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Effects of the COVID-19 lockdowns on aesthetic and affective evaluations of natural and urban scenes

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Abstract

The ongoing COVID-19 pandemic and subsequent UK lockdowns restricted mobility, altered access to the outdoors and led to changes in the environment (e.g., reduced traffic, pollution and crowding). This likely altered the way people evaluated outdoor environments. Here we investigated aesthetic and emotional responses (liking, openness, relaxation) to paintings and photographs depicting landscapes and urban scenes in three UK cohorts: pre-lockdown, spring 2020 lockdown, and winter 2021 lockdown. Participants (N = 334) reported higher levels of liking, openness and relaxation for landscapes and urban scenes during the two lockdown periods compared to pre-lockdown levels. Importantly, evaluations in the lockdown groups were influenced by the types of places visited most frequently. These findings aid our understanding of the psychological effects of lockdowns on evaluations of outdoor environments and are relevant to the development of policies for the promotion of wellbeing, including the design of more open and relaxing urban spaces.

Keywords: aesthetic preferences, landscapes, urban spaces, paintings, photographs, COVID-19

Introduction

The ongoing Coronavirus disease (COVID-19) outbreak was officially labelled a pandemic by the World Health Organization (WHO) on March 12th, 2020, and it had profound global effects on society, the economy and the environment (e.g., Chakraborty & Maity, 2020). Due to disease transmission via close contact between persons, many countries implemented interventions to confine human populations to curb the exponential spread of the virus and to reduce pressures on healthcare systems. The United Kingdom (UK) Government imposed a lockdown on March 23, 2020, and on January 5th, 2021 that confined all citizens to their homes except for essential trips (getting food or medicine), once-daily exercise or travelling to work as a key worker. Implementation of strict lockdown measures, with prolonged confinement at home, profoundly affected many aspects of people's daily lives (Aragonés & Sevillano, 2020).

In particular, the lockdowns severely restricted people's ability to access outdoor environments beyond their local neighbourhoods (Ribeiro et al., 2021). In addition, unprecedented changes took place in the outdoor environment, including reduced levels of vehicular traffic, pedestrians, noise and improved air quality (Aletta et al., 2020; Jephcote et al., 2021; UK Department for Transport, 2020). Anecdotal evidence suggests that lockdown may have increased appreciation for the natural world (Jones, 2020; Lancashire Wildlife Trust, 2020), and empirical research has indicated that the COVID-19 elicited positive shifts in public awareness of local natural features such as forests and birdlife and increased appreciation in general of green spaces and wildlife (Rousseau & Deschacht, 2020). Research has established the importance of exposure to nearby nature in reducing the negative psychological effects associated with the COVID-19 crisis, for example by means of garden use or green views from a home window (Corley et al., 2021; Soga et al., 2020) or even by viewing images of nature (Mintz et al.,

2021). However, it remains unclear how peoples' aesthetic and emotive evaluations of urban and natural scenes changed during the lockdowns compared to the pre-lockdown period.

Seminal work in environmental psychology has shown that aesthetic and affective responses to natural scenes are influenced by their visual and structural properties (for review, see Ulrich, 1983). However, aesthetic and affective responses result from the interaction between the scene, both in its form and content, and the way these properties are processed by the viewer. Psychological characteristics such as sensation-seeking and openness to experience are known to influence viewers' appraisals of natural scenes (Harrison & Clark, 2020; Ulrich & Zuckerman, 1981). Changes to patterns of access and exposure to natural environments may be an important additional factor influencing appraisals of outdoor environments. The 2020 and 2021 lockdowns in the UK restricted travel and visits to outdoor environments were reduced and confined to local areas. Additionally, a number of changes took place in outdoor environments, in particular in urban environments, where there was a sharply decreased level of traffic, reduced number of people, and quieter streets. The current study aimed to empirically assess whether the COVID-19 lockdowns caused changes in viewers' evaluations of images of natural and urban scenes, compared to pre-lockdown levels.

While largely an exploratory study due to the unprecedented nature of the pandemic, nevertheless we tentatively suspected that the lockdown-related restrictions to outdoor environments, and the changes to the environments due to reduced human presence, may have led outdoor environments to be perceived as more novel and interesting, leading to enhanced aesthetic responses compared to the pre-COVID-19 cohort. Additionally, we tested the specificity of any lockdown-related increase in liking of outdoor environments by testing whether lockdown increased only participants' appreciation of natural scenes, or whether there was increased liking for both natural and urban scenes.

A number of studies have shown that spatial properties related to the openness of a scene are an important visual influence on the experience of the scene (Tveit, 2009; for review, see Ulrich, 1983). Given the sharply decreased amount of vehicular traffic (on average 52% of normal levels) during the 2020 lockdown (UK Department for Transport, 2020), and the reduction in people on streets, we predicted that ratings related to perceived openness for urban scenes would be increased during the lockdowns, compared to pre-lockdown levels.

