Can Nature Make Us More Caring? Effects of Immersion in Nature on Intrinsic Aspirations and Generosity

Netta Weinstein
Andrew K. Przybylski
Richard M. Ryan
University of Rochester

Four studies examined the effects of nature on valuing intrinsic and extrinsic aspirations. Intrinsic aspirations reflected prosocial and other-focused value orientations, and extrinsic aspirations predicted self-focused value orientations. Participants immersed in natural environments reported higher valuing of intrinsic aspirations and lower valuing of extrinsic aspirations, whereas those immersed in non-natural environments reported increased valuing of extrinsic aspirations and no change of intrinsic aspirations. Three studies explored experiences of nature relatedness and autonomy as underlying mechanisms of these effects, showing that nature immersion elicited these processes whereas non-nature immersion thwarted them and that they in turn predicted higher intrinsic and lower extrinsic aspirations. Studies 3 and 4 also extended the paradigm by testing these effects on generous decision making indicative of valuing intrinsic versus extrinsic aspirations.

Keywords: *nature; aspirations; autonomy; relatedness; immersion*

People prefer to be surrounded by environments rich in natural objects. When given the opportunity, they seek out the most abundant collections of trees, water, or mountains available to them. If such environments are not available, people often incorporate into their indoor environments symbols or selections from nature, including plants, pets, flower vases, and paintings or photographs depicting nature. Research has shown that people may derive benefits from their efforts to contact nature, such as greater well-being (Tarrant, 1996), energy (Ryan et al., 2008; Stilgoe, 2001), and physical health (e.g., Kaplan, 1995; Leather, Pyrgas, Beale, & Lawrence, 1998; Ulrich, 1984). Nature can also increase relaxation (Plante, Cage, Clements, & Stover, 2006) and reduce stress (Ulrich et al., 1991).

In part, positive effects of nature may depend on the degree of immersion. That is, the effects of nature experiences may be especially robust when individuals are *immersed* in these environments, when they feel that they are fully present rather than distracted by thoughts and external stimuli unrelated to the natural or non-natural environments. When immersed, individuals more fully attend to the characteristics and therefore recognize and make contact with more aspects of the environment (Bystrom, Barfield, & Hendrix, 1999). Supporting research found that immersion in virtual worlds accounts for greater memory of those environments (Mania & Chalmers, 2001) and is correlated with higher enjoyment consequent of engaging them (Ryan, Rigby & Przybylski, 2006). As well, immersion may elicit a fuller experience and thus a more robust reaction to natural or non-natural stimuli.

INTRINSIC AND EXTRINSIC ASPIRATIONS

Although a number of studies examining the positive effects of nature focus on well-being and restorative benefits of exposure to nature (e.g., Kaplan, 1995), little is known about the potential effects nature has on valued goals (Kasser & Ryan, 1993, 1996). Value-laden goals,

Authors' Note: Correspondence concerning this article should be addressed to Netta Weinstein, Clinical and Social Sciences in Psychology, University of Rochester, 738 Library Road, Rochester, NY 14627; e-mail: netta@psych.rochester.edu.

PSPB, Vol. 35 No. 10, October 2009 1315-1329
DOI: 10.1177/0146167209341649

referred to as *life aspirations,* influence important life decisions, define specific perceived values, and affect the direction and quality of life experiences. In a pervasive way, they shape perceptions, judgments, and behaviors (Kasser, 2002). Two general types of aspirations have been identified as being particularly informative: intrinsic and extrinsic life aspirations. *Intrinsic aspirations* concern the pursuit of goals that in themselves satisfy basic psychological needs (e.g., personal growth, intimacy, community). *Extrinsic aspirations* focus on externally valued goods that are not inherently rewarding but are sought to derive positive regard or rewards from others (e.g., money, image, fame). Kasser and Ryan (1996) posited that these two types of aspirations are qualitatively different and relate differently to well-being outcomes, which has now been shown in a number of studies (see Sheldon, Ryan, Deci, & Kasser, 2004). Moreover, the relevance of these categories has been demonstrated in both Eastern and Western nations (Grouzet et al., 2005; Ryan et al., 1999).

In the current article we suggest that psychological contact with, or phenomenal immersion in, nature contexts will facilitate valuing of more prosocial and less self-focused values and value-laden behaviors. That is, when people are in contact with natural scenes or living objects they will demonstrate a more intrinsic value set, orienting them to greater connection and a focus on others. In contrast, exposure to non-natural and artificial environments will elicit more extrinsic goals. We now elaborate on the basis for these hypotheses, exploring two underlying mechanisms for these effects.

THE MEDIATING ROLES OF PERSONAL AUTONOMY AND RELATEDNESS TO NATURE

We suggest that nature influences the valuing of intrinsic and extrinsic aspirations by enhancing feelings of personal autonomy and increasing feelings of relatedness to nature. The first route for nature exposure to affect life aspirations is through supporting autonomy, the experience that one can express oneself or behave in ways that are self-endorsed and compatible with abiding, superordinate interests and values (Deci & Ryan, 2000; Ryan & Deci, 2000). Phenomenologically, autonomy is experienced as being in touch with oneself or having a sense of inner congruency and self-authorship, and freedom from external and internal pressures. Although little empirical work has directly linked nature exposure with autonomy, there is good reason to expect their relation (Ryan, 1995). Specifically, nature can bolster autonomy directly by affording stimulating sensations (e.g., environmental stimuli that are naturally interesting and personally satisfying and that facilitate orientation to the present; Kaplan, 1995) and opportunities to integrate experience by encouraging introspection and a coherent sense of self (Walker, Hull, & Roggenbuck, 1998), and indirectly by providing an alternative to the pressuring elements of everyday life (Stein & Lee, 1995). In either case, nature affords individuals the chance to follow their interests and reduces pressures, fears, introjects, and societal expectations. Research has consistently demonstrated that contexts supporting autonomy are strongly linked to happiness and well-being across cultures (e.g., Chirkov, Ryan, Kim, & Kaplan, 2003). Important for the present research, higher experience of autonomy also predicts valuing of intrinsic aspirations and devaluing extrinsic ones (Sheldon et al., 2004). In part, this relation is such that intrinsic goals are typically pursued for autonomous reasons whereas extrinsic goals are not (Carver & Baird, 1998). In part because autonomy reflects a state of self-congruence and awareness of interests, values, and needs, exposure to nature may elicit higher valuing of intrinsic aspirations.

Relatedness to nature is a second experience that might support the link between nature exposure and life aspirations. Relatedness to nature is thought of as the extent to which individuals include nature in their representation of themselves (Schultz, 2002) or view themselves as intimately related to nature (Mayer & Frantz, 2004). Research demonstrates that the more time people spend in it, the more they feel a sense of connectedness to nature (Kals, Schumacher, & Montada, 1999; Mayer & Frantz, 2004). Thus, the experience of being part of nature is dynamic, changing from day to day and moment to moment as a function of experiences with nature (Vining, Merrick, & Price, 2008). Furthermore, many behaviors indicative of intrinsic aspiration, such as relational emotions (e.g., love and care; Vining et al., 2008), relational mind-sets (e.g., perspective taking and altruism), and less selfish decision making (e.g., consumerism, Mayer & Frantz, 2004; environmental decision making, Vining, 1987) have been linked to connectedness to nature. By increasing connectedness to nature, it is plausible that short periods of exposure could elicit higher valuating of intrinsic aspirations.

THE PRESENT RESEARCH

Given the literature discussed here, we suggest that natural environments, unlike human-made environments, can increase valuing of intrinsic aspirations and decrease valuing of extrinsic aspirations because natural environments create experiences fostering autonomy and nature relatedness.

In the current studies we focus on two intrinsic aspirations that concern connecting with and caring for

others, namely, those focused on the development of close relationships and community contributions. Both express desires congruent with the relational inclinations of humans (Deci & Ryan, 2000). The first, *relationship aspirations*, refers to a goal orientation toward developing close and satisfying relationships with other people. The second, *community aspirations*, involves seeking to positively affect the larger social community, for example, by engaging in prosocial behaviors that support community wellness. Such intrinsic aspirations have been shown to elicit a sense of energy or vitality and positive affect and to ameliorate experiences of depression and physical illnesses (Kasser, 2002; Kasser & Ryan, 1996). Likewise, we selected two extrinsic aspirations, namely, gaining *fame* or *wealth,* which are more self-focused than other-focused and are relatively noncommunal (Grouzet et al., 2005). The first, *wealth aspirations*, involves seeking to attain wealth and material goods. *Fame aspirations* involve acquiring attention and approval from others. Extrinsic aspirations have been related negatively to vitality and subjective well-being, and positively to depression, narcissism, and physical illnesses (e.g., Emmons, 1991; Kasser & Ryan, 1996).

