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How to Measure The Restorative Quality of Environments: The PRS-11

Margherita Pasini ^a *, Rita Berto ^a, Margherita Brondino ^a,
Rob Hall ^b, Catherine Ortner ^c

^a Department of Philosophy, Pedagogy and Psychology, University of Verona, Via San Francesco 22, Verona 37129, Italy

^b Environmetrics Pty Ltd, PO Box 793, Pymble NSW 2073 Australia

^c Department of Psychology, Thompson Rivers University, 900 McGill Rd, Kamloops BC V2C 0C8, Canada

Abstract

The Perceived Restorativeness Scale (PRS) has been reported relatively frequently in the literature, despite the psychometric and factorial properties of the scale not being well established. We argue that a detailed understanding of the meaning of individual items is the proper starting point for scale development and used this approach to develop shorter (11-item rather than 26-item) parallel versions in both Italian and English. Data collected from samples of Italian ($n = 230$) and English speakers ($n = 100$) were analysed by Confirmatory Factor Analysis (CFA), comparing a 5 models based on previous published research and underlying theory. A four-factor model that mirrored four elements of Attention Restoration Theory (ART) had the best fit to the data. The resulting composite scale was invariant across nationality and gender.

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1. Introduction

Despite the fact that use of the Perceived Restorativeness Scale (PRS); (Hartig, Kaiser, & Bowler, 1997a) has been reported relatively frequently in the literature dealing with the extent to which particular environments have restorative qualities, our review of this literature suggests that the psychometric properties of the scale have not been established in a definitive way. In part, this is because some items vary from study to study and in part because the majority of studies are aimed at using rather than analyzing the scale (Bodin & Hartig, 2003; Lehto, 2013; Pals,

* Margherita Pasini. Tel.: +30-045-802-8558
E-mail address: margherita.pasini@univr.it

Steg, Siero, & Van der Zee, 2009; Norling, Sibthorp, Ruddell, 2008). The PRS is based on the Attention Restoration Theory (ART; Kaplan, 1995) and it was initially made up of 26 items aimed to measure an individual's perception of 5 restorative factors assumed to be present to a greater or lesser extent in the environment. These factors are physical and/or psychological "being-away" from demands on directed attention; "fascination" a type of attention assumed to be effortless and without capacity limitations; the "coherence" and "scope" perceived in an environment; the "compatibility" between one's inclinations and environmental demands (for more details see Berto, 2005; Purcell, Peron, Berto, 2001). As originally formulated, ART focussed on 4 restorative factors: being-away, fascination, extent and compatibility. However, extent was subsequently thought to comprise two elements: the "coherence" and the "scope" of an environment. Since Hartig et al.'s work (1997a) there have been only two published studies aimed at assessing the psychometric characteristics of the scale (Pasini Berto, Scopelliti, & Carrus, 2009; Han, 2003). Given the differences in the items across studies, it is difficult to match PRS factor solutions to each other and in a precise way to ART. The articles describing the initial development of the PRS (Hartig et al., 1997a; Hartig, Korpela, Evans, Gärbling, 1997b) do not provide a detailed rationale for the item development and, hence, the likely validity of any particular item.

In the research described here, we set out to do two things. The first was to develop a shorter version of the PRS to make it more suitable for use in research contexts where time is limited, and the second was to establish the psychometric properties of the items and overall scale in a more robust way. We began the review of each item in the original scale using cognitive interviewing with Italian, Canadian and Australian subjects to gain a better understanding of the language used by laypeople when discussing the restorative quality of environments. This process also gave us a better understanding of how people interpreted the existing wording of the items and the link between the items and the theoretical a-priori factors (ART; Kaplan, 1995). Developing a scale that can be used in multiple languages presents a number of challenges. For example, differences in the verb tenses between the Italian and English versions of the 26-item PRS affected the interpretation of "being away". The present tense produced the greatest degree of clarity in people's understanding of the items and this tense was adopted for the development of the shorter scale in both languages. In line with previous research (Hinkin, 1995; Pals et al., 2009), our interviews showed it to be important to avoid double negation and to use positive wording.

A comparison of the high Alpha value for the 26-item PRS (0.94, Berto, 2007: 0.95; Pasini et al., 2009) with the Alpha for a scale with only 5 items (0.79; Berto, 2005) suggested that the alpha measure may not be telling us anything very helpful. This suggested that not only the number of items matters but also their meaning needed review.

