Biospheric Values Predict Ecological Cooperation in a Commons Dilemma Scenario

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Abstract

In ecological commons dilemma research, environmental values tend to be treated as a monolith. However, environmental values vary and they do not equally predict proenvironmental behavior. In this study, we investigated the impact of three kinds of proenvironmental values (egoistic, altruistic, and biospheric) on competitive and cooperative behavior in a hypothetical ecological commons dilemma scenario. Two hundred Canadian undergraduate students completed an online survey assessing proenvironmental value orientation and commons dilemma decision-making tendencies. In line with our hypothesis, controlling for demographic characteristics (e.g., gender) and key facets of social desirability (e.g., impression management), egoistic, altruistic, and biospheric values positively predicted competition, altruistic cooperation, and ecological cooperation, respectively, within the commons dilemma. Results show that to promote the sustainable consumption of shared ecological resources, it is prudent for educators, environmental managers, and policy makers to encourage the expression of biospheric values. Key Words: Commons dilemma—Proenvironmental values—Environmental concern—Proenvironmental behavior—Cooperation.

Introduction

Ecological dilemmas, such as climate change and global reductions in biodiversity, are associated with the overexploitation and the myopic use of natural resources (e.g., minerals, arable land, and fresh water; Biel & Garling, 1995; Smith, 2017). Natural resource depletion is caused, to a great extent, by egocentric human activities intended to maximize personal short-term social and/or economic gain at the expense of what may be best for society and nature (Huckelba & Van Lange, 2020; Knez, 2016; Ponting, 1993). Conflicts over the consumption and allocation of natural resources characterize what are known as *commons dilemmas*.

A group of individuals or in-group members sharing a natural resource (e.g., water, clean air, grazing land, electricity, and recreational space) can collapse the resource by overuse or inequitable harvesting. This state of resource system collapse is known as the *tragedy of the commons* (Hardin, 1968). Studying the intrapsychic, interpersonal, cultural, and geophysical factors that either abate or encourage cooperative and mindful ecological resource decision-making has been a key focus for researchers to achieve sustainable environmental management outcomes (Liu & Hao, 2020; Sussman, Lavellee, & Gifford, 2016). Proenvironmental values have shown promise as a significant predictor of cooperative resource sharing in commons dilemmas (e.g., Sussman et al., 2016).

However, there is notable variability in the kinds of "green" values that people may express, which differentially impact the probability of behaving in a proenvironmental manner (Davis & Stroink, 2016; Schultz, 2001; Schultz et al., 2005; Stern & Dietz, 1994; Stern, Dietz, & Kalof, 1993). The goal of this research was to examine how

different types of proenvironmental values may impact resource consumption and allocation decisions within the context of a hypothetical ecological commons dilemma.

The commons dilemma

Commons dilemmas often, but not always, represent mixed-motive situations because of conflicts between a desire for personal gain for oneself or one's family and friends with the motive to behave cooperatively to benefit the community (Shankar & Pavitt, 2002). But these dilemmas can also be characterized by conflict between interdependent groups of people sharing a natural resource, or a conflict between personal gains or group benefits and the longevity of the natural resource (Arnocky, Stroink, & DeCicco, 2007). In a commons dilemma game, the defection (D) response is a dominating strategy, whereas the cooperation (C) response is the cooperative choice (Dawes, 1980).

Because of the individual cost associated with cooperation, such as sacrificing one's desires, limiting one's freedom to consume, and spending money, defection may represent a rational decision to maximize personal benefits as opposed to increasing the collective gain (Chen & Gifford, 2015). The pursuit of self-interest seems to be the prevailing strategy employed in simulated commons dilemmas (Gifford & Hine, 1997). However, the crux of behaving selfishly is that if all parties involved similarly defect, then everyone suffers in the long term and the resource base is exhausted. Thus, in a typical commons dilemma, everyone stands to benefit more if the majority cooperate than if all rule in favor of defection (Dawes, 1980).

The role of values in commons dilemmas

Several researchers have demonstrated the importance of values as an intrapersonal factor in predicting commons dilemma decision-making [reviewed in Gifford (2006)]. For instance, people with a prosocial value orientation, denoting a heightened concern for the gains and losses of others, behave more cooperatively in a commons dilemma game (Kaiser & Byrka, 2011; Liebrand, 1984; Sheldon & McGregor, 2000; Van Vugt, 2009). In contrast, those with a proself value orientation seek to maximize their own personal benefits and are more individualistic, competitive, and more prone to defection [reviewed in Brucks and Van Lange (2007)]. Furthermore, in the context of a competitive resource dilemma where resources are knowingly distributed unfairly, those who do not value cooperation tend not to behave cooperatively (Kramer, McClinktock, & Messick, 1986).

