Supplementary Information

Greenery, sky and water in view and how people judge urban soundscapes

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This Supplementary Information contains 28 tables reporting supporting analyses, validation and robustness checks. Study procedures, measure definitions and statistical methods are described in the main manuscript.

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S1 Supplementary Tables

Table S1. Convergent validity of the photograph colour layer against the segmentation shares. The within-site r is the partial correlation net of site, wave and capture system.

Pair	n	r	r within sites
Green-pixel fraction vs greenery share	2,261	0.799	0.714
Excess green vs greenery share	2,261	0.717	0.577
Sky-pixel fraction (top) vs sky share	2,261	0.667	0.722
Brightness vs sky share	2,261	0.075	0.333
Edge density vs built share	2,261	−0.274	−0.214
Green-pixel fraction vs nature share	2,261	0.793	0.695

Table S2. Out-of-sample skill by predictor block and estimator. Grouped 10-fold cross-validation repeated ten times, with shared panoramas kept in one fold and the adjustment for site and wave estimated within each training fold; SD is across the ten repeats. The rows with n = 2,261 use the respondents with photograph metrics and add the capture-system proxy to the adjustment.

n	Outcome	Model	CV R^2	SD
2,262	OA	Linear, auditory	0.1978	0.0013
2,262	OA	Linear, composition	−0.0013	0.0008
2,262	OA	Linear, auditory + composition	0.1959	0.0012
2,262	OA	Forest, auditory	0.2438	0.0043
2,262	OA	Forest, composition	0.0026	0.0021
2,262	OA	Forest, auditory + composition	0.2439	0.0043
2,262	*ISO-P*	Linear, auditory	0.1670	0.0007
2,262	*ISO-P*	Linear, composition	−0.0044	0.0011
2,262	*ISO-P*	Linear, auditory + composition	0.1630	0.0012
2,262	*ISO-P*	Forest, auditory	0.1884	0.0031
2,262	*ISO-P*	Forest, composition	−0.0025	0.0026
2,262	*ISO-P*	Forest, auditory + composition	0.1869	0.0038
2,262	Harmony	Linear, auditory	0.1397	0.0013
2,262	Harmony	Linear, composition	−0.0012	0.0012
2,262	Harmony	Linear, auditory + composition	0.1388	0.0020
2,262	Harmony	Forest, auditory	0.1651	0.0021
2,262	Harmony	Forest, composition	−0.0005	0.0018
2,262	Harmony	Forest, auditory + composition	0.1630	0.0024
2,262	*ISO-E*	Linear, auditory	0.0171	0.0011
2,262	*ISO-E*	Linear, composition	0.0082	0.0010
2,262	*ISO-E*	Linear, auditory + composition	0.0239	0.0017
2,262	*ISO-E*	Forest, auditory	0.0228	0.0033
2,262	*ISO-E*	Forest, composition	0.0034	0.0023
2,262	*ISO-E*	Forest, auditory + composition	0.0249	0.0026
2,261	OA	Linear, auditory	0.1989	0.0017
2,261	OA	Linear, auditory + composition	0.1959	0.0020
2,261	OA	Linear, auditory + condition	0.1985	0.0021
2,261	OA	Linear, auditory + composition + condition	0.1949	0.0020
2,261	*ISO-P*	Linear, auditory	0.1662	0.0007
2,261	*ISO-P*	Linear, auditory + composition	0.1624	0.0016
2,261	*ISO-P*	Linear, auditory + condition	0.1626	0.0011
2,261	*ISO-P*	Linear, auditory + composition + condition	0.1583	0.0021
2,261	Harmony	Linear, auditory	0.1410	0.0017
2,261	Harmony	Linear, auditory + composition	0.1382	0.0023
2,261	Harmony	Linear, auditory + condition	0.1349	0.0019
2,261	Harmony	Linear, auditory + composition + condition	0.1323	0.0025
2,261	*ISO-E*	Linear, auditory	0.0174	0.0014
2,261	*ISO-E*	Linear, auditory + composition	0.0238	0.0018
2,261	*ISO-E*	Linear, auditory + condition	0.0165	0.0026
2,261	*ISO-E*	Linear, auditory + composition + condition	0.0243	0.0026

Table S3. Gains in cross-validated R^2 from adding a visual block, against their permutation distributions. Each gain equals the corresponding difference in Supplementary Table S2, computed before rounding. The added block is permuted across panoramas within site-by-wave cells (and capture system where n = 2,261), with 1,000 permutations for the linear models and 200 for the forest. The permuted column gives the 5th–95th percentile range of the gains under permutation. Permuted gains are centred below zero because uninformative predictors reduce out-of-sample R^2.