Even the PRS's authors struggled to settle on (i) the number of items making up the scale and (ii) the factorial structure (Hartig et al., 1996). However, across published studies, two components of a restorative experience are consistently identified present in each analysis: "being-away" and "fascination" (Pasini & Berto, 2007; Pasini et al., 2009; Purcell et al., 2001). These are the core features of the ART (Kaplan, 1995; Kaplan & Kaplan, 1981).

From our exploratory analysis and from our review of the literature it turns out that the "compatibility" items have not loaded onto a separate factor in any convincing way (Hartig et al., 1997a; Pals et al., 2009; Pasini & Berto, 2007). This may be due to a conceptual problem in that "compatibility" is a loose kind of personality measure embedded in the ART. Consequently, we did not include the compatibility items when developing the shorter scale being described here.

2. Method

2.1. Participants

This study involved 330 participants, 230 from Italy and 100 from Canada. Mean age was 23.5 years (from 18 to 45, sd 6.08), and 55.7% were females.

2.2. Material

Ten colour photographs of outdoor environments were used. The photographs spanned the range from totally natural to totally built environments as well as the entire range from low to high preference and restorativeness scores

(Berto, 2005, 2007; Hernandez et al., 2001; Purcell et al., 2001). The photographs represented five environmental categories (two photographs per category): Industrial zone, housing, city streets, hills, lakes.

2.3. Measurement instrument

Seventeen items were selected from the original 26-item version of Hartig et al.'s (1997a) and Pasini et al.'s (2009) instruments, and in some cases modified, using the cognitive interview technique (Willis, 2005) and recommendations from previous research. The original 6 being-away items were all preserved, while one of the 7 fascination items was considered to be tapping the scope dimension (Tenngart & Hagerhall, 2008). Finally, two scope items; one coherence item and the 6 compatibility items were removed. Both an Italian and an English translation were drafted by native speakers and checked by reverse translation. Subject's judgments were made on a 0 to 10-point scale, where 0 = not at all, 6 = rather much, and 10 = completely.

2.4. Procedure

Participants were randomly assigned to 10 subgroups. One of the 10 photographs was randomly assigned to each subgroup. Subjects received a copy of the PRS-17 and a sheet with the following instructions: *We are interested in how you experience this environment. To help us understand your experience, we have provided the following statements for you to respond to. Please read carefully, then ask yourself: "how much does this statements apply to my experience there?". To indicate your answer, circle only one numbers on the rating scale beside the statement. A sample of the rating scale is given below and at the top of each subsequent page. So, for example, if you think that the statement does not at all apply to your experience of the environment, then you would circle "0" (not at all), if you think it applies rather much, then you would circle "6" (rather much), but if you think that it apply very much, you would circle 10 (very much).* If the subject correctly understood the instruction then the photo was shown. Subjects had to rate each item of the PRS-17 in relation to the photograph.

2.5. Data analyses

Confirmatory Factor Analysis (CFA) was used to find the best factor structure of the scale, using both the ART concepts and previous factorial studies to inform the analysis. In a second step, the best model was tested for measurement invariance across pictures, gender and country. Finally, ANOVA was used to check differences in the ratings across the different environmental categories.

3. Results

Five models were compared (see Table 1) using CFA. At first the model with 17 items predicted by 3 latent factors (Being away, Fascination and Extent) was estimated (Model 1). It should be noted that the Fascination item 10 in Hartig et al.'s scale (1997a) ("Places like that are large enough to allow exploration in many directions"), also included in this 17-item version, has been interpreted as a Scope item following Tenngart & Hagerhall's suggestion (2008). Model 1 showed bad fit indexes and some very low factor loadings (e.g. .39). Therefore, we decided to delete some items from the scale. This process was guided by previous findings in the restorativeness literature and by the examination of the item statistics and modification indexes from the CFA analysis. We chose to maintain items common to previous research and to eliminate items with low factor loadings, and also items that have been found to be problematic in previous studies. At the end of this process, 11 items remained, and some alternative models were estimated to compare with some of the more convincing factor structures reported in the literature. First, we analysed a model (Model 2) with 11 items predicted by a general factor. Factor loadings ranged from .25 to .83 and fit indexes were unacceptable. A third estimated model (Model 3) followed suggestions by Herzog (2003) and Tenngart & Hagerhall (2008), and was composed of 3 factors: Being away (3 items), Fascination (3 items) and Extent (5 items). Model 3 showed a great improvement in all fit indexes, but some factor loadings remained problematic (e.g. .34). We decided to estimate models that assumed the two components of Extent (Coherence and Scope) as distinct. Therefore, the fourth model (Model 4) was composed by 3 factors (Being away, Fascination and

Coherence) following Hartig and Purcell's suggestions (Hartig et al, 1997a; Purcell et al., 2001). Each factor predicted 3 items. Fit indexes were excellent and factor loadings ranged from .43 to .88. The last model (Model 5) added the two-item Scope dimension. Fit indexes were good, even if worse than Model 4, but showed, on average, higher factor loadings than Model 4. On the basis of its statistical characteristics and the fact that a four dimensional model might provide a more complete picture of restorativeness, we chose this final model to use for further analysis (see Appendix A for the PRS-11 final version).

