Chapter 5 **Appendix**

Local Environmental Quality and Happiness in Mega Cities: Additional Regression Models

As noted in the main text of the chapter, we estimate several variations of our principal model, plus a reduced-choice model that has a stronger causal interpretation but includes a much more limited range of environmental data.

Four variations of the main model are presented in Table A4. These arise from the combination of two treatments: first, whether or not we include local-area (MSOA) fixed effects; and second, whether or not we interact all environmental characteristics with being outdoors. The inclusion of local-area fixed effects makes little difference to the results, which is encouraging for the robustness of our findings. The interaction of environmental characteristics with being outdoors is important, however. In the absence of the interaction, there are few significant effects. Presumably this is because weather, green space, and so on do not strongly affect people in the indoor environments in which they spend most of their time. By contrast, most environmental characteristics do show significant effects in interaction with being outdoors, where people experience them more directly. The discussion in the main text is focused on Model 4 in Table A4, which has both local-area fixed effects and environmental characteristics interacted with being outdoors.

Our 'low-choice' model is presented in Table A5. In terms of environmental characteristics, it includes only weather conditions and average air pollution concentrations, measured at the level of the city as a whole. We take weather observations from a single weather station (London Heathrow airport) at the nearest available time and within two hours before/after the response, and we link each response with London Air Quality Network (LAQN) estimates of background NO2 and PM10 concentrations across London as a whole for the relevant date and hour. We deliberately exclude other environmental characteristics, such as green space, and other controls, such as activity and location, over which individuals have a high degree of choice. An element of choice, however, remains – individuals might choose to escape the city entirely, or wear a face mask to filter out
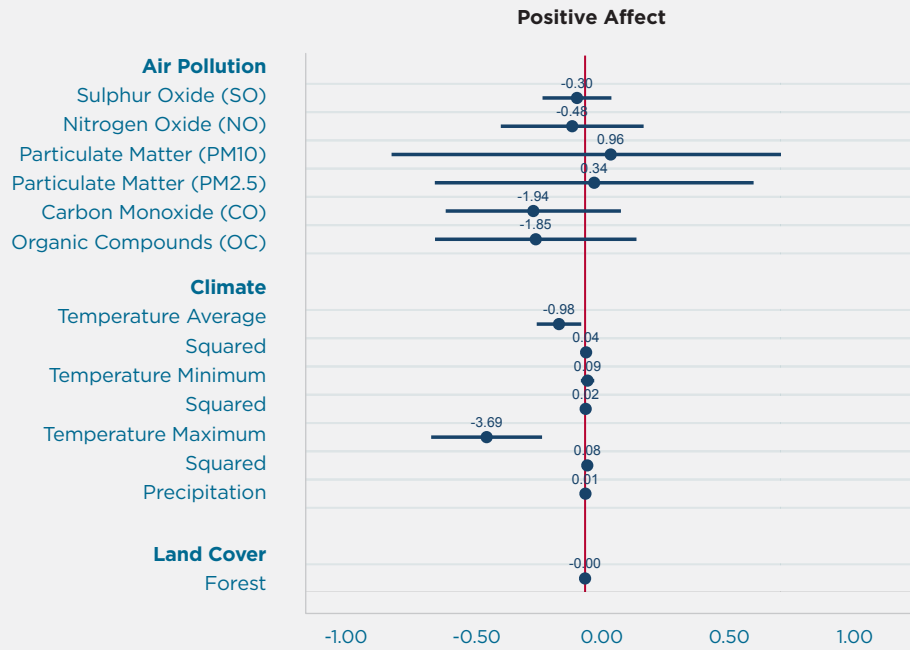
pollution, for example – but the effects estimated in the low-choice model should nevertheless bear somewhat stronger causal interpretation.

Weather effects in the low-choice model are very similar to those of the main models that interact weather conditions with being outdoors, but with the effect sizes somewhat reduced, as we might expect. Happiness is increased, and by increasing margins, by cloudless skies, partial sun, and continuous sunshine. The latter adds almost one percentage point of happiness compared to no sun at all. Happiness is also higher by just over one percentage point when the air temperature exceeds 25°C compared to temperatures below freezing. Happiness falls slightly as wind speeds rise, so that at 15 knots or more, happiness is slightly over half a percentage point lower than in still conditions. The effects of daylight and rain are not significantly different from zero in this specification.

As regards air quality, in the low-choice model low NO2 is associated with a modest increase in reported happiness: responses subject to the lowest pollutant concentrations (the bottom 5%) are 0.34 percentage points happier than those at the middle quartiles, and those subject to low concentrations (the next 20%) are 0.16 percentage points happier. This is a small but meaningful boost in well-being. Neither low nor high concentrations of PM10 are seen to affect happiness at the 5% significance level (though there does appear to be a modest *upward* trend with increasing concentration, which is not intuitive). Note that the NO2 and PM10 variables are not strongly correlated, and results obtained when they are entered separately in their own regressions (not shown) differ little from these ones.

Table A7 presents some additional regression estimates supporting Chapter 1. In this model, which is run for the full sample (not just Greater London responses), all activities are interacted both with being with friend(s) and with being with a partner.

Figure A1: How Environmental Quality Affects Positive Affect Around the World

Positive Affect

Air Pollution
Sulphur Oxide (SO) — -0.30
Nitrogen Oxide (NO) — -0.48
Particulate Matter (PM10) — 0.96
Particulate Matter (PM2.5) — 0.34
Carbon Monoxide (CO) — -1.94
Organic Compounds (OC) — -1.85

Climate
Temperature Average — -0.98
Squared — 0.04
Temperature Minimum — 0.09
Squared — 0.02
Temperature Maximum — -3.69
Squared — 0.08
Precipitation — 0.01

Land Cover
Forest — -0.00

(x-axis: -1.00, -0.50, 0.00, 0.50, 1.00)

Notes: Plotted coefficients are obtained from separate models regressing positive affect on each environmental factor alongside controls at the individual, household, and country level. See Table A2 in this Appendix for the full regression table. Confidence bands are 95%.

Sources: Gallup World Poll, 2005 to 2015; OECD Environmental Database; World Bank and World Bank Climate Change Knowledge Portal.

Figure A2: How Environmental Quality Affects Negative Affect Around the World

Negative Affect

Air Pollution
- Sulphur Oxide (SO) — -0.48
- Nitrogen Oxide (NO) — -0.36
- Particulate Matter (PM10) — -0.59
- Particulate Matter (PM2.5) — 1.19
- Carbon Monoxide (CO) — -4.55
- Organic Compounds (OC) — -4.27

Climate
- Temperature Average — 0.70
- Squared — 0.01
- Temperature Minimum — 0.54
- Squared — 0.01
- Temperature Maximum — -0.47
- Squared — 0.03
- Precipitation — -0.01

Land Cover
- Forest — -0.03

-1.00 -0.50 0.00 0.50 1.00
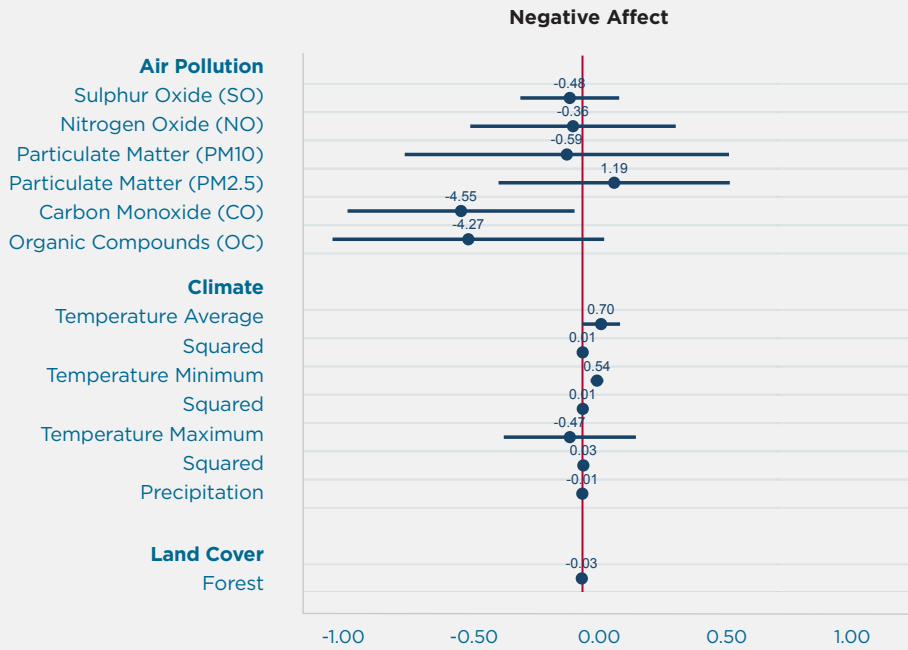
Notes: Plotted coefficients are obtained from separate models regressing negative affect on each environmental factor alongside controls at the individual, household, and country level. See Table A3 in this Appendix for the full regression table. Confidence bands are 95%.