n	Outcome	Block added	Added to	Estimator	Gain	Permuted, 5th–95th	p_{perm}
2,262	OA	Composition	Auditory	Linear	−0.0019	[−0.0053, −0.0004]	0.213
2,262	OA	Composition	Auditory	Forest	0.0001	[−0.0077, 0.0027]	0.199
2,262	*ISO-P*	Composition	Auditory	Linear	−0.0040	[−0.0057, −0.0005]	0.557
2,262	*ISO-P*	Composition	Auditory	Forest	−0.0015	[−0.0079, 0.0005]	0.159
2,262	Harmony	Composition	Auditory	Linear	−0.0009	[−0.0054, 0.0001]	0.103
2,262	Harmony	Composition	Auditory	Forest	−0.0021	[−0.0055, 0.0009]	0.333
2,262	*ISO-E*	Composition	Auditory	Linear	0.0068	[−0.0065, 0.0002]	0.001
2,262	*ISO-E*	Composition	Auditory	Forest	0.0021	[−0.0064, 0.0023]	0.070
2,261	OA	Composition	Auditory	Linear	−0.0030	[−0.0054, −0.0007]	0.352
2,261	OA	Condition	Auditory	Linear	−0.0004	[−0.0054, 0.0003]	0.083
2,261	OA	Condition	Auditory + composition	Linear	−0.0009	[−0.0056, −0.0001]	0.106
2,261	*ISO-P*	Composition	Auditory	Linear	−0.0038	[−0.0056, −0.0002]	0.577
2,261	*ISO-P*	Condition	Auditory	Linear	−0.0035	[−0.0054, 0.0004]	0.572
2,261	*ISO-P*	Condition	Auditory + composition	Linear	−0.0041	[−0.0055, 0.0003]	0.668
2,261	Harmony	Composition	Auditory	Linear	−0.0028	[−0.0056, −0.0006]	0.281
2,261	Harmony	Condition	Auditory	Linear	−0.0060	[−0.0062, −0.0012]	0.923
2,261	Harmony	Condition	Auditory + composition	Linear	−0.0058	[−0.0063, −0.0014]	0.876
2,261	*ISO-E*	Composition	Auditory	Linear	0.0065	[−0.0066, −0.0002]	0.001
2,261	*ISO-E*	Condition	Auditory	Linear	−0.0008	[−0.0059, 0.0016]	0.242
2,261	*ISO-E*	Condition	Auditory + composition	Linear	0.0005	[−0.0064, 0.0004]	0.04995

Table S4. The curvature family. Centred quadratic terms for the eight composites on four outcomes (32-test Benjamini–Hochberg family, $n = 2{,}262$). No non-linear dose–response is significant.

Outcome	Composite	Quadratic estimate	SE	p	q
Harmony	Built surface	−0.008	0.015	0.599	0.707
ISO-E	Built surface	−0.015	0.014	0.286	0.707
ISO-P	Built surface	0.013	0.014	0.378	0.707
OA	Built surface	−0.011	0.015	0.456	0.707
Harmony	Street furniture	0.008	0.008	0.331	0.707
ISO-E	Street furniture	0.006	0.008	0.426	0.707
ISO-P	Street furniture	−0.005	0.008	0.516	0.707
OA	Street furniture	0.010	0.008	0.189	0.707
Harmony	Greenery	−0.010	0.020	0.640	0.707
ISO-E	Greenery	−0.020	0.020	0.312	0.707
ISO-P	Greenery	−0.032	0.020	0.119	0.707
OA	Greenery	−0.028	0.021	0.187	0.707
ISO-E	Paving	0.008	0.016	0.621	0.707
ISO-P	Paving	−0.015	0.016	0.359	0.707
OA	Paving	−0.021	0.017	0.204	0.707
Harmony	People	0.010	0.014	0.491	0.707
ISO-E	People	0.007	0.014	0.591	0.707
ISO-P	People	0.023	0.014	0.098	0.707
OA	People	0.013	0.014	0.348	0.707
Harmony	Sky	0.020	0.018	0.270	0.707
ISO-E	Sky	−0.010	0.018	0.578	0.707
OA	Sky	−0.033	0.019	0.072	0.707
Harmony	Vehicles	−0.003	0.005	0.604	0.707
ISO-E	Vehicles	0.005	0.005	0.363	0.707
OA	Vehicles	−0.004	0.005	0.461	0.707
Harmony	Water	−0.004	0.008	0.617	0.707
ISO-E	Water	0.010	0.008	0.215	0.707
ISO-P	Water	−0.008	0.008	0.320	0.707
OA	Water	−0.012	0.008	0.144	0.707
Harmony	Paving	−0.007	0.016	0.688	0.710
ISO-P	Vehicles	0.002	0.005	0.687	0.710
ISO-P	Sky	−0.003	0.018	0.860	0.860

Table S5. Prediction at held-out sites by predictor block. Each of the 12 sites is held out in turn, and linear models with wave fixed effects fitted to the other 11 sites predict its respondents. R^2 is measured against the wave-only model fitted to the same 11 sites, for the respondents (person level) and for the site means (site level). The 95% CIs come from 1,000 site-cluster bootstrap resamples of the held-out errors, paired across blocks. (a) Held-out R^2 by block. (b) Share of each outcome's variance that lies between sites, and gain in held-out R^2 [95% CI] from adding the composites to the auditory measures. The gain is given at the person and site levels and, at the person level, with the wave terms left out of every model.

(a)

n	Outcome	Block	Person-level R^2	95% CI	Site-level R^2	95% CI
2,262	OA	Composition	−0.008	[−0.021, 0.000]	−0.120	[−1.042, 0.350]
2,262	OA	Auditory	0.185	[0.147, 0.266]	0.081	[−1.090, 0.463]
2,262	OA	Auditory + composition	0.191	[0.155, 0.265]	0.123	[−1.103, 0.535]
2,228	OA	Measured acoustics	0.005	[−0.009, 0.015]	−0.081	[−0.246, 0.235]
2,262	*ISO-P*	Composition	−0.008	[−0.024, 0.007]	0.167	[−0.117, 0.403]
2,262	*ISO-P*	Auditory	0.164	[0.121, 0.226]	0.292	[−0.816, 0.582]
2,262	*ISO-P*	Auditory + composition	0.164	[0.119, 0.226]	0.358	[−0.911, 0.709]
2,228	*ISO-P*	Measured acoustics	0.002	[−0.018, 0.021]	−0.062	[−0.243, 0.262]
2,262	Harmony	Composition	0.000	[−0.010, 0.011]	0.105	[−0.111, 0.334]
2,262	Harmony	Auditory	0.127	[0.093, 0.188]	0.037	[−0.718, 0.483]
2,262	Harmony	Auditory + composition	0.140	[0.107, 0.208]	0.442	[−0.045, 0.687]
2,228	Harmony	Measured acoustics	−0.004	[−0.008, 0.004]	−0.024	[−0.175, 0.130]
2,262	*ISO-E*	Composition	−0.004	[−0.028, 0.014]	−0.114	[−0.478, 0.167]
2,262	*ISO-E*	Auditory	0.034	[0.016, 0.050]	0.271	[0.120, 0.387]
2,262	*ISO-E*	Auditory + composition	0.024	[−0.002, 0.045]	0.079	[−0.421, 0.416]
2,228	*ISO-E*	Measured acoustics	0.016	[−0.002, 0.032]	0.060	[−0.284, 0.287]