An extensive body of evidence in environmental psychology has established that exposure to natural environments is associated with increased physiological relaxation (e.g., Ulrich et al., 1991). According to the Stress Reduction Theory, viewing or visiting natural environments following a stressful situation rapidly promotes physiological recovery and relaxation (Ulrich, 1983). Given the sharp decrease in traffic and reduction in noise (Smith et al., 2020) and pollution levels (in particular of nitrogen oxides; Higham, Ramirez, Greem & Morse, 2020) during the lockdowns, we suspected that relaxation ratings, particularly for urban scenes, might increase during the lockdown periods.

Given the beneficial psychological effects of exposure to outdoor natural environments (Hartig & Kahn, 2016), it is important to understand how disruptions to the usual way of life influence evaluations of these environments. Hence, the current study examined how the two COVID-19 lockdowns affected participants' aesthetic and affective ratings of paintings and photographs of landscapes and urban scenes. Further, it examined whether ratings were associated with the frequency and locations of outdoor movements during the lockdown periods. By investigating aesthetic and emotional environmental preferences during the COVID-19 lockdowns, the findings could increase our understanding of the positive association between exposure to nearby nature and emotional well-being during the crisis (Corley et al., 2021; Mintz et al., 2021; Soga et al., 2020) and contribute to the goal of

promoting the design of aesthetically pleasing, open and relaxing natural spaces, especially in urban environments.

Material and Methods

Participants

A total of 334 participants completed this study. The pre-COVID-19 cohort (pre-CO19) took part in the survey in January and February 2020 and consisted of 86 participants, with 80 females and 6 males aged between 18–38 years (M = 20.81 years, SD = 4.14). The second cohort was recruited after the March 2020 lockdown, between April and early June ($CO19_{spring}$) and consisted of 112 participants (66 females, 46 males), with an age range of 18–48 (M = 23.69 years, SD = 6.97). The third cohort ($CO19_{winter}$) was recruited between January and early February 2021, and consisted of 136 participants (62 females, 73 males, 1 not disclosed) with ages between 18–45 years old (M = 22.94 years, SD = 5.29).

All participants were fluent English speakers and were living in the United Kingdom at the time of the study, mainly Liverpool and London. Most participants were students at universities based in those two cities, but the respondents' actual addresses were unknown. Participation was voluntary. Roughly one third of the participants received course credits, one third were paid £9.00/h (via Prolific.co.uk), and the remaining participants volunteered for no pay or course credits (recruited via social media, word of mouth and "snowballing"). The study received ethical approval from the Ethics Committees at Liverpool Hope University and Kingston University London and was carried out in accordance with the ethical standards of the British Psychological Society and the Declaration of Helsinki 2013.

Visual stimuli

A total of 200 digital images were selected for this study. One hundred images were of paintings and 100 were of photographs. The photographs were selected from specialist photography websites and photographers known to the authors, and the paintings were selected from the Artstor database (www.artstor.org). Each image type was equally divided into two categories: 'landscape' and 'urban'. The landscape category included images depicting natural environments and spaces (e.g. scenes with trees, rivers, parks, flowers, forests, oceans etc.), and the urban category included images showing man-made artefacts and spaces (e.g. scenes with buildings, streets, objects etc). The luminance and size of all the images was adjusted with Adobe Photoshop (1024 x 800 pixels, either in portrait or landscape format).

All paintings were displayed in colour (see Figure 1 for example images). For the photographs, 24 were in black and white and 76 were in colour. The landscape and urban categories each contained 12 black and white and 38 colour photographs. Participants could complete the survey on their smartphones, tablets, laptops, or desktop computers. Since all images seen by a given participant were on the same digital platform, the comparisons of ratings for landscapes and urban scenes should not have been affected by the display format. Moreover, it is unlikely that the use of digital display type differed markedly across the three groups.

Pandemic-related behaviour questions

The online survey during the CO19spring and CO19winter lockdowns was identical to the first survey, except for the addition of two behavioural questions. The first question was: "How often do you leave your home during lockdown (e.g. for exercise, a walk, shopping, etc.)?" Participants had to choose their answer from six options: "every day", "every other day", "every three days", "once or twice a

week", "less than once a week", and "never". Those answers were later aggregated into three categories: often (every day and every other day), sometimes (every three days and once or twice a week), and rarely (less than once a week and never).

Participants who went out were then asked: "If you are able to leave your home occasionally during lockdown, apart from shopping, where do you go?" The options for answers were: "to an urban green space (e.g., a park)", "for a walk around local streets", "for a walk in the countryside", and "other". Answers were aggregated into three categories: nature (countryside and green spaces inside towns), urban (local streets), and "other".

Procedure

The three online data collection periods are referred to as pre-CO19, $CO19_{spring}$ and $CO19_{winter}$. The photograph and painting set presented to each cohort was identical. Each participant viewed and rated 40 images: 20 landscape scenes (10 photos and 10 paintings) and 20 urban scenes (10 photos and 10 paintings). The images were selected pseudo-randomly from the complete set of 200 images, and each image in the set was rated by roughly 40 participants. Participants used a 7-point Likert scale to provide their ratings to three questions accompanying each image. The instructions were as follows:

"You will see some images of photographs/paintings. You are asked to judge them in terms of how much you like them, how "open" the space in the image feels like, and how relaxing you imagine you would feel in such space. Use the 7-point slider after each image to enter your answers (0 = Not a lot; 6 = A lot)".

