
Green and blue settings as providers of mental health ecosystem services: Comparing urban beaches and parks and building a predictive model of psychological restoration

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ABSTRACT

Urban beaches and parks are providers of numerous ecosystem services. In the cultural sphere, place bonding and psychological restoration might significantly contribute to the health and well-being of citizens. In this manuscript, we present a study aimed to evaluate the extent to which three urban beaches and three urban parks offered these advantages to a sample of users (n = 429) in the city of Donostia-San Sebastián (Spain). A second aim was to build a predictive model of restoration through both objective and subjective measures. We assessed the design and physical features of the settings using the Natural Environment Scoring Tool (NEST) and gathered a range of information about the users via a paper & pencil questionnaire. The survey included socio-demo- graphics, questions regarding the frequency and patterns of use, and four different psycho-environmental scales: Perceived Restorativeness Scale (PRS), Place Attachment and Identification Scale, and Restoration Outcome Scales (ROS). We found differences regarding the profile of users and the activities carried out in each of the settings. Users of beaches reported higher levels of attachment, identification, and experienced restoration than the participants surveyed in urban parks ($p < .001$). Regression analyses revealed that the main predictors of experienced restoration where perceived restorativeness (β = 0.49), attachment (β = 0.22), and identification (β = 0.15), whereas the physical/design features of the environment and the routines of use made a negligible contribution in this regard. The results of the regression analyses were extended by conducting dominance and relative weight analyses.

Keywords:
Attention restoration Stress recovery Place bonding Expert assessment Field study

1. Introduction

Since the beginning of the century, nature and nature-like environments and infrastructures have been valued for their contribution to several areas related to the life and health of human beings. The Millennium Ecosystem Assessment report (WHO, 2005) distinguished between three categories of service that such environments may offer: 1) the provision of resources necessary for human life (e.g., food or fresh water), 2) the regulation of natural phenomena such as temperature or the absorption of rainwater, and, 3) the facilitation of social and cultural interactions and experiences, all of which make a significant contribution to human well-being (Fisher, Turner, & Morling, 2009).

Previous works have highlighted the multitude of services provided by green and blue settings and infrastructures in urban contexts, such as the reduction of heat and air pollution levels (Kabisch, van den Bosch, & Lafortezza, 2017). Moreover, there is an increasing interest in their role in the mitigation and adaptation to climate change through, for ex- ample, the reduction of energy expenditure for thermal regulation in buildings (Demuzere et al., 2014) and coping with extreme weather events (Voskamp & Van de Ven, 2015). In the social and cultural sphere,

most of the studied services are related to increased physical activity – including more active modes of transport – along with re- creation, socialization, and the improvement of mental health (Demuzere et al., 2014; Kabisch et al., 2017). However, this category also comprises aesthetic experiences, a sense of place, and even spirituality (Julian, Daly, & Weaver, 2018) and appears to have been developed to a lesser extent when compared with other types of services, which is probably due to some of its defining features (Dickinson & Hobbs, 2017; Dou, Zhen, De Groot, Du, & Yu, 2017)[1]. According to some authors, aesthetic enjoyment is a relevant motive for visiting urban green and blue spaces (Dou et al., 2017) and has important im- plications for human well-being due to the psychological restoration that is generated by such spaces (Subiza-Pérez, Hauru, Korpela, Haapala, & Lehvävirta, 2019; Ulrich, 1983). At the city level, parks and beaches are relatively large, diverse and impactful settings and might therefore be good providers of these sort of services. In this context, even though cities usually have urban parks or forests, the presence of beaches within urban boundaries is limited to coastal settlements. In the case of Spain, many important cities (e.g. Barcelona, Valencia, Cádiz) have one or more beaches which are frequently used by citizens and tourists seeking for resting, socializing or practicing sports.

1.1. Mental health ecosystem services: people–place bonding and restoration

In this epigraph we present two ecosystem services that could be classified as *mental health* services (Bratman et al., 2019), and that form part of the cultural group of services, namely place bonding and psy- chological restoration. Both sets of services have been the subject of inquiry for researchers on ecosystem services in recent years (Bryce et al., 2016). In the following paragraphs, we define these services and describe their main contributions to human health and well-being.

