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Exploring psychological restoration in favorite indoor and outdoor urban places using a top-down perspective

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ABSTRACT

Most studies on psychological restoration and favorite places have addressed restoration in green or blue outdoor settings whereas the interest around built and indoor settings has been scarce. In this study, we analyzed restorative experiences in favorite indoor and outdoor urban places using a top-down approach by including psycho-environmental variables (nature and urban orientedness, place bonding) and personality traits (Big Five). A sample of 945 university students and staff recruited in 5 western countries (Finland, Spain, The Netherlands, UK and Australia) answered an online questionnaire. In the linear regression models, perceived restorative potential, place attachment and place identification were the strongest predictors of subjective restoration. Personality traits did not play a significant role in restorative experiences. This work extends restoration research by considering the role of indoor, as well as outdoor environments and highlights the role of certain top-down characteristics in restorative experiences.

1. Introduction

Restoration refers to replenishing depleted psychological resources and takes place when a person in a state of mental and or emotional fatigue visits, contemplates or uses a place with certain qualities (Hartig, 2004; Kaplan & Kaplan, 1989; Ulrich, 1993). There is strong evidence for the restorative properties of nature, nature-like or urban-with-nature environments (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Gascon et al., 2015; McMahan & Estes, 2015; Twohig-Bennett & Jones, 2018) and a growing interest in the restorative potential of built and indoor settings (Bornioli, Parkhurst, & Morgan, 2018a; Staats, Jahncke, Herzog, & Hartig, 2016; Stigsdotter, Corazon, Sidenius, Kristiansen, & Grahn, 2017, pp. 145–154; Weber & Trojan, 2018). However, the majority of literature on restoration, detailed in the following sections, has greatly favored nature/green over built/grey settings, and outdoor over indoor settings. This might have been guided by the conception of restoration as an evolutionary-based, and subsequently universal, response towards certain landscape features (Kaplan & Kaplan, 1989; Ulrich, 1993) and might have made researchers and practitioners assume that outdoor and green settings are always more restorative than indoor and built settings respectively. Nevertheless, this may not be the case for everybody and so the purpose of the current study is to broaden our understanding of restoration in the urban context by focusing on favorite urban indoor and outdoor places. More specifically, we are interested in the cognitive and affective benefits emerging from the restoration process, which have been labelled as restorative outcomes elsewhere (Hartig, Lindblom, & Ovefelt, 1998).

Restoration involves a person-environment transaction and as such, may be influenced by characteristics of the person and the environment (top down vs. bottom up respectively). To date there has been greater focus on bottom-up explanations for restoration (e.g. restorative and other qualities of the environment) rather than top-down explanations

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of social and personal variables (e.g. personality traits, cultural variables) (Menatti, Subiza-Pérez, Villalpando-Flores, Vozmediano, & San Juan, 2019; Ratcliffe & Korpela, 2016). Bottom-up explanations draw on research that shows that physical features of places can foster or hinder restoration. Relevant coarse features uncovered to date are views (Elsadek, Liu, & Xie, 2020; Lee, Williams, Sargent, Williams, & Johnson, 2015; Masoudinejad & Hartig, 2020), the presence of green and blue elements (Lindal & Hartig, 2015; Nordh, Hartig, Hagerhall, & Fry, 2009; White et al., 2010), other people (Carrus et al., 2015; Nordh, Alalouch, & Hartig, 2011) and traffic (Peschardt, Stigsdotter, & Schipperrijn, 2014). Personal objects can also trigger positive psychological reactions and might be of particular relevance in indoor places such as the home (Bornioli, Parkhurst, & Morgan, 2018b; Korpela, 1989), although most research so far has focused on outdoor settings. On the other hand, top-down explanations draw on research on favorite places which has centered on psychological bonding to a given place and its associations with restoration (Korpela & Hartig, 1996; Korpela & Ylén, 2009; Korpela, Ylén, Tyrväinen, & Silvennoinen, 2008; Main, 2013).

It is important to distinguish restorative outcomes or experiences from study of perceived restorative potential, or 'restorativeness'. Perceived restorative potential is an individual's appraisal of the restorative qualities of a given place (e.g., whether it possesses the four qualities described in Attention Restoration Theory, and/or would be likely to result in a restorative experience). This has been defined as perceived restorativeness (Hartig, Korpela, Evans, & Gärling, 1997), or simply restorativeness elsewhere (Han, 2018). A 'restorative outcome' (or simply restoration following Han, 2018) refers to achieved physiological and/or psychological recovery through contact with an environment. This outcome might be objectively measured (e.g., through change in physiological arousal or task-based attention performance, as in Ulrich et al., 1991), subjectively measured through change in self-reported psychological state (see, e.g., Bowler et al., 2010, for a review), or subjectively measured via a state measure of restoration (such as the Restoration Outcome Scale; Korpela et al., 2008). In this study, we aim to increase understanding of relationships between restoration and favorite places, both indoor and outdoor. We do so by examining perceived restorative potential and subjectively evaluated restoration in these places; comparing such perceptions in favorite outdoor and indoor places; and investigating the contributing role of top-down variables and physical features.