(b)

Outcome	Between sites (%)	Person level	Site level	Person level, no wave terms
OA	3.4	0.005 [−0.005, 0.012]	0.042 [−0.271, 0.294]	0.002 [−0.007, 0.007]
ISO-P	2.5	0.001 [−0.008, 0.007]	0.067 [−0.256, 0.232]	0.002 [−0.006, 0.006]
Harmony	3.3	0.013 [0.004, 0.031]	0.405 [0.146, 0.715]	0.008 [−0.003, 0.024]
ISO-E	3.3	−0.010 [−0.030, 0.007]	−0.192 [−0.581, 0.047]	0.000 [−0.024, 0.018]

Table S6. The full scene-composition family. Eight composites by five outcomes (wave-adjusted site-random-intercept LMMs, n = 2,262; Benjamini–Hochberg within the 40-test family).

Outcome	Composite	Estimate	SE	p	q
ISO-P	Greenery	0.036	0.027	0.186	0.530
ISO-P	Sky	0.027	0.025	0.285	0.671
ISO-P	Water	0.039	0.022	0.075	0.313
ISO-P	Paving	−0.013	0.022	0.561	0.801
ISO-P	Built surface	−0.056	0.025	0.028	0.210
ISO-P	People	−0.014	0.022	0.537	0.801
ISO-P	Vehicles	−0.023	0.023	0.324	0.720
ISO-P	Street furniture	−0.031	0.021	0.139	0.427
ISO-E	Greenery	0.005	0.028	0.863	0.976
ISO-E	Sky	−0.060	0.026	0.018	0.210
ISO-E	Water	0.001	0.022	0.946	0.976
ISO-E	Paving	0.008	0.022	0.710	0.926
ISO-E	Built surface	−0.003	0.026	0.910	0.976
ISO-E	People	0.048	0.022	0.031	0.210
ISO-E	Vehicles	0.102	0.024	<0.001	<0.001
ISO-E	Street furniture	0.007	0.021	0.718	0.926
OA	Greenery	0.013	0.028	0.647	0.892
OA	Sky	0.057	0.026	0.032	0.210
OA	Water	0.029	0.022	0.199	0.530
OA	Paving	−0.017	0.022	0.450	0.749
OA	Built surface	−0.021	0.027	0.436	0.749
OA	People	−0.044	0.023	0.054	0.268
OA	Vehicles	−0.019	0.024	0.433	0.749
OA	Street furniture	−0.037	0.021	0.078	0.313
Perceived loudness	Greenery	−0.022	0.027	0.425	0.749
Perceived loudness	Sky	−0.008	0.025	0.744	0.930
Perceived loudness	Water	0.013	0.022	0.542	0.801
Perceived loudness	Paving	−0.001	0.022	0.980	0.980
Perceived loudness	Built surface	−0.002	0.025	0.952	0.976
Perceived loudness	People	0.037	0.023	0.102	0.345
Perceived loudness	Vehicles	0.047	0.023	0.042	0.241
Perceived loudness	Street furniture	0.003	0.021	0.884	0.976
Harmony	Greenery	0.008	0.028	0.785	0.951
Harmony	Sky	0.042	0.026	0.103	0.345
Harmony	Water	0.005	0.022	0.830	0.976
Harmony	Paving	−0.027	0.022	0.225	0.562
Harmony	Built surface	0.019	0.026	0.474	0.758
Harmony	People	−0.052	0.023	0.021	0.210
Harmony	Vehicles	0.019	0.023	0.412	0.749
Harmony	Street furniture	−0.017	0.021	0.415	0.749

Table S7. The full audio-visual match/conflict family. Seven constituent-controlled indices by five outcomes (35-test Benjamini–Hochberg family, n = 2,262).

Outcome	Index	Estimate	SE	p	q
ISO-E	heard-and-seen traffic	0.070	0.021	<0.001	0.014
ISO-E	traffic-in-nature conflict	−0.072	0.022	<0.001	0.014
ISO-E	nature-hard balance match	0.067	0.021	0.001	0.017
OA	heard-and-seen traffic	−0.060	0.021	0.004	0.035
ISO-E	activity match	0.052	0.020	0.011	0.078
ISO-E	heard-and-seen people	0.050	0.020	0.014	0.082
Harmony	heard-and-seen people	0.044	0.021	0.032	0.160
OA	activity match	−0.041	0.021	0.048	0.195
Harmony	activity match	0.039	0.020	0.052	0.195
ISO-P	traffic-in-nature conflict	−0.040	0.021	0.056	0.195
Harmony	traffic-in-nature conflict	−0.040	0.021	0.063	0.201
ISO-P	nature-in-traffic conflict	0.031	0.020	0.126	0.367
Harmony	nature-in-traffic conflict	0.027	0.020	0.184	0.454
ISO-P	heard-and-seen nature	0.026	0.020	0.206	0.454
OA	heard-and-seen nature	0.026	0.021	0.218	0.454
OA	heard-and-seen people	0.026	0.021	0.221	0.454
RAQ	nature-in-traffic conflict	0.025	0.020	0.225	0.454
OA	nature-hard balance match	−0.025	0.021	0.233	0.454
Harmony	heard-and-seen nature	0.023	0.021	0.259	0.477
ISO-E	nature-in-traffic conflict	−0.021	0.020	0.292	0.490
RAQ	nature-hard balance match	−0.022	0.021	0.294	0.490
Harmony	nature-hard balance match	0.019	0.020	0.350	0.557
OA	nature-in-traffic conflict	0.018	0.021	0.378	0.576
ISO-P	heard-and-seen traffic	−0.014	0.020	0.484	0.706
Harmony	heard-and-seen traffic	0.012	0.020	0.558	0.770
RAQ	activity match	−0.011	0.020	0.587	0.770
ISO-E	heard-and-seen nature	0.010	0.021	0.622	0.770
OA	traffic-in-nature conflict	0.011	0.022	0.624	0.770
RAQ	heard-and-seen nature	0.010	0.021	0.645	0.770
RAQ	heard-and-seen traffic	−0.009	0.020	0.660	0.770
ISO-P	activity match	−0.005	0.020	0.788	0.871
ISO-P	nature-hard balance match	0.005	0.020	0.821	0.871
RAQ	traffic-in-nature conflict	−0.005	0.021	0.821	0.871
ISO-P	heard-and-seen people	−0.001	0.021	0.956	0.982
RAQ	heard-and-seen people	4.8×10^{-4}	0.021	0.982	0.982