In the literature on sense of place, we can distinguish between two related but independent constructs, namely place attachment and place identification (Hernandez, Hidalgo, & Ruiz, 2014). Place attachment is an affective bond that people establish with places or locations that are important to them, such as the home, the neighbourhood or their favourite leisure destination (Hidalgo & Hernández, 2001; Lewicka, 2011). The current literature describes how the places to which one is attached provide the person with a plethora of benefits – or psychological services – ranging from feelings of familiarity, rootedness and self- esteem, to a sense of relaxation and positive mood (Scannell & Gifford, 2017b, 2017a). On the other hand, place identification is the part of the self that includes the meanings, thoughts and values that define a person's identity, and which are closely related to places (Droseltis & Vignoles, 2010; Uzzell, Pol, & Badenas, 2002; Valera & Pol, 1994). When a person identifies with a given place, they experience a sense of belongingness and a sense of personal fit with this location. These settings contribute to personal well-being through the strengthening of self-esteem and self-efficacy and the feeling of self-continuity (Lewicka, 2008; Valera, 1996). Following Dickinson and Hobbs (2017), even though a sense of place makes a relevant contribution to well-being, more work is needed within the ecosystem services literature in order to fully understand all of its implications.

Restoration is defined as the set of processes leading to the renewal of physiological, psychological and social resources that become depleted when coping with the tasks and demands of everyday life (Hartig, 2004, 2017). The main theories of psychological restoration are Attention Restoration Theory (Kaplan & Kaplan, 1989) and Stress Recovery Theory (Ulrich, 1981, 1993), which characterize restorative environments as non-demanding and aesthetically pleasing settings, usually with living/nature elements that foster a sense of disconnection from the stresses of daily life, whilst facilitating the practice of activities that are enjoyed by the individual. The available evidence indicates that contact with restorative environments reduces physiological dis- tress, improves cognitive performance, and triggers a more positive mood state (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Gascon et al., 2015; Haluza, Schönbauer, & Cervinka, 2014; McMahan & Estes, 2015; Ohly et al., 2016).

At the city level, urban parks and beaches could be good providers of both types of mental health ecosystem services. These spaces usually offer high levels of biodiversity and scenic beauty whilst serving as refuges from the nuances and hassles related to everyday life (hustles, work demands, and responsibilities). People usually visit these settings to relax and amuse themselves, to practice sport or other activities, and to socialize. All of these experiences foster the development of attach- ment and identification and might grant restoration to the visitors of those settings.

1.2. The role of psychological bonds in psychological restoration

Psychological restoration has traditionally been understood as an evolutionary response to particular environmental features and con- figurations that have been essential to human survival throughout history (Kaplan & Kaplan, 1989; Ulrich, 1993; Ulrich et al., 1991). Hence, restoration has been portrayed as a bottom-up process, a psychological response elicited by the presence of certain environmental features and/or configurations. However, in the last decade, these explanations have been brought into question (Haga, Halin, Holmgren, & Sörqvist, 2016). Works by Joye and collaborators (Joye & de Block, 2011; Joye & Dewitte, 2018; Joye & van den Berg, 2011) have high- lighted concerns regarding, for example, the specific features that theoretically bring about restoration and the general restorative experiences in various green settings that appear to be lacking in the reports found in the

literature. For instance, restoration theories posited that restoration would occur in the presence of environmental features re- lated to the evolution of the species (e.g. elements providing shelter or food). However, there is a relevant amount of published evidence on the restorative effects of green roofs, green parks or even urban squares, settings that do not provide with many of those services or advantages (Hartig, Evans, Jamner, Davis, & Gärling, 2003; Lee, Williams, Sargent, Williams, & Johnson, 2015; Subiza-Pérez, Vozmediano, & San Juan, 2020).

