A Diminishment of Desire: Exposure to Nature Relative to Urban Environments Dampens
Materialism

Yannick Joye^{1*}, Jan Willem Bolderdijk², Massimo A. F. Köster³, Paul K. Piff⁴

¹ISM University of Management and Economics, Department of Management, Arkliu g. 18,
LT-01305 Vilnius, Lithuania, yanjoy@faculty.ism.lt

²University of Groningen, Faculty of Economics and Business, Nettelbosje 2, 9747
AE Groningen, The Netherlands, j.w.bolderdijk@rug.nl

³KU Leuven, Faculty of Psychology and Educational Sciences, Tiensestraat 102, 3000
Leuven, Belgium, Massimo.Koester@kuleuven.be

⁴University of California Irvine, Department of Psychological Science,
4324 Social and Behavioral Sciences Gateway, Irvine, California, United States,
ppiff@uci.edu

This manuscript has been accepted for publication in *Urban Forestry & Urban Greening* on
July 4, 2020 (DOI: <https://doi.org/10.1016/j.ufug.2020.126783>).

Abstract

Materialism – the ideation and overemphasis of physical possessions, status and image values – is highly prevalent in present-day societies, and is associated with numerous psychological and societal costs. In three studies, we tested whether exposure to nature versus urban environments would be associated with decreased materialism. In Study 1, using consumer data from The United States, we found that the relative state-level prevalence of nature – as measured by the availability of natural amenities (a proxy for the presence of beautiful nature) and land dedicated to wilderness and forest – was linked to reduced materialism. In Study 2, we found that participants whose attention was directed towards a natural element of their environment – a grove of trees – attached less importance to materialistic values than individuals whose attention was directed towards an urban element – a building. In Study 3, we conceptually replicated this finding: after seeing videos of a forest walk or of grand natural scenes (e.g., soaring mountain peaks), participants became less interested in wealth, status, and image values relative to participants who viewed a video of an urban walk – an effect that was mediated by the activation of altruistic values. These findings testify to the role nature contact can play in reducing materialism, and in combatting materialism’s negative effects on people and planet.

1. Introduction

In 2013, a worldwide survey conducted in twenty countries and comprising 16,039 respondents revealed that almost half felt pressured to make money and be successful, and one third defined success by their possessions (Ipsos, 2013). Nowadays, normative values of materialism – reflecting the ideation and pursuit of wealth, status and popularity – are difficult to avoid: the ability to afford and acquire “show off” goods is believed by many to provide a sure path to success and happiness and is linked to greater esteem and popularity (Richins, 1994; Chang and Arkin, 2002). Modern urban environments compound these inclinations. Cities abound with stimuli – such as corporate buildings, shops, commercial ads – that signal the importance of attaining wealth and fame, whereas the prevalence of social media, and their tendency to trigger social comparisons, may drive people evermore to seek status through conspicuous consumption (Taylor and Strutton, 2016).

While materialism is commonly understood as a goal that reflects how important individuals find it to pursue and acquire money and possessions, recent work in psychology stresses that this goal is subsumed by overarching egoistic concerns of attaining high status and popularity within social groups (Kasser, 2016). Despite its prevalence, materialism can exact a number of pernicious effects upon individuals and society (Kasser, 2016). Individuals pursuing wealth, status and popularity are, for example, more likely to engage in risky activities, such as gambling and credit overuse, that can undermine their financial and emotional security (Richins, 2011). By prioritizing “fame and fortune” over other valued goals, materialistic individuals typically invest less time in activities and goals that might enhance their well-being (Burroughs and Rindfleisch, 2002; Grouzet et al., 2005), such as developing high-quality interpersonal relationships (Kasser and Kasser, 2001), acquiring new experiences (Van Boven, 2005), or volunteering and helping others (Sheldon and Kasser, 1995). In addition, the relentless pursuit of material possessions produces waste, and heavily

burdens collective resources like land, water and energy (Hurst et al., 2013), thereby jeopardizing the well-being of the environment as well as of current and future generations. Materialistic pursuits, it seems, are costly for the self and for others.

Given the potentially harmful emotional, social, and societal consequences of materialism, researchers have been called upon to investigate avenues for reducing the importance people place on materialistic values (Burroughs et al., 2013; Kasser, 2016). With the present work, we follow up on this call. Guided by popular culture (e.g., Jon Krakauer's 1996 book *Into the Wild*) and by anecdotal accounts linking being in nature to decreased materialism, we empirically examined whether exposure to natural (versus built) environments is associated with reduced materialism.

How exactly might materialistic inclinations be reduced – whether through nature contact or via other processes? In a comprehensive review of the literature on materialism, Kasser (2016) identified three general pathways. A first pathway involves limiting exposure to messages in one's (social) environment that glorify money and possessions – think for example of restricting television/screen time (Shrum et al., 2011). A second strategy consists of trying to tackle the underlying problem, and reduce insecurities about meeting physical and psychological needs, which can fuel materialism (e.g., boosting interpersonal security; Clark et al., 2011). A third pathway builds on the notion that materialistic values are part of a larger value system that can be organized in a “circumplex” (Schwartz, 1992), and that within that circumplex close lying values are consistent with each other, whereas more distant values can conflict with one another. Given that individuals cannot hold or act on opposing values at the same time (Burroughs and Rindfleisch, 2002), activating values that are in relative opposition to materialism in the value circumplex (e.g., altruistic values) may suppress materialistic inclinations.

Nature may attenuate materialism via the pathways outlined by Kasser (2016). First and foremost, when in nature, one is physically away from materialism-amplifying urban environments; natural areas are often devoid of messages, objects, and events that communicate how important it is for individuals to attain money, status and popularity. Second, ample environmental psychology studies have shown that being in nature can increase happiness (Hartig et al., 2014), and in that capacity nature can provide an antidote to insecurities and worries about meeting one's psychological and physical needs, known to drive materialism (Arndt et al., 2004). Third, natural settings have been shown to make individuals attach greater importance to self-transcendent values, and behaviours that benefit others rather than the self (Joye and Bolderdijk, 2015; Piff et al., 2015; Goldy and Piff, 2020). Altruistic values are a good example of such self-transcendent values and represent the value attached to the wellbeing of others. Since self-transcendent values and behaviours are in opposition to the cluster of self-enhancement values to which materialism belongs (Schwartz, 1992; Kasser, 2016), nature exposure might suppress materialistic inclinations by activating self-transcendent values, such as altruism.

Guided by this analysis of pathways to reduced materialism, we tested the link between nature and materialism, as well as two potential pathways underlying this link — increased happiness and/or the activation of self-transcendent values. Importantly, previous work has already hinted at the potential of nature to reduce materialism. In particular, a series of lab studies by Weinstein, Przybylski and Ryan (2009) revealed that nature decreases extrinsic aspirations (including the desire for wealth) through increased nature relatedness and autonomy. The current work builds upon and extends this research in essential ways. First, Weinstein et al. (2009) primarily obtained data using self-reports, which may not reflect actual behavioral tendencies (Baumeister et al., 2007). In Study 1, we used consumer data to test the link between nature and materialistic behavior. Second, we checked if the negative

association between nature exposure and materialism also holds outside the lab, by examining if geographical variation in naturalness across US states predicts lowered materialism in those states (Study 1), and by testing whether immersion in an actual natural environment attenuates the salience of materialistic values (Study 2). A third extension is that we exposed participants to different types of nature (forest and grand nature; Study 3), and analyzed if the proposed negative effect of nature on materialism was more pronounced for certain types of nature than for others. The third study furthermore tested if the effects are mediated by increases in happiness and/or altruism.

