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ORIGINAL ARTICLE

# Connectedness and well-being in simulated nature

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## Abstract

People relate to nature physically, cognitively and emotionally, and this relationship fosters their well-being. There are several types of environments that vary according to their degree of naturalness, raising the question of whether they each exert different effects on people, connectedness and well-being. In order to study the extent to which environmental connectedness and well-being are a function of viewing different types of nature, we conducted a study with 454 participants from five different countries, who viewed images on a computer screen of one of three types of environment (totally natural, quasi-natural or non-natural) and responded to a series of associated items. The results of a mediation analysis showed an indirect effect of type of environment on well-being through positive and negative affect and connectedness to nature. The corresponding ANOVAs revealed differences in the connectedness and well-being elicited by different types of environment, and in preference: totally natural and quasi-natural environments (with no differences between them) showed differences with non-natural environments. Therefore, our study results suggest the usefulness of images of natural environments in fostering people's well-being and connectedness to nature.

**KEYWORDS**

connectedness to nature, naturalness, preference, well-being

**INTRODUCTION**

Throughout time and cultures, people have believed that contact with nature is beneficial to health and that natural elements such as plants or water have the capacity to alleviate anxiety and help us to cope with everyday stress (e.g. Hartig et al., 1991). This belief has even led to the extreme of viewing nature as a product advertised and sold for its positive effects. Research has shown that contact with nature increases levels of subjective well-being (e.g. Marselle et al., 2014) and positive affect (Izenstark et al., 2021), reduces stress (e.g. Tyrväinen et al., 2014), and improves human cognition (e.g. Berman et al., 2008; Mayer et al., 2009). Thus, well-being has become one of the most popular variables in environmental psychology (Olivos & Clayton, 2017). This can be both eudaimonic and hedonic, with each being associated with different forms of contact. For instance, White et al. (2017) observed that a greater frequency with which people visit natural environments is associated with higher levels of eudaimonic well-being, while occasional visits to natural environments are associated with hedonic well-being or, more specifically, with positive affect. Various theories have been proposed to explain this effect of nature. For example, Ulrich's (1979) stress reduction theory states that contact with nature promotes people's health by helping to alleviate the stress of everyday life. In contrast to the stress response, restoration includes numerous positive psychological changes, based on an evolutionary preference for natural environments. Meanwhile, Kaplan and Kaplan's (1989) attention restoration theory states that nature has the capacity to replenish attention levels fatigued by the cognitive effort involved in prolonged attention, by means of unconscious processes triggered by the presence of natural environments, because interaction with nature requires the use of faculties of concentration that are not habitually employed. This theory has also been linked to a preference for natural environments (e.g. Korpela & Hartig, 1996), which may play an important role in facilitating restoration by attracting people to such environments (Herzog et al., 2003).

Lastly, Mayer et al. (2009) have proposed that contact with nature increases people's level of well-being due to connectedness with nature, which acts as a mediating mechanism between the two. The relationship between connectedness to nature and well-being has been systematically observed in the literature, as evidenced by the recent meta-analysis conducted by Pritchard et al. (2020). This mechanism has been conceptualized for different authors, who refers to it as 'emotional affinity toward nature' (Kals et al., 1999), 'inclusion of nature in self' (Schultz, 2001), 'environmental identity' (Clayton, 2003), 'connectedness to nature' (Mayer & Frantz, 2004), 'connectivity with nature' (Dutcher et al., 2007), 'nature relatedness' (Nisbet et al., 2009), and 'love and care for nature' (Perkins, 2010). However, despite the different concepts and measures, these are all expressions of the same construct: a subjective connection to nature (Capaldi et al., 2014; Tam, 2013). These relations between Nature and human-being refer not only to how nature forms part of individuals' identity, but also to how individuals perceive themselves as a part of nature (Dutcher et al., 2007).

The study of subjective well-being has basically been guided by two concepts (Ryff & Keyes, 1995). The first of these uses life satisfaction—the degree to which people perceive their

life as being close to their ideal of a good life—as an indicator of subjective well-being. The second refers to a predominance of positive over negative affect. Positive affect reflects the degree to which a person feels excited, active and alert, in a state of high energy, with maximum focus and pleasure (Watson et al., 1988). Negative affect is a state of distress and displeasure, and includes moods such as anger, contempt, disgust, guilt, fear and anxiety. Both dimensions, however, have been found to be independent, and therefore, the balance between them has been taken as an index of happiness (Ryff, 1989). In this work, subjective well-being will be understood on the basis of this second perspective. As Diener (2000) points out, people will have higher levels of well-being when they experience many positive emotions and few negative emotions.

