Still not that bad for the grey city: **a field study on restorative effects of built open urban places.**

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Title: *Still not that bad for the grey city:* a field study on restorative effects of open built urban places.

Abstract: Attention Restoration Theory (*ART*) and Stress Recovery Theory (*SRT*), highlight the restorative properties of natural or green environments. However, the study of the psychological benefits obtained through contact with built open urban places, such as squares or streets, has received far less attention. In this paper we present a within-subjects pretest-posttest quasi-experimental field study that assessed the restoration experience of a sample of university students (N = 34) visiting two squares in a European city. Statistical analyses revealed that participants' attentional performance improved and negative affect (depression and stress) decreased after spending 20 minutes in the squares. There was no increase in positive affect. Nature orientedness was significantly related to some of the pretest-posttest changes, leading to lower fatigue and attentional restoration in one square. The results suggest that built open urban settings can provide some restorative benefits.

Keywords: psychological restoration, squares, built environment, stress-recovery, urban planning

1. Introduction

1.1 The question of restoration in urban built settings

This study will continue the investigation of the nascent issue of the restorative potential of urban places by simultaneously assessing both aesthetic experiences and person-place bonding. Restorative potential refers to *restoration and restorative experiences*, that is, the recovery from events or behaviours causing cognitive fatigue and/or emotional distress and the improvement of emotional, physiological and attentional states (Kaplan & Kaplan, 1989; Ulrich, 1993). Our research is based mainly on two different but easily reconcilable theories of human-nature interactions, namely Attention Restoration Theory (ART, Kaplan& Kaplan, 1989) and Stress Recovery Theory (SRT, Ulrich, 1993). The former proposes that cognitive resources can be

recovered through the contact with settings experienced as psychologically distant from daily context (being away), being aesthetically-engaging and interest-raising (fascination), rich and coherent in content (extent) and meeting the person's needs and inclinations (compatibility). On the other hand, SRT postulates that recovery from emotional distress may occur when in watered and/or vegetated open natural environments having moderate complexity that are safe and non-demanding. Despite presenting remarkable differences in terms of explanatory processes, involved psychological variables and relevant environmental cues, current restoration studies often integrate the main premises of both theories (Subiza-Pérez, Vozmediano, & San Juan, 2019b).

Studies comparing restoration in natural vs urban settings have been criticized for their tendency to compare beautiful natural settings to unattractive or unpleasant urban ones (Karmanov & Hamel, 2008; Staats et al. 2016). Hence, available evidence might have been affected by this bias and consequently underestimated the restorative value of pleasant urban settings. Thus, recent survey studies have started the debate on the role of open urban places where greenness is not the only main attribute for restoration, emphasizing that size, design, equipment and use are key attributes as well. Thus, apart from the presence of greenness (Lorenzo et al., 2016; Nordh, Hartig, Hagerhall, & Fry, 2009), Peschardt and Stigsdotter (2013) reported that sensorial qualities of open urban places (e.g. serene or diverse) were associated with the restorative experience. For social landscape, understood as the presence of other users, a study found that moderate numbers of users of an urban place were more associated with restoration than low and high ones (Nordh, Alalouch, & Hartig, 2011). However, social interactions in green settings may sometimes reduce its restorative potential (Carrus et al., 2015). Some evidence points out the restorative value of different activities such as socializing, walking or playing with children (Lorenzo et al., 2016; Nordh & Østby, 2013). Finally, two studies found that being in places with noise, traffic and other disturbing variables may impair the psychological experiences (Nordh & Østby, 2013; Peschardt, Stigsdotter, & Schipperijn, 2014).

A few experimental and exploratory findings corroborate the above-mentioned survey findings. Two studies revealed that open urban places – apart from parks and urban forests– such as cultural/historical or recreational spaces, were perceived as almost equally restorative as greener environments (Fornara & Troffa, 2009; Galindo & Hidalgo, 2005). Recently, Xu, Zhao, & Ye (2018) found that cultural environments – human made landscapes which hold a variety of culturally defined social representations, meanings and behavioural patterns (Menatti & Casado da Rocha, 2016; Stobbelaar & Pedroli, 2011)– have similar general restorative potential as natural ones, both wild or tended. Cultural landscapes received analogous ratings for emotional, cognitive and behavioural restoration as their natural counterparts. The only statistically significant difference was found for physiological restoration, with natural landscapes getting higher rates. In addition, a recent review including pretest-posttest experimental field studies on psychological restoration found that when using urban settings (no parks, urban forests or university campuses), results did not usually support the idea of open urban places having negative psychological implications (Subiza-Pérez, Vozmediano, et al., 2019b). That finding is more relevant when noticing that the most common urban settings used in these studies were commercial streets with moderate to high presence of people and vehicles. Similarly, Johansson, Hartig, & Staats, (2011) found that both natural and urban walks reduced negative affect and had positive effects on revitalization (depending on social company) after a 40-minute walk along an urban street and in a park. In another study, a sample of 38 individuals showed comparable restorative patterns (in terms of mood and cortisol patterns) when walking either on a path along a canal, through an urban park, or residential district, although the natural environment conferred additional cognitive benefits after leaving the environment (Gidlow et al., 2016). Stigsdotter and collaborators found that a walk through the built historic downtown area of Copenhagen did not cause any psychological or physiological impairment, and that its effect on affective and physiological measures (*mood state, blood pressure and heart rate variability*) did not differ substantially from a walk through an Arboretum (Stigsdotter, Corazon,

Sidenius, Kristiansen, & Grahn, 2017). A study by Bornioli and colleagues also showed that simulated walks through historic and mix (grey + green) pedestrianized urban environments led to increments in hedonic tone (Bornioli, Parkhurst, & Morgan, 2018).