Table S8. Visual and cross-modal cues on *ISO-E*. The eight candidate routes of the pathway analysis, corrected as one pre-specified 8-test family (n = 2,262). Ordinary least squares with fixed site and wave effects, the specification of the indirect-path bootstrap in Supplementary Table S9.

Cue	Family	Slope on *ISO-E*	SE	p	q
visible vehicles	Visual	0.122	0.025	<0.001	<0.001
heard-and-seen traffic	Cross-modal	0.071	0.021	<0.001	0.002
traffic-in-nature conflict	Cross-modal	−0.071	0.022	0.001	0.002
nature-hard balance match	Cross-modal	0.069	0.021	0.001	0.002
visible activity	Visual	0.063	0.024	0.008	0.012
visible traffic/road	Visual	0.047	0.023	0.043	0.047
visible people	Visual	0.045	0.023	0.044	0.047
social amenity	Visual	0.044	0.022	0.047	0.047

Table S9. Indirect paths from the cues through *ISO-E* into overall evaluation. Each indirect effect is the product of the cue's slope on *ISO-E* and the slope of *ISO-E* on overall evaluation, from the models of Supplementary Table S8. Site-cluster bootstrap intervals (1,000 resamples of whole sites) were computed for three cues.

Cue	Indirect effect	Bootstrap 95% CI
visible vehicles	−0.007	[−0.013, 0.001]
visible traffic/road	−0.003	–
visible people	−0.003	–
visible activity	−0.004	–
social amenity	−0.002	–
heard-and-seen traffic	−0.004	[−0.009, 0.001]
traffic-in-nature conflict	0.004	–
nature-hard balance match	−0.004	[−0.010, -1.8×10^{-4}]

Table S10. Internal greenery structure beyond amount. Tree/grass/herbaceous fractions, flower content, layering and diversity (24-test Benjamini–Hochberg family; n = 2,159 respondents with a greenery share above 5%). Each model adjusts for the greenery share and has site and site-by-wave random effects.

Outcome	Predictor	Estimate	SE	p	q
ISO-E	Vegetation diversity	−0.069	0.024	0.005	0.118
ISO-E	Flower content of greenery	−0.067	0.027	0.014	0.169
ISO-E	Tree fraction	0.058	0.026	0.027	0.220
OA	Layering	0.046	0.024	0.059	0.352
OA	Tree fraction	−0.041	0.027	0.130	0.366
OA	Herbaceous fraction	0.052	0.031	0.096	0.366
OA	Flower content of greenery	0.043	0.027	0.109	0.366
Harmony	Layering	0.036	0.024	0.136	0.366
ISO-E	Herbaceous fraction	−0.047	0.032	0.137	0.366
OA	Vegetation diversity	0.033	0.025	0.179	0.415
ISO-E	Grass fraction	−0.032	0.025	0.190	0.415
ISO-P	Flower content of greenery	0.033	0.027	0.230	0.424
Harmony	Flower content of greenery	0.032	0.026	0.229	0.424
Harmony	Vegetation diversity	0.023	0.024	0.342	0.586
ISO-P	Vegetation diversity	−0.019	0.024	0.426	0.682
ISO-P	Layering	0.018	0.024	0.459	0.688
ISO-P	Grass fraction	−0.016	0.025	0.504	0.712
ISO-E	Layering	−0.014	0.024	0.556	0.741
ISO-P	Tree fraction	0.012	0.026	0.660	0.768
OA	Grass fraction	0.009	0.025	0.700	0.768
Harmony	Tree fraction	−0.010	0.026	0.704	0.768
Harmony	Grass fraction	0.009	0.024	0.700	0.768
ISO-P	Herbaceous fraction	−0.004	0.031	0.901	0.902
Harmony	Herbaceous fraction	0.004	0.031	0.902	0.902

Table S11. The constructed-scene family. Seven constructed scene descriptors by five outcomes (35-test Benjamini–Hochberg family, n = 2,262), with no effect remaining significant.