1.1. The Present Research

In three studies we looked at whether (experiencing) natural relative to built environments is associated with reductions in materialism, using both correlational (Study 1) and experimental research designs (Study 2 and 3). Study 1 was an exploratory correlational study in which we assessed whether in US states with high levels of on natural amenities, wilderness and forest areas, there would be less materialism than in states with fewer natural areas. We gauged state-level materialism using secondary data pertaining to the consumption and availability of luxury goods.

In Study 2 – a field experiment – we examined whether the suggested link between naturalness and materialism would also hold at the individual level by examining if exposing participants to nature (a grove of trees), relative to a built environment (a university building) would cause a relative decrease in materialism. We measured materialism using the materialistic values scale (MVS; Richins, 2004), a well-validated measure of how much importance participants attach to having/acquiring money and possessions.

Study 3 was a lab study designed to gauge the effectiveness of different types of nature (forest, grand nature) in discouraging materialism, as well as to shed light on the

process(es) that might underlie this effect. Specifically, we explored two distinct pathways: Does nature dampen materialism by boosting happiness (Hartig et al., 2014) or by activating altruistic values, which are inimical to materialism (Piff et al., 2015)? Study 3 also extends our analysis of materialism by assessing egoistic value orientations (Steg et al., 2014). Like the MVS, egoistic value orientations measure the importance people attach to material wealth, but also includes other essential motivations underlying materialism, namely high status and popularity.

2. Linking the Availability of Nature to State-Level Materialism in the US

The methodological approach of Study 1 was inspired by recent research that shows that regional/geographical variations in US states' socioeconomic and psycho-social situation can predict inter-state differences in psychological traits and behavior (Brethel-Haurwitz and Marsh, 2014; Walasek and Brown, 2015; Bach et al., 2017). Walasek and Brown (2015), for instance, found that online searching for positional goods was most prevalent in US states with high levels of income inequality. Higher state-level subjective wellbeing has furthermore been linked to increased kidney donation rates (Brethel-Haurwitz and Marsh, 2014), and higher state-level empathy is associated with a lower prevalence of anti-social behavior across states, such as burglary and aggravated assaults (Bach et al., 2017).

Guided by this previous work (Brethel-Haurwitz and Marsh, 2014; Walasek and Brown, 2015; Bach et al., 2017), in the present study we explored whether US states that are rich in nature are also less materialistic than states with comparatively less (readily accessible) nature. As proxies for the presence of recreational nature in each US state, we used (a) the natural amenities index (McGranahan, 1999), (b) the percentage of wilderness and (c) the percentage national forest area per US state. Based on available state-level data, we created a composite materialism index per US state, including expenditures on status goods in those

states, and the presence of luxury brand/goods stores and financial institutions. Using multiple linear regression analyses, we tested whether the three naturalness proxies were negatively related to US state-level materialism, after adjusting for state income, population size, income inequality, percentage of urban inhabitants, percentage of foreign-born individuals, and remoteness. Using G*Power (Faul et al., 2007), we found that sample offered 80% power to detect a value of 0.14 for the R^2 increase of the naturalness proxies in a multiple linear regression ($\alpha = .05$).

2.1. Proxies for Materialism

We were able to obtain seven proxies that reflect differences in US states materialistic tendencies (see Table A2 in the Appendix for correlations between these proxies).

2.1.1. Diamond size

First, based on 15,000 consumer inquiries, we obtained for each US state the average size of diamonds (in carats) sold in 2015 to the online jewelry and diamond buying service *WP Diamonds* ($M = 1.32$, $SD = 0.13$; <https://www.wpdiamonds.com/diamond-jewelry/report-2015>; no data for Washington DC). Diamonds represent a valid indicator of materialism, as they are almost exclusively non-utilitarian and aesthetic goods, indexing luxury consumption and spending *par excellence* (Wang and Wallendorf, 2006).

2.1.2. Clothing and Footwear

Second, given that clothing involvement predicts materialism (Browne and Kaldenberg, 1997; O'Cass, 2001), we used yearly US state-level personal consumption expenditures (in million dollars; averaged from 2013 until 2017; $M = 7166.52$, $SD = 9418.95$) on clothing and footwear as a second indicator of materialism (<https://www.bea.gov>).

2.1.3. Financial Institutions

The third, fourth, and fifth proxies for materialism capture the presence of financial institutions/services across the US states. We specifically counted per US state the number of FDIC-insured commercial banks ($M = 104.99$, $SD = 107.47$; <https://www.fdic.gov>) and commercial bank branches ($M = 1581.96$, $SD = 1512.77$; <https://www.fdic.gov>) for the period 2013 until 2017, and also the number of financial business services, based on the 2012 US census ($M = 9180.06$, $SD = 9643.11$; <https://factfinder.census.gov>). This was guided by past work that has shown that the number of financial institutions/services per US county is positively associated with materialistic values in those areas – probably because materialistic individuals are more focused on money and require more services to manage it (Zhang et al., 2014).

2.1.4. Luxury Brands

Finally, for our sixth and seventh proxies of materialism, we focused on the state-level prevalence of retailers selling luxurious consumer goods. Building on research showing that consumers specifically identify the brands Ralph Lauren and Mercedes-Benz as luxury brands that epitomize materialism (Vigneron and Johnson, 2004; Walasek and Brown, 2015), we counted the number of Ralph Lauren stores ($M = 4.16$, $SD = 5.63$; www.ralphlauren.com) and Mercedes-Benz dealers ($M = 7.57$, $SD = 9.14$; <https://www.mbusa.com/mercedes/dealers>) per US state.

After standardizing each of the seven proxies, a reliability analysis showed excellent internal consistency ($\alpha = .93$), leading us to average the items to make an overall materialism index. California turned out to be the most materialistic US state, whereas Vermont was the least materialistic one (see Table A1 in the Appendix for state materialism scores).

2.2. Naturalness Predictors: Natural Amenities, Wilderness and National Forest

To assess the link between state-level naturalness and materialism, we secured three naturalness predictors, all of which allowed us to quantify the presence of nature on the US state level. These predictors were: the natural amenities index (McGranahan, 1999), the percentage of wilderness area, and the percentage of national forest area per US state (see Table A1 in the Appendix for state naturalness scores).