1. [Liking]. “How much do you like this image?” This dimension addressed aesthetic preferences by asking participants how much they liked each image presented.
2. [Openness]. “How 'open' do you judge the space depicted in this image?” This dimension examined the perceived amount of space in the images, its openness. A nature image can be perceived as “closed” if it contains dense woodland, or “open” if it contains expansive fields, while a urban image can be rated as “closed” if it is has walls and tall buildings, or “open” if the buildings are low and spaced.
3. [Relaxation]. “How relaxed do you feel in this space?” This dimension assessed the participants’ perceived levels of relaxation in the environments depicted in the landscapes and urban scenes.

The stimuli, research materials and data for this study are available at the Open Science Framework (https://osf.io/498m5/).

FIG 1 HERE

Figure 1.

Examples of photos (a) and (b) paintings of landscapes and photos (c) and paintings (d) of urban scenes.

Data Analysis

Data analysis was performed using IBM SPSS Statistics for Windows, Version 27.0 and R Statistical Software (v3.6.2; R Core Team 2021). Three-way mixed-design ANOVAs were conducted with the factors Cohort (pre-CO19, $CO19_{spring}$, $CO19_{winter}$), Image Type (photographs, paintings) and Scene (urban, landscape) separately for each type of rating (Liking, Openness and Relaxation) to investigate differences in evaluations in the two lockdowns (spring of 2020 and winter of 2021) compared to pre-COVID-19. Estimation analysis (Ho et al., 2019) was used to graphically represent the results using the Cohen's *d* effect size measure. To assess the effects of the places that people reported visiting when they left their home, three-way mixed-design ANOVAs were conducted with the factors Place (green space, urban space, other), COVID-19 cohort ($CO19_{spring}$, $CO19_{winter}$) and Scene (landscape, urban) separately for each type of rating (Liking, Openness and Relaxation).

Results

The evaluation of photographs and paintings was measured in terms of Liking, Openness, and Relaxation ratings to the landscape and urban scenes (Table 1).

	Photographs Landscape	**Photographs Urban Scene**	**Paintings Landscape**	**Paintings Urban Scenes**
Liking preCOV19	3.95 ± .08 [3.80, 4.10]	3.15 ± .09 [2.96, 3.34]	3.90 ± .09 [3.73, 4.07]	3.19 ± .09 [3.01, 3.37]
Liking COV19spring	4.16 ± .07 [4.02, 4.29]	3.40 ± .08 [3.24, 3.57]	4.09 ± .08 [3.94, 4.24]	3.60 ± .08 [3.44, 3.76]
Liking COV19winter	4.02 ± .06 [3.90, 4.14]	3.13 ± .07 [2.99, 3.28]	4.20 ± .07 [4.06, 4.34]	3.54 ± .07 [3.40, 3.68]
Openness preCOV19	4.33 ± .08 [4.18, 4.48]	2.68 ± .09 [2.51, 2.85]	4.42 ± .09 [4.25, 4.58]	2.87 ± .09 [2.69, 3.04]
Openness COV19spring	4.50 ± .07 [4.37, 4.63]	2.88 ± .07 [2.73, 3.03]	4.69 ± .08 [4.54, 4.84]	3.24 ± .08 [3.09, 3.40]
Openness COV19winter	4.45 ± .06 [4.33, 4.57]	2.72 ± .07 [2.58, 2.85]	4.56 ± .07 [4.42, 4.69]	3.05 ± .07 [2.91, 3.19]
Relaxation preCOV19	3.44 ± .08 [3.27, 3.60]	2.48 ± .08 [2.32, 2.63]	3.89 ± .09 [3.72, 4.07]	2.79 ± .09 [2.62, 2.96]
Relaxation COV19spring	3.73 ± .07 [3.58, 3.87]	2.74 ± .08 [2.60, 2.87]	4.24 ± .08 [4.09, 4.39]	3.04 ± .08 [2.90, 3.19]
Relaxation COV19winter	3.55 ± .07 [3.42, 3.68]	3.37 ± .06 [3.25, 3.49]	4.23 ± .07 [4.09, 4.37]	3.03 ± .08 [2.90, 3.17]

Table 1.

Mean ratings, standard error and 95% confidence interval for Liking, Openness and Relaxation for photographs and paintings in three periods: pre-COVID-19, spring COVID-19 lockdown ($COV19_{spring}$), and winter COVID-19 lockdown ($COV19_{winter}$).