Sources: Gallup World Poll, 2005 to 2015; OECD Environmental Database; World Bank and World Bank Climate Change Knowledge Portal.
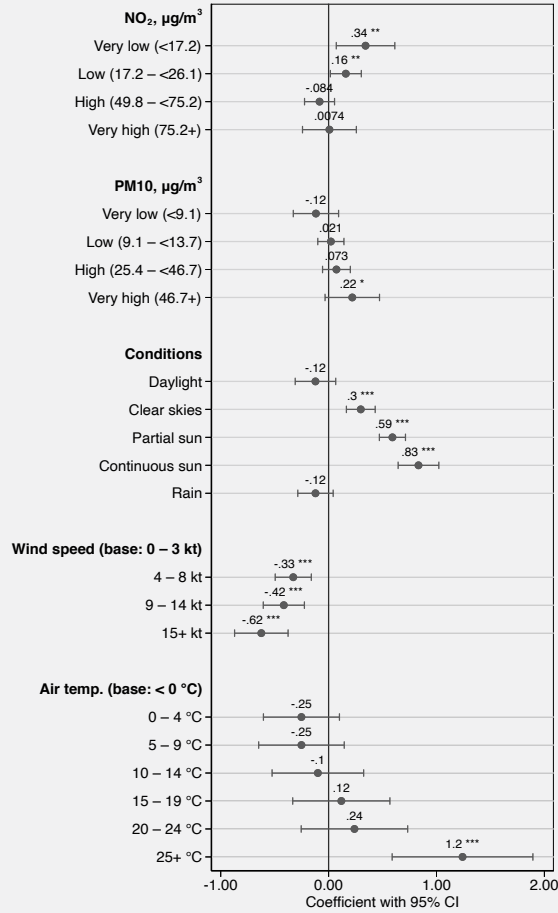
Figure A3: Happiness Impacts of Air Quality and Weather Conditions in Greater London, UK: Low-Choice Model

NO$_2$, μg/m^3
Very low (<17.2) — .34 **
Low (17.2 – <26.1) — .16 **
High (49.8 – <75.2) — -.084
Very high (75.2+) — .0074

PM10, μg/m^3
Very low (<9.1) — -.12
Low (9.1 – <13.7) — .021
High (25.4 – <46.7) — .073
Very high (46.7+) — .22 *

Conditions
Daylight — -.12
Clear skies — .3 ***
Partial sun — .59 ***
Continuous sun — .83 ***
Rain — -.12

Wind speed (base: 0 – 3 kt)
4 – 8 kt — -.33 ***
9 – 14 kt — -.42 ***
15+ kt — -.62 ***

Air temp. (base: < 0 °C)
0 – 4 °C — -.25
5 – 9 °C — -.25
10 – 14 °C — -.1
15 – 19 °C — .12
20 – 24 °C — .24
25+ °C — 1.2 ***

Coefficient with 95% CI (-1.00, 0.00, 1.00, 2.00)

Notes: Plotted coefficients are obtained from a single model (see Table A4), regressing reported happiness (scaled 0 – 100) on all environmental factors, alongside date and time controls and individual fixed effects.

Sources: Mappiness data set; London Air Quality Network; UK Met Office.

Confidence bands are at the 95% level.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table A1: How Environmental Quality Affects Life Evaluation Around the World

	Life Evaluation				
	(1)	(2)	(3)	(4)	(5)
Air Pollution					
Sulphur Oxide (SO)	-0.0230				
	(0.0829)				
Nitrogen Oxide (NO)		0.0255			
		(0.190)			
Particulate Matter (PM10)			-0.637**		
			(0.235)		
Particulate Matter (PM2.5)				-0.359**	
				(0.176)	
Carbon Monoxide (CO)					0.110
					(0.189)
Organic Compounds (OC)					
Climate					
Temperature Average					
Squared					
Temperature Minimum					
Squared					
Temperature Maximum					
Squared					
Precipitation					
Land Cover					
Forest					
Controls					
Age	-0.0617***	-0.0617***	-0.0606***	-0.0595***	-0.0614***
	(0.00463)	(0.00464)	(0.00521)	(0.00531)	(0.00457)
Age Squared	0.000610***	0.000610***	0.000586***	0.000577***	0.000608***
	(4.75e-05)	(4.77e-05)	(5.37e-05)	(5.51e-05)	(4.75e-05)
Is Female	0.172***	0.172***	0.170***	0.170***	0.171***
	(0.0163)	(0.0164)	(0.0152)	(0.0152)	(0.0159)
Is Partnered	0.115***	0.113***	0.108***	0.104***	0.112***
	(0.0302)	(0.0300)	(0.0324)	(0.0322)	(0.0308)
Is Separated	-0.172***	-0.172***	-0.176***	-0.180***	-0.175***
	(0.0230)	(0.0234)	(0.0258)	(0.0244)	(0.0224)
Is Widowed	-0.225***	-0.226***	-0.229***	-0.235***	-0.229***
	(0.0478)	(0.0477)	(0.0471)	(0.0469)	(0.0466)
Has Health Problem	-0.722***	-0.723***	-0.713***	-0.719***	-0.727***
	(0.0326)	(0.0324)	(0.0360)	(0.0358)	(0.0319)
Has Primary Education	-0.470***	-0.470***	-0.450***	-0.444***	-0.469***
	(0.0754)	(0.0755)	(0.0752)	(0.0782)	(0.0734)
Has Tertiary Education	0.238***	0.238***	0.268***	0.258***	0.239***
	(0.0339)	(0.0340)	(0.0359)	(0.0362)	(0.0340)

	(6)	(7)	(8)	(9)	(10)	(11)
	0.287					
	(0.178)					
		-0.131**				
		(0.0495)				
		0.00354*				
		(0.00193)				
			-0.0242			
			(0.0150)			
			0.00134			
			(0.00120)			
				-0.300**		
				(0.122)		
				0.00602*		
				(0.00299)		
					-0.000297	
					(0.000938)	
						0.00307
						(0.00694)
	-0.0611***	-0.0595***	-0.0599***	-0.0607***	-0.0618***	-0.0640***
	(0.00462)	(0.00491)	(0.00477)	(0.00466)	(0.00459)	(0.00516)
	0.000604***	0.000585***	0.000591***	0.000595***	0.000611***	0.000627***
	(4.76e-05)	(5.18e-05)	(5.05e-05)	(4.89e-05)	(4.68e-05)	(5.46e-05)
	0.171***	0.174***	0.173***	0.174***	0.172***	0.175***
	(0.0162)	(0.0163)	(0.0165)	(0.0159)	(0.0161)	(0.0158)
	0.111***	0.118***	0.113***	0.122***	0.113***	0.117***
	(0.0304)	(0.0288)	(0.0302)	(0.0273)	(0.0303)	(0.0302)
	-0.177***	-0.174***	-0.178***	-0.166***	-0.173***	-0.178***
	(0.0240)	(0.0221)	(0.0227)	(0.0195)	(0.0219)	(0.0253)
	-0.230***	-0.207***	-0.217***	-0.206***	-0.226***	-0.224***
	(0.0479)	(0.0379)	(0.0402)	(0.0403)	(0.0475)	(0.0470)
	-0.726***	-0.735***	-0.733***	-0.725***	-0.723***	-0.724***
	(0.0325)	(0.0310)	(0.0318)	(0.0288)	(0.0324)	(0.0333)
	-0.467***	-0.438***	-0.449***	-0.448***	-0.472***	-0.475***
	(0.0752)	(0.0605)	(0.0624)	(0.0615)	(0.0749)	(0.0807)
	0.239***	0.223***	0.230***	0.216***	0.237***	0.247***
	(0.0337)	(0.0389)	(0.0371)	(0.0358)	(0.0339)	(0.0377)

Table A1: How Environmental Quality Affects Life Evaluation Around the World (continued)

	Life Evaluation				
	(1)	(2)	(3)	(4)	(5)
Is Part-Time Employed	0.234***	0.236***	0.234***	0.233***	0.238***
	(0.0246)	(0.0249)	(0.0233)	(0.0224)	(0.0244)
Is Underemployed	-0.274***	-0.273***	-0.272***	-0.266***	-0.269***
	(0.0436)	(0.0440)	(0.0423)	(0.0427)	(0.0426)
Is Self-Employed	0.0697*	0.0694*	0.0689*	0.0655*	0.0733**
	(0.0349)	(0.0356)	(0.0365)	(0.0371)	(0.0344)
Is Unemployed	-0.729***	-0.729***	-0.763***	-0.759***	-0.722***
	(0.0432)	(0.0439)	(0.0448)	(0.0464)	(0.0397)
Is Out of Labour Force	-0.0299	-0.0298	-0.0273	-0.0268	-0.0279
	(0.0282)	(0.0291)	(0.0303)	(0.0303)	(0.0286)
Annual Household Income	0.534***	0.535***	0.514***	0.525***	0.534***
	(0.0694)	(0.0696)	(0.0705)	(0.0716)	(0.0700)
Number of Individuals in Household	-0.0589***	-0.0584***	-0.0595***	-0.0569***	-0.0586***
	(0.0168)	(0.0168)	(0.0170)	(0.0176)	(0.0167)
Has Children in Household	0.0657***	0.0660***	0.0625***	0.0637***	0.0652***
	(0.0144)	(0.0146)	(0.0140)	(0.0142)	(0.0140)
Is Urban	-0.0451*	-0.0463*	-0.0498*	-0.0517*	-0.0459*
	(0.0263)	(0.0251)	(0.0285)	(0.0291)	(0.0263)
GDP Per Capita	2.12e-05	2.13e-05*	1.83e-05	1.92e-05*	2.21e-05
	(1.32e-05)	(1.21e-05)	(1.08e-05)	(1.12e-05)	(1.34e-05)
Population Density	0.00106	0.00111	-0.00120	-0.000365	0.00129*
	(0.000708)	(0.000725)	(0.00102)	(0.000916)	(0.000697)
Population Level	-2.15e-09**	-2.06e-09**	-4.48e-09***	-3.24e-09***	-2.04e-09**
	(8.00e-10)	(7.99e-10)	(1.06e-09)	(8.61e-10)	(7.75e-10)
Observations	258,212	258,212	231,695	231,695	258,212
Adjusted R Squared	0.224	0.224	0.231	0.229	0.224
Constant	Yes	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Region-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes

Robust standard errors clustered at country level in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Notes: We take the natural logarithm of our air pollution measures to reduce their skewedness while leaving all other environmental factors in their natural units.