In the context of a cooperative commons dilemma game (i.e., resources are knowingly equally distributed) valuing cooperation does not appear to have much of an influence on cooperative commons decision-making (Kramer et al., 1986). An extrinsic value orientation (i.e., prioritizing approval and gratification from others) has also been associated with a tendency to exploit the commons for personal gain (Sheldon & McGregor, 2000). This becomes particularly problematic when groups consist of a higher number of people with extrinsic values, because they increase the risk of exhausting the resource base that all the players are dependent upon. In contrast, those with an intrinsic value orientation, who emphasize personal growth, emotional intimacy, and communal involvement, harvest less on an individual level and promote the longevity of the commons (Sheldon & McGregor, 2000).

When the commons is of ecological relevance (i.e., where natural resources are at stake), proenvironmental values have been shown to be a significant predictor of cooperation (Sussman et al., 2016). For example, Sussman et al. (2016) found that in a competitive commons dilemma, proenvironmental values abated selfish harvesting of fish and increased cooperative tendencies. However, proenvironmental values had little influence on cooperative behavior in the context of a cooperative commons dilemma. Therefore, when resources are plentiful and shared equally among individuals, proenvironmental values may not predict more sustainable harvesting strategies.

Despite evidence supporting the importance of the relation between valuing the environment and encouraging conservation behavior (e.g., Davis & Stroink, 2016; de Groot & Steg, 2009; Schultz, 2001; Schultz et al., 2005; Stern et al., 1993), there is limited research regarding the influence of proenvironmental values within the context of an ecological commons dilemma (e.g., Arnocky & Stroink, 2011; Hine, Gifford, Heath, Cooksey, & Quain, 2009; Kortenkamp & Moore, 2001; Sussman et al., 2016). Moreover, several investigators studying the role of proenvironmental values on commons dilemma decision-making have treated these values as a unitary construct (e.g., Smith & Bell, 1992; Sussman et al., 2016).

Proenvironmental values, however, correspond to varying motives that differentially influence perceptions of natural resource consumption and distribution, as well as intentions to behave in an ecologically friendly manner (Arnocky & Stroink, 2011; Davis, Arnocky, & Stroink, 2019; Davis & Stroink, 2016; de Groot & Steg, 2009; Hine et al., 2009; Schultz, 2001; Swami, Chamorro-Premuzic, Snelgar, & Furnham, 2010).

Using value-belief-norm theory (Stern & Dietz, 1994), three distinct, yet interrelated, proenvironmental values can be delineated: egoistic, altruistic, and biospheric. Each value within this tripartite model embodies beliefs about the perceived negative outcomes of environmental destruction on various "objects" that people may

value (Schultz, 2001). When valued objects (e.g., the self, other human beings, and nonhuman life) are threatened, people become motivated to protect them. The primary valued object for someone possessing egoistic values is the self, which translates into wanting to protect nature because of the potential negative consequence that environmental degradation could have for oneself.

In contrast, those with altruistic values are motivated to protect the environment out of concern for the welfare of other people because they value all of humanity. The valued objects of those with biospheric values extend to a diverse array of organisms within the biosphere (e.g., marine life), which promotes conservation effort out of concern for all nonhuman life. Schultz's (2001) value typology also mirrors Merchant's (1992) tripartite model of environmental ethics in relation to natural resource dilemmas, described as egocentric, homocentric, and ecocentric ethics.

Merchant (1992) speculated that those with egocentric ethics feel that they have a right to extract natural resources to improve their own lives, whereas those with homocentric ethics encourage using natural resources to maximize the social good. Finally, those with ecocentric ethics believe that natural resources, in and of themselves, have intrinsic value. Therefore, variability in proenvironmental values, and closely related environmental ethics, may have a significant impact on motives and decision-making regarding natural resources in the context of a commons dilemma (Hardin, 1968; Hine et al., 2009; Kortenkamp & Moore, 2001; Merchant, 1992; Sussman et al., 2016).

In an experimental study, Kortenkamp and Moore (2001) found that internal (i.e., internally motivated), but not external (i.e., externally motivated), proenvironmental attitudes were positively linked to both ecocentric (similar to biospheric values) and anthropocentric (similar to altruistic values) moral considerations across four ecological commons dilemmas (overgrazing, logging, cutting firewood, and building a new landfill). These authors also showed how participants increased their ecocentric and anthropocentric considerations when provided with details about the negative environmental impacts of the four dilemmas.

Surprisingly, participants espoused far fewer ecocentric moral considerations for the cattle grazing dilemma, and significantly more ecocentric concerns for the garbage landfill dilemma. In a follow-up experiment, ecocentric moral reasoning was higher when ecological damage in the grazing dilemma was made salient, whereas ecocentric considerations were lower when social conflict was emphasized (Kortenkamp & Moore, 2001). In a virtual fishing commons dilemma scenario, Hine et al. (2009) found that those higher in anthropocentric environmental attitudes harvested more fish each season. These individuals were also less likely to reduce their harvesting in the face of feedback that the resource base was dwindling. However, surprisingly participants' ecocentric attitudes did not significantly covary with their harvesting behavior.

