Psychological Richness Enhances Pro-environmental Behavioral Intention

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Date: 2023-03-07T00:00:00+00:00

Abstract

Understanding the relationship between well-being and pro-environmental behavior holds important practical significance for promoting sustainable social development. To explore the positive antecedents influencing pro-environmental behavior, this research focused on the psychological richness dimension of well-being, examining the effect of psychological richness on pro-environmental behavior and its underlying mechanisms and boundary conditions through 10 sub-studies (N = 2979). The results revealed that higher levels of psychological richness lead to greater willingness to make efforts and behavioral changes for environmental protection (Studies 1.1-1.4), because psychological richness enhances self-expansion levels (Studies 2.1-2.4), and the predictive effect of self-expansion on pro-environmental behavior is more pronounced when individuals perceive nature as smaller than the self (Studies 3.1-3.2). These findings reveal the positive role of well-being in pro-environmental behavior and provide insights for promoting public participation in building a sustainable society.

Full Text

Psychological Richness Increases Pro-Environmental Behavioral Intentions

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Abstract

Understanding the relationship between well-being, positive factors, and pro-environmental behavior holds significant practical importance for promoting sustainable social development. To explore the positive antecedents of pro-environmental behavior, this research focuses on the well-being orientation of psychological richness. Through ten sub-studies (N = 2979), we examined the effect of psychological richness on pro-environmental behavior and its underlying mechanisms and boundary conditions. The results revealed that higher levels of psychological richness were associated with greater willingness to make efforts and behavioral changes for environmental protection (Studies 1.1–1.4). This relationship was mediated by increased self-expansion (Studies 2.1–2.4), and the predictive effect of self-expansion on pro-environmental behavior was more pronounced when individuals perceived nature as smaller than the self (Studies 3.1–3.2). These findings illuminate the positive role of well-being in pro-environmental behavior and provide insights for promoting public participation in building a sustainable society.

Keywords: psychological richness, pro-environmental behavior, self-expansion, nature-self size

1. Introduction

Global environmental problems such as global warming, air pollution, and resource scarcity are largely caused by human behavior (Fritsche & Masson, 2021), while individual pro-environmental behaviors (e.g., energy conservation, green travel) can reduce environmental damage and help protect the natural environment (Lange & Dewitte, 2019). However, when it comes to environmental protection, the general public typically associates it with negative outcomes such as sacrifice, suffering, and discomfort (Pritchard, 2010; Venhoeven et al., 2013). Environmental psychologists have also predominantly focused on the role of negative traits or emotions in pro-environmental behavior while relatively neglecting the influence of positive factors (Corral-Verdugo, 2012). In reality, environmental protection concerns the well-being of individuals and society, and pro-environmental behavior therefore originates from human motivation to pursue happiness (Sagiv et al., 2015; van Riper et al., 2019).

Positive psychology research on well-being encompasses three orientations: hedonism (hedonic, Diener, 1984), eudaimonism (eudaimonic, Baumeister et al., 2013), and psychological richness (Oishi et al., 2019). However, previous studies have primarily concentrated on the effects of traditional dualistic well-being on pro-environmental behavior, and no research has yet examined the relationship between psychological richness and pro-environmental behavior. Hedonic well-being, also known as subjective well-being (Diener, 1984), typically comprises life satisfaction (Diener, 1984) and positive affect (Kahneman, 1999). Research has found that individuals with high hedonic levels are less willing to reduce meat consumption and save energy (Steg et al., 2014) and may exhibit fewer pro-

environmental behaviors during travel (van Riper et al., 2019). Unlike hedonic well-being, eudaimonic well-being emphasizes psychological well-being (Huta & Waterman, 2014) and focuses more on meaning in life and life goals (Martela & Steger, 2016; Steger et al., 2006). However, current empirical research indicates that eudaimonic well-being cannot directly predict pro-environmental behavior (Shin et al., 2022; van Riper et al., 2019). This suggests that defining well-being solely from hedonic and eudaimonic perspectives may limit our understanding of the relationship between pro-environmental behavior and a happy life. Moreover, excessive focus on the role of negative traits hinders researchers'exploration of positive antecedents of pro-environmental behavior (Corral-Verdugo, 2012). Therefore, this study adopts a positive psychology perspective, focusing on the well-being orientation of psychological richness to investigate how psychological richness influences pro-environmental behavior and to examine the potential psychological mechanisms and boundary conditions affecting this relationship.

1.1 Psychological Richness and Pro-Environmental Behavior

Pro-environmental behavior refers to actions that help protect the natural environment and reduce environmental damage (Lange & Dewitte, 2019). The motivation behind such behavior is rooted not only in human values (Steg & Vlek, 2009) but also in the pursuit of happiness (Sagiv et al., 2015). Unlike traditional dualistic well-being concepts, psychological richness does not require actions or experiences to have objective value, nor does it advocate that people pursue pleasure while avoiding potentially painful activities (Besser & Oishi, 2020). Instead, psychological richness is characterized by novel, diverse, interesting, perspective-changing, complex, and challenging life experiences (Oishi et al., 2019) and is positively correlated with holistic thinking and attributional complexity (Oishi & Westgate, 2022). Therefore, individuals with high psychological richness are more psychologically mature and wise (Grossmann et al., 2020). As a new well-being concept, psychological richness is both a relatively stable life value orientation and a temporary psychological experience that people have in direct or indirect life experiences (Oishi & Westgate, 2022). Consequently, psychological richness is closely linked to openness (Oishi et al., 2019) but differs substantially from sensation-seeking personality traits that pursue dangerous stimulation and unrestrained feelings.

Most importantly, the concept of psychological richness breaks the opposition of traditional dualistic well-being (Oishi & Westgate, 2022), providing new possibilities for understanding the relationship between well-being and pro-environmental behavior. Although no research has directly examined the relationship between psychological richness and pro-environmental behavior, psychological richness is closely connected to many factors that influence pro-environmental behavior, such as openness to experience, awe (Oishi & Westgate, 2022), and self-expansion (Hoot & Friedman, 2011). First, openness to experience is an important predictor of both psychological richness and pro-environmental behavior (Gifford & Nilsson, 2014; Oishi et al., 2019). As

psychological richness increases, individuals' openness also increases (Oishi et al., 2019), making people more likely to care for nature, accept novel and unusual environmental concepts and behaviors (Poškus, 2018), and exhibit more pro-environmental behavior (Markowitz et al., 2012). Second, psychological richness is similar to awe (Oishi & Westgate, 2022); both are related to novel stimuli and the need for cognitive restructuring and are complex, self-related emotional experiences (Keltner & Haidt, 2003; Piff et al., 2015). Since awe positively predicts pro-environmental behavior (Bethelmy & Corraliza, 2019), psychological richness may produce similar effects. Third, psychologically rich experiences can help individuals fulfill their need for self-expansion (Oishi & Westgate, 2022), which is beneficial for improving pro-environmental attitudes and behavioral intentions (Hoot & Friedman, 2011; Wolsko & Lindberg, 2013).

