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Adaptation and Validation of the Perceived Restorativeness Scale (PRS) for the Portuguese Population: A Study on the Assessment of the Restorative Effect of Environments

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Abstract: The relationship between natural environments and psychological well-being has gained increasing attention in environmental and health sciences. However, there is still a lack of robust quantitative instruments to assess the restorative potential of different environments. This study aimed to adapt and validate the Portuguese version of the Perceived Restorativeness Scale (PRS), an instrument based on Attention Restoration Theory that evaluates the perceived restorative qualities of environments. In Study 1, 410 participants completed the Portuguese PRS, and exploratory and confirmatory factor analyses confirmed a five-factor structure (being away, fascination, coherence, compatibility, and legibility), with good internal consistency and acceptable model fit indices. Measurement invariance analyses showed configural and metric invariance across gender. In Study 2, 212 participants completed the PRS along with additional validated measures: the Sublime Emotion toward Nature Scale (SEN), an aesthetic evaluation of landscapes, and the Positive and Negative Affect Schedule (PANAS). The PRS showed strong convergent and discriminant validity and significantly predicted restorative outcomes. These findings support the psychometric robustness of the Portuguese PRS and its applicability in assessing how people perceive the restorative potential of natural and built environments. This tool may support future research and public policies aiming to promote sustainable environments that foster mental health and well-being.

Keywords: Perceived Restorativeness Scale; restorative environments; psychological well-being; environmental perception; scale validation; green spaces; nature and health

In loving memory of Gabriela, whose passion, wisdom, and warmth continue to inspire this work and those who had the privilege of working with her.

1. Introduction

In recent years, there has been a remarkable increase in research highlighting the psychological benefits of nature (Capaldi et al., 2015; Kaplan, 1995). While some environments and environmental elements can generate stress, others have the potential to facilitate recovery from such states (Browning et al., 2022; Gonçalves et al., 2023). Von Lindern et al. (2017) define restorative environments as those that place less demand on an individual's physiological and psychological resources, thus allowing for the renewal of cognitive resources essential for effective functioning (Hartig et al., 1997). Although, theoretically, any environment may contribute to this process at some point, evidence suggests that certain environments are more likely to become sources of restorative

experiences than others. These environments possess specific features that promote restoration and the replenishment of mental and emotional resources, offering a refuge to alleviate stress and restore mental vitality (e.g., Gonçalves et al., 2023; Hartig et al., 1997; Liu et al., 2022). Understanding restorative interactions between people and the environment is crucial for environmental design, planning, and policy (Kaplan & Kaplan, 1989; Ulrich, 1992) and evaluating the restorative qualities of these interactions can support the practical application of this knowledge (Hartig et al., 1996). According to Hartig et al. (1997), these features can be captured by asking individuals about their perceptions of the environment. Thus, an instrument that evaluates perceived restorativeness can help to identify what people need from the spaces around them. It also guides urban design toward healthier spaces and helps assess the effectiveness of environmental changes, offering valuable insights for public policy and interior design. Based on Attention Restoration Theory (ART), numerous studies have investigated the restorative qualities of various types of environments (see Chen et al., 2017, for a review). A pioneering study in this field by Hartig and colleagues (1997) led to the development of the Perceived Restorativeness Scale (PRS), designed to measure the perceived restorative qualities of environments. Over the past decades, the PRS has been widely recognized as a reliable tool and increasingly used to assess perceptions of restorative features in both natural and built environments (e.g., Pasini et al., 2009). Despite its frequent use in the literature on restorative environments, Pasini et al. (2014) emphasize that the psychometric properties of the scale have not been firmly established. This is partly due to variability in the items used across studies and the fact that most research has focused on applying the scale rather than critically analyzing it (Bodin & Hartig, 2003; Lehto, 2013; Pals et al., 2009; Pasini et al., 2014). That is, there is a lack of studies examining the specific psychometric characteristics of the scale itself (e.g., Pasini et al., 2009), particularly in Portuguese. Therefore, the main objective of this study is to adapt and validate the five-factor version of the PRS proposed by Hartig et al. (1997) for the Portuguese population, analyzing its psychometric properties using various statistical procedures, including cross-validation, predictive, concurrent, and discriminant validity, as well as measurement invariance. Studying the psychometric properties of the PRS is essential to ensure measurement validity and reliability, enhance scientific credibility, allow for appropriate application in different contexts, facilitate comparison across studies, and identify possible improvements to enhance the scale's effectiveness and utility. Furthermore, adapting and validating the scale in Portuguese ensures that the instrument is culturally sensitive and linguistically accurate for Portuguese-speaking individuals, enabling the collection of reliable data and supporting its use in academic, clinical, and research settings across Portuguese-speaking countries, thereby advancing scientific knowledge and understanding of restorative environments in these specific contexts.