The present studies examined effects of nature and immersion on intrinsic and extrinsic aspirations by exposing participants to images of either natural or human-made environments, and using an imagery script designed to enhance the experience. The final study explores these effects by exposing participants to plants. We hypothesized that exposure to nature would facilitate valuing intrinsic aspirations and devaluing extrinsic aspirations and that this effect would be enhanced (moderated) by immersion in the environment. Studies 2-4 were designed to replicate and extend these hypotheses by testing the mediating role of enhanced autonomy and relatedness to nature on the moderated link between condition (nature vs. human-made) and immersion (high vs. low immersion) on change in intrinsic or prosocial and extrinsic or self-focused aspirations. Studies 3 and 4 introduced decision-making behaviors indicative of intrinsic aspiration, namely, generosity as an additional assessment of values. Positive affect is controlled for throughout the present studies to ensure that effects of nature on values do not rely on increased happiness elicited by nature.

STUDY 1

Method

Participants

Ninety-eight individuals (70 women, 28 men) participated. Ages ranged from 19 to 54 years (M = 20). Sixty-one percent of participants were Caucasian, 5% African American, 4% Latino or Latina, 21% Asian American, and 9% Other. Eighty-six percent spoke English as a first language, and 14% identified another language as their first language. Results from MANOVAs and contrast-coded regression revealed no main or interactive effects for gender, age, ethnicity, or native language on observations of aspirations (extrinsic versus intrinsic) or immersion, ps > .05. Therefore, these constructs were not included in primary analyses. Supplementary analyses controlling for these constructs did not change the direction, significance, or effect sizes in subsequent analyses.

Materials

Nature slides. Four slides were used in each condition, depicting either building or urban scenes (e.g., depicting a city street with buildings on either side) or nature scenes (e.g., depicting a desert canyon). Urban and nature slides were approximately matched on color, complexity, layout, and amount of light present (see Figure 1 for a black-and-white version of a pair of matched slides). For example, human-made slides showing open, flat images were matched with nature images depicting a similar layout. Slides were selected from a larger pool of 40 images when they depicted scenes of almost entirely human-made or natural environments, matched an opposite-condition slide, were high in quality and clear, and did not depict affectively imbued content, such as academic contexts, identifiable buildings (such as firehouses, restaurants, etc.), or animals. Slide matching was based on consensus ratings made by a group of eight trained judges naïve to the nature of the study. Slides were shown for 2 min each on a 19-in. screen and were coupled with a script typically used in imagery exercises (Schwartz, Weinberger, & Singer, 1981). This script, used in both conditions, encouraged participants to attend to their environments, notice colors and textures, and imagine sounds and smells (see the appendix).

Immersion. Immersion in nature or human-made environments was measured using an adapted version of the Player Experience of Need Satisfaction Physical Presence scale initially developed for interactive environments (Ryan et al., 2006). Items were modified to reflect immersion in noninteractive environments. Eight items assessed immersion in the environments present in slides using a 5-point scale ranging from 1 (*not at all*) to 5 (*very much*). Items included "How completely were all your senses engaged?" "How much did you feel that you were in the places you saw?" and "How much did the visual aspects of the environments involve you?"

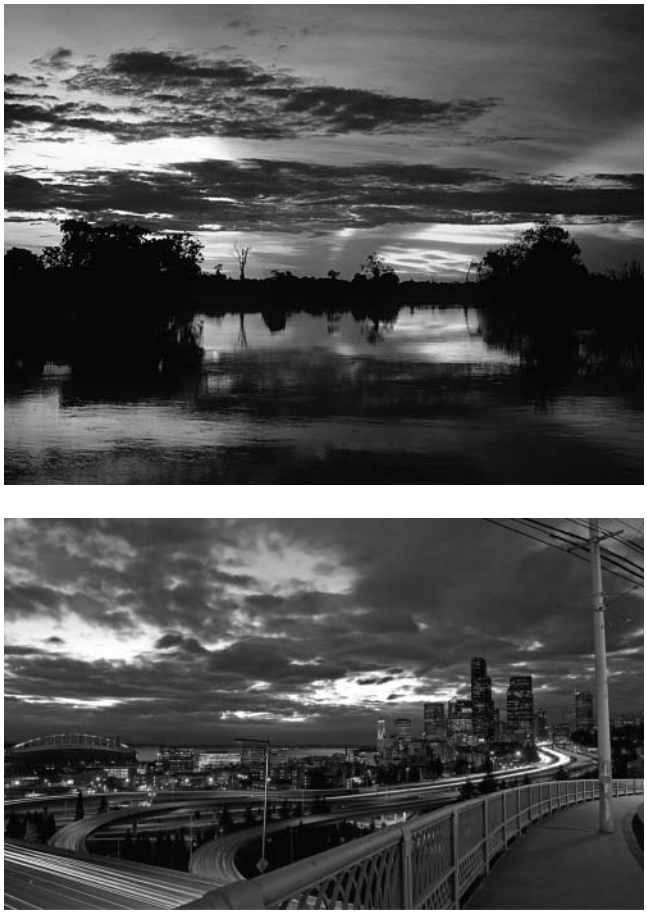

Figure 1 Sample paired slides depicting natural and human-made scenes.

Internal reliability for this scale was high in the present study (α = .84) and consistent with past research (α = .85; Przybylski, Ryan, & Rigby, 2009).

Aspiration Index (Kasser & Ryan, 1993). Participants responded to items assessing the personal importance of each of four life aspirations on a 5-point scale, ranging from 1 (*not at all important*) to 5 (*very important*). Internal reliability for the subscales was acceptable in both past studies (Kasser & Ryan, 1996) and present research (αs = .71-.84). The extrinsic aspiration composite was constructed by averaging the Fame and Fortune subscales (*r*s = .62 and .63), and intrinsic aspirations were computed by averaging the Closeness and Community subscales (*r*s = .67 and .65). Sample items were: wealth, "To be financially successful"; fame, "To be admired by many people"; connectedness, "To have deep enduring relationships"; community, "To work toward the betterment of society." The two scales did not correlate at Time 1 ($r = .03$) but negatively correlated at Time 2 ($r = -.25$, $p < .05$).

Positive affect. Positive affect was assessed using the Positive Affect subscale of the nine-item Emmons Mood Indicator (Diener & Emmons, 1984). Participants reported on how much joy, happiness, pleasure, and enjoyment/fun they experienced after the nature manipulation (α = .89) using a 7-point Likert-type scale ranging from 1 (*not at all*) to 7 (*extremely*).

Procedure

Participants were randomly assigned to either a nature or non-nature condition. They first completed a package of questionnaires including assessments of intrinsic and extrinsic aspirations among filler scales. Following this, participants in the nature condition viewed slides showing natural settings and those in the non-nature condition viewed slides depicting cityscapes. While viewing slides, participants listened, using headphones, to a recorded script designed to orient them to the experience of being in each setting. The same script was used for both conditions (for a complete script, see the appendix). After the manipulation, participants completed a second packet of questionnaires that assessed their intrinsic and extrinsic aspirations for a second time, as well as positive affect and immersion.

Results

Data Analytic Strategy and Preliminary Analyses

Two sets of multiple hierarchical linear regression analyses explored the interacting effects of non-nature versus nature environments by immersion on aspirations. In both models, main effects of nature and immersion, and initial standing on aspirations and postmanipulation positive affect were entered in the first step of the regression, and the interaction term was entered in the second step (see Table 1 for covariate effects and a summary of the results).

Means and Pearson correlations are reported in Table 2 and show that individuals reported similar levels of aspirations at the onset of the study and after the manipulation. Additionally, Time 1 aspirations were strongly correlated with those reported at Time 2. Table 3 shows relations between condition and immersion, as well as separate aspiration change scores (Time 2 – Time 1; computed for preliminary analyses). These preliminary analyses showed that the nature condition predicted lower reports of wealth and fame and higher reports of community and relationships after the manipulation. Immersion did not relate to wealth or fame

TABLE 1: Effects of Covariates, Main Effects, and Interactions Across Studies

Outcome	*Step*	*Covariate*	*Study 1*[a] β	*Study 2*[b] β	*Study 3*[c] β	*Study 4*[d] β
Intrinsic aspirations	1	Initial aspiration	.68**	.65**	.61**	.73**
		Positive affect	.08	.27*	.21*	.19
		Biased responding	—	—	.07	.22*
		Nature	.12*	.23**	.34**	.26*
		Immersion	.06	.04	.08	.16
	2	Nature × Immerse	.20*	.32**	.39**	.37**
Extrinsic aspirations	1	Initial aspiration	.74**	.69**	.76**	.64**
		Positive affect	–.07	–.10	–.19*	–.15
		Biased responding	—	—	–.09	–.03
		Nature	–.18**	–.22**	–.31**	–.24**
		Immersion	.04	–.04	.08	–.03
	2	Nature × Immerse	–.18**	–.21**	–.20*	–.26**
Decision task	1	Positive affect	—	—	.32**	.37**
		Biased responding	—	—	.02	.04
		Nature	—	—	.44**	.41**
		Immersion	—	—	.08	.05
	2	Nature × Immerse	—	—	.38**	.46**

a. $df = 93$. b. $df = 107$. c. $df = 79$ (decision task $df = 80$). d. $df = 66$ (decision task $df = 67$).
*$p < .05$. **$p < .01$.