Based on this reasoning, we propose Hypothesis H1: Individuals with higher levels of psychological richness are more willing to engage in pro-environmental behavior.

1.2 Self-Expansion, Psychological Richness, and Pro-Environmental Behavior

Self-expansion is the process by which individuals add positive content to their self-concept (Aron & Aron, 1986; McIntyre et al., 2015). Specifically, it involves incorporating new identities, characteristics, attributes, resources, knowledge, and perspectives into existing schemas and beliefs (Aron & Aron, 1986; Aron et al., 2013) or discovering previously neglected aspects of the self-concept (Lewandowski & Bizzoco, 2007). A psychologically rich life helps individuals broaden their horizons and expand social relationships, fulfilling the need for self-expansion (Oishi & Westgate, 2022). Building intimate interpersonal relationships and pursuing novel, challenging, and interesting experiences can broaden one' s perspective (Mattingly et al., 2012), increase people' s perception of the self (Aron & Aron, 1986), and thereby enrich and expand the self-concept (Mattingly & Lewandowski, 2014).

Expanding the self-concept is an indispensable component in forming sustainable social identities (Postmes et al., 2014), and self-expansion is therefore widely used to explain the overlap between self and others and the connection between self and nature (e.g., Aron et al., 2013; Nolan & Schultz, 2014). According to the self-expansion model, Schultz (2000) proposed that the characteristics and traits of the natural environment can serve the purpose of self-expansion, suggesting that self-expansion may include three dimensions: self, humanity, and biosphere (Nolan & Schultz, 2014; Tang et al., 2017). Among these, nature connectedness, which is closely related to pro-environmental behavior, is a type or manifestation of self-expansion (Hoot & Friedman, 2011; Olivos & Clayton, 2017).

Furthermore, relational self-expansion identity, which involves incorporating others or higher social units into the self (e.g., community identity, national

identity, world citizen identity), is also positively correlated with environmental concern and pro-environmental behavior (Brieger, 2019; Clayton & Kilinç, 2013). Therefore, on the one hand, self-expansion can reduce the psychological distance between individuals and their communities, nature, and other groups (Brieger, 2019), strengthen connections between people and nature and others (Lou & Li, 2021; Schultz, 2000), and thereby increase pro-environmental behavioral intentions and frequency (Tang et al., 2017). On the other hand, self-expansion can promote self-growth (Mattingly & Lewandowski, 2014), enhance self-efficacy and competence (Aron et al., 2013), and thus strengthen the ability to cope with complex environmental problems (Bostrom et al., 2019; Markowitz & Shariff, 2012).

Based on this reasoning, we propose Hypothesis H2: Self-expansion is the mediating mechanism underlying the relationship between psychological richness and pro-environmental behavior.

1.3 The Moderating Role of Nature-Self Size

Although psychological richness has an important indirect effect on pro-environmental behavior, this effect may vary due to individual differences. Therefore, it is necessary to consider whether the influence of psychological richness on pro-environmental behavior through self-expansion is moderated by other factors. Nature-self size refers to individuals' psychological representation of the relative size relationship between nature and the self, which influences self-transcendent pro-environmental attitudes and behaviors (Jacobs & McConnell, 2022). Moreover, nature and the self change dynamically together (McConnell & Jacobs, 2020), and each has boundaries (Fodor, 2009). This implies that self-expansion has limits, and its effect on pro-environmental behavior may change as the relative relationship between nature and the self changes. Therefore, this study explores whether nature-self size moderates the path through which psychological richness influences pro-environmental behavior via self-expansion.

For individuals who perceive nature as smaller and lower in status than themselves, as self-expansion increases, people can correct their original, mistaken perceptions (Mattingly et al., 2014), develop more pro-environmental identity and perspectives (Lou & Li, 2021; Udall et al., 2020), and thereby enhance pro-environmental attitudes and behavioral intentions (Brieger, 2019; Clayton & Kilinç, 2013). Conversely, when perceiving nature as much larger than the self, people become aware of their own smallness and develop strong awe toward nature (Keltner & Haidt, 2003), thus also exhibiting more pro-environmental behavior (Bethelmy & Corraliza, 2019). However, as individuals perceive nature as increasingly vast and grand while the self becomes increasingly small and weak, people may develop negative awe toward nature (Gordon et al., 2017). Negative awe creates distance between people and things and triggers fear and feelings of helplessness (Dong et al., 2014), ultimately reducing individual self-control (Gordon et al., 2017) and making people prefer in-groups or smaller

groups (e.g., Bai et al., 2017). This means that individual self-identity expansion may be limited, self-efficacy may be reduced, and the effect of self-expansion on pro-environmental behavior may be weakened.

Based on this reasoning, we propose Hypothesis H3: Nature-self size moderates the latter half of the path through which psychological richness influences pro-environmental behavior via self-expansion. Specifically, when nature is represented as larger relative to the self, the effect of self-expansion on pro-environmental behavior will be weakened.

1.4 Overview of Studies

This study aims to examine the relationship between psychological richness and pro-environmental behavior and its psychological mechanisms and boundary conditions. Accordingly, we propose that individuals with higher levels of psychological richness will have higher pro-environmental behavioral intentions, and this effect is mediated by self-expansion and moderated by nature-self size. Study 1 uses four sub-studies to verify whether psychological richness can enhance pro-environmental behavioral intentions. Study 2 uses questionnaire surveys and experimental-causal-chain design paradigms to conduct four sub-studies, further examining whether self-expansion is the psychological mechanism underlying the relationship between psychological richness and pro-environmental behavior. Study 3 uses two sub-studies to explore possible boundary conditions, specifically testing the moderating role of nature-self size.