In the present study, we adopted an experimental design following San Juan, Subiza-Pérez, & Vozmediano (2017). It measured the change of attentional capacity and affective state of two groups of students after spending 30 minutes walking and sitting in one of two urban squares. Participants experienced an improvement in their attentional performance and a reduction of negative affect.

1.2 Aesthetics and restoration in open urban places

Preferences are fundamental aesthetic evaluations that literature has frequently related with restorative experiences. It is suggested that preferences are based on the evaluation of the restorative potential of the places (Hidalgo, Berto, Galindo, & Getrevi, 2006; Purcell, Peron, & Berto, 2001) or more broadly, on the effect that they may have for health and well-being (Hartig & Staats, 2006). Previous studies have shown that preference and restoration are strongly correlated (Abkar, Kamal, Maulan, Mariapan, & Davoodi, 2011; Tenngart Ivarsson & Hagerhall, 2008). However, the evidence is scarce for urban built places, thus the current study addresses this gap by adding a measure to quantify the aesthetic qualities of the urban squares.

In this context, literature is rich in psycho-environmental indicators that might be related to aesthetic and restorative experiences (Appleton, 1975; Kaplan & Kaplan, 1989; Lynch, 1960; Stamps, 2005; Tveit, Ode, & Fry, 2006). For example, the following features have been included in a measure aimed at assessing the restorative potential of urban built places (Subiza-Pérez et al., 2019a). *Coherence* is defined as the sense of order and harmony of the scene and *mystery* is the impossibility to perceive the wholeness of the environment, happening when elements such as trees or walls cover parts of it. *Exploration* and *orientation* are operationalized as the degree that a person can orientate and navigate easily in the place and the extent which

the environment invites to be explored. *Prospect* is the quality of environments offering an open overview and the *enclosure* rating is composed by visual and locomotive permeability, that imply the absence of elements raising difficulties to visually control and move through the place. Openness, as a physical feature of places, has been theoretically linked to the aesthetic and restorative potential of places (Nasar, 1994). Studies by Galindo and Hidalgo (2005) and Hidalgo and colleagues (2006) found that openness was a key factor that differentiates attractive urban places from unattractive ones. Size, another feature of urban places related to openness in the compact city, is also associated with restorative potential of urban settings (Nordh et al., 2009; Nordh & Østby, 2013). *Imageability*, closely linked to legibility, gathers notions reflecting the ability of the person to decode the social and physical characteristics of the place and the potential of it to generate a vivid impression and memory in the person's mind. Related to this latter quality, the *identity*, *uniqueness* and *singularity aspects* of the place in relation to the rest of the urban landscape are important.

1.3 The role of individual factors in restorative experiences: nature and urban orientedness, place attachment and identification

In addition to physical characteristics of the environment, individual factors and dispositions – reflecting the top-down effects rather than bottom-up effects - can shape our restorative experiences (Ratcliffe & Korpela, 2016). The construct of *nature relatedness or connectedness* is defined as the way people view their relationship with the natural world and their feelings of subjective connection and attitudes towards it (Nisbet, Zelenski, & Murphy, 2009). It is known that individuals' feelings of connectedness to nature may vary and that they are related to hedonic and eudaimonic well-being (Capaldi, Passmore, Nisbet, Zelenski, & Dopko, 2015) and happiness (Capaldi, Dopko, & Zelenski, 2014). People reporting a natural environment identity have rated nature landscapes higher in restorativeness (Wilkie & Stavridou, 2013). This congruence was replicated in another study which also found greater mood improvement

(Wilkie & Clouston, 2015). The other side of personal orientation towards nature is urban orientedness (Tyrväinen, Silvennoinen, Korpela, & Ylen, 2007), which together with nature orientedness, has been related to restoration in extensively managed nature areas (Korpela, Ylén, Tyrväinen, & Silvennoinen, 2008). A recent study found that participants shown pictures of landscapes matching the urban identity of the city where the study took place, not only improved their attentional performance but also assigned greater importance to intrinsic vs extrinsic motivations compared to the participants who received a definition of the city in rural/country terms (Morton, van der Bles, & Haslam, 2017). On the other hand, a recent study showed that people scoring low in urban orientedness experienced lower restoration in more human-managed experimental settings (woodland forest > urban park > city centre) (Ojala, Korpela, Tyrväinen, Tiittanen, & Lanki, 2019). Thus, urban orientedness and spending time in urban settings may indeed be associated with the strength and quality of the restorative experience in urban settings, which deserves further investigation.

Secondly, evidence points to the important role of psychological bonding with specific places in the restorative experience (Korpela & Hartig, 1996; Korpela & Ylén, 2009). *Place attachment* refers to a positive emotional tie towards a place that fosters a tendency to maintain closeness to it (Hidalgo & Hernández, 2001). On the other hand, *place identification* describes meanings and mental representations of places that may shape self-concept (Belanche, Casaló, & Flavián, 2017; Droseltis & Vignoles, 2010; Proshansky, 1978; Valera & Pol, 1994). For example, attachment (in the form of place identity and place dependence) positively predicted restorative perceptions in an online study where Finnish residents rated their favourite place (Ratcliffe & Korpela, 2016). Fifty-five per cent of these favourite places were described as mostly or entirely natural, 31% were described as half-built and half-natural, including cities and local neighbourhoods, observation towers, old buildings, and summer cottages; and 14% were described as mostly or entirely built/urban places, e.g. city centres, pubs, universities, and indoor environments such as home.

To summarize, *nature and urban orientedness, place attachment* and *place identification* may inform about the benefits of a specific environment for a person and thus, were taken into account in the present study. The more a particular natural or urban place forms a part of a person's life, memories and self-concept and the stronger the psychological bond to the place is, the more likely the person achieves stronger restoration and aesthetic enjoyment in these environments.