2.2.1. Natural Amenities

The natural amenities index is the sum of six measures of climate, topography, and water area, and it is available for each US county (<https://www.ers.usda.gov/data-products/natural-amenities-scale/>). US areas scoring high in natural amenities abound with natural areas/features (Ferguson and Tamburello, 2015) – especially mountainous regions and vast water expanses – but also have temperate climatological conditions, which facilitate recreational activities (Tucker and Gilliland, 2007). We averaged the county-level natural amenities per US state ($M = 0.53$, $SD = 2.14$; no data for Alaska and Hawaii). California is the US state scoring highest on natural amenities, whereas Minnesota scores lowest.

2.2.2. Wilderness

The second naturalness predictor is the percentage of federally designated wilderness area per US state. Wilderness areas are relatively unspoiled natural places that can offer a retreat from urban development and civilization. Based on data from the organization Wilderness Connect (www.wilderness.net), we calculated the percentage of acres of designated wilderness area per US state as a function of that state's total land area ($M = 2.09$, $SD = 3.65$). Most wilderness areas are situated in the west, and they are often reachable in a day's drive from urban metropolitan areas.

2.2.3. *National Forest*

Our third naturalness predictor was based on the observation that forests are a particularly popular destination for nature recreation (Grahn and Stigsdotter, 2003). Therefore, using data from the US Department of Agriculture that lists the total acreage of national forest per US state (<https://www.fs.fed.us>), we calculated the percentage of land dedicated to national forest per US state as a function of total state land area ($M = 7.94$, $SD = 8.93$). Idaho has the highest percentage of national forest, whereas ten states have no designated national forest areas at all (e.g., Maryland, Rhode Island).

2.2.4. *Correlations Between Naturalness Proxies*

Importantly, these naturalness predictors do not solely capture the presence of nature *per se* but also the presence of environmental factors (e.g., weather) that facilitate their accessibility and use. A correlation analysis revealed moderate to strong positive correlations between all three naturalness predictors (wilderness – natural amenities, $r(49) = .75$, $p < .001$; wilderness – national forest, $r(51) = .63$, $p < .001$; natural amenities – national forest, $r(49) = .56$, $p < .001$).

2.3. *Control Variables*

In our target analyses we adjusted for five socioeconomic factors that might explain state-level variance in materialism. Our choice of these factors was determined a priori, and based on Walasek and Brown (2015), who used them as control/predictor variables in their research on the determinants of online search terms related to status products. The variables are: income inequality (“gini index”; ranging from 0 to 1, with higher values indicating more inequality; $M = 0.46$, $SD = 0.02$), personal yearly income per capita (in dollars; $M = 31005.75$, $SD = 5173.12$), percentage of urban inhabitants (based on the 2010 decennial census; $M =$

72.50, $SD = 15.52$), percentage of foreign-born residents ($M = 9.25$, $SD = 6.12$) and population size ($M = 6294204.06$, $SD = 7184338.73$). Unless mentioned otherwise, all data covered the period 2013 until 2017, and were downloaded from the US Census Bureau website (<https://factfinder.census.gov>).

We also adjusted (post-hoc) for one variable that might be confounded with the naturalness proxies, namely state remoteness. Specifically, it may simply be that the remoteness from urban areas (where one can shop and spend) and not solely the naturalness of wilderness/natural areas that prevents citizens from pursuing/attaining a materialistic lifestyle. In our target analyses we therefore adjusted for each state's remoteness by using the Frontier and Remoteness (FAR) index (US Department of Agriculture; <https://www.ers.usda.gov/data-products/frontier-and-remote-area-codes/>), which maps the percentage of rural/urban state area that is far removed (by car) from the closest nearby urban area ($M = 27.83$, $SD = 27.06$).

A correlation analysis confirmed that US states' FAR index indeed correlated negatively with the materialism index ($r(51) = -.31$, $p = .028$), and positively with all naturalness predictors (natural amenities: $r(49) = .32$, $p = .025$; wilderness: $r(51) = .49$, $p < .001$; national forest: $r(51) = .37$, $p < .001$), thus underlining the importance of adjusting for remoteness.

2.4. Analysis Strategy

We conducted stepwise multiple linear regressions to identify associations between the three indicators of naturalness and materialism. In each of these three analyses, we first regressed the materialism index onto the six control variables. In the second step, we added the three naturalness predictors, and tested whether these significantly predicted materialism above and beyond any of the control variables.

Table 1

Results of the regression analyses (1000 bootstrap samples, 95% confidence intervals) regressing the materialism index onto control variables (step 1) and the naturalness proxies (step 2)

Step		Model 1 (natural amenities as naturalness proxy)						Model 2 (wilderness as naturalness proxy)						Model 3 (national forest as naturalness proxy)								
		β	SE	p	ULCI	LLCI	F	R ²	β	SE	p	ULCI	LLCI	F	R ²	β	SE	p	ULCI	LLCI	F	R ²
1							120.08***	.95						123.20***	.94						123.20***	.94
	constant		1.16	.700	-3.340	1.257				1.10	.580	-3.410	1.001				1.10	.580	-3.265	1.121		
	population	.94	0.00	.001	0.000	0.000			.96	0.00	.001	0.000	0.000			.96	0.00	.001	0.000	0.000		
	income	-.01	0.00	.811	-0.000	0.000			.01	0.00	.892	-0.000	0.000			.01	0.00	.907	-0.000	0.000		
	inequality	-.02	2.30	.687	-4.723	4.739			-.02	2.19	.760	-4.092	4.531			-.02	2.16	.725	-4.348	4.317		
	% foreign	.00	0.01	.961	-0.025	0.020			-.02	0.01	.762	-0.028	0.014			-.02	0.01	.788	-0.029	0.017		
	% urban	.05	0.00	.426	-0.005	0.010			.05	0.00	.477	-0.005	0.009			.05	0.00	.471	-0.005	0.009		
	remoteness	-.05	0.00	.372	-0.004	0.002			-.03	0.00	.536	-0.004	0.002			-.03	0.00	.516	-0.004	0.002		
2							179.70***	.97						127.81***	.95						124.22***	.95
	constant		1.02	.532	-3.156	0.842				0.95	.981	-2.355	1.437				1.04	.702	-2.887	1.383		
	population	.91	0.00	.001	0.000	0.000			1.00	0.00	.001	0.000	0.000			.98	0.00	.001	0.000	0.000		
	income	-.10	0.00	.061	-0.000	0.000			.01	0.00	.825	-0.000	0.000			-.01	0.00	.814	-0.000	0.000		
	inequality	-.01	2.00	.907	-3.245	4.456			-.05	1.91	.312	-5.006	2.726			-.02	2.04	.650	-4.474	3.487		
	% foreign	.16	0.01	.054	0.000	0.042			.02	0.01	.759	-0.017	0.023			-.03	0.01	.750	-0.028	0.018		
	% urban	.08	0.00	.172	-0.002	0.010			.04	0.00	.534	-0.006	0.008			.05	0.00	.392	-0.005	0.009		
	remoteness	.04	0.00	.382	-0.001	0.005			.03	0.00	.380	-0.001	0.004			.01	0.00	.854	-0.002	0.003		
	n. amenities	-.21	0.02	.001	-0.120	-0.048			-	-	-	-	-			-	-	-	-	-		
	% wilderness	-	-	-	-	-			-.14	0.02	.045	-0.069	-0.005			-	-	-	-	-		
	% forest	-	-	-	-	-			-	-	-	-	-			-.11	0.00	.004	-0.016	-0.004		

Note: * $p < .050$, ** $p < .010$; *** $p < .001$; Model 1: $\Delta F, p < .001$; Model 2: $\Delta F, p = .003$; Model 3: $\Delta F, p = .006$

2.5. Results and Discussion

The results of the multiple linear regressions (Table 1) show that for all three models in step 1, population size predicts materialism, with more highly populated states scoring higher on the materialism index. More importantly, step 2 reveals that US states with more natural amenities and more wilderness and national forest areas score lower on the materialism index than less natural states. Importantly, these associations are not driven by state-level differences in population size, urbanization, income, income inequality, foreign born residents, or state remoteness.

