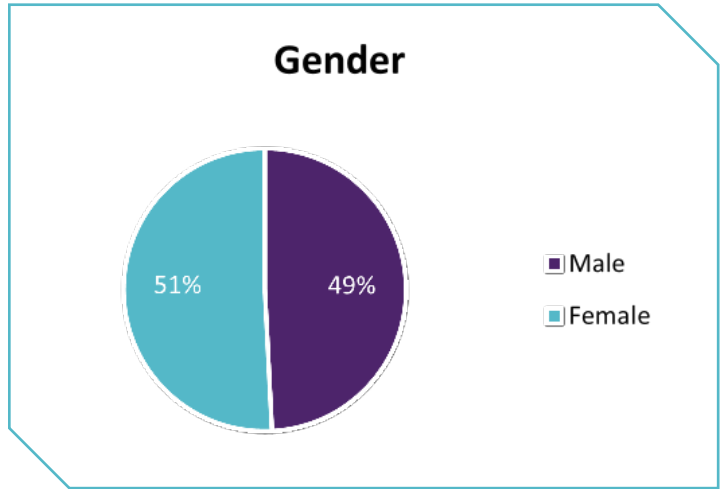
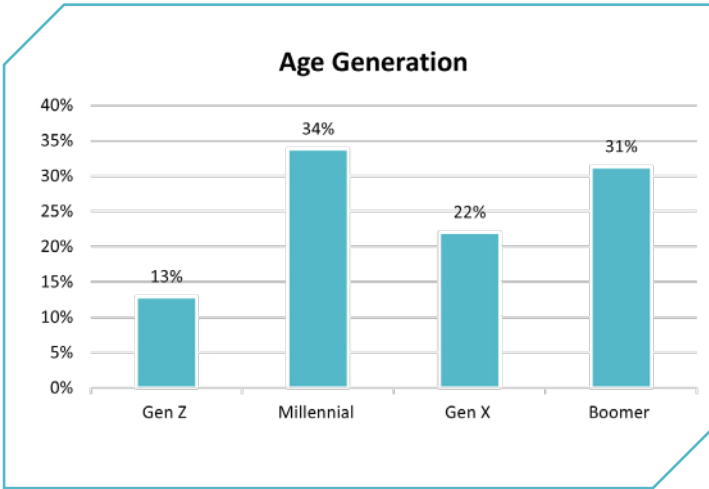
¹⁵ Gabrys, R. L., Tabri, N., Anisman, H., & Matheson, K. (2018). Cognitive control and flexibility in the context of stress and depressive symptoms: The cognitive control and flexibility questionnaire. *Frontiers in psychology*, 9, 2219.

¹⁶ This is a slightly different measure of cognitive flexibility than was utilized in our 2020 study. The Cognitive Flexibility Inventory (CFI) developed by Dennis & Wal (2009) that was accessed previously does not include a cognitive control aspect to the measure, and previous research (Langenbach et al., 2019) has demonstrated cognitive control to be an important component of cognitive capacity when discussing eco-conscious behavior. Thus, we chose to use the CCFQ which includes two sub-scales: cognitive flexibility and cognitive control. In doing so, we can effectively replicate the findings from our previous study (using the cognitive flexibility sub-scale) and simultaneously test the reliability of previous research on PEB (using the cognitive control sub-scale).

¹⁷ Items in the PEB assessment were adopted and modified from Whitmarsh & O’Neill (2010) and Sudbury-Riley & Kohlbacher (2015).

¹⁸ Mayer, F.S. & McPherson Frantz, C. (2004). The connectedness to nature scale: A measure of individuals’ feeling in community with nature. *Journal of Environmental Psychology*, 24, 503-515.