1.1. Restorative Environments

Research on restorative environments emerged in the late 1980s and has increasingly gained prominence in the field of environment–behavior studies and landscape research (Hartig et al., 2011). In the domain of environmental psychology, the concept of restorative environments has become increasingly relevant due to its positive impact on mental recovery, stress reduction, and overall psychophysical well-being (Xie et al., 2022). This area of study explores the environmental features that promote psychological well-being, often quantifying such outcomes. Restoration is defined as the recovery of psychological resources that are depleted by everyday demands (Hartig, 2004), encompassing cognitive (e.g., attentional performance), affective (e.g., positive mood, energy), and social aspects (e.g., communication, leadership). In this context, a distinction is made between restoration—recovery from psychological depletion—and instoration, which refers to the strengthening or development of other personal skills or competencies (Hartig, 2017). The literature has largely focused on restoration (Bornioli & Subiza-Pérez, 2023).

Research in this area has been guided by two main theories: Attention Restoration Theory (ART; Kaplan & Kaplan, 1989) and Stress Recovery Theory (SRT; Ulrich, 1993; Ulrich et al., 1991). Both theories suggest that contact with environments that possess certain characteristics can assist in recovering from attentional fatigue and emotional discomfort, thereby improving psychological well-

being. Despite their conceptual differences, research on psychological restoration typically integrates both perspectives (Bornioli & Subiza-Pérez, 2023; Subiza-Pérez et al., 2019).

These theories describe nature, or certain types of natural environments, as primary sources of restorative experiences. ART proposes that restorative environments are identified by four key properties: they provide a sense of psychological distance from everyday concerns (being away), they offer organized and engaging visual content (extent), they are aesthetically pleasing and visually interesting (fascination), and they align with individual needs and preferences (compatibility). While researchers acknowledge that environments with these characteristics may be restorative, they also note that natural environments tend to score higher on these dimensions than urban settings, which often impose greater cognitive demands (Kaplan, 1995; Kaplan & Berman, 2010; Menardo et al., 2021; Zhang et al., 2023). According to Ulrich's SRT, urban environments—particularly those lacking green or blue spaces—are perceived as promoting cognitive and emotional fatigue due to their limited aesthetic value and the presence of noise, traffic, and crowding. From this perspective, built urban settings are not conducive to immediate psychological restoration, whereas natural environments are considered the most effective in supporting emotional recovery (Ulrich, 1991; 1993).

Despite the theoretical distinctions, both ART and SRT converge on a crucial point: contact with nature has the potential to promote human well-being (Capaldi et al., 2015).

1.2. Restorative Environments: Assessment Tools and Measures

Guided by Attention Restoration Theory (ART), numerous studies have explored the dimensions of restorative qualities across different environments (see Chen et al., 2017, for a review). According to Kaplan (1995), the restorative qualities of an environment are understood through four key characteristics: being away, extent, fascination, and compatibility. This structure has been widely used and evaluated in subsequent studies, although various approaches have been adopted to represent and measure the "extent" dimension (Chen et al., 2017). Initially, this dimension included both coherence and scope as subdimensions. In some studies, extent was represented solely by coherence (e.g., Cole & Hall, 2010; Felsten, 2009; Han, 2003; Hartig et al., 1997; Hug et al., 2009; Pals et al., 2009), while in others, it was represented only by scope (e.g., Bagot, 2004; Bagot et al., 2007; Norling et al., 2008). However, some studies incorporated and evaluated both subdimensions of extent (e.g., Kim et al., 2014; Pasini et al., 2014; Payne, 2013). Moreover, in previous studies, the "being away" dimension was subdivided into two distinct components: physical distance (Bagot, 2004), also described as novelty (Laumann et al., 2001; Pals et al., 2009), and psychological distance (Bagot, 2004), referred to as escapism (Laumann et al., 2001; Pals et al., 2009). For example, Payne (2013), in developing a scale to assess restoration in soundscapes, divided "being away" into "being-away-from" and "being-away-to." In summary, various studies have been conducted to measure and understand how different aspects of environments can positively influence mental and emotional restoration. Notable examples include the Restorative Components of Environments Scale (Laumann et al., 2001), composed of 22 items across five factors, with an additional dimension called "novelty"; the Perceived Restorative Characteristics Questionnaire, based on five factors and focused on restoration in environments such as zoos (Pals et al., 2009); and the Restorative State Scale, developed to assess changes in an individual's restorative state (Van den Berg et al., 2014).