TABLE 2: Studies 1 and 2 Correlations Between Condition, Immersion, Intrinsic Aspiration (IA), and Extrinsic Aspiration (EA) Before and After the Study Manipulations

	M_1	M_2	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1. Condition	—	—	—	.12	–.09	.20*	.29**	.16	–.09	–.36**
2. Immersion	0.0	0.0	.14	—	–.14	.10	.19	.04	.02	–.02
3. IA before	4.2	3.9	.03	–.08	—	.51**	.00	.03	.06	.38**
4. IA after	4.3	3.9	.21*	.19	.61**	—	.86**	.17	–.25*	–.12
5. Δ IA	0.0	0.0	.31**	.18	.00	.81**	—	.17	.08	–.36**
6. EA before	2.6	2.4	.07	.04	–.15	.12	.15	—	.79**	.00
7. EA after	2.5	2.3	–.15	–.12	–.05	–.23*	.75**	.72**	—	.62**
8. Δ EA	0.0	0.0	–.33**	.05	.18	–.16	–.27**	.00	.68**	—

NOTE: Coefficients for Study 1 are reported above the diagonal; those for Study 2 are reported below the diagonal. M_1 are the observed means for variables in Study 1, and M_2 are means observed in Study 2. The number of participants varies by study ($N = 98$ for Study 1; $N = 112$ for Study 2).
*$p < .05$. **$p < .01$.

but modestly and positively related to community and relationships.

Primary Analyses

Intrinsic aspirations. Controlling for positive affect and initial aspiration reports, nature predicted higher intrinsic aspirations, β = .12, $t(93) = 2.64$, $p < .05$, but no effect for immersion, β = .06, $t(93) = 1.32$, $p > .05$, qualified by a significant two-way interaction between immersion and condition, β = .20, $t(92) = 2.35$, $p < .05$ (see Figure 2). Simple effects examining this interaction showed that the more participants were immersed in natural environments, the greater their increase in intrinsic aspirations, β = .32, $t(45) = 2.10$, $p < .05$. On the other hand, participants exposed to human-made environments were not affected by the level of immersion, β = –.06, $t(45) = –0.60$, $p > .05$.

Extrinsic aspirations. Exposure to nature predicted lower valuing of extrinsic aspirations at Time 2, β = –.18, $t(93) = –3.60$, $p < .01$, but no effect for immersion, β = .04, $t(93) = 0.62$, $p > .05$. The main effect was qualified by a two-way interaction (Figure 2), β = –.18, $t(92) = –3.22$, $p < .01$. Simple effects showed that for participants in the nature condition, immersion negatively predicted extrinsic valuing, β = –.19, $t(45) = –2.05$, $p < .05$. On the other hand, as individuals were more immersed in human-made environments, they reported higher extrinsic aspirations, β = .17, $t(45) = 2.40$, $p < .05$.

TABLE 3: Changes in Aspiration Subscales (From Time 1 to Time 2) Correlated With Condition and Immersion

	Changes in Aspirations (T2 – T1)			
Level 1	*Wealth*	*Fame*	*Community*	*Relationship*
Study 1[a]				
Condition	–.38**	–.34**	.21*	.34**
Immersion	–.10	.06	.19†	.25*
Study 2[b]				
Condition	–.35**	–.28**	.31**	.38**
Immersion	–.13	–.04	.15	.18†
Study 3[c]				
Condition	–.39**	–.32**	.24*	.35**
Immersion	–.07	–.05	.10	.14
Study 4[d]				
Condition	–.24*	–.22†	.27*	.23*
Immersion	–.08	–.02	.11	.21*

a. $N = 98$. b. $N = 112$. c. $N = 85$. d. $N = 72$.
†$p < .07$. *$p < .05$. **$p < .01$.

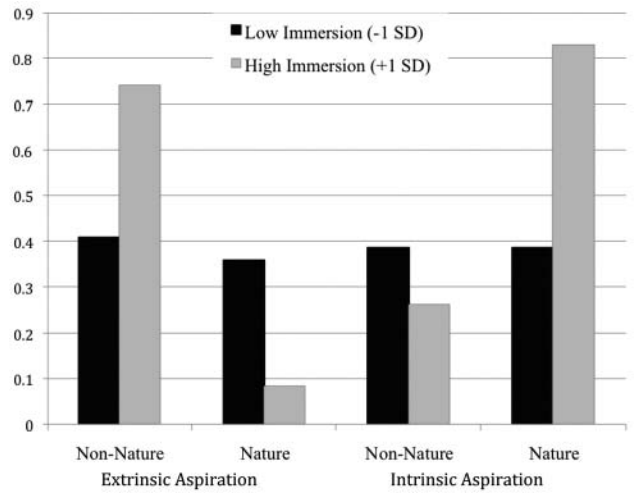

Figure 2 Study 1 Nature × Immersion (standardized) interaction predicting intrinsic and extrinsic aspirations.

Discussion

Study 1 showed that participants exposed to natural (as opposed to human-made) environments valued intrinsic aspirations and devalued extrinsic aspirations. As expected, the effect of exposure to natural versus human-made environments on change in intrinsic aspirations was moderated by level of immersion. Specifically, as individuals were more immersed in the slides presenting natural settings, they experienced greater increases in intrinsic aspirations. Immersion in non-nature scenes, on the other hand, led to valuing of extrinsic aspirations and devaluing of intrinsic ones. As these results were exploratory, Study 2 was aimed at replicating Study 1 findings and testing the mediating roles of relatedness to nature and personal autonomy on the moderated relations observed in Study 1.

STUDY 2

Method

Participants

One-hundred and twelve individuals (70 women, 42 men) participated. Ages ranged from 18 to 25 years ($M = 20$). Fifty-four percent were Caucasian, 5% African American, 4% Latino or Latina, 21% Asian American, and 9% other ethnicities (7% of participants did not report their ethnicity). Eighty-six percent spoke English as a first language, and 14% identified another first language. As in Study 1, these demographic differences did not relate to or interact with other observed variables (ps > .05) and were not included in subsequent analyses.

Materials and Procedure

The procedure was similar to that of Study 1 except that participants also completed the Connectedness to Nature scale (CNS) and Autonomy subscale of the Basic Psychological Needs scale following the manipulation. Positive affect ($\alpha = .89$), immersion ($\alpha = .82$), and aspirations (αs = .72-.81) were assessed similarly to Study 1.

Connectedness to nature. We used an adapted version of the 14-item CNS (Mayer & Frantz, 2004) to measure state–nature relatedness. Participants responded on a scale of 1 (*strongly disagree*) to 5 *(strongly agree*) to items such as "I feel a sense of oneness with the natural world around me" and "I feel that I belong to the Earth as equally as it belongs to me." This scale has demonstrated good internal reliability in past ($\alpha = .84$; Frantz, Mayer, Norton, & Rock, 2005) and present ($\alpha = .86$) research.

Personal autonomy. State-level personal autonomy was assessed with the seven-item Autonomy subscale of the Basic Psychological Needs scale (Gagné, 2003; Ilardi, Leone, Kasser, & Ryan, 1993). This measure has been used in prior empirical studies (e.g., Gagné, 2003; Kashdan, Julian, Merritt, & Uswatte, 2006) and assesses the extent to which participants experienced autonomy using a 7-point scale ranging from 1 (*not at all true*) to 7 (*very much true*). Sample items include: "I currently feel free to decide for myself how to live my life" and "Right now, I feel like I can be myself" ($\alpha = 89$).

Slides. A different set of eight slides (four for each condition) was used in Study 2 to ensure that effects

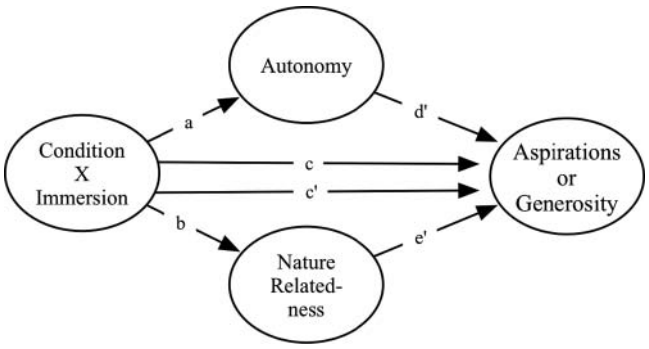

Figure 3 Mediation by autonomy and nature relatedness on the effects of nature on relatedness and generosity.

observed in Study 1 were generalizable to images besides those implemented in the previous study. As in Study 1, slides were selected from a larger pool and were matched, using consensus ratings, on color, complexity, layout, and amount of light present.