1.4 Study aims

The aim of this study was to continue the path initiated by a previous field study assessing the restorative potential of urban squares (San Juan et al., 2017). We selected urban squares (settings hereafter) as openness and size have been related to restoration in previous studies (reviewed in section 1.2). In city planning, Thwaites et al. (2005) proposed to take advantage of the compact, dense and multifunctional design of modern cities in order to build a network of small open urban places for rest and recovery.

For this study we established five hypotheses:

- H_1 Participants will improve their attentional and affective state after visiting the squares. That is, they will have a restorative experience.
- H_2 Visiting the two settings selected for the study will lead to similar restorative experiences.
- H_3 Nature (negatively) and urban (positively) orientedness will be significantly associated with restorative experiences.
- H_4 Place bonding – in the form of place attachment and place identification – will be positively related to restorative and aesthetic experiences.
- H_5 Restoration and aesthetic scores will be positively related.

Based on ART and SRT's premises, we included several outcomes to assess the environmental experience of participants: a) attentional restoration, b) affective restoration and, c) aesthetic experience. Attentional and affective states before visiting the settings were also registered in order to record the change scores and to measure the participants' initial level

of depletion and need for restoration. Additionally, we gathered participants' personal memories of the experimental settings and evaluated their content to investigate the role of personal relevancy of our settings.

2. Methods

2.1 Sample

The sample consisted of 34 students at the University of Tampere (UTA), of whom 25 indicated their gender as female (73.52%). The participants' mean age was 25.62 years (*sd* = 6.91). All of them were Finnish and 8 (23.53%) were born in the city where the study took place. On average, they had lived in the city for 6.8 years.

2.2 Description of the settings

The selection of the squares was based on expert evaluations on the presence of vegetation and several psycho-environmental indicators, using a tool presented below. A group of three expert raters in environmental psychology assessed four square-like open spaces with a section of a systematic social observation tool developed to assess the restorative potential of open urban places (Subiza-Pérez, Vozmediano, & San Juan, 2019a). The aim was to find two equal urban squares with similar restorative qualities to determine whether restoration is possible in urban squares and to minimize the risk of detecting restorative effects due to some specific characteristics of a single setting. All four places met the definition of a square, understood as an open space surrounded by buildings or roads (Moughtin & Mertens, 2003; Zucker, 1959).

As a result of this assessment, two open places of the central districts of the city were selected as experimental settings (see Table 1 for the scores of each place and Figure 1 for pictures). Being open urban places with a square-like design, the two experimental settings were found to be easily navigable and legible (Lynch, 1960), even though they may present limited amusements and amenities to encourage exploration. Another common feature of these places

was the low levels of mystery. Furthermore, they showed the principal elements that appear in open urban places designed for or supporting pedestrian use; benches, fountains and pieces of art. Streets with quite heavy car traffic surround both squares. Setting 1 also contains a shop, a small playground for children and an orthodox church. It is, however, plausible to assume that most participants were not members of the orthodox community due to low membership rates (1.1%; Official Statistics of Finland, 2016), and, accordingly, membership would not explain or bias average attachment to setting 1.

Figure 1. Pictures of settings 1 (left) and 2 (right).

The evaluations also showed some differences in the selected settings, allowing the comparison of the restorativeness and aesthetic experiences between them. Although both presented low levels of greenness (only some trees and relatively small extensions of grass), setting 2 was rated higher for the number and diversity of green elements. However, the main difference between the two settings rested on the singularity, identity and uniqueness that they have within the city. As shown in Table 1, setting 2 seems to have a more eminent and symbolic position than setting 1 in the city.

Table 1. Results of the objective environmental evaluation of the two settings.			
	ICC	**Setting 1**	**Setting 2**
Natural elements: density [0-15]	.88	2 (0)	4.33 (0.58)
Natural elements: diversity [0-15]	.94	2 (0)	3.67 (0.58)
Natural elements: aesthetic potential [0-50]	.80	7.67 (3.51)	15 (9.64)
Psycho-environmental indexes:			
Orientation [0-4]	-	4 (0)	4 (0)
Coherence [0-4]	.23	3.45 (0.69)	3.78 (0.19)
Enclosure [0-5]	-	3.78 (0.39)	4 (0.58)
Imageability [0-5]	-	4.22 (1.07)	4.22 (0.84)
Prospect [0-5]	.50	5 (0)	5 (0)
Mystery [0-5]	.93	0.33 (0.58)	1 (0)
Singularity [0-5]	.71	3.67 (0.58)	4.33 (0.58)
Identity [0-5]	. 53	2.33 (2.31)	4 (0)
Uniqueness [0-5]	.77	2.67 (1.6)	4.33 (0.58)
Exploration [0-5]	.62	2.67 (0.29)	3 (2)

Note: the table shows the mean score and standard deviation (in brackets) for each environmental variable assessed by the raters. Greater ratings indicate a higher presence of these environmental features in the setting. Numbers inside square brackets define the range of possible scores for each variable. ICC (Intraclass Correlation Coefficient) column shows the inter-rater reliability score for each variable. This analysis may reveal negative indexes (not interpretable) if there is low data variability which has been indicated as "-".Following Hallgren (2012), ICC values indicate the following levels of agreement: >.75 = excellent , .60-.74 = good , .40-.59 fair and < .40 = poor agreement.

2.3 Procedure

Information about the study and an invitation to participate was sent by email to a sample of UTA students. In addition, some students were invited to participate during a lecture in exchange for course credits. The participants were informed that the study was about the use of public urban places and its psychological experience, and were guaranteed anonymity and confidentiality during data gathering, analyses and the dissemination of the results. After the expression of interest, the person received an email containing further information and the link to the on-line questionnaire. Participants had to fill in the on-line survey before attending the field sessions, thus implicitly giving their informed consent by completing the questionnaire. Once the surveys were done, several sessions were scheduled in weekdays (morning, mid-day and afternoon), and participants selected the ones that suited them from an online calendar.