Participation Demographics



PRIMARY FINDINGS

Validation

To ensure our sample was nationally representative and aligned with national trends, we validated our overall findings against results reported in national public opinion surveys and academic research. We found that the direction and trends of our sample's beliefs in climate change, climate change emotions, and frequency of PEBs mirrored trends from Pew Research Center and Yale/George Mason University Program on Climate Change Communication national surveys^{3,19,20}, confirming that our sample is representative of the most common climate change sentiments and behavior within the US population.

Replication

Our primary research goal was to recreate the Green Personas segmentation system and replicate how well they predict PEBs. To do this, we first developed the Green Persona groups by creating the statistical intersection of cognitive flexibility (hereafter referred to as CF) and belief in climate change (hereafter referred to as BCC) variables according to the original Green Personas development protocol⁵. Then, we assigned respondents to the persona groups as follows:

- Respondents with high CF and high BCC (A1s) represent 29% of the sample;
- Respondents with low CF and high BCC (A2s) represent 23% of the sample;
- Respondents with high CF and low BCC (B1s) represent 21% of the sample; and
- Respondents with low CF and low BCC (B2s) represent 27% of the sample.

Next, we aimed to replicate the predictive power of our Green Personas on PEBs and hypothesized that the Green Personas would predict PEBs in accordance with the findings from the 2020 study, such that the groups with high BCC (A1s and A2s) would engage in more PEBs than groups with low BCC (B1s and B2s), and that those with high CF (A1s and B1s) would engage in more PEBs than groups with low CF (A2s and B2s). Moreover, we also predicted that the interaction between CF and BCC would yield the highest PEBs for those with high scores on both (A1s) relative to those with low scores on both (B2s). Finally, we predicted that even when CF was low, if BCC was high, then we should see higher PEBs than when CF is high and BCC is low. In other words, the A2 group should have higher PEBs than the B1 group.