Ratcliffe & Korpela (2016, 2017) asserted that one of the main limitations of considering psychological restoration as a universal evolutionary-based response triggered by certain environmental features is the subsequent neglect of personal variables that could also account for this response and claimed for more studies using a top- down perspective. Indeed, the works of these authors reflect a new trend in restoration studies that has recently emerged, an approach that considers the role of other variables and mechanisms. Researchers have begun to analyse which personal and social variables –among others – might also be implicated in the experience of restoration from a top-down perspective. For example, Haga et al. (2016) showed that the perceived restorative potential and the actual restorative effect of a given sound varied depending on whether it was presented to the participants as a natural or industrial sound. This indicates that the meaning ascribed to a stimulus could moderate its restorative potential. Recent research has also shown that attachment and identity tied to certain environments can boost or strengthen the restorative experience of these and the associated salutogenic outcomes (Knez & Eliasson, 2017; Knez, Sang, Gunnarsson, & Hedblom, 2018; Liu et al., 2020; Menatti, Subiza-Pérez, Villalpando-Flores, Vozmediano, & San Juan, 2019; Morton, van der Bles, & Haslam, 2017; Wilkie & Clouston, 2015; Wilkie & Stavridou, 2013; Ysseldyk, Haslam, & Morton, 2016). Of special interest for this study are the results of two previous works that seem to indicate the existence of a stronger association between place attachment and restoration than between place identification and the latter (Menatti et al., 2019; Subiza-Pérez, Vozmediano, & San Juan, 2017). These findings are compatible with those reported by Knez and colleagues, who have consistently shown that in comparison with cognitive components, the emotional components of place bonding are more closely related to well-being when spending time in natural and urban green settings (Knez & Eliasson, 2017; Knez et al., 2018).

1.3. Study aim and objectives

With this study, we aimed to evaluate two particular mental health services that may be experienced by the users of urban beaches and parks: place bonding and psychological restoration. Our goal was to establish the magnitude of those experiences in these settings and evaluate the contribution of a wide range of objective, behavioural, and psychological variables towards the experience of restoration. Given the premises developed in Epigraph 1.2., we were also intrigued by the possible role of attachment and identification with those settings in the experience of restoration. We collected data on these variables using an objective assessment of the settings and by conducting a field survey. This allowed us to obtain information about the physical/design features of the study settings and the routines and psychological experiences of their users. We hypothesized that the objective characteristics of the settings, the patterns of use, and the psychological bonding to the place would be related to the restoration experienced when spending time in that particular place. Further, we also wanted to characterize the user profiles, patterns of use, psychological restoration, and person- place bonding in the two types of settings, detecting significant differences (if any) that might exist between them.

2. Methods

2.1. Participants and study settings

A total of 429 people participated in the study, of which 219 indicated their gender as female (51.05%). The mean age of the participants was 40.72 years (*SD* = 17.82). The sample was recruited from the users of three urban parks ("green settings"; n = 215) and three urban beaches ("blue settings"; n = 214) in Donostia-San Sebastián, a medium sized European city in the Basque Country that is home to around 180.000 people and it is located on the Northern coast of Spain. It has been described elsewhere as a bourgeois city with a marked compact grid pattern design (Fernández Cuesta, 2011) which makes it friendly and walkable. Commerce and tourism – both at the national and international level (García-Hernández, de la Calle-Vaquero, & Yubero, 2017) – are the main activities of the city, which also stands out for its high levels of non-motorized mobility (Oses, Rojí, Gurrutxaga, & Larrauri, 2017). It has a remarkable aesthetic potential, both in natural and architectural terms, which partially lies in its richness of open natural spaces such as promenades along the coast, along with the river that crosses the city and beaches. It also boasts several parks of a considerable size, which are frequently used by the residents of the city.

2.2. Instruments

We conducted the objective assessment of the study settings using the Natural Environment Scoring Tool (NEST; Gidlow et al., 2018). This tool is composed of 47 items divided into eight domains: *Accessibility, Recreation facilities, Amenities, Aesthetics – natural, Aesthetics – non- natural, Significant natural features, Incivilities* and *Usability*. In

addition to assigning a score for each domain, NEST allows for the calculation of an overall score. We decided to use NEST because it was a recently developed tool, which was designed after a comprehensive review of previous tools, and allowed to calculate an overall quality score sensitive to each setting typology (urban beaches and parks in this study).

The questionnaire for the users of the settings was prompted by previous research (Carrus et al., 2015; Lafortezza, Carrus, Sanesi, & Davies, 2009; Subiza-Pérez, Vozmediano, & San Juan, 2019b). It included questions regarding demographics (age and gender) and use of the place (distance from residence, weekly and monthly frequency of use, length of use, and performed activities). We registered nine different activities: walking, meeting friends and relatives, performance of physical activity, reading, landscape contemplation, sunbathing/en- joying the sun, drinking/eating something, spending time with dependants (e.g., children) and walking the dog. Participants had to indicate whether they usually perform those activities (Yes/No) in the setting where they were interviewed.