Although these findings are consistent with the notion that access and exposure to nature is associated with lower materialism, our study is also limited in ways that we sought to address in a subsequent study. First, the central measures of nature and materialism are all state-level measures that, while conceptually related to our construct of interest (i.e., materialism), are proxies. Second, the correlational nature of the results constrains the causal inferences that can be drawn. While our theoretical account posits that exposure to nature reduces materialism, the reverse path cannot be excluded: there might well be a self-selection process where relatively low-materialistic people typically choose to live in states with a high prevalence of (recreational) nature. Alternatively, states with more land area dedicated to consumer settings (e.g., banks, retailers) might simply leave less space for (preserving) natural areas. To minimize alternative explanations for our findings, and to verify that nature can indeed have a relative negative *causal* effect on materialism, we conducted two further experiments.

3. The Effect of a Grove of Trees Versus Buildings on Materialistic Values

In this experimental study participants either focused their attention on natural elements in their environment (a grove of trees) or on built elements (a university campus building). We

examined whether participants' materialistic tendencies would be reduced after focusing their attention on the natural rather than on the built elements of their environment.

3.1. Participants and Design

The study was approved by the university's ethical board. Ninety-nine students from a US university participated in this study. Although we recorded demographic information, these data were lost due to a coding error. The study was a between-subjects design with type of setting (nature versus built) as the between-subjects factor, and materialistic values as the dependent variable. This sample offered 80% power to detect a Cohen's d of 0.57 for an independent-sample t -test ($\alpha = .05$, two-tailed; Faul et al., 2007).

3.2. Materials and Procedure

The study was run on the campus grounds during autumn, with autumn days being typically mild and sunny (California). Participants arrived in the lab and provided informed consent before completing demographics. Following this, the experimenter walked them (one participant per session) from the lab to a location on the campus where the environmental exposure would take place. Using an online data tracking sheet, participants were randomly assigned to either the nature or built condition. In both conditions, participants stood on the same spot but had to turn (their gaze) in opposite ways, either to trees or to a building complex (Fig. 1).

Fig. 1: Photos of the grove of trees (left) and the building (right) participants had to look at for Study 2. The trees and building were of about equal height.

In the nature condition, participants were requested to look at a grove of trees ($n = 51$), whereas in the built condition they viewed a campus building from the identical location ($n = 48$). Participants had to watch these elements for one full minute and, while watching, were asked to think about how the trees (building) made them feel while watching (adapted from Piff et al., 2015). When one minute had elapsed, they were asked to fill out the 6-item version of the materialistic values scale (MVS; Richins, 2004; see Appendix for items), which measures how much individuals deem materialism as central to their lives, as a source of happiness, and as a requirement for success (1 = “strongly disagree” to 5 = “strongly agree”; $\alpha = .79$). When these measures were complete, participants were thanked and debriefed.

3.3. Results and Discussion

A two-tailed independent samples *t*-test revealed that participants who had looked at the grove of trees scored lower on materialism ($M = 2.91$, $SD = 0.80$) compared to participants who had watched the campus building ($M = 3.25$, $SD = 0.72$), $t(97) = -2.18$, $p = .032$, Cohen's $d = 0.44$, 95% CI -0.64 to -0.03. This suggests that, relative to built elements, exposure to nature can indeed temporarily lower the importance people attach to materialistic values. While these results are consistent with our hypothesis, several questions remain. First, we only focused on one type of nature setting (trees). Thus the questions of whether nature in general leads to less materialism than built environments or of whether certain types of nature are more or less effective than others remain unanswered. Second, the current findings do not allow us to clearly delineate which process(es) underlie(s) the effect of nature exposure on materialistic pursuit. We conducted a follow-up study to address these issues.

4. The Effect of a Forest Versus Grand Nature on Materialism

In this experimental laboratory study, we aimed to extend our initial findings linking nature exposure to reduced materialism in several ways. First, we explored whether some types of nature would be more effective in decreasing materialism than others. For this, we contrasted an urban condition with two nature conditions – i.e., a video of an urban setting was compared to either a video of a forest or of grand natural scenes (e.g., footage of soaring mountain peaks, huge waterfalls). Our choice for grand nature was informed by the fact that such nature has been found to encourage behaviors consistent with self-transcendent values (i.e., increased prosociality; Joye and Bolderdijk, 2015; Piff et al., 2015), making it potentially especially effective in suppressing values opposed to self-transcendence, including materialism.

Second, we measured four different value orientations rather than one, these being egoistic, altruistic, biospheric, and hedonic value orientations (Steg et al., 2014). From this set of value orientations, we were particularly interested in whether nature exposure would reduce participants' egoistic value orientation. As discussed earlier, materialism comprises more than the importance people attach to possessions and money; it also includes the pursuit of status and image values (Kasser, 2016), facets captured by the egoistic value orientation. Because our analysis of egoism was part of a more extensive measurement of other value orientations, we could account for differences in participants' use of the scales measuring these value orientations (Schwartz, 2012). This enabled us to ascertain the specificity of the effect of nature on egoism above and beyond other (social) values. We also measured all values before the environmental manipulation to increase statistical power: it allowed us to control for pre-existing individual differences in value orientations.

A third change is that we tested two potential mediating mechanisms: increased happiness and the activation of altruistic values. Ample research has shown that exposure to nature and noticing nature makes people happier (Hartig et al., 2014), and can increase positive affect (Passmore and Holder, 2017) and mental wellbeing (Pensini et al., 2016). As research has documented a negative association between positive emotional states – such as happiness – and materialism (Kasser, 2016), increased happiness might underlie the dampening effect of nature on materialism. Besides considering happiness as a mediator, we tested whether nature could also suppress materialism by activating altruistic values, since a focus on the well-being of others is inimical to the desire to pursue individual status and gain through acquisition (Schwartz, 1992; Burroughs and Rindfleisch, 2002; Kasser, 2016).