Using a hypothetical ecological commons dilemma scenario, Arnocky and Stroink (2011) found that egoistic, altruistic, and biospheric proenvironmental values shared different correlations with varying kinds of resource consumption and sharing decisions. Egoistic values correlated positively with competition (i.e., defection) over shared natural resources. Altruistic values correlated positively with altruistic cooperation, denoting a desire to want to work with and help the other hypothetical players in the commons dilemma. Finally, biospheric values were positively associated with a proclivity to respect, work with, and preserve the ecological commons itself (cattle and grazing land).

The authors labeled this resource sharing tendency "ecological cooperation." The key focus, however, of the study by Arnocky and Stroink (2011) concerned gender differences in proenvironmentalism. They did not investigate how specific kinds of proenvironmental values emphasizing the self, others, and the biosphere predict varying approaches to resource sharing surrounding similar valued objects such as resource competition, cooperation, and biocentric caring. Furthermore, Arnocky and Stroink (2011) did not use multivariate analyses (e.g., multiple regression) to control for the shared overlap among environmental values to avoid misattributing unique effects to one variable over another.

The present study

The goal of this study was to examine whether different kinds of proenvironmental values as part of Schultz's (2001) tripartite model could be used to predict participants' resource sharing tendencies within a self-report ecological commons dilemma. Specifically, we tested the hypothesis that egoistic, altruistic, and biospheric proenvironmental values would positively predict competitive, altruistically cooperative, and ecologically cooperative resource sharing tendencies, respectively. Evidence indicates that different kinds of proenvironmental attitudes, ethics, and values do not equally predict proenvironmental behavior (e.g., Davis & Stroink, 2016) or commons dilemma resource competition and sharing (e.g., Hine et al., 2009; Kortenkamp & Moore, 2001).

However, at times environmental values have been assessed in a unidimensional way (e.g., Sussman et al., 2016). Furthermore, there is inconsistent evidence as to whether more ecocentric and biospheric values promote sustainable and ecologically mindful resource consumption within commons dilemmas (e.g., Arnocky & Stroink, 2011;

Hine et al., 2009). It is also important to control for the shared overlap among different environmental values using multivariate techniques to isolate unique effects (e.g., Hine et al., 2009), which some have not done (e.g., Arnocky & Stroink, 2011). Moreover, researchers often do not statistically control for social desirability, which has been shown to influence responses on measures of pro-environmental values, concern, and behavior (Milfont, 2009; Vilar, Milfont, & Sibley, 2020). Therefore, we controlled for the influence of social desirability in our analyses.

Method

Overview

Following others (e.g., Aitken, Chapman, & McClure, 2011; Arnocky & Stroink, 2011; Arnocky et al., 2007; Campbell, Bonacci, Shelton, Exline, & Bushman, 2004), a self-report survey methodology was used for this study. This approach allowed us to assess the associations between varying proenvironmental values, different classes of hypothetical commons dilemma behavior, and the tendency to portray oneself in a socially desirable manner. In the commons dilemma literature, researchers often use a computer simulated fishing game (e.g., FISH 3.1) to test how differing geophysical (e.g., resource scarcity), interpersonal (e.g., trust), and intrapersonal (e.g., values) factors influence resource allocation and consumption (e.g., Gifford & Gifford, 2000; Gifford & Wells, 1991; Sussman et al., 2016).

This approach is valuable because participants believe that they are playing against other people, when they are really participating in a game with computer players. This may provide a more ecologically valid assessment of publicly made natural resource decisions, where interpersonal influences (e.g., conformity) are salient. However, many kinds of proenvironmental behavior involving shared natural resources that humans engage in on a daily basis are private, such as energy conservation (e.g., limiting personal water and energy usage) and sustainable consumption (Gkargkavouzi et al., 2019). Therefore, anonymous self-report measures can provide unique insight into how people navigate commons decisions under the cloak of anonymity.

Participants and procedure

This study included 200 participants recruited from undergraduate courses at a small university in northwestern Ontario. The mean age of the sample was 20.21 ($SD = 4.50$, range = 18–48). Of the sample, 83.5% ($n = 167$) identified as women, and 71.5% ($n = 143$) indicated that they were Caucasian and 25.5% ($n = 51$) selected non-Caucasian ethnic identities (e.g., East Asian, African Canadian, and Indigenous). Participants reported their parents' education, which ranged from 1 (*Some elementary school*) to 10 (*Completed a graduate degree*). Median parental education corresponded to "*Completed college program*" (25.1%; $n = 98$), followed by "*Completed a university degree*" (22.3% $n = 87$). Of the sample, 56.5% ($n = 113$) reported that they were affiliated with a mainstream religion (Christianity, Islam, Taoism, etc.), whereas 30.5% ($n = 61$) were unaffiliated (e.g., atheist, agnostic, and spiritual). Across the entire sample, most participants identified as Christian (50%; $n = 100$).