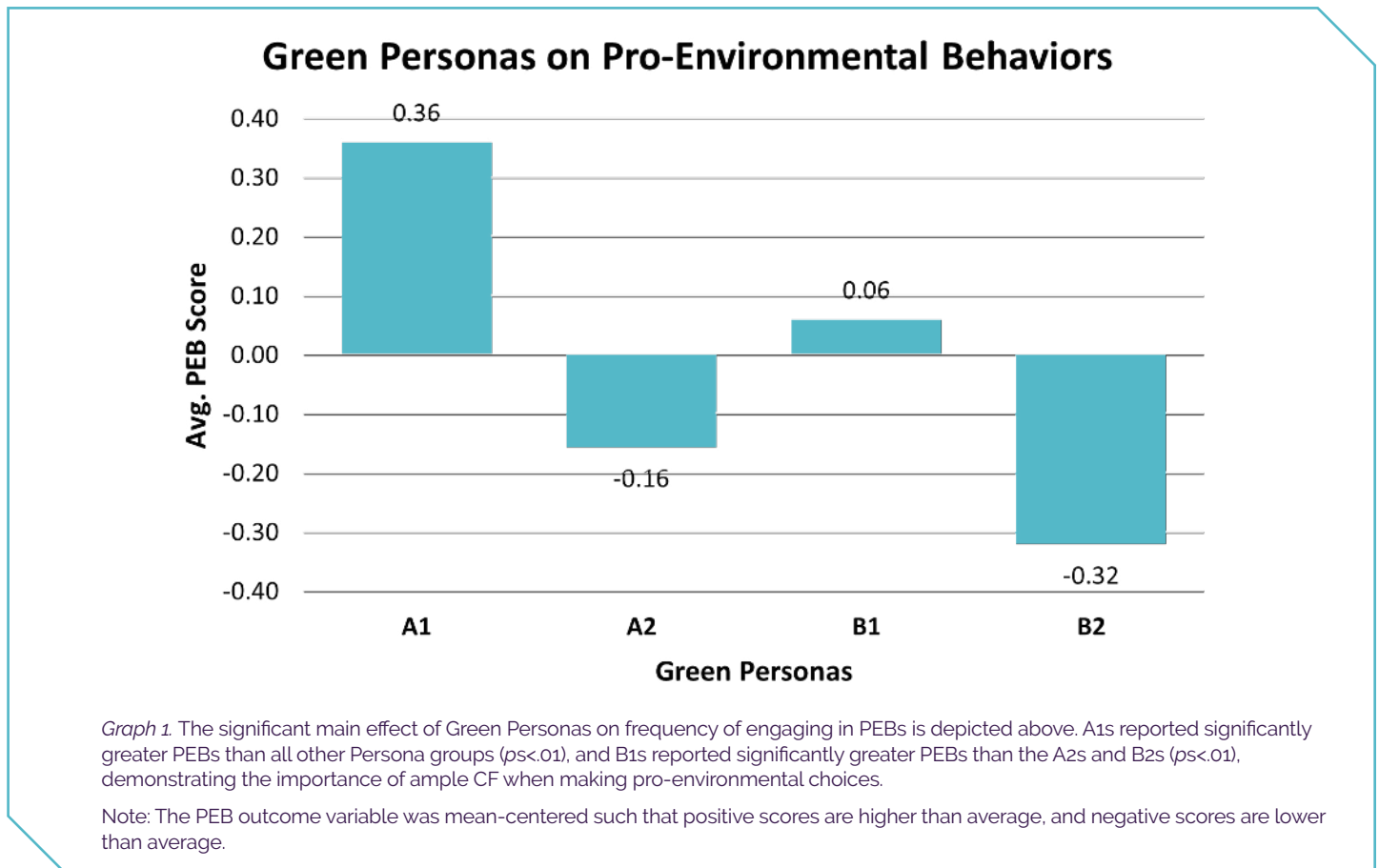


¹⁹ Pew Research Center. (2019). US public views on climate and energy. Pew Research Center, 25.

²⁰ Pew Research Center. (2021). Gen Z, Millennials stand out for climate change activism, social media engagement with issue. Pew Research Center, 26.

To test this, we ran a univariate analysis of variance (ANOVA) with Green Personas (A1, A2, B1, B2) as our independent variable and the average PEB score as our dependent variable²¹. The analysis yielded a significant main effect of Green Personas^{22,23} with partial support for our hypotheses. As predicted, A1s reported the highest average PEB scores ($M = 0.36$) and B2s reported the lowest average PEB scores ($M = -0.32$). Counter to our predictions, the B1 group reported the second highest average PEB score ($M = 0.06$), rather than the A2 group ($M = -0.16$). This suggests that having high cognitive flexibility is a stronger predictor of PEB than one's personal beliefs.

Interestingly, this aligns with Cavrak's original hypothesis in the Green Personas development study such that high cognitive flexibility is essential to performing eco-conscious behaviors. One possible reason for the inconsistency between the A2s and B1s from the 2020 study to the current data could reflect the increasing acceptance that climate change is occurring and human-driven (a well-documented trend in public opinion surveys¹⁷). Obvious signs of climate change, such as more extreme natural disaster events and rising average planetary temperatures, could have led people to reflect, modify, and update their belief structure on this topic. Future research should test this assumption directly.



²¹ We mean-centered the PEB variable (i.e., the average PEB score was subtracted from each individual score). In doing so, positive and negative scores indicate higher- and lower-than-average behaviors, respectively.

