

Environment Preference and Environment Type Congruence:
Effects on Perceived Restoration Potential and Restoration Outcomes

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Abstract

1
2 The study aims were to replicate initial findings of an environmental preference/environment
3 type “congruence effect” on judgements of perceived restoration potential (Wilkie and
4 Stavridou, 2013) and explore if this congruence influenced restoration outcomes. University
5 students ($N = 120$) categorized themselves as ‘country’ *or* ‘city’ persons to indicate
6 environmental preference (nature, urban), viewed an imagery slideshow of one environment
7 (nature, urban green space, urban street), and completed pre-post imagery measures of
8 directed attention, mood, and fatigue. They also rated environments like those in the
9 slideshow for perceived restoration potential and then completed a place identity measure in
10 reference to their preferred environment. The use of the dichotomous environmental
11 preference variable as an indicator of place identity was supported with equal, moderate-to-
12 high levels of place identity reported by both groups. An environment type main effect
13 indicated better positive/negative mood and fatigue outcomes for those in the nature
14 condition compared to the urban street condition. Urban green space exposure resulted in a
15 better improvement to negative mood compared to urban street exposure. Nature and urban
16 green spaces provided equivalent changes in direct attention, mood, and fatigue. There was
17 no environment type effect on directed attention or perceived restoration potential. The
18 environmental preference/environment type congruence findings replicated the previously
19 reported effect on perceived restoration potential (Wilkie and Stavridou, 2013). The highest
20 ratings were after exposure to congruent nature environments and the lowest from exposure
21 to urban street imagery incongruent with a nature preference. A pattern of both significant
22 and non-significant results across outcomes indicated the congruence effect was more evident
23 in those who preferred nature; urban preferences resulted in similar benefits outcomes across
24 environments. These findings support growing evidence urban green spaces provide a range

1 of benefits; and suggest person-place concepts such as place identity should also be
2 considered in restoration research.

3 Keywords: Directed attention, environmental psychology, place identity, mood

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1 Environmental Preference and Environment Type Congruence: Effects on
2 Perceived Restoration Potential and Restoration Outcomes

3 The link between the environment and our well-being is robustly established, with an
4 emphasis placed on nature's benefits over urban locales (Bowler, Buyung-Ali, Knight, and
5 Pullin, 2010; Beute and de Kort, 2014; Beyer, Kaltenbach, Szabo, Bogar, Nieto, and Malecki,
6 2014; Pasenen, Tryväinen, and Korpela, 2014). Yet, even when encouraged to do so, people
7 often do not use available nature resources in need of cognitive or emotional restoration
8 (Eriksson and Nordlund, 2013; Herzog, Chen, & Primeau, 2002).

9 Wilkie and Stavridou (2013) proposed a possible explanation for this lack of
10 engagement with nature in these circumstances. They found the interaction between an
11 individual's environmental preference, which they considered representative of place
12 identity, and environment type influenced judgements of the potential for directed attention
13 restoration to occur. Specifically, persons who preferred nature judged the restoration
14 potential of incongruent urban locations lower than for nature settings congruent with their
15 preference, while those with urban preferences perceived equivalent opportunities for
16 restoration in both congruent urban and incongruent nature environments. Wilkie and
17 Stavridou concluded the variations in perceived restoration potential due to this congruence
18 effect may explain when nature locations are not always chosen when in need of restoration;
19 and speculated persons with an urban preference do not seek nature because they perceive the
20 city as restorative. This preliminary 'congruence effect' finding also reinforced the
21 importance of considering individual-level person-place factors in studies of restorative
22 environments (Smith, Davenport, Anderson, and Leahy, 2011; Jun, Kyle, Vlachopoulos,
23 Theodorakis, Absher, and Hammitt, 2012).

24 The current study was a conceptual replication (Schmidt, 2009) of Wilkie and
25 Stavridou (2013). The aims were to replicate the environmental preference/type congruence

1 effect on judgements of perceived restoration potential and extend this research through three
2 modifications: confirmation environmental preference can represent place identity,
3 introduction of an urban green space condition, and the addition of measures of restoration
4 outcomes.

5 *Environmental preference represents place identity*

6 Typically environmental preference has been grounded in attention restoration theory
7 (Kaplan, 1995). It is defined as liking an environment or finding it attractive (White and
8 Gatersleben, 2011; Eriksson and Nordlund, 2013) and viewed as a consequence of directed
9 attention fatigue (Herzog et. al, 2002; Joye and van den Berg, 2011). Wilkie and Stavridou
10 (2013) challenged this definition in two ways. They suggested environmental preference
11 represented the individual's place identity, or the part of the self-concept inextricably linked
12 to place (Proshansky, Fabian, and Kaminoff, 1987); and that preference has a causal
13 influence on environmental perception. However, environmental preference was
14 operationally defined by asking participants to categorize themselves as a 'country or city
15 person' without confirming if this categorization reflected place identity. Therefore, it was
16 important to rectify this methodological concern in the current study.