In this context, the pioneering study by Hartig and colleagues (1997) stands out, as they developed the Perceived Restorativeness Scale (PRS) to assess perceived restorative qualities in environments. Although initially inspired by ART and based on the four components contributing to restoration (Kaplan, 1995), the latest version of the PRS proposed by the authors divides the "extent" construct into two distinct factors: coherence and scope (Hartig et al., 1997). The PRS is a 26-item scale designed to measure five restorative factors present to varying degrees, in an environment: (1) being away – it is essential that a restorative environment provides a sense of distance, allowing individuals to escape daily distractions and obligations. This involves letting go of specific thoughts and goals to experience tranquillity (Kaplan & Kaplan, 1989); (2) fascination – considered a core element of a restorative experience, fascination involves an effortless attention response to natural stimuli, relieving mental fatigue. It includes attraction to specific elements and is fundamental for exploration

and understanding of an environment (Berto, 2005; Kaplan, 1995); (3) coherence – refers to a physically or conceptually cohesive environment that supports exploration and interpretation; (4) scope – refers to environmental features that extend in time and space, creating a sense of immersion and the possibility of spending time in the setting; and (5) compatibility – refers to the alignment between the environmental support for intended activities and individual inclinations (Berto, 2005; Pasini et al., 2009; Purcell et al., 2001).

Given the inconsistencies between dimensions and subdimensions, Pasini et al. (2014) noted that since the original work by Hartig et al. (1997), few studies have focused on assessing the psychometric properties of the scale. Noteworthy validations of the PRS have been carried out in Japanese (Shibata et al., 2008), Italian (Pasini et al., 2009), German (Hug et al., 2009), and Spanish, where it has been widely used, including in Spain (Hernández & Hidalgo, 2005) and Mexico (Martínez-Soto & Montero, 2010). A study also aimed to develop a shortened version of the PRS (Pasini et al., 2014).

In short, as previously mentioned, there is no validated version of the PRS in Portuguese, and the factorial structure of the scale remains an open question. Therefore, the present study aims to test the psychometric characteristics of the Portuguese version of the PRS.

1.3. The Present Investigation

Overall, the aim of this investigation is to obtain a quantitative instrument, characterized by its validity and reliability, capable of assessing the restorative effect of environments. The lack of tools that allow for the analysis of how environmental settings influence individuals' recovery processes in their daily lives led us to the adaptation and validation of the Perceived Restorativeness Scale (PRS) for the Portuguese population, carried out through two studies. The first study focuses on construct validity through cross-validation, including exploratory and confirmatory factor analyses, internal consistency analysis, and measurement invariance across gender. The second study addresses the convergent, discriminant, and predictive validity of the PRS. These approaches aim to provide a comprehensive assessment of the instrument's quality and utility for future research and application.

2. Study 1

In Study 1, the aim was to assess the construct validity of the Portuguese version of the PRS through cross-validation procedures, including exploratory and confirmatory factor analyses (EFA and CFA), internal consistency analysis, and measurement invariance across gender.

2.1. Methodology

2.1.2. Sample

The sample consisted of 410 participants, the majority of whom were female (62.7%), with ages ranging from 16 to 85 years (M = 28.40; SD = 13.25). Most participants were single, divorced, or widowed (81.5%) and had completed secondary education or technical/vocational training (65.4%). Regarding professional background, the majority worked in non-specified sectors (73.2%), while smaller proportions were employed in tourism/hospitality (1.7%), law (1.2%), and biomedical/health-related fields such as nursing, nutrition, and dietetics (3.4%), among others.
In terms of residential environment, most participants had lived in urban areas during childhood (47.6%) and currently reside in urban settings (68.0%).