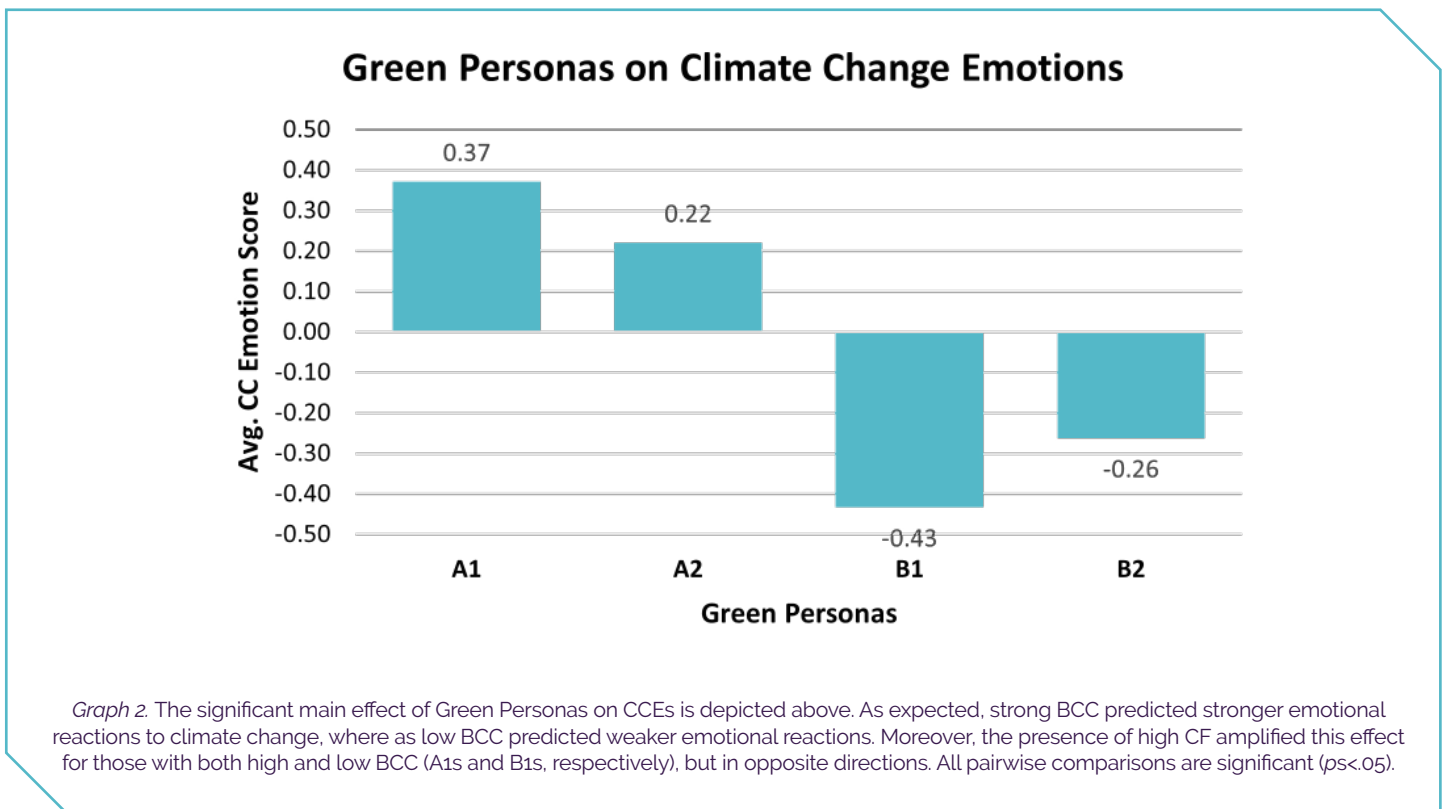
²² Main effect of Green Personas on PEB: $F(3,1394) = 41.62, p < .001$.

²³ Although Langenbach et al. (2019) found a significant interaction between cognitive control and belief in climate change, we replicated this analysis and did not find a significant interaction, $F(1,1397) = .01, p = .925$. We concluded that cognitive flexibility is the appropriate measure to use in the Green Personas system.

Extension

Next, we explored whether the Green Personas would effectively segment the population on other environment-related metrics, including climate change emotions (CCE), time in nature (TiN), and connectedness to nature (CNS). First, we tested the influence of Green Personas on CCE by running a univariate ANOVA with the mean-centered CCE score as the dependent variable. Similar to our predictions for PEB, we expected that having higher CF and stronger BCC would predict stronger CCE and that BCC would drive this effect. Specifically, we predicted that A1s would have significantly higher emotion scores than the other persona groups, followed by A2s with the second-highest scores, whereas B2s would have the lowest emotion scores overall.

