



Dimensions of social dominance and their associations with environmentalism[☆]



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ABSTRACT

Individual differences in the preference for group-based hierarchy and inequality, as indexed by social dominance orientation (SDO), have been shown to predict environment-relevant variables. To date the literature examining the SDO–environmentalism link has used the traditional unidimensional conceptualisation of SDO. This article reports three studies using the new measurement and conceptualisation of SDO that involves the SDO₇ scale and the sub-dimensions of intergroup dominance (SDO-D) and intergroup anti-egalitarianism (SDO-E). SDO-D entails support for group-based dominance achieved via overt oppression and aggressive intergroup behaviour, and SDO-E entails support for group-based inequality subtly achieved via unequal distribution of resources. Our results show anti-egalitarianism to be the main SDO sub-dimension related to environmentalism. While SDO-D is either a weaker or non-significant predictor, individuals with high levels of SDO-E were less willing to make personal sacrifices for the environment, value environmental protection and endorse climate change beliefs. Interestingly, neither facet of SDO predicted change in environmentalism over a five-month period; but climate change denial predicted change in SDO-E while pro-environmental attitudes predicted change in SDO-D over time.

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1. Introduction

Social dominance theory is a prominent intergroup relations theory that focuses on individuals' attitudes about inequality between social groups (Pratto, Sidanius, Stallworth, & Malle, 1994; Sidanius & Pratto, 1999). Social dominance orientation (SDO) is a measure of this attitudinal support for inequality and hierarchical relations between groups in society. SDO is a powerful predictor of intergroup attitudes and behaviours, including prejudice against derogated social groups (e.g., unemployed people, psychiatric patients; Cantal, Milfont, Wilson, & Gouveia, 2015) and beliefs and policies supporting greater levels of group-based inequalities (e.g., political conservatism, internal attributions for poverty, opposition to social welfare and affirmative action; Kteily, Ho, & Sidanius, 2012; Sidanius & Pratto, 1999).

Beyond its explanatory power of a wide array of variables relevant to intergroup relations, an increasing number of recent studies have demonstrated the importance of SDO in understanding human–nature interactions. These studies show that individual levels of SDO not only

predict intergroup attitudes and behaviours but also attitudes and behaviours directed towards the natural environment. In particular, research has shown that individuals high in SDO are less likely to value preserving nature (Milfont, Richter, Sibley, Wilson, & Fischer, 2013) and less likely to believe that humans should live harmoniously with nature (Jackson, Bitacola, Janes, & Esses, 2013). High-SDO individuals are also more likely to deny the reality of climate change and its human causes (Häkkinen & Akrami, 2014; Jylhä & Akrami, 2015; Milfont et al., 2013, Study 4), and to be more supportive of environmental exploitation when this benefits their in-group (Milfont & Sibley, 2014). Research has also shown SDO to predict other environment-relevant variables such as meat consumption (Allen, Wilson, Ng & Dunne, 2000) and exploitation of animals (Dhont & Hodson, 2014).

Besides its relationship with environment-relevant attitudes and behaviours, research has shown that SDO helps explain well-established findings in the environmental psychology literature. While political affiliation is one of the strongest predictors of climate change denial (Hornsey, Harris, Bain & Fielding, 2016), SDO mediates the influence of political orientation on denial (Jylhä, Cantal, Akrami, & Milfont, 2016), suggesting that support for group-based inequality might partially explain conservatives' opposition to climate change. Moreover, SDO mediates the well-known gender difference in environmentalism, indicating that men tend to be less concerned about environmental problems because men generally have higher levels of SDO (Milfont & Sibley, 2016).

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These recent studies have demonstrated the critical role SDO plays, not only in understanding human–human interactions, but also in understanding human–nature interactions, and in particular human-based hierarchical views towards the natural environment. However, studies examining the predictive role of SDO on environment-relevant variables have so far examined SDO as a unidimensional construct. A recent advancement of social dominance theory is the separation of SDO into two specific sub-dimensions: support for intergroup dominance (SDO-D) and support for intergroup anti-egalitarianism (SDO-E). In the current article, we contribute to this literature by examining the extent to which the sub-dimensions of SDO differentially predict measures of environmentalism.

1.1. SDO sub-dimensions and environmentalism

SDO research has recently argued for the theoretically important and empirically sound separation of SDO into the distinct sub-dimensions of SDO-D and SDO-E (e.g., Bergh, Sidanius, & Sibley, 2015; Ho et al., 2012; Ho et al., 2015; Jost & Thompson, 2000). In the context of intergroup relations, SDO-D relates to overt racism and aggression towards other groups in which dominant groups actively oppress subordinate groups. In contrast, SDO-E is associated with beliefs that legitimize this inequality and more passive resistance of policies that aim to redistribute social power. As detailed by Ho et al. (2015), “Whereas individuals high on SDO-D prefer dominance hierarchies where high power groups oppress and subjugate low power groups, and are willing to achieve this form of inequality by use of very aggressive measures, individuals high on SDO-E prefer hierarchies where resources are inequitably distributed, and which can be defended by anti-egalitarian ideologies.” (p. 1022).