17 *More than nature OR built environments*

18 Comparisons of nature vs. urban street environments have been criticized as an
19 extreme dichotomy (Velarde, Fry and Tviet, 2007); especially since studies indicate quite
20 varied urban green spaces can positively influence restoration outcomes. Using the same
21 validated measures as the current study, Tryväinen and colleagues (2014) compared
22 participant's mood and perceived restoration potential judgements across three urban
23 conditions: street, park, and forest. They found perceived restoration potential was highest
24 for urban forests, followed by the urban park and city streets; and that both urban park and
25 forest exposure resulted in equal improvements in positive mood. In another study using

1 different mood and state-level restoration measures to the current study, three urban nature
2 locations which varied in naturalness (urban parkland, tended and untended urban
3 woodlands) provided equivalent benefits to mood and better than the least natural urban street
4 setting (van den Berg, Jorgensen, and Wilson, 2014). Both the criticisms of the nature/urban
5 street dichotomy and the findings of these two studies suggest an urban green space condition
6 would enhance the current study and naturalness should be incorporated into the research
7 design.

8 *Restoration as well as restoration potential*

9 Wilkie and Stavridou (2013) presented preliminary evidence of an environmental
10 preference/environment type “congruence effect” on perceptions of an environment as
11 potentially restorative; but restoration outcomes associated with such environments were not
12 measured. It is useful to understand how perception shapes the consideration of
13 environmental resources, particularly given other factors such as priming (Stevens, 2014) and
14 setting attitudes (Staats, Kieviet, and Hartig, 2003) can influence the expectation of
15 restoration; but it is also necessary to determine if congruence also affects outcomes such as
16 directed attention, mood, and fatigue previously associated with exposure to nature (e.g.
17 Hartig, Mang, and Evans, 1991; Berman, Jonides, and Kaplan, 2008; Tyrväinen et. al., 2014;
18 van den Berg et al., 2014).

19 *Study hypotheses*

20 This study aims were to replicate the environmental preference/environment type
21 congruence effect on perceived restoration potential and extend the study with the addition of
22 an urban green space condition and restoration outcomes. It was also important to determine
23 whether environmental preference represented place identity.

1 The following hypotheses were tested:

- 2 • H₁: Nature and urban environmental preference groups will report equal levels of
3 place identification with their preferred location.
- 4 • H₂: Environment type will influence restoration outcomes and judgements of
5 perceived restoration potential.
 - 6 ○ H_{2A}: Exposure to nature environments will result in the highest restoration
7 outcomes/perceived restoration potential.
 - 8 ○ H_{2B}: Exposure to urban green spaces will result in similar outcomes/perceived
9 restoration potential to nature.
 - 10 ○ H_{2C}: Exposure to urban street images will result in the worst restoration
11 outcomes/perceived restoration potential.
- 12 • H₃: Environmental preference/environment type congruence influences restoration
13 outcomes and perceived restoration potential.
 - 14 ○ H_{3A}: Exposure to congruent environments provides the highest
15 outcomes/perceived restoration potential and incongruent ones the least.
 - 16 ○ H_{3B}: The congruence effect will be more evident in persons with a nature
17 preference.

18 **Method**

19 *Sample characteristics*

20 University students received class credit for participation as part of a research
21 engagement scheme in first and second year undergraduate research methods ($N = 120$; 74%
22 female; $M_{\text{age}} = 23.70$, $SD = 7.26$). Participation was considered voluntary because students
23 could choose from a large number of projects and/or complete written journal summaries to
24 fulfil requirements.

1 *Environmental preference*

2 Participants were asked ‘*Do you consider yourself as a city person or a country*
3 *person?*’ to capture environmental preference as a representation of their place identity.
4
5 ‘Country persons’ were categorized as having a nature preference ($n = 47$) and the others an
6 urban preference ($n = 73$). No other criteria were used to categorize environmental
7 preference.

8 They also completed Drosletis and Vignoles’ (2010) 7-item place identity scale.
9 Sample items included ‘This place reflects the type of person I am’ and ‘I feel this is the
10 place where I fit.’ Items were rated on a scale from 0 (*not at all true of this place*) to 10
11 (*completely true of this place*); and place identity was calculated as the mean of all items.
12 Cronbach’s alpha for the scale was .92 with this sample. This scale was chosen instead of the
13 connectedness to nature scale (CNS, Mayer and Franz, 2004) or the environmental identity
14 scale (EID, Clayton, 2003). The CNS shares some conceptual overlap with place identity
15 (Perrin and Bennassi, 2009); but is not grounded in social identity theory (Tam, 2013), which
16 is integral to place identity theory (Proshansky, et al., 1987; Drosletis and Vignoles, 2010).
17 The EID, although based on a social identity framework, only focused on identification with
18 nature settings and does not consider identification with other locations (i.e. cities).
19 Therefore, Drosletis and Vignoles’ measure was considered best suited to the current study
20 because it captured the importance of place to identity, whether urban or nature.