To test this, we ran a univariate ANOVA with Green Personas (A1, A2, B1, B2) as our independent variable and the average CCE score as our dependent variable²⁴. We found a significant main effect of Green Personas²⁵, but only partial support for our predictions. As expected, the two high belief groups (A1s and A2s) had significantly higher CCE scores than the low belief groups (B1s and B2s), but interestingly the positive influence of CF on CCE was only evident for the high CF and high BCC group (A1s). Contrary to our hypothesis, the high CF but low BCC group (B1s) reported significantly lower CCE scores than their low CF counterparts (B2s). See Graph 2. One possible explanation for this unexpected finding is that low belief individuals with higher CF (B1s) are better able to align their emotional reactions to climate change with their belief system (i.e., their weak emotional response to climate change reflects their limited or nonexistent belief in climate change) than those with lower CF (B2s). Future studies would be needed to test this directly.



²⁴ As with previous DVs, we mean-centered the CCE variable (i.e., the average CCE score was subtracted from each individual score). In doing so, positive and negative scores indicate higher- and lower-than-average emotions, respectively.

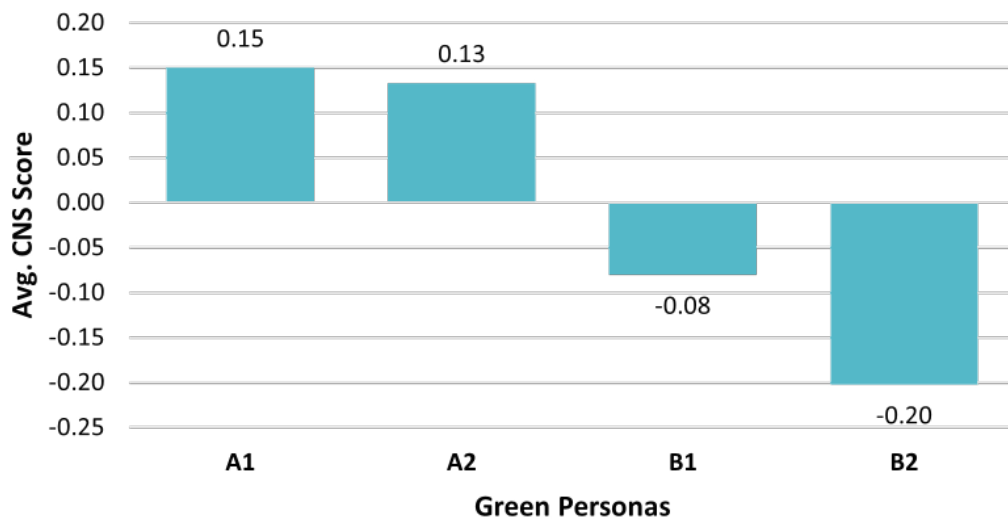
²⁵ Main effect of Green Personas on Climate Change Emotions: $F(3,1394) = 46.75, p < .001$.

Second, we tested the influence of Green Personas on CNS by running a univariate ANOVA with Green Personas as the independent variable and CNS as the dependent variable. Again, we hypothesized that high BCC overall would predict higher CNS scores, which would be moderated by high versus low CF.

As predicted, the results showed a significant main effect of Green Personas on CNS²⁶ whereby the strong BCC groups (A1s and A2s) had significantly higher CNS scores than the low BCC groups (B1s and B2s; see Graph 3). Although there was no observed difference in CNS scores among the strong BCC groups (A1s and A2s, $p=ns$), we found a significant difference among the low BCC groups (B1s and B2s, $p<.001$). These data suggest that even among those with a weak belief in climate change, ample cognitive resources service to bolster one's connection to nature, a finding that demonstrates the critical role of CF in recognizing and internalizing the distinctions and overlaps between humanity and nature.