To our knowledge, no research to date has broadened the two-dimensional SDO approach in relation to environmentalism. However, there is reason to think that the dimensions may relate differently to environmental attitudes. Although measurement of SDO was developed to probe attitudes towards intergroup relations, SDO generalizes to non-human relationships, specifically the relationship between humans and the natural environment (Milfont et al., 2013). Either aspect of SDO could feasibly drive this association. For example, lower concern for the environment might be related to SDO-D because of a preference for human dominance over nature, or be related to SDO-E because of a preference for the hierarchical distribution of natural resources.

Indeed, recent theorising regarding the distinction between the SDO sub-dimensions and past research on the SDO–environmentalism link allows us to make preliminary predictions on the differential associations between the SDO sub-dimensions and environment-relevant variables. Relative to SDO-E, SDO-D is a stronger predictor of intergroup dominance and support for aggressive and violent attitudes towards low status groups. Previous findings and theoretical argumentations suggest that SDO-D would be the stronger predictor of environment-relevant variables for at least three reasons. First, the dominance label describing SDO-D could be linked to the “dominant social paradigm” expressing the view that the natural world was created for the benefit of humankind (Pirages & Ehrlich, 1974). Likewise, the intergroup dominance indexed by SDO-D could be translated into human dominance over nature (see Milfont et al., 2013). Finally, the oppressive aspect of SDO-D could emerge in environment-relevant preferences and decision making. For example, Jackson et al. (2013, Study 4) found that when given the choice, high-SDO individuals prefer to direct environmental hazards associated with a manufacturing plant to countries with low economic standing, even though the resources from the plant benefit their own social group. Consistent with a dominance view of SDO, hierarchy is achieved in this context through oppressing a group of lower power and status.

Notwithstanding these perspectives linking environmentalism more strongly with SDO-D, we would tentatively argue that the combined empirical evidence and recent theoretical development suggest that SDO-E is in fact the stronger predictor of environment-relevant

variables. Notably, SDO-E is a stronger predictor than SDO-D of support for the unequal distribution of resources and opposition to policies that promote greater equality (Ho et al., 2015). This support for unequal distribution of resources indexed by SDO-E has been observed in the context of environmental research. Milfont and Sibley's (2014) hierarchy enhancing hypothesis of environmental exploitation correctly predicted that SDO relates to environmental exploitation when this leads to a widening of the gap between high- and low-status social groups. Indeed, they showed that SDO predicts support for a mining operation only when the operation results in increased social inequality, thus allocating the high-status group a disproportionate amount of natural resources. Jackson et al. (2013, Study 2) similarly found that SDO predicts exploitation only when one's own country benefits. Hence, both of these studies allude to a more anti-egalitarian take on the SDO–environmentalism link, where hierarchy is maintained through unequal resource distribution.

This conclusion that SDO-E is the main predictor of environment-relevant variables is also consistent with other findings relating the SDO sub-dimensions and individual differences. Compared to SDO-D, SDO-E had overall stronger negative associations with political conservatism, empathic concerns and harm/care and fairness/reciprocity dimensions of morality (Ho et al., 2015). Previous research has shown that political conservatism is one main negative predictor of climate change denial (Hornsey et al., 2016; Milfont, Milojev, Greaves, & Sibley, 2015), and both empathic orientations (Milfont & Sibley, 2016) and moral concerns related to harm and care (Feinberg & Willer, 2013) are positively associated with pro-environmental attitudes. These patterns of associations lead to an expectation that SDO-E is negatively associated and a stronger predictor of environment-relevant variables compared to SDO-D.

1.2. The present study

Recent findings demonstrate the usefulness of the distinct components of SDO in predicting intergroup attitudes and behaviour. We extend this literature into the environmental domain. Our main goal was to examine whether the SDO sub-dimensions differentially relate to environment-relevant variables. Using SDO-D and SDO-E will help tease out the main distinct aspects of SDO related to environmentalism by showing which of the sub-dimensions is the main driver of environmental exploitation. Based on previous findings, we expect that the SDO–environmentalism link will be mainly driven by SDO-E rather than SDO-D, which would suggest an anti-egalitarianism motive rather than a simple dominance motive towards the natural environment.

In addition to establishing which SDO sub-dimension is more strongly associated with environment-relevant variables, a secondary goal of our study is to provide further evidence of the psychometric properties of the new SDO₇ measure in a distinct national and socio-political context (cf. Ho et al., 2015, p. 1024). This measure addresses methodological issues of the SDO₆ scale by providing balanced measures of SDO-D and SDO-E (Ho et al., 2012; Ho et al., 2015).