Outcome	Parameter	Estimate	SE	p	q
ISO-P	Scene diversity	−0.008	0.023	0.729	0.773
ISO-P	Dominance	0.030	0.024	0.206	0.450
ISO-P	Natural–hard mixedness	0.054	0.025	0.030	0.203
ISO-P	Open horizon	0.058	0.024	0.015	0.203
ISO-P	Mobility infrastructure	−0.045	0.023	0.049	0.203
ISO-P	Social amenity	−0.013	0.022	0.554	0.698
ISO-P	Restorative cues	0.054	0.022	0.014	0.203
ISO-E	Scene diversity	0.022	0.023	0.336	0.535
ISO-E	Dominance	−0.024	0.024	0.311	0.518
ISO-E	Natural–hard mixedness	0.011	0.025	0.650	0.758
ISO-E	Open horizon	−0.036	0.025	0.147	0.367
ISO-E	Mobility infrastructure	0.041	0.023	0.070	0.205
ISO-E	Social amenity	0.047	0.022	0.034	0.203
ISO-E	Restorative cues	−0.022	0.022	0.310	0.518
OA	Scene diversity	0.026	0.024	0.283	0.518
OA	Dominance	−0.030	0.025	0.227	0.468
OA	Natural–hard mixedness	0.008	0.026	0.763	0.786
OA	Open horizon	0.048	0.025	0.058	0.203
OA	Mobility infrastructure	−0.012	0.023	0.609	0.735
OA	Social amenity	−0.044	0.023	0.056	0.203
OA	Restorative cues	0.043	0.022	0.058	0.203
Harmony	Scene diversity	0.018	0.024	0.442	0.645
Harmony	Dominance	−0.004	0.024	0.883	0.883
Harmony	Natural–hard mixedness	−0.017	0.025	0.509	0.698
Harmony	Open horizon	0.015	0.025	0.559	0.698
Harmony	Mobility infrastructure	0.008	0.023	0.715	0.773
Harmony	Social amenity	−0.050	0.022	0.027	0.203
Harmony	Restorative cues	0.017	0.022	0.437	0.645
RAQ	Scene diversity	−0.009	0.024	0.688	0.773
RAQ	Dominance	0.015	0.024	0.537	0.698
RAQ	Natural–hard mixedness	0.033	0.026	0.200	0.450
RAQ	Open horizon	0.029	0.025	0.245	0.476
RAQ	Mobility infrastructure	−0.045	0.023	0.050	0.203
RAQ	Social amenity	−0.037	0.022	0.102	0.274
RAQ	Restorative cues	0.041	0.022	0.064	0.203

Table S12. Season-stratified visual-effect slopes. Site and site-by-wave random effects.

Season	n	Effect	Estimate	SE	p
Autumn	756	Greenery → *ISO-P*	0.078	0.049	0.114
Autumn	756	Greenery → OA	−0.003	0.049	0.948
Autumn	756	Greenery → Harmony	−0.032	0.041	0.440
Autumn	756	Visible vehicles → *ISO-E*	0.129	0.050	0.010
Autumn	756	Heard-and-seen traffic → OA	−0.120	0.043	0.005
Autumn	756	Water in view → OA	0.266	0.093	0.005
Autumn	756	Flowers in view → OA	0.163	0.101	0.109
Spring	851	Greenery → *ISO-P*	0.105	0.048	0.033
Spring	851	Greenery → OA	0.129	0.042	0.004
Spring	851	Greenery → Harmony	0.086	0.049	0.085
Spring	851	Visible vehicles → *ISO-E*	0.011	0.097	0.911
Spring	851	Heard-and-seen traffic → OA	−0.020	0.033	0.551
Spring	851	Water in view → OA	0.198	0.120	0.101
Spring	851	Flowers in view → OA	0.441	0.146	0.003
Summer	154	Greenery → *ISO-P*	−0.120	0.091	0.189
Summer	154	Greenery → OA	−0.157	0.103	0.130
Summer	154	Greenery → Harmony	0.036	0.104	0.732
Summer	154	Visible vehicles → *ISO-E*	0.148	0.236	0.531
Summer	154	Heard-and-seen traffic → OA	0.133	0.106	0.214
Summer	154	Water in view → OA	0.438	0.178	0.032
Summer	154	Flowers in view → OA	−0.720	0.709	0.312

Table S13. Greenery-by-season interactions. 5-outcome Benjamini–Hochberg family; multi-season subset, n = 1,761.

Outcome	Autumn slope	× spring	p	× summer	Joint p	Joint q
ISO-P	0.079	0.020	0.762	−0.197	0.137	0.262
ISO-E	0.081	−0.097	0.171	0.096	0.157	0.262
OA	−0.001	0.110	0.063	−0.161	0.023	0.113
Harmony	−0.025	0.094	0.097	0.068	0.243	0.303
Perceived loudness	−0.042	0.010	0.862	0.144	0.416	0.416

Table S14. Perceived-source-by-season interactions. 12-test Benjamini–Hochberg family; multi-season subset.

Outcome	Predictor	× spring	× summer	Joint p	Joint q
OA	natural sounds	0.185	0.129	0.001	0.018
ISO-P	natural sounds	0.147	0.031	0.012	0.0497
Harmony	natural sounds	0.148	0.155	0.009	0.0497
OA	traffic noise	−0.105	0.044	0.062	0.157
Harmony	human sounds	0.004	−0.199	0.066	0.157
OA	human sounds	−0.051	−0.188	0.113	0.227
ISO-E	traffic noise	0.022	−0.135	0.191	0.328
ISO-P	traffic noise	−0.012	0.006	0.962	0.962
ISO-P	human sounds	0.006	0.065	0.767	0.962
Harmony	traffic noise	−0.026	−0.029	0.859	0.962
ISO-E	natural sounds	0.015	−0.015	0.922	0.962
ISO-E	human sounds	0.013	−0.029	0.883	0.962

Table S15. Season-stratified perceived-source slopes. Site and site-by-wave random effects.