Undergraduate student participants were invited to participate in the "Altruism and Environmental Behaviour Study." Some data from this project were published in an article on reproductive attitudes, environmental values, and conservation behavior (Davis et al., 2019). Inclusion criteria for this study were that participants needed to be at least 18 years of age and enrolled as a part-time or full-time undergraduate student at Lakehead University. If interested, participants accessed an online survey through SONA, where they first read a cover letter and consented to participate. Upon completing the online survey, participants were debriefed and awarded partial course credit as compensation.

This study received ethical approval from an appointed research ethics committee at Lakehead University. The sample was drawn from this population because previous research shows how young adult university students have a heightened awareness of and concern for environmental problems [e.g., climate change; Corner et al. (2015)]. Educated young adults are, therefore, key stakeholders in helping to curb environmental degradation (Ojala & Lakew, 2017). Consequently, it is important to examine the environmental values and behavior of this population to find solutions that will lead to more sustainable consumption of natural resources (Shafiei & Maleksaeidi, 2020; Yu, Yu, & Chao, 2017).

Materials

Data collection

Environmental Motives Scale. The Environmental Motives Scale (EMS) is a 12-item self-report scale designed by Schultz (2001), which was used to assess an individual's level and type of environmental concern arising from human induced environmental destruction related to three classes of valued "objects" (the self, other people, and the biosphere). These different valued objects are reflected in three subscales on the EMS: Egoistic (e.g., "*My health*"), Altruistic (e.g., "*All people*"), and Biospheric (e.g., "*Marine Life*").

Participants responded to items using a 7-point Likert-type scale ranging from 1 (*Not important*) to 7 (*Supreme importance*). Items for

each respective subscale were averaged to create mean scale scores, with higher scores describing a stronger expression of egoistic, altruistic, and biospheric values. Cronbach's alpha (α) values were calculated to examine if the subscales demonstrated evidence of internal consistency reliability (i.e., how closely related the items were as a group). The Egoistic ($\alpha = 0.83$), Altruistic ($\alpha = 0.81$), and Biospheric ($\alpha = 0.85$), subscales of the EMS were all internally consistent in this study.

Self-Report Commons Dilemma Scale. The Self-Report Commons Dilemma Scale (SRCD) is a 10-item measure created by Arnocky et al. (2007), which was used to assess resource sharing tendencies within a hypothetical ecological commons dilemma. Participants first read the following passage: "Imagine that you are a farmer raising cattle. You share grazing land on the Canada–US border with five other people. Specifically, you share the land with two other Canadians and three Americans. You each have 10 cattle feeding off the land and the land renews itself without a problem at these numbers.

You have discovered a way to have five more cattle feeding off the land without the others knowing, and adding five more cattle would not cause too much depletion of the land. Having more cattle on the land will earn you more money, but if everyone were to add five more cattle, the land would not renew fast enough, damaging the shared pasture and surrounding ecosystem." Participants then responded to items using a 5-point Likert-type scale ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*) about different approaches to resource sharing belonging to three subscales: the Competition (e.g., "*It is important to me that I increase the amount of money I make*"), Altruistic Cooperation (e.g., "*It is important to me that I cooperate with all of the other farmers*"), and Ecological Cooperation subscales (e.g., "*It is important to me that I protect the ecosystem*").

Items for each respective subscale were averaged to calculate mean scale scores, with higher scores describing higher levels of competition, altruistic cooperation, and ecological cooperation. The Competition ($\alpha = 0.76$), Altruistic Cooperation ($\alpha = 0.66$), and Ecological Cooperation subscales ($\alpha = 0.87$), all had adequate internal consistency reliability in this study.

Balanced Inventory of Desirable Responding Short Form. The 16-item Balanced Inventory of Desirable Responding Short Form (BIDR-16) (Bobbio & Manganelli, 2011), which is an abridged version of the BIDR (Paulhus, 1991), was used to assess socially desirable responding. Social desirability is a response style whereby people respond to questions to make themselves look good (Paulhus, 1991). The BIDR-16 includes two factors: Self-Deceptive Enhancement (e.g., "*My first impressions of people usually turn out to be right*") and Impression Management (e.g., "*I sometimes tell lies if I have to*" [reverse-coded]).

Self-deceptive enhancement involves the unconscious tendency to perceive oneself in a positive way to protect and maintain high self-esteem. Impression management describes a conscious tendency to portray oneself in an unrealistically favorably way to others. Participants responded to items using a 7-point Likert-type response scale ranging from 1 (*Not true*) to 7 (*Very true*). Items for each respective subscale were averaged to create mean scale scores, with higher scores denoting greater self-deceptive enhancement and impression management. Both the Self-Deceptive Enhancement ($\alpha = 0.71$) and Impression Management subscales ($\alpha = 0.68$) had adequate internal consistency.