21 *Restoration Outcomes*

22 *Directed attention.* A proof-reading task requiring identification of the letter ‘a’ in
23 English text was used to measure directed attention (maximum score = 41; Healy, 1994). It
24 was chosen as an ecologically valid task for the student sample and a similar task has been
used in previous studies (Hartig, et al., 1991; Bowler, et al., 2010).

1 *Mood.* The Positive and Negative Affect Scale (PANAS, Watson, Clark, and
2 Tellegen, 1988) is a self-report scale of 10 positive (e.g. excited) and 10 negative (e.g. upset)
3 states (1 = *very slightly or not at all*; 3 = *moderately*; 5 = *extremely*). Positive and negative
4 mood scores were calculated as the sum of appropriate scale items (maximum = 50). The
5 PANAS has been used in prior nature research (Berman et al., 2008; Tyräinen, et al., 2014).
6 In the current study, the internal consistency for the sub-scales ranged from .70 - .89.

7 *Fatigue.* One item assessed current fatigue level ‘Please indicated how mentally
8 fatigued do you feel right now?’ using a rating scale from 1 (*no fatigue*) to 4 (*somewhat*
9 *fatigued*) to 7 (*completely fatigued*). A similar single-item measure was used by Staats
10 and Hartig (2004).

11 *Perceived restoration potential.* The 12-item version of the Perceived Restoration
12 Scale (Hartig, Korpela, Evans, and Gärling, 1997) measured the extent to which
13 environments similar to those in study were perceived as likely to provide directed attention
14 restoration (1 = *not at all*; 7 = *completely*). A mean scale score was generated. Cronbach’s
15 alpha indicated good internal consistency (.91).

16 *Experimental stimuli*

17 Sets of 10 images represented three environment conditions (Fig. 1): nature, urban
18 green space, and urban street. The non-water nature and urban street images from Wilkie and
19 Stavridou (2013) were used in the current study. Urban green space images were chosen
20 from freely available stock photographs with some showing people, automobiles, or physical
21 structures such as bridges or buildings. Images were not assessed for specific characteristics
22 such as the ratio of green space.

23 A separate volunteer sample ($N = 12$, demographics not obtained) of research staff and
24 students enrolled in an undergraduate environmental psychology class were randomly
25 allocated to one condition and rated the naturalness of each image 1 = *urban* to 7 =

1 *natural*. No credits were awarded for participation. Nature images were significantly more
2 natural ($M = 5.86$; $SD = .38$) than urban green space images ($M = 3.10$; $SD = .80$), which
3 were more natural than urban street images rated as urban ($M = 1.78$; $SD = .45$), $F(2, 11) =$
4 52.97 , $p < .001$.

5 *Design and procedure*

6 The quasi-experimental 2 x 3 design consisted of two independent variables:
7 environmental preference (nature/urban) and environment type (nature/urban green
8 space/urban street). A six-level congruence variable was created for post-hoc analyses:
9 nature preference/nature imagery ($n = 16$), nature preference/urban green space imagery ($n =$
10 7), urban preference/urban green space imagery ($n = 13$), urban preference/urban street
11 imagery ($n = 26$), urban preference/nature imagery ($n = 34$), and nature preference/urban
12 street imagery ($n = 24$). There was no difference in participant's reported nature/urban
13 preference across environment types ($\chi^2 = 2.86$, $p = .24$).

14 The dependent variables were place identity, directed attention, mood
15 (positive/negative), fatigue, and perceived restoration potential. The change in restoration
16 outcomes was calculated so that positive values indicated an improvement. For directed
17 attention and positive mood, change was calculated as post imagery – baseline and baseline –
18 post imagery for negative mood and fatigue. The exceptions were place identity and
19 perceived restoration potential, which were only measured post-imagery.

20 British Psychological Society ethics guidelines (BPS, 2010) were implemented.
21 Environment type conditions were allocated prior to participant arrival by alternating
22 conditions; environment preference was categorized after the study based on participant
23 responses. The 30-minute session took place during a normal university day in the second
24 academic term; daily academic demands were considered an indicator of likely cognitive
25 fatigue (e.g. Karmanov and Hamel, 2008). In order to provide students with a range of

1 research engagement opportunities, sessions were offered throughout the day and week.
 2 Most participants completed the study in the afternoon ($n = 67\%$), with fewer in the late
 3 afternoon ($n = 24\%$), or morning ($n = 9\%$). There was no significant difference in
 4 environment type ($\chi^2 = 0.93, p = .92$) or environment preference ($\chi^2 = 4.21, p = .12$) by time
 5 of day. Participation mostly occurred Monday – Wednesday (94%).