All participants visited both squares in small groups of 2-5 participants, depending on their availability. Visits were scheduled in a counterbalanced order to avoid possible order effects. The meeting point for place 1 was an office in the Department of Psychology and, for place 2, a public library close by. After arrival, participants completed the pretest questionnaire and walked to the experimental settings with one researcher (<3 minutes). When in the setting, participants were instructed to spend 10 minutes walking freely through it and another 10 minutes sitting on one of the benches in the location. The order of those activities was randomized for each session to balance order effects. During activities, participants did not speak to each other, were not close to each other and did not use any technological device, tobacco or alcohol. When the time was over, the researcher approached them again and posttest measures were taken on-site. At the end of the second field session, participants were debriefed and they could share their perceptions and opinions about the study and its topic. Before leaving, they were kindly thanked. A schema of the procedure is shown in Figure 2. The field session of the study took place in spring 2017, between the 3rd of May and the 9th of June. The weather was good and no session was conducted in the presence of rain or extremely cold weather.

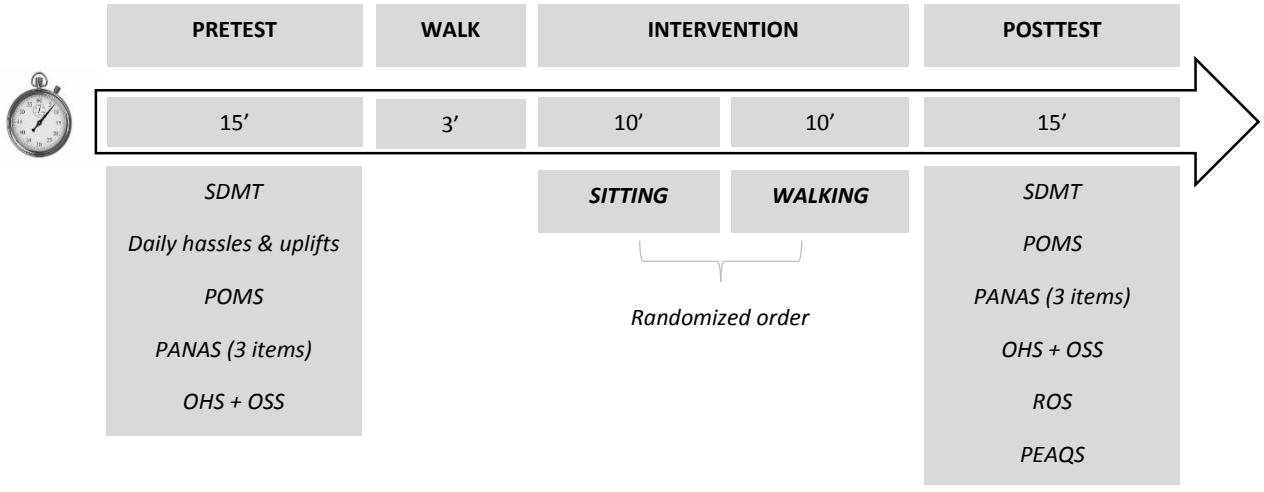

Figure 2. Graphical depiction of study's procedure. Minutes are the units of time used for the description of the procedure.

We decided against including any prior fatiguing task under the assumption that fatiguing tasks used in other studies may generate a sort of "artificial depletion" different to the one students – or people more broadly – get in their everyday life. Therefore, it made more sense to us to work with the psychological fatigue or depletion participants brought to the study situation in order to achieve more generalizable conclusions.

2.4. Instruments

Data was collected with an online questionnaire that participants filled in at the enrolment time, usually a month before the field sessions, and with pretest and posttest questionnaires during the sessions. The instruments were presented in Finnish.

2.4.1 On-line questionnaire

The On-line questionnaire comprised a general information section that included questions regarding age, gender, the length of residence (city and country) and birth data (city and country). Additionally, this section comprised two other instruments: 1) *Nature-urban orientedness scale (e.g. Sometimes I feel compelled to visit nature)* – a tool that measures nature and urban inclinations of respondents with 4 items for each one-(Tyrväinen et al., 2007) and 2) the short version of the *Nature Relatedness Scale* (Nisbet & Zelenski, 2013). This second scale consists of 6 items reflecting identification with nature and contact with nature (e.g. my relationship to nature is an important part of who I am). Both instruments were presented with a 0 (totally disagree) to 4 (totally agree) Likert scale.

Secondly, the questionnaire included two identical sections dedicated to each of the experimental settings used in the study. After being shown a photograph of the place and its location on a city map, participants had to report their degree of familiarity with the place (0 = not at all – 4= totally), the time since the first time they had been there, and the number of times they had gone or passed by the place in the last week and month. Several scales were used here. First, a 6-item scale designed ad hoc by the authors was used to obtain the participants'

assessments of a set of psycho-environmental features (coherence, navigability, diversity, complexity, imageability and identity). Scores of this scale are not reported here. Secondly, *Perceived Restorativeness Scale* (Hartig, Korpela, Evans, & Gärling, 1997), a tool to assess the main components of restorative experiences and places according to Attention Restoration Theory was used with a 0-6 (not at all – totally) Likert range. Place bonding was measured through an adaptation of the *Attachment and Identification Scale* (Ruiz, Hernández, & Hidalgo, 2011) for specific locations (Subiza-Pérez, Vozmediano, & San Juan, 2017). This scale presents 7 items for *attachment* (i.e. When I don´t go to this place for a while, I am willing to go there) and 3 for *identificatio*n (e.g. I belong here). Due to the possibility of under-representing the latter concept, two more items were added: *this place means a lot to me* [extracted from Kyle, Graefe, & Manning's scale (2005)] and *this place is important to me* (designed ad hoc). Finally, participants were asked to report a memory they had of that place. Content analysis of the memories is not included here.