Season	n	Outcome	Predictor	Estimate	SE	p
Autumn	756	*ISO-P*	natural sounds	0.068	0.037	0.067
Autumn	756	*ISO-P*	traffic noise	−0.191	0.037	<0.001
Autumn	756	*ISO-P*	human sounds	−0.034	0.035	0.331
Autumn	756	OA	natural sounds	0.050	0.038	0.185
Autumn	756	OA	traffic noise	−0.160	0.036	<0.001
Autumn	756	OA	human sounds	0.003	0.035	0.932
Autumn	756	Harmony	natural sounds	0.029	0.037	0.435
Autumn	756	Harmony	traffic noise	−0.189	0.034	<0.001
Autumn	756	Harmony	human sounds	−0.031	0.035	0.375
Autumn	756	*ISO-E*	natural sounds	−0.014	0.038	0.719
Autumn	756	*ISO-E*	traffic noise	−0.040	0.038	0.292
Autumn	756	*ISO-E*	human sounds	0.088	0.035	0.012
Spring	851	*ISO-P*	natural sounds	0.223	0.035	<0.001
Spring	851	*ISO-P*	traffic noise	−0.198	0.036	<0.001
Spring	851	*ISO-P*	human sounds	−0.027	0.034	0.423
Spring	851	OA	natural sounds	0.251	0.035	<0.001
Spring	851	OA	traffic noise	−0.247	0.036	<0.001
Spring	851	OA	human sounds	−0.054	0.035	0.121
Spring	851	Harmony	natural sounds	0.187	0.034	<0.001
Spring	851	Harmony	traffic noise	−0.215	0.035	<0.001
Spring	851	Harmony	human sounds	−0.032	0.033	0.343
Spring	851	*ISO-E*	natural sounds	−0.003	0.036	0.934
Spring	851	*ISO-E*	traffic noise	−0.021	0.036	0.562
Spring	851	*ISO-E*	human sounds	0.103	0.033	0.002
Summer	154	*ISO-P*	natural sounds	0.101	0.070	0.152
Summer	154	*ISO-P*	traffic noise	−0.181	0.073	0.014
Summer	154	*ISO-P*	human sounds	0.024	0.076	0.755
Summer	154	OA	natural sounds	0.201	0.078	0.010
Summer	154	OA	traffic noise	−0.108	0.082	0.194
Summer	154	OA	human sounds	−0.189	0.086	0.028
Summer	154	Harmony	natural sounds	0.190	0.078	0.016
Summer	154	Harmony	traffic noise	−0.219	0.082	0.008
Summer	154	Harmony	human sounds	−0.233	0.085	0.007
Summer	154	*ISO-E*	natural sounds	−0.023	0.081	0.777
Summer	154	*ISO-E*	traffic noise	−0.177	0.084	0.036
Summer	154	*ISO-E*	human sounds	0.071	0.088	0.420

Table S16. Seasonal greenery and natural-sound interactions under daily temperature and air-quality adjustment.

Interaction	× spring	p	Joint p
Greenery × season → OA	0.112	0.045	0.020
Natural sounds × season → OA	0.183	3.8×10^{-4}	0.002
Natural sounds × season → *ISO-P*	0.141	0.006	0.018
Natural sounds × season → Harmony	0.146	0.004	0.010

Table S17. Date-level weather and air-quality main effects on the evaluation outcomes. 20-test Benjamini–Hochberg family; site and survey-date random intercepts, without wave terms.

Outcome	Covariate	Estimate	SE	p	q
OA	Rain day	0.117	0.078	0.148	0.820
Harmony	Relative humidity	−0.045	0.031	0.164	0.820
ISO-E	Wind speed	−0.086	0.054	0.126	0.820
ISO-E	Rain day	0.205	0.112	0.082	0.820
OA	Relative humidity	−0.043	0.034	0.220	0.845
Harmony	Air quality index	−0.056	0.047	0.253	0.845
ISO-P	Temperature	0.046	0.045	0.315	0.878
ISO-P	Relative humidity	−0.027	0.045	0.565	0.878
ISO-P	Air quality index	−0.028	0.050	0.575	0.878
ISO-P	Wind speed	−0.022	0.050	0.657	0.878
ISO-P	Rain day	0.092	0.103	0.383	0.878
OA	Air quality index	−0.034	0.049	0.494	0.878
OA	Wind speed	−0.026	0.040	0.521	0.878
Harmony	Temperature	−0.014	0.032	0.678	0.878
ISO-E	Relative humidity	−0.020	0.052	0.702	0.878
ISO-E	Air quality index	−0.030	0.056	0.599	0.878
Harmony	Rain day	0.020	0.079	0.802	0.901
ISO-E	Temperature	0.013	0.052	0.811	0.901
OA	Temperature	−0.005	0.034	0.893	0.940
Harmony	Wind speed	−0.002	0.039	0.958	0.958

Table S18. Season contrasts on the chromatic vegetation metrics. Autumn and spring in the multi-season subset (n = 1,606), with site and site-by-wave random effects and the capture-system proxy; q over the six rows.

Metric	Type	Spring − autumn	SE	p	Metric SD	In SD units	q
Greenery share (quantity)	Quantity	0.005	0.041	0.901	0.161	0.033	0.901
Green-pixel fraction	Chromatic	0.040	0.035	0.265	0.112	0.358	0.318
Vegetation saturation	Chromatic	0.055	0.031	0.094	0.092	0.596	0.283
Vegetation hue (yellow shift)	Chromatic	2.711	2.090	0.215	8.698	0.312	0.318
Excess green	Chromatic	0.017	0.014	0.252	0.052	0.332	0.318
Colourfulness	Chromatic	−0.038	0.017	0.039	0.051	−0.756	0.237

Table S19. The full scene-condition-metric family. Nine photograph metrics by four outcomes (36-test Benjamini–Hochberg family, n = 2,261; every model includes wave, capture-system proxy, site and panorama-group terms; the colour metrics are adjusted for the greenery share and sky blueness for the sky share).