The second part of the questionnaire contained the Spanish short version of the *Perceived Restorativeness Scale (PRS;* Negrín, Hernández- Fernaud, Hess, & Hernández, 2017; $\alpha = 0.79$), with 5 items measuring *being away, fascination, coherence, compatibility* and *scope* (e.g. "This is a fascinating place that keeps my curiosity alive and stops me from get-ting bored"). It also included the *Spanish version of the Restoration Outcome Scale* (ROS-S; Subiza-Pérez, Vozmediano, & San Juan, 2017; $\alpha = 0.93$; e.g. "I feel calmer after being here), an 8-item scale measuring the main aspects of a restorative experience: *relaxation and calmness*, *attention restoration*, *clearing one's thoughts,* and *reflection*. Finally, the questionnaire also contained the *Place Attachment* and *Place Identification Scale* (Ruiz, Hernández, & Hidalgo, 2011), in the version created by Subiza-Pérez et al. (2017) consisting of 9 items (6 for at- tachment – $\alpha = 0.91$, e.g. "I would regret not coming to this place" – and 3 for identification – $\alpha = 0.96$, e.g. "I feel that I belong to this place). All these scales used a 0–5 Likert response format.

2.3. Procedure

Three trained researchers visited the six study sites at the same time and assessed them using NEST. Each auditor analysed the settings individually. Following this task, the data collection group visited the settings at different times of the day both during the week and the weekend. Different time slots (11–13 h, 13–15 h and 16–18 h) were selected to gather the maximum variability regarding users and activities. Upon arriving at the settings, they approached people there and informed them about the objectives of the study. We defined two eligibility criteria beforehand: 1) participants had to be frequent users of the place (tourists and first/second-timers were not invited to participate) and 2) they had to be aged at least 18 years. Users that decided to take part were given the questionnaire attached to a clipboard and were fully instructed on how to complete it. When finished, participants were briefly debriefed and kindly thanked for their participation.

Following this procedure, the data were collected between June and July 2018.

2.4. Data analyses

First, ratings of the objective assessment of blue and green settings were compiled, calculating an average score for each auditor and sub- domain. With these individual average scores, we then calculated the reliability of NEST using the Intraclass Correlation Coefficient (ICC). Second, we descriptively assessed the profile of users and the activities they performed in green and blue settings separately and, using chi- squared analyses and F-tests (MANOVA), we checked whether there were different patterns of usage. Third, we ran a Welch's *F*-test to compare the perceived restorativeness, place attachment, place identification, and experienced restoration between each setting.

Finally, with the objective of building a predictive model of the restoration achieved in the study settings, we ran a hierarchical linear regression. For this analysis, aimed to the objective of understanding which variables account for restoration in urban green and blue set- tings, we used ROS-S as the outcome variable and PRS as predictor. We began by conducting correlation analyses to detect if any aspects of the data we gathered (e.g., objective measures, gender, or performed activities) were significantly associated with the restorative outcomes reported by participants. Variables significantly related to the outcome were then introduced in the regression in the corresponding block; 1) objective assessment variables, 2) demographics, 3) use of the setting and activities and 4) psycho-environmental variables. Due to the limitations of correlations and standardized regression coefficients as indicators of the contribution of each predictor variable in regression models (Budescu, 1993; Darlington & Hayes, 2017; Johnson, 2000), we used two SPSS utilities to analyse the role of each of the variables maintained in the final step of the hierarchical regression model. Specifically, we conducted a dominance analysis and estimated the relative weights of each predictor by using the RLM (Darlington & Hayes, 2017) and MIMR-Raw (Lorenzo-Seva, Ferrando, & Chico, 2010) programs respectively.

Table 1
Results of the objective environmental evaluation of the study settings.

	Blue settings	Green settings
Access [0–18]	3.11(0.19)	5.56 (0.51)
Recreational facilities [0–36]	8.56 (2.37)	8 (0.58)
Amenities [0–30]	11.33 (0.34)	9.6 (1.77)
Aesthetics – natural [0–24]	2.56 (0.51)	8.11 (0.518)
Aesthetic – non-natural [0–4]	0.78 (1.07)	2 (0)
Incivilities [0–18]	17.55 (0.39)	17.56 (0.20)
Significant natural features [0–3]	1.33 (0.58)	1.33 (0.34)
Usability [0–33]	23.11 (1.17)	17.89 (2.68)
Global score [0–18]	6.56 (0.62)	7.10 (0.10)

Note: the table shows the mean score and standard deviation (in parentheses) for each environmental variable assessed by the raters. Higher ratings indicate a greater presence of these environmental features (except for the incivilities index, which is the opposite). Numbers inside square brackets (left column) denote the range of possible scores for each variable.