Results

Data Analytic Strategy and Preliminary Analyses

Analyses were identical to those conducted in Study 1 and controlled for initial aspirations and positive affect after the manipulation. Table 1 presents covariate, main, and interacting effects for all analyses. Means and correlations are reported in the bottom half of Table 2 and show that individuals reported similar levels of aspirations at the onset of the study and after the manipulation. Few correlations were consistently significant, except for those between intrinsic (and extrinsic aspirations) before and after the manipulation. This is not surprising considering the general stability of chosen life values. Table 3 presents correlations between condition and immersion, and specific aspirations. These preliminary analyses showed that nature condition negatively related to wealth and fame, but these did not relate to immersion. Condition correlated positively with community and relationship aspirations. Immersion only marginally related to relationships but not to community aspirations.

To test mediations by nature relatedness and autonomy for the moderated relations observed between condition and immersion, mediated moderation analyses were conducted according to the recommendations outlined by Muller, Judd, and Yzerbyt (2005). Figure 3 depicts the structure of the moderated mediation for this and subsequent studies. Mediation analyses required that a Condition × Immersion interaction effect on aspirations be demonstrated (path c). Second, the moderating effect on nature connectedness and autonomy must be demonstrated (paths a and b), as well as main effects of nature connectedness and autonomy on aspirations (indirect effects; path d and e). Finally, it must be shown that the interaction effect no longer predicts aspirations when controlling for nature connectedness and autonomy.

Primary Analyses

Intrinsic aspirations. Controlling for initial reports of intrinsic aspirations and for positive affect after the manipulation, nature predicted valuing intrinsic aspirations, $\beta = .23$, $t(107) = 4.04$, $p < .01$, but no effect for immersion, $\beta = .04$, $t(107) = 0.98$, $p > .05$. The main effect was qualified by a two-way interaction, $\beta = .32$, $t(106) = 3.62$, $p < .01$. Simple effects were consistent with those of Study 1 (see Figure 2) and showed that as individuals became more immersed in natural environments, they reported valuing intrinsic aspirations, $\beta = .37$, $t(49) = 3.05$, $p < .01$. Immersion did not predict intrinsic aspirations in human-made environments, $\beta = -.12$, $t(50) = -1.24$, $p > .05$.

Extrinsic aspirations. Those exposed to nature reported lower extrinsic aspirations, $\beta = -.22$, $t(107) = -4.03$, $p < .01$, but no effect for immersion, $\beta = -.04$, $t(107) = -1.02$, $p > .05$. Condition and immersion interacted, $\beta = -.21$, $t(106) = -3.35$, $p < .01$. Relations were consistent with those of Study 1, indicating that as participants were more immersed in natural environments they devalued extrinsic aspirations, $\beta = -.14$, $t(49) = -2.13$, $p < .05$. On the other hand, immersion predicted valuing extrinsic aspirations in non-nature, $\beta = .19$, $t(50) = 2.96$, $p < .01$.

Mediational Analyses

Mediating constructs. Results showed that the Immersion × Nature interaction predicted *nature relatedness*, $\beta = .18$, $t(106) = 3.75$, $p < .01$, such that participants exposed to nature experienced more nature relatedness with more immersion, $\beta = .23$, $t(49) = 5.02$, $p < .01$, whereas those exposed to non-nature environments were marginally less connected to nature with higher immersion, $\beta = -.15$, $t(50) = -1.95$, $p < .06$. The Immersion × Nature interaction also predicted *autonomy*, $\beta = .31$, $t(106) = 4.28$, $p < .01$, such that participants in the nature condition experienced more autonomy as they were more immersed, $\beta = .27$, $t(49) = 3.92$, $p < .01$, whereas those in the non-nature condition reported less autonomy as they were more immersed, $\beta = -.29$, $t(50) = -4.15$, $p < .01$.

Intrinsic aspiration mediated. Recall that the Condition × Immersion interaction predicted valuing of

intrinsic aspirations (path c), as well as nature relatedness and autonomy (paths a and b). Additionally, higher nature relatedness predicted increases in intrinsic aspirations, $\beta = .42$, $t(108) = 5.02$, $p < .01$, as did autonomy, $\beta = .38$, $t(108) = 4.51$, $p < .01$ (paths d′ and e′). Moreover, as expected, when controlling for nature relatedness and autonomy, the interaction effect (c′) dropped to nonsignificance, $\beta = .05$, $t(104) = 0.89$, $p > .05$. Sobel's (1982) test of indirect effect was $z = 3.00$, $p < .01$ for nature relatedness, and $z = 3.11$, $p < .01$ for autonomy.

Extrinsic aspiration mediated. Analyses described previously showed that the Condition × Immersion interaction predicted extrinsic aspirations espoused after the manipulation, as well as nature relatedness and autonomy. Furthermore, higher nature relatedness was linked to devaluing of extrinsic aspirations, $\beta = -.36$, $t(108) = -4.12$, $p < .01$, as was autonomy, $\beta = -.33$, $t(108) = -3.84$, $p < .01$. When including these mediators in the model, the interaction effect on extrinsic motivation dropped to nonsignificance, $\beta = -.08$, $t(104) = -1.19$, $p > .05$. The indirect effect was $z = 2.77$, $p < .01$ for nature relatedness and $z = 2.86$, $p < .01$ for autonomy.

Discussion

As in Study 1, nature versus non-nature scenes elicited valuing of intrinsic aspirations and devaluing of extrinsic aspirations. Immersion interacted with condition such that after viewing a set of slides, those highly immersed in natural settings reported higher valuing of intrinsic aspirations and lower valuing of extrinsic aspirations. In contrast, when exposed to and immersed in non-nature scenes, participants espoused higher extrinsic aspirations and no change in intrinsic aspirations. Immersion also influenced the experiences of autonomy and nature relatedness after exposure to nature and non-nature contexts. Participants felt more autonomous and nature related as they were more immersed in nature contexts and less so as they were more immersed in non-nature contexts. Experiences of autonomy and nature relatedness fully mediated the effects on both intrinsic and extrinsic aspirations.

Study 3 expanded on the previous studies by exploring behavioral indices of changes in aspirations after exposure to nature, testing whether such environments influence generosity or miserliness to another student. We expected that those immersed in nature environments would be more generous (indicative of valuing intrinsic aspirations above extrinsic aspirations) as compared to those immersed in a human-made environment.

STUDY 3

Method

Participants

Eighty-five students (51 women, 34 men; ages 18-32, $M = 21$) participated. Of these, 58% were Caucasian, 14% African American, 5% Latino or Latina, 20% Asian American, and 3% Other. Ninety-four percent spoke English as a first language. Demographic differences were not related to other observed variables (ps > .05) and were thus not included in primary analyses.

Materials and Procedure

The Study 3 procedure was largely similar to that of Studies 1 and 2. Participants completed an initial set of surveys, including an assessment of their valuing intrinsic and extrinsic aspirations (subscale αs = .70-.84) and the Balanced Inventory of Desirable Responding (BIDR; description follows), and were shown slides depicting either nature or non-nature scenes (as a function of their randomly assigned condition). Following this, participants reported on state positive affect ($\alpha = .85$), immersion ($\alpha = .72$), and aspirations (αs = .74-.83). Participants also reported their connectedness to nature and state autonomy (αs = .70 and .79, respectively) and, finally, completed the decision task.

Decision task. Students were instructed to participate in what was described as a "funds distribution" task, presumably focused on how individuals make decisions about money. They were told that they had been assigned to the "decision maker" condition and that they had been given a $5 prize to distribute as they wished. If participants chose to give the $5 to a second student participating in that study, they were told, we would double the amount, and give the second student $10 to distribute as he or she likes. If the second student decided to return the $5, the participant would get this money back, and both would have $5. If the second student did not return the $5, he or she would be left with $10, but the participant would have nothing. Participants were told that in either case experimenters would not know their responses (reported online) and they would not meet the other student, and thus their decision would be private. This task was adapted from Croson and Buchan (1999) and thought to assess valuing of others (intrinsic aspiration) as opposed to valuing of money (extrinsic aspirations) because participants would have nothing to gain if they chose to trust the other participant but could lose their study prize by doing so. Fifty-nine percent of participants chose to give away their money; 41% chose to keep it.