We report three studies examining our research goals, first examining the factor structure of SDO and then its association with environment-relevant variables. In Study 1, we use items from the SDO₆ to test our prediction that the two-factor model provides a better fit to the data than the conventional unidimensional model of SDO. We then use the SDO₇ in Studies 2 and 3 to replicate the findings reported by Ho et al. (2015) that a four-factor model—with two substantive factors (SDO-D and SDO-E) and two method factors (pro-trait and con-trait)—provides better fit to the data when compared to alternative models.

For the concurrent associations between SDO dimensions and environmentalism in Studies 1 to 3, we expect SDO-E to be more strongly related to environment-relevant variables than SDO-D. Study 3 also tests the longitudinal associations between the SDO sub-dimensions and environmentalism. Given that SDO is thought to be relatively stable and a

cause of prejudice (Sidanius & Pratto, 1999), we expect SDO to predict changes in environment-relevant variables, indicating that SDO may lead to an increase in climate change denial and decrease of pro-environmental attitudes over time.

2. Study 1

Our main aim is to examine whether environment-relevant variables are differentially predicted by SDO-D and SDO-E. As an initial test, Study 1 uses data from the 2009 New Zealand Attitudes and Values Study (NZAVS). These data were previously used to test the predictive utility of the SDO-D and SDO-E aspects of SDO in predicting socio-political attitudes (Bergh et al., 2015). Here we focus on their predictive utility regarding environment-relevant variables, and the data have the advantages of a large, nationally representative sample and the inclusion of multiple measures of environmentalism.

2.1. Participants and procedure

We included participants who responded to the NZAVS in 2009. Invitations to participate in a mail-based survey were sent to people randomly sampled from the New Zealand Electoral Roll. This study includes 6516 participants (59% female), which were on average 48 years old ($M = 48.09$, $SD = 15.75$). Furthermore, 79% of participants were born in New Zealand and the majority (86%) identified as New Zealand European. Full details about the sample, including the procedure, retention rates, and demographics of participants, are available on the NZAVS website.

2.2. Measures

2.2.1. Social dominance orientation

In the present study SDO was assessed using six items from the SDO₆ scale (Sidanius & Pratto, 1999). Three items favoured Dominance (e.g., “To get ahead in life, it is sometimes okay to step on other groups”), and three favoured egalitarianism (e.g., “We should have increased social equality”). Participants rated the extent to which they agreed with each item on a 7-point Likert scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*).

2.2.2. Environmentalism

Four measures of environmentalism were included in the present study. *Climate change belief* was assessed with the items “climate change is real” and “climate change is caused by humans”, and participants rated these items on the same 7-point agreement scale. Liu and Sibley's (2012) environmental sacrifice items assessed both willingness to make sacrifices for the environment and actually having made sacrifices and changes for the environment. Two items assessed *willingness to sacrifice* (e.g., “Are you willing to change your daily routine in order to protect the environment?” and “Are you willing to make sacrifices to your standard of living (e.g. accept higher prices, drive less, conserve energy) in order to protect the environment?”). These items are reworded to assess having *made sacrifices* by changing the willingness stem to “Have you made changes” and “Have you made sacrifices”, respectively. Participants responded to these items on a 7-point Likert-type scale from 1 (*definitely no*) to 7 (*definitely yes*), with a midpoint of 4 signifying ‘maybe’. *Environmental value* was assessed using a single item from Schwartz' (1992) value scale. This value item was administered with other value items with the instructions: “Please circle the number that best represents how important each of the following values is for you as a guiding principle in your life.” Participants rated the importance of “Protecting the environment (preserving nature)” as a guiding principle in their life on a scale ranging from –1 (opposed to my values) to 0 (not important) to 3 (important) to 6 (very important) to 7 (of supreme importance).

2.3. Statistical analysis

For all studies presented in this paper, the measures were part of omnibus surveys including other measures used for other research. Bergh et al. (2015) used the Study 1 dataset to demonstrate that the dimensions of SDO differentially predict intergroup relations. We thus followed their method of using a robust maximum likelihood estimator for all structural equation modelling analyses in this paper, which was constructed in Mplus (version 7.3, Muthén & Muthén, 1998–2010).

A number of indices were used to evaluate the goodness of fit of the tested models: the chi-square test statistic (χ^2), the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). Satisfactory fit is indicated by a CFI value above 0.95, an RMSEA value below 0.06, and an SRMR value below 0.08 (Hu & Bentler, 1999). When comparing the relative goodness of fit of nested models, the accepted model is the one that show lower values for the Akaike Information Criterion (AIC), and significant improvements in the Satorra-Bentler scaled chi-square difference (scaled $\Delta\chi^2$) test, which is mean adjusted to approximate the chi-square under conditions of non-normality (Muthén & Muthén, 2005).