2.1.3. Instruments

To assess the restorative potential of an environment, this study adopted a subjective evaluation approach (Negrín et al., 2017), based on the perceived components of restoration as described in the Attention Restoration Theory. The instrument used was the Perceived Restorativeness Scale (PRS), originally developed by Hartig and colleagues, who were the first to propose a measure focused on restorative properties. The scale was later refined and published in 1996 and 1997 (Hartig et al., 1996b; Hartig et al., 1997b). This multidimensional scale comprises 26 items rated on a 7-point Likert scale

(1 – Not at all; 7 – Completely), distributed across five factors: being away (items 1–5), fascination (items 6–13), coherence (items 14–17), compatibility (items 18–22), and legibility (items 23–26). In the original study, the subscales demonstrated good reliability, with acceptable internal consistency coefficients (αs > .75). In addition to the PRS, participants answered a brief set of sociodemographic questions (e.g., age, marital status, gender, and type of environment experienced in childhood and currently). For face validity purposes, a back-translation procedure was conducted following Hambleton et al. (2004). The scale was first translated from English into Portuguese independently by two bilingual translators. These two versions were then back-translated into English by two other bilingual individuals working independently. The translated versions were compared with the original, and necessary adjustments were made in collaboration with experienced psychology professionals to produce a final version. A pre-test was then conducted with 15 individuals (not included in the final sample) to assess clarity and identify potential issues in comprehension. The Cronbach's alpha obtained in this pilot phase was above .70, and no comprehension problems were reported. The Oviedo Infrequency Scale (Fonseca-Pedrero et al., 2009) was included to detect and exclude participants who may have responded in a random, pseudo-random, or dishonest manner.

2.2. Procedures

2.2.1. Data Collection

This study followed all ethical principles required for research involving human participants. The research protocol was approved by the Ethics Committee Board and the Data Protection Officer from University of the Algarve, which oversees the ethical standards and procedures applied. Data collection was conducted via printed questionnaires and email distribution, using a self-report protocol with an average completion time of approximately 15 minutes. Participants were fully informed about the study, including details on informed consent, data protection, anonymity, confidentiality, non-discrimination, and the voluntary nature of participation, with the right to withdraw at any time. Data collection took place between March and October 2024, and only fully completed questionnaires were included in the final analysis.

2.2.2. Data Analysis

Data were analysed using SPSS (Statistical Package for the Social Sciences) and SPSS AMOS, version 28.0, adopting a significance level of 0.05. The psychometric properties of the Perceived Restorativeness Scale were assessed through exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and internal consistency analysis. To verify cross-validation, the sample was randomly divided into two independent groups: 195 participants were used for CFA, and 215 for EFA. Cross-validation is a methodological approach used to empirically assess the replicability of results across samples and is essential for ensuring the reliability and generalizability of findings. Construct validity was assessed through EFA using the maximum likelihood method and Varimax orthogonal rotation. Several fit indices were considered, including chi-square (χ^2), the relative chi-square (CMIN/DF), Comparative Fit Index (CFI), Goodness of Fit Index (GFI), and Root Mean Square Error of Approximation (RMSEA). Internal consistency was assessed using Cronbach's alpha, with values above 0.70 considered acceptable. These analyses were conducted to ensure the quality and validity of the measurement tools used in the study.

3. Results

3.1. Descriptive Statistic

Table 1 presents the descriptive statistics for the Perceived Restorativeness Scale, including means, standard deviations, skewness, and kurtosis indices. Item means ranged from 1.69 (item 17) to 6.40 (item 13), based on a 7-point Likert scale (1 – Not at all; 7 – Completely). Item-total correlations ranged from −0.138 to 0.714, being reasonably high for most items, indicating that they contribute positively to the overall scale. Regarding skewness (−2.240 to 3.794) and kurtosis (−0.941 to 4.643), the

variation in values supports the assumption of normal distribution, as values remained below 2 and 7, respectively (Bentler & Wu, 2002; Curran et al., 1996; Finney & DiStefano, 2006). Cronbach's alpha if the item were deleted ranged from 0.885 to 0.903, with all values above the acceptable threshold of 0.70, confirming good internal consistency across all items. All items also explained a substantial amount of variance (R^2 ranging from 0.146 to 0.714).

Table 1. Descriptive statistics of items.