Analytic plan

Independent samples *t*-tests were used to compare differences across measured variables regarding demographic characteristics (e.g., gender). Pearson product-moment correlations were calculated to examine the bivariate associations between proenvironmental values, resource sharing tendencies within the commons dilemma, and social desirability. To assess whether key factors of social desirability (self-deceptive enhancement and impression management) were significantly influencing the associations between variables at the bivariate level, partial correlations were calculated whereby these factors of social desirability were statistically controlled for.

Fisher's *r*-to-*z* transformations were then computed using an online calculator (see Lenhard & Lenhard, 2014), which converted correlations into *z*-scores and allowed for an examination of whether the Pearson correlations were significantly different from the partial correlations (self-deceptive enhancement and impression management controlled). To test our hypothesis, three multiple regression models were run with the three types of resource sharing tendencies (competition, altruistic cooperation, and ecological cooperation) serving as the dependent variables.

The three different kinds of proenvironmental values (egoistic, altruistic, and biospheric) were entered into each model as the predictor variables. Demographic variables (gender, parental education, ethnicity, and religious status) were entered at the first step of each regression analysis to statistically control for their influence. Similarly, self-deceptive enhancement and impression management were entered at the second step of each analysis as covariates to control for their influence. The predictor variables were then entered into

the models at the third step of the analyses. The coefficient of determination (R^2) was used to assess the amount of variability that the predictors were accounting for in the outcome variables.

Results

Descriptive statistics were generated for each measured variable (see Table 1). Skewness (−1.07 to 0.40) and kurtosis statistics (−0.25 to 1.82) indicated that data approximated a normal distribution. There was a gender difference in altruistic values, $t(195) = -4.08$, $p < 0.001$, $d = 0.71$, with women ($n = 167$; $M = 5.85$, $SD = 0.82$) scoring higher than men ($n = 30$; $M = 5.14$, $SD = 1.16$). Differences regarding religious status were also found for altruistic cooperation, $t(172) = -2.58$, $p = 0.011$, $d = 0.39$, whereby religious participants scored higher ($n = 113$; $M = 3.96$, $SD = 0.60$) than nonreligious participants ($n = 61$; $M = 3.67$, $SD = 0.85$).

A difference also emerged for self-deceptive enhancement, $t(172) = 2.21$, $p = 0.029$, $d = 0.35$, with nonreligious participants ($M = 4.79$, $SD = 0.80$) scoring higher than those identifying with a mainstream religion ($M = 4.51$, $SD = 0.80$). No ethnic differences emerged between Caucasian ($n = 143$) and non-Caucasian individuals ($n = 51$) across variables. Pearson product-moment correlations showed that mean parental education did not correlate with environmental values, commons dilemma resource sharing tendencies, or the two factors comprising social desirability.

Pearson correlations showed that, despite trending in a positive direction, egoistic values did not correlate with competition (Table 1). As expected, altruistic values correlated positively with altruistic cooperation, and biospheric values correlated positively with ecological cooperation. Self-deceptive enhancement correlated positively with egoistic and biospheric values, whereas impression management correlated positively with altruistic values, altruistic cooperation, and ecological cooperation. Impression management also correlated negatively with competition. Partial correlations were then calculated to statistically control for the influence of self-deceptive enhancement and impression management. Fisher's *r*-to-*z* transformations showed that none of the Pearson correlations

Table 1. Bivariate Correlations and Descriptive Statistics for all Measures

	1	2	3	4	5	6	7	8
1. Egoistic values	–							
2. Altruistic values	0.57**	–						
3. Biospheric values	0.05	0.29**	–					
4. Competition	0.13	−0.16*	−0.22**	–				
5. Altruistic cooperation	0.15*	0.38**	0.27**	−0.41**	–			
6. Ecological cooperation	0.06	0.27**	0.53**	−0.43**	0.56**	–		
7. Self-deceptive enhancement	0.23**	0.12	0.16*	−0.02	0.13	0.10	–	
8. Impression management	0.11	0.18*	0.02	−0.29**	0.23**	0.21**	0.08	–
N	200	200	200	199	199	198	199	199
Minimum	1.50	2.00	2.67	1.00	1.00	1.00	2.38	1.14
Maximum	7.00	7.00	7.00	5.00	5.00	5.00	7.00	7.00
Range	5.50	5.00	4.33	4.00	4.00	4.00	4.63	5.86
M	5.48	5.74	5.77	2.52	3.85	4.20	4.62	3.65
SD	0.99	0.92	0.97	0.79	0.72	0.65	0.82	1.00

Correlations significant at *$p < 0.05$ and **$p < 0.01$ two-tailed.

N = sample size; *M*, sample mean; *SD*, sample standard deviation.

differed significantly from the partial correlations. Nonetheless, there was a significant positive partial correlation between egoistic values and competition, $r = 0.17$, $p = 0.019$.