Sources: Gallup World Poll, 2005 to 2015; OECD Environmental Database; World Bank and World Bank Climate Change Knowledge Portal.

	(6)	(7)	(8)	(9)	(10)	(11)
	0.241***	0.215***	0.223***	0.222***	0.237***	0.232***
	(0.0245)	(0.0220)	(0.0238)	(0.0205)	(0.0234)	(0.0255)
	-0.272***	-0.277***	-0.269***	-0.289***	-0.271***	-0.277***
	(0.0439)	(0.0400)	(0.0416)	(0.0383)	(0.0425)	(0.0456)
	0.0750**	0.0844**	0.0821**	0.0736**	0.0715**	0.0731*
	(0.0344)	(0.0340)	(0.0341)	(0.0328)	(0.0326)	(0.0383)
	-0.721***	-0.708***	-0.716***	-0.712***	-0.728***	-0.733***
	(0.0438)	(0.0392)	(0.0394)	(0.0380)	(0.0429)	(0.0425)
	-0.0217	-0.0274	-0.0302	-0.0197	-0.0298	-0.0309
	(0.0297)	(0.0290)	(0.0285)	(0.0275)	(0.0284)	(0.0304)
	0.537***	0.502***	0.517***	0.513***	0.536***	0.517***
	(0.0697)	(0.0599)	(0.0642)	(0.0600)	(0.0701)	(0.0697)
	-0.0582***	-0.0372***	-0.0438***	-0.0447***	-0.0589***	-0.0589***
	(0.0166)	(0.0131)	(0.0138)	(0.0144)	(0.0169)	(0.0167)
	0.0659***	0.0560***	0.0564***	0.0687***	0.0658***	0.0597***
	(0.0148)	(0.0135)	(0.0137)	(0.0147)	(0.0144)	(0.0144)
	-0.0482*	-0.0319	-0.0375	-0.0364	-0.0459*	-0.0442
	(0.0259)	(0.0234)	(0.0249)	(0.0233)	(0.0265)	(0.0268)
	1.93e-05	2.01e-05*	2.19e-05*	1.85e-05*	2.19e-05	2.31e-05*
	(1.27e-05)	(1.01e-05)	(1.14e-05)	(1.01e-05)	(1.30e-05)	(1.36e-05)
	0.00145*	0.00175***	0.00173***	0.00117*	0.00111	0.00142*
	(0.000766)	(0.000553)	(0.000615)	(0.000631)	(0.000688)	(0.000721)
	-1.55e-09*	2.02e-09	6.74e-10	1.03e-10	-2.02e-09***	-2.08e-09**
	(8.38e-10)	(2.25e-09)	(2.30e-09)	(1.27e-09)	(7.19e-10)	(8.66e-10)
	258,212	258,212	258,212	258,212	258,212	226,052
	0.225	0.232	0.228	0.232	0.224	0.223
	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes

Table A2: How Environmental Quality Affects Positive Affect Around the World

	Positive Affect				
	(1)	(2)	(3)	(4)	(5)
Air Pollution					
Sulphur Oxide (SO)	-0.0230				
	(0.0829)				
Nitrogen Oxide (NO)		0.0255			
		(0.190)			
Particulate Matter (PM10)			-0.637**		
			(0.235)		
Particulate Matter (PM2.5)				-0.359**	
				(0.176)	
Carbon Monoxide (CO)					0.110
					(0.189)
Organic Compounds (OC)					
Climate					
Temperature Average					
Squared					
Temperature Minimum					
Squared					
Temperature Maximum					
Squared					
Precipitation					
Land Cover					
Forest					
Controls					
Age	-0.0617***	-0.0617***	-0.0606***	-0.0595***	-0.0614***
	(0.00463)	(0.00464)	(0.00521)	(0.00531)	(0.00457)
Age Squared	0.000610***	0.000610***	0.000586***	0.000577***	0.000608***
	(4.75e-05)	(4.77e-05)	(5.37e-05)	(5.51e-05)	(4.75e-05)
Is Female	0.172***	0.172***	0.170***	0.170***	0.171***
	(0.0163)	(0.0164)	(0.0152)	(0.0152)	(0.0159)
Is Partnered	0.115***	0.113***	0.108***	0.104***	0.112***
	(0.0302)	(0.0300)	(0.0324)	(0.0322)	(0.0308)
Is Separated	-0.172***	-0.172***	-0.176***	-0.180***	-0.175***
	(0.0230)	(0.0234)	(0.0258)	(0.0244)	(0.0224)
Is Widowed	-0.225***	-0.226***	-0.229***	-0.235***	-0.229***
	(0.0478)	(0.0477)	(0.0471)	(0.0469)	(0.0466)
Has Health Problem	-0.722***	-0.723***	-0.713***	-0.719***	-0.727***
	(0.0326)	(0.0324)	(0.0360)	(0.0358)	(0.0319)
Has Primary Education	-0.470***	-0.470***	-0.450***	-0.444***	-0.469***
	(0.0754)	(0.0755)	(0.0752)	(0.0782)	(0.0734)
Has Tertiary Education	0.238***	0.238***	0.268***	0.258***	0.239***
	(0.0339)	(0.0340)	(0.0359)	(0.0362)	(0.0340)

	(6)	(7)	(8)	(9)	(10)	(11)
	0.287					
	(0.178)					
		-0.131**				
		(0.0495)				
		0.00354*				
		(0.00193)				
			-0.0242			
			(0.0150)			
			0.00134			
			(0.00120)			
				-0.300**		
				(0.122)		
				0.00602*		
				(0.00299)		
					-0.000297	
					(0.000938)	
						0.00307
						(0.00694)
	-0.0611***	-0.0595***	-0.0599***	-0.0607***	-0.0618***	-0.0640***
	(0.00462)	(0.00491)	(0.00477)	(0.00466)	(0.00459)	(0.00516)
	0.000604***	0.000585***	0.000591***	0.000595***	0.000611***	0.000627***
	(4.76e-05)	(5.18e-05)	(5.05e-05)	(4.89e-05)	(4.68e-05)	(5.46e-05)
	0.171***	0.174***	0.173***	0.174***	0.172***	0.175***
	(0.0162)	(0.0163)	(0.0165)	(0.0159)	(0.0161)	(0.0158)
	0.111***	0.118***	0.113***	0.122***	0.113***	0.117***
	(0.0304)	(0.0288)	(0.0302)	(0.0273)	(0.0303)	(0.0302)
	-0.177***	-0.174***	-0.178***	-0.166***	-0.173***	-0.178***
	(0.0240)	(0.0221)	(0.0227)	(0.0195)	(0.0219)	(0.0253)
	-0.230***	-0.207***	-0.217***	-0.206***	-0.226***	-0.224***
	(0.0479)	(0.0379)	(0.0402)	(0.0403)	(0.0475)	(0.0470)
	-0.726***	-0.735***	-0.733***	-0.725***	-0.723***	-0.724***
	(0.0325)	(0.0310)	(0.0318)	(0.0288)	(0.0324)	(0.0333)
	-0.467***	-0.438***	-0.449***	-0.448***	-0.472***	-0.475***
	(0.0752)	(0.0605)	(0.0624)	(0.0615)	(0.0749)	(0.0807)
	0.239***	0.223***	0.230***	0.216***	0.237***	0.247***
	(0.0337)	(0.0389)	(0.0371)	(0.0358)	(0.0339)	(0.0377)

Table A2: How Environmental Quality Affects Positive Affect Around the World (continued)