1.1. Psycho-environmental top-down variables related to restoration

Despite the emphasis on bottom-up explanations for restoration, there are several top-down psychological constructs that likely play a role in restorative experiences. Psychological orientation towards nature or urban settings, also known as nature and urban orientedness, describes the subjective connection that a person may have towards different environments (Ojala, Korpela, Tyrväinen, Tiittanen, & Lanki, 2019; cf. Zelenski & Nisbet, 2014). This connection, which varies among individuals, could explain different patterns in the types of places people select for leisure, as well as the attitudes and preferences people hold towards them. When applied to restoration, for example, it would be plausible to expect nature-oriented people to search for restoration in parks or forests, whereas urban-oriented people might seek restoration in urban squares, cafés or museums. Similarly, levels of restoration might differ when visiting places that match, or do not match, one's personal orientation. This is exemplified by studies in which people with a general preference for nature rated images of natural settings the most potentially restorative, and urban images the least restorative (Wilkie & Clouston, 2015; Wilkie & Stavridou, 2013). Conversely, participants who defined themselves as city-oriented rated urban streets and natural/nature-like settings with similar perceived restorative potential. This is consistent with recent studies showing that people with low urban orientedness experienced lower restoration in increasingly urban settings (Ojala et al., 2019) and those with greater nature-orientedness experienced lower attention restoration after spending 15 min in an urban square (Subiza-Pérez, Korpela, & Pasanen, 2021).

Nature and urban orientedness may guide and frame environmental decisions and experiences, and consequently make some people more prone to spend leisure time in certain kinds of places. Nevertheless, within those typologies, people may develop greater ties to specific locations such as their home, a park in their city or their favorite café. These ties are reflected as the concepts of place attachment and identification. Moreover, it has been suggested that people establish stronger bonds with places of small (e.g. the home) or large size (e.g. the country) compared to places of moderate size, such as parks, streets or squares (so-called curvilinear hypothesis of place attachment; Lewicka, 2010). Therefore, in the present study we propose that:

H1. Outdoor settings will be rated as more restorative than indoor ones.

H2. Nature orientedness will be negatively associated with subjectively experienced restoration in indoor settings and positively in outdoor settings.

H3. Urban orientedness will be positively associated with subjectively experienced restoration both in outdoor and indoor settings.

The constructs of place attachment and place identification depict the emotional and cognitive bonds that people establish with places relevant to them (Droseltis & Vignoles, 2010; Lewicka, 2011; Scannell & Gifford, 2010). Place attachment is considered as an affective–emotional bond with places, whereas place identity is a cognitive component of self-concept and/or of personal identity in relation to the place one belongs to (Hernández, Martín, Ruiz, & Hidalgo, 2010). Notwithstanding the close relationship between both constructs, several works have shown their distinct theoretical content and used them consequently as different variables (Casakin, Hernández, & Ruiz, 2015; Hernandez, Hidalgo, & Ruiz, 2014; Ruiz, Hernández, & Hidalgo, 2011). The question of whether people experience more restoration in places that are their object of attachment and identification converges with literature on favorite places (Korpela, Korhonen, Nummi, Martos, & Sallay, 2020; Korpela, 1992; Korpela & Ylén, 2007). Ratcliffe and Korpela (2016, 2017) have shown that place attachment and identity are related to the perceived restorative potential of favorite places and may also mediate the effects of place-related memories. Other studies have revealed that place attachment and identification were linked not only with the perceived restorative potential of landscapes (Menatti et al., 2019) but also with actual experienced restoration in urban squares (Subiza-Pérez, Vozmediano, & San Juan, 2020). These studies also provide evidence for a closer link between attachment and restoration than between identification and restoration. Some of these assumptions have been experimentally tested in a study conducted by Liu et al. (2020). The authors manipulated pictures showing parks in two different Chinese cities by adding iconic design elements of each location. They found that manipulated images (with greater presence of endemic iconic features; e.g. pavement style or special plants) were perceived as more restorative than the original pictures (see also Liu et al., 2021). In the present study we propose that:

H4. Place attachment and identification will be greater for indoor settings than for outdoor ones (in line with the curvilinear distribution of place attachment; Lewicka, 2010).

H5. Place attachment and identification will be positively associated with subjectively experienced restoration.

H6. Subjectively experienced restoration will be more strongly associated with place attachment than place identification.

Finally, perceived restorative qualities of environments may be related to restoration outcomes. This means that the fact that a person perceives a setting as providing restorative potential may enhance their subjective or objective restorative experience there. Conversely, if a

person does not perceive a given place as able to provide restorative outcomes, this could hinder its possible salutogenic effects. Subiza-Pérez et al. (2020) found that perceived restorative potential positively predicted restorative outcomes in urban squares even after controlling for attachment, identification, use patterns and some physical and design features.

1.2. Personality traits as other plausible top-down variables

It is likely that psychological experience and behaviors in environments are influenced not only by environmental preferences, perceptions of restorativeness and place bonding, but also by personality (John, Soto, & Naumann, 2008). Individual differences in personality (e.g., the Big Five personality traits of extraversion, agreeableness, openness to experience, conscientiousness, and neuroticism) affect behavior choices, experiences, and wellbeing (Deneve & Copper, 1998). However, there is limited existing research on the association between personality traits and psychological restoration and what little exists is diverse in terms of selection of study settings, the methods and instruments used, and the obtained results. For instance, a study by Mehl, Gosling, and Pennebaker (2006) showed that participants scoring high in agreeableness spent more time in cafés and less time in bars than their counterparts with lower scores in agreeableness, and people with high conscientiousness scores spent more time outdoors than people with lower scores. This highlights the potential role of personality in influencing visits to different environments and as such, is worthy of consideration for restorative experience.