2.1 Study 1.1: The Correlational Relationship Between Psychological Richness and Pro-Environmental Behavior

Study 1.1 used both university student and non-student populations as participants to examine the correlational relationship between psychological richness and pro-environmental behavior. Before formal testing, we revised the Chinese version of the English Psychological Rich Life Questionnaire developed by Oishi et al. (2019). After translation and back-translation, combined with the Life Satisfaction Scale (Diener et al., 1985), Meaning in Life Questionnaire (Steger et al., 2006), Sensation Seeking Scale (Hoyle et al., 2002), and Positive and Negative Affect Schedule (Diener et al., 2010), we administered the questionnaire to 485 randomly recruited university students from Hubei, Henan, Guangdong, and Heilongjiang. Item analysis, reliability and validity testing, and equivalence testing indicated that compared with the original 17-item scale, deleting items 14, 15, 16, and 17 (which all used reverse scoring and had factor loadings below 0.5) resulted in better model fit: $^2 = 251.60$, df = 62, $^2/\text{df} = 4.06$, CFI = 0.95, TLI = 0.94, NFI = 0.93, IFI = 0.95, RMSEA = 0.09, SRMR = 0.04, with stability across gender and urban/rural groups. Criterion-related validity tests showed that psychological richness was significantly positively correlated with life satisfaction ($r = 0.65$, $p < 0.001$), positive affect ($r = 0.56$, $p < 0.001$), sensation seeking ($r = 0.34$, $p < 0.001$), and meaning in life ($r = 0.62$, $p < 0.001$), but

not significantly correlated with negative affect (r = -0.04, p > 0.05). Therefore, the revised Chinese version of the Psychological Rich Life Questionnaire could be used in subsequent research.

2.1.1 Research Design and Procedure

Through convenience sampling, we randomly recruited 273 university students from Hubei, Henan, and Guangzhou. After obtaining informed consent, participants entered the Qualtrics platform to participate in the study. We excluded 11 participants who did not complete all questions or failed the attention check, leaving 262 valid participants (M age = 20.38 years, SD = 3.32), including 103 males and 159 females. After completing the survey, all participants received course credits as compensation. Simultaneously, we posted survey advertisements on the Tencent Questionnaire platform and limited participant characteristics to non-university students, recruiting 227 participants. After excluding 9 participants with overly short response times or who failed the attention check, we obtained 218 valid participants (M age = 29.42 years, SD = 9.11). After completing the survey, all participants received monetary compensation.

We administered the Chinese version of the Psychological Rich Life Questionnaire (e.g., "My life is rich in experiences"), with all items rated on a 7-point Likert scale (1 = "strongly disagree," 7 = "strongly agree"). The scale's Cronbach's α was 0.92 for the university student group and 0.95 for the non-student group. Next, we used the Pro-Environmental Behavior Scale developed by Fielding and Head (2012) to measure the frequency of participants' daily environmental protection behaviors, consisting of 6 items such as "Save energy at home," rated on a 5-point Likert scale (1 = "never," 5 = "always"). The scale's Cronbach's α was 0.75 for the university student group and 0.70 for the non-student group. Finally, we collected participants' basic demographic information.

2.1.2 Results and Discussion

Correlation analysis results showed that psychological richness was significantly positively correlated with pro-environmental behavior in both university student and non-student participants, with correlation coefficients of $r(262) = 0.22$, $p < 0.001$ and $r(218) = 0.55$, $p < 0.001$, respectively. Moreover, after controlling for age (Wiernik et al., 2013) and social class (Gifford & Nilsson, 2014) in the non-student group, the positive correlation between psychological richness and pro-environmental behavior remained significant, $r(218) = 0.38$, $p < 0.001$. This indicates that individuals with higher psychological richness engage in more environmental protection behaviors in daily life, supporting research hypothesis H1. Next, we further explored the effect of psychological richness on pro-environmental behavior using experimental methods.

2.2 Study 1.2: The Effect of Psychological Richness on Green Travel Behavior

According to previous research, among individuals' daily life experiences, travel has the strongest predictive power for psychological richness, while ordinary, stable daily life is associated with lower levels of perceived psychological richness (Oishi et al., 2021). Therefore, Study 1.2 used a recall paradigm to manipulate psychological richness and test its effect on pro-environmental behavior.

2.2.1 Research Design and Procedure

Using G*Power software (Faul et al., 2007), we calculated that a minimum of 171 participants was needed to achieve a medium effect size (f = 0.25, power = 0.90). We therefore recruited 242 participants through the Credamo platform and randomly assigned them to the psychological richness group or the control group to complete a recall writing task. Ultimately, 181 participants (M age = 30.75 years, SD = 9.25) completed the writing task according to instructions and passed the attention check, including 73 males.

Participants in the psychological richness group (n = 86) were asked to recall and write about an unforgettable travel experience based on the presented definition of psychological richness. Participants in the control group (n = 95) were asked to recall and write about an ordinary day in their daily life according to the instructions. For manipulation check, participants reported their current feelings by completing the Psychological Richness Scale (Oishi et al., 2020, α = 0.93), including items such as "I think this experience is interesting," "···is novel," "···is psychologically enriching." All questions were rated on a 5-point Likert scale (1 = "strongly disagree," 5 = "strongly agree"). Subsequently, following Lee et al. (2013), all participants read the following information and reported their pro-environmental behavioral intentions: "Please imagine that you plan to travel to a warm southern city for a week. During this trip, to what extent would you (1) 'clean up the place after a picnic or beach leisure to make it as clean as before' ; (2) 'report to scenic area management if I see someone damaging the environment here' ; (3) 'prioritize purchasing products with environmental labels' ." All items were rated on a 7-point Likert scale (1 = "very unlikely," 7 = "very likely," α = 0.52). Finally, we collected participants' basic demographic information.

2.2.2 Results and Discussion

ANOVA results showed that participants in the psychological richness group (M = 3.85, SD = 0.50) reported higher psychological richness than those in the control group (M = 2.24, SD = 0.71), F(1,179) = 304.15, p < 0.001, p^2 = 0.63, indicating that the experimental manipulation of psychological richness was effective. Moreover, participants in the psychological richness group (M = 5.98, SD = 0.68) also showed higher green travel tendencies than those in the control group (M = 5.62, SD = 0.81), F(1,179) = 10.37, p = 0.0024, p^2

= 0.06. After controlling for gender and age, the difference between the two groups remained significant, $F(1,176) = 9.34$, $p = 0.003$, $p^2 = 0.05$. This result suggests that state psychological richness can also enhance individuals' pro-environmental behavioral intentions.

2.3 Study 1.3: The Effect of Psychological Richness on Willingness to Participate in Environmental Public Welfare Activities

Study 1.2 demonstrated that recalling past unforgettable travel experiences can activate psychological richness and influence individuals' pro-environmental behavior in future travel. However, this effect might be confounded by increased positive expectations about future travel resulting from the recalled memorable travel experiences. To rule out this factor, Study 1.3 was conducted.

2.3.1 Research Design and Procedure

We recruited 180 university students through a combination of online promotion and on-site library publicity. Ultimately, 161 participants (M age = 20.04 years, SD = 2.27) completed all responses on the Qualtrics online platform and passed the attention check, including 116 females.