These three factors have been linked to contact with nature, with the research showing higher levels of life satisfaction and positive affect, as well as lower levels of negative affect, after contact with it (Biedenweg et al., 2017; Mayer et al., 2009). However, it is not always possible for people to access nature because of changes in how we now live: The majority of day-to-day tasks are performed in an urban world and people frequently lack sufficient time or resources to engage in activities in non-urban natural spaces.

Given many people's distance from the rural world, simulated nature may provide an alternative for those for whom contact with real nature is not possible, as it has also been shown to have beneficial effects (e.g. Kjellgren & Buhrkall, 2010). Several studies have reported that, regardless of the format, contact with nature via video (Laumann et al., 2003), sounds (Alvarsson et al., 2010) and photographs (Berto, 2005) have a positive effect on people. In a study of sounds, for example, Haga et al. (2016) found that participants' simple belief that the sound they were hearing came from nature-aroused higher levels of well-being than when they believed it came from a city. Thus, the meanings people attribute to nature and what they subjectively consider natural may affect the capacity of nature to enhance well-being.

In this respect, it has been found that people distinguish between various types of natural environment based on their degree of human intervention (Mausner, 1996; Pasca et al., 2020). Thus, environments lie on a continuum from most to least human-intervened, each possessing different characteristics. Taking this variable into account, the extreme (totally natural and non-natural) and intermediate (quasi-natural) categories have been shown to be well and identically defined in two different cultural contexts. This raises the question of whether each of them exerts a different effect on people, connectedness and well-being, along the lines indicated by Carrus et al. (2013), who found that people perceive different degrees of restorative potential according to each environment's degree of naturalness, i.e. the degree to which an environment is considered to be natural.

Consequently, the aims of our study were to examine the extent to which people's well-being is influenced by looking at different types of environment and to determine their preference for and connectedness with these.

## PILOT STUDY

In order to achieve our objective, we conducted an initial pilot study to select the stimuli for our study, in which simulated nature would be investigated by means of photographs.

Although a previously validated set of photographs was available (Pasca et al., 2020), they were not of sufficient quality to be enlarged.

## Method

### Participants

A total of 35 students from the Faculty of Psychology at the Complutense University of Madrid (Spain) participated in the selection of stimuli for this study.

### Instruments and procedures

First, 30 photographs were selected based on Mausner's (1996) definition of the extreme and intermediate categories of different environments ('totally natural', 'quasi-natural' and 'non-natural'), which have subsequently been shown to be perceived differently in terms of degree of naturalness (Pasca et al., 2020). To this end, we conducted a search on Google to identify public domain photographs of high quality, because they would subsequently require enlargement.

Participants then answered an online questionnaire in which they had to evaluate each of the 30 photographs, the first 10 of which belonged to the 'totally natural' category, the next 10 to the 'quasi-natural' category and the last 10 to the 'non-natural' category. Four photographs from the same category, validated in a previous study (Pasca et al., 2020), appeared at the top of the screen. Below these images appeared one of the new photographs selected for evaluation, theoretically corresponding to the same category as the four shown above. At the bottom of the screen, participants had to indicate the extent to which the photograph shown below belonged to the same category as the four shown above, using a 7-point scale where 1 meant *not at all* and 7 meant *very much*. They evaluated each of the 30 photographs using the same procedure.

## Results

Thirty *t* tests were performed for one sample, comparing the mean category membership of each photograph against a value of 3.5 (mean value on the rating scale). As shown in Table 1, we selected the five photographs from each category whose means showed the greatest statistically significant positive differences with the test value. Thus, photographs 2, 3, 4, 6 and 8 were selected for the 'totally natural' category; 11, 12, 14, 15 and 16 for the 'quasi-natural' category; and 21, 23, 24, 26 and 28 for the 'non-natural' category.

## STUDY 1

After selecting the study stimuli, we performed a further study to examine the extent to which people's well-being is influenced by viewing different types of environment and determine their preference for and connectedness to these. We adopted a mediational model, hypothesising that positive and negative affect and connectedness to nature can act as mediators in explaining well-being according to different types of environment based on their degree of naturalness.