Results

3.1. Objective assessment of the study settings

The results of the objective assessment of the study settings are shown in Table 1. Reliability analyses revealed that, following Hallgren (2012), most of the objective indexes measured with NEST showed good and excellent performance; Access (ICC = 0.77), Recreational facilities (ICC = 0.71), Amenities (ICC = 0.76), Aesthetics – natural (ICC = 0.98), Aesthetic – non-natural (ICC = 0.63), Incivilities (ICC = 0.63), Significant natural features (ICC = 0.86) and Usability (ICC = 0.89). The overall measure also showed very good internal consistency (ICC = 0.89).

Inspection of the table reveals that both types of settings received similar ratings for recreational facilities, amenities and aesthetic – non- natural, incivilities. Nonetheless, in comparison with green settings, the blue settings were rated as being less accessible, having lower natural aesthetic potential, and being more usable. Finally, the blue and green settings obtained similar global scores.

3.2. Activities and user profile by type of setting

Participants lived between 1 and 120 min (M = 20.32, SD = 19.44) walking distance from the study sites. They usually visited the place where they were interviewed 2.62 times (SD = 1.97) a week and 10.40 times (SD = 8.26) a month and spent 107. 92 (SD = 96.45) minutes there per visit on average. Taking the sample as a whole, the majority of the reported activities were walking and reading (71.3% each) followed by landscape contemplation (56.4%), sun-bathing (48%) and meeting friends and relatives (41%). Lower frequencies were found for exercising (28.2%), drinking/eating something (25.2%) or taking care of children or dependants (17.2%). The least common activity was walking the dog (7.9%).

With the aim of establishing whether there were significant differences in user profiles and usage patterns between green and blue set- tings, several analyses were conducted. Participants recruited in both settings were equal in terms of gender [$\chi^2(2) = 1.07$; p = .587]. A MANOVA (see Table 2) revealed that users of blue settings were younger than their counterparts, lived further from the setting in which they were survey and used it more times in a week and a month. The results of this analysis also revealed that people spent a considerably greater amount of time during their visits to blue settings than to green settings.

When analysing the distribution of activities according to type of setting, we found an unequal distribution of the activities of walking [$\chi^2(2) = 22.79$; p < .001], meeting friends and relatives [$\chi^2(2) = 16.67$; p < .001], exercising [$\chi^2(2) = 45.28$; p < .001], contemplating the landscape [$\chi^2(2) = 7.74$; p = .005], sun-bathing [$\chi^2(2) = 81.68$; p < .001] and taking care of children and dependants [$\chi^2(2) = 4.27$; p = .039]. These analyses indicated that people using the blue settings are more likely to meet friends, exercise, and sun- bathe whereas users of green settings show a greater tendency to walk, contemplate the landscape, and look after other people. However, no statistically significant differences were found for reading [$\chi^2(2) = 0.87$; p = .352], walking the dog [$\chi^2(2) = 2.09$; p = .149] and eating/drinking something [$\chi^2(2) = 3.07$; p = .08].

3.3. Psychological experience of the settings

According to the results of the analysis shown in Table 3, blue and green settings were perceived to be equally restorative although the former yielded greater attachment and identification scores. As indicated by the responses of the participants, restoration rates were also higher in the beaches than in the parks. The size of the differences for attachment, identification, and restoration was small (ηp^2 = 0.03, 0.05 and 0.05 respectively).

3.4. Prediction of psychological restoration in the study settings

We ran correlation analyses (see Table 4) to select the variables for the hierarchical regression model. Approximately only half of the variables measured in the study were found to be significantly associated ($p < .05$) with experienced restoration. Males, in comparison to women, reported lower restorative outcomes. Only five physical/design features were significantly related to the outcome and this relationship was negative most of the times. Variables reflecting use patterns and activities were hardly related to ROS-S scores, with only frequency of visits and landscape contemplation being below the statistical significance level. Finally, psycho-environmental variables were more closely related to such an outcome than the objective and use-related variables.

This information was then used to build a hierarchical regression model (see Table 5) to predict experienced restoration through the significantly associated variables ($p < .05$). Since the variables coming from the objective assessment were highly correlated – which would eventually lead to multicollinearity issues within the model – we decided to introduce the variable with the highest association with the outcome (usability).