2.4.2 Field session questionnaire

Both pretest and posttest sections of the questionnaire used during the field sessions were composed of the following instruments. *Symbol Digits Modalities Test* (SDMT) measures attentional performance in a 90-second symbol-digit pairing task. The score (0-120) is calculated after subtracting the mistakes from the total answers. To avoid or reduce learning effects, parallel versions of the tool (using different symbols) were used (Hinton-Bayre & Geffen, 2005). *Daily Hassles and Uplifts Scale* (DeLongis, Folkman, & Lazarus, 1988) was used to evaluate participants' need of restoration before each session. This scale reported the extent to which several life domains had been a matter of concern and joy in the two days before the experiment. Thirty-six items of the Finnish version of *Profile of Mood States* (POMS), grouped in the sub-scales of *depression-dejection*, *vigour*, *confusion*, *tension-anxiety*, *anger-hostility* and *fatigu*e, were used in a 0 (very slightly or not at all) - 4 (extremely) Likert scale. To assess positive

affect, three items (interested, enthusiastic and attentive) from the positive affect sub-scale from Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) were selected. *Overall Happiness and Stress Scales* (OHS & OSS), two items in a 0 to 100 scale, were also included.

Finally, in addition to the above-mentioned measures, the posttest section of the field session questionnaire included *Restoration Outcome Scale* (ROS) and *Perceived Environmental Aesthetic Qualities Scale (PEAQS)*. ROS (Korpela & Ylén, 2009) is a 9-item scale designed to measure the main features of a restorative experience: relaxation, attention restoration, clearing one's thoughts, subjective vitality and self-confidence (e.g. "After being here I feel restored and relaxed"). For this study, we included two additional items measuring reflection (e.g. "Here I´ve thought about my priorities and life goals"), designed ad hoc for the Spanish version of the tool (Subiza-Pérez et al., 2017). PEAQS (Subiza-Pérez, Hauru, Korpela, Haapala, & Lehvävirta, 2019) is a 21-item scale specifically created to evaluate the aesthetic experiences of environments. This scale comprises items regarding *harmony*, *excitement & exploration, multisensory experience of nature, visual spaciousness & diversity* and *sublimity*, such as« This place fits well with its surroundings », « I feel like exploring this place » and « This place is unspeakably spectacular". Both scales were used in a 0 (not at all) – 6 (completely) Likert fashion.

2.5 Data analysis

The settings were compared in terms of the pre-visit scales in the online questionnaire to check if there were differences in their perceived restorative potential and the psychological bonds towards them. In order to check whether participants improved their psychological state in the squares ($H_{1)}$and if their restorative experiences in both settings were comparable(H_2), we run Repeated Measures MANOVA that compared pretest and posttest field sessions' measures, taking into account the clustered nature of the data. In addition to statistical significance (defined as $p < .05$), we report and assess effect sizes by partial eta squared of each significant effect. H_3 was concerned with the possible associations between nature/urban orientedness and

restoration, therefore we conducted two different types of analyses. First, we added *Nature and urban orientedness as moderators* in the above-mentioned MANOVA models. Second, we conducted correlational analyses between *Nature and urban orientedness* and post-visit ROS scores. A similar procedure was used to test H_4, which expected a positive relationship between place bonding variables and restoration. This time using place attachment and identification as moderators and correlates of post-visit restoration. Finally, we run correlational analyses between achieved restoration and environmental aesthetic experience to verify if both were positively associated (H_5).

3. Results

3.1 Sample descriptives

Table 2 shows that participants reported moderate levels of nature relatedness, nature orientedness and urban orientedness. The selected settings were rated low on restorativeness, attachment and identification. Repeated measures MANOVA revealed that setting 1 was rated greater than setting 2 in *familiarity*, whereas *PRS - global score* and *place attachment* were rated greater in Place 2. *Identification* ratings were also higher in Place 2, but the difference did not reach statistical significance (p = .053). The reliabilities of the scales were good with Cronbach's α between .71 and .88. The only case below the .70 threshold was for *nature orientedness*, with α=.65.

Regarding the use of Place 1, 44% of the participants had visited it the week before the experiment, and 82% in the last month. A similar pattern was observed in Place 2, with 33% of the sample visiting it in the past week and 62% in the past month.

Table 2. Mean score and standard deviation of scales included in the on-line questionnaire.

Sample descriptives

Nature orientedness[0-4]	2.81 (0.79)
Urban orientedness[0-4]	2.66 (0.86)
Nature relatedness [0-4]	1.97 (0.88)

Setting-wise variables

	Setting 1	Setting 2	F (1,33)	*p*
*Familiarity [0-4]***	2.41 (0.70)	2.00 (0.82)	9.40	.004
*PRS - global score [0-6]**	2.65 (0.89)	2.80 (0.85)	5.09	.031
PRS - being away [0-6]	1.53 (1.30)	1.78 (1.26)	2.03	.164
PRS- fascination [0-6]	2.63 (1.20)	2.75 (1.18)	1.29	.264
PRS- extent [0-6]	3.56 (1.18)	3.84(1.40)	2.91	.097
PRS - compatibility [0-6]	2.37 (1.17)	2.41(1.20)	0.09	.773
*Place attachment [0-5]**	1.06 (0.76)	1.51 (0.83)	7.10	.012
Place identification [0-5]	0.57 (0.62)	0.87 (0.87)	4.04	.053

Note: *= *p* value < .05; **= *p* value < .01.

3.2 Analyses regarding H_1, H_2 and H_3

Table 3 shows pretest and posttest scores for each experimental setting. According to pretest scores on daily hassles and uplifts, participants seemed to be in a low need of restoration.