Green Personas on Connectedness to Nature



Graph 3. The significant main effect of Green Personas on CNS is depicted above. Respondents with strong BCC (A1s and A2s) reported the highest CNS scores relative to those with weak BCC (B1s and B2s). Although there was no difference in scores between the A1s and A2s ($p=ns$), we did observe significant differences between B1s and B2s ($p<.01$).

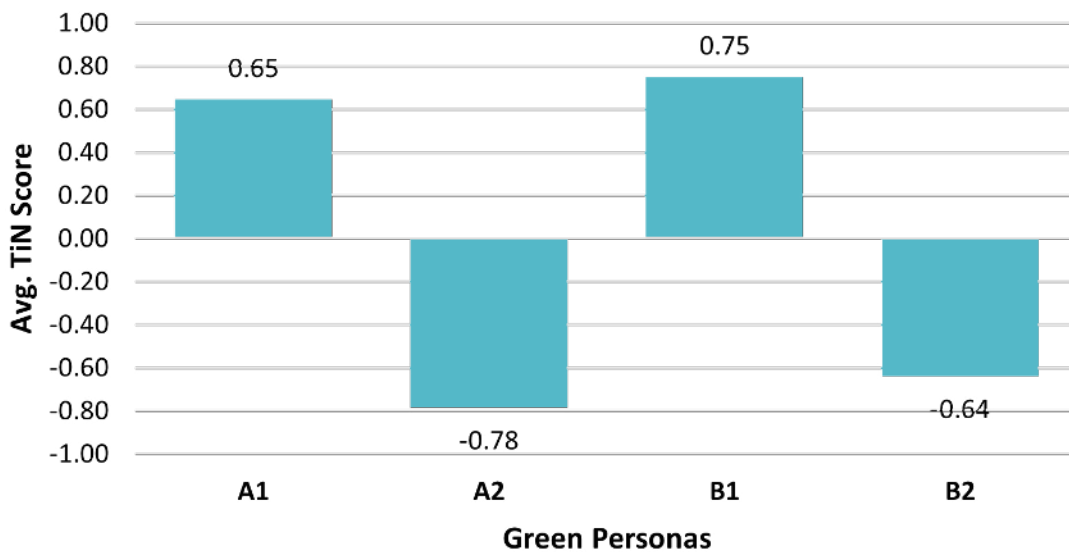
²⁶ Main effect of Green Personas on Connectedness to Nature: $F(3,1394) = 49.57, p = <.001$.



Finally, we tested whether our Green Personas would significantly predict TiN and ran a univariate ANOVA with Green Personas as the independent variable and TiN score as the dependent variable. Consistent with our earlier predictions, we anticipated that although CF and BCC would separately predict TiN scores, strong BCC scores would drive this effect. As such, we expected A1s to report the statistically highest TiN scores, A2s to report the second highest scores, and B1s and B2s to report the statistically lowest scores.

Once again, we found a significant main effect of Green Personas on TiN²⁷, but unexpectedly found that persona groups with high CF (A1s and B1s), rather than those with strong BCC scores, reported the highest TiN and were not significantly different from one another (*Ms* = 0.65 and 0.75, respectively). Those low in CF (A2s and B2s) had similarly low TiN scores and did not statistically differ (*Ms* = -0.78 and -0.68, respectively). See Graph 4. Taken together, these data suggest that BCC has minimal influence over how often or with whom respondents spend time in nature.

Green Personas on Time in Nature



Graph 4. The significant main effect of Green Personas on the TiN is depicted above. Respondents with high CF (A1s and B1s) reported significantly higher TiN than those low in CF (A2s and B2s) ($p < .01$). Contrary to our predictions, there were no significant differences in TiN based on BCC among either high or low CF groups ($p = ns$).

²⁷ Main effect of Green Personas on Time in Nature: $F(3,1394) = 19.92, p < .001$.