Metric	Block	Outcome	Estimate	SE	p	q
Colourfulness	chromatic	Harmony	0.029	0.024	0.231	0.578
Colourfulness	chromatic	*ISO-E*	0.007	0.024	0.774	0.847
Colourfulness	chromatic	*ISO-P*	0.047	0.024	0.051	0.254
Colourfulness	chromatic	OA	0.059	0.025	0.017	0.124
Edge density	structure	Harmony	−0.010	0.030	0.738	0.847
Edge density	structure	*ISO-E*	0.016	0.030	0.588	0.796
Edge density	structure	*ISO-P*	0.057	0.030	0.056	0.254
Edge density	structure	OA	0.034	0.031	0.273	0.578
Luminance entropy	structure	Harmony	0.023	0.042	0.588	0.796
Luminance entropy	structure	*ISO-E*	0.037	0.042	0.367	0.629
Luminance entropy	structure	*ISO-P*	0.058	0.042	0.165	0.540
Luminance entropy	structure	OA	0.012	0.043	0.777	0.847
Excess green	chromatic	Harmony	0.001	0.036	0.972	0.974
Excess green	chromatic	*ISO-E*	0.020	0.036	0.578	0.796
Excess green	chromatic	*ISO-P*	−0.014	0.036	0.695	0.847
Excess green	chromatic	OA	0.037	0.037	0.322	0.629
Brightness	luminance	Harmony	0.045	0.040	0.259	0.578
Brightness	luminance	*ISO-E*	0.038	0.039	0.332	0.629
Brightness	luminance	*ISO-P*	0.048	0.039	0.220	0.578
Brightness	luminance	OA	0.049	0.040	0.224	0.578
RMS contrast	luminance	Harmony	−0.039	0.035	0.260	0.578
RMS contrast	luminance	*ISO-E*	0.017	0.034	0.619	0.796
RMS contrast	luminance	*ISO-P*	−0.053	0.034	0.122	0.439
RMS contrast	luminance	OA	−0.077	0.035	0.030	0.180
Sky blueness	sky	Harmony	0.068	0.027	0.011	0.099
Sky blueness	sky	*ISO-E*	0.070	0.026	0.008	0.099
Sky blueness	sky	*ISO-P*	0.074	0.026	0.005	0.090
Sky blueness	sky	OA	0.103	0.027	<0.001	0.006
Vegetation hue (yellow shift)	chromatic	Harmony	−0.008	0.025	0.734	0.847
Vegetation hue (yellow shift)	chromatic	*ISO-E*	−0.014	0.024	0.553	0.796
Vegetation hue (yellow shift)	chromatic	*ISO-P*	0.013	0.025	0.597	0.796
Vegetation hue (yellow shift)	chromatic	OA	0.001	0.025	0.974	0.974
Vegetation saturation	chromatic	Harmony	−0.015	0.026	0.564	0.796
Vegetation saturation	chromatic	*ISO-E*	−0.046	0.026	0.076	0.304
Vegetation saturation	chromatic	*ISO-P*	−0.024	0.026	0.358	0.629
Vegetation saturation	chromatic	OA	0.006	0.027	0.834	0.883

Table S20. The sky-blueness effect across specifications. Adjustment for all auditory measures, season strata and the perceived-loudness interaction.

Specification	n	Estimate	SE	p
Sound-adjusted, OA	2,261	0.066	0.024	0.007
Sound-adjusted, *ISO-P*	2,261	0.038	0.024	0.113
Sound-adjusted, Harmony	2,261	0.033	0.025	0.190
Autumn subset, OA	755	0.023	0.048	0.638
Spring subset, OA	851	0.119	0.040	0.003
× perceived loudness, OA	2,228	−0.009	0.020	0.645
× perceived loudness, *ISO-P*	2,228	−0.006	0.020	0.756

Table S21. Visual effects by perceived loudness. The 7-test moderation family (n = 2,229).

Effect	Interaction	SE	p	q
Water in view → OA	0.167	0.052	0.001	0.010
Visible vehicles → *ISO-E*	0.033	0.016	0.043	0.151
Sky → *ISO-P*	0.032	0.020	0.103	0.240
Greenery → OA	−0.018	0.020	0.380	0.532
People → OA	0.021	0.021	0.314	0.532
Greenery → *ISO-P*	0.004	0.020	0.826	0.879
Flowers in view → OA	−0.009	0.060	0.879	0.879

Table S22. Visual-effect slopes within L_{Aeq} tertiles of the photo-valid acoustic sample.

Tertile	n	Effect	Estimate	SE	p
Quiet	743	Greenery → *ISO-P*	0.041	0.043	0.346
Quiet	743	Greenery → OA	0.015	0.045	0.730
Quiet	743	Flowers in view → OA	0.275	0.123	0.026
Quiet	743	Water in view → OA	0.080	0.094	0.399
Quiet	743	Visible vehicles → *ISO-E*	0.026	0.052	0.623
Quiet	743	Sky → *ISO-P*	0.089	0.043	0.038
Quiet	743	People → OA	−0.029	0.044	0.514
Mid	743	Greenery → *ISO-P*	0.044	0.048	0.360
Mid	743	Greenery → OA	0.051	0.045	0.256
Mid	743	Flowers in view → OA	0.223	0.096	0.021
Mid	743	Water in view → OA	0.145	0.108	0.180
Mid	743	Visible vehicles → *ISO-E*	0.035	0.045	0.445
Mid	743	Sky → *ISO-P*	0.009	0.047	0.847
Mid	743	People → OA	−0.070	0.036	0.055
Loud	743	Greenery → *ISO-P*	0.094	0.047	0.049
Loud	743	Greenery → OA	0.003	0.049	0.947
Loud	743	Flowers in view → OA	0.185	0.127	0.148
Loud	743	Water in view → OA	0.425	0.114	<0.001
Loud	743	Visible vehicles → *ISO-E*	0.087	0.036	0.019
Loud	743	Sky → *ISO-P*	−0.013	0.043	0.761
Loud	743	People → OA	−0.056	0.039	0.154

Table S23. The corresponding metered-L_{Aeq} interactions. Acoustic sample (n = 2,229); none remains significant after correction within its own 7-test family.