TABLE 1 mean differences with the test value of 3.5

Photograph	M	SD	T	Difference in means
1	4.31	1.69	2.84	0.81**
2	5.17	1.42	6.94	1.67*** <sup>a</sup>
3	4.69	1.43	4.90	1.19*** <sup>a</sup>
4	5.29	1.47	7.20	1.79*** <sup>a</sup>
5	4.34	1.64	3.03	0.84**
6	5.86	1.22	11.47	2.36*** <sup>a</sup>
7	4.31	1.49	3.23	0.81**
8	4.57	1.63	3.88	1.07*** <sup>a</sup>
9	4.00	1.46	2.03	0.50
10	3.46	1.60	-0.16	-0.04
11	6.49	0.82	21.60	2.99*** <sup>a</sup>
12	6.00	1.14	13.00	2.50*** <sup>a</sup>
13	4.57	1.20	5.30	1.07**
14	5.83	0.82	16.76	2.33*** <sup>a</sup>
15	5.63	0.84	14.94	2.13*** <sup>a</sup>
16	6.17	0.92	17.12	2.67*** <sup>a</sup>
17	5.06	1.06	8.73	1.56**
18	4.69	1.43	4.90	1.19**
19	5.40	1.03	10.86	1.90**
20	3.74	1.92	0.75	0.24
21	5.43	1.67	6.84	1.93*** <sup>a</sup>
22	3.91	1.87	1.31	0.41
23	5.66	1.03	12.42	2.16*** <sup>a</sup>
24	5.77	1.26	10.65	2.27*** <sup>a</sup>
25	3.77	1.85	0.87	0.27
26	5.40	1.14	9.84	1.90*** <sup>a</sup>
27	4.94	1.51	5.64	1.44**
28	5.34	1.59	6.86	1.84*** <sup>a</sup>
29	4.23	1.73	2.49	0.73*
30	4.51	1.69	3.56	1.01**

Note: Photographs 1–10 belong to the ‘totally natural’ category, 11–20 to the ‘quasi-natural’ category and 21–30 to the ‘non-natural’ category. Test value = 3.5

<sup>a</sup>Photograph selected for Study 1.

\* $p < .05$ . \*\* $p < .01$ .

## Method

### Participants

Study participants comprised 454 students from five countries: Spain ( $n = 93$ ), Mexico ( $n = 92$ ), Italy ( $n = 96$ ), France ( $n = 88$ ) and Portugal ( $n = 85$ ). Of these, 78.4% were women, and the mean age was 20.92 ( $SD = 3.15$ ). A detailed description of the sample by country can be found in Table 2. Data can be found on the Open Science Framework (<https://osf.io/ucr86/>).

### Design

We used an experimental design in which participants from each country were randomly assigned to one of three experimental groups (Table 3): ‘totally natural’ condition, ‘quasi-natural’ condition and ‘non-natural’ condition.

### Instruments and procedures

In this study, we used the 15 photographs (see Figure 1) obtained for the three environment categories.

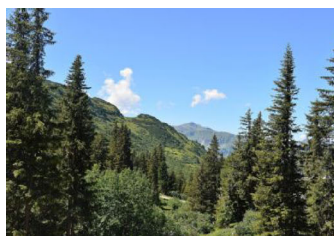
A computer software was designed and developed specifically for the study with three versions (‘totally natural’, ‘quasi-natural’ and ‘non-natural’), each containing images from the corresponding environment category. The software presented the first of the five photographs from the corresponding category for 30 s in full-screen mode. Then, the next screen opened automatically, displaying the same image at a reduced size followed by an item adapted from the INS (inclusion of nature in self; Schultz, 2001) asking about the degree to which the participant felt included in the landscape shown—instead the degree to which they felt included in the general term ‘Nature’. Participants had to choose one of the pairs of concentric circles, each of which represents the greater or lesser overlap between human beings and nature. This was followed by the presentation of another item in visual analogue scale format from 0 to 100, asking about the degree of happiness that it aroused in the participant. This measure of happiness was included as it has been suggested that it is the term by which people mean subjective well-being (Diener, 2000; Diener et al., 2018; Seligman & Csikszentmihalyi, 2000), happiness has been used in the literature as a measure of well-being (Li et al., 2021; Proyer et al., 2017; Proyer et al., 2021). Next, the second image was shown for 30 s, and the same procedure was followed