6 After consenting to participate, participants provided fatigue and mood ratings,
 7 completed the directed attention task, and viewed an E-prime slideshow. Each image
 8 presented for 15 seconds on a loop over 7 minutes (Berto, 2005). They provided
 9 demographics, completed the perceived restoration scale with clear instructions to rate
 10 environments like those they had just viewed, repeated fatigue/mood/directed attention tasks,
 11 and then completed the place identity scale in reference to the place consistent with the type
 12 of person they were (city or country). Finally, a video of a laughing baby was shown to
 13 counteract any negative effects from viewing non-preferred environments.

14 **Results**

15 Descriptive statistics for place identity and restoration outcomes overall, by
 16 environmental preference, and environment type are provided in Table 1. At baseline,
 17 participants were “*somewhat*” fatigued, in a “*moderately*” positive mood, and in “*not at all*”
 18 to “*a little bit*” of a negative mood. After exposure to the environment imagery, participants
 19 were slightly less fatigued, reported a small reduction in negative mood, but also a slightly
 20 lower level of positive mood. The level of performance on the directed attention task was
 21 high at baseline and post-imagery. Study participation generally improved these outcomes
 22 except positive mood, which was reduced (all $p \leq .01$).

23 There were no gender differences in the restoration outcomes (all $t(118), p > .19$).
 24 Separate one-way analyses of variance (ANOVA) were implemented to determine if time of
 25 day influenced restoration outcomes; outcome correlations were not suited to multi-variate

1 ANOVA (MANOVA). Only negative mood ($F(2, 119) = 5.44, p = .01$) and perceived
 2 restoration potential ratings ($F(2, 119) = 4.26, p = .02$) differed by time of day (all other $p >$
 3 $.22$). Late afternoon participants reported more improved negative mood ($M = 3.10, SD$
 4 $= 3.51$) compared to afternoon participants ($M = 1.08, SD = 2.68; p = .004$). Morning
 5 participants rated environments as potentially more restorative ($M = 5.73, SD = 0.79$) than
 6 afternoon participants ($M = 4.79, SD = 1.08; p = .02$). However, because of unequal
 7 distributions across environmental preference and environment type, time of day could not be
 8 included in further analyses.

9 *Environmental preference represents place identity*

10 Overall, mean ratings indicated the sample did have moderate-to-high place identity
 11 associated with their preferred location. The comparison between those with nature and urban
 12 preferences indicated their levels of place identity were equal, $t(75.43) = 0.34, p = .74$.

13 *The effect of environment type*

14 To test the remaining hypotheses, separate 2 x 3 (Environmental Preference x
 15 Environment Type) analyses of variance (ANOVA) were implemented for each outcome
 16 variable; outcome correlations were not suited to MANOVA. In this section, the main effects
 17 of environment type on restoration outcomes and perceived restoration potential are
 18 presented. There was no *a priori* expectation environmental preference should independently
 19 influence any outcomes and none of the environmental preference main effects were
 20 significant (all $p \geq .10$). These results are not reported further. Environmental
 21 preference/environment type interactions resulting from these ANOVA's follow in the
 22 section focused on the hypothesized congruence effect.

23 *Directed attention.* The main effect of environment type on directed attention was not
 24 significant, $F(2, 114) = 1.54, p = .22, \eta^2_p = .03$. There was a general improvement of
 25 approximately two to three points on the task by all groups.

1 *Mood.* Environment type impacted changes in positive mood ratings, $F(2, 114) = 4.60$,
 2 $p = .01$, $\eta^2_p = .08$. Nature imagery exposure resulted in small improvements to positive mood
 3 that were significantly higher after exposure to urban street images ($p < .01$), whose positive
 4 mood declined by approximately 4 points. Changes in positive mood did not differ between
 5 participants in nature and urban green space conditions ($p = .54$); or between urban green
 6 space and urban street conditions ($p = .11$). Environment type affected negative mood (F
 7 $(2,114) = 3.54$, $p = .03$, $\eta^2_p = .06$). Significant improvements resulted from either urban green
 8 space or nature imagery exposure when compared to urban street imagery exposure (both $p <$
 9 $.05$). Nature and urban green space conditions did not differ ($p = .81$)

10 *Fatigue.* Perceived level of fatigue was significantly affected by environment type, F
 11 $(2,114) = 5.58$, $p < .01$, $\eta^2_p = .09$. Post-hoc analyses indicated that both nature and urban
 12 green space images provided equivalent, small improvements to fatigue ($p = .10$); fatigue
 13 after viewing urban green space or urban street images was also similar ($p = .42$). Only
 14 nature image exposure significantly improved fatigue compared to urban street imagery
 15 exposure ($p = .001$).

16 *Perceived restoration potential.* A Kruskal-Wallis analysis was conducted after a 2 x 3
 17 ANOVA indicated inequality of variances. The environment type main effect was non-
 18 significant ($\chi^2 = 4.71$, $df = 2$, $p = .10$); all environment types were rated as *rather* restorative.