Liking

A 3 x 2 x 2 ANOVA was conducted with the factors Cohort (pre-CO19, $CO19_{spring}$, $CO19_{winter}$), Image Type (photographs, paintings) and Scene (urban, landscape). A main effect of Image Type ($F(1,331) = 10.45$, $p < .001$, $\eta^2 = .031$) was observed, The aggregated Liking ratings for all photographs ($M = 3.64$, $SE = 0.04$, 95% CI [3.56, 3.71]) were significantly lower than the aggregated ratings for paintings ($M = 3.75$, $SE = 0.04$, 95% CI [3.67, 3.83), $p = .001$. There was also a main effect of Scene ($F(1,331) = 360.48$, $p < .001$, $\eta^2 = .521$), but no significant interaction with Cohort ($F(2,331) = 1.95$, $p = .145$, $\eta^2 = .012$). The aggregated ratings for landscapes ($M = 4.05$, $SE = 0.04$, 95% CI [3.98, 4.12]) were higher than for the aggregated ratings for urban scenes ($M = 3.34$, $SE = 0.04$, 95% CI [3.25, 3.42]) (Table 1). Further, there was a significant interaction between the Image Type and Scene ($F(1,331) = 13.00$, $p < .001$, $\eta^2 = .038$), but no interaction with Cohort ($F < 1$).

We found a main effect of Cohort ($F(2,331) = 4.322$, $p = .014$, $\eta^2 = .025$). Planned comparisons showed significantly higher Liking ratings in $CO19_{spring}$ and $CO19_{winter}$ compared to pre-CO19 ($p = .006$), but no difference between $CO19_{spring}$ and $CO19_{winter}$ ($p = .240$). We also observed an interaction between Cohort and Image Type ($F(2,331) = 6.51$, $p = .002$). To examine this interaction, we compared Liking ratings for Photos compared to Liking ratings for paintings separately for each cohort. There was no difference in ratings for the pre-CO19 and $CO19_{spring}$ cohorts (all ps > .3), however in the $CO19_{winter}$ cohort there were higher Liking ratings for paintings compared to photographs ($p < .001$). Graphical summaries of the findings are provided in Figure 2.

FIG 2 HERE

Openness

A 3 x 2 x 2 ANOVA with factors Cohort (pre-CO19, $CO19_{spring}$, $CO19_{winter}$), Image Type (photographs, paintings) and Scene (urban, landscape) showed a main effect of Image Type ($F(1,330) = 39.12$, $p < .001$, $\eta^2 = .106$) but no interaction with Cohort ($F(2,330) = 1.31$, $p = .271$). The aggregated Openness ratings for all photographs ($M = 3.59$, $SE = 0.03$, 95% CI [3.53, 3.66]) was significantly lower than the aggregated Openness ratings for paintings ($M = 3.80$, $SE = 0.04$, 95% CI [3.73, 3.88), $p < .001$. There was a main effect of Scene ($F(1,330) = 1462.92$, $p < .001$, $\eta^2 = .816$), but it did not interact with Cohort ($F < 1$). The aggregated rating for landscapes ($M = 4.49$, $SE = 0.04$, 95% CI [4.42, 4.56]) was higher than for the aggregated rating for urban scenes ($M = 2.91$, $SE = 0.04$, 95% CI [2.83, 2.98]) (Table 1; Figure 2b). We also found a significant interaction between Image Type and Scene ($F(1,330) = 8.72$, $p = .003$, $\eta^2 = .026$), but there was no interaction with Cohort ($F < 1$).

There was a significant main effect of Cohort ($F(2,331) = 5.479$, $p = .005$, $\eta^2 = .032$). Planned comparisons revealed that Openness ratings in the $CO19_{spring}$ and $CO19_{winter}$ cohorts were higher than Openness ratings in the pre-CO19 cohort ($p = .005$). There was no difference in Openness ratings between the $CO19_{winter}$ cohort and the $CO19_{spring}$ cohort ($p = .061$).

Relaxation

For Relaxation ratings, a 3 x 2 x 2 ANOVA with the factors Cohort (pre-CO19, $CO19_{spring}$, $CO19_{winter}$), Image Type (photographs, paintings) and Scene (urban, landscape) showed a main effect of Image Type ($F(1,331) = 99.54$, $p < .001$, $\eta^2 = .231$), a main effect of Scene ($F(1,331) = 614.68$, $p < .001$,

η^2 = .650), and a main effect of Cohort (F(2,331) = 12.76, p < .001). In addition to second order interactions, there was a significant interaction between Image Type, Scene and Cohort (F(2,331) = 21.77, p < .001).

To investigate the 3-way interaction, we conducted 2-way ANOVAs with factors Scene and Cohort at each level of Image Type. For photos, there was a significant interaction between Scene and Cohort (F(2,331) = 35.31, p < .001). This two-way interaction was investigated with one-way ANOVAs at each level of Scene. For photos of landscape scenes, there was a significant difference in Relaxation ratings between the 3 cohorts (F(2,333) = 3.67, p = .026). Planned comparisons revealed that Relaxation ratings were higher in the two COVID-19 cohorts compared to pre-CO19 (p = .037), but there was no difference between $CO19_{spring}$ and $CO19_{winter}$ (p = .069). For photos of urban scenes, there was a significant difference in Relaxation ratings between the 3 cohorts (F(2,333) = 45.39, p < .001). Planned comparisons revealed that Relaxation ratings were higher in the two COVID-19 cohorts compared to pre-CO19 (p < .001). In addition, Relaxation ratings were higher in the $CO19_{winter}$ cohort compared to the $CO19_{spring}$ cohort (p < .001).