**TABLE 2** Mean (and standard deviation) age and gender distribution by country

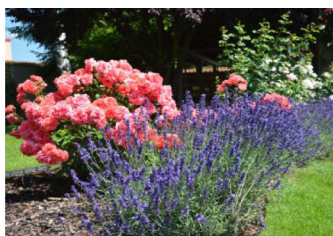
	Mean age	% of women
Spain	20.08 (0.181)	71.0
Mexico	20.09 (0.240)	98.9
Italy	20.96 (0.175)	68.8
France	21.86 (0.583)	79.5
Portugal	19.56 (0.238)	74.1

TABLE 3 Sample size for each condition by country

Country	Condition	N
Spain	Totally natural	30
	Quasi-natural	30
	Non-natural	33
Mexico	Totally natural	32
	Quasi-natural	30
	Non-natural	30
Italy	Totally natural	34
	Quasi-natural	30
	Non-natural	32
France	Totally natural	30
	Quasi-natural	28
	Non-natural	30
Portugal	Totally natural	28
	Quasi-natural	30
	Non-natural	27



Totally natural



Quasi-natural



Non-natural

FIGURE 1 Example of photographs used in the software. Totally natural, quasi-natural and non-natural

until all five photographs corresponding to the category had been presented. Once the five photographs and their corresponding items had been presented, we continued with a new situation in which connectedness to nature was measured using a reduced 7-item version of the connectedness to nature scale (CNS; Pasca et al., 2017). Because this version of the CNS is in Spanish, for the other versions of the software, the seven corresponding items were extracted from the Italian (Pirchio et al., 2021), French (Navarro et al., 2017) and Portuguese (Loureiro & Veloso, 2014) adaptations of the CNS.

Instead of presenting all scale items together on a single screen, each item was presented separately on consecutive screens. Following the onscreen instruction ‘taking into account the following landscapes...’, each of the five images that participants had viewed previously were shown again with the corresponding item beneath. Subsequently, following the same format as in the previous scale and presenting the same five photographs, the positive and negative affect scale (PANAS; Watson et al., 1988) was presented, with each item appearing separately in



sequence. Specifically, in the software used in Spain and Mexico, the López-Gómez et al. (2015) adaptation was used; the version of Terraciano et al. (2003) was used for the Italian language software; the version of Caci and Baylé (2007) was used for the French software; and the Galinha and Pais-Ribeiro (2005) version was used for the Portuguese software. Finally, to measure preference, participants were asked on a new screen to rate how much they liked each of the landscapes, one by one.

The software required installation in a computer classroom, where participants completed the tests, and was translated from the Spanish version into the vernacular language of each country.

## Results

To test our meditational hypotheses concerning the relationship between naturalness and well-being, we used the PROCESS macro for SPSS (Hayes, 2013), which simultaneously tested the role of positive and negative affect, as well as CNS, as mediators. A bootstrapping procedure (with 5000 bootstrap samples) was used to estimate 95% bias-corrected confidence intervals (bias-corrected; BC 95% confidence interval [CI]). A BC 95% CI that does not include zero provides evidence of a significant indirect effect (MacKinnon et al., 2000; Preacher & Hayes, 2008). As shown in Figure 1, the model provided estimates of the total, direct and indirect effects of the naturalness on well-being through positive and negative mood and CNS. Mediating analyses revealed significant indirect effects of naturalness on well-being through positive mood (point estimate = 1.82, BC 95% CI [0.89, 2.93]), negative mood (point estimate = 0.77, BC 95% CI [0.13 to 1.53]) and CNS (point estimate = 0.47, BC 95% CI [0.08, 1.03]) (see Figure 2).

We further investigated whether our mediating model was affected by the addition of covariates, such as participants' gender and age, and found that the indirect effects did not substantially change. None of the indirect effects 95% CIs contained 0. We found a positive and significant relationship between age and CNS ( $\beta = .15, p < .0001$ ), whereas analyses showed a negative and significant relationship between age and negative mood ( $\beta = -.11, p < .001$ ). Older participants showed a less negative mood and a greater CNS. We further tested whether the paths of the model (i.e. a1, b1, a2, b2, a3, b3, c; see Figure 1) varied as a function of the country where we collected the data. No evidence for significant interaction emerged (all  $ps > .10$ ).

Second, we performed a two-factor ANOVA (type of environment  $\times$  country) for each of the variables studied: connectedness, well-being and preference. The results (Table 4) indicated that the effect of each of the factors was statistically significant for all the variables analysed, whereas there was no statistically significant effect of the interaction between type of environment viewed and the participants' country, as had been found in the previous analysis.