TABLE 4: Studies 3 and 4 Correlations Between Study Condition, Immersion, Intrinsic Aspiration (IA), and Extrinsic Aspiration (EA) Before and After Plant Manipulation

	M_3	M_4	1	2	3	4	5	6	7	8	9
1. Condition	—	—	—	.12	–.09	.20*	.29**	.16	–.09	–.36**	.44**
2. Immersion	0.0	0.0	.12	—	.11	.04	.15	.00	–.07	–.13	.09
3. IA before	4.1	3.9	.06	.03	—	.65**	.00	–.21*	–.14	.19	.27*
4. IA after	4.1	3.8	.22*	.22	.58**	—	.75**	.12	–.22*	–.12	.31**
5. Δ IA	0.0	0.0	.32**	.24*	.00	.79**	—	.17	.08	–.26*	.53**
6. EA before	2.7	2.8	.05	.04	–.21	–.05	.07	—	.71**	.00	.24*
7. EA after	3.6	3.2	–.19	–.14	–.14	–.25*	.62**	.80**	—	.60**	.38**
8. Δ EA	0.0	0.0	–.36**	.05	.06	–.07	–.31**	.00	.72**	—	–.61**
9. Trust	—	—	.41**	.13	.25*	.28*	.56**	–.23	–.39**	–.65**	—

NOTE: Study 3 results are reported above the diagonal; those for Study 4 are reported below the diagonal. M_3 are the observed means for variables in Study 3, and M_4 are means observed in Study 4. The number of participants varies by study ($N = 85$ for Study 3; $N = 72$ for Study 4). Trust reflects valuing IA over EA.
*$p < .05$. **$p < .01$.

BIDR (Paulhus, 1988). We assessed responses on the BIDR to help maintain the validity of the self-reports (Paulhus, 1988). Using a scale of 1 (*not true*) to 7 (*very true*), participants responded to the 20-item Impression Management subscale of the BIDR (present study $\alpha = .73$).

Results

Data Analytic Strategy and Preliminary Analyses

Means and Pearson correlations between observed variables are presented in Table 4. These preliminary analyses showed that, overall, aspirations did not change as a function of the manipulation. Consistent with the previous studies, there were significant relations between aspirations before and after the manipulation, condition and change in aspirations, and trust and both condition and aspirations. Correlations between aspirations and decisions were robust (decision task and change in intrinsic aspirations: $r = .53$; decision task and change in extrinsic aspirations: $r = –.61$). This is particularly important as we expect that change in aspirations underlies participant decision making on this task.

Hierarchical regressions assessed the main and moderating effects of condition and immersion, controlling for initial aspirations reported at the onset of the study, and positive affect after the manipulation (see Table 1 for their effects on aspirations and decision making). Main effects and covariates were entered in Step 1 of the regression models; the interacting effect was entered in Step 2. As in Study 2, mediated moderation analyses were conducted according to recommendations by Muller et al. (2005), controlling for autonomy and nature relatedness in Step 1 to explore their mediating effects on the Condition × Immersion interaction.

Primary Analyses

Intrinsic aspirations. Consistent with previous studies (and Figure 2), the presence of nature predicted higher reports of intrinsic aspirations, $\beta = .34$, $t(79) = 3.50$, $p < .01$, though there was no effect of immersion, $\beta = .08$, $t(79) = 0.91$, $p > .05$. Effects were subsumed by a two-way interaction, $\beta = .39$, $t(78) = 4.02$, $p < .01$, showing that as individuals were more immersed in natural environments, they reported more intrinsic aspirations, $\beta = .28$, $t(38) = 2.92$, $p < .05$. Immersion in non-nature environments did not predict intrinsic aspirations, $\beta = –.11$, $t(37) = –1.29$, $p > .05$.

Extrinsic aspirations. Nature predicted less valuing of extrinsic aspirations, $\beta = –.31$, $t(79) = –3.20$, $p < .01$, but no effect for immersion, $\beta = .08$, $t(79) = 1.02$, $p > .05$. Immersion interacted with condition, $\beta = –.20$, $t(78) = –2.52$, $p < .05$. For participants in the nature condition, higher immersion predicted less extrinsic valuing, $\beta = –.24$, $t(38) = –2.61$, $p < .05$. For those in human-made environments, immersion marginally predicted higher valuing of extrinsic aspirations, $\beta = .16$, $t(37) = 1.98$, $p < .06$.

Decision task. As expected, people were more generous when exposed to nature, $\beta = .44$, $t(80) = 4.04$, $p < .01$, but there was no effect for immersion, $\beta = .08$, $t(80) = 0.95$, $p > .05$. A two-way interaction, $\beta = .38$, $t(79) = 3.99$, $p < .01$, showed that as individuals were more immersed in nature they were also more generous, $\beta = .33$, $t(39) = 2.89$, $p < .01$, whereas as they were more immersed in the non-natural lab setting they were less generous, $\beta = –.30$, $t(38) = –3.16$, $p < .01$.

Mediating constructs. Consistent with Study 2, the Immersion × Nature interaction predicted *nature*

relatedness, β = .33, $t(79) = 3.21$, $p < .01$, such that participants in the nature condition experienced more nature relatedness insofar as they were more immersed, β = .24, $t(39) = 2.32$, $p < .05$, whereas those in the non-nature condition were less connected to nature insofar as they were more immersed in their environment, β = –.20, $t(38) = –2.59$, $p < .05$. The Immersion × Nature interaction also predicted *autonomy*, β = .30, $t(79) = 3.63$, $p < .01$, such that participants in the nature condition felt more autonomous as they were more immersed in the environment, β = .25, $t(39) = 2.70$, $p < .05$, whereas those in the non-nature condition reported marginally less autonomy as they were more immersed, β = –.18, $t(38) = –1.98$, $p < .06$.

Mediational Analyses

Intrinsic aspiration mediated. As described previously, the Condition × Immersion interaction predicted valuing of intrinsic aspirations, as well as nature relatedness and autonomy. Additionally, higher nature relatedness predicted increases in intrinsic aspirations, β = .23, $t(78) = 2.23$, $p < .05$, as did autonomy, β = .32, $t(78) = 3.55$, $p < .01$. Moreover, consistent with Study 2, when controlling for nature relatedness and autonomy, the interaction effect dropped to nonsignificance, β = .04, $t(77) = 0.72$, $p > .05$. The indirect effect was $z = 1.83$, $p < .07$ for nature relatedness, and $z = 2.53$ $p < .05$ for autonomy.

Extrinsic aspiration mediated. Analyses described previously demonstrated that the Condition × Immersion interaction predicted valuing extrinsic aspirations, as well as nature relatedness and autonomy. A negative effect was also present between nature relatedness and extrinsic aspirations, β = –.26, $t(78) = –2.73$, $p < .01$, and between autonomy and extrinsic aspirations, β = –.40, $t(78) = –4.41$, $p < .01$. When including these mediators in the model, the interaction effect on extrinsic motivation dropped to nonsignificance, β = –.14, $t(77) = –1.52$, $p > .05$. The indirect effect was $z = 2.07$, $p < .05$ for nature relatedness, and $z = 2.80$, $p < .01$ for autonomy.

Decision task mediated. The Condition × Immersion interaction predicted valuing of intrinsic aspirations over extrinsic aspirations, as indicated by more generosity during the decisions task. Also, nature relatedness predicted more generous decisions, β = .35, $t(79) = 3.59$, $p < .01$, as did autonomy, β = .36, $t(79) = 3.45$, $p < .01$. Moreover, as expected, when controlling for nature relatedness and autonomy, the interaction effect dropped to nonsignificance, β = .09, $t(78) = 1.01$, $p > .05$, indicating that immersion in nature only related to value-laden behavior insofar as participants experienced more autonomy and nature relatedness that they were consequently more generous (nature relatedness: $z = 2.39$; autonomy: $z = 2.50$; ps < .05).

Discussion

Study 3 showed results consistent with those of the previous studies. As participants were more immersed in nature contexts, they reported higher valuing of intrinsic and lower valuing of extrinsic aspirations. On the other hand, higher immersion in non-nature contexts elicited higher valuing of extrinsic and no change in intrinsic aspirations. As in Study 2, participants felt more autonomous and nature related as they were more immersed in nature and less so as they were more immersed in non-nature images; experiences of relatedness and autonomy fully mediated the effects on both intrinsic and extrinsic aspirations. Nature and immersion also had a remarkable interacting effect predicting generous decision making indicative of higher valuing of intrinsic and devaluing of extrinsic values. As individuals were more immersed in nature slides, they were more likely to make generous decisions; as they were more immersed in non-nature slides, they were less generous and greedier. These effects, as well, were mediated by the processes of autonomy and nature relatedness.

Instead of manipulating nature by exposure to slides on a computer screen, Study 4 extends the paradigm of Studies 1-3 and manipulated nature through the presence or absence of living plants in the laboratory setting. We sought to examine whether exposure to high versus low levels of nature would differentially affect valuing of intrinsic versus extrinsic aspirations, even when controlling for biased responding and positive affect.

STUDY 4

Method

Participants

Seventy-five students participated; 3 were excluded from analyses because they identified the nature of the study during debriefing. Of those remaining, 41 were women and 31 were men. Ages ranged from 18 to 24 years ($M = 20$). Sixty-eight percent were Caucasian, 7% African American, 4% Latino or Latina, 11% Asian American, and 10% Other. Ninety-two percent spoke English as a first language. As in previous studies, demographic differences were not related to and did not interact with other observed variables (ps > .05) and were not considered in subsequent analyses.