Three multiple regression analyses were carried out to assess the hypothesis that the three types of proenvironmental values (egoistic, altruistic, and biospheric) would positively predict the three kinds of commons dilemma resource sharing tendencies (competition, altruistic cooperation, and ecological cooperation; see Table 2). Demographic characteristics (step 1), as well as self-deceptive enhancement and impression management (step 2) were statistically controlled for in each analysis. In the first regression model, none of the demographic variables predicted competition at the first step of the analysis. At the second step, impression management negatively predicted competition. At the third step, egoistic values positively predicted competition, which was characterized by a small to moderate effect size [$\beta = 0.20–0.50$; Ferguson (2016)]. Both altruistic and biospheric values negatively predicted competition. At the third step of the analysis, the predictor variables collectively accounted for 21% of the variance in competition scores.

For the second multiple regression model, at the first step, being affiliated with a religion positively predicted altruistic cooperation. At the second step, both self-deceptive enhancement and impression management positively predicted altruistic cooperation. At the third step, altruistic values positively predicted altruistic cooperation, which was described by a small to moderate effect size. Biospheric values also positively predicted this outcome. At the third step, the predictors collectively accounted for 25% of the variance in altruistic cooperation scores.

In the third regression model, none of the demographic variables predicted ecological cooperation. At the second step of the analysis,

Table 2. Multiple Regression Analyses with Environmental Values Predicting Commons Dilemma Resource Sharing Tendencies

	COMPETITION			ALTRUISTIC COOPERATION			ECOLOGICAL COOPERATION		
	b	*β*	*p*	*b*	*β*	*p*	*b*	*β*	*p*
Step 1									
Gender	0.05	0.02	0.792	0.14	0.07	0.388	0.12	0.07	0.396
Parental education	−0.02	−0.05	0.539	−0.02	−0.06	0.399	−0.02	−0.05	0.483
Ethnicity	0.11	0.06	0.452	0.01	0.01	0.943	−0.11	−0.07	0.354
Religious status	0.10	0.06	0.441	0.27	0.18	0.024	−0.10	−0.07	0.381
R^2	0.01			0.05			0.01		
Step 2									
SDE	0.03	0.03	0.709	0.13	0.15	0.048	0.06	0.08	0.324
IM	−0.25	−0.31	<0.001	0.14	0.20	0.010	0.14	0.22	0.005
R^2	0.10			0.11			0.07		
Step 3									
Egoistic values	0.25	0.31	<0.001	−0.09	−0.12	0.177	−0.05	−0.08	0.278
Altruistic values	−0.23	−0.27	0.005	0.27	0.34	<0.001	0.10	0.15	0.062
Biospheric values	−0.13	−0.16	0.039	0.14	0.19	0.012	0.33	0.49	<0.001
R^2	0.21			0.25			0.34		

b = unstandardized regression coefficient, *β* = standardized regression coefficient, R^2 = coefficient of determination; SDE = Self-Deceptive Enhancement; IM = Impression Management; gender coded: 0 = men, 1 = women; parental education coded 0 = some elementary to 10 = some university; ethnicity coded: 0 = Caucasian, 1 = non-Caucasian; religious status coded: 0 = nonaffiliated (agnostic, atheist, spiritual, etc.), 1 = affiliated with religion (Christianity, Taoism, Hinduism, etc.).

impression management positively predicted ecological cooperation. At the third step, only biospheric values positively predicted the outcome variable, which was characterized by a moderate effect size ($\sim\beta = 0.50$). At this third step, the predictor variables accounted for 34% of the variance in ecological cooperation scores.

For the three kinds of proenvironmental values in each multiple regression model, the tolerance statistics (0.55–0.86) fell within an acceptable range (>0.20) and variance inflation factor estimates (1.17–1.82) did not pass a problematic threshold [<5; Thompson et al. (2017)]. This suggested that multicollinearity, where independent variables are too highly correlated, was not an issue in the regression analyses.

Discussion

In support of our hypothesis, controlling for demographic variables (e.g., gender) and key factors of social desirability (self-deceptive enhancement and impression management), egoistic, altruistic, and biospheric proenvironmental values positively predicted competition, altruistic cooperation, and ecological cooperation, respectively, in the commons dilemma. This result suggests that proenvironmental values should not be approached as a unidimensional monolith within the context of ecological commons dilemmas, which some researchers have often done in the past (e.g., Smith & Bell, 1992; Sussman et al., 2016).

Given these results, educators, environmental managers, and policy makers should look for ways of promoting biospheric values to encourage the sustainable management and consumption of ecological commons. Scholars have found that nature connectedness and an ecological identity, both of which share strong positive relations with biospheric values, can be heightened through participation in environmental education programs and a greater frequency of nature contact (Bruni, Fraser, & Schultz, 2008; Kahn & Kellert, 2002; Liefländer, Fröhlich, Bogner, & Schultz, 2013; Schultz & Tabanico, 2007). Perhaps then biospheric values could be promoted and sustained through similar means.