The means for each of the variables for each of the three types of environment are shown in Table 5, where it can be seen that differences were found ( $p < .01$ ) between the group that viewed non-natural environments and the groups that viewed totally natural and quasi-natural environments. Meanwhile, the means for each of the variables for each country are shown in Table 6. However, only the main effects of type of environment were taken into account, because the main effects of country might be due to the way nature is understood and valued in each of the different countries (e.g. Pasca et al., 2018). Furthermore, the analysis of the interaction between both variables shows that it is not statistically significant ( $p > .05$ ) for the different dependent variables -except INS ( $p < .01$ ) which is not included in the mediational model-, therefore the country of the participants does not affect the differences found based on the type of environment.

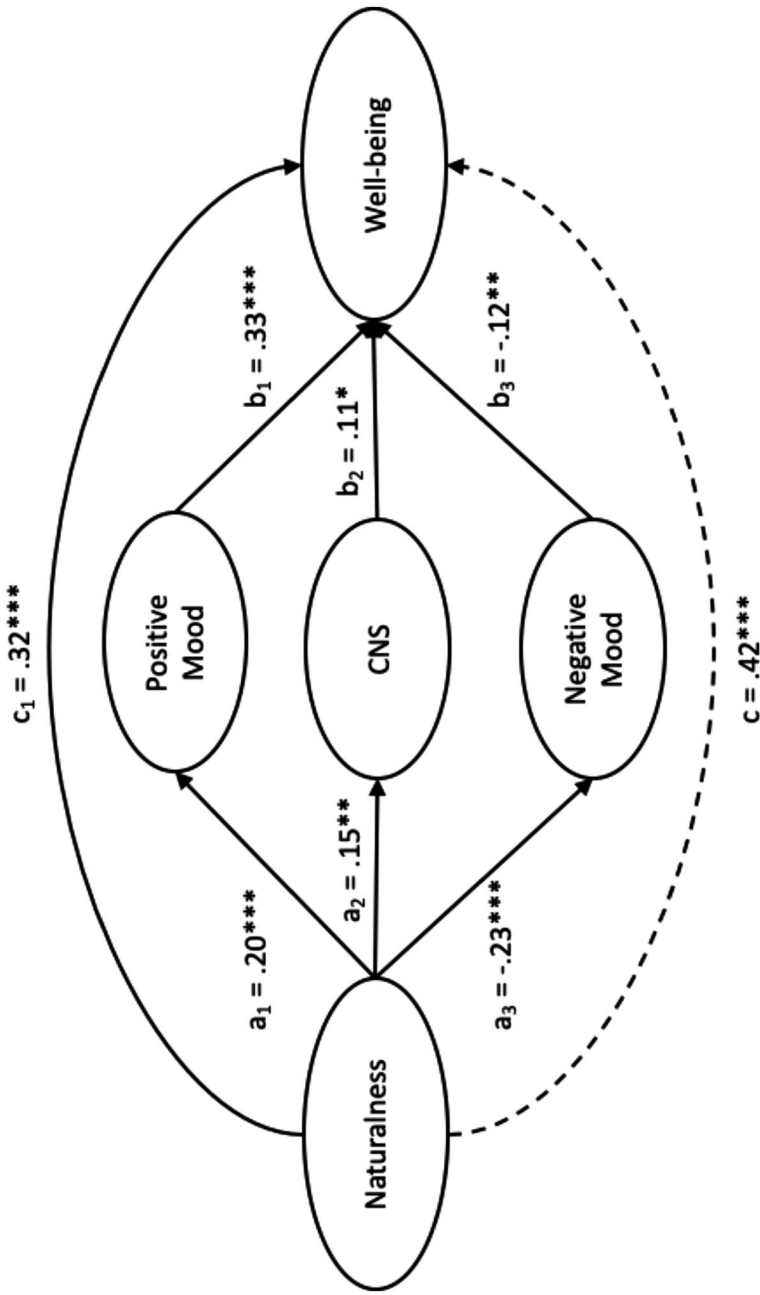


FIGURE 2 Mediation model, showing the effect of naturalness on well-being through positive and negative mood and connectedness to nature. Note: Path values represent standardised regression coefficients. The (c1) value represents the effect, from bootstrapping analyses, of naturalness on well-being after the mediators are included. Dotted line (c) represents the effect of naturalness on well-being prior to inclusion of the mediating variables. \* $p < .05$ , \*\* $p < .01$ ; \*\*\* $p < .001$ . CNS, connectedness to nature scale