Item	M	SD	Corrected item-total correlation	Sk $SE = 0.12$	Ku $SE = 0.24$	R^2	Cronbach's alfa (α) if item deleted
1	5.71	1.561	0.484	-1.478	1.697	0.455	0.891
2	6.08	1.323	0.497	-1.746	3.016	0.518	0.891
3	6.02	1.321	0.429	-1.591	2.408	0-554	0.892
4	5.66	1.378	0.468	-1.158	1.251	0.543	0.891
5	5.41	1.541	0.484	-0.988	0.534	0.534	0.891
6	6.04	1.221	0.651	-1.287	1.141	0.631	0.888
7	5.69	1.365	0.571	-1.095	0.814	0.486	0.889
8	5.60	1.625	0.499	-1.067	0.344	0.486	0.890
9	5.30	1.611	0.509	-0.599	-0.608	0.529	0.890
10	5.26	1.607	0.461	-0.774	-0.129	0.449	0.891
11	6.24	1.346	0.423	-2.059	3.794	0.381	0.892
12	6.05	1.352	0.602	-1.675	2.448	0.595	0.889
13	6.40	1.177	0.302	-2.240	4.643	0.321	0.894
14	3.70	1.827	0.403	0.335	-0.941	0.395	0.893
15	1.92	1.375	-0.138	1.673	2.293	0.520	0.903
16	2.63	1.705	0.146	0.957	-0.157	0.398	0.899
17	1.69	1.304	-0.100	2.232	4.608	0.501	0.902
18	5.39	1.553	0.690	-0.972	0.348	0.595	0.886
19	5.32	1.623	0.699	-0.944	0.199	0.624	0.886
20	5.17	1.784	0.703	-0.812	-0.315	0.666	0.885
21	5.41	1.541	0.714	-0.893	0.035	0.655	0.886
22	5.41	1.556	0.697	-0.957	0.304	0.629	0.886
23	5.00	1.791	0.582	-0.673	-0.591	0.558	0.888
24	5.14	1.841	0.481	-0.737	-0.497	0.585	0.891
25	5.03	1.718	0.490	-0.572	-0.631	0.676	0.891
26	4.99	1.669	0.468	-0.566	-0.424	0.634	0.891

N = 411. The total scale α = .895. Each item was rated on a 7-point scale to indicate the extent to which the given statement describes their experience in the given setting.

3.2. Exploratory Factor Analysis (EFA)

To examine the underlying structure of the Perceived Restorativeness Scale, an exploratory factor analysis was conducted. The Kaiser-Meyer-Olkin (KMO) measure indicated sampling adequacy with a value of 0.889 (Bartlett's Test of Sphericity = 3260.259; df = 325; p < 0.001). Maximum likelihood extraction with Varimax rotation revealed a five-factor solution explaining 66.99% of the total variance. Table 2 shows that items 11 and 13 loaded on Factor 5 instead of Factor 2, as proposed in the original version.

Table 2. Main components extracted from PRS (factor weights and communalities).

	Factor					Communalities
	1	2	3	4	5	

Item 1	0.571				0.538
Item 2	0.689				0.576
Item 3	0.717				0.672
Item 4	0.759				0.649
Item 5	0.701				0.593
Item 6		0.493			0.745
Item 7		0.643			0.611
Item 8		0.664			0.588
Item 9		0.755			0.559
Item 10		0.697			0.561
Item 11				0.397	0.518
Item 12		0.480			0.653
Item 13				0.456	0.427
Item 14				0.358	0.457
Item 15				0.782	0.584
Item 16				0.537	0.463
Item 17				0.809	0.614
Item 18			0.639		0.648
Item 19			0.755		0.711
Item 20			0.715		0.707
Item 21			0.730		0.744
Item 22			0.682		0.723
Item 23				0.615	0.584
Item 24				0.824	0.651
Item 25				0.817	0.688
Item 26				0.749	0.673

3.3. Confirmatory Factor Analysis (CFA)

The 26 items of the PRS were subjected to confirmatory factor analysis (CFA) using maximum likelihood estimation. The model showed acceptable fit indices: $\chi^2(289) = 622.135$, resulting in a CMIN/DF of 2.15, which is considered a good indicator of model fit (Byrne, 2001). The values for CFI (0.845), NFI (0.751), and TLI (0.812) were close to 1, suggesting acceptable fit (Bentler, 1990; Byrne, 2001; Marôco, 2011). The RMSEA value (0.07) also fell within the acceptable range (Hu & Bentler, 1999; Ullman, 2006). However, it is important to note that models with small samples and low degrees of freedom may produce artificially inflated RMSEA values (Kenny et al., 2015). Given the results from the exploratory analysis, a second model was tested in which items 11 and 13 were loaded on Factor 5. However, model fit did not improve, as shown in Table 3.