	Positive Affect				
	(1)	(2)	(3)	(4)	(5)
Is Part-Time Employed	0.234***	0.236***	0.234***	0.233***	0.238***
	(0.0246)	(0.0249)	(0.0233)	(0.0224)	(0.0244)
Is Underemployed	-0.274***	-0.273***	-0.272***	-0.266***	-0.269***
	(0.0436)	(0.0440)	(0.0423)	(0.0427)	(0.0426)
Is Self-Employed	0.0697*	0.0694*	0.0689*	0.0655*	0.0733**
	(0.0349)	(0.0356)	(0.0365)	(0.0371)	(0.0344)
Is Unemployed	-0.729***	-0.729***	-0.763***	-0.759***	-0.722***
	(0.0432)	(0.0439)	(0.0448)	(0.0464)	(0.0397)
Is Out of Labour Force	-0.0299	-0.0298	-0.0273	-0.0268	-0.0279
	(0.0282)	(0.0291)	(0.0303)	(0.0303)	(0.0286)
Annual Household Income	0.534***	0.535***	0.514***	0.525***	0.534***
	(0.0694)	(0.0696)	(0.0705)	(0.0716)	(0.0700)
Number of Individuals in Household	-0.0589***	-0.0584***	-0.0595***	-0.0569***	-0.0586***
	(0.0168)	(0.0168)	(0.0170)	(0.0176)	(0.0167)
Has Children in Household	0.0657***	0.0660***	0.0625***	0.0637***	0.0652***
	(0.0144)	(0.0146)	(0.0140)	(0.0142)	(0.0140)
Is Urban	-0.0451*	-0.0463*	-0.0498*	-0.0517*	-0.0459*
	(0.0263)	(0.0251)	(0.0285)	(0.0291)	(0.0263)
GDP Per Capita	2.12e-05	2.13e-05*	1.83e-05	1.92e-05*	2.21e-05
	(1.32e-05)	(1.21e-05)	(1.08e-05)	(1.12e-05)	(1.34e-05)
Population Density	0.00106	0.00111	-0.00120	-0.000365	0.00129*
	(0.000708)	(0.000725)	(0.00102)	(0.000916)	(0.000697)
Population Level	-2.15e-09**	-2.06e-09**	-4.48e-09***	-3.24e-09***	-2.04e-09**
	(8.00e-10)	(7.99e-10)	(1.06e-09)	(8.61e-10)	(7.75e-10)
Observations	258,212	258,212	231,695	231,695	258,212
Adjusted R Squared	0.224	0.224	0.231	0.229	0.224
Constant	Yes	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Region-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes

Robust standard errors clustered at country level in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Notes: We take the natural logarithm of our air pollution measures to reduce their skewedness while leaving all other environmental factors in their natural units.

Sources: Gallup World Poll, 2005 to 2015; OECD Environmental Database; World Bank and World Bank Climate Change Knowledge Portal.

	(6)	(7)	(8)	(9)	(10)	(11)
	0.241***	0.215***	0.223***	0.222***	0.237***	0.232***
	(0.0245)	(0.0220)	(0.0238)	(0.0205)	(0.0234)	(0.0255)
	-0.272***	-0.277***	-0.269***	-0.289***	-0.271***	-0.277***
	(0.0439)	(0.0400)	(0.0416)	(0.0383)	(0.0425)	(0.0456)
	0.0750**	0.0844**	0.0821**	0.0736**	0.0715**	0.0731*
	(0.0344)	(0.0340)	(0.0341)	(0.0328)	(0.0326)	(0.0383)
	-0.721***	-0.708***	-0.716***	-0.712***	-0.728***	-0.733***
	(0.0438)	(0.0392)	(0.0394)	(0.0380)	(0.0429)	(0.0425)
	-0.0217	-0.0274	-0.0302	-0.0197	-0.0298	-0.0309
	(0.0297)	(0.0290)	(0.0285)	(0.0275)	(0.0284)	(0.0304)
	0.537***	0.502***	0.517***	0.513***	0.536***	0.517***
	(0.0697)	(0.0599)	(0.0642)	(0.0600)	(0.0701)	(0.0697)
	-0.0582***	-0.0372***	-0.0438***	-0.0447***	-0.0589***	-0.0589***
	(0.0166)	(0.0131)	(0.0138)	(0.0144)	(0.0169)	(0.0167)
	0.0659***	0.0560***	0.0564***	0.0687***	0.0658***	0.0597***
	(0.0148)	(0.0135)	(0.0137)	(0.0147)	(0.0144)	(0.0144)
	-0.0482*	-0.0319	-0.0375	-0.0364	-0.0459*	-0.0442
	(0.0259)	(0.0234)	(0.0249)	(0.0233)	(0.0265)	(0.0268)
	1.93e-05	2.01e-05*	2.19e-05*	1.85e-05*	2.19e-05	2.31e-05*
	(1.27e-05)	(1.01e-05)	(1.14e-05)	(1.01e-05)	(1.30e-05)	(1.36e-05)
	0.00145*	0.00175***	0.00173***	0.00117*	0.00111	0.00142*
	(0.000766)	(0.000553)	(0.000615)	(0.000631)	(0.000688)	(0.000721)
	-1.55e-09*	2.02e-09	6.74e-10	1.03e-10	-2.02e-09***	-2.08e-09**
	(8.38e-10)	(2.25e-09)	(2.30e-09)	(1.27e-09)	(7.19e-10)	(8.66e-10)
	258,212	258,212	258,212	258,212	258,212	226,052
	0.225	0.232	0.228	0.232	0.224	0.223
	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes

Table A3: How Environmental Quality Affects Positive Affect Around the World

	Negative Affect				
	(1)	(2)	(3)	(4)	(5)
Air Pollution					
Sulphur Oxide (SO)	-0.476				
	(0.909)				
Nitrogen Oxide (NO)		-0.355			
		(1.891)			
Particulate Matter (PM10)			-0.586		
			(2.968)		
Particulate Matter (PM2.5)				1.186	
				(2.116)	
Carbon Monoxide (CO)					-4.547**
					(2.088)
Organic Compounds (OC)					
Climate					
Temperature Average					
Squared					
Temperature Minimum					
Squared					
Temperature Maximum					
Squared					
Precipitation					
Land Cover					
Forest					
Controls					
Age	0.509***	0.509***	0.510***	0.508***	0.500***
	(0.0592)	(0.0591)	(0.0636)	(0.0636)	(0.0577)
Age Squared	-0.00634***	-0.00634***	-0.00633***	-0.00630***	-0.00626***
	(0.000519)	(0.000520)	(0.000570)	(0.000572)	(0.000513)
Is Female	3.271***	3.273***	3.350***	3.339***	3.318***
	(0.230)	(0.231)	(0.242)	(0.240)	(0.228)
Is Partnered	-0.116	-0.123	-0.107	-0.136	-0.0528
	(0.285)	(0.278)	(0.317)	(0.306)	(0.303)
Is Separated	2.512***	2.508***	2.434***	2.403***	2.615***
	(0.371)	(0.367)	(0.382)	(0.372)	(0.352)
Is Widowed	2.392***	2.383***	2.519***	2.454***	2.508***
	(0.304)	(0.306)	(0.359)	(0.346)	(0.323)
Has Health Problem	16.03***	16.02***	16.05***	16.03***	16.18***
	(0.628)	(0.634)	(0.682)	(0.692)	(0.611)
Has Primary Education	4.031***	4.020***	4.266***	4.208***	3.984***
	(0.871)	(0.876)	(0.928)	(0.936)	(0.822)
Has Tertiary Education	-0.731*	-0.730**	-0.764*	-0.778*	-0.787**
	(0.363)	(0.359)	(0.397)	(0.403)	(0.340)

	(6)	(7)	(8)	(9)	(10)	(11)
	-4.273*					
	(2.499)					
		0.697*				
		(0.348)				
		0.00693				
		(0.0180)				
			0.543***			
			(0.117)			
			0.0109			
			(0.00761)			
				-0.474		
				(1.216)		
				0.0319		
				(0.0341)		
					-0.00725	
					(0.0130)	
						-0.0267
						(0.0391)
	0.502***	0.485***	0.478***	0.496***	0.508***	0.510***
	(0.0602)	(0.0583)	(0.0574)	(0.0564)	(0.0609)	(0.0634)
	-0.00625***	-0.00606***	-0.00602***	-0.00617***	-0.00631***	-0.00630***
	(0.000542)	(0.000528)	(0.000527)	(0.000502)	(0.000537)	(0.000575)
	3.284***	3.246***	3.267***	3.258***	3.267***	3.368***
	(0.229)	(0.227)	(0.225)	(0.231)	(0.228)	(0.250)
	-0.0827	-0.177	-0.0874	-0.220	-0.148	-0.139
	(0.287)	(0.280)	(0.295)	(0.273)	(0.288)	(0.267)
	2.573***	2.622***	2.709***	2.561***	2.475***	2.503***
	(0.370)	(0.327)	(0.311)	(0.333)	(0.354)	(0.389)
	2.441***	2.330***	2.511***	2.305***	2.357***	2.394***
	(0.320)	(0.313)	(0.337)	(0.302)	(0.318)	(0.306)
	16.07***	16.24***	16.32***	16.16***	16.01***	15.91***
	(0.633)	(0.574)	(0.586)	(0.565)	(0.626)	(0.654)
	3.962***	3.517***	3.451***	3.596***	3.967***	4.018***
	(0.903)	(0.585)	(0.614)	(0.622)	(0.892)	(0.898)
	-0.742**	-0.520	-0.633**	-0.488	-0.750**	-0.825**
	(0.342)	(0.311)	(0.301)	(0.309)	(0.352)	(0.377)

Table A3: How Environmental Quality Affects Positive Affect Around the World (continued)