Table 1. Fit indexes and comparisons between the alternative models; BA =being-away, FA = fascination; EXT = extent; COH = coherence; SCO = scope

Competitive models	χ^2 (df)	$\Delta\chi^2$ (df)	CFI	TLI	RMSEA	SRMR	AIC	BIC
Model 1. Four factors (BA, FA, EXT) – 17 items	528.51(116)		.85	.83	.10	.07	602.51	743.07
Model 2. General factor – 11 items	267.71 (44)	260.80 (72)***	.86	.82	.12	.07	311.71	395.29
Model 3. Three factors model (BA, FA and EXT) – 11 items	146.09(40)	121.61 (3)***	.93	.91	.09	.05	198.09	296.87
Model 4. Three factors model (BA, FA and COH) – 9 items	62.57 (23)	83.52 (17)***	.97	.95	.07	.04	106.57	190.15
Model 5. Four factors (BA, FA, COH and SCO) – 11 items	111.27(38)	48.70 (14)***	.95	.93	.08	.04	169.27	279.44

** p<.001

The results of the multi-group analysis, to test the invariance of the factor structure, showed that the model is strongly invariant across countries ($\Delta\text{CFI}=.008$; $\Delta\text{RMSEA}=.001$), whereas not only strong invariance, but also strict invariance (factor loadings, item intercepts, and item uniqueness invariance) was found across genders ($\Delta\text{CFI}=.004$; $\Delta\text{RMSEA}=.006$). A failure of the calculations to converge meant that we were unable to test the invariance across the stimulus images.

In order to assess whether the PRS-11 discriminates among environmental categories, a one-way ANOVA were performed. This analysis showed that the PRS-11 scores of the five environmental categories differ from one another [$F_{(4,330)}=24.474$; $p<.001$; effect size was moderate: $\eta^2=.23$]. Post-hoc comparisons (with Bonferroni correction) showed that hills and lakes had the highest PRS scores, followed by housing and city streets with significantly lower PRS scores. Industrial zone had the lowest PRS score.

4. Conclusion and discussion

In case of self-rating instruments one could argue that when research subjects use the scale to rate the same stimulus, they respond in various ways depending on their prior experiences, their interpretation of the wording, and the stimulus attributes. In contrast, ART assumes our "prior experience" in relation to natural stimuli to be the same (see Wilson's biophilia hypothesis, 1984; Kaplan's psycho-evolutionary perspective, in Kaplan & Kaplan, 1989): From the Wilson and Kaplan perspective, human beings are biologically organised to respond to natural environments in a direct way, i.e. by experiencing and reporting strong preferences and high levels of potential restorativeness. While developing a short form of the PRS, we have shown that the semantic aspects of a scale item make a substantial difference in the way people assess environmental stimuli. Importantly, we have demonstrated that beginning with cognitive interviewing do develop an in-depth understanding of the meaning of each item resulted in a scale that was independent of subject's gender and nationality. More research is needed in this direction to define an instrument completely independent from stimulus attributes as well. This kind of independence is fundamental for a self-rating scale to be a good measurement instrument.

Appendix A.

The PRS-11 (in brackets the original number and factor in Hartig et al.'s 1997a scale)

Fascination

Places like that are fascinating (FA 12)

In places like this my attention is drawn to many interesting things (FA 7)

In places like this it is hard to be bored (FA 11)

Being Away

Places like that are a refuge from nuisances (B-A 1)

To get away from things that usually demand my attention I like to go to places like this (B-A 5)

To stop thinking about the things that I must get done I like to go to places like this (B-A 4)

Coherence

There is a clear order in the physical arrangement of places like this (COH 15 Rev)

In places like this it is easy to see how things are organised (COH 26)

In places like this everything seems to have its proper place (new item)

Scope

That place is large enough to allow exploration in many directions (FA 10)

In places like that there are few boundaries to limit my possibility for moving about (new item)

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