For paintings, there was a significant main effect of Cohort (F(2,331) = 6.16, p = .002), but no interaction between Scene and Cohort (F(2,331) = .335, p = .715). Planned comparisons revealed that Relaxation ratings were higher in the two COVID-19 cohorts compared to pre-CO19 (p = .001), but there was no difference between $CO19_{spring}$ and $CO19_{winter}$ (p = .892). Graphical summaries of the findings are provided in Figure 3.

FIG 3 HERE

Behaviour during confinement

Figure 4 shows the frequencies of responses for each COVID-19 group to questions about how often participants went outside (Fig 4A), and the locations they visited when outside (Fig 4B).

FIG 4 HERE

We examined if there was a relationship between the frequency that respondents reported leaving their homes, and participants' ratings of the images. There were no significant correlations between the frequency of leaving home and any of the ratings, for either COVID-19 groups (all *r*s > -.114 < .168).

To assess the effects of the places that people reported visiting when they left their home on their ratings, we conducted three-way mixed ANOVAs with the factors Place (green space, urban space, other), COVID-19 cohort ($CO19_{spring}$, $CO19_{winter}$) and Scene (landscape, urban) separately for each type of rating (Liking, Openness and Relaxation). The Liking ratings were aggregated over image type (photos and landscapes). In these ANOVAs we report here only significant effects of the Place factor, as effects involving the Cohort and Scene factors have been reported in previous sections.

For Liking ratings, there was a significant effect of Place ($F(2,241) = 3.469$, $p = .033$, $\eta^2 = .028$), which was moderated by Scene ($F(2,241) = 3.717$, $p = .026$, $\eta^2 = .030$). To investigate the significant interaction between Place and Scene, we conducted a separate one-way independent ANOVA with the factor Place for each level of the Scene factor. For landscape images, there was no main effect of Place $F(2,246) = 1.447$, $p = .237$, $\eta^2 = .012$). For urban images, we found a main effect of Place ($F(2,246) = 4.424$, $p = .013$, $\eta^2 = .035$). Planned comparisons showed that the liking ratings for urban images were higher for participants who reported going to urban locations ($M = 3.59$; $SD = .09$), compared to natural or other locations ($M = 3.28$; $SD = .09$) ($p = .003$).

For Openness ratings, there was a significant main effect of Place ($F(2,241) = 5.764$, $p = .004$, $\eta^2 = .046$). No other main effects or interactions including the Place factor were significant. Planned comparisons revealed that participants who visited urban spaces gave higher Openness ratings compared to those who visited green spaces ($p = .005$). No other comparisons were significant.

For ratings of Relaxation, there was a significant effect of Place ($F(2,241) = 7.287$, $p = .001$, $\eta^2 = .057$), which was moderated by Scene ($F(2,241) = 5.073$, $p = .007$, $\eta^2 = .040$). To explore the significant interaction between Place and Scene, we conducted separate one-way independent ANOVAs with the factor Place for each level of Scene. For landscape images, there was no main effect of Place $F(2,246) = 2.614$, $p = .075$, $\eta^2 = .021$). For urban images, we found a main effect of Place ($F(2,246) = 10.957$, $p < .001$, $\eta^2 = .082$). Planned comparisons showed that the Relaxation ratings for urban images were higher for participants who reported going to urban locations ($M = 3.34$; $SD = .08$), compared to natural or other locations ($M = 2.88$; $SD = .08$) ($p < .001$).

Discussion

The ongoing COVID-19 pandemic of coronavirus disease led to the imposition of strict lockdowns in the UK in 2020 and 2021 which restricted access to outdoor environments and altered outdoor environments through reduced human presence. The current study aimed to investigate whether the COVID-19 lockdowns in 2020 and 2021 influenced viewers' evaluations of outdoor scenes. One group of participants viewed a series of images of landscape and urban scenes just prior to the UK lockdown (Jan-Feb 2020). A second group of participants viewed the same images during the 2020 UK lockdown (Apr-Jun 2020), and a third group viewed them during the 2021 UK lockdown (Jan-Feb 2021). Our results showed that evaluations of the images were significantly altered during the lockdown

periods compared to before the lockdown. Specifically, the results showed that participants reported higher liking, and increased levels of openness and relaxation, in images of landscapes and urban scenes during the two lockdowns compared to pre-lockdown. Additionally, the types of places that participants visited during the lockdowns influenced their evaluations of the images. Together, the findings showed that the COVID-19 lockdowns influenced aesthetic and affective evaluations of outdoor environments, and we discuss possible explanations and implications of these findings below.

Images of outdoor environments can elicit a variety of aesthetic responses that vary in complexity and depth (Joye & Bolderdijk, 2015; Silvia, Fayn, Nusbaum, & Beaty, 2015). In our study the first evaluation investigated aesthetic preference by asking the viewers how much they liked each image. Overall, landscapes were preferred compared to urban scenes, in agreement with numerous studies in environmental psychology that took place both before (Balling & Falk, 1982; Valtchanov & Ellard, 2010; for review, see Ulrich, 1983) and during the COVID-19 crisis (Mintz et al., 2021). In relation to viewing natural versus urban scenes, it is noteworthy that Mintz and colleagues (2021) found that participants who viewed a series of nature images reported higher levels of positive affect and lower levels of stress compared to those who viewed urban images, indicating the potential psychological benefits of observing images of nature. Interestingly, they also found that participants who viewed urban scenes reported lower levels of negative affect compared to a control group who viewed no images, suggesting that the psychological benefits of viewing outdoor scenes were not restricted to nature scenes.