	Negative Affect				
	(1)	(2)	(3)	(4)	(5)
Is Part-Time Employed	-2.061***	-2.051***	-1.852***	-1.762***	-2.166***
	(0.271)	(0.274)	(0.286)	(0.306)	(0.287)
Is Underemployed	3.734***	3.752***	3.879***	3.931***	3.586***
	(0.512)	(0.517)	(0.562)	(0.549)	(0.498)
Is Self-Employed	2.536***	2.522***	2.669***	2.718***	2.355***
	(0.375)	(0.373)	(0.391)	(0.384)	(0.318)
Is Unemployed	7.965***	7.975***	8.134***	8.208***	7.682***
	(0.807)	(0.806)	(0.842)	(0.838)	(0.713)
Is Out of Labour Force	-0.390	-0.400	-0.356	-0.355	-0.490
	(0.401)	(0.401)	(0.448)	(0.448)	(0.394)
Annual Household Income	-2.925***	-2.917***	-2.934***	-2.856***	-2.888***
	(0.365)	(0.353)	(0.416)	(0.403)	(0.357)
Number of Individuals in Household	0.666***	0.673***	0.710***	0.679***	0.678***
	(0.121)	(0.122)	(0.141)	(0.147)	(0.118)
Has Children in Household	-1.871***	-1.869***	-1.981***	-1.959***	-1.842***
	(0.173)	(0.173)	(0.176)	(0.177)	(0.164)
Is Urban	1.436***	1.436***	1.410***	1.420***	1.440***
	(0.304)	(0.285)	(0.322)	(0.329)	(0.278)
GDP Per Capita	-3.41e-05	-1.82e-05	-2.99e-05	-1.85e-05	-4.11e-05
	(4.87e-05)	(6.54e-05)	(5.26e-05)	(4.97e-05)	(5.71e-05)
Value Added in Agriculture	0.000816	0.00113	1.03e-05	0.00530	-0.00707
	(0.00518)	(0.00490)	(0.0107)	(0.00845)	(0.00662)
Value Added in Industry	7.04e-09	6.46e-09	4.31e-09	1.26e-08	3.83e-09
	(8.70e-09)	(8.69e-09)	(1.60e-08)	(1.29e-08)	(9.66e-09)
Population Density	0.509***	0.509***	0.510***	0.508***	0.500***
	(0.0592)	(0.0591)	(0.0636)	(0.0636)	(0.0577)
Environmental Tax Revenue	-0.00634***	-0.00634***	-0.00633***	-0.00630***	-0.00626***
	(0.000519)	(0.000520)	(0.000570)	(0.000572)	(0.000513)
Observations	259,254	259,254	232,659	232,659	259,254
Adjusted R Squared	0.107	0.107	0.107	0.107	0.110
Constant	Yes	Yes	Yes	Yes	Yes
Region Fixed Effects	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Region-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes

Robust standard errors clustered at country level in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Notes: We take the natural logarithm of our air pollution measures to reduce their skewedness while leaving all other environmental factors in their natural units.

Sources: Gallup World Poll, 2005 to 2015; OECD Environmental Database; World Bank and World Bank Climate Change Knowledge Portal.

	(6)	(7)	(8)	(9)	(10)	(11)
	-2.126***	-1.817***	-1.905***	-1.863***	-2.010***	-2.145***
	(0.291)	(0.303)	(0.308)	(0.305)	(0.297)	(0.311)
	3.727***	3.642***	3.449***	3.718***	3.801***	3.623***
	(0.518)	(0.449)	(0.446)	(0.465)	(0.500)	(0.526)
	2.437***	2.320***	2.249***	2.414***	2.581***	2.415***
	(0.363)	(0.288)	(0.278)	(0.303)	(0.348)	(0.353)
	7.865***	7.510***	7.485***	7.563***	7.988***	7.869***
	(0.765)	(0.650)	(0.661)	(0.641)	(0.805)	(0.794)
	-0.521	-0.477	-0.461	-0.495	-0.386	-0.470
	(0.418)	(0.355)	(0.364)	(0.365)	(0.400)	(0.416)
	-2.945***	-2.654***	-2.775***	-2.728***	-2.877***	-2.806***
	(0.355)	(0.306)	(0.338)	(0.309)	(0.369)	(0.351)
	0.671***	0.541***	0.574***	0.599***	0.664***	0.683***
	(0.119)	(0.107)	(0.107)	(0.109)	(0.117)	(0.135)
	-1.868***	-1.762***	-1.717***	-1.857***	-1.867***	-1.887***
	(0.179)	(0.166)	(0.163)	(0.173)	(0.175)	(0.171)
	1.465***	1.138***	1.181***	1.150***	1.420***	1.504***
	(0.299)	(0.215)	(0.228)	(0.220)	(0.316)	(0.294)
	1.20e-05	-4.62e-06	-2.39e-05	1.30e-05	-2.02e-05	-2.32e-05
	(4.99e-05)	(2.94e-05)	(4.05e-05)	(3.15e-05)	(4.70e-05)	(4.84e-05)
	-0.00397	-0.00801	-0.0114*	-0.000422	0.00188	-0.00144
	(0.00677)	(0.00515)	(0.00630)	(0.00485)	(0.00508)	(0.00647)
	-1.31e-09	-1.46e-08	-2.55e-09	-2.67e-09	1.02e-08	3.77e-09
	(1.11e-08)	(1.46e-08)	(1.47e-08)	(9.02e-09)	(9.24e-09)	(8.89e-09)
	0.502***	0.485***	0.478***	0.496***	0.508***	0.510***
	(0.0602)	(0.0583)	(0.0574)	(0.0564)	(0.0609)	(0.0634)
	-0.00625***	-0.00606***	-0.00602***	-0.00617***	-0.00631***	-0.00630***
	(0.000542)	(0.000528)	(0.000527)	(0.000502)	(0.000537)	(0.000575)
	259,254	259,254	259,254	259,254	259,254	226,933
	0.108	0.115	0.114	0.114	0.107	0.106
	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes
	Yes	Yes	Yes	Yes	Yes	Yes

Table A4: Happiness Impacts of Environmental Characteristics and Controls in Greater London, UK: Regression Models

	1		2		3		4	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Green and blue space								
Public green space	0.458**	(0.226)	0.522***	(0.183)				
Street trees	0.281	(0.260)	0.112	(0.189)				
Thames, <10m	0.556	(0.353)	0.814***	(0.299)				
Thames, 10 – 50m	3.320	(2.197)	1.950***	(0.711)				
Canal centreline, <20m	-0.0746	(0.785)	-0.0245	(0.815)				
Pond/lake, <10m	1.396	(0.971)	1.358	(1.240)				
Pond/lake, 10 - 50m	0.352	(0.835)	0.506	(0.720)				
Public green space x outdoors					1.118***	(0.298)	1.029***	(0.351)
Street trees x outdoors					0.993***	(0.330)	0.981***	(0.336)
Thames, <10m x outdoors					1.157**	(0.511)	1.284***	(0.378)
Thames, 10 – 50m x outdoors					2.548**	(1.264)	2.198**	(0.938)
Canal centreline, <20m x outdoors					1.610*	(0.872)	1.767**	(0.719)
Pond/lake, <10m x outdoors					1.601	(1.143)	1.295	(1.191)
Pond/lake, 10 - 50m x outdoors					0.892	(0.991)	0.947	(1.039)
NO$_2$, µg/m³								
Very low (<16.4)	0.214	(0.179)	0.292*	(0.149)				
Low (16.4 – <28.4)	0.0888	(0.0899)	0.137*	(0.0799)				
High (57.2 – <95.8)	0.0102	(0.0819)	-0.0338	(0.0769)				
Very high (95.8+)	-0.0185	(0.158)	-0.140	(0.152)				
Very low (<16.4) x outdoors					-0.230	(0.383)	-0.130	(0.370)
Low (16.4 – <28.4) x outdoors					0.164	(0.220)	0.236	(0.220)
High (57.2 – <95.8) x outdoors					-0.0972	(0.217)	-0.154	(0.246)
Very high (95.8+) x outdoors					-0.0456	(0.355)	-0.290	(0.320)
PM10, µg/m³								
Very low (<5.5)	-0.136	(0.137)	-0.133	(0.136)				
Low (5.5 – <8.1)	0.0274	(0.0719)	0.0328	(0.0694)				
High (17.1 – <38.4)	-0.0156	(0.0756)	-0.0171	(0.0715)				
Very high (38.4+)	0.101	(0.138)	0.115	(0.132)				
Very low (<5.5) x outdoors					0.0922	(0.432)	0.118	(0.415)
Low (5.5 – <8.1) x outdoors					0.110	(0.216)	0.106	(0.215)
High (17.1 – <38.4) x outdoors					-0.148	(0.211)	-0.139	(0.211)
Very high (38.4+) x outdoors					0.224	(0.350)	0.269	(0.374)
Noise								
Quiet	-0.902***	(0.0751)	-0.918***	(0.0749)				
Loud	0.769***	(0.0995)	0.781***	(0.105)				
Quiet x outdoors					-0.619*	(0.371)	-0.667*	(0.372)
Loud x outdoors					0.238	(0.220)	0.251	(0.220)
Conditions								
Daylight	0.00748	(0.0990)	0.000809	(0.107)				
Clear skies	0.189*	(0.106)	0.299***	(0.0898)				