Table 3. Goodness-of-fit indices of the Perceived Restorativeness Scale.

	χ^2	df	CMIN/df	CFI	RMSEA	TLI	NFI
Original structure	622.135	289	2.15	0.845	0.07	0.812	0.751
Item 11 and 13 on factor 5	715.082	289	2.474	0.802	0.08	0.759	0.714

3.4. Reliability

The reliability of the Perceived Restorativeness Scale was assessed using Cronbach's alpha coefficient. The total scale showed a Cronbach's alpha of 0.87. The subscales yielded the following reliability values: Being Away (items 1–5; α = .83), Fascination (items 6–13; α = .84), Coherence (items 14–17; α = .70), Compatibility (items 18–22; α = .90), and Legibility (items 23–26; α = .87). All dimensions demonstrated acceptable internal consistency.

3.5. Measurement Invariance Across Gender

A multi-group analysis was first conducted using the unconstrained model, which indicated acceptable model fit for both male and female groups (configural invariance): $\chi^2(578) = 1486.789$, CMIN/df = 2.572, p < 0.001; NFI = 0.75; CFI = 0.83; TLI = 0.79; RMSEA = 0.06 (see Table 4). Based on this baseline model, further models with increasing constraints were tested to assess measurement weights and structural covariances. Comparison of the unconstrained model with the metric model (measurement weights) revealed no significant differences (df = 26; $\Delta\chi^2$ = 20.29; p = 0.502), thus supporting the invariance of factor loadings across gender. However, the comparison with the scalar model (measurement intercepts) showed significant differences (df = 21; $\Delta\chi^2$ = 45.69; p = 0.010), indicating that imposing constraints on item intercepts negatively impacted model fit. Finally, the comparison between the unconstrained model and the structural covariance model (df = 15; $\Delta\chi^2$ = 79.03; p = 0.000) revealed significant differences, suggesting factorial variance in how men and women interpret the construct of perceived restorativeness. In other words, the results demonstrate that men and women differ in how they perceive and respond to the dimensions of the Perceived Restorativeness Scale.

Table 4. Models fit indexes.

	χ^2	df	CMIN/df	CFI	RMSEA	TLI	NFI
Unconstrained	1486.789	578	2.572	.827	.063	.789	.750
Measurement Weights (metric)	1507.088	599	2.516	.827	.061	.797	.746
Measurement Intercepts (scalar)	1552.779	625	2.484	.823	.061	.801	.739
Structural Covariance	1586.127	640	2.478	.819	.061	.802	.733

4. Study 2

As part of the ongoing validation process of the Portuguese version of the Perceived Restorativeness Scale (PRS), the second study aimed to assess the scale's convergent, discriminant, and predictive validity. To this end, variables theoretically related to the perception of restorative environments were included to examine whether the PRS is coherently associated with relevant constructs in the fields of environmental psychology and well-being.

Three complementary measures were used in this study. The first, the Sublime Emotion toward Nature (SEN) scale, assesses transcendental emotions evoked by nature, such as awe and inspiring energy. These emotions reflect a deep and positive connection with the natural environment and have been associated with the perception of psychological restoration. The second measure, Aesthetic Evaluation of the Landscape, allows for the analysis of the subjective perception of environmental aesthetic attributes, such as naturalness, maintenance, and visual openness—features often linked to the attractiveness and restorative potential of spaces. Finally, the Positive and Negative Affect Schedule(PANAS) was used to measure the positive and negative emotions experienced, enabling an analysis of how perceived restorativeness relates to participants' emotional states. Including these variables allowed for testing whether the PRS correlates consistently with aesthetic appreciation, positive nature-related emotions, and positive affect, as well as negatively with negative affect, as predicted in the literature. In addition, the predictive power of the PRS on perceived restoration outcomes was tested, contributing to a more comprehensive evaluation of the instrument's external validity.