Going beyond previous studies, we investigated changes in liking of outdoor scenes during the COVID-19 crisis compared to before the crisis. We found that liking ratings were higher in the $CO19_{spring}$ and $CO19_{winter}$ groups compared to the preCO19 group, and that this difference was not modulated by the type of scene presented (i.e., urban vs. landscape). This points to a non-selective increase in

preference for all outdoor scenes during the COVID-19 lockdowns, regardless of the type of scene depicted. There are several potential explanations for the increased preference for outdoor scenes during the lockdowns. Firstly, we consider that psychological effects of restricted access to outdoor environments, compared to pre-lockdown levels, may be a factor in this non-selective pattern of enhanced aesthetic responses during the lockdowns. In our study only 24% of participants reported going outside at least once a day during the lockdown, and another study has shown that during the COVID-19 lockdown there was a significant reduction in the use of public natural spaces (Ribeiro et al., 2021).From a psychological perspective this restricted opportunity to engage with the outside world may have resulted in dishabituation, which would have the effect of making the outside world appear more novel (e.g., Fantz, 1964; Berlyne, 1970; Olst, 1971). It is well-known that dishabituation, and the consequent increase in novelty, leads to the formation of preference (e.g., Bevins and Bardo, 1999; Klebaur and Bardo, 1999). Secondly, because of travel restrictions, people may have spent more time in nearby outdoor spaces (e.g., in a garden) or had more frequent 'indirect' exposure to outdoor environments via, for example, views from their property. Indeed, Ribeiro and colleagues (2021) found that frequency of exposure to private green space and greenery increased compared to pre-lockdown levels. Anecdotal evidence suggests that lockdown led to increased attention to, and observation of, local outdoor environments which caused them to appear more novel and interesting (Jones, 2020; Lancashire Wildlife Trust, 2020), and empirical research has found positive shifts in public awareness of local natural features and enhanced appreciation of green spaces and wildlife during the COVID-19 crisis (Rousseau & Deschacht, 2020). Together, these factors may have contributed to the increased liking of images of outdoor settings, regardless of whether the scene was predominantly urban or natural, however it is clear that further research is needed to fully explain the increased liking in the lockdown groups.

Our results clearly point to an enhanced preference for images of outdoor environments in the lockdown periods compared to prior to the lockdown. It is likely that changes to outdoor settings by the reduced presence of humans contributed to the enhanced aesthetic responses during lockdowns. For example, there may have been reduced levels of rubbish and vandalism, which often trigger feelings of disgust and decay (Felisberti, 2021), due to the reduced level of crowding in urban spaces. An intriguing additional possibility is that cognitive load, which is known to be influenced by the external environment (Berman, Jonides, & Kaplan, 2008), might have been lower in urban environments in the lockdowns due to the reduced amount of noise, traffic and people, thereby allowing more cognitive resources to be devoted to appreciating the aesthetic qualities of the environment. These speculations are supported by the results showing that the places that participants reported visiting on the occasions when they left their homes influenced their liking ratings for urban images, but not for landscape images. Specifically, we found that for images depicting urban environments, liking ratings were higher for participants who reported visiting urban locations, compared to participants who reported going to natural or other non-urban locations. Therefore, it could be that increased liking for urban environments by those who tended to visit them more often was due to the physical changes (for example, reduced traffic and noise) that took place in urban environments during the lockdowns (Aletta et al., 2020; Jephcote et al., 2021). Interestingly, in the $CO19_{winter}$ cohort, paintings were liked more than photographs, but the reason for this difference is not clear.

The second dimension measured the amount of space perceivable to the viewer in the presented images, which is referred to as visual depth or openness (Kaplan & Kaplan, 1989). In landscapes openness is decreased by the presence of features such as dense woodland or steep cliffs which spatially enclose the scene, and openness is increased by features such as expansive areas of field. For urban scenes, features like walls and tall buildings typically enclose the scene by blocking views, while

elements like wide avenues and lower buildings increase the level of openness. It is noteworthy that a high level of traffic is known to influence perceptual judgements of urban scenes (Nasar, 1989) and negatively influences the depth of view. We found that both urban and landscape scenes were rated as higher in openness by the two lockdown cohorts, compared to the preCO19 cohort. We speculate that the higher openness ratings in the lockdown cohorts was most likely due to the decreased presence of people and traffic in outdoor environments during the lockdown, which may have increased the level of visibility in the scenes, and thereby increased their perceived spaciousness. We found that participants who visited urban spaces more often during lockdown rated both urban and landscape pictures higher in openness compared to those who visited green spaces. It may be that, for those participants who more frequently visited urban areas during the lockdowns, the increased sense of spaciousness felt in the urban environments due to reduced levels of traffic and noise also influenced their perception of space in other (i.e., natural) environments.