Similar to Study 1.2, participants in the psychological richness group (n = 68) and control group (n = 93) completed a recall writing task according to instructions (minimum 80 characters). For manipulation check, all participants completed the Psychological Richness Scale (Oishi et al., 2020, $\alpha = 0.71$). Then, following Sharpe et al. (2021), we presented participants with three environmental news reports related to university students' daily lives and invited them to report their willingness to participate in environmental activities after reading. The first two messages used positive descriptions, while the third used reverse description to reduce social desirability effects and was reverse-coded during data analysis. All items were rated on a 7-point Likert scale (1 = "very unwilling," 7 = "very willing," $\alpha = 0.76$). Finally, we collected participants' basic demographic information.

2.3.2 Results and Discussion

Manipulation check results showed that participants who recalled travel experiences (M = 3.98, SD = 0.65) reported higher psychological richness than those who recalled ordinary daily life experiences (M = 2.97, SD = 0.55), $F(1, 159) = 113.23$, $p < 0.001$, $p^2 = 0.41$, indicating that the experimental manipulation was effective. ANOVA results showed that participants in the psychological richness group (M = 5.13, SD = 0.73) also reported higher willingness to participate in environmental activities than those in the control group (M = 4.87, SD = 0.83), $F(1,159) = 4.48$, $p = 0.036$, $p^2 = 0.03$. Moreover, after controlling for gender and age, the difference in willingness to participate in environmental

activities between the two groups remained significant, $F(1,157) = 2.63$, $p = 0.043$, $p^2 = 0.03$. Thus, Study 1.3 replicated the results of Study 1.2.

2.4 Study 1.4: The Effect of Psychological Richness on Willingness to Make Environmental Efforts

Psychological richness originates not only from novel, interesting, unexpected, complex, and challenging life experiences but also includes perspective change as an indispensable factor (Oishi & Westgate, 2022). To further test hypothesis H1, Study 1.4 manipulated perspective change to activate psychological richness, following Bae and Buttrick (2021), and examined its effect on willingness to make environmental efforts.

2.4.1 Research Design and Procedure

(1) Pilot Study Before the formal study, we conducted a pilot study to test the experimental materials for psychological richness. We recruited 100 participants through the Credamo platform, excluded 7 who failed the attention check, and retained 93 valid participants (M age = 31.42 years, SD = 7.38), including 36 males. After obtaining informed consent, participants were randomly assigned to the psychological richness group or control group to complete corresponding experimental tasks. Participants in the psychological richness group ($n = 47$) first viewed an image without identity information [Figure 1a: see original paper] and then imagined and wrote about the story behind the photo or the emotions they experienced from it. They were then shown the complete image [Figure 1b: see original paper] and the protagonist' s past 曲折人生经历 (twisted life experiences) to activate perspective change. Participants in the control group ($n = 46$) saw the complete photo directly [Figure 1b: see original paper] and were asked to write 4-6 sentences expressing their thoughts and feelings. Unlike the psychological richness group, the control group was not introduced to the protagonist' s past 曲折人生经历 (twisted life experiences).

Subsequently, participants reported the degree of perspective change and psychological richness they experienced while reading the experimental materials. Perspective change was measured with items including "My view of the photo changed"and "This photo challenged some of my original beliefs"(Bae & Buttrick, 2021, $\alpha = 0.65$). The psychological richness measure was the same as in Study 1.2 ($\alpha = 0.79$). ANOVA results indicated that the experimental group showed significantly higher perspective change than the control group, but there was no significant difference in psychological richness between the two groups. After analyzing the written content, we found that the familiarity of the experimental materials might have affected participants' psychological richness experience, so we controlled for this factor in the formal experiment.

(2) Formal Experiment We recruited 200 participants through the Credamo platform to ensure the study achieved a medium effect size ($f = 0.25$, power = 0.90). All participants reported that they had never seen or heard about the

news stories related to the figures in the experimental materials. We excluded 6 participants who did not follow the writing instructions or failed the attention check, leaving 194 valid participants (M age = 30.55 years, SD = 8.85), including 66 males.

Participants in the psychological richness group (n = 100) and control group (n = 94) completed the same experimental tasks as in the pilot study and filled out the perspective change scale ($\alpha = 0.76$) and psychological richness scale ($\alpha = 0.78$). Next, participants completed pro-environmental behavioral intention items, including "I plan to engage in more behaviors that are beneficial to environmental protection," "I plan to make more efforts to protect the environment," and "If given the opportunity to donate to a public welfare environmental organization, I would be willing to contribute" (1 = "very unwilling," 7 = "very willing" ; Larson et al., 2015, $\alpha = 0.69$).

2.4.2 Results and Discussion

Manipulation check results showed that participants in the psychological richness group (M = 4.05, SD = 0.83) reported higher perspective change than the control group (M = 3.38, SD = 1.04), $F(1, 192) = 24.79$, $p < 0.001$, $p^2 = 0.11$. Simultaneously, the psychological richness group (M = 5.67, SD = 0.54) also showed significantly higher psychological richness than the control group (M = 5.50, SD = 0.64), $F(1, 192) = 3.98$, $p = 0.048$, $p^2 = 0.02$, indicating that the experimental manipulation of psychological richness was effective. ANOVA results showed that the psychological richness group (M = 6.1, SD = 0.61) exhibited higher pro-environmental behavioral intentions than the control group (M = 5.92, SD = 0.78), $F(1, 192) = 5.26$, $p = 0.023$, $p^2 = 0.03$. After controlling for gender and age, the difference in pro-environmental behavior between the two groups remained significant, $F(1, 190) = 8.22$, $p = 0.005$, $p^2 = 0.04$. Therefore, Study 1.4 replicated the results of Studies 1.2 and 1.3, once again confirming the positive effect of state psychological richness on pro-environmental behavior.

In summary, through questionnaire surveys and experimental research, Study 1 found that both trait psychological richness and state psychological richness can enhance individuals' willingness to engage in pro-environmental behavior, thereby supporting research hypothesis H1.

3. Study 2: The Mediating Mechanism Between Psychological Richness and Pro-Environmental Behavior

In Study 2, we used questionnaire surveys and experimental-causal-chain design (Spencer et al., 2005) to test hypothesis H2 and examine the mediating role of self-expansion in the relationship between psychological richness and pro-environmental behavior.

3.1 Study 2.1: The Relationship Between Psychological Richness, Self-Expansion, and Pro-Environmental Behavior

Study 2.1 used a questionnaire survey to explore the relationships among psychological richness, self-expansion, and pro-environmental behavior and to test whether self-expansion mediates the relationship between psychological richness and pro-environmental behavior.