OUTCOMES, CONCLUSIONS, TIPS FOR AUDIENCE

The primary goal of this study was to replicate the development of the Green Personas and confirm that this segmentation system can effectively and consistently predict patterns in consumers' PEBs, as well as other environmental attitudes, perceptions, and behaviors. Through the replication and extension analyses we reported above, we found that the mechanisms which drive behaviors, emotions, and attitudes differ in subtle but important ways. First, CF plays a vital role in influencing eco-conscious behaviors, above and beyond that which is motivated by beliefs around climate change. Second, the strength of beliefs about the causes and consequences of climate change is the critical predictor of one's negative emotionality toward climate change, as well as the extent of one's felt connection to nature.

Table 1. The four Green Persona groups and their key characteristics are summarized above.

Green Persona	Sustainable Living Spender (A1s)	Climate Conscious (A2s)	Climate Change Skeptic (B1s)	Climate Change Denier (B2s)
Cognitive Flexibility	High	Low	High	Low
Belief in Climate Change	High	High	Low	Low
Pro-Environmental Behavior	Very High	Low	High	Very Low
Climate Change Emotions	Very High	High	Very Low	Low
Connection to Nature	Very High	Very High	Low	Very Low
Time in Nature	Very High	Very Low	Very High	Very Low

Our data support the hypothesis that having high CF is essential for performing PEBs because “green” behaviors often require more planning and effort, such as researching the environmental impacts of products before purchases or donating money to environmental organizations. This pattern was evident in the data reported here and is consistent with previous research^{28,29}. In the current study, high CF also predicted spending more time in nature, which may reflect the planning and effort most people must engage in to access green spaces. Together, these findings highlight the necessity of having the cognitive capacity to perform more onerous environmental behaviors.

Despite the myriad research aimed at identifying the primary motivators of PEBs, less research has focused on understanding one's emotional responses to a changing global climate. Arguably, having a strong belief in climate change is required before one might experience a strong emotional reaction to the increasingly destructive effects of climate change. The current research lends support to this assertion in that both high belief groups reported significantly stronger climate change emotions than the low belief groups; however, additional analyses are required before determining if there is a clear linear relationship from beliefs to emotions or if there is evidence of a more reciprocal (or recursive) relationship in play such that they mutually inform each other. Regardless of the nature of the relationship between climate change beliefs and emotions, both factors, in conjunction with CF, could uniquely inform the PEB debate. Ongoing analyses are already underway to test this directly.

²⁸ Cavrak, S. (2020). The Cognitive Psychology Behind Eco-Consumerism. AnalyticsIQ.com.

²⁹ Langenbach, Berger, Baumgartner & Knoch (2019). Cognitive Resources Moderate the Relationship Between Pro-Environmental Behavior and Green Behavior. Environment and Behavior, 1-17. doi: 10.1177/0013916519843127.

There is a well-documented sentiment across the US that more people are increasingly endorsing the belief that climate change is happening, human-caused, and likely to affect them personally³⁰. This trend, along with the data presented here, suggests that PEBs (including green consumption) will also continue increasing into the future. As such, this is a ripe opportunity for businesses and organizations across a wide variety of sectors to begin strategizing around the sustainability opportunities available to them, including how and to whom they should market their product, service, or mission. The Green Personas segmentation system provides empirically driven insights into consumers' psychological capacities and motivations around green consumption allowing for greater personalization at the product, service, and marketing levels.

If you have questions about this data, our research process, or how we can help you understand your consumer base, please contact sales@analyticsiq.com for more information.

³⁰ Leiserowitz, A., Maibach, E., Rosenthal, S., Kotcher, J., Carman, J., Neyens, L., Myers, T., Goldberg, M., Campbell, E., Lacroix, K., & Marlon, J. (2022). *Climate Change in the American Mind*, April 2022. Yale University and George Mason University. New Haven, CT: Yale Program on Climate

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