The third dimension assessed viewers' levels of relaxation in the environments. We found that all images (i.e., both photographs and paintings, and urban and landscape scenes) were rated as significantly more relaxing by both COVID-19 groups compared to the pre-COVID-19 cohort. We speculate that the increased relaxation ratings to images of outdoor environments was related to the decreased levels of traffic and crowds in outdoor environments during the lockdowns. This interpretation is supported by the finding that participants who visited urban spaces more frequently reported higher levels of relaxation in urban images, compared to those who visited green or other spaces. Presumably, the effects of decreased crowds and traffic on viewers' sense of relaxation was most pronounced in urban settings.

This study increases our understanding of the effects of the COVID-19 related lockdowns on our evaluations of outdoor environments, although several limitations should be noted. Firstly, participants

viewed images of environments rather than real environments. Secondly, the locations where the participants lived were unknown and so it cannot be ruled out that evaluations may have been different for participants who lived in urban areas, compared to those living in rural areas.

In conclusion, the current study aimed to understand whether the COVID-19 related lockdowns in the UK (in spring 2020 and winter 2021) influenced viewers' evaluations of outdoor environments. We found that regardless of whether images were of landscapes or urban scenes, they were liked more during the lockdowns than before. Viewers during the lockdowns rated images of both landscapes and urban scenes as being more visually open and relaxing. Importantly, the evaluations of the images in the lockdown groups, in particular for urban images, were influenced by the types of places visited most frequency. Studies have reported positive associations between exposure to nearby nature and emotional well-being during the COVID-19 crisis (Corley et al., 2021; Mintz et al., 2021; Soga et al., 2020), and the current findings further our understanding of this relationship by showing how the lockdowns influenced evaluations of outdoor scenes compared to the pre-lockdown period. This understanding is also important in relation to the knowledge that enhanced appreciation of outdoor (especially natural) environments is associated not only with enhanced levels of well-being (Capaldi et al., 2017; Zhang, Howell, & Iyer, 2014), but also more pro-environmental behaviours (Alcock et al., 2020) and increased connection to nature (Harrison & Clark, 2020). The findings are also relevant to the design of open and relaxing natural spaces in urban environments, which appear to be enjoyed more when traffic and crowding were significantly reduced. Finally, this study raises the important question regarding whether the more positive evaluation of outdoor environments may extend beyond the period of the COVID-19 lockdowns, and future research should investigate this.