19 *The effect of environmental preference/environment type congruence*

20 In this section, the environmental preference/environment type interactions are
 21 presented to test the hypothesized congruence effect. The results were generated from the 2
 22 x 3 ANOVA's used to test for the main effect of environment type. Post-hoc analyses were
 23 conducted using the 6-level congruence variable described in the method section. These
 24 interactions are presented in Figs. 2 a – e.

1 *Directed attention.* The environmental preference/environment type interaction was
 2 non-significant ($F(2, 114) = 0.99, p = .38, \eta^2_p = .02$). However, the pattern of results
 3 suggested the congruent nature preference/imagery condition realized slightly better gains
 4 compared to both incongruent nature preference/urban imagery conditions (Fig. 2a).

5 *Mood.* Environmental preference/environment type interacted to significantly to effect
 6 positive mood, $F(2, 114) = 3.96, p = .02, \eta^2_p = .07$ (Fig. 2b). A post-hoc ANOVA
 7 (Bonferroni adjustment) was conducted using the 6-level congruence variable. The only
 8 significant difference was between the congruent nature preference/nature imagery condition
 9 compared to the incongruent nature preference/urban street imagery condition ($d = 7.54; p <$
 10 $.01$). The environmental preference/environment interaction did not affect negative mood (F
 11 $(2,114) = 0.61, p = .54, \eta^2_p = .01$); all conditions reported improved negative mood outcomes
 12 even after exposure to non or moderately congruent imagery (Fig. 2c).

13 *Fatigue.* There was no environmental preference/environment type interaction on
 14 fatigue levels, $F(2,114) = 1.98, p = .14, \eta^2_p = .03$. All participants reported small
 15 improvements to fatigue levels except those in the incongruent nature/urban street imagery
 16 group, who reported a small increase in fatigue (Fig. 2d).

17 *Perceived restoration potential.* Due to the inequality of variances identified in the
 18 main effects analyses, a Kruskal-Wallis analysis was conducted using the 6-level post-hoc
 19 variable. The environmental preference/environment type interaction was significant ($\chi^2 =$
 20 $33.53, df = 5, p < .001$, see Figure 2e). Six post-hoc analyses (Mann-Whitney, Bonferroni
 21 adjusted $p = .008$) were conducted:

- 22 1. Perceived restoration potential ratings by the congruent nature preference/nature
 23 imagery group were higher than the:
 - 24 a. the congruent urban preference/urban street group with the next highest rating
 25 ($z = -3.28, p < .001$); and

1 b. the incongruent urban preference/nature imagery group with the second lowest
2 rating ($z = -4.74, p < .001$).

3 2. The congruent urban preference/urban street group with the second highest perceived
4 restoration potential ratings were:

5 a. equal to the incongruent urban preference/nature imagery group ($z = -1.64, p =$
6 $.05$); but were

7 b. higher than the incongruent nature preference/urban street imagery group with
8 the lowest perceived restoration potential rating ($z = -2.53, p = .005$).

9 3. A comparison of the three groups with the lowest perceived restoration potential
10 lowest indicated:

11 a. the moderately congruent nature preference/urban green space imagery and
12 incongruent urban preference/nature imagery groups provided equivalent
13 ratings ($z = -1.15, p = .07$); and

14 b. the incongruent urban preference/nature imagery group's did not differ from
15 the incongruent nature preference/urban street imagery group ($z = -1.61, p =$
16 $.05$).

17 The results indicated a mixed congruence effect. The congruent nature preference/nature
18 imagery group reported higher perceived restoration potential ratings compared to all other
19 conditions. Experience of the congruent urban preference/urban street imagery resulted in
20 equivalent perceived restoration potential ratings to the moderately congruent urban
21 preference/urban green space imagery, nature preference/urban green space imagery, and
22 incongruent urban preference/nature imagery. The lowest perceived restoration potential was
23 from participants who experienced urban street images incongruent to their nature preference.

24 In figures 2a-e, both the significant and non-significant results illustrated different
25 patterns of restoration outcomes and perceived restoration potential as a result of the

1 congruence effect. Nature persons were more varied across environment types, while people
2 with an urban preference were generally consistent in their outcomes. The only exception
3 was change in negative mood; both groups were variable across environments.

4 **Discussion**

5 This study was a conceptual replication of Wilkie and Stavridou (2013). The primary
6 aims were to replicate the environmental preference/type congruence effect on judgements of
7 perceived restoration potential and to establish whether this effect influenced three restorative
8 outcomes. A secondary aim was to confirm whether environmental preference represented
9 place identity.