Table A4: Happiness Impacts of Environmental Characteristics and Controls in Greater London, UK: Regression Models (continued)

		Happiness (0 – 100)						
	1		**2**		**3**		**4**	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Rain	-0.0602	(0.0809)	-0.0546	(0.0855)				
Partial sun	0.542***	(0.0618)	0.537***	(0.0597)				
Continuous sun	0.879***	(0.0916)	0.861***	(0.103)				
Daylight x outdoors					-0.277	(0.254)	-0.262	(0.249)
Clear skies x outdoors					0.229	(0.277)	0.378	(0.272)
Rain x outdoors					-1.018***	(0.318)	-0.983***	(0.309)
Partial sun x outdoors					0.976***	(0.188)	0.967***	(0.201)
Continuous sun x outdoors					1.712***	(0.262)	1.676***	(0.280)
Wind speed (base: 0 – 3 kt)								
4 – 8 kt	-0.225***	(0.0829)	-0.221***	(0.0811)				
9 – 14 kt	-0.284***	(0.0965)	-0.303***	(0.0889)				
15+ kt	-0.430***	(0.131)	-0.454***	(0.118)				
4 – 8 kt x outdoors					-0.347	(0.285)	-0.417	(0.259)
9 – 14 kt x outdoors					-0.602**	(0.294)	-0.708**	(0.288)
15+ kt x outdoors					-0.734*	(0.411)	-0.870**	(0.364)
Air temperature (base: < 0Ð ºC)								
0 – 4 °C	-0.264	(0.184)	-0.284	(0.184)				
5 – 9 °C	-0.318	(0.202)	-0.368*	(0.208)				
10 – 14 °C	-0.135	(0.217)	-0.194	(0.222)				
15 – 19 °C	-0.00285	(0.231)	-0.0775	(0.239)				
20 – 24 °C	0.0545	(0.256)	-0.0548	(0.271)				
25+ °C	1.081***	(0.366)	1.004***	(0.360)				
0 – 4 °C x outdoors					0.725	(0.688)	0.719	(0.747)
5 – 9 °C x outdoors					0.531	(0.683)	0.442	(0.688)
10 – 14 °C x outdoors					0.528	(0.671)	0.433	(0.696)
15 – 19 °C x outdoors					1.147*	(0.679)	1.011	(0.712)
20 – 24 °C x outdoors					0.746	(0.704)	0.626	(0.715)
25+ °C x outdoors					2.871***	(0.806)	2.847***	(0.805)
Selected activities								
Walking, hiking	2.032***	(0.270)	2.087***	(0.276)	1.968***	(0.271)	2.032***	(0.275)
Sports, running, exercise	6.902***	(0.291)	6.951***	(0.298)	6.904***	(0.291)	6.955***	(0.299)
Gardening, allotment	6.348***	(0.646)	6.197***	(0.591)	6.201***	(0.645)	6.016***	(0.590)
Birdwatching, nature watching	4.414***	(0.627)	4.406***	(0.631)	3.901***	(0.636)	3.905***	(0.629)
Other activities								
Working, studying	-1.242***	(0.129)	-1.193***	(0.123)	-1.305***	(0.134)	-1.250***	(0.123)
In a meeting, seminar, class	0.408**	(0.171)	0.348**	(0.168)	0.464***	(0.173)	0.401**	(0.169)
Travelling, commuting	-1.712***	(0.151)	-1.658***	(0.165)	-1.530***	(0.151)	-1.471***	(0.163)
Cooking, preparing food	2.346***	(0.175)	2.367***	(0.166)	2.374***	(0.175)	2.397***	(0.167)
Housework, chores, DIY	-0.186	(0.176)	-0.153	(0.174)	-0.180	(0.177)	-0.148	(0.175)
Waiting, queueing	-3.214***	(0.279)	-3.211***	(0.281)	-3.186***	(0.280)	-3.179***	(0.281)
Shopping, errands	0.603***	(0.153)	0.599***	(0.166)	0.671***	(0.155)	0.675***	(0.166)

Table A4: Happiness Impacts of Environmental Characteristics and Controls in Greater London, UK: Regression Models (continued)

	Happiness (0 – 100)							
	1		**2**		**3**		**4**	
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Admin, finances, organising	-1.448***	(0.240)	-1.440***	(0.230)	-1.480***	(0.241)	-1.472***	(0.231)
Childcare, playing with children	2.427***	(0.300)	2.486***	(0.281)	2.438***	(0.301)	2.505***	(0.281)
Pet care, playing with pets	4.031***	(0.426)	3.966***	(0.415)	3.996***	(0.432)	3.928***	(0.418)
Care or help for adults	-2.437*	(1.369)	-2.477**	(1.256)	-2.428*	(1.389)	-2.478*	(1.269)
Sleeping, resting, relaxing	0.701***	(0.176)	0.766***	(0.159)	0.612***	(0.179)	0.682***	(0.159)
Sick in bed	-16.66***	(0.588)	-16.66***	(0.585)	-16.73***	(0.594)	-16.73***	(0.589)
Meditating, religious activities	4.084***	(0.558)	4.088***	(0.523)	4.040***	(0.561)	4.059***	(0.523)
Washing, dressing, grooming	1.786***	(0.154)	1.829***	(0.146)	1.739***	(0.155)	1.781***	(0.147)
Talking, chatting, socialising	4.475***	(0.148)	4.472***	(0.155)	4.511***	(0.149)	4.509***	(0.154)
Intimacy, making love	11.40***	(0.473)	11.43***	(0.540)	11.41***	(0.473)	11.43***	(0.538)
Eating, snacking	2.011***	(0.122)	2.037***	(0.118)	2.048***	(0.123)	2.075***	(0.120)
Drinking tea/coffee	1.774***	(0.129)	1.762***	(0.123)	1.783***	(0.129)	1.774***	(0.122)
Drinking alcohol	3.566***	(0.197)	3.565***	(0.196)	3.630***	(0.197)	3.624***	(0.197)
Smoking	-0.167	(0.363)	-0.186	(0.338)	-0.135	(0.363)	-0.149	(0.339)
Texting, email, social media	1.221***	(0.138)	1.196***	(0.129)	1.196***	(0.138)	1.169***	(0.129)
Browsing the Internet	0.612***	(0.126)	0.634***	(0.127)	0.560***	(0.126)	0.580***	(0.128)
Watching TV, film	2.316***	(0.131)	2.313***	(0.125)	2.314***	(0.131)	2.313***	(0.125)
Listening to music	3.375***	(0.205)	3.319***	(0.205)	3.416***	(0.205)	3.360***	(0.205)
Listening to speech/podcast	1.932***	(0.259)	1.946***	(0.253)	1.963***	(0.260)	1.978***	(0.253)
Reading	1.900***	(0.214)	1.897***	(0.212)	1.856***	(0.217)	1.849***	(0.211)
Theatre, dance, concert	5.886***	(0.443)	5.851***	(0.403)	6.022***	(0.445)	5.971***	(0.405)
Exhibition, museum, library	4.727***	(0.366)	4.871***	(0.377)	4.747***	(0.364)	4.871***	(0.384)
Match, sporting event	2.483***	(0.753)	2.660***	(0.642)	2.517***	(0.742)	2.696***	(0.641)
Computer games, iPhone games	2.502***	(0.238)	2.485***	(0.231)	2.456***	(0.239)	2.445***	(0.231)
Hunting, fishing	0.171	(2.885)	0.396	(2.959)	0.376	(2.883)	0.581	(2.954)
Other games, puzzles	2.621***	(0.446)	2.647***	(0.438)	2.632***	(0.443)	2.665***	(0.433)
Gambling, betting	-0.794	(1.288)	-0.712	(1.255)	-0.661	(1.289)	-0.591	(1.255)
Hobbies, arts, crafts	5.154***	(0.483)	5.111***	(0.462)	5.145***	(0.490)	5.087***	(0.463)
Singing, performing	4.985***	(0.535)	4.943***	(0.530)	5.047***	(0.539)	5.006***	(0.535)
Something else (version < 1.0.2)	-0.993**	(0.393)	-1.024***	(0.387)	-1.017***	(0.393)	-1.045***	(0.387)
Something else (version >= 1.0.2)	-2.633***	(0.247)	-2.642***	(0.271)	-2.660***	(0.247)	-2.666***	(0.272)
Companionship								
Spouse, partner, girl/boyfriend	3.949***	(0.217)	3.927***	(0.198)	3.980***	(0.219)	3.964***	(0.198)
Children	0.338	(0.266)	0.394	(0.258)	0.380	(0.265)	0.441*	(0.257)
Friends	3.956***	(0.150)	3.920***	(0.155)	4.017***	(0.150)	3.984***	(0.156)
Other family members	0.633***	(0.214)	0.668***	(0.200)	0.671***	(0.214)	0.709***	(0.200)
Colleagues, classmates	0.135	(0.160)	0.172	(0.136)	0.188	(0.164)	0.227*	(0.134)
Clients, customers	1.771***	(0.362)	1.662***	(0.313)	1.820***	(0.371)	1.713***	(0.319)
Others	-0.293	(0.240)	-0.264	(0.245)	-0.276	(0.241)	-0.243	(0.245)
Location (base: indoors)								
Outdoors	2.209***	(0.134)	2.213***	(0.137)	1.393*	(0.746)	1.564**	(0.763)
In a vehicle	-0.695***	(0.180)	-0.555***	(0.184)	-0.779***	(0.182)	-0.640***	(0.182)