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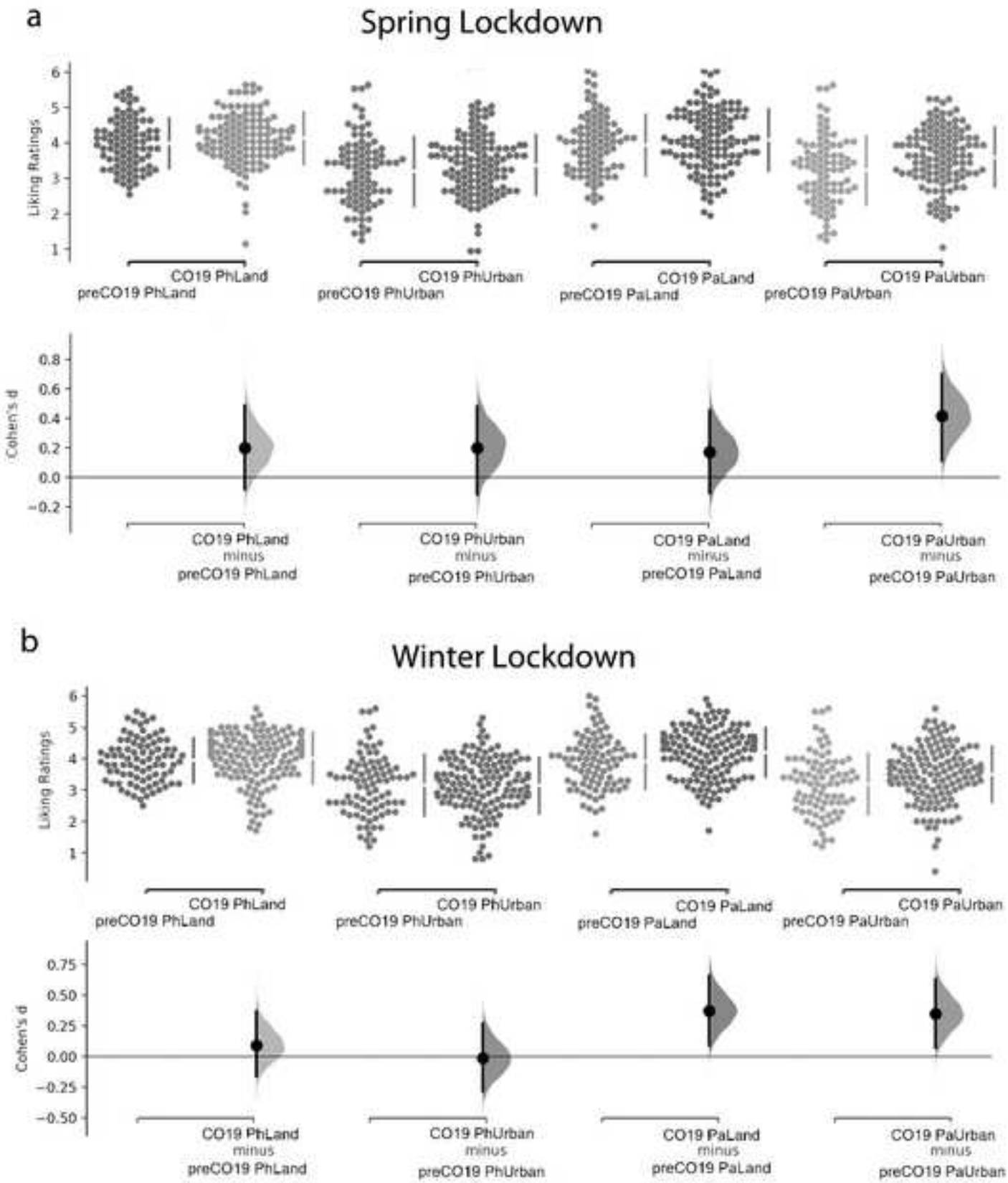
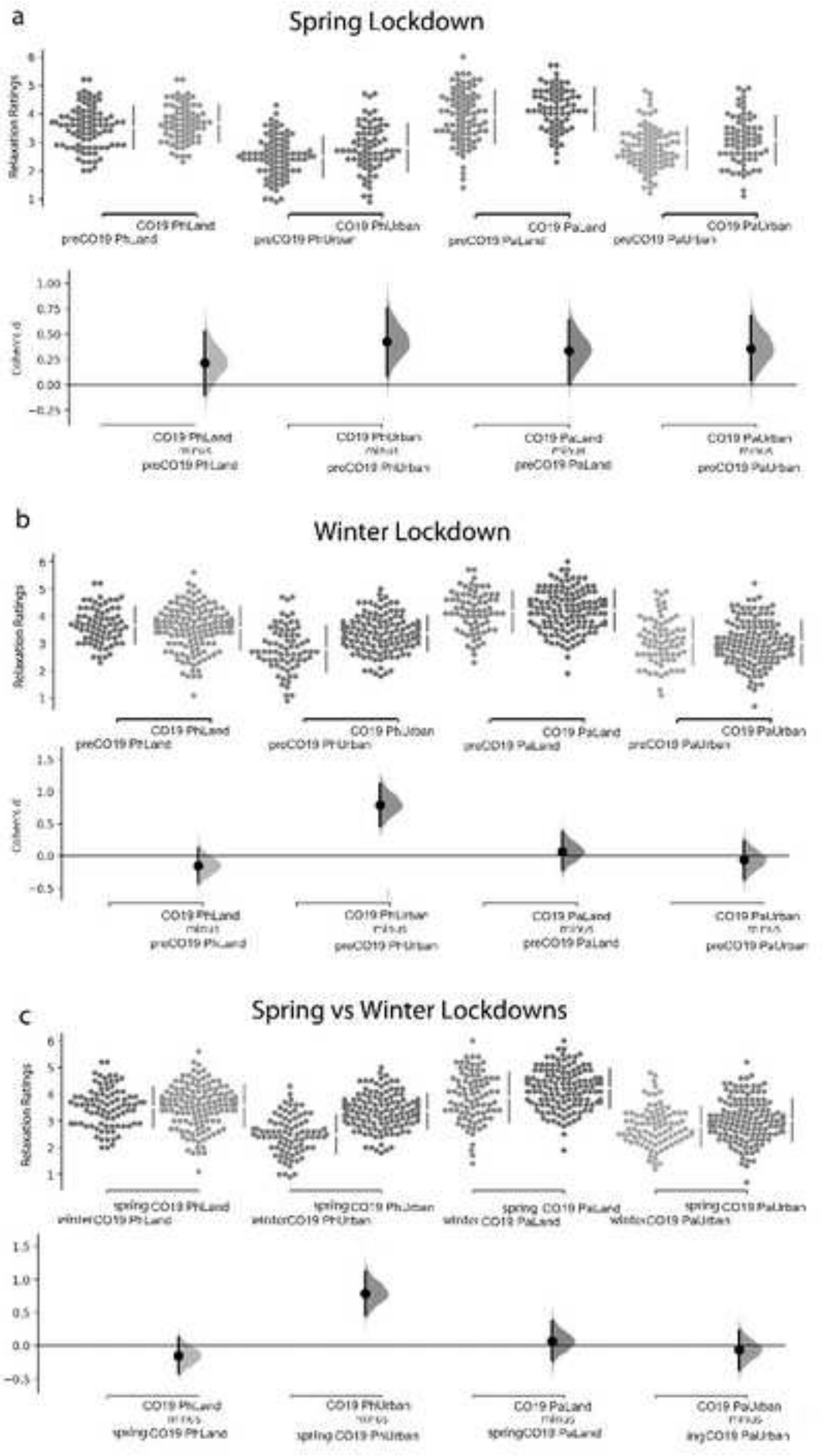
Figure

Figure



Figure



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