10 *Environmental preference as an indicator of place identity*

11 Although it was a secondary aim, it was important to first clarify if the nature/urban
12 environmental preference variable used by Wilkie and Stavridou (2013) represented place
13 identity. In the current study, participants in both categories reported equal, moderate-to-high
14 levels of place identity with their preferred location; this supports this dichotomous variable
15 as an indicator of place identity. Previously, the self-extension/identity affirmation
16 component of place identity predicted desires to fulfil lifestyle outcomes in (Smith et al.,
17 2011) and involvement with (Jun et al., 2012) nature; and suggests environmental preference
18 here probably represents this aspect of place identity. This dichotomous variable is also
19 useful to captures relationships to *place*, not only to nature. With limited exceptions (e.g.
20 Korpela, Ylèn, Tryväinen, and Silvonnoinen, 2008; Smith et. al., 2011), studies implement
21 the Connectedness to Nature Scale (Mayer and Franz, 2004) or the Environmental Identity
22 Scale (Clayton, 2003) when exploring the relationship between environments and restorative
23 outcomes. Mayer and his colleagues (2009) provided evidence the congruence between
24 nature connectedness and nature exposure explains a large proportion of the positive ‘nature’
25 effect. However, using these two scales renders it impossible to explore whether a

1 connection/identification with urban environments has a similar influence. For this reason,
2 we recommend the integration of *place* identity in environment-wellbeing studies; and
3 propose the urban/nature preference variable can be an efficient method to achieve this.

4 *Urban green spaces can equal nature for restoration outcomes*

5 The *a priori* expectations of better restoration due to nature exposure and lower
6 restoration after urban street exposure were confirmed. There were greater improvements to
7 positive mood, negative mood, and fatigue after viewing nature imagery compared to urban
8 street imagery. These results are consistent with findings that nature is better than urban
9 street settings for our well-being (e.g. Berman et. al, 2008; Berman et. al, 2012; Bowler et. al,
10 2010; Hartig et. al, 1991; Ulrich, 1979). However, we also presented evidence exposure to
11 urban green spaces resulted in similar effects to nature on some outcomes. Considered along
12 with recent reports of improved restoration from urban green spaces compared to urban street
13 settings (Tryväinen, et al., 2014; van den Berg et al., 2014), the current findings strengthen
14 the case for positive potential of urban green environments.

15 *The environmental preference/environment type congruence effect*

16 In Wilkie and Stavridou (2013), experiencing nature imagery congruent to a nature
17 preference resulted in the highest restoration potential ratings; and the incongruent nature
18 preference/urban street imagery experience was rated as the least restorative. These findings
19 were replicated in the current study. The congruent nature preference/nature imagery group
20 rated the nature environment higher than all other preference/environment type combinations,
21 including the congruent urban preference/urban street imagery group. The lowest
22 rating was from those exposed to urban street images incongruent with their nature
23 preference. The congruence effect was also expected to similarly influence actual restoration
24 outcomes, but this was only partially supported. The only outcome significantly affected by

1 congruence was positive mood; and then only the congruent nature preference/nature imagery
2 and incongruent nature preference/urban street imagery groups differed.

3 However, a pattern of non-significant results suggested there was more variability in
4 perceived restoration potential from individuals with a nature preference across the three
5 environment conditions compared to those with an urban preference, who rated all three
6 locations similarly in restorative potential. Similar non-significant data trends also suggested
7 greater variability between ‘nature lovers’ and ‘city persons’, particularly for positive mood.
8 The exception was the non-significant trend in negative mood that indicated more variability
9 amongst ‘city persons’ than the others.

10 Overall, the results indicate a congruence effect may be more substantive in individuals
11 with a nature-related place identity. This replicated Wilkie and Stavridou’s findings and
12 supports the suggestion people with urban preferences may not need to seek out nature for
13 restoration. However, this explanation should be specifically tested in future studies.

14 *Methodological reflections*

15 The sample was predominantly female university students in emerging adulthood.
16 Although there were no gender differences on any variable, future samples should better
17 represent the general population. This is particularly important in regards to age since both
18 restorative experiences (Scopellitti & Guiliani, 2004) and place identity vary over the life
19 span (Rollero and De Picolli, 2010). Time of day should also be systematically incorporated
20 into the research design, given the findings of its significant effect on some outcomes.

21 Proof-reading was used to measure directed attention because it was considered to be
22 a real-world task relevant to the sample; but its needs further consideration due to a clear
23 ceiling effect at baseline. Although our null findings replicated Emfield and Neider (2014),
24 who found environment type did not affect performance on a range of cognitive tasks,

1 researchers conducting future studies may consider using a cognitive test battery to more
2 robustly test for any influence of congruence on directed attention.

3 The level of naturalness was varied across imagery conditions and the findings, both
4 here and elsewhere (van den Berg et al., 2014), highlight naturalness as an important
5 characteristic of restorative environments. Yet what makes a specific setting *natural enough*
6 is not clear. This should be explored in future research along with other factors such as the
7 presence of water (White et al., 2010; Wilkie and Stavriou, 2013;) or usability features like
8 seating (Abuldkarim and Nasar, 2014). Finally, the use of imagery in the current study
9 further illustrated that simulation rather than actual environmental exposure can be beneficial
10 (Kjellgren and Buhrkall, 2010); but it is also important to extend research on the congruence
11 effect into real-world situations.