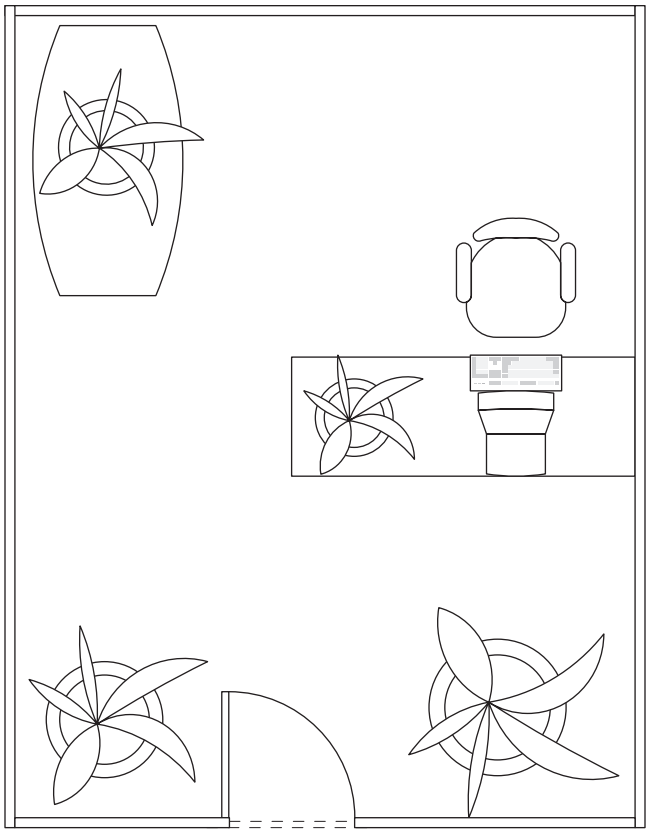

Figure 4 Study 4 lab setup.

Materials and Procedure

Participants completed an online questionnaire the night before coming to the lab, which included baseline intrinsic and extrinsic aspirations and the BIDR. Before participants arrived, they were randomly assigned to one of two conditions. In the nature condition, the lab room was furnished with four plants of varying types and sizes (lab layout presented in Figure 4). If participants were placed in the non-nature condition the lab did not contain these plants. Besides the presence or absence of these plants, all other characteristics of the lab room remained unchanged. As in the previous studies, participants completed a number of filler surveys and assessments of positive affect ($\alpha = .86$) upon entering the lab. They were then instructed to take a 5-min relaxation period, after which they completed assessments of intrinsic and extrinsic aspirations (αs = .69-.78), immersion ($\alpha = .78$), nature connectedness ($\alpha = .75$), and personal autonomy ($\alpha = .83$). Finally, participants then engaged in the economic decision task indicative of valued aspirations (in the present study, 54% of participants gave their money; 46% kept it).

Results

Data Analytic Strategy and Preliminary Analyses

Means and Pearson correlations between observed variables are presented under the diagonal in Table 4. These preliminary analyses showed that although previous studies showed no overall change in aspirations after the manipulation, the present participants reported higher extrinsic aspirations after they arrived at the lab as compared to before participating. Consistent with the previous studies, a robust correlation was present between aspirations valued at Time 1 and Time 2, and condition related to change in aspirations and to decision making. As in Study 3, aspirations strongly correlated with decision making (generosity and change in intrinsic aspirations: $r = .56$; generosity and change in extrinsic aspirations: $r = -.65$). Mediated moderation effects were tested as in Study 3.

Primary Analyses

Intrinsic aspirations. Consistent with previous studies, the presence of nature predicted higher reports of intrinsic aspirations, $\beta = .26$, $t(66) = 2.15$, $p < .05$. Also, there was a marginal effect for immersion, $\beta = .16$, $t(66) = 1.92$, $p < .06$. A two-way interaction qualified these effects, $\beta = .37$, $t(65) = 4.14$, $p < .01$, indicating that as individuals became more immersed in natural environments, they reported more intrinsic aspirations, $\beta = .25$, $t(31) = 2.11$, $p < .05$. Immersion did not predict intrinsic aspirations for those with no plants, $\beta = -.14$, $t(31) = -1.49$, $p > .05$.

Extrinsic aspirations. Those exposed to nature (plants) reported lower extrinsic aspirations, $\beta = -.24$, $t(66) = -2.71$, $p < .01$, but no effect for immersion, $\beta = -.03$, $t(66) = -0.87$, $p > .05$. Condition and immersion interacted, $\beta = -.26$, $t(65) = -3.25$, $p < .01$, showing relations consistent with those of previous studies. As participants were more immersed in an environment in which nature was present, they devalued extrinsic aspirations, $\beta = -.26$, $t(31) = -2.22$, $p < .05$. On the other hand, those who were more immersed in a non-nature environment reported more extrinsic aspirations, $\beta = .29$, $t(31) = 2.04$, $p < .05$.

Decision task. As in Study 3, people were more generous when nature was present, $\beta = .41$, $t(67) = 3.75$, $p < .01$, but no effect for immersion, $\beta = .05$, $t(67) = 0.41$, $p > .05$. A two-way interaction, $\beta = .46$, $t(66) = 4.12$, $p < .01$, showed that as individuals became more immersed in the setting with living plants they were more generous, $\beta = .32$, $t(32) = 2.87$, $p < .01$, but when more immersed in the non-natural lab setting they were less generous, $\beta = -.34$, $t(32) = -2.99$, $p < .01$.

Mediating constructs. Results were consistent with Studies 2 and 3. The Immersion × Nature interaction predicted *nature relatedness*, β = .27, $t(65) = 2.50$, $p < .05$. Participants in the nature condition experienced marginally more nature relatedness when immersed, β = .18, $t(33) = 1.98$, $p < .06$, whereas those in the non-nature condition were less connected to nature when immersed, β = –.20, $t(33) = –2.79$, $p < .01$. This interaction also predicted *autonomy*, β = .30, $t(65) = 4.07$, $p < .01$, such that immersion in nature elicited autonomy, β = .26, $t(33) = 3.57$, $p < .01$, though immersion in a plant-devoid lab thwarted autonomy, β = –.18, $t(33) = –1.78$, $p < .09$.

Mediational Analyses

Intrinsic aspiration mediated. Mediating constructs predicted higher intrinsic aspirations: nature, β = .45, $t(64) = 5.15$, $p < .01$, and autonomy, β = .41, $t(64) = 4.62$, $p < .01$. Consistent with previous studies, controlling for nature relatedness and autonomy reduced the moderation effect to nonsignificance, β = .09, $t(63) = 1.04$, $p > .05$. Sobel's test was $z = 2.25$, $p < .05$ for nature relatedness and $z = 3.05$, $p < .01$ for autonomy.

Extrinsic aspiration mediated. Those who felt related to nature devalued extrinsic aspirations, β = –.41, $t(64) = –4.45$, $p < .01$, as did those who felt autonomous, β = –.36, $t(64) = –3.91$, $p < .01$. When including these mediators in the model, the interaction effect on extrinsic motivation dropped to nonsignificance, β = –.11, $t(63) = –1.19$, $p > .05$ (nature relatedness $z = 2.18$, $p < .05$; autonomy $z = 2.82$, $p < .01$).

Decision task mediated. The Condition × Immersion interaction predicted valuing of intrinsic aspirations over extrinsic aspirations, as indicated by being more generous during the decisions task. Notably, those who felt related to nature were more generous, β = .44, $t(65) = 4.00$, $p < .01$, as were those who experienced autonomy, β = .36, $t(65) = 3.45$, $p < .01$. When accounting for these experiences, the interaction effect was no longer significant, β = .05, $t(64) = 0.08$, $p > .05$ ($z = 2.12$, $p < .05$ for nature relatedness and $z = 2.63$, $p < .01$ for autonomy).

Discussion

Study 4, using a different and in vivo indoor nature versus non-nature contrast, found consistent effects on extrinsic and intrinsic aspirations. Participants who were immersed in a lab setting with plants present reported higher valuing of intrinsic aspirations, whereas non-nature contexts did not influence intrinsic aspirations. When plants were not present, immersion in the lab setting related to higher valuing of extrinsic aspirations and devaluing of intrinsic ones. As in Studies 2 and 3, participants felt more autonomous and nature related as they were more immersed in the plant-filled lab and less so as they were more immersed in the plant-free lab; these experiences fully mediated the effects on both intrinsic and extrinsic aspirations. As in Study 3, nature and immersion predicted generous decision making, reflecting an other-focused value orientation. Immersion in a plant-filled lab enhanced generosity whereas immersion in a plant-devoid lab inhibited it; these effects were mediated by autonomy and nature relatedness.