Table A4: Happiness Impacts of Environmental Characteristics and Controls in Greater London, UK: Regression Models (continued)

| | Happiness (0 – 100) | | | | | | | |
| | 1 | | 2 | | 3 | | 4 | |
	Coeff	SE	Coeff	SE	Coeff	SE	Coeff	SE
Location (base: at home)								
Work	-1.849***	(0.198)	-2.025***	(0.202)	-1.754***	(0.195)	-1.942***	(0.201)
Elsewhere	1.121***	(0.154)	0.968***	(0.157)	1.290***	(0.151)	1.136***	(0.158)
Hour of day x weekend/ weekend dummies (46)	Yes		Yes		Yes		Yes	
Day of week/public holiday dummies (7)	Yes		Yes		Yes		Yes	
Month dummies (11)	Yes		Yes		Yes		Yes	
Year dummies (8)	Yes		Yes		Yes		Yes	
Christmas week dummy	Yes		Yes		Yes		Yes	
Number of earlier responses (3rd order polynomial)	Yes		Yes		Yes		Yes	
Individual fixed effects	Yes		Yes		Yes		Yes	
Local area (MSOA) fixed effects	No		Yes		No		Yes	
Constant	62.49***	(1.109)	63.63***	(1.203)	61.69***	(1.102)	62.92***	(1.193)
N	503814		501325		503814		501325	
Clusters: individuals	15466		12977		15466		12977	
Clusters: local areas (MSOAs)	—		982		—		982	

Model 4 is the preferred specification presented in the main text.

Robust standard errors, clustered at individual level and (for models 2 and 4) local-area level, in parentheses.

Sources: Mappiness data set; London Air Quality Network; OS Open Greenspace; OS Open Rivers; ONS boundary data; EU EEA European Urban Atlas, Street Tree layer; Centre for Ecology & Hydrology, Lakes Portal; UK Met Office.

$* \ p < 0.1, ** \ p < 0.05, *** \ p < 0.01$

Table A5. Happiness Impacts of Air Quality and Weather Conditions in Greater London, UK: Low-Choice Regression Model

	Happiness (0 – 100)	
Background NO$_2$, µg/m³		
Very low (<17.2)	0.342**	(0.139)
Low (17.2 – <26.1)	0.159**	(0.0731)
High (49.8 – <75.2)	-0.0840	(0.0710)
Very high (75.2+)	0.00739	(0.127)
Background PM10, µg/m³		
Very low (<9.1)	-0.118	(0.107)
Low (9.1 – 13.7)	0.0212	(0.0619)
High (25.4 – <46.7)	0.0726	(0.0656)
Very high (46.7+)	0.219*	(0.129)
Conditions		
Daylight	-0.122	(0.0959)
Clear skies	0.298***	(0.0680)
Partial sun	0.591***	(0.0617)
Continuous sun	0.833***	(0.0964)
Rain	-0.122	(0.0834)
Wind speed (base: 0 – 3kt)		
4 – 8 kt	-0.328***	(0.0854)
9 – 14 kt	-0.415***	(0.0973)
15+ kt	-0.624***	(0.126)
Air temperature (base: < 0°C)		
0 – 4 °C	-0.252	(0.180)
5 – 9 °C	-0.252	(0.202)
10 – 14 °C	-0.0998	(0.217)
15 – 19 °C	0.118	(0.230)
20 – 24 °C	0.239	(0.252)
25+ °C	1.241***	(0.333)
Hour of day x weekend/weekend dummies (46)	Yes	
Day of week/public holiday dummies (7)	Yes	
Month dummies (11)	Yes	
Year dummies (8)	Yes	
Christmas week dummy	Yes	
Number of earlier responses (3rd order polynomial)	Yes	
Individual fixed effects (15,839)	Yes	
Constant	67.29***	(1.074)
N	606,479	
Individuals	15,839	

Robust standard errors, clustered at individual level, in parentheses.

Sources: Mappiness data set; London Air Quality Network; UK Met Office.

* p < 0.1, ** p < 0.05, *** p < 0.01

Table A6. Descriptive Statistics: Environmental Characteristics of Mappiness Observations, Greater London

Binary variable	Proportion of observations (%)	Number of observations
Green and blue spaces		
Public green space	2.74	13,731
Street trees	5.64	28,294
Thames, <10m	1.68	8,434
Thames, 10 – 50m	0.86	4,305
Canal centreline, <20m	0.27	1,362
Pond/lake, <10m	0.12	610
Pond/lake, 10 - 50m	0.18	893
Public green space x outdoors	0.82	4,098
Street trees x outdoors	0.61	3,071
Thames, <10m x outdoors	0.21	1,060
Thames, 10 – 50m x outdoors	0.08	414
Canal centreline, <20m x outdoors	0.05	228
Pond/lake, <10m x outdoors	0.03	135
Pond/lake, 10 - 50m x outdoors	0.05	226
NO_2, µg/m³		
Very low (<16.4)	5.02	25,158
Low (16.4 – <28.4)	20.12	100,867
High (57.2 – <95.8)	19.79	99,231
Very high (95.8+)	4.85	24,291
Very low (<16.4) x outdoors	0.56	2,822
Low (16.4 – <28.4) x outdoors	2.03	10,161
High (57.2 – <95.8) x outdoors	1.84	9,229
Very high (95.8+) x outdoors	0.61	3,068
PM10, µg/m³		
Very low (<5.5)	5.06	25,388
Low (5.5 – <8.1)	20.3	101,746
High (17.1 – <38.4)	19.92	99,878
Very high (38.4+)	5.04	25,281
Very low (<5.5) x outdoors	0.39	1,936
Low (5.5 – <8.1) x outdoors	1.8	9,000
High (17.1 – <38.4) x outdoors	2.08	10,434
Very high (38.4+) x outdoors	0.58	2,887
Noise		
Quiet	21.74	108,993
Loud	23.38	117,224
Quiet x outdoors	0.52	2,608
Loud x outdoors	2.57	12,897
Conditions		
Daylight	78.91	395,582
Clear skies	8.65	43,354
Rain	9.61	48,185
No sun	57.34	287,476
Partial sun	29.81	149,439
Continuous sun	12.85	64,410
Daylight x outdoors	7.9	39,588
Clear skies x outdoors	0.94	4,704

Table A6. Descriptive Statistics: Environmental Characteristics of Mappiness Observations, Greater London (continued)

Binary variable	Proportion of observations (%)	Number of observations
Rain x outdoors	0.64	3,215
No sun x outdoors	4.51	22,586
Partial sun x outdoors	3.25	16,313
Continuous sun x outdoors	1.61	8,063
Wind speed		
0 – 3 kt	9.95	49,894
4 – 8 kt	41.68	208,963
9 – 14 kt	40.22	201,613
15+ kt	8.15	40,855
0 – 3 kt x outdoors	0.86	4,331
4 – 8 kt x outdoors	4	20,032
9 – 14 kt x outdoors	3.81	19,122
15+ kt x outdoors	0.69	3,477
Air temperature		
< 0 °C	2.84	14,253
0 – 4 °C	11.35	56,885
5 – 9 °C	22.9	114,783
10 – 14 °C	28.24	141,561
15 – 19 °C	26.68	133,766
20 – 24 °C	6.86	34,381
25+ °C	1.14	5,696
< 0 °C x outdoors	0.17	839
0 – 4 °C x outdoors	0.73	3,682
5 – 9 °C x outdoors	1.65	8,252
10 – 14 °C x outdoors	2.54	12,737
15 – 19 °C x outdoors	3.01	15,093
20 – 24 °C x outdoors	1.06	5,299
25+ °C x outdoors	0.21	1,060
Selected activities		
Walking, hiking	1.5	7,496
Sports, running, exercise	1.22	6,127
Gardening, allotment	0.19	974
Birdwatching, nature watching	0.14	686
Location		
Indoors	84.53	423,788
Outdoors	9.37	46,962
In a vehicle	6.1	30,575
Location		
At home	42.31	212,096
At work	32.4	162,446
Elsewhere	25.29	126,783

Notes: Statistics are reported here for all responses included in our preferred model specification (N = 501,325) as presented in Model 4, Table A4.