12 **Conclusion**

13 The results indicated urban green space can be equally as restorative to nature in some
14 instances; and further substantiated criticisms of the nature vs. urban street dichotomy in
15 environment-wellbeing studies (Karmanov & Hamel, 2008; Velarde et al., 2007). Significant
16 and non-significant findings also suggested variation in both perceived restoration potential
17 and some restorative outcomes were partially due to an environmental
18 preference/environment type congruence effect, especially for nature lovers. Although the
19 congruence effect may (but not necessarily) influence well-being, the antecedent perception
20 of a lack of restoration potential may stop engagement with even the most well-designed
21 urban green spaces. This highlights the role individual factors could play in urban green
22 space usage (James et al., 2009; Jorgensen and Gobster, 2010; Irvine, Warber, Devine-Wright
23 and Gaston, 2013; Zhang, Howell, and Iyer, 2014). Future research should explore
24 systematically how this congruence effect can inform to urban design to enhance well-being
25 and maximize their use.

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24 relation between connectedness to nature and psychological well-being. Journal of
25 Environmental Psychology, 38, 55-63.

1 Figure 1 Sample environment stimuli.

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1 A Nature



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3 B Urban green space



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5 C Urban street



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ENVIRONMENT PREFERENCE, TYPE, RESTORATION OUTCOMES 1

1 Figure 2 Environmental preference/environment type congruence effects on restoration and
2 perceived restoration potential.

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4 Note: Environmental preference main effects were all non-significant (all $p \geq .10$). M.E.
5 refers to environment type main effect (Nature $N = 47$; Urban $N = 73$). Int. refers to the
6 environmental preference x environment type interaction. Significant post-hoc differences
7 are noted and listed by environmental preference/environment type.

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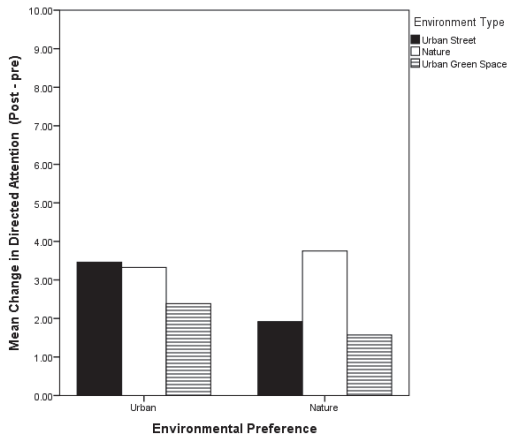
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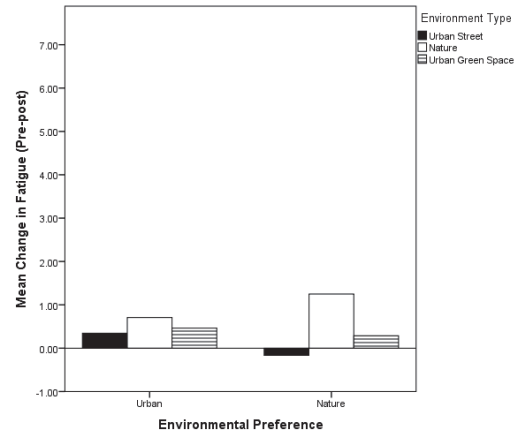
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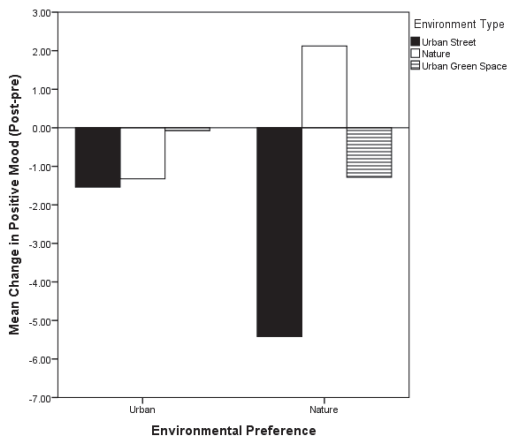
ENVIRONMENT PREFERENCE, TYPE, RESTORATION OUTCOMES 2