4.1. Participants and Design

The study was approved by the university's ethical board. One hundred and forty-nine students from a European university participated in this lab study, as well as in a preceding baseline measurement (100 females, 47 males, 2 “unsure” about gender; age: $M = 20.70$, $SD = 2.05$). The study was a between-subjects design, with environment (forest vs. grand nature vs. urban environment) as the between-subjects variable, and the egoistic value orientation as the dependent variable. Two participants were not included in the analyses because they failed to pass an attention check. This final sample of 147 participants offered 80% power to detect an $\eta_p^2 = 0.06$ for fixed effects, main effects and interactions in an ANCOVA ($\alpha = .05$; Faul et al., 2007).

4.2. Materials and Procedure

Participants completed a baseline measure of value priorities on average about three months before the actual lab study. We measured value orientations, using a shortened version of Schwartz's Basic Value Scale (Schwartz, 1992) developed by Steg et al. (2014). This scale consists of sixteen items, covering four different value orientations. Most pertinent to our investigation, it measures the egoistic value orientation – capturing materialistic motivations for wealth, status and image (items: “social power”, “wealth”, “authority”, “being influential”, and “being ambitious”) – but it also gauges altruistic (items: “equality”, “a world at peace”, “being helpful”, “social justice”), biospheric (items: “respecting the earth”, “unity with nature”, “protecting the environment”, and “preventing pollution”), and hedonic (items: “pleasure”, “enjoying life”, and “being self-indulgent”) value orientations. Following Schwartz (1992), participants rated the importance of all items as guiding principles in their lives on a 9-point scale, ranging from -1 = “opposed to my principles”, 0 = “not important” to 7 = “extremely important”.

For each of the four value orientations we calculated a baseline value priority score by subtracting for each participant the mean score on all sixteen items from the mean score on the items associated with a particular value orientation (Schwartz, 2012). This allowed us to control for individual differences in the use of the scale.

The second and main part of the study took place in the lab, where we tested the effect of watching videos of either natural or urban environments on participants' value priorities. After asking for informed consent and requesting demographic information, participants were randomly assigned to one of three environmental conditions: either a three-minute video of a forest walk ($n = 54$), footage of grand nature scenes/phenomena ($n = 48$), or a video of an urban walk ($n = 45$). Screen size and resolution were identical across the lab computers on which the videos were displayed.

In the forest condition, participants were shown a video of an autumn forest trail walk filmed from a first-person perspective (<https://youtu.be/cPe9yu23pdY>). The grand nature condition consisted of video shots taken from the BBC series *Planet Earth* with sweeping views of vast nature scenes, including – among others – vast glaciers, soaring mountains and huge waterfalls (<https://youtu.be/fkl3rZNCvOM>). Past research into the effects of grand nature has successfully used videos from this TV series as stimulus material (Piff et al., 2015). The urban condition was a video of a walk in Berlin filmed from a first-person perspective, showing some pedestrians and cars, but with very few natural elements (<https://www.youtube.com/watch?v=D7hEJ1NU0iw&t=3s>).

Immediately after watching one of the three videos, we asked participants to rate how happy they felt (1 = “strongly disagree” to “7 strongly agree”), and gauged their value orientations a second time (additional measures taken in this study are mentioned in the Appendix). Values were assessed and analyzed identically to the baseline measure completed upon enrollment. This enabled us to calculate a post-manipulation score of value priorities for

the four value orientations in precisely the same way as for the baseline scores. Finally, participants were debriefed and thanked for their participation.

4.3. Results

4.3.1. Primary Analysis: Effects of Environments on the Importance of Egoism.

As outlined in the introduction to the present study, we focused on participants' egoistic value orientation in our primary analysis; materialism reflects how important individuals find it to pursue and acquire money and possessions as well as to attain high status and popularity (Kasser, 2016). The egoistic value orientation adds to the previous studies because it captures the latter two aspects of materialism as well.

A one-way ANCOVA with environment (forest, grand nature, urban environment) as the between-subjects variable, post-manipulation egoistic value orientation as the dependent variable, and baseline egoistic value orientation as the covariate yielded a significant overall effect, $F(2, 143) = 3.47, p = .034, \eta_p^2 = 0.05$. Planned comparisons showed that, after adjusting for pre-existing individual differences in egoism, participants' egoistic value orientation was significantly lower in the forest ($M = -1.59, SD = 0.98, M_{adjusted} = -1.67$) and grand nature condition ($M = -1.66, SD = 1.05, M_{adjusted} = -1.62$) than in the urban condition ($M = -1.39, SD = 1.03, M_{adjusted} = -1.34$; forest – urban: $p = .014, 95\% CI -0.60$ to -0.07 ; grand nature – urban: $p = .044, 95\% CI -0.55$ to -0.01), but not significantly different between both nature conditions, $p = .671, 95\% CI -0.31$ to 0.20 . Relative to participants who had watched footage of an urban walk, participants who had seen a video of a forest walk or of grand nature reported reduced materialism, as measured by their egoistic value orientation.

4.3.2. Secondary Analyses

Having found that the exposure to both types of nature led to less materialism compared to an exposure to the urban scenery, we next tested whether this effect was driven by the fact that natural (versus urban) videos had increased happiness, and/or activated values inimical to materialism – i.e., altruistic values (Burroughs and Rindfleisch, 2002). We first report the results of the analyses testing the effect of the environments on happiness and altruistic values, after which we present the mediation analyses.

4.3.2.1. The Effect of Environments on Happiness

In line with the notion that nature can boost happiness (Hartig et al., 2014), a one-way ANOVA showed that environment (forest, grand nature, urban) indeed significantly influenced happiness, $F(2, 144) = 31.84, p < .001, \eta_p^2 = 0.31$, with participants feeling significantly happier after watching a forest ($M = 5.02, SD = 1.21$) or a grand nature video ($M = 5.21, SD = 1.38$), than after watching an urban video ($M = 3.24, SD = 1.35$; forest – urban: $p < .001$, 95% CI 1.25 to 2.30; grand nature – urban: $p < .001$, 95% CI 1.43 to 2.50). The two nature conditions did not differ significantly in terms of happiness, $p = .466$, 95% CI -0.70 to 0.32.

4.3.2.2. The Effect of Environments on the Importance of Altruism

A one-way ANCOVA with environment (forest, grand nature, urban environment) as the between-subjects variable, post-manipulation altruistic value orientation as the dependent variable, while adjusting for the baseline score on altruistic value orientation, yielded a marginally significant effect, $F(2, 143) = 2.38, p = .096, \eta_p^2 = 0.03$. Altruism was significantly higher in the forest ($M = 1.01, SD = 0.72, M_{adjusted} = 1.09$) than in the urban condition ($M = 0.94, SD = 0.79, M_{adjusted} = 0.84$), $p = .033$, 95% CI 0.02 to 0.48, but did not differ significantly between the grand nature ($M = 1.00, SD = 0.85, M_{adjusted} = 1.01$) and urban

condition, $p = .153$, 95% CI -0.06 to 0.40, nor between the two nature conditions, $p = .481$, 95% CI -0.14 to 0.30. These results indicate that watching a forest walk relative to urban scenes not only led to a relative decrease in egoism, but also to an increase in the prioritization of others' wellbeing and egalitarianism (i.e., altruism).