As explained in Section 2.4, we finally conducted both dominance and relative weight analyses to further assess the contribution of the six significant predictors in Step 3. Dominance indexes are shown in Table 6. This analysis revealed that the order of dominance between predictors is the following: perceived restorativeness > place attach- ment > place identification > usability > landscape contemplation > frequency of use (per month). Additionally, relative weight analysis revealed that perceived restorativeness accounted for 53.2% of the total variance explained by the model (58.5%) whereas place attachment and place identification accounted for 23.6% and 15.4% respectively. Of minor relevance were usability (5.5%) the activity of contemplating the landscape (1.6%), and the frequency of use (0.8%).

Table 2
Mean, standard deviation and MANOVA comparisons of age, home-setting distance, and use patterns in blue and green settings.

	Blue settings	Green settings	F (1, 428)	*p*
Age (years)	35.55 (15.89)	*45.88* (18.19)	35.54	< 0.001
Home-setting distance (walking distance in minutes)	23.32 (22.91)	17.09 (14.17)	10.10	0.002
Visits per week (times/week)	2.97 (2.02)	2.26 (1.86)	14.51	< 0.001
Visits per month (times/month)	12.06 (8.56)	8.73 (7.61)	18.10	< 0.001
Time per visit (minutes/visit)	158.53 (102.37)	58.30 (56.53)	149.90	< 0.001

Table 3
Mean, standard deviation and MANOVA comparisons of perceived restorativeness, place attachment, place identification and experienced restoration.

	Blue settings	Green settings	Welch's F	*p*
Perceived restorativeness	3.81 (0.84)	3.92 (0.75)	2.21	0.138
Place Attachment	4.15 (0.81)	3.77 (0.91)	20.69	< 0.001
Place identification	3.53 (1.44)	2.90 (1.47)	20.89	< 0.001
Experienced restoration	3.76 (0.84)	3.44 (1.03)	12.12	0.001

Note: all these variables are distributed in a 0–4 range.

Table 4
Correlation between experienced restoration and other study variables.

	Experienced restoration
Sociodemographic variables	
Gender	−0.11*
Age	–
Objective assessment	
Access	−0.13**
Recreational facilities	–
Amenities	0.12*
Natural features	−0.13**
Aesthetics non natural	−0.13**
Incivilities	–
Significant natural features	–
Global score	–
Usability	0.19**
Use of the setting and activities	
Frequency of use (weekly)	0.13**
Frequency of use (month)	0.12**
Time of use (minutes/time)	–
Walking	–
Meeting friends and relatives	–
Practicing physical activity	–
Reading	–
Landscape contemplation	0.11*
Walking the dog	–
Spending time with dependants	–
Sunbathing/enjoying the sun	–
Eating/drinking something	–
Psycho-environmental variables	
Perceived restorativeness	0.68***
Place attachment	0.63***
Place identification	0.53***

Note: * = p value $<$ 0.05; ** = p value $<$ 0.01. Non-significant coefficients are not reported. Gender coefficient is a biserial correlation coefficient and indicates that being a male (compared to being a woman) was negatively associated to experienced restoration scores.

4. Discussion

Green and blue settings and infrastructures within cities are key providers of a number of ecosystem services. The objective of this study was to evaluate the extent to which urban beaches and parks in the city of Donostia-San Sebastián provided their users with place bonding and restoration related ecosystem services and explore the association be- tween a diverse set of variables and the restoration experienced in such settings. We found that women and men used both types of settings equally whereas blue settings were more frequently visited by young people in comparison with their older counterparts. Beach visitors at- tended the beaches more often and for longer periods of time and were more likely to meet friends, as well as take part in exercise and sunbathing. Conversely, visitors to green settings were more likely to walk, contemplate the landscape, and look after other people when spending time in that location. According to our results, visitors showed moderate to high levels of psychological attachment to these settings and felt that they could identify with these places to a moderate extent. Moreover, they reported moderate and high restorative experiences there. We found that beaches, in comparison with parks, triggered greater levels of attachment and identification. Further, whilst both types of settings were perceived as equally restorative, beaches also provided more intense restorative experiences. Nevertheless, the differences are not of large size ($\eta p^2 < 0.05$). However, all these conclusions are not readily generalizable to the users of such settings as a whole (within the study city or abroad) due to the data collection and sampling strategies implemented for this

study.