Table 3. Pretest-posttest scores by experimental setting

	Setting 1		**Setting 2**	
Measure	**Pretest**	**Posttest**	**Pretest**	**Posttest**
Daily hassles [0-3]	1.00 (0.38)	-	0.97 (0.34)	-
Daily uplifts [0-3]	1.05 (0.35)	-	1.05 (0.37)	-
SDMT – Mistakes	0.41 (0.70)	0.41 (0.61)	0.47 (0.79)	0.56 (1.02)
SDMT – General Score *[0-120]*	53.82 (11.12)	61.06 (10.12)	59.91 (10.82)	60.62 (9.93)
Depression-Dejection [0-4]	0.84 (0.39)	0.49 (0.36)	0.97 (0.36)	0.48 (0.32)
Vigor [0-4]	1.45 (0.51)	1.20 (0.56)	1.43 (0.46)	1.28 (0.52)
Confusion [0-4]	0.95 (0.59)	0.95 (0.57)	0.84 (0.68)	1.01 (0.54)
Tension-Anxiety [0-4]	0.84 (0.64)	0.86 (0.48)	0.80 (0.69)	0.76 (0.47)
Anger-Hostility [0-4]	0.78 (0.44)	0.28 (0.28)	0.78 (0.48)	0.28 (0.46)
Fatigue [0-4]	0.95 (0.75)	0.86 (0.67)	0.98 (0.59)	0.86 (0.63)
Positive Affect [0-4]	1.38 (0.52)	1.37 (0.55)	1.36 (0,44)	1.38 (0.39)
Stress [0-100]	54.85 (23.92)	44.74 (23,52)	48.59 (21.45)	41.38 (21.47)
Happiness [0-100]	66.00 (21.91)	66.53 (21.12)	68.06 (23.23)	72.32 (18.88)

Note: average, standard deviation for pretest and posttest scores for each of the variables included in the field questionnaire.

Analyses regarding H_1, shown in the upper part of Table 4, indicated that participants showed reductions in the variables depression-dejection [F (1,33) = 89.33 ; p = < .001; ηp^2= 0.73], anger-hostility [F (1,33) = 143.17 ; p < .001; ηp^2= 0.81] and stress [F (1,33) = 61.33 ; p = < .001; ηp^2= 0.65], and an increase in SDMT - general score [F (1,33), = 44.3, p <.001, ηp^2= 0.57] and a decrease in vigour [F (1,33) = 6.83 ; p = .013; ηp^2= 0.17] after spending 20 minutes at the settings. Thus, these scores reveal that spending time in both experimental settings reduced some negative affect indicators and improved performance in the attention task on one aspect. According to partial eta squared values, the size of these effects was large.

Regarding differences in restoration between the settings (H_2), the increase in SDMT general score was greater in setting 1 [F (1,33) = 17.83, p <.001, ηp^2= 0.35]. There were no other differences in restoration between the settings (upper part of Table 4). Again, the size of this effect was large.

Examining the role of UO (urban-orientedness) (H_3), time and UO interacted for confusion [F (1,32) = 4.88; p = .034; ηp^2= 0.13], suggesting an increase in confusion for the participants with higher urban orientedness. We also found a significant time x setting x UO on vigour [F (1,32) = 5.15; p = .030; ηp^2= 0.14], indicating that greater urban-orientedness predicted higher vigour reductions in setting 1. These effects were moderate in size.

In the case of NO (nature-orientedness) (H_3), the analyses showed time x setting x NO interaction effects on SDMT- mistakes [F (1,32) = 4.49; p = .042; ηp^2= 0.12], SDMT- general score [F (1,32) = 9.93; p = .004; ηp^2= 0.24], vigour [F (1,32) = 5.34; p = .027; ηp^2= 0.14] and fatigue [F (1,32) = 7.35; p = .011; ηp^2= 0.19]. The marginal means of these associations indicated that greater nature-orientedness predicted lower improvement in attentional performance and

lower decreases in fatigue and vigour in setting 2. Partial eta squared values indicate that these changes were large but for SDMT-mistakes these can be considered moderate.

In order to test H_3, we also ran correlational analyses between NO, UO and ROS scores. We found a negative correlation between NO and UO (r = - .46, p = .006) but no association between the former variables and ROS scores.

Table 4. Results of repeated measures MANOVAs to test H_1, H_2& H_3

Model	Effect	Outcome																					
		SDMT - mistakes		SDMT – general		Depression-dejection		Vigour		Confusion		Tension-anxiety		Anger- Hostility		Fatigue		Positive Affect		Stress		Happiness	
		F	p	F	p	F	p	F	p	F	p	F	p	F	p	F	p	F	p	F	p	F	p
Time and place only (H_1 and H_2)	Time Df (1,33)	0.11	.744	**44.3**	**<.001**	**89.33**	**< .001**	**6.83**	**.013**	1.54	.223	.029	.867	**143.17**	**< .001**	1.30	.262	0.01	.933	**61.36**	**< .001**	2.29	.140
	Place Df (1,33)	0.63	.433	**7.31**	**.011**	1.15	.292	0.19	.664	0.10	.756	0.71	.407	0	1	0.03	.868	0.01	.948	2.06	.161	2.30	.139
	Time x place Df (1,33)	0.11	.744	**17.83**	**< .001**	2.79	.104	0.79	.382	2.54	.120	0.28	.598	0.02	.905	0.07	.799	0.08	.786	1.58	.218	2.23	.145
Moderation models (H_3)	**UO**																						
	Time x UO Df (1,32)	0.91	.347	2.70	.110	2.78	.105	0.79	.382	**4.88**	**.034**	0.44	.514	0.06	.813	2.01	.126	0.64	.431	0.03	.857	0.01	.939
	Time x Place x UO Df (1,32)	1.91	.176	1.62	.212	3.76	.061	**5.15**	**.030**	0.01	.946	1.37	.250	0.67	.418	1.01	.321	2.14	.153	1.15	.291	0.58	.453
	NO																						
	Time x NO Df (1,32)	1.73	.198	0.72	.402	0.02	.888	0.89	.353	0.07	.793	0.20	.661	0.08	.782	0.24	.627	0.29	.597	2.40	.131	0.27	.605
	Time x Place x NO Df (1,32)	**4.49**	**.042**	**9.93**	**.004**	0.79	.380	**5.34**	**.027**	0.01	.928	0.71	.407	0.03	.865	**7.35**	**.011**	0.03	.855	0.02	.883	0.12	.736

Note: Significant effects ($p < .05$) are highlighted in bold.