3.1.1 Research Design and Procedure

According to Monte Carlo simulation methods, Schönbrodt and Perugini (2013) recommended that the sample size should be at least 250 to ensure stable correlations between variables. We recruited 280 participants through the Credamo platform, excluded 4 who failed the attention check, and retained 276 valid participants (M age = 31.06 years, SD = 7.40), including 111 males.

We administered the same Chinese version of the Psychological Rich Life Questionnaire used in Study 1.1 ($\alpha = 0.92$), the Pro-Environmental Behavior Scale (Fielding & Head, 2012, $\alpha = 0.71$), and the Personal Self-Expansion Questionnaire (Mattingly & Lewandowski, 2013, $\alpha = 0.74$). The self-expansion questionnaire consisted of 5 items, such as "My past life experiences have broadened my understanding of things," rated on a 7-point scale (1 = "strongly disagree," 7 = "strongly agree"). Finally, we collected participants' basic demographic information.

3.1.2 Results and Discussion

Correlation analysis results showed that psychological richness was significantly positively correlated with pro-environmental behavior, $r(276) = 0.56$, $p < 0.001$, and with self-expansion, $r(276) = 0.68$, $p < 0.001$. Self-expansion was also significantly positively correlated with pro-environmental behavior, $r(276) = 0.42$, $p < 0.001$.

With pro-environmental behavior as the dependent variable, psychological richness as the independent variable, self-expansion as the mediator, and age (Wiernik et al., 2013) and gender (Zelezny et al., 2000) as control variables, we conducted a mediation effect test using Model 4 in the Process plugin. The path coefficients are shown in [Figure 2: see original paper]. Bootstrap analysis with 5,000 samples indicated that the mediating effect of self-expansion was significant, $b = 0.13$, $SE = 0.03$, 95% CI [0.075, 0.184]. This demonstrates that self-expansion plays a significant mediating role between psychological richness and pro-environmental behavior, supporting hypothesis H2.

3.2 Study 2.2: The Effect of Psychological Richness on Self-Expansion

Study 2.2 used the same experimental method as Study 1.4 to activate psychological richness and test its effect on self-expansion.

3.2.1 Research Design and Procedure

We randomly recruited 203 participants through the Credamo platform, excluded 3 who failed the attention check, and obtained a final valid sample of 200 participants (M age = 30.67 years, SD = 8.99), including 76 males.

The manipulation of psychological richness was the same as in Study 1.4, with participants in different experimental conditions completing the perspective change task according to instructions. Participants then reported the degree of perspective change experienced during the experiment (as in Study 1.4, α = 0.76), psychological richness (as in Study 1.2, α = 0.84), and self-expansion level (as in Study 2.1, α = 0.86). To exclude the influence of material familiarity, participants reported their familiarity with the news stories in the experimental materials (1 = "very unfamiliar," 7 = "very familiar"). Finally, we collected participants' basic demographic information.

3.2.3 Results and Discussion

Manipulation check results showed that participants in the psychological richness group (M = 3.94, SD = 0.85) reported significantly higher perspective change than the control group (M = 3.35, SD = 1.11), F(1, 198) = 17.75, p < 0.001, p^2 = 0.08, and also higher psychological richness (M = 5.74, SD = 0.55) than the control group (M = 5.30, SD = 0.81), F(1, 198) = 20.23, p < 0.001, p^2 = 0.09. Moreover, all participants reported being unfamiliar with or unaware of the news stories in the experimental materials, indicating that the experimental manipulation of psychological richness was effective. Additionally, participants in the psychological richness group (M = 5.96, SD = 0.61) showed significantly higher self-expansion levels than the control group (M = 5.59, SD = 0.96), F(1, 198) = 10.91, p = 0.001, p^2 = 0.005. After controlling for gender and age, the difference in self-expansion levels remained significant, F(1, 196) = 12.22, p = 0.001, p^2 = 0.06. This demonstrates that psychological richness can significantly affect individuals' self-expansion levels.

3.3 Study 2.3: The Effect of Self-Expansion on Pro-Environmental Behavior

Building on Study 2.2, Study 2.3 manipulated self-expansion following previous research paradigms and tested its effect on pro-environmental behavior.

3.2.1 Research Design and Procedure

We recruited 223 participants through the Credamo platform to meet the minimum sample size of 171 required for a between-subjects experimental design calculated by G*Power software (Faul et al., 2007) (f = 0.25, power = 0.90). We excluded 16 participants who did not follow instructions or failed the attention check, leaving 207 valid participants (M age = 28.95 years, SD = 9.01), including 95 males.

Following the experimental paradigm for self-expansion from Besta et al. (2018), participants in the experimental group (n = 103) were asked to recall and write about a recent collective activity they had participated in, while participants in the control group (n = 104) were asked to recall and write about a solo dining experience from the previous day, with both requiring a minimum of 80 characters.

For manipulation check, participants completed the Personal Self-Expansion Questionnaire (as in Study 2.3, Mattingly & Lewandowski, 2013, $\alpha = 0.89$). Subsequently, participants were presented with a recruitment message for an environmental activity and asked to report their pro-environmental behavioral intentions after reading it (Gärling et al., 2003, $\alpha = 0.73$), including "I would donate to an environmental organization," "I would sign a petition supporting environmental activities," and "I would participate in online or offline campaigns to boycott companies that damage the environment" (1 = "very unlikely," 7 = "very likely"). Finally, we collected participants' basic demographic information.

3.3.2 Results and Discussion

Manipulation check results showed that participants in the experimental group (M = 5.71, SD = 0.85) reported significantly higher self-expansion levels than the control group (M = 5.06, SD = 1.38), $F(1, 205) = 21.83$, $p < 0.001$, $p^2 = 0.10$, indicating that the experimental manipulation of self-expansion was effective. ANOVA on pro-environmental behavioral intentions revealed that the experimental group (M = 5.89, SD = 0.77) reported higher pro-environmental behavioral intentions than the control group (M = 5.52, SD = 1.03), $F(1, 205) = 8.79$, $p = 0.003$, $p^2 = 0.04$. Moreover, after controlling for age and gender, the difference between groups remained significant, $F(1, 203) = 7.05$, $p = 0.009$, $p^2 = 0.03$. This demonstrates that self-expansion significantly affects individuals' pro-environmental behavioral intentions.

3.4 Study 2.4: Psychological Richness Influences Pro-Environmental Behavior Through Self-Expansion

To further test hypothesis H2, Study 2.4 used experimental methods to manipulate psychological richness and examine the mediating role of self-expansion in the relationship between psychological richness and pro-environmental behavior.