In addition to affecting time spent in certain settings, there is some evidence that certain personality traits—conscientiousness, neuroticism, and extraversion particularly—may be more related to restoration than others. In a study of mountain hikers and visitors, Johnsen (2013) found that conscientiousness was positively associated with relaxation and attention restoration but did not find any link between neuroticism or extraversion and restoration. Another study conducted in the home environment showed that participants scoring high in neuroticism tended to perceive their bedrooms as having less restorative potential and that neuroticism strengthened the relationship between perceived restorative potential and satisfaction with the bedroom (Meagher, 2016). Using Geographic Information Systems and the answers to a large Australian household survey, Ambrey and Cartlidge (2017) found that participants low in neuroticism benefited more from exposure to residential greenness in terms of greater life satisfaction and mental health. Respondents scoring high on conscientiousness also showed a stronger protective link between exposure to residential greenspace and self-reported stress rates. Twedt, Rainey, and Proffitt (2019) reported that more extraverted participants assigned higher and lower restorative potential scores to natural and built settings, respectively, than their more introverted counterparts. More recently, and using a virtual reality environment depicting an urban park, Senese et al. (2020) found that the addition of a water installation increased fascination with the park – a central component of restorative potential – and that this was partially explained by participants' levels of extraversion. Nevertheless, they did not find any other statistically significant link between the other the Big Five personality traits and any other Attention Restoration Theory's components indicating perceived restorativeness (Fascination, Being Away, Coherence, and Compatibility).

Since current evidence on personality traits differences is scarce and heterogeneous, we did not formulate any hypothesis regarding this objective and rather included this in an exploratory capacity in this study.

1.3. Country-wise differences in favorite places

Literature on restoration and preferred landscapes has often framed psychological and behavioral responses to environments as evolutionarily-based – and therefore universal – mechanisms (Appleton, 1975; Orians & Heerwagen, 1992; Ulrich et al., 1991). However, research shows that culture exerts an influence on the way societies relate to their environment (Milfont, 2012) and may influence experiences of restoration (Qureshi, Breuste, & Jim, 2013). This is evident for both built and natural environments. For example, Staats et al. (2016) found that Swedish, American and Dutch participants differed in their preference for café and mall settings and the extent they thought those places might result in restoration. Another recent study also found country of origin influenced psychological responses to urban gardens (Elsadek, Sun, Sugiyama, & Fujii, 2019). Inclusion of cultural aspects has been emphasized as a way to better understand how and why certain environments can support health and wellbeing outcomes (see, e.g., Markevych et al., 2017). Our study responds to such calls by collecting data cross-culturally to examine any potential differences in favorite place types and features. Specifically, we collect data from two English-speaking countries on different continents (UK and Australia), and three European countries with distinct cultures (Finland, the Netherlands, and Spain). The countries corresponded to the countries of residence of the co-authors of the study which, added to the following recruitment strategy (see epigraph 2.1), makes ours a convenience or incidental sample. Due to the above-mentioned reasons for the selection of the countries involved in the study and the recruitment strategy described in epigraph 2.1, we did not set a priori hypotheses and considered this analysis exploratory.

1.4. Study aim

This study examined subjective restorative experiences in indoor and outdoor favorite urban places, with a focus on the potential role of top-down variables. We established four main objectives for this study. First, we aimed to characterize and compare indoor and outdoor favorite places. We compared them in terms of their physical features, place attachment and identification, restorative value (Hypotheses 1 and 2), and country-wise distributions to explore any potential differences. Second, we analyzed the roles of top-down psycho-environmental variables, personality traits and physical features in the experience of psychological restoration in these places (Hypotheses 3–6). Third, we aimed to assess whether personality traits moderate the relationship between restoration and its predictors. Fourth, we aimed to identify the participants who reported greater restoration in favorite indoor, compared to outdoor places, and examined whether nature and urban orientedness and the Big-Five personality variables explain this tendency.

2. Methods

2.1. Participants and design

A total of 945 staff and students at six different universities in five countries responded to the online survey, of whom 503 (53.2%) indicated their gender as female. Mean age was 26.57 years, with a standard deviation of 10.84 years. At least 100[1] participants were recruited at each location and their sample sizes were relatively similar (Finland = 167; Spain = 104; UK [University of Surrey] = 181, [University of the West of England, Bristol] = 111; Netherlands = 190; Australia = 192). Participants were recruited through email distribution lists, online bulletins, portals, and newsletters, and research participation systems, and in the case of UK [University of the West of England, Bristol] and Finland, they were rewarded with course credits. The study was initially approved by the Committee for Research with Human Beings of the University of the Basque Country UPV/EHU (ref. M10_2018_183) and

[1] This minimum was established to have more than 25 participants per predictor variable in the regression models (see epigraph 2.4) and ensure adequate numbers in each university for the other analyses described there.

additionally received all necessary approvals appropriate to the rest of the involved universities (see Supplementary Material). Data collection took place between September 2018 and June 2019.

2.2. Measures and procedure

Participants provided informed consent to participate. The online questionnaire began with a general information section in which participants indicated their age, gender, and completed the *Nature and Urban Orientedness scale* (Tyrväinen, Silvennoinen, Korpela, & Ylen, 2007) and the *Big Five short questionnaire* (Gosling, Rentfrow, & Swann, 2003). The *Nature and Urban Orientedness scale* contains eight items (e.g. "Sometimes I feel compelled to visit nature") and is answered using a 5-point Likert scale (0 = totally disagree; 4 = totally agree). The *Big-Five short questionnaire* involves 10 descriptive items (e.g. critical, quarrelsome, reserved, quiet or extraverted, enthusiastic) answered using a 7-point Likert scale (0 = disagree strongly; 6 = agree strongly), which can be grouped into the five personality traits (2 items per trait): openness, conscientiousness, extraversion, agreeableness, and neuroticism.