4.3.2.3. The Mediating Effects of Altruistic Values and Happiness

To test if happiness and/or the altruism mediated the effect of environment on materialism, we first calculated an egoism/altruism change score by subtracting the baseline value priority scores from post-manipulation scores. We then performed two multi-categorical mediation analyses (model 4 in version 2 of PROCESS, 5000 bootstrap samples; Hayes and Preacher, 2014), with environment as the independent variable, the egoism change score as the dependent variable, and either happiness or the altruism change score as the mediators. This analysis specifically tested whether happiness or the altruism change score mediated the difference between the forest and urban condition (coding: D1), and between the grand nature and urban condition (coding: D2) on the egoism change score.

For happiness as mediator, the bias-corrected 95% confidence intervals for the indirect effect of D1 (forest vs. urban) and D2 (grand nature vs. urban) through happiness included zero (D1: -0.0764 to 0.0118; D2: -0.0791 to 0.2709), suggesting that this item did not exert any mediating influence in the current study. For the altruism change score, the bias-corrected 95% confidence intervals for the indirect effect of D1 (forest vs. urban) and D2 (grand nature vs. urban) through the altruism change score did not include zero (D1: 0.0500 to 0.3148; D2: 0.0052 to 0.2341; see Fig. 2 for the path model). This finding is consistent with the notion that differences in the importance attached to materialism between natural and urban settings arose because natural versus urban environments led to an increased

appreciation of values opposed to materialism (Kasser, 2016), in this case altruistic values (reflecting an increased regard for the needs and wellbeing of others and egalitarianism).

Fig. 2. Regression coefficients (unstandardized) for the relationship between type of environment and materialism (measured by egoism change scores), mediated by altruism (measured by altruism change scores). Regression coefficients between D1/D2 and egoism, controlling for altruism, are in parentheses.

4.4. Discussion

Study 3 shows that participants became less interested in wealth, status and image after watching videos of natural scenes, compared to watching a video of an urban walk. In line with earlier work that has shown that individuals can behave more prosocially after contact with nature (Joye and Bolderdijk, 2015; Piff et al., 2015; Goldy and Piff, 2020), we also observed a relative increase in altruism after watching the forest compared to the urban video. Mediation analysis revealed that the difference between the nature and urban sceneries on materialism was mediated by the difference in altruism evoked by the different environments (Burroughs and Rindfleisch, 2002) – a finding that is consistent with the notion that activating altruism through natural environments can suppress egoistic values (Kasser, 2016). Although research has suggested that grand nature can encourage behaviors and values

that are inimical to materialism more than “mundane” nature (Joye and Bolderdijk, 2015), in the current study such grand nature did not have any stronger effects on participants’ value orientations than the more mundane forest condition.

5. General Discussion

The quest for possessions, money, image and status can be a costly endeavor; it is associated with lower levels of wellbeing, and known to lead to increased compulsive consumption, depression, anxiety and risky health behavior (Dittmar et al., 2014; Kasser, 2016). Considering the potentially pernicious effects associated with materialistic lifestyles, researchers have been called upon to investigate avenues for reducing the importance people attach to materialistic values. Guided by this call, we tested if exposure to natural versus urban environments could fruitfully dampen materialistic ideation and pursuit.

In a first correlational study, we found that the US state-level prevalence of natural amenities, wilderness and forest area is associated with lower materialism in the US, as indicated by an aggregate measure of materialism, comprising the availability and consumption of luxury goods. In a subsequent experiment in the field, we found that participants who looked at a grove of trees scored lower on materialistic values compared to individuals who had spent the same time looking at buildings from the same spot. In a third lab experiment, we replicated this finding using the egoistic value orientation as an extended measure of materialism, while also comparing the effects of *different* natural environments on materialism. Analyses further suggested that natural (relative to built) environments suppressed materialism via increasing altruistic values.

Although our studies provide initial support for the notion that, relative to urban environments, nature can reduce materialism, there are also certain limitations worth noting. While we relied on available proxies of materialism involving actual consumer data (e.g.,

spending on clothing/footwear) in Study 1, we still used self-reports to measure materialism in Study 2 and 3. We hope that future studies will try to replicate our findings with implicit and/or behavioral measures of materialism. One suggestion would be to gauge visual attention to luxury products (e.g., by using the dot probe procedure; MacLeod et al., 1986) and test whether exposure to natural versus urban/control environments would bias perceptual attention away from luxury products.

Another limitation is that our two experimental studies only revealed the instantaneous effect of natural versus urban scenes on materialism, thus raising the question of what the effect of longer and/or intense exposure to (imagery of) natural and urban environments may be on one's materialistic values. Longitudinal research using assessments of materialism across multiple time points could shed light on this issue.

Our two experiments could also be improved by including a control condition. Given that our experiments assessed *relative* differences between the environmental conditions on materialism, we are unable to pinpoint definitively where the effect on materialism is situated – does nature reduce materialism or does the built environment increase it? Although our findings dovetail with prior work indicating that exposure to nature can reduce self-enhancing tendencies (Joye and Bolderdijk, 2015; Piff et al., 2015; Goldy and Piff, 2020), it is entirely plausible that urban environments may also serve to increase materialism, especially given that they are rife with materialistic media that remind of the importance of materialistic pursuit (Ashikali and Dittmar, 2012).

The current study adds important insights to a growing body of research on the potential benefits of nature experiences, such as improved cognitive functioning and reduced psychological stress (Hartig et al., 2014). Beyond these well-documented effects, the present work offers a glimpse of the potential materialism-reducing effects of nature (relative to urban settings), and yields intriguing possibilities for real world interventions. Our findings indicate

that materialism can be counteracted by organizing one's life to accommodate frequent exposure to or immersion in natural settings, and away from urban environments. Results from Study 2 show that in mixed (i.e., green and grey) settings, offering views on greenery might temporarily dampen materialism, thus pointing to the importance of enriching urban spaces with pockets of greenery.

Study 3 indicates that people need not seek out extraordinary nature to experience its social effects; immersion in green/forested areas suffices to yield decreases in materialism and increased prioritization of others' welfare. Note furthermore, that the fact that in Study 3 we did not find that extraordinary nature elicited more altruism than the urban walk might well be due to the fact that the footage of extraordinary nature contained several shots of potentially fear-inducing phenomena, such as video shots of an avalanche and of soaring cliffs/mountains. When faced with such grand but potentially threatening stimuli, people might prioritize their immediate and individual welfare over the welfare of others, which might explain why extraordinary nature did not result in a boost of altruism compared to the urban condition.

Placing an excessive focus on material goods can be detrimental to personal wellbeing (Dittmar et al., 2014). However, in a social environment where one's friends, family, colleagues and acquaintances strive for and appear to be fulfilled by the acquisition of material goods, deprioritizing materialism can be notoriously difficult. Our research suggests that even fleeting exposure to or immersion in nature – and especially greenspace – can decrease this materialistic orientation and helping individuals set aside the costly pursuit of image and status. Future work could extend these insights by examining further mechanisms by which nature attenuates materialistic pursuits and provides an outlet for escaping their pitfalls.