TABLE 4 Two-factor ANOVA results for connectedness, well-being and preference

Factor	F	GI	Sig.	$\hat{\omega}^2$
Connectedness				
Type of environment	5.790	2439	.003	.021
Country	12.597	4439	.000	
Interaction	1.204	8439	.295	
INS				
Type of environment	26.962	2439	.000	.102
Country	7.270	4439	.000	
Interaction	2.643	8439	.008	
Positive affect				
Type of environment	13.282	2439	.000	.051
Country	22.306	4439	.000	
Interaction	1.287	8439	.248	
Negative affect				
Type of environment	17.287	2439	.000	.067
Country	11.774	4439	.000	
Interaction	0.636	8439	.748	
Well-being				
Type of environment	63.659	2439	.000	.216
Country	10.900	4439	.000	
Interaction	1.426	8439	.183	
Preference				
Type of environment	106.155	2439	.000	.317
Country	8.710	4439	.000	
Interaction	1.535	8439	.143	

TABLE 5 Means (and standard deviations) in connectedness, well-being and preference for each type of environment

	Connectedness	INS	Positive affect	Negative affect	Well-being	Preference
Totally natural	5.375 (0.073) <sup>a</sup>	3.166 (0.952) <sup>a</sup>	3.268 (0.060) <sup>a</sup>	1.552 (0.052) <sup>a</sup>	64.122 (1.623) <sup>a</sup>	3.906 (0.058) <sup>a</sup>
Quasi-natural	5.297 (0.075) <sup>a</sup>	2.983 (0.952) <sup>a</sup>	3.249 (0.061) <sup>a</sup>	1.583 (0.053) <sup>a</sup>	59.609 (1.653) <sup>a</sup>	3.566 (0.059) <sup>b</sup>
Non-natural	5.036 (0.074) <sup>b</sup>	2.442 (0.854) <sup>b</sup>	2.880 (0.060) <sup>b</sup>	1.946 (0.053) <sup>b</sup>	39.650 (1.634) <sup>b</sup>	2.735 (0.059) <sup>c</sup>

Note: Different superscripts in the same column denote statistically significant differences between categories ( $p < .01$ ).

**TABLE 6** Means (and standard deviations) in connectedness, well-being and preference for country

	<b>Connectedness</b>	<b>INS</b>	<b>Positive affect</b>	<b>Negative affect</b>	<b>Well-being</b>	<b>Preference</b>
Spain	4.962 (0.890)	2.688 (0.852)	3.171 (0.724)	1.669 (0.632)	52.179 (21.391)	3.316 (0.814)
Mexico	5.766 (0.811)	3.170 (0.727)	3.459 (0.785)	1.735 (0.580)	51.922 (20.697)	3.409 (0.813)
Italy	5.377 (0.906)	3.077 (1.115)	3.444 (0.791)	1.675 (0.666)	65.852 (20.761)	3.767 (0.854)
France	5.070 (0.894)	2.766 (1.045)	2.566 (0.793)	1.365 (0.611)	54.321 (25.847)	3.346 (0.911)
Portugal	4.995 (1.082)	2.588 (0.938)	3.006 (0.700)	2.029 (0.842)	47.718 (25.041)	3.169 (0.978)

## CONCLUSION

Our results indicate, first, that viewing different types of environment arouses different degrees of well-being. In concrete terms, the visualisation of more natural environments is associated with higher levels of well-being. This occurs through two mediational pathways. On the one hand, in line with the definition of happiness proposed by Ryff (1989), we found that it was explained by levels of positive and negative affect. Thus, different types of environment aroused different levels of positive and negative affect, determining the level of well-being of a person viewing a particular type of landscape. A similar result was reported by Foo (2016), who studied people's well-being in three forests distinguished by their degree of naturalness. Psychophysiological studies have also shown that natural environments are more restorative than built environments (Mahamane et al., 2020).