Table A7. Companionship-Activity Interactions, Full Sample

Binary variable	Happiness (0 – 100)	
	Coeff	SE
Activities		
Working, studying	-1.398***	(0.0942)
In a meeting, seminar, class	0.693***	(0.138)
Travelling, commuting	-1.888***	(0.116)
Cooking, preparing food	2.756***	(0.119)
Housework, chores, DIY	0.494***	(0.105)
Waiting, queueing	-3.539***	(0.159)
Shopping, errands	0.977***	(0.111)
Admin, finances, organising	-0.817***	(0.157)
Childcare, playing with children	4.285***	(0.182)
Pet care, playing with pets	3.866***	(0.235)
Care or help for adults	-3.679***	(0.798)
Sleeping, resting, relaxing	0.466***	(0.115)
Sick in bed	-18.33***	(0.372)
Meditating, religious activities	5.561***	(0.443)
Washing, dressing, grooming	2.601***	(0.106)
Talking, chatting, socialising	5.375***	(0.103)
Intimacy, making love	10.18***	(0.497)
Eating, snacking	2.008***	(0.0786)
Drinking tea/coffee	2.016***	(0.0972)
Drinking alcohol	3.903***	(0.155)
Smoking	-0.188	(0.227)
Texting, email, social media	1.280***	(0.0924)
Browsing the Internet	1.019***	(0.103)
Watching TV, film	2.338***	(0.0827)
Listening to music	3.449***	(0.113)
Listening to speech/podcast	1.937***	(0.142)
Reading	2.299***	(0.158)
Theatre, dance, concert	8.013***	(0.386)
Exhibition, museum, library	6.116***	(0.373)
Match, sporting event	3.896***	(0.366)
Walking, hiking	2.157***	(0.167)
Sports, running, exercise	7.604***	(0.178)
Gardening, allotment	5.910***	(0.319)
Birdwatching, nature watching	5.350***	(0.387)
Computer games, iPhone games	3.016***	(0.125)
Hunting, fishing	4.246**	(1.725)
Other games, puzzles	3.062***	(0.391)
Gambling, betting	0.775	(0.895)
Hobbies, arts, crafts	5.932***	(0.249)
Singing, performing	6.835***	(0.379)
Something else (version < 1.0.2)	-2.558***	(0.192)
Something else (version >= 1.0.2)	-3.597***	(0.699)

Table A7. Companionship-Activity Interactions, Full Sample (continued)

Binary variable	Happiness (0 – 100)	
	Coeff	SE
Companionship		
Spouse, partner, girl/boyfriend	4.680***	(0.139)
Children	0.378***	(0.135)
Other family members	0.669***	(0.0856)
Colleagues, classmates	-0.438***	(0.115)
Clients, customers	0.880***	(0.289)
Friends	6.296***	(0.132)
Others	-0.713***	(0.145)
Friend x activity interactions		
Friend x Working, studying	-0.943***	(0.194)
Friend x In a meeting, seminar, class	-1.310***	(0.260)
Friend x Travelling, commuting	0.867***	(0.173)
Friend x Cooking, preparing food	-1.928***	(0.198)
Friend x Housework, chores, DIY	-1.787***	(0.281)
Friend x Waiting, queueing	0.753***	(0.285)
Friend x Shopping, errands	-0.266	(0.230)
Friend x Admin, finances, organising	-0.380	(0.334)
Friend x Childcare, playing with children	-2.412***	(0.234)
Friend x Pet care, playing with pets	-1.600***	(0.414)
Friend x Care or help for adults	1.540	(0.984)
Friend x Sleeping, resting, relaxing	-0.702***	(0.195)
Friend x Sick in bed	0.550	(0.804)
Friend x Meditating, religious activities	-3.515***	(0.676)
Friend x Washing, dressing, grooming	-1.534***	(0.289)
Friend x Talking, chatting, socialising	-2.372***	(0.112)
Friend x Intimacy, making love	-0.436	(0.814)
Friend x Eating, snacking	-0.536***	(0.106)
Friend x Drinking tea/coffee	-1.271***	(0.161)
Friend x Drinking alcohol	0.371**	(0.161)
Friend x Smoking	1.385***	(0.328)
Friend x Texting, email, social media	-1.009***	(0.218)
Friend x Browsing the Internet	-1.491***	(0.260)
Friend x Watching TV, film	-1.977***	(0.142)
Friend x Listening to music	-1.262***	(0.164)
Friend x Listening to speech/podcast	-2.104***	(0.436)
Friend x Reading	-2.518***	(0.339)
Friend x Theatre, dance, concert	-3.153***	(0.407)
Friend x Exhibition, museum, library	-3.296***	(0.499)
Friend x Match, sporting event	-3.064***	(0.377)
Friend x Walking, hiking	-0.882***	(0.262)
Friend x Sports, running, exercise	-3.535***	(0.292)
Friend x Gardening, allotment	-2.825***	(0.765)
Friend x Birdwatching, nature watching	-1.972**	(0.786)
Friend x Computer games, iPhone games	-1.129***	(0.282)
Friend x Hunting, fishing	1.614	(1.797)
Friend x Other games, puzzles	-0.572	(0.462)

Table A7. Companionship-Activity Interactions, Full Sample (continued)

	Happiness (0 – 100)	
Binary variable	**Coeff**	**SE**
Friend x Gambling, betting	1.941*	(1.101)
Friend x Hobbies, arts, crafts	-2.730***	(0.425)
Friend x Singing, performing	-2.335***	(0.485)
Friend x Something else (version < 1.0.2)	3.822***	(0.393)
Friend x Something else (version >= 1.0.2)	3.489***	(0.659)
Partner x activity interactions		
Partner x Working, studying	-0.710***	(0.198)
Partner x In a meeting, seminar, class	-1.348***	(0.498)
Partner x Travelling, commuting	0.861***	(0.145)
Partner x Cooking, preparing food	-0.789***	(0.148)
Partner x Housework, chores, DIY	-2.784***	(0.153)
Partner x Waiting, queueing	-0.265	(0.264)
Partner x Shopping, errands	-0.569***	(0.175)
Partner x Admin, finances, organising	-1.794***	(0.239)
Partner x Childcare, playing with children	-3.019***	(0.213)
Partner x Pet care, playing with pets	-1.208***	(0.327)
Partner x Care or help for adults	-2.253	(1.422)
Partner x Sleeping, resting, relaxing	1.890***	(0.149)
Partner x Sick in bed	-0.972	(0.743)
Partner x Meditating, religious activities	-2.424**	(0.974)
Partner x Washing, dressing, grooming	-1.439***	(0.163)
Partner x Talking, chatting, socialising	-1.598***	(0.130)
Partner x Intimacy, making love	2.850***	(0.534)
Partner x Eating, snacking	0.351***	(0.104)
Partner x Drinking tea/coffee	-1.417***	(0.147)
Partner x Drinking alcohol	-1.017***	(0.170)
Partner x Smoking	1.271***	(0.377)
Partner x Texting, email, social media	-1.438***	(0.180)
Partner x Browsing the Internet	-0.559***	(0.168)
Partner x Watching TV, film	0.410***	(0.110)
Partner x Listening to music	0.0153	(0.166)
Partner x Listening to speech/podcast	-0.683**	(0.335)
Partner x Reading	-0.716***	(0.191)
Partner x Theatre, dance, concert	-0.997**	(0.426)
Partner x Exhibition, museum, library	-0.395	(0.472)
Partner x Match, sporting event	-2.150***	(0.465)
Partner x Walking, hiking	2.097***	(0.245)
Partner x Sports, running, exercise	-1.998***	(0.315)
Partner x Gardening, allotment	-2.298***	(0.451)
Partner x Birdwatching, nature watching	-0.814	(0.576)
Partner x Computer games, iPhone games	-0.828***	(0.196)
Partner x Hunting, fishing	0.804	(2.229)
Partner x Other games, puzzles	-0.671	(0.463)
Partner x Gambling, betting	0.395	(1.278)
Partner x Hobbies, arts, crafts	-1.584***	(0.349)
Partner x Singing, performing	-1.189**	(0.507)

Table A7. Companionship-Activity Interactions, Full Sample (continued)

Binary variable	Happiness (0 – 100)	
	Coeff	**SE**
Partner x Something else (version < 1.0.2)	2.794***	(0.377)
Partner x Something else (version >= 1.0.2)	-0.911**	(0.409)
Conditions		
Daylight	0.0292	(0.0488)
Clear skies	0.144***	(0.0392)
Rain	-0.241***	(0.0399)
Partial sun	0.460***	(0.0304)
Continuous sun	0.900***	(0.0454)
Wind speed (base: 0 – 3 kt)		
4 – 8 kt	-0.0248	(0.0375)
9 – 14 kt	-0.102**	(0.0419)
15+ kt	-0.220***	(0.0559)
Air temperature (base: < 0Ð °C)		
0 – 4 °C	-0.386***	(0.0961)
5 – 9 °C	-0.349***	(0.116)
10 – 14 °C	-0.242*	(0.127)
15 – 19 °C	-0.208	(0.136)
20 – 24 °C	-0.0113	(0.159)
25+ °C	0.747***	(0.249)
Location (base: indoors)		
Outdoors	2.834***	(0.0979)
In a vehicle	0.0128	(0.107)
Location (base: home)		
Work	-2.066***	(0.110)
Elsewhere	1.591***	(0.0698)
Hour of day x weekend/weekend dummies (46)	Yes	
Day of week/public holiday dummies (7)	Yes	
Month dummies (11)	Yes	
Year dummies (8)	Yes	
Christmas week dummy	Yes	
Number of earlier responses (3rd order polynomial)	Yes	
Individual fixed effects (35,543)	Yes	
Constant	62.45***	(0.711)
N	2385711	
Clusters: individuals	35,543	

Notes: Standard errors in parentheses.

* p < 0.10, ** p < 0.05, *** p < 0.01