Our results also show that it is important to control for social desirability when assessing self-reported environmental values and commons dilemma decision-making, particularly impression management. These results accord with previous work where small-to-moderate effects were found between socially desirable responding with environmental values and behavior (Milfont, 2009; Sintov & Prescott, 2011; Vilar et al., 2020). Therefore, impression management seems to exert a consistent, but subtle, impact that is relevant for environmental psychology researchers to consider in their work.

Many interacting factors likely determine why certain kinds of "green" values promote cooperative and/or ecologically sensitive resource consumption and allocation decisions. Egoistic, altruistic, and biospheric proenvironmental values are associated with a different amount of importance placed on the preservation of particular valued "objects," including the self, others, and the biosphere (Schultz, 2001). Egoistic values embody a shallow level of nature connectedness (Davis & Stroink, 2016; Schultz, 2001; Schultz, Shriver, Tabanico, & Khazian, 2004), an individualistic definition of self (Arnocky et al., 2007; Kopelman, 2009), a desire for self-enhancement (Schultz & Zelezny, 1999), and a lower likelihood of engaging in self-reported conservation behavior (Davis et al., 2019; Davis & Stroink, 2016).

Unsurprisingly, these egoistic values also promote competitive resource decision-making within ecological commons dilemmas (Arnocky & Stroink, 2011). Altruistic values represent a slightly higher degree of nature inclusivity; however, this is principally motivated by concern for other human beings, not for nature. These altruistic values appear to primarily enhance cooperation with, and concern for, the other players sharing the resource base in an ecological commons dilemma (i.e., altruistic cooperation). In contrast, biospheric values denote a deeper ecological connection to and concern for the integrity of the biosphere, which is predictive of respecting and valuing the ecological commons itself (Arnocky & Stroink, 2011).

It may be asserted that an egoistic proenvironmental value orientation could be compatible with sustaining a resource base over time to maximize personal benefits (e.g., monetary rewards). However, our results, and those found by Arnocky and Stroink (2011), indicate that egoistic values are associated with, and positively predictive of, a desire to compete; opting for relatively higher-risk decisions that place the longevity of the commons in jeopardy. Previous investigators have also found that competitive value orientations are linked to greater intentions to selfishly exploit the commons [Bonaiuto et al. (2008); see Pletzer et al. (2018) for meta-analysis].

Moreover, narcissism, a personality trait denoting elevated levels of egocentrism, is associated with greater harvesting of ecological commons, which consequently increases the probability of resource system collapse (Campbell, Bush, Brunell, & Shelton, 2005). In addition, those with extrinsic value orientations, who are more egoistic, express less empathy (Sheldon & Kasser, 1995), and tend to harvest more resources in commons dilemmas and generate less profit in the long term because they tend to exhaust the resource base (Sheldon & McGregor, 2000). Collectively, these results indicate that

egoistic proenvironmental values are unlikely to be conducive to sustainable, long-term, and ecologically sensitive natural resource decision-making.

Limitations

Several limitations of this study should be noted. Our sample was largely comprised of young adult women who were undergraduate students, which is not representative of Canadian young adults (Statistics Canada, 2019). Previous research in environmental psychology shows how women are more likely to espouse a proenvironmental orientation (Desrochers, Albert, Milfont, Kelly, & Arnocky, 2019), and to cooperate in commons dilemma games than men (Arnocky & Stroink, 2011). Furthermore, those with more education tend to express more concern for the environment [reviewed in Gifford and Nilsson (2014)], and are more likely to engage in proenvironmental behavior (Meyer, 2015). This skew in the gender and education level of the participants in our sample could, therefore, have influenced the results. Although, neither gender or mean parental education emerged as significant predictors of our commons dilemma resource sharing when entered as covariates in our multiple regression models.

The validity of the resource competition and sharing tendencies included in the SRCD (Arnocky et al., 2007) is also uncertain. As a self-report attitudinal measure, it is unclear whether it would be predictive of actual competitive, altruistic, and ecologically conscious behavior when dealing with natural resource decisions in the real world (i.e., whether it is externally valid). Using the SRCD, Arnocky and Stroink (2011) showed how competition shared a negative relation with self-reported proenvironmental behavior, whereas altruistic and ecological cooperation were positively correlated with this outcome.

These results support the convergent validity of the scale and the argument that the resource sharing tendencies measured through the SRCD (Arnocky et al., 2007), likely bear on actual ecological behavior. The items on the SRCD also explicitly ask about the reasons why respondents might or might not compete or cooperate. Often in commons dilemma research, respondent's cooperative behavior is measured, but the reasons underpinning their decisions are neglected.