3.3 Analyses regarding, H_4 and H_5

ROS ratings were quite comparable in setting 1 (*M* = 2.78; *SD* = 1.08) and setting 2 (*M* = 2.75; *SD* = 0.89), revealing that participants experienced low-to-medium restoration. The magnitudes of the reported aesthetic experiences were quite similar as well (S1 - *M* = 2.60; *SD* = 0.78 & S2 - *M* = 2.90; *SD* = 0.68).

In contrast to H_4, the repeated measures MANOVAs showed no evidence suggesting that place attachment or place identification would moderate the pre-post changes in attention or mood (Table 5). However, *place attachment* and *place identification* were 1) strongly correlated with each other, 2) not correlated with *ROS* scores, 3) correlated with participants' aesthetic experience (with *place attachment* having a greater correlation coefficient, particularly in place 2). Furthermore, supporting H_5, 4) *ROS* and *PEAQS* scores were moderately associated. Results of this analysis are illustrated in Table 6.

Table 5. Results of repeated measures MANOVAs to test H_4

Model	Effect		Outcome: SDMT – mistakes		SDMT - general		Depression-dejection		Vigour		Confusion		Tension-anxiety		Anger-Hostility		Fatigue		Positive Affect		Stress		Happiness	
			F	p	F	p	F	p	F	p	F	p	F	p	F	p	F	p	F	p	F	p	F	p
Moderation models (H_4)	Place 1																							
	Time attachment Df (1,32)	x	0.01	.906	0.10	.852	0.01	.951	0.32	.579	1.23	.277	0.14	.713	0.02	.885	1.23	.267	0.20	.661	0.06	.815	0.03	.837
	Time identification Df (1,32)	x	0.77	.388	0.01	.914	0.41	.525	0.15	.703	0.67	.419	0.28	.602	0.08	.781	0.11	.745	0.74	.395	0.01	.943	0.30	.585
	Place 2																							
	Time attachment Df (1,32)	x	1.22	.278	0.21	.650	0.07	.789	0.65	.425	0.04	.850	1.11	.299	0.04	.835	3.69	.064	0.94	.256	1.34	.256	0.01	.952
	Time identification Df (1,32)	x	0.06	.805	0.24	.630	0.22	.645	3.22	.082	0.10	.750	0.35	.566	0.95	.337	1.99	.168	1.04	.315	1.02	.320	0.01	.946

Table 6. Place attachment, identification, ROS and AES correlations for settings 1 and 2

	Place Identification		*ROS*		*PEAQS*	
	S1	S2	S1	S2	S1	S2
Place attachment	.83***	.83***	.21	.32	.37*	.56***
Place Identification	-	-	.19	.09	.40*	.44**
ROS	-	-	-	-	.37*	.57***

4. Discussion

In this study, two open urban public places were selected in a European city and visited by a sample of university students for 20 minutes each. The squares were common and ordinary places with a low presence of natural elements.

The participants evaluated both settings with moderate to low ratings in measures of perceived restorativeness (*PRS*), experienced restoration (*ROS*) and aesthetic experience (*PEAQS*). Nevertheless, the findings indicated that the experience of walking, sitting and contemplating in the selected settings led to an increase in attentional performance and a decrease in experiences of depression-sadness and stress, with effect sizes that were moderate and comparable to previous studies such as San Juan et al. (2017). Therefore, H_1 was only partially supported because participants showed no change in their level of positive affect. It seems that we observed "a lower end" or an "incomplete restorative experience". This is congruent with the results of a recent meta-analysis that consistently found a decrease of negative affect after visits to open urban places while positive affect remained constant (Stenfors et al., 2019). We also expected both settings to offer comparable restorative experiences (H_2) and evidence points in that direction, with both places showing the same pattern of effects for attention restoration, depression-sadness, stress and restoration outcomes.

As indicated in section 2.2, both study sites included few amenities and amusements. These physical features, along with low levels of mystery and limited options for exploration might have offered fewer opportunities for restorative experiences. Similarly, traffic noise may have undermined or affected the participants' psychological restoration. It seems that to improve positive affect, squares should include elements fostering aesthetic pleasure or interest, such as pieces of art, masses of water, architectonical diversity or even attractive and dynamic social activities or interactions (Thwaites, Simkins, & Mathers, 2011). In this study, both settings included some examples of such items but, globally, offered limited aesthetic potential and amenities. Future studies should examine whether elements fostering aesthetic pleasure and social interactions actually increase the restorative potential of urban settings. In addition, "cultural compatibility" could also explain these findings. Contrary to Mediterranean or Latin countries, spending free time in a public square might not be very frequent for Finnish citizens, whereas activities in nature are more characteristic (Korpela & Kinnunen, 2011; Österlund-Pötzsch, 2013; Pietilä et al., 2015). However, spending time in open urban places, characterized by low levels of greenness, traffic exposure, noises, and city life, did not deteriorate attentional performance or induce emotional distress. Thus, our results indicated that exposure to both settings decreased negative affect and conserved or improved attentional functioning. Therefore, we conclude that some open urban places can be useful for mitigating the deleterious effects of stress and sustained cognitive efforts. The types and features of these places deserve further study.