4.1. Methodology

4.1.1. Sample

The sample consisted of 212 participants, the majority of whom were female (70.8%), with ages ranging from 18 to 73 years (M = 30.22; SD = 13.23). Most participants were single, divorced, or widowed (73.6%) and had completed secondary education or technical/vocational training (54.2%).

In terms of educational background, the most represented fields were Psychology (25.2%), Management/Economics (17.8%), and Architecture (8.9%). Other areas such as Education, Tourism, Health, and Law had lower representation. Regarding residential environment during childhood, most participants reported having lived in urban areas (45.2%), followed by rural (28.1%) and semi-urban (26.7%) settings. Currently, 69.0% of participants reside in urban areas, while 20.5% live in semi-urban areas and 10.5% in rural areas.

4.1.2. Instruments

In addition to the *Perceived Restorativeness Scale* validated in Study 1, the following instruments were used:

Sublime Emotion toward Nature (SEN) – Developed by Bethelmy and Corraliza (2019), this 18-item scale assesses transcendental emotions evoked by nature. It is structured into two main factors: Awe, which reflects feelings of reverence and vulnerability in response to nature's grandeur, and Inspiring Energy, which captures sensations of vitality, joy, and connectedness with the natural environment. Items are rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument is widely used to understand how nature elicits deep, restorative emotional experiences.

Aesthetic Evaluation – Perception of landscape aesthetics was assessed using the scale developed by Sevenant and Antrop (2009), which includes cognitive evaluations of specific landscape attributes. Unlike previous studies where participants viewed images of landscapes, in this study, they were asked to imagine the most beautiful and pleasant landscape they know and respond based on that mental image. Sixteen landscape attributes were evaluated on a 7-point scale, covering dimensions such as care and maintenance, naturalness, disturbance, openness, among others.

Positive and Negative Affect Schedule (PANAS) – To assess participants' positive and negative affective states, the Portuguese version of the PANAS (Watson et al., 1988), adapted by Galinha and Pais-Ribeiro (2005), was used. The scale consists of 20 adjectives describing emotional states: 10 positive (e.g., enthusiastic, inspired, determined) and 10 negative (e.g., distressed, nervous, guilty). Participants rated the extent to which they experienced each affective state when thinking about their chosen landscape, using a 5-point Likert scale (1 – very slightly or not at all; 5 – extremely).

Restoration Outcome Scale (ROS) – The perception of restorative experiences was assessed using the Restoration Outcome Scale (ROS), developed by Korpela et al. (2008). The scale consists of six items reflecting feelings of relaxation and calm (e.g., "I feel calmer after being here"), attention restoration ("My concentration and alertness clearly increase here"), and mental clearing ("Visiting this place helps me forget everyday worries"). Items are rated on a 7-point Likert scale (1 = not at all; 7 = completely).

4.1.3. Data Collection and Analysis Procedures

The data collection procedures were the same as those used in Study 1. Data were analysed using SPSS (version 28.0), adopting a significance level of 0.05. To assess the convergent and discriminant validity of the Perceived Restorativeness Scale (PRS), Pearson correlation analyses were conducted with theoretically related variables: Sublime Emotion toward Nature (SEN), Aesthetic Evaluation, and PANAS (Positive and Negative Affect). Additionally, a multiple regression analysis was performed to test the predictive validity of the PRS in relation to self-reported restoration outcomes.

5. Results

5.1. Convergent and Discriminant Validity

To assess convergent validity, correlations between the PRS and the Aesthetic Evaluation scale, PANAS Positive, and the Sublime Emotion toward Nature scale were examined. Table 5 shows that the PRS correlated positively and significantly with all these variables (r > .513; p < .001). For discriminant validity, a negative correlation was observed between the PRS and the PANAS Negative dimension (r = −.165; p < .05).

Table 5. Correlations among study variables.

	PRS	AE	PP	PN
PRS	-			
Aesthetic Evaluation (AE)	.513**	-		
PANAS Positive (PP)	.558**	.242**	-	
PANAS Negative	-.165*	-.087	-.515**	-
SEN	.639**	.320**	.501**	-.046

5.2. Predictive Validity

To assess the predictive validity of the PRS in relation to restorative outcomes, a multiple regression analysis was conducted. The results showed that the PRS significantly predicted approximately 33% of the variance in restoration outcome (β = .575; t(211) = 10.195, p < .001).