After the general information section, participants were asked to fill in two sequential favorite place sections. These latter parts of the questionnaire were identical in content but addressed either the favorite outdoor place or the favorite indoor place. In these, participants were asked: "*Please think about your favorite outdoor/indoor place in the city where you work or study. You will find below a series of questions in respect to that place and to what you think and feel about it. There are no correct or incorrect answers, we just want to know your personal experience in that place*". They were asked to indicate the name of the place and assign it to a category in a pre-defined typology list[2] (including a "other" option). Then, to measure perceived restorativeness, the participants were asked to complete the five-item *Short Perceived Restorativeness Scale* (Negrín, Hernández-Fernaud, Hess, & Hernández, 2017; based on Hartig et al., 1997), with greater scores indicating a higher perceived restorative potential, and a 7-item scale on the physical features of the environments (e.g. the presence of greenery, traffic or views) (Korpela & Hartig, 1996). Place attachment (e.g. *When I don't go to this place for a while, I am willing to go there*) and identification (e.g. *I belong there*) were measured using seven items (four for attachment and three for identification; Ruiz et al., 2011). To evaluate subjective restoration, participants were instructed to "think about how you usually feel when and after being in that place" and then asked to fill in an extended 11-item version of the *Restoration Outcome Scale* (ROS; Korpela et al., 2008) regarding relaxation and calmness, attention restoration, clearing one's thoughts, self-confidence, vitality and reflection when visiting their favorite place. Items comprising notions of reflection were developed by Subiza-Pérez, Vozmediano, and San Juan (2017).[3] The items comprising each of these variables are shown in Supplementary Table 1.

All the aforementioned instruments used a 6-point Likert scale (0 = not at all; 5 = totally). The questionnaire was presented in English in all cases but Spain, where it was in Spanish. Participants also answered three open-ended questions about motivations and benefits involved in visiting their favorite places, however responses are not reported here due to scope and space constraints.

In order to avoid possible order effects, two parallel versions of the questionnaire were prepared: one with the favorite outdoor place first and the other with favorite outdoor place second. In the UK, Netherlands, and Australia, participants were randomly assigned to the two versions of the questionnaire using Qualtrics. Google Forms was used in Finland and Spain, and as automatic randomization was not possible, a manual randomization, based on the initial of the participant's given name, was employed. After completing the questionnaire, participants were thanked, debriefed, and provided with contact information of the research team.

2.3. Data analysis

To address the first study objective, the characterization and comparison of favorite outdoor and indoor settings and experiences within them, we ran descriptive analyses for the main study variables. First, we identified the most popular types of outdoor and indoor places. Second, we checked whether place typology selection varied across countries. We then compared indoor and outdoor settings in terms of their physical features, perceived restorative potential, place attachment and identification, subjective restoration and positive affect by using Welch's ANOVA for repeated measures comparisons. Effect size was measured by partial eta squared, with 0.0099 considered small, 0.059 medium and 0.138 as a large effect (Richardson, 2011).

To address the second objective, the roles of top-down psycho-environmental variables, personality traits and physical features of the places in subjective restoration, we analyzed the bivariate associations between study variables and restorative outcomes by zero-order correlations or repeated measures ANOVA tests, depending on the measurement level of the variables. Variables showing $p < .05$ associations were then included in two separate multiple linear regression models to assess their role as predictors of ROS scores in both indoor and outdoor settings. Dominance analyses were conducted afterwards to ascertain whether, as posited in hypothesis 4, the link between place attachment and restoration was stronger than that between place identification and restoration.

To address the third study objective, the possible moderating role of personality traits between subjective restoration and its main predictors, we ran moderation models to test whether personality traits that were significantly associated with restoration moderated the relationships between restoration and its predictors.

To address the fourth study objective, the role of individual differences on subjective restoration in indoor or outdoor settings, we grouped the participants based on which setting (indoor/outdoor) they evaluated with greater subjective restoration, and performed ANOVAs and a binary logistic regression to check whether study variables such as the nature and urban orientedness and the Big-Five variables could predict this outcome. All the analyses were conducted with IBM SPSS v.25 and the PROCESS (Hayes, 2013) and RLM (Darlington & Hayes, 2017) SPSS macros.

3. Results

Most of the psychometric scales showed tolerable or good internal consistency; Urban Orientedness (UO;α = 0.74), Extraversion (α = 0.75), Neuroticism (α = 0.62) PRS (α = 0.66/0.71), place attachment (α = 0.86/0.88), place identification (α = 0.89/0.90), ROS (α = 0.91/0.93) and PAS (α = 0.90/0.91).[4] Internal consistency was low for Nature Orientedness (NO; α = 0.51) and Conscientiousness (α = 0.53) and unacceptable for agreeableness and openness to experience (α = 0.38);

[2] Indoor place typologies included in the questionnaire: A bar/café/restaurant, a library, a museum or cultural center, a cinema or a theatre, a church or spiritual center, my home (or a room of it), the home of somebody else (or a room of it), an indoor sport facility and a shop.Outdoor place typologies included in the questionnaire: A square, an urban forest, a viewpoint, a sport field/court, a street or a section of a street, a park, a neighborhood and the terrace of a bar/café/restaurant.

[3] ROS has been widely used to: 1) measure restorative experiences after visiting places (Korpela & Ylén, 2009; Subiza-Pérez et al., 2020), 2) evaluate places the person has not just been in but knows and frequently visits (i.e. the purpose in this study) (Ratcliffe & Korpela, 2016), or 3) describe the imagined restorative outcomes a person thinks he/she would get if visited a certain place (Menatti et al., 2019).

[4] Double values indicate the reliability index for the scale in the indoor (first) and outdoor (second) settings.

the latter two were removed from further analyses.