References

- Arndt, J., Solomon, S., Kasser, T., Sheldon, K.M., 2004. The urge to splurge: A terror management account of materialism and consumer behavior. *Journal of Consumer Psychology* 14, 198-212.
- Ashikali, E.M., Dittmar, H., 2012. The effect of priming materialism on women's responses to thin-ideal media. *British Journal of Social Psychology* 51, 514-533.
- Bach, R. A., Defever, A.M., Chopik, W.J., Konrath, S.H., 2017. Geographic variation in empathy: A state-level analysis. *Journal of Research in Personality* 68, 124-130.
- Baumeister, R.F., Vohs, K.D., Funder, D.C., 2007. Psychology as the science of self-reports and finger movements: Whatever happened to actual behavior? *Perspectives on Psychological Science* 2, 396-403.
- Brethel-Haurwitz, K.M., Marsh, A.A., 2014. Geographical differences in subjective well-being predict extraordinary altruism. *Psychological Science* 25, 762-771.
- Browne, B.A., Kaldenberg, D.O., 1997. Conceptualizing self-monitoring: Links to materialism and product involvement. *Journal of Consumer Marketing* 14, 31-44.
- Burroughs, J.E., Chaplin, L.N., Pandelaere, M., Norton, M.I., Ordabayeva, N., Gunz, A., Dinauer, L., 2013. Using motivation theory to develop a transformative consumer research agenda for reducing materialism in society. *Journal of Public Policy Marketing* 32, 18-31.
- Burroughs, J.E., Rindfleisch, A., 2002. Materialism and well-being: A conflicting values perspective. *Journal of Consumer research* 29, 348-370.
- Chang, L., Arkin, R.M., 2002. Materialism as an attempt to cope with uncertainty. *Psychology & Marketing* 19, 389-406.

Clark, M.S., Greenberg, A., Hill, E., Lemay, E.P., Clark-Polner, E., Roosth, D., 2011.

Heightened interpersonal security diminishes the monetary value of possessions. *Journal of Experimental Social Psychology* 47, 359-364.

Dittmar, H., Bond, R., Hurst, M., Kasser, T., 2014. The relationship between materialism and personal well-being: A meta-analysis. *Journal of Personality and Social Psychology* 107, 879-924.

Faul, F., Erdfelder, E., Lang, A.-G., Buchner, A., 2007. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods* 39, 175-191.

Ferguson, T.W., Tamburello, J.A., 2015. The natural environment as a spiritual resource: A theory of regional variation in religious adherence. *Sociology of Religion* 76, 295-314.

Goldy, S.P., Piff, P.K., 2020. Toward a Social Ecology of Prosociality: Why, When, and Where Nature Enhances Social Connection. *Current Opinion in Psychology* 32, 27-31.

Grahn, P., Stigsdotter, U.A., 2003. Landscape planning and stress. *Urban Forestry & Urban Greening* 2, 1-18.

Grouzet, F.M., Kasser, T., Ahuvia, A., Dols, J.M.F., Kim, Y., Lau, S., ... Sheldon, K.M., 2005. The structure of goal contents across 15 cultures. *Journal of Personality and Social Psychology* 89, 800-816.

Hartig, T., Mitchell, R., De Vries, S., Frumkin, H., 2014. Nature and health. *Annual Review of Public Health* 35, 207-228.

Hayes, A.F., Preacher, K.J., 2014. Statistical mediation analysis with a multicategorical independent variable. *British Journal of Mathematical and Statistical Psychology* 67, 451-470.

- Hurst, M., Dittmar, H., Bond, R., Kasser, T., 2013. The relationship between materialistic values and environmental attitudes and behaviors: A meta-analysis. *Journal of Environmental Psychology* 36, 257-269.
- Ignell, C., Davies, P., Lundholm, C., 2019. A longitudinal study of upper secondary school students' values and beliefs regarding policy responses to climate change. *Environmental Education Research* 25, 615-632.
- Joye, Y., Bolderdijk, J.W. 2015. An exploratory study into the effects of extraordinary nature on emotions, mood, and prosociality. *Frontiers in Psychology* 5, 1577.
- Kasser, T., 2016. Materialistic values and goals. *Annual Review of Psychology* 67, 489-514.
- Kasser, T., Kasser, V.G., 2001. The dreams of people high and low in materialism. *Journal of Economic Psychology* 22, 693-719.
- MacLeod, C., Mathews, A., Tata, P., 1986. Attentional bias in emotional disorders. *Journal of Abnormal Psychology* 95, 15-20.
- McGranahan, D.A., 1999. Natural amenities drive rural population change (No. 33955). United States Department of Agriculture, Economic Research Service.
- O'Cass, A., 2001. Consumer self-monitoring, materialism and involvement in fashion clothing. *Australasian Marketing Journal* 9, 46-60.
- Passmore, H.A., Holder, M.D., 2017. Noticing nature: Individual and social benefits of a two-week intervention. *The Journal of Positive Psychology* 12, 537-546.
- Pensini, P., Horn, E., Caltabiano, N.J., 2016. An Exploration of the Relationships between Adults' Childhood and Current Nature Exposure and Their Mental Well-Being. *Children, Youth and Environments* 26, 125-147.
- Piff, P.K., Dietze, P., Feinberg, M., Stancato, D.M., Keltner, D., 2015. Awe, the small self, and prosocial behavior. *Journal of Personality and Social Psychology* 108, 883-899.

- Richins, M.L., 1994. Special possessions and the expression of material values. *Journal of Consumer Research* 21, 522-533.
- Richins, M.L., 2004. The material values scale: Measurement properties and development of a short form. *Journal of Consumer Research* 31, 209-219.
- Richins, M.L., 2011. Materialism, transformation expectations, and spending: Implications for credit use. *Journal of Public Policy & Marketing* 30, 141-156.
- Schwartz, S.H., 1992. Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. *Advances in Experimental Social Psychology* 25, 1-65.
- Schwartz, S.H., 2012. An overview of the Schwartz theory of basic values. *Online Readings in Psychology and Culture* 2, 11.
- Sheldon, K.M., Kasser, T. 1995. Coherence and congruence: Two aspects of personality integration. *Journal of Personality and Social Psychology* 68, 531-543.
- Shrum, L.J., Lee, J., Burroughs, J.E., Rindfleisch, A., 2011. An online process model of second-order cultivation effects: How television cultivates materialism and its consequences for life satisfaction. *Human Communication Research* 37, 34-57.
- Steg, L., Perlaviciute, G., Van der Werff, E., Lurvink, J., 2014. The significance of hedonic values for environmentally relevant attitudes, preferences, and actions. *Environment and Behavior* 46, 163-192.
- Taylor, D.G., Strutton, D., 2016. Does Facebook usage lead to conspicuous consumption? The role of envy, narcissism and self-promotion. *Journal of Research in Interactive Marketing* 10, 231-248.
- Tucker, P., Gilliland, J. 2007., The effect of season and weather on physical activity: a systematic review. *Public Health* 121, 909-922.