6. Discussion

The main objective of this study was to adapt and validate the Portuguese version of the Perceived Restorativeness Scale (PRS), based on the five-factor model proposed by Hartig et al. (1997). The results support the psychometric adequacy of the Portuguese version, reinforcing the applicability of the instrument across different cultural contexts and contributing to the consolidation of a robust tool for studying perceived restorative qualities of environments. The factorial structure of the scale was generally consistent with the original model, revealing five conceptually coherent factors aligned with the principles of Attention Restoration Theory (ART) by Kaplan and Kaplan (1989): being away, fascination, coherence, compatibility, and legibility (an expanded version of the original "extent" dimension). These findings are in line with previous validations of the PRS in other languages (e.g., Pasini et al., 2009; Shibata et al., 2008), supporting the robustness of its factorial structure.

ART posits that restorative environments have features that support the recovery of directed attention following prolonged cognitive effort. The current findings suggest that Portuguese participants recognized these features, providing empirical validation of ART within the Portuguese population. Additionally, the results lend support to Stress Recovery Theory(SRT) by Ulrich (1993), showing that environments perceived as restorative are associated with higher levels of positive emotions and lower levels of negative affect, consistent with the beneficial emotional effects expected from exposure to nature.

Regarding convergent and discriminant validity, the PRS showed significant correlations with aesthetic evaluations of environments, transcendental emotions related to nature (SEN), and positive affect. Its negative correlation with negative affect further reinforces the utility of the PRS in understanding emotional responses to the environment. These findings confirm that environments perceived as restorative are not only rated more aesthetically pleasing but also promote more positive and inspiring emotional states, as suggested in the literature (e.g., Berto, 2005; Capaldi et al., 2015).

The predictive validity of the PRS was also demonstrated, as the scale explained a significant proportion of the variance in perceived restoration outcomes. This is particularly relevant as it highlights the practical utility of the scale for assessing the psychological impact of environments, with potential applications in urban planning, the design of public spaces, and the promotion of well-being in therapeutic or educational contexts.

However, this study is not without limitations. First, although the sample size was adequate, it was non-probabilistic and not representative of the Portuguese population, which limits the generalizability of the findings. Second, the data were based on self-report measures, which may be subject to social desirability bias or selective memory. Furthermore, responses were based on imagined or previously experienced environments rather than controlled exposure to real physical settings, which may affect the accuracy of perceived restorativeness. Finally, measurement invariance across gender revealed significant differences at the scalar and structural covariance levels, suggesting that men and women may interpret or value the scale's dimensions differently.

For future research, it is recommended that the study be replicated with more representative and diverse samples (e.g., by region, age group, socioeconomic status), and that the PRS be applied in real-world contexts using experimental protocols involving controlled exposure to natural and urban environments. Longitudinal studies could also explore the effects of repeated exposure to restorative environments on psychological health and cognitive performance. It would also be valuable to test the PRS in clinical populations or educational settings to assess its potential for supporting interventions in mental health, well-being, and learning. Finally, further analysis of measurement invariance across other sociodemographic and cultural groups is advised to ensure the cross-cultural applicability of the Portuguese version of the scale.

7. Conclusion

The results of this study confirm that the Portuguese version of the Perceived Restorativeness Scale (PRS) is a valid and reliable instrument for assessing the perception of restorative qualities in environments. Its adaptation to the Portuguese context represents a valuable contribution to research and practice in public health and environmental sustainability, providing a sensitive measure of the psychological impact of physical spaces—particularly green and natural areas—on population well-being. At a time when urban planning and environmental policy must balance ecological concerns with human needs, the PRS offers a useful evidence-based tool to support decision-making. It can be applied to the evaluation of urban parks, therapeutic gardens, green infrastructure, or rehabilitation spaces, promoting urban design practices that foster psychological recovery, stress reduction, and mental health. Moreover, it may be used in studies aimed at monitoring the effects of exposure to natural environments on vulnerable populations such as the elderly, individuals with chronic illnesses, or healthcare professionals—contributing to the development of more sustainable, human-centered strategies. Thus, the validation of the PRS in Portuguese not only strengthens its international applicability but also establishes it as a strategic tool for promoting a balanced approach to environmental and human health, aligned with the principles of green and sustainable health advocated by this journal.

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