3.1. Description of the settings and comparisons between indoor and outdoor favorite places

The most commonly reported favorite indoor places were one's home (30.3%); bars, cafés or restaurants (19.9%); libraries (14.7%) and museums or cultural centers (5.3%). Other types of places (e.g., cinemas, churches, shops, sport facilities, malls) were scarce (<5% for each category). For the favorite outdoor places, parks (34.7%), urban forests (11.6%) and bodies of water (9.5%) were most frequently reported. Open built/grey settings, such as squares, streets and the terraces of bars together formed 12.7% of responses. Compared with outdoor settings, favorite indoor settings were described as more populated ($\eta p^2 = 0.016$, small effect size) and having a greater presence of personal things ($\eta p^2 = 0.319$, large effect size). On the other hand, favorite indoor settings scored lower in terms of perceived traffic ($\eta p^2 = 0.023$, small effect size), beautiful views ($\eta p^2 = 0.450$, large effect size), greenness ($\eta p^2 = 0.553$, large effect size) and blueness ($\eta p^2 = 0.378$, large effect size). This information is shown in Table 1. The results of the bivariate analyses, designed to compare the subjective restorative experiences and place bonding reported in favorite indoor and outdoor settings, supported hypotheses 1 and 2 (Table 1). Although indoor and outdoor places did not significantly differ on perceived restorative potential, outdoor places provided greater subjective restorative *outcomes* (as measured with ROS) but elicited lower attachment and identification than indoor places (in line with H_4). These differences were either small or moderate in size.

Country-wise analyses are shown in Supplementary Tables 2 and 3 as these were exploratory and we did not formulate specific hypotheses about how these should operate. Supplementary Table 2 shows the distribution (frequency and percentage) of place typologies for favorite indoor and outdoor settings and the results of the chi-squared test that analyzed its distribution by country. To give a few examples, bars, cafés and restaurants were more likely selected in the UK- [University of the West of England, Bristol] than in the rest of the sample and more unlikely within the Finnish sample. Regarding outdoor settings, Spanish participants were more prone to report viewpoints as favorite places whereas this category was scarcely selected by Dutch and Australian participants.[5] Regarding the defining features of selected favorite places (Supplementary Table 3), we found small to medium effect size differences by country in most features. For instance, Spanish participants indicated that their favorite indoor places showed greater greenery than the rest of the samples (except Australian). On the other hand, Dutch participants reported that their favorite outdoor settings were more quiet and calm than did Finnish and UK [University of Surrey] participants. Due to the gender and age differences detected among the samples (e.g. Spanish and Australian samples were older than the rest), we performed post-hoc analyses and repeated the features comparisons controlling for age and gender. The results of these analyses are shown in Supplementary Table 4. Doing so, we observed that some of the previously found effects disappeared but, all in all, the finding of the country samples differing in some of the defining features of favorite indoor and outdoor places kept true.

Table 1
Means and standard deviations for physical features, psycho-environmental features and subjective restoration in favorite indoor and outdoor places. Differences in Welch's F scores are shown using *p* values and effect sizes (ηp^2).

Variable	Outdoor place	Indoor place	Welch F	*p* value	ηp^2
Physical features					
It is quiet and calm	3.08 (1.58)	3.02 (1.71)	0.91	.341	.001
There are other people	3.07 (1.41)	3.33 (1.62)	13.17	<.001	.016
There is traffic (or it's observable)	1.50 (1.46)	1.20 (1.41)	19.35	<.001	.023
My own/personal things are there	0.41 (1)	2.02 (2.22)	386.24	<.001	.319
It has beautiful views (or they're observable)	3.78 (1.41)	2.01 (1.66)	673.02	<.001	.450
It has water (or it's observable)	3.26 (1.94)	1.23 (1.82)	500.20	<.001	.378
It has greenery (or it's observable)	4.01 (1.49)	1.65 (1.69)	1019.62	<.001	.553
Psycho-environmental variables					
Perceived restorative potential (PRS)	2.95 (0.93)	2.89 (0.93)	2.53	.112	.003
Place attachment	3.33 (1.16)	3.51 (1.23)	13.29	<.001	.017
Place identification	1.70 (1.47)	2.30 (1.62)	84.68	<.001	.097
Subjective restoration					
Subjective restoration (ROS)	3.01 (1.10)	2.75 (1.11)	37.85	<.001	.046

Note: All the variables showed in the table were presented in a 0–5 Likert range.

3.2. Top-down and physical correlates of self-reported restoration in favorite urban settings

3.2.1. Indoor settings

Correlational analyses (displayed in Supplementary Table 5) showed that subjective restoration (ROS score) was significantly and positively related to nature and urban orientedness, extraversion, the quietness and calmness of the place, the presence of personal things, beautiful views, bodies of water and greenery, perceived restorativeness, attachment, and identification. Perceived traffic was negatively related to restoration.

A multiple linear regression model, including the 11 significant predictors from the above analyses, explained 45% of the variance in ROS (see Table 2). After controlling for the other included variables, the quietness and calmness of the place, its perceived restorative potential, and the levels of place attachment and identification were significant predictors of ROS scores (Table 2). Dominance analyses assigned an index of 1 to place attachment (respective to place identification), indicating that in all the possible models built from the set of selected variables, place attachment plays a stronger predictive role than place identification.

The initial expectation of nature orientedness being positively related to restorative outcomes in outdoor and urban orientedness in indoor favorite places (H_2 & H_3) was not supported. However, these results fully support the hypothesis that place attachment and identification are positively associated with subjective restoration (H_5) in the case of favorite indoor settings, and also for H_6 that subjective restoration is more strongly associated with place attachment than place identification.