3.4.1 Research Design and Procedure

G*Power 3.1 software (Faul et al., 2007) calculated that a minimum sample size of 171 was needed for a one-factor between-subjects experimental design (f = 0.25, power = 0.90). We therefore randomly recruited 211 participants through the Credamo platform, excluded 3 who failed the attention check, and obtained 208 valid participants (M age = 27.76 years, SD = 7.76), including 79 males.

The psychological richness group (n = 101) and control group (n = 107) completed the same recall writing task as in Study 1.2 and filled out the psychological richness questionnaire (as in Study 1.2, $\alpha = 0.95$) and self-expansion questionnaire (as in Study 2.1, $\alpha = 0.83$). Then, following Wu and Yang (2018), participants were asked to imagine they were traveling and choose between two transportation options, with Option 1 being air travel and Option 2 being train travel (the pro-environmental behavior). Finally, we collected participants' basic demographic information.

3.4.2 Results and Discussion

Manipulation check results showed that participants in the psychological richness group (M = 4.18, SD = 0.34) reported higher psychological richness than the control group (M = 2.74, SD = 0.78), $F(1, 206) = 290.97$, $p < 0.001$, $p^2 = 0.59$, indicating that the experimental manipulation of psychological richness was effective. Coding Option 2 as 1 and using gender and age as covariates, we conducted logistic regression analysis on Option 2 with psychological richness as the independent variable. Results showed that psychological richness significantly predicted pro-environmental behavior, b = 0.95, SE = 0.29, Wald ^{2} = 10.75, p = .001. Consistent with our hypothesis, 47.66% of participants in the control group chose Option 2, while 70.29% of participants in the psychological richness condition preferred the environmentally friendly travel option. Meanwhile, gender and age had no significant effect on travel option choice (ps > 0.07).

We further tested the mediating role of self-expansion in the relationship between psychological richness and pro-environmental behavior. Using psychological richness as the independent variable, pro-environmental behavior as the dependent variable, self-expansion as the mediator, and gender and age as control variables, we conducted mediation analysis using Model 4 in the Process plugin. The path coefficients are shown in [Figure 3: see original paper]. Bootstrap analysis with 5,000 samples indicated that the mediating effect of self-expansion was significant, b = 0.16, SE = 0.09, 95% CI [0.0208, 0.3721]. This demonstrates that self-expansion plays a significant mediating role between psychological richness and pro-environmental behavior, once again supporting hypothesis H2.

4. Study 3: The Moderating Role of Nature-Self Size

Study 2 found that self-expansion is the reason why psychological richness influences pro-environmental behavior. Building on this, Study 3 explores whether

the mediating process of self-expansion is moderated by nature-self size.

4.1 Study 3.1: Experimental Manipulation of Psychological Richness

Study 3.1 used a recall priming method to manipulate psychological richness and test the moderating effect of nature-self size.

4.1.1 Research Design and Procedure

We recruited 223 participants through the Credamo platform, excluded 12 who failed the attention check or did not complete the task according to instructions, and obtained 211 valid participants (M age = 28.81 years, SD = 7.25), including 89 males.

The manipulation of psychological richness was the same as in Study 1.2, with participants in the psychological richness group (n = 100) and control group (n = 111) completing different recall writing tasks according to instructions. Participants then completed the psychological richness questionnaire (as in Study 1.2, Oishi et al., 2020, $\alpha = 0.94$) and self-expansion questionnaire (as in Study 2.3, Mattingly & Lewandowski, 2013, $\alpha = 0.91$). Next, participants reported the extent to which they were willing to make sacrifices for environmental protection (Liu & Sibley, 2012, $\alpha = 0.74$), including "To protect the natural environment, I am willing to make certain sacrifices in living standards (e.g., accept higher prices, drive less, save energy)" and "I would change my daily habits to protect the environment" (1 = "very unwilling," 7 = "very willing"). To understand how participants represented the size relationship between themselves and nature, we administered the Nature-Self Size Questionnaire developed by McConnell and Jacobs (2020). In this questionnaire, the self and nature are represented by two independent circles; from image 1 to image 7, the circle representing the self gradually becomes smaller while the circle representing nature gradually becomes larger, with higher numbers indicating that individuals perceive nature as larger and themselves as smaller. Finally, we collected participants' basic demographic information.

4.1.2 Results and Discussion

Manipulation check results showed that participants in the psychological richness group (M = 4.15, SD = 0.35) reported higher psychological richness than the control group (M = 2.60, SD = 0.76), $F(1, 209) = 347.65$, $p < 0.001$, $p^2 = 0.62$, indicating that the experimental manipulation was effective. Similarly, ANOVA on environmental protection willingness revealed that the psychological richness group (M = 5.58, SD = 0.71) was more willing to make sacrifices for environmental protection than the control group (M = 5.18, SD = 1.08), $F(1, 209) = 9.54$, $p = 0.002$, $p^2 = 0.044$. After controlling for gender and age, the difference between groups remained significant, $F(1, 207) = 6.49$, $p = 0.012$, $p^2 = 0.03$.

We then coded the psychological richness group as 1 and the control group as 0, with gender and age as control variables, psychological richness as the independent variable, environmental willingness as the dependent variable, self-expansion as the mediator, and nature-self size as the moderator, conducting moderated mediation analysis using Model 14 in Process. Results showed that nature-self size significantly affected environmental willingness, b = 0.58, SE = 0.16, t = 3.65, 95% CI [0.2469, 0.8872], and the interaction between self-expansion and nature-self size significantly affected environmental willingness, b = -0.10, SE = 0.03, t = -3.23, p = 0.0014, 95% CI [-0.1690, -0.0409]. Meanwhile, the moderated mediation index was -0.15, SE = 0.07, 95% CI [-0.2986, -0.0384], indicating that nature-self size moderated the latter half of the path through which psychological richness influences environmental willingness via self-expansion.

Simple slope analysis results are shown in [Figure 4: see original paper]. When nature was perceived as larger relative to the self, self-expansion significantly positively predicted environmental willingness, b = 0.23, SE = 0.06, t = 3.81, p < 0.001, 95% CI [0.1123, 0.3536]. When nature was perceived as relatively smaller than the self, self-expansion also significantly positively predicted environmental willingness, b = 0.45, SE = 0.06, t = 7.05, p < 0.001, 95% CI [0.3527, 0.5784]. Moreover, when nature was relatively smaller than the self, the predictive effect of self-expansion on environmental willingness was stronger, validating hypothesis H3.