It is also important to consider the relevance of the commons dilemma scenario depicted in the SRCD (Arnocky et al., 2007) for Canadian young adult undergraduate university students. We did not ask whether participants had previously worked on a farm with livestock, or about their level of knowledge regarding the sustainability of Canadian cattle farming practices. Most commons dilemma research does not involve "real common pool resource users," which limits the external validity of the results (Baur, Liechti, & Binder, 2014, p. 658).

The cattle ranching scenario described in the SRCD (Arnocky et al., 2007) also informs participants that they can earn money by having more cattle on the land. Finances can be viewed as a "need" under the category of decision-maker influences (Gifford, 2008). Questions on the SRCD ask about these financial incentives, one of which involves a general desire to acquire more money ("*It is important to me that I increase the amount of money I make*"), whereas the other signals a desire to outcompete rival farmers for financial reasons ("*It is important to me that I make more money than the other farmers*"). Someone may express a motivation to obtain more money because they need to support themselves and/or their families.

For example, most coffee plantations are located in economically developing countries where growers have poor financial returns, which promotes higher resource consumption and exacerbates the environmental impact of the activity (Chanakya & De Alwis, 2004). Simply asking participants in commons dilemmas whether they desire more money, therefore, cannot differentiate between various motives for pursuing financial gain. In contrast, asking about an inclination to make more money than rivals seems to more evidently reflect egoistic interests and less concern for the integrity of the shared natural resource pool.

Considering the aforementioned limitations, several recommendations for future empirical work can be provided. It will be advantageous to recruit a more diverse sample of Canadian young adults, as well as participants from different age groups (e.g., middle-aged adults) and cultural circumstances (e.g., the United States) to examine how generalizable the findings of this study are. Descriptive statistics for the three environmental values included in the EMS (Schultz, 2001) in this study were similar to those found in other studies on Canadian young adult university students (Arnocky et al., 2007; Arnocky & Stroink, 2011; Davis & Stroink, 2016), as well as students from other countries (Schultz et al., 2014). But how do farmers respond to these kinds of questions?

Few have explored this question empirically. In a study of middle-aged farmers (field crop producers) in Northern Serbia, Despotović et al. (2021) found similar mean scores on the Biospheric Values subscale to ours. But the standard deviation values found in this study were larger, signifying that there was more variability in the responses provided by these farmers (see also Zhang et al., 2020). Unfortunately, the two previous studies where the SRCD were used (Arnocky & Stroink, 2011; Arnocky et al., 2007) had similar sample characteristics (i.e., young adult women undergraduate students). Therefore, it would

be fruitful to recruit farmers, preferably in the cattle ranching industry, to compare their scores on the EMS (Schultz, 2001) and SRCD (Arnocky et al., 2007) with those of Canadian young adults. At the very least, it will be important for future scholars using the SRCD to assess whether participants have experience working with livestock and their level of knowledge regarding the sustainability of livestock ranching practices.

It is also necessary to establish the external validity of the SRCD (Arnocky et al., 2007). The SRCD could be used in conjunction with experimental approaches, such as the virtual fishing game FISH (Gifford & Gifford, 2000; Gifford & Wells, 1991), to examine if defection and selfish harvesting positively correlates with scores on the Competition subscale. The same approach could be used to see if the Altruistic and Ecological Cooperation subscales of the SRCD map onto cooperative and ecological minded resources consumption behavior, respectively. Given that competition for monetary resources can be underpinned by different motivations, such as to support one's family or for avarice, it may be advantageous to expand on the item content of the Competition subscale of the SRCD to get at this nuance. Alternatively, the instructions on the SRCD could be varied to emphasize to participants that the monetary competition is out of financial need, or for the purpose of greed.

Conclusion

Studying how people navigate conflicts between self-interested, prosocial, and ecocentric natural resource consumption decisions requires an interdisciplinary and multimethod approach that honors the complexity of these dilemmas (Chen & Gifford, 2015). From an environmental psychological perspective, intrapersonal factors such as goals, values, and aspirations have been shown to impact cooperative behavior within commons dilemma scenarios (Gifford, 2006). Proenvironmental values can promote cooperation in ecological commons dilemmas (Sussman et al., 2016); however, not all types of proenvironmental values are associated with cooperative and ecologically minded behavior (Arnocky & Stroink, 2011; Davis & Stroink, 2016).

In this study, controlling for demographic factors (e.g., gender) and keys facets of social desirability (e.g., impression management), we showed that particular kinds of proenvironmental values organized around the self, other people, and the biosphere (Schultz, 2001), differentially predicted care for and respect of the cattle and grazing land in an ecological commons dilemma. Further studying means of fostering sustainable and environmentally sensitive resource allocation decisions will help to mitigate the anthropogenic damage caused to the biosphere through the careless extraction and consumption of natural resources.

Authors' Contributions

A.C.D. submitted the research proposal to ethics, collected the data, conducted the analyses, wrote the article draft, and carried out the changes recommended by the editor and reviewers. S.A. and M.L.S. helped to write and edit the article.

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