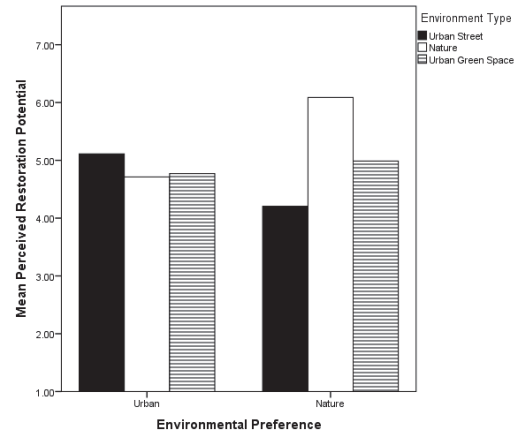
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2 2A) Directed attention (Max. = 41; M.E.
3 $p = .22$, Int. $p = .38$).
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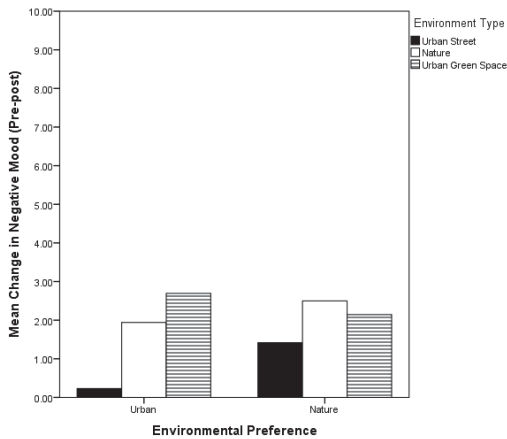
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13 2D) Fatigue (7 = completely; M.E.
14 $p < .01$, $N > US$; Int. $p = .14$).
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6 2B) Positive mood (Max. =50; M.E. $p = .01$,
7 $N > US$; Int. $p = .02$, $NP/N > NP/US$).
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17 2E) Perceived restoration potential (7 =
18 completely; M.E. $p = .10$; Int. $p < .001$;
19 $NP/N > all$; $UP/US = UP/N$; $UP/US > NP/US$).
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10 2C) Negative mood (maximum =50, M.E.
11 $p = .03$, $UGS = N > US$; Int. $p = .54$).

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Table 1

Place Identity and Restoration Outcomes by Environmental Preference and Environment Type

Outcome	Overall				Environmental Preference ^a			Environment Type				
	Baseline	Post-imagery	Change ^b		Urban	Nature		Nature	Urban Green Space	Urban Street	<i>p</i>	Post-hoc
Place Identity ^c	-	7.45 (1.95)	-		7.48 (1.65)	7.35 (2.34)	-	-	-	-		
Directed Attention ^d	35.64 (4.85)	38.57 (3.87)	2.93 (3.40)		3.21 (3.37)	2.49 (3.43)	3.46 (3.63)	2.10 (2.08)	2.72 (3.55)			
Positive Mood ^e	29.27 (6.49)	27.68 (7.65)	-1.59 (6.56)		-1.18 (6.12)	-2.23 (7.22)	-0.22 (6.13)	-0.50 (5.86)	-3.40 (6.93)	**	N > US	
Negative Mood ^e	13.54 (4.35)	11.91 (3.04)	1.63 (2.95)		1.47 (3.04)	1.89 (2.82)	2.12 (3.00)	2.50 (3.35)	0.80 (2.55)	*	N = UGS > US	
Fatigue ^f	3.71 (1.25)	3.23 (1.36)	0.48 (1.34)		0.53 (1.31)	0.38 (1.38)	0.88 (1.19)	0.40 (1.88)	0.10 (1.43)	**	N > US	
Perceived Restoration Potential ^f	-	4.90 (1.07)	-		4.87 (0.91)	4.96 (1.28)	5.15 (1.03)	4.85 (0.51)	4.68 (1.22)			

Note: Values in parentheses indicate the standard deviation. *p* values are for main effects of ANOVA. * $p < .05$; ** $p < .01$

^aThe main effect of environmental preference on all dependent variables was non-significant ($p \leq .10$)

^bChanges in directed attention and positive mood were calculated post - pretest scores; changes in negative mood and fatigue were calculated pre - posttest scores. A positive number indicated an improved outcome. All values except baseline and post-imagery indicate change, with positive values indicating improvement except place identity and perceived restoration potential which were only measured post-imagery.

^cPlace identity was measured using Drosletis & Vignoles, 2010. 10 = completely true of this place.

^dDirected attention was measured using Heeley's proofreading task. Maximum score = 41.

^eMood was measured using the Positive and Negative Affect Scale (Watson, Clark and Tellegen, 1988). Maximum score = 50.

^fFatigue refers to a single-item rating of perceived level of general fatigue. Perceived restoration potential refers to the perceived likelihood of restoration from directed attention fatigue measured using the 12-item version of the PRS (Hartig, et al., 1997; Han, 2007). Maximum score for both = 7.

Highlights

- Environment preference/type congruence effects perceived restoration potential.
- Environment preference/type congruence effects positive mood.
- The congruence effect is more influential on those with a nature preference.
- Urban green space can equal nature's influence on some restoration outcomes.
- Environmental preference is representative of place identity.