On the other hand, our mediational model showed that connectedness to nature is an intermediate variable between type of environment and well-being. This finding provides evidence for the model proposed by Mayer et al. (2009), which states that the higher levels of well-being aroused by natural environments are due to connectedness to nature. This relationship has been confirmed by Schnell et al. (2019), who found that people who felt more connected to nature showed higher levels of well-being, explaining 49% of the variance in well-being. As Mayer et al. (2009) pointed out, 'people need to feel a sense of belonging to something larger than themselves and that this need may be fulfilled through a sense of belonging or connectedness to the natural world' (p. 635).

Second, the results of the analysis of variance revealed where the differences between the environments lie. In terms of connectedness to nature, natural environments arouse higher levels of connectedness than built environments. However, we found no differences in this variable between participants viewing totally natural or quasi-natural environments, that is, people feel as connected to totally natural environments as to quasi-natural ones. Similarly, Wyles et al. (2019) found that coastal environments led to very similar levels of connectivity as urban green environments.

Regarding well-being, viewing natural environments arouses higher levels of well-being than viewing built environments, as has been shown in the literature (e.g. Beute & de Kort, 2018; Hartig et al., 1991). In our study, we observed a lower presence of negative affect, a

higher presence of positive affect and a higher level of well-being in participants who viewed natural environments. However, we found no differences in these variables between participants viewing totally natural or quasi-natural environments. This indicates that although these are different categories of nature, their effect on people is similar. Hence, parks or gardens are often considered to represent nature, even in research conducted on nature (e.g. Bratman et al., 2012).

Besides the distinction between totally natural and quasi-natural environments, our results showed lower negative affect in people who had viewed natural images compared to those who viewed images of built environments. Similarly, the former also showed higher positive affect. According to Diener (1984), one of the conditions for characterising subjective well-being is that there should be not only low levels of negative affect, but also high levels of positive affect. Therefore, it can be concluded that the effect of simulated nature is related to subjective well-being.

Restoration theories have been associated with a preference for natural environments (e.g. Korpela et al., 2001), with people's preferred environments being more restorative. We observed this relationship in the present study, finding a greater preference for natural environments, which aroused higher levels of well-being and positive affect.

Consequently, our study highlights the need to expose people to natural landscapes, for example, through photographs or paintings of these environments, as opposed to images of urban environments.

Finally, it is necessary to point out some of the limitations of the study. First, the sample used was composed of students. However, because the topic to be addressed is not included in the academic plan of the degree, these students can be considered laypeople in the subject. Second, this study has taken into account the naturalness of the environments based on the degree of human intervention, as proposed by Mausner (1996). Thus, the environment categories (totally natural, quasi-natural and no-natural) have been taken into account globally. As Wyles et al. (2019) point out, different landscapes based on their quality can lead to different levels of connectedness and carry different restorative potential. In the present work, elements in the photographs such as animals—an indicator of the quality of a natural environment—were omitted to avoid the presence of biases. In this way, the effect of the degree of naturalness (absence of human control) on the results was isolated. In the future, taking into account the results found, it would be of interest to combine this variable with others such as quality, the degree of greenness or safety they trigger. Third, this paper has focused on variables related to the hedonic perspective of well-being. Recent research suggests that although visits to natural environments are more strongly related to hedonic well-being, they are related to eudaimonic well-being as well (Schnell et al., 2019). These studies found such a relationship after people visited a park, i.e., in terms of our research, a quasi-natural environment. Therefore, it would be necessary to study in the future whether there are also differences in this type of well-being based on the visualisation of different types of environment. Fourth, connectedness to nature has been studied in order to determine whether there are differences in people's connection to different types of environments. However, it would be of interest in the future to consider pre–post differences, that is, whether connectedness changes after viewing photographs of the environments or remains stable with respect to the baseline. Finally, this study has focused on nature simulated from photographs. As highlighted above, other types of simulation have also shown beneficial effects in the literature (e.g. Alvarsson et al., 2010), so it would be of interest to study the effects found in this work in the case of sounds, virtual reality or videos from different environments.

On the other hand, it is necessary to point out the relevance of the results obtained based on the application possibilities. For example, it could be interesting to place photographs of natural environments in organisational settings such as an office or a classroom. In this way, the benefits of prolonged contemplation on well-being could be observed. In addition, the effect of such contemplation on other variables such as performance or attentional capacity could be studied.

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## ETHICS STATEMENT

This study was conducted following the ethical principles of psychologists and code of conduct laid out by the American Psychological Association (APA). The study also complied with Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April on the protection of personal data.

## DATA AVAILABILITY STATEMENT

Data can be found on the Open Science Framework <https://osf.io/ucr86/>

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