3.2.2. Outdoor settings

Results showed that subjective restoration (ROS) in favorite outdoor settings was positively correlated with nature orientedness, extraversion, the place being quiet and calm, the presence of views, water, greenery, perceived restorativeness, attachment, and identification (Supplementary Table 5). On the other hand, the presence of other people and traffic were negatively associated with subjective restoration.

The linear regression model (Table 2) explained a large share of the variance in ROS (65%), with PRS, attachment and identification being

[5] ANOVA [$F(5,846) = 98.83$, $p < .001$] and Chi-squared [$X^2(15) = 314.82$ $p < .001$] analyses revealed that country samples were quite dissimilar in terms of age (with Spanish and Australian participants being older than the rest of the sample) and women being overrepresented in Finland, Spain and UK [University 1] samples and underrepresented in the Netherlands, Australia and UK [University 2].

Table 2
Multiple linear regression model to predict ROS scores in favorite indoor and outdoor places through significantly related study variables.

	Indoor places							Outdoor places						
Predictors	B	SE B	β	95% CI β	*t*	*P*	VIF	Predictors	B	SE B	β	95% CI β	*t*	*p*	VIF
Constant	−0.04	0.19			−0.22	0.83		Constant	−0.17	0.14			−1.19	.236	
Nature orientedness	0.09	0.04	**0.06**	**0.01–0.11**	**2.02**	**.044**	1.17	Nature orientedness	0.06	0.03	0.04	0.01–0.11	1.66	.097	1.14
Urban orientedness	0.03	0.04	0.02	−0.04–0.07	0.66	.513	1.21	Extraversion	0.02	0.02	0.02	−0.02–0.07	1.16	.248	1.03
Extraversion	0.03	0.02	0.04	−0.02–0.09	1.33	.185	1.06	**It is quiet and calm**	0.10	0.02	**0.15**	**0.09–0.20**	**5.09**	**< .001**	1.90
It is quiet and calm	0.08	0.02	**0.12**	**0.06–0.18**	**4.14**	**< .001**	1.26	There are other people	> −0.01	0.02	> −0.01	−0.05–0.05	−0.09	.928	1.43
There is traffic	−0.03	0.02	−0.04	−0.09–0.02	−1.40	.163	1.06	There is traffic	−0.03	0.02	−0.04	−0.09–0.1	1.54	.124	1.44
My own/personal things	−0.04	0.02	−0.07	−0.14–0.01	−1.97	.050	1.92	It has beautiful views	0.03	0.02	0.04	−0.02–0.09	1.34	.182	1.91
It has beautiful views	0.01	0.02	0.01	−0.05–.08	0.46	.649	1.48	It has water	0.02	0.01	0.03	−0.02–0.08	1.33	.183	1.43
It has water	0.03	0.02	0.04	−0.01–0.10	1.47	.142	1.20	It has greenery	0.04	0.02	0.05	−0.01–0.10	1.76	.079	1.69
It has greenery	0.01	0.02	0.02	−0.05–0.09	0.56	.575	1.72	**PRS**	0.39	0.03	**0.33**	**0.27–0.38**	**12.06**	**< .001**	1.74
PRS	0.38	0.03	**0.34**	**0.28–0.39**	**11.30**	**< .001**	1.35	**Attachment**	0.32	0.03	**0.34**	**0.27–0.40**	**10.39**	**< .001**	2.44
Attachment	0.24	0.04	**0.27**	**0.19–0.34**	**6.81**	**< .001**	2.31	**Identification**	0.10	0.02	**0.13**	**0.08–0.19**	**4.62**	**< .001**	1.96
Identification	0.13	0.03	**0.19**	**0.10–0.27**	**4.26**	**< .001**	2.86								
Model statistics								Model statistics							
F	58.25							F	138.86						
Degrees of freedom	12, 818							Degrees of freedom	11, 816						
P	<.001							*P*	<.001						
Adjusted R^2	0.45							Adjusted R^2	0.65						
Durbin-Watson	1.93							Durbin-Watson	1.93						

Note: β = standardized regression coefficient. Statistically significant predictors are in bold.

the most relevant predictors. Dominance analyses showed that place attachment was always a better predictor of subjective restoration — meaning that explained greater shares of the variance — in all the potential models fitted with the set of predictors included in the analysis (dominance index = 1). Also, the calmness of the place positively predicted ROS scores.

H_2 and H_3 remained unsupported as nature orientedness and urban orientedness were not associated with restoration in indoor settings or outdoor settings as hypothesized. Despite the former, we obtained further support for the hypothesis that place attachment and identification are associated with subjective restoration (H_5) and that restoration is more strongly associated with place attachment than place identification (H_6).

3.3. Testing the moderating role of nature orientedness, urban orientedness and extraversion

Of the 20 moderation models which were tested[6] (12 for ROS-indoors and 8 for ROS-outdoors), none showed any indication that extraversion or place orientations would moderate the relationships between the predictors and ROS (see Supplementary Tables 6 and 7). Agreeableness and conscientiousness were not included in this analysis due to their low reliability issues, neither was neuroticism because it was not significantly associated with ROS scores.

3.4. Developing restoration preference profiles

A third (34.9%) of the sample reported greater psychological restoration (ROS scores) in their favorite indoor place than in their favorite outdoor place. ANOVA tests indicated that participants in this "indoor preference" group showed lower nature (W–$F = 10.26$, $p = .001$) and greater urban orientedness (W–$F = 6.34$, $p = .012$), compared with those who reported higher restoration outdoors. In the binary logistic regression model (Supplementary Table 8), nature orientedness reduced the probability of greater subjective restoration in the indoor favorite place. Nevertheless, urban orientedness scores did not make a relevant contribution to the model.