4.2 Study 3.2: The Correlational Relationship Among Nature-Self, Self-Expansion, and Pro-Environmental Behavior

To replicate the results of Study 3.1, Study 3.2 used cross-sectional survey data to retest the moderating effect of nature-self size.

4.2.1 Research Design and Procedure

We recruited 560 participants through the Credamo platform, excluded 10 who failed the attention check, and obtained 550 valid participants (M age = 30.11 years, SD = 6.56), including 217 males.

First, participants completed the Psychological Rich Life Questionnaire (as in Study 1.1, α = 0.92), Self-Expansion Questionnaire (as in Study 2.1, Mattingly & Lewandowski, 2013, α = 0.83), and Nature-Self Size Questionnaire (as in Study 3.1, McConnell & Jacobs, 2020). Next, we administered the Pro-Environmental Behavior Questionnaire (Gu et al., 2020, α = 0.67), including items such as "Turn off lights when leaving a room," "Set air conditioning temperature to 26-28 degrees in summer," and "Print and copy double-sided," with participants reporting the frequency of these activities in their daily lives (1 = "never," 5 = "always"). Finally, we collected participants' basic demographic information.

4.2.2 Results and Discussion

Correlation analysis results showed that psychological richness was significantly positively correlated with self-expansion, $r(550) = 0.68$, $p < 0.001$, and with pro-environmental behavior, $r(550) = 0.50$, $p < 0.001$. Self-expansion was also significantly positively correlated with pro-environmental behavior, $r(550) = 0.54$, $p < 0.001$. The correlations between nature-self size and the main variables were not significant.

We then used gender and age as control variables and conducted moderated mediation analysis using Model 14 in Process. Results showed that nature-self size significantly positively predicted pro-environmental behavior, $b = 0.36$, $SE = 0.07$, $t = 5.01$, $p < 0.001$. Simultaneously, the interaction between self-expansion and nature-self size significantly predicted pro-environmental behavior, $b = -0.06$, $SE = 0.01$, $t = -4.69$, $p < 0.001$, 95% CI [-0.0831, -0.0340], indicating that nature-self size affects the relationship between self-expansion and pro-environmental behavior. The moderated mediation index was -0.03, $SE = 0.01$, 95% CI [-0.0468, -0.0175], demonstrating that nature-self size moderates the latter half of the path through which psychological richness influences pro-environmental behavior via self-expansion.

Further simple slope analysis, shown in [Figure 5: see original paper], revealed that when nature was perceived as larger relative to the self, self-expansion significantly positively predicted pro-environmental behavior, $b = 0.11$, $SE = 0.04$, $t = 3.08$, $p = 0.002$, 95% CI [0.0416, 0.1876]. When nature was perceived as relatively smaller than the self, self-expansion also significantly positively predicted pro-environmental behavior, $b = 0.26$, $SE = 0.03$, $t = 8.21$, $p < 0.001$, 95% CI [0.1991, 0.3243]. Moreover, when nature was relatively smaller than the self, the predictive effect of self-expansion on pro-environmental behavior was stronger. Therefore, Study 3.2 replicated the results of Study 3.1 and supported hypothesis H3.

5. General Discussion

This study explored how psychological richness influences pro-environmental behavior and its underlying mechanisms and boundary conditions. Through ten progressive studies, we found that psychological richness can enhance pro-environmental behavioral intentions, with self-expansion playing a mediating role between them, and this mediating process being moderated by nature-self size. Overall, this study used recall priming paradigms (Studies 1.2–1.3, 2.4, 3.1) and information priming paradigms (Studies 1.4, 2.2) to examine various pro-environmental behaviors including green travel behavior (Study 1.2), environmental activity participation willingness (Study 1.3), and environmental effort willingness (Study 1.4). Combining questionnaire surveys (Studies 1.1, 2.1, 3.2) and experimental-causal-chain designs (Studies 2.2–2.4), the sample covered both university students (Studies 1.1, 1.3) and diverse occupational groups from online platforms (Studies 1.3–1.4, 2.1–3.2). This diversity in ex-

perimental manipulations and sample populations provides assurance for the robustness of the research findings.

5.1 The Effect of Psychological Richness on Pro-Environmental Behavior

Study 1, through four sub-studies, explored the effect of psychological richness on pro-environmental behavior and found that both trait psychological richness and state psychological richness can enhance individuals' pro-environmental behavioral intentions. This result expands research on pro-environmental behavior from a positive psychology perspective and enriches the exploration of antecedents of pro-environmental behavior. Although researchers have gradually begun to focus on the relationship between well-being and pro-environmental behavior after recognizing the "negative bias" in environmental psychology research (Pritchard, 2010), results have shown that hedonic well-being is typically negatively correlated with pro-environmental behavior (Steg et al., 2011), while eudaimonic well-being cannot directly predict pro-environmental behavior (Shin et al., 2022; van Riper et al., 2019).

Shin et al. suggested that this may be because traditional dualistic well-being is related to self-centered needs (e.g., power, social status) and temporary pleasure (Shin et al., 2022). In other words, hedonism and eudaimonism emphasize the outcomes and values of behaviors, leading individuals to consider the costs and benefits of pro-environmental behavior (Steg & Vlek, 2009), which results in lower willingness to engage in pro-environmental behavior. However, psychological richness does not require behaviors or activities to have objective value and meaning but rather emphasizes experiencing and feeling diverse life experiences with an open mindset (Besser & Oishi, 2020), providing new avenues for exploring the relationship between well-being and pro-environmental behavior. Therefore, this study focused on the well-being concept of psychological richness and found that pursuing a psychologically rich life can increase people' s pro-environmental behavioral intentions.

Although no direct research has examined the effect of psychological richness on pro-environmental behavior, studies have shown that individuals with higher psychological richness are more likely to accept social change (Oishi & Westgate, 2022). Our study validates this conclusion in the environmental protection domain and also enriches the exploration of the consequences of psychological richness. Oishi et al. examined the relationships among hedonism, eudaimonism, psychological richness, and system justification and social change, finding that traditional dualistic well-being was positively correlated with system justification, while psychological richness was negatively correlated with system justification. This means that individuals holding traditional dualistic well-being concepts are more likely to maintain existing social order, while those holding psychological richness well-being concepts are more likely to accept social change (Oishi & Westgate, 2022). Environmental issues have become a universal challenge for social development, urgently requiring behavioral changes to mitigate

the impacts of environmental degradation (Eom et al., 2019). The results of Study 1 support previous conclusions, finding that individuals with higher psychological richness are more willing to support social change in environmental protection, accept environmental life concepts and paradigms, and actively engage in pro-environmental behaviors in daily life (Poškus, 2018). Therefore, our research demonstrates that pursuing happiness and engaging in environmental protection are not contradictory, and that protecting the environment is not only related to human motivation to pursue happiness (Sagiv et al., 2015) but also depends on how individuals define a happy life (Binder et al., 2020).