We also aimed to build a predictive model of psychological restoration using the physical/design variables of the settings and the patterns of use displayed by the visitors. Moreover, and in accord with an emerging line of research (Menatti et al., 2019; Morton et al., 2017; Ratcliffe & Korpela, 2016, 2017; Wilkie & Clouston, 2015; Wilkie & Stavridou, 2013), we included attachment and identification with the settings in order to ascertain whether these variables actually make a meaningful contribution to the experience of restoration. The results of this analysis revealed that, in order of relevance, perceived restorativeness of the setting, attachment and identification, the activity of contemplating the landscape and the usability of the setting significantly predicted such an outcome. First, these results encourage further research on top-down variables in restoration since the psychological variables were by far the most important predictors in terms of explained variance. The fact that the extent to which a person regards a place to be restorative is a factor that contributes towards the experience of restoration is compatible with the findings of previous research (Haga et al., 2016; Ruiz, Pérez, & Hernández, 2013) and with the subjectivist perspective on landscape perception/experience that posits that beauty – or, in this case, restoration – is in the look of the beholder (Heras-Escribano & de Pinedo-García, 2018). The fact that place attachment, compared with place identification, showed a stronger association with restoration is in line with the results of previous studies discussed in the introduction (Knez & Eliasson, 2017; Knez et al., 2018; Menatti et al., 2019; Subiza-Pérez et al., 2017). Bratman et al. (2012) posited that part of the restorative benefits of nature and nature-like settings may come from the feeling of "belonging to some- thing greater than oneself", which has been usually interpreted as connection with nature (Capaldi et al., 2014), which may offer benefits similar to the inclusion in social groups and identities (Bratman et al., 2012; Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). However, we know from environmental psychology works that place attachment and identification may work also as relevant social and individual categories (Droseltis & Vignoles, 2010; Lewicka, 2011; Morton et al., 2017; Valera & Pol, 1994; Ysseldyk et al., 2016). Therefore, we could expect that some of the positive rewards of expending time in the study settings may come from a feeling of connectedness with others and/or with personally relevant contents.

The model explained half of the variance (53%) of the ROS-S scores. Even though this represents a considerable proportion of the variance, there is undoubtedly scope for identifying further explanatory variables. Surprisingly, physical/design variables were only mildly associated with restoration scores and explained no more than 5% of the variance. Moreover, access and aesthetic potential of natural and non-natural elements within the settings were negatively correlated with experienced restoration scores, which does not agree with the main premises of restoration theories (Kaplan & Kaplan, 1989; Ulrich, 1983; Ulrich et al., 1991) and should be confirmed or rejected by future studies. This unexpected result could be related to the use of The Natural Environment Scoring Tool (Gidlow et al., 2018) to assess the study settings. This tool was originally designed to measure the quality of urban natural environments and listed several factors (sub-dimensions) that might encourage or discourage their use by citizens. Although some sub-dimensions converge with factors highlighted by restoration theories (Amenities & Recreational Facilities – Compatibility; Aesthetics – Fascination), the tool lacks some of the variables that have previously been linked to psychological restoration and landscape preference (Kaplan & Kaplan, 1989; Lothian, 2017; Ulrich, 1993). Examples of these include coherence, complexity, mystery, and biodiversity. Thus, future studies should incorporate these variables to obtain a more ac- curate impression of the influence of physical/design features of green/ blue settings on restoration. At this point, it could be advisable to assess the presence of such qualities not only by counting the number or collecting the presence of a given element (e.g. trees, grass, benches or fountains), but also by including a subjective evaluation (of the raters) about the presence or absence of features of a much more abstract nature. In this regard, a recently published assessment tool – the IE- PREU (Spanish acronym for Inventory for the Assessment of the Restorative Potential of Urban Spaces) – which includes some of these indicators, might provide the basis for such future work (Subiza-Pérez, Vozmediano, & San Juan, 2019).

Interestingly, frequency of use was a positive predictor in the second step of the model, but this became a negative predictor in the third step. This appears to indicate that after controlling for place-bonding variables[2], the more a person visits a restorative environment the lower the actual recovery experienced. In terms of restoration theories, two potential explanations can be put forward to explain this observation. First, psychological depletion or fatigue is a necessary prerequisite for restoration (Hartig, 2017). Thus, a greater number of visits could reduce the need for restoration in subsequent visits because there is *less to be restored* each time. Second, it also seems plausible that more visits could lead to habituation to the environment that would therefore trigger less interest, fascination, or aesthetic enjoyment. Consequently, the reduced immersion and engagement would hinder – at least to some extent – the rates of recovery and refreshment.