4. Discussion

Literature on psychological restoration has strongly emphasized the benefits of natural green/blue environments over built/grey and indoor settings, with explanations mostly involving bottom-up environmental properties that neglect the assessment of personal top-down variables. This study aimed to address this research gap, focusing both on the types and features of indoor and outdoor favorite places, and place attachment and identification towards them. We also examined subjective ratings of restoration in these favorite urban places, assessed the role of Big-Five personal traits, and explored the role of nature and urban orientedness in restoration using a multi-country sample.

Homes, bars, cafés and restaurants and libraries were the most commonly described favorite indoor settings, whereas urban parks, forests and water bodies were the most popular outdoor settings. Overall, our hypotheses were partially supported. Study results supported our first hypothesis because, as expected, favorite outdoor places were rated higher on subjective restoration outcomes. They partially supported our second and third hypotheses because nature orientedness

[6] We run a total of 20 models which emerged from crossing the significant physical design and top-down psychological variables with the personal trait variables significantly related to the outcome in the bivariate analyses. This means 12 models for ROS-Indoor (Quietness & Calmness/PRS/Attachment/Identification x Nature orientedness/Urban Orientedness/Extraversion) and 8 models for ROS-Outdoor (Quietness & Calmness/PRS/Attachment/Identification x Nature orientedness/Extraversion).

was negatively associated with subjective restoration in indoor settings and positively in outdoor settings; while urban orientedness was positively associated with subjective restoration both in outdoor and indoor settings. Additionally, nature orientedness was positively correlated to restoration indoors and outdoors but was a significant predictor only indoors, while urban orientedness showed correlations in the expected direction and was positively but non-significantly related to restoration in the indoor multivariate model only. This contradicts previous research showing that nature orientedness and nature preference are positively linked to restoration (Ojala et al., 2019; Wilkie & Clouston, 2015; Wilkie & Stavridou, 2013). Our fourth, fifth, and sixth hypotheses were also supported: indoor settings were rated higher on attachment and identification (Lewicka, 2010), indicating that, while both indoor and outdoor settings can facilitate restoration, personal indoor settings may relate more to self- and privacy-regulation (cf. Korpela et al., 2020). Similarly, reflecting the importance of the connection between self (top-down effect) and place, place attachment and identification were consistently associated with subjective restoration scores, and subjective restoration was more strongly associated with place attachment than place identification, which aligns with previous research (Menatti et al., 2019; Subiza-Pérez et al., 2020).

Gathering information about physical, design, and social features of favorite places (e.g. the presence of views, traffic, etc.) helped us to describe the settings and revealed that indoor places were characterized by a greater number of people using the place and personal things. On the other hand, favorite outdoor places were characterized by a greater presence of green and natural elements as well as traffic. Most of the above-mentioned variables were significantly correlated with restoration in favorite places, but only the quietness and calmness of the place remained a significant predictor of restoration when controlling for the rest of the features of the place. This aligns with previous research showing that the quietness of environments is one of the crucial components of restorative experiences (e.g. Nordh, Evensen, & Skår, 2017), and extends this finding to indoor settings. Subjective restoration outcomes indoors were also predicted by the availability of personal things, which might be explained by the fact that homes were frequently described as favorite indoor urban settings. This highlights the relevance of home and personal belongings in restoration as part of not only stress- and emotion- but also self-regulation (Korpela, 1992). Restoration in nature may be associated with being alone (Staats & Hartig, 2004) and thus the presence of many other people has been seen as an impediment to restoration. However, there is growing evidence for the value of other people for restoration in urban settings. For instance, Staats et al. (2016) found that being accompanied by a relative or friend increased the restoration likelihood scores in diverse urban places. Similarly, studies by Nordh and colleagues have consistently reported an association between a moderate number of people in an open urban place and its perceived restorative potential (Nordh et al., 2009, 2010, 2011). Additionally, Bornioli et al. (2018b) found that perceiving a sense of community supported positive affective appraisals and perceived attention restoration in urban environments.

A key aim of this study was to contribute to emerging literature on top-down variables and psychological restoration. Therefore, we included the personal traits of nature and urban orientedness and the Big Five personality traits. However, links between personality and restoration remain unclear. While they were weakly correlated with subjective restoration, they were not significant predictors when controlling for other variables and did not appear to moderate effects on restoration. Unexpectedly, nature orientedness was the only personality variable that positively predicted subjective restoration in the indoor place, although greater nature orientedness was also associated with lower likelihood of subjective restoration in indoor compared to outdoor favorite places. Overall this appears inconsistent with previous research which has shown that conscientiousness (Johnsen, 2013), neuroticism (Meagher, 2016) and extraversion (Ambrey & Cartlidge, 2017; Senese et al., 2020) were associated with perceived restorativeness or restoration outcomes. Our ability to disentangle the possible effects of the Big Five traits might have been limited by the measure we selected. Big Five questionnaires are usually composed of many items per domain and Gosling et al.'s (2003) brief instrument, although extensively used, might have undermined our capacity to account for the full breadth of each trait. Moreover, we could not examine agreeableness and openness to experience due to very poor internal consistency.