- Van Boven, L. 2005., Experientialism, materialism, and the pursuit of happiness. *Review of General Psychology* 9, 132-142.
- Vigneron, F., Johnson, L.W., 2004., Measuring perceptions of brand luxury. *Journal of Brand Management* 11, 484-506.
- Walasek, L., Brown, G.D., 2015. Income inequality and status seeking: Searching for positional goods in unequal US States. *Psychological Science* 26, 527-533.
- Wang, J., Wallendorf, M., 2006. Materialism, status signaling, and product satisfaction. *Journal of the Academy of Marketing Science* 34, 494-505.
- Weinstein, N., Przybylski, A.K., Ryan, R.M., 2009. Can nature make us more caring? Effects of immersion in nature on intrinsic aspirations and generosity. *Personality and Social Psychology Bulletin* 35, 1315-1329.
- Zhang, J.W., Howell, R.T., Howell, C.J., 2016. Living in wealthy neighborhoods increases material desires and maladaptive consumption. *Journal of Consumer Culture* 16, 297-316.

APPENDIX

1. Additional Information for Study 1

1.1. Table A1

Table A1

Mean scores for the proxies for materialism and naturalness per US state used in Study 1.

US state	n. amenities	% wilderness	% forest	materialism
Alabama	0.25	0.13	3.95	-0.24
Alaska	-	15.72	6.56	-0.52
Arizona	4.87	6.21	16.25	-0.13
Arkansas	0.02	0.46	10.53	-0.26
California	6.73	15.31	24.20	3.14
Colorado	4.03	5.62	23.02	-0.08
Connecticut	1.80	0.00	0.00	-0.32
Delaware	0.00	0.00	0.00	-0.76
District of Columbia	-0.76	0.00	0.00	-0.79
Florida	2.94	4.09	3.58	1.85
Georgia	0.32	1.31	4.66	0.50
Hawaii	-	3.75	0.00	-0.72
Idaho	2.02	9.06	40.88	-0.74
Illinois	-2.12	0.09	2.05	1.48
Indiana	-2.28	0.05	2.79	-0.02
Iowa	-2.61	0.00	0.00	-0.15
Kansas	-1.04	0.00	0.00	-0.23
Kentucky	-0.46	0.07	5.55	-0.26
Louisiana	-0.34	0.06	3.57	-0.13
Maine	0.83	0.09	0.27	-0.74
Maryland	-0.07	0.00	0.00	0.39
Massachusetts	0.74	0.06	0.00	0.05
Michigan	-1.41	0.80	13.35	0.61
Minnesota	-2.88	1.60	9.51	0.06
Mississippi	-0.39	0.04	7.85	-0.39
Missouri	-0.32	0.16	6.88	0.19
Montana	1.36	3.75	20.57	-0.62
Nebraska	-1.45	0.03	0.71	-0.39
Nevada	4.72	4.90	8.95	-0.34
New Hampshire	0.24	2.40	14.15	-0.66
New Jersey	0.15	0.21	0.00	0.46
New Mexico	3.54	2.54	12.86	-0.70
New York	-0.58	0.00	0.05	1.80
North Carolina	0.36	0.36	9.58	0.19

North Dakota	-2.50	0.09	0.00	-0.72
Ohio	-1.73	0.00	3.26	0.42
Oklahoma	0.59	0.05	1.61	-0.10
Oregon	3.78	4.07	28.26	-0.41
Pennsylvania	-0.18	0.03	2.57	0.70
Rhode Island	1.68	0.00	0.00	-0.75
South Carolina	0.32	0.35	7.11	-0.19
South Dakota	-1.60	0.16	2.89	-0.54
Tennessee	0.03	0.32	4.59	0.00
Texas	1.27	0.05	1.03	2.49
Utah	3.41	3.45	17.37	-0.45
Vermont	-0.41	1.70	14.07	-0.99
Virginia	-0.09	0.85	12.76	0.37
Washington	2.78	10.50	24.45	-0.05
West Virginia	-0.59	0.77	12.28	-0.55
Wisconsin	-1.71	0.23	5.72	-0.01
Wyoming	2.88	4.92	14.60	-0.83

1.2. Table A2

Table A2

Pearson correlations between the seven proxies for materialism used in Study 1.

	1	2	3	4	5	6	7
1. carat	-						
2. PCE clothing/footwear	.441**	-					
3. commercial banks	.190	.404**	-				
4. commercial bank branches	.486**	.931**	.571**	-			
5. financial business services	.454**	.965**	.535**	.984**	-		
6. Ralph Lauren stores	.409**	.940**	.253	.867**	.900**	-	
7. Mercedes-Benz dealers	.457**	.952**	.401**	.949**	.973**	.911**	-

Note: ** $p < .010$.

1.3. Information About the Remoteness Level Used in Study 1

In Study 1 we adjusted for US state remoteness. For this, we used FAR level 2. Areas that have this level of remoteness or frontier character “...consist of rural areas and urban areas up to 25,000 people that are: 45 minutes or more from an urban area of 25,000-49,999 people; and 60 minutes or more from an urban area of 50,000 or more people” (<https://www.ers.usda.gov/data-products/frontier-and-remote-area-codes/documentation/>).

2. Additional Information for Study 2

2.1. Items of the short version of the MVS

The short 6-item version of the MVS consists of the following items: “Buying things gives me a lot of pleasure”; “I like a lot of luxury in my life”; “My life would be better if I owned certain things I don’t have”; “I’d be happier if I could afford to buy more things”; “I admire people who own expensive homes, cars, and clothes”; “The things I own say a lot about how well I’m doing in life”.

2.2. An Impression of the Campus Grounds Where Study 2 Took Place

Fig. A1: Google maps capture of the campus grounds where Study 2 took place.

3. Additional Information for Study 3

3.1. Table A3

Table A3

Means (standard deviation) per condition for scores on the additional emotions measured in Study 3

	forest	grand nature	urban
amusement	3.54 (1.41) _a	3.35 (1.71) _a	3.33 (1.45) _a
anger	1.54 (0.75) _a	1.98 (1.51) _b	1.56 (0.81) _{ab}
awe	3.57 (1.82) _a	4.63 (1.75) _b	2.44 (1.52) _c
disgust	1.31 (0.80) _a	1.58 (1.15) _a	1.56 (0.76) _a
fear	1.50 (1.02) _a	2.48 (1.75) _b	1.71 (1.14) _a
sadness	2.31 (1.62) _a	2.77 (1.88) _a	2.27 (1.36) _a
self-diminishment	3.48 (1.12) _a	4.12 (1.30) _b	3.32(1.18) _a

Note: Means not sharing subscripts differ significantly at $p < .050$ according to Tukey's Honestly Significant Difference comparison. Self-diminishment was the average of the following items (taken from Piff et al. 2015): "I feel small or insignificant," "I feel the presence of something greater than myself," "I feel part of some greater entity," and "I feel like I am in the presence of something grand" (1 = strongly disagree, to 7 = strongly agree; $\alpha = .85$).