In our view, the combination of objective and subjective measures, the size of the sample and the number of settings assessed are all strengths of this study. Nonetheless, we also recognize that there are certain limitations that need to be considered. First, due to the procedure we followed to recruit participants, the results might be affected by a self-selection bias and might not be generalizable to the users of the study settings as a whole. Second, as previously discussed, the reduced contribution of physical/design variables in the restoration model could be related to the tool used for evaluating these variables, and therefore further studies are needed with alternative tools.

Further, all the settings were located within the same city, a city where the purely urban landscape is of considerable aesthetic value, and therefore the contrast between the urban settings and the blue/green setting could be reduced in comparison with other cities. Additional studies in cities where the contrast between urban and naturalized areas is higher, as well as studies in other kinds of blue and green urban settings, would be advisable for confirming our findings. Following with settings, we only focused on two specific typologies and therefore future studies will benefit from including a wider range of green (e.g. green roofs, green corridors) and blue (e.g. rivers, ponds) settings. Finally, the study was focused on the routine experiences of regular visitors, and therefore some results could be the product of a completed process of bonding and habituation to the settings. Some of the findings and proposed explanations could benefit from future work that considers the experience of first-time visitors or new inhabitants with less experience of the city and settings.

Table 5
Hierarchical regression model to predict experienced restoration through study variables.

Model variables	Step 1		Step 2		Step 3		Step 4	
	β	*p*	β	*p*	β	*p*	β	*p*
Usability	0.18	< 0.001	0.19	< 0.001	0.19	< 0.001	0.17	< 0.001
Gender (Ref. Female)	–	–	−0.12	0.015	−0.10	0.028	−0.02	0.465
Frequency of use (month)	–	–	–	–	0.09	0.052	−0.09	0.007
Landscape contemplation	–	–	–	–	0.13	0.005	0.09	0.005
Perceived restorativeness	–	–	–	–	–	–	0.49	< 0.001
Place attachment	–	–	–	–	–	–	0.22	< 0.001
Place identification	–	–	–	–	–	–	0.15	0.001
Model statistics								
F	14.66		10.38		8.09		83.74	
Degrees of freedom	1 , 428		2, 426		4 , 424		7 , 421	
p	< 0.001		< 0.001		< 0.001		< 0.001	
Adjusted R^2	0.031		0.042		0.062		0.575	
Δ Adjusted R^2	–		0.011		0.020		0.513	

Note: β = standardized regression coefficient. Durbin-Watson = 1.90, Average VIF = 1.55.

Table 6
Dominance matrix with the 6 significant predictors of experienced restoration.

	Usability	Frequency of use (week)	Landscape contemplation	Perceived restorativeness	Place attachment	Place identification
Usability	–	0.750	0.625	0	0.250	0.250
Frequency of use (month)	0.250	–	0.063	0	0	0
Landscape contemplation	0.375	0.938	–	0	0	0.063
Perceived restorativeness	1	1	1	–	1	1
Place attachment	0.750	1	1	0	–	1
Place identification	0.750	1	0.938	0	0	–

Note: Dominance indexes range from 0 to 1 and indicate the proportion of times when the predictor in a row makes a more relevant contribution to the model (in terms of explained variance) than the predictor in the column.

5. Final remarks and conclusions

The present work has contributed to the current literature on ecosystem services by analysing the role of blue and green urban settings as providers of two mental health services: place bonding and psychological restoration. The results have confirmed the suitability of such a perspective: both blue and green urban settings were found to be restorative and therefore provide psychological health benefits to citizens. Moreover, the findings of this study emphasize the role of those ecosystems – as providers of psychological health services – not only as passive objects for contemplation, but as stimulating elements that contribute to the psychosocial wellbeing of citizens that interpret them according, in part, to their perceptions and psychological bonds with those ecosystems. Therefore, taking care of the blue and green spaces in our cities and promoting initiatives and activities that might strengthen the psychological and social connections of citizenship with the former may be a good idea for improving the quality of urban life.

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Green and blue settings as providers of mental health ecosystem services: comparing urban beaches and parks and building a predictive model of psychological restoration

Authors Statement

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.landurbplan.2020.103926.

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