The finding that nature orientedness was negatively related to improvements in attention restoration and reductions in fatigue and vigour (but only in setting 2) is in line with previous results indicating that nature oriented people assign less restorative value to urban environments (Wilkie & Clouston, 2015; Wilkie & Stavridou, 2013). As the squares included both green and built elements, the attentional focus of nature oriented people might have varied between green and built elements. It seems that this mismatch between nature orientedness

and the experimental setting (urban) led to a weaker restorative experience for the nature oriented people in setting 2. On the other hand, urban orientedness was positively and significantly associated with pretest-posttest changes in confusion and vigour (only in setting 1). Taken together, these results illustrate a different restorative pattern depending on a specific personal trait (nature/urban orientation) and the square each individual is experiencing. However, neither nature orientedness nor urban orientedness was significantly associated to ROS scores. Hence, we found only a limited support for H_3. However, at this point we should acknowledge that the limited size of our study sample might have compromised our ability to find significant results (that is, statistical power) and define this part of our findings as solid. Future studies using larger samples will help to strengthen this line of research.

Building on previous studies on the role of place bonding in the restoration process (Morton et al., 2017; Ratcliffe & Korpela, 2016, 2017; Ysseldyk, Haslam, & Morton, 2016), we measured place attachment, identification and memories. In this line, H_4 stated that attachment and identification would be positively related to restorative and aesthetic experiences in the study settings. With our data at hand, we cannot fully corroborate H_4 because congruent results were only obtained between bonding and environmental aesthetic scores. We find three plausible explanations for the lack of relation between bonding and restoration. First, at the statistical level, sample's size may have prevented us again from finding significant effects due to limited statistical power. Secondly, and in the conceptual sphere, the levels of attachment and identification with the places were relatively low. It might be possible that the contribution of these variables to restoration occurs more strongly in places of greater personal relevancy. Thirdly, studies by Ratcliffe and Korpela (2016, 2017) registered imagined or remembered restorative experiences through questionnaires where participants reported memories and restorative experiences at the same time, whereas in this study place bonding variables were measured some weeks before the square visits. Nevertheless, a relationship between place bonding and aesthetic experience was detected, indicating that the greater the bonding with a

place, the greater the aesthetic value of it. Further research could explore the relationship among these factors and better disentangle the role of each in the experience of a place with more complex studies and analysis strategies. For instance, including places with different levels of personal relevancy for participants (e.g. favourite, daily and liked/disliked places) could help to better explore these relationships and provide a deeper understanding of them. We also anticipated that restoration and aesthetic scores would be positively related (H_5) and we found supporting evidence showing a significant positive and medium-sized relation between these variables.

The study design and measurements had some limitations. We used a small university sample with a self-selection bias due to voluntary participation. According to the pretest scores, participants expressed a low need for restoration before each of the experimental sessions that could have led to low-level restorative experiences. Physical variables such as noise or pollution could not be controlled.

5. Conclusion

In this study, we found out that open urban squares provided the "low end" of restorative experience, i.e. visits to such places stop the increase of negative feelings and even reduced some of them (depression and stress,) but they had little impact on increasing positive feelings. Urban open places provided experiences that seem to block the accumulation of attentional fatigue and negative mood. This effect applied particularly to more urban-oriented people. As urban densification seems to offer increasingly fewer opportunities for green recreation (van der Berg, Hartig, &Staats, 2007; Thwaites et al., 2005), further studies of people's experiences of and inclinations towards built urban environments are important in order to boost their restorative potential and related health benefits.

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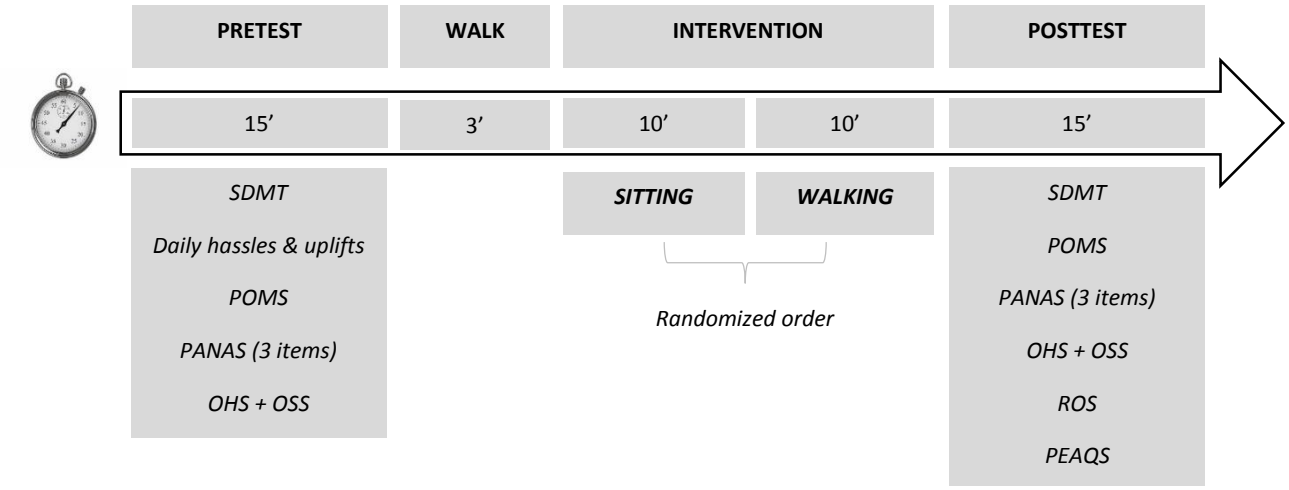

Figure 2. Graphical depiction of study’s procedure. Minutes are the units of time used for the description of the procedure.