This study was conducted at six different universities from five countries and our results showed slightly different place selection patterns between countries. For example, museums and cultural centers were more frequently reported as favorite indoor places by Spanish and Australian participants than by than Finnish and Dutch ones. On the other hand, terraces at restaurants and bars were more common in participants from the UK [University of the West of England, Bristol] and the Netherlands than in the rest of the sample. Preferences together with the supply of places is important when trying to understand the role of everyday surroundings in restoration and when planning or making recommendations for restorative environments. Some differences in the favorite settings' spatial configurations were also found, although they have to be interpreted with caution due to the non-representativeness of the samples here used and their differences in terms of age and gender.

Recent studies have also revealed that a considerable number of people (approximately 40%) consider urban, built or mixed urban and natural environments as their favorite places (Korpela et al., 2020; Ratcliffe & Korpela, 2016). In this study we saw that a third of the sample reported greater restoration in their favorite indoor setting than in the favorite outdoor setting. Moreover, we found that these respondents were less nature oriented than the rest of the sample. Hence, taking these results together, we consider that future studies should develop these lines of inquiry and explore restorative experiences in non-natural contexts, including for example home environments, outdoor built environments, and social contexts (*authors, under review)*. The existence of different restoration profiles — stable groups of people with distinct place selection, use and restoration patterns — needs to be corroborated by future research. If confirmed, environmental psychology will then face the challenge of developing theoretical and empirical understanding that can inspire policies and interventions to profile-congruent restorative places at diverse scales such as the home, the neighborhood and the city.

4.1. Limitations and suggestions for future research

The results of this study are to be considered in light of its limitations. First, even though we recruited a relatively large international sample, participants were university students and staff who volunteered to take part in the survey, which might affect the generalizability of our findings. Second, as discussed earlier in this manuscript, we focused on western countries and this might have constrained our ability to thoroughly disentangle cultural factors influencing restorative experiences because selected countries might not be "different enough". In addition, the selection of countries was based on convenience, so may not generalize more broadly to other Western university populations is also compromised. Third, the questionnaire was presented in English for all participants except for Spanish which might have affected our results. Fourth, we used a subjective measure of restorative outcomes (ROS) for the participants to report the restorative benefits they obtain when visiting their favorite places. As it is an exercise that requires the use of both memory and imagination as explained before, our conclusions have to be regarded within this context and further studies should approach this matter using methodologies allowing to measure the actual restoration obtained after a given visit (e.g. pretest-posttest designs). Indeed, experimental approaches such as the ones developed by Morton and colleagues (Morton, van der Bles, & Haslam, 2017; Ysseldyk, Haslam, & Morton, 2016) could report insightful results that will help to clarify 1) the actual dimensions of restorative experiences in indoor vs outdoor settings, and, 2) the differences in restorative outcomes experienced by

people scoring high and low in certain top-down traits (e.g. nature relatedness or neuroticism). Another line of inquiry that has not been addressed in this study but could lead to interesting developments is the analysis of the potential place selection differences among people living in dissimilar residential typologies (e.g. apartment vs semi-detached house with garden). Similarly, due to the age composition of our sample, we could not inspect the influence of age in place selection patterns and/or subjective restorative outcomes (see Scopelliti & Giuliani, 2004). Finally, there were two variables (agreeableness and openness to experiences) that could not be used in the analyses due to very low reliability indexes and others which internal consistency was tolerable. This might be due to the fact that they measure very broad constructs (John, Robins, & Pervin, 2008, pg. 119) with very few items. Despite these methodological limitations, we believe that our approach usefully contributes to our understanding of restoration and wellbeing across different types of environments and for different types of people and can serve as a basis for future research.

Due to the fact that this study was conducted before the emergence of the COVID pandemic, our results and conclusions do not reflect the psychological and behavioral changes that have taken place since the outbreak. Nevertheless, our study might serve as a baseline measurement for future studies interested in understanding urban restoration in a post-COVID context.

5. Conclusion and practical implications

This study aimed to explore subjective psychological restoration in favorite indoor and outdoor urban settings using a diverse set of top-down variables. In line with our hypotheses, outdoor—in comparison with indoor—settings provided stronger ratings of restorative experiences but lower place bonding levels. Furthermore, perceived restorative potential, place attachment and place identification were (in that order) the strongest predictors of subjective restoration in both indoor and outdoor settings. Personality traits, nature and urban orientedness were rarely associated with restoration and made a negligible contribution in multivariate and moderation models. This work contributes to, and helps to consolidate, the emerging literature on restoration using a top-down perspective and could be of use for further developments in the field. Nevertheless, due to the fact that evidence shown here comes from a single study, the interpretation of findings needs to be done with caution and further studies are required to support and even extend those.

This research also has important practical implications. First, spending time in outdoor nature settings, in particular, seems to offer restorative benefits to help regulate stress-related conditions. Second, the results of this study invite further development of knowledge about the restorative features and experiences in indoor environments, a matter largely neglected in environmental psychology and related disciplines. The need to make homes more supportive of restoration and psychological well-being more widely (Graham, Gosling, & Travis, 2015) has been dramatically placed on the agenda by the Covid-19 pandemic. Third and finally, future lines of research should explore whether the restorative experience of favorite outdoor and indoor settings is changing due to psychological reactions to the pandemic and the behavioral restrictions and recommendations established by national and international institutions.

CRediT authorship contribution statement

Mikel Subiza-Pérez: Conceptualization, Data collection, Formal analysis, Writing – original draft. **Tytti Pasanen:** Data collection, Writing – review & editing. **Eleanor Ratcliffe:** Data collection, Writing – review & editing. **Kate Lee:** Data collection, Writing – review & editing. **Anna Bornioli:** Data collection, Writing – review & editing. **Jessica de Bloom:** Data collection, Writing – review & editing. **Kalevi Korpela:** Conceptualization, Data collection, Writing – review & editing.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jenvp.2021.101706.

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