Effect	Interaction	SE	p	q
Visible vehicles → *ISO-E*	0.048	0.020	0.016	0.110
Water in view → OA	0.091	0.057	0.109	0.370
Sky → *ISO-P*	−0.030	0.021	0.159	0.370
Greenery → OA	−0.014	0.023	0.540	0.875
Flowers in view → OA	0.021	0.066	0.750	0.875
People → OA	0.010	0.021	0.635	0.875
Greenery → *ISO-P*	0.003	0.023	0.901	0.901

Table S24. The element family. 8-test Benjamini–Hochberg family, $n = 2{,}262$. Water counts as in view when the water composite exceeds 0.5% of the view, and flowers and sculpture or fountain when their shares exceed 0.1%. The people share enters per SD.

Element	Outcome	Estimate	SE	p	q
Water in view	*ISO-P*	0.174	0.060	0.004	0.009
Water in view	OA	0.198	0.061	0.001	0.005
Sculpture or fountain in view	*ISO-P*	−0.110	0.070	0.116	0.155
Sculpture or fountain in view	OA	−0.026	0.072	0.722	0.722
Flowers in view	*ISO-P*	0.129	0.068	0.057	0.091
Flowers in view	OA	0.228	0.069	<0.001	0.005
People share	*ISO-P*	−0.014	0.022	0.537	0.614
People share	OA	−0.044	0.023	0.054	0.091

Table S25. Site-restricted element effects under site-cluster bootstrap. 1,000 resamples, of which 980–1,000 converged; models restricted to sites where the element varies.

Effect	95% CI	Excludes zero
Visible vehicles → *ISO-E*	[−0.023, 0.157]	no
Heard-and-seen traffic → OA	[−0.099, 0.004]	no
Water in view → OA	[−0.048, 0.274]	no
Flowers in view → OA	[0.159, 0.365]	yes

Table S26. Visitor-familiarity moderation of seven visual effects. Harmonised local/tourist coding.

Effect	Interaction	SE	p	q
Sky → *ISO-P*	0.119	0.061	0.050	0.351
People → OA	−0.066	0.054	0.224	0.784
Flowers in view → OA	0.116	0.189	0.541	0.884
Water in view → OA	0.081	0.170	0.631	0.884
Visible vehicles → *ISO-E*	0.115	0.134	0.392	0.884
Greenery → *ISO-P*	−0.015	0.056	0.788	0.919
Greenery → OA	0.003	0.057	0.952	0.952

Table S27. Visit-stage (staying versus in-transit) moderation of seven visual effects.

Effect	Interaction	SE	p	q
Greenery → *ISO-P*	0.028	0.050	0.570	0.671
Flowers in view → OA	−0.123	0.123	0.318	0.671
Water in view → OA	−0.110	0.128	0.389	0.671
Visible vehicles → *ISO-E*	−0.093	0.103	0.363	0.671
Sky → *ISO-P*	−0.028	0.049	0.575	0.671
People → OA	−0.078	0.050	0.116	0.671
Greenery → OA	0.010	0.052	0.852	0.852

Table S28. Refits of the reported effects. Each effect of Table 2 is shown as reported and in three refits. The first adds a panorama-group random effect, because respondents at one measurement point share their photographs; the sky-blueness model includes this term as reported. The second splits each effect into a within-site and a between-site component, and the third, for the water effects, adds the auditory measures. Robustness refits of significant effects; no separate q applies.

Effect	Specification	Estimate	SE	p	n
Visible vehicles → *ISO-E*	As reported	0.102	0.024	<0.001	2,262
	Plus panorama-group random effect	0.102	0.024	<0.001	2,262
	Within-site component	0.121	0.025	<0.001	2,262
	Between-site component	−0.061	0.059	0.321	2,262
Sky blueness → OA	As reported	0.103	0.027	<0.001	2,261
	Within-site component	0.102	0.028	<0.001	2,261
	Between-site component	0.102	0.120	0.412	2,261
Water in view → OA	As reported	0.198	0.061	0.001	2,262
	Plus panorama-group random effect	0.198	0.062	0.001	2,262
	Within-site component	0.178	0.063	0.005	2,262
	Between-site component	0.724	0.275	0.044	2,262
	Natural-sound salience added	0.165	0.061	0.007	2,262
	All auditory measures added	0.099	0.055	0.074	2,262
Water in view → *ISO-P*	As reported	0.174	0.060	0.004	2,262
	Plus panorama-group random effect	0.174	0.060	0.004	2,262
	Within-site component	0.143	0.061	0.020	2,262
	Between-site component	0.732	0.231	0.016	2,262
	Natural-sound salience added	0.141	0.059	0.016	2,262
	All auditory measures added	0.085	0.054	0.121	2,262
Flowers in view → OA	As reported	0.228	0.069	<0.001	2,262
	Plus panorama-group random effect	0.225	0.070	0.001	2,262
	Within-site component	0.243	0.070	<0.001	2,262
	Between-site component	−0.402	0.368	0.315	2,262
Water × perceived loudness → OA	As reported	0.167	0.052	0.001	2,229
	Plus panorama-group random effect	0.164	0.052	0.002	2,229
	Within-site component	0.164	0.053	0.002	2,229
	Between-site component	1.962	1.074	0.098	2,229
	Source salience ratings added	0.157	0.050	0.002	2,229
Heard-and-seen traffic → OA	As reported	−0.057	0.020	0.004	2,262
	Plus panorama-group random effect	−0.058	0.020	0.004	2,262
	Within-site component	−0.055	0.020	0.005	2,262
	Between-site component	−1.068	0.479	0.048	2,262
Nature-hard balance match → *ISO-E*	As reported	0.067	0.021	0.001	2,262
	Plus panorama-group random effect	0.067	0.021	0.001	2,262
	Within-site component	0.069	0.021	0.001	2,262
	Between-site component	−0.149	0.318	0.654	2,262