5.2 The Mediating Role of Self-Expansion

Psychological richness facilitates the expansion of self-concept, which is the underlying mechanism explaining differences in pro-environmental behavior performance. Through four sub-studies in Study 2, we found that in the process of pursuing psychological richness, individuals can typically expand their self-identity boundaries, develop new perspectives and resources, and enhance problem-solving abilities, making them more willing to participate in environmental activities.

Consistent with previous research, by expanding self-identity boundaries, people can not only recognize their own needs but also attend to and value the needs and desires of others, and this extension of identity and perspective can enhance individuals'environmental concern and pro-environmental behavioral willingness (Udall et al., 2020). For example, to protect the self, others, and society from environmental problems, people may engage in more pro-environmental behaviors (Schultz, 2000; Tang et al., 2017). In addition to adding positive content to the self-concept, Mattingly et al. (2014) suggested that self-expansion can also reduce negative content in the self-concept, serving a self-pruning function. In other words, rich experiences can help people shift from self-centered orientation to altruism, thereby developing a strong desire to contribute to humanity (Tahir & Gruber, 2002). Our research supports this conclusion, demonstrating that psychological richness can correct erroneous self-concepts and reduce anthropocentric thinking in the human-nature relationship (Kopnina, 2013) while increasing self-expansion levels, thereby enhancing individuals' pro-environmental attitudes and behavioral intentions.

Furthermore, Study 2 also showed that psychological richness can enhance individuals' sense of efficacy while meeting self-expansion needs, thereby increasing the agency and likelihood of pro-environmental behavior. This aligns with the Social Identity Model of Pro-Environmental Action (Fritsche & Masson, 2021) and is consistent with previous research on the relationship between efficacy and pro-environmental behavior. In Studies 2.1–2.4, participants believed that psychologically rich experiences not only expanded their self-boundaries cognitively but also improved their knowledge reserves and problem-solving abilities. Therefore, when facing abstract and complex environmental problems (Markowitz & Shariff, 2012), participants with higher psychological richness and self-expansion

levels reported higher pro-environmental behavioral intentions. This is consistent with the Social Identity Model of Pro-Environmental Action, which suggests that expanding self-concept facilitates the formation of sustainable social identities (Postmes et al., 2014), enhances individuals' self-efficacy and collective efficacy for pro-environmental behavior, and thereby positively influences pro-environmental behavioral intentions.

5.3 The Moderating Role of Nature-Self Size

Study 3, through two sub-studies, found that although self-expansion mediates the relationship between psychological richness and pro-environmental behavior, this mediating process is moderated by nature-self size. Specifically, compared to individuals who perceive nature as smaller than themselves, the promoting effect of self-expansion on pro-environmental behavior is weakened among those who perceive nature as larger than themselves. Consistent with previous research, when perceiving nature as more vast and grand than the self, people experience feelings of small self and develop awe toward nature, which can positively influence pro-environmental attitudes and behaviors (McConnell & Jacobs, 2020). However, many previous studies only required participants to report the overlap between nature and self, or the size of self, the size of other things, and the integration degree of self and other things (e.g., Piff et al., 2015; Shiota et al., 2007), without simultaneously considering that nature and self change dynamically together (McConnell & Jacobs, 2020) and have boundaries (Fodor, 2009). Based on this, Study 3 examined the situation where nature and self size change together and tested the effect of self-expansion on pro-environmental behavior under different conditions. The results revealed that people might develop negative awe and feelings of powerlessness when perceiving nature as too large and themselves as too small (Krenzer, 2018), thereby inhibiting the effect of self-expansion on pro-environmental behavior. Therefore, we found that the effect of psychological richness on pro-environmental behavior through self-expansion is moderated by nature-self size.

5.4 Research Significance and Limitations

The significance of this study is reflected in several aspects. First, it expands research on the antecedents of pro-environmental behavior and provides a new theoretical framework for explaining pro-environmental behavior. Previous research has mainly explored the effects of individual values and emotions on pro-environmental behavior, particularly emphasizing the role of negative emotions and traits while neglecting the relationship between positive factors and pro-environmental behavior (Corral-Verdugo, 2012). Our research demonstrates that pursuing happiness is also an important motivation for environmental protection. Moreover, unlike hedonic and eudaimonic well-being, constructing personal well-being from the perspective of psychological richness can expand self-identity concepts, help people form more identity identifications, enhance self-efficacy for pro-environmental behavior, and thereby increase the willingness

and frequency of environmental protection. Second, the study provides practical insights for encouraging people to participate in building a sustainable society. "Enriching people' s spiritual world, achieving common prosperity for all people, and promoting harmonious coexistence between humans and nature" are essential requirements of Chinese-style modernization, which is precisely the connotation of psychological richness and pro-environmental behavior.

Although we used multiple methods to ensure research rigor and verified our hypotheses, the study has certain limitations. First, pro-environmental behavior was mostly measured as behavioral intention in hypothetical scenarios and relied on self-reports, lacking more objective and actual behavioral measures. Although many previous studies have not strictly distinguished between pro-environmental behavioral intention and actual pro-environmental behavior (e.g., Geiger et al., 2021), pro-environmental cognition and emotion in real situations may not necessarily translate into concrete, observable behaviors (Lange & Dewitte, 2019). Moreover, due to social desirability effects, participants may have overestimated their pro-environmental behavioral intentions in their reports (Kormos & Gifford, 2014). Therefore, future research could use on-site observation or multiple instruments to record participants' actual pro-environmental behavior to improve ecological validity and practical significance. Second, due to practical constraints, participants in multiple sub-studies were recruited from online platforms, and online experiments were predominantly used, which may have compromised participant quality and experimental process control. Future research could manipulate environmental richness through laboratory experiments or use experience sampling methods to retest the relationship between psychological richness and pro-environmental behavior. Third, in this study, psychological richness was mainly manipulated using recall paradigms, which provides a reference method for empirical research on psychological richness that is still in its early stages, but further development and improvement are still needed.

The conclusions of this study are as follows: (1) Psychological richness can enhance pro-environmental behavioral intentions; (2) Self-expansion mediates the relationship between psychological richness and pro-environmental behavior; (3) The mediating effect of self-expansion is moderated by nature-self size, and this effect is more pronounced when nature is perceived as relatively smaller than the self.

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Note: Figure translations are in progress. See original paper for figures.