GENERAL DISCUSSION

Natural settings have been shown to facilitate an impressive collection of well-being outcomes and other indicators of positive functioning (e.g., Herzog, Black, Fountaine, & Knotts, 1997; Kaplan & Talbot, 1983; Plante et al., 2006; Ryan et al., 2008; Tarrant, 1996). The present studies extended this past research in two ways. First, we examined whether nature effects might be moderated by degree of immersion. More important, we tested nature effects on one's salient life values and aspirations, which represent cognitive sets that pervasively shape perceptions, judgments, and behaviors. Aspirations are distinct from the previously demonstrated outcomes of nature exposure in that they directly relate to specific contents of human motivation and can motivate prosocial actions that further influence well-being (Ryan, Sheldon, Kasser, & Deci, 1996).

The current experiments examined the hypothesis that immersion in nature would increase valuing of intrinsic aspirations and decrease valuing of extrinsic aspirations, compared to immersion in non-nature environments. To test this hypothesis, participants in three studies were exposed to images of either natural or non-natural environments while listening to a guided imagery script, and they reported on aspirations both before and after image presentations. In Study 4, the presence or absence of plants was manipulated. All studies showed that participants exposed to nature valued intrinsic goals more and extrinsic goals less than they had before exposure. Importantly, these effects were evident after controlling for biased responding and positive affect elicited by the manipulation. Moderation analyses in all studies showed that individuals immersed in their environments largely carried this effect. Namely, for those who were exposed to nature environments and reported immersion also reported increases in intrinsic aspirations and decreases in extrinsic ones. On the other hand, immersion did not affect reports of intrinsic aspirations for those exposed to non-nature environments, and it actually predicted

higher valuing of extrinsic aspirations. Overall, these results are interesting because they suggest that nature, which is inherently unrelated to human intervention, brings individuals closer to others, whereas human-made environments orient goals toward more selfish or self-interested ends.

Studies 2-4 tested the hypothesis that exposure to nature elicits experiences of two processes in particular, relatedness to nature and personal autonomy, that in turn underlie the effects of condition and immersion on change in aspirations. Consistent with expectations by Mayer and Frantz (2004), we postulated that nature exposure would facilitate a sense of relatedness to nature. Additionally, we expected that nature might facilitate autonomy by presenting individuals with inherently stimulating and interesting stimuli (Kaplan, 1995) that orient individuals to their present and internal states (Walker et al., 1998) and by removing daily pressures (Stein & Lee, 1995). Mediated moderation analyses supported these hypotheses. Interestingly, higher immersion in nature predicted higher nature relatedness and autonomy, whereas higher immersion in non-nature predicted lower nature relatedness and autonomy. The result that immersion in non-nature settings thwarted experiences of relatedness and autonomy is interesting and consistent with speculations that living in modern, non-nature environments may have a powerful isolating and/or self-alienating effect on people (Frantz et al., 2005; Vining et al., 2008).

Nature relatedness and autonomy independently and robustly predicted higher intrinsic aspirations and lower extrinsic ones. These results, as well, are novel but consistent with expectations and with past research (e.g., Sheldon et al., 2004; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004). When including these constructs in the model, the Condition × Immersion interaction no longer predicted either extrinsic or intrinsic aspirations, suggesting that nature may affect aspirations by enhancing connection and autonomy, both experiences congruent with natural inclinations of humans (Deci & Ryan, 1985). When natural inclinations were supported in these ways, individuals oriented toward values more intrinsic and self-congruent.

Studies 3 and 4 explored effects of natural elements on decision making indicative of valuing intrinsic aspirations over extrinsic aspirations. Participants decided to either share their money, gaining only the knowledge that the money would be shared with a second student but potentially losing all funds, or keep their money without risk of loss but without benefit to another student. Those more immersed in natural settings were more generous, whereas those immersed in non-natural settings were less likely to give. Feelings of autonomy and nature relatedness were responsible for the willingness to give to others, indicating that these experiences facilitated a willingness to promote others' interests as well as one's own. In other words, autonomy and relatedness encouraged participants to focus on their intrinsic values for relationships and community rather than on personal gain.

The present studies demonstrated effects for nature on immersion in lab settings using brief exposures to slides and plants. We did not examine the time course of these effects but we suspect that they are brief. Nonetheless, results suggest the potential for broader effects that can be elicited in "real-life" settings, where the presence of nature can be more rich and enduring. For example, living in more natural surroundings may conduce to more robust and lasting intrinsic (as opposed to extrinsic) aspiration sets and to greater caring for others. These findings may also speak to a number of observations that urban dwellers as compared to rural residents show more reservation, indifference, and estrangement from others (Morris, 1968; Wirth, 1938) and that small-town residents as opposed to city dwellers exhibit more helpful behaviors (Korte, 1978). Related to this, the present findings highlight the importance of effective urban planning that incorporates green spaces and other representatives of nature (e.g., Galindo & Rodriguez, 2000; Parsons, Tassinary, Ulrich, Hebl, & Grossman-Alexander, 1998). The present results suggest that such designs may also influence life aspirations and community orientations of residents, perhaps promoting stronger community identity and care for others, and in these ways facilitate well-being of residents. Of course, these speculations await further research.

On first blush, the shift in values calls to mind an interesting alternative explanation to the present findings, namely, that exposing participants to nature or human-made environments directly primed or activated preexisting intrinsic and extrinsic aspirations. This explanation makes intuitive sense in one condition (city primes may make wealth and fame salient), but the link between nature imagery and intrinsic aspirations seems more tenuous (because community and relationships are equally if not more ubiquitous in cities than in nature). Future studies should examine this hypothesis; perhaps by examining salience of aspirations using word-completion tasks (e.g., Anderson, Carnagey, & Eubanks, 2003) or other accessibility and activation methods. The full mediations by autonomy and nature relatedness on the relations between immersed nature exposure and life aspirations suggest that straightforward priming might not underlie these effects. To more completely vet the alternative hypotheses in the current data, we conducted ancillary analyses to examine mediation by relatedness and autonomy on the main effects of condition. Results demonstrated full mediation for the main effect of nature, suggesting that the direct effect on aspirations was dependent on autonomy and nature

relatedness across aspirations in Studies 2-4. This does not rule out the possibility that nature exposure primed autonomy or relatedness and that these primed effects subsequently led to shifts in aspirations. Additionally, nature slides may have elicited the identified reactions by reminding individuals of previous nature experiences, in which case simply presenting semantic primes may attain similar benefits. Future studies should extricate the particular effects attained from viewing images from those of priming.

There are several notable limitations to the present studies. First, the findings from these studies were based primarily on data collected through self-report and would benefit from replication with alternate behavioral assessments of aspirations and values. Although the decision-making task provided a preliminary behavioral assessment of intrinsic aspirations, diverse behavioral tasks directly tapping intrinsic aspirations would supplement the current findings. Second, our principal moderating construct, the level of immersion experienced by participants, was not experimentally manipulated. The present findings would be bolstered by designs that experimentally manipulate the level of graphic fidelity or the presence of distracters between conditions to influence participant immersion. Finally, the present study did not consider between-person differences in susceptibility to immersion. It is possible but unlikely that dispositional differences such as trait absorption (Tellegen & Atkinson, 1974) share variance with life aspirations. Future research should account for such between-person variability to rule them out as causal factors when assessing the impact of virtual natural and urban settings on change in aspirations.

Despite limitations, the present work explores previously unknown relations between nature, autonomy, and values. The role of immersion in enhancing these effects and the impact on value-laden decision making offer a greater understanding of the role of nature in the human experience. Together these findings suggest that full contact with nature can have humanizing effects, fostering greater authenticity and connectedness and, in turn, other versus self-orientations that enhance valuing of and generosity toward others. In these experiments, people's contact with nature was relatively weak, consisting of brief exposure to slides of natural landscapes or sitting among plants in an office space. Given that these brief exposures appear to have yielded a reliable impact in creating a more prosocial value set, we might speculate about the more general balance of nature and nonnature in people's lives and its societal effects. Our results suggest that to the extent our links with nature are disrupted, we may also lose some connection with each other. This relation, if sustained, has broad implications for environmental psychology and community design.

APPENDIX

Imagery script: Imagine yourself in this place [pause]. Look around, noticing all aspects of your environment [pause]. Pay attention to the colors [pause]. Notice the textures. Imagine yourself breathing in the air; notice any smells that may be present [pause]. Imagine any sounds you may hear [pause]. Let yourself take in all the aspects of the environment in front of you.

REFERENCES

Anderson, C. A., Carnagey, N. L., & Eubanks, J. (2003). Exposure to violent media: The effects of songs with violent lyrics on aggressive thoughts and feelings. *Journal of Personality and Social Psychology, 84*, 960-971.

Bystrom, K.-E., Barfield, W., & Hendrix, C. (1999). A conceptual model of the sense of presence in virtual environments. *Presence, Teleoperators and Virtual Environments, 8*, 241-244.

Carver, C. S., & Baird, E. (1998). The American dream revisited: Is it what you want or why you want it that matters? *Psychological Science, 9*, 289-292.

Chirkov, V. I., Ryan, R. M., Kim, Y., & Kaplan, U. (2003). Differentiating autonomy from individualism and independence: A self-determination theory perspective on internalization of cultural orientations and well-being. *Journal of Personality and Social Psychology, 84*, 97-110.

Croson, R., & Buchan, N. (1999). Gender and culture: International experimental evidence from trust games. *American Economic Review, 89*, 386-391.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*, 227-268.

Diener, E., & Emmons, R. A. (1984). The independence of positive and negative affect. *Journal of Personality and Social Psychology, 47*, 1105-1117.

Emmons, R. A. (1991). Personal strivings, daily life evens, and psychological and physical well-being. *Journal of Personality, 59*, 453-472.

Frantz, C. M., Mayer, F. S., Norton, C., & Rock, M. (2005). There is no "I" in nature: The influence of self-awareness on connectedness to nature. *Journal of Environmental Psychology, 25*, 427-436.

Gagné, M. (2003). The role of autonomy support and autonomy orientation in prosocial behavior engagement. *Motivation and Emotion, 27*, 199-223.

Galindo, M. P. G., & Rodriguez, J. A. C. (2000). Environmental aesthetics and psychological wellbeing: Relationships between preference judgments for urban landscapes and other relevant affective responses. *Psychology in Spain, 4*, 13-27.

Grouzet, F. M. E., Ahuvia, A., Kim, Y., Ryan, R. M., Schmuck, P., Kasser, T., et al. (2005). The structure of goal contents across 15 cultures. *Journal of Personality and Social Psychology*, *89*, 800-816.

Herzog, T. R., Black, A. M., Fountaine, K. A., & Knotts, D. J. (1997). Reflection and attentional recovery as distinctive benefits of restorative environments. *Journal of Environmental Psychology, 17*, 165-170.

Ilardi, B. C., Leone, D., Kasser, R., & Ryan, R. M. (1993). Employee and supervisor ratings of motivation: Main effects and discrepancies associated with job satisfaction and adjustment in a factory setting. *Journal of Applied Social Psychology, 23*, 1789-1805.

Kals, E., Schumacher, D., & Montada, L. (1999). Emotional affinity toward nature as a motivational basis to protect nature. *Environment and Behavior, 31*, 178-202.

Kaplan S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology, 15*, 169-182.

Kaplan, S., & Talbot, J. F. (1983). Psychological benefits of a wilderness experience. In I. Altman & J. F. Wohlwill (Eds.), *Behavior and the natural environment* (pp. 163-203). New York: Plenum.

Kashdan, T. B., Julian, T., Merritt, K., & Uswatte, G. (2006). Social anxiety and posttraumatic stress in combat veterans: Relations to well-being and character strengths. *Behavior Research and Therapy, 44,* 561-583.

Kasser, T. (2002). Sketches for a self-determination theory of values. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 123-140). Rochester, NY: University of Rochester Press.

Kasser, T., & Ryan, R. M. (1993). A dark side of the American dream: Correlates of financial success as a central life aspiration. *Journal of Personality and Social Psychology, 65,* 410-422.

Kasser, T., & Ryan, R. M. (1996). Further examining the American dream: Differential correlates of intrinsic and extrinsic goals. *Personality and Social Psychology Bulletin, 22,* 280-287.

Korte, C. (1978). Helpfulness in the urban environment. In A. Baum, J. E. Singer, & S. Valins (Eds.), *Advances in environmental psychology: Vol. 1. The urban environment* (pp. 85-109). New York: John Wiley & Sons.

Leather, P., Pyrgas, M., Beale, D., & Lawrence, C. (1998). Windows in the workplace. *Environment and Behaviour, 30,* 739-763.

Mania, K., & Chalmers, A. (2001). The effects of levels of immersion on memory and presence in virtual environments: A reality centered approach. *CyberPsychology and Behavior, 4,* 247-264.

Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology, 24,* 503-515.

Morris, R. N. (1968). *Urban sociology.* New York: Praeger.

Muller, D., Judd, C. M., & Yzerbyt, V. Y. (2005). When moderation is mediated and mediation is moderated. *Journal of Personality and Social Psychology, 89*, 852-863.

Parsons, R., Tassinary, L. G., Ulrich, R. S., Hebl, M. R., & Grossman-Alexander, M. (1998). The view from the road: Implications for stress recovery and immunization. *Journal of Environmental Psychology, 18*(2), 113-140.

Paulhus, D. L. (1988). *Assessing self-deception and impression management in self-reports: The Balanced Inventory of Desirable Responding.* Manual available from the author at the Department of Psychology, University of British Columbia, Vancouver, BC, Canada V6T lY7.

Plante, T. G., Cage, C., Clements, S., & Stover, A. (2006). Psychological benefits of exercise paired with virtual reality: Outdoor exercise energizes while indoor virtual exercise relaxes. *International Journal of Stress Management, 13*, 108-117.

Przybylski, A. K., Ryan, R. M., & Rigby, C. S. (2009). The motivating role of violence in video-games. *Personality and Social Psychology Bulletin, 35,* 243-259.

Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of Personality, 63,* 397-427.

Ryan, R. M., Chirkov, V. I., Little, T. D., Sheldon, K. M., Timoshina, E., & Deci, E. L. (1999). The American Dream in Russia: Extrinsic aspirations and well-being in two cultures. *Personality and Social Psychology Bulletin, 25*, 1509-1524.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55,* 68-78.

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion, 30,* 347-363.

Ryan, R. M., Sheldon, K. M., Kasser, T., & Deci, E. L. (1996). All goals are not created equal: An organismic perspective on the nature of goals and their regulation. In P. M. Gollwitzer & J. A. Bargh (Eds.), *The psychology of action: Linking cognition and motivation to behavior* (pp. 7-26). New York: Guilford.

Ryan, R. M., Weinstein, N., Bernstein, J., Brown, K. W., Mastella, L., & Gagné, M. (2008). *Vitalizing effects of being outdoors and in nature.* Manuscript under review.

Schultz, P. W. (2002). Inclusion with nature: Understanding the psychology of human-nature interactions. In P. Schmuck & P. W. Schultz (Eds.), *The psychology of sustainable development* (pp. 61-78). New York: Kluwer.

Schwartz, G. E., Weinberger, D. A., & Singer, J. A. (1981). Cardiovascular differentiation of happiness, sadness, anger, and fear following imagery and exercise. *Psychosomatic Medicine, 43*, 343-364.

Sheldon, K. M., Ryan, R. M., Deci, E. L., & Kasser T. (2004). The independent effects of goal contents and motives on well-being: It's both what you pursue and why you pursue it. *Personality and Social Psychology Bulletin, 30,* 475-486.

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhardt (Ed.), *Sociological methodology* (pp. 290-312). Washington, DC: American Sociological Association.

Stein, T. V., & Lee, M. E. (1995). Managing recreation resources for positive outcomes: An application of benefits-based management. *Journal of Park and Recreation Administration, 13*(2), 52-70.

Stilgoe, J. R. (2001). Gone barefoot lately? *American Journal of Preventative Medicine, 20*, 243-244.

Tarrant, M. A. (1996). Attending to past outdoor recreation experiences: Symptom reporting and changes in affect. *Journal of Leisure Research, 28*, 1-17.

Tellegen, A., & Atkinson, G. (1974). Openness to absorbing and self-altering experiences ("absorption"), a trait related to hypnotic susceptibility. *Journal of Abnormal Psychology, 83*, 268-277.

Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science, 224*, 420-421.

Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology, 11,* 201-230.

Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K. M., & Deci, E. L. (2004). Motivating learning, performance, and persistence: The synergistic effects of intrinsic goal contents and autonomy-supportive contexts. *Journal of Personality and Social Psychology, 87,* 246-260.

Vining, J. (1987). Environmental decisions: The interaction of emotions, information, and decision context. *Journal of Environmental Psychology, 7*, 13-30.

Vining, J., Merrick, M. S., & Price, E. A. (2008). The distinction between humans and nature: Human perceptions of connectedness to nature and elements of the natural and unnatural. *Research in Human Ecology, 15,* 1-11.

Walker, G. J., Hull, R. B., IV, & Roggenbuck, J. W. (1998). On-site optimal experiences and their relationship to off-site benefits. *Journal of Leisure Research, 30,* 453-471.

Wirth, L. (1938). Urbanism as a way of life. In R. Sennett (Ed.), *Classic essays on the culture of cities* (pp. 143-164). New York: Appleton-Century-Crofts.

Received December 6, 2008
Revision accepted March 17, 2009