In Study 1, we checked whether the two-factor model of SDO has superior fit compared to the unidimensional model. For the one-factor model, all SDO items load to form a unitary construct. For the two-factor model, SDO-E items load to form one factor and SDO-D items load to form the second factor, with the latent factors allowed to correlate. We also used Mplus to assess the relationships between SDO-D, SDO-E, and environmentalism using path models. The path models were constructed with the latent factors of SDO-D and SDO-E predicting latent factors of our environmental variables (aside from environmental value, which was measured using a single item).

2.4. Results and discussion

Table 1 shows indices of model fit for all confirmatory factor analysis conducted for the three studies presented in this paper. The two-factor model in Study 1 provided a significantly better fit to the data than the one-factor model, scaled $\Delta\chi^2(1) = 425.22$, $p < 0.001$. Table 2 presents the descriptive statistics and correlations between the measures, and Cronbach's alphas for each scale, which demonstrate acceptable reliability.

Our path model demonstrated acceptable fit ($\chi^2(51) = 747.26$, $p < 0.001$, RMSEA = 0.05, CFI = 0.96, SRMR = 0.03). Because of the large sample size of the NZAVS, we used a conservative p -value of 0.01 to assess statistical significance. Fig. 1 shows that SDO-E was the stronger predictor of environmentalism.

Specifically, SDO-E is a stronger predictor than SDO-D of willingness to make sacrifices for the environment (SDO-E: $\beta = -0.30$, $p < 0.001$, 95% CI [–0.34, –0.25]; SDO-D: $\beta = -0.07$, $p = 0.004$, 95% CI [–0.12, –0.02]), reporting having made sacrifices for the environment (SDO-E: $\beta = -0.20$, $p < 0.001$, 95% CI [–0.24, –0.15]; SDO-D: $\beta = -0.09$, $p < 0.001$, 95% CI [–0.14, –0.04]), the environmental value of ‘protecting nature’ (SDO-E: $\beta = -0.23$, $p < 0.001$, 95% CI [–0.27, –0.20]; SDO-D: $\beta = -0.03$, $p = 0.212$, 95% CI [–0.07, 0.02]), and climate change belief (SDO-E: $\beta = -0.39$, $p < 0.001$, 95% CI [–0.43, –0.34]; SDO-D: $\beta = 0.08$, $p = 0.002$, 95% CI [–0.03, 0.12]). As a formal test of which dimension is the stronger predictor, we report results of Wald tests in the Supplementary Material. These tests show that SDO-E is a significantly stronger predictor than SDO-D of all environmental variables except having made sacrifices for the environment.

These findings provide a clear indication that the associations between SDO and environment-relevant variables observed in past studies are primarily driven by opposition to equality between groups, and to a lesser extent dominance. However, Study 1 is limited in using a shortened version of the SDO₆ scale, which is conflated with wording direction, meaning that all SDO-D items are pro-trait and all SDO-E items

Table 1
Model fit for the competing models in each study.

	χ^2	df	CFI	AIC	RMSEA	90% CI RMSEA	SRMR
Study 1							
One-factor model	761.32	9	0.84	135,887.32	0.11	[0.11, 0.12]	0.07
Two-factors model	135.33	8	0.97	135,041.03	0.05	[0.04, 0.06]	0.03
Study 2							
One-factor model	421.30	104	0.86	26,412.34	0.08	[0.07, 0.09]	0.06
Two-substantive-factors model	284.83	103	0.92	26,230.84	0.06	[0.05, 0.07]	0.05
Two-method-factors model	297.14	103	0.92	26,248.35	0.06	[0.05, 0.07]	0.05
Four-factors model	150.81	86	0.97	26,036.22	0.04	[0.03, 0.05]	0.03
Study 3 (Time 1)							
One-factor model	374.59	104	0.90	36,484.34	0.06	[0.06, 0.07]	0.05
Two-substantive-factors model	268.84	103	0.94	36,354.40	0.05	[0.04, 0.06]	0.04
Two-method-factors model	321.07	103	0.92	36,419.50	0.06	[0.05, 0.06]	0.04
Four-factors model	122.56	86	0.99	36,203.07	0.03	[0.01, 0.04]	0.02

Note. χ^2 = chi-square, df = degrees of freedom, CFI = comparative fit index, RMSEA = root mean square approximation, 90% CI RMSEA = confidence interval around RMSEA of the change in fit between models, AIC = Akaike Information Criterion, SRMR = standardized root mean square residual.

are con-trait. It is thus possible that wording direction and the particular subset of SDO-D and SDO-E items included could influence the pattern of results. We conducted Study 2 to replicate these initial findings using a SDO scale especially developed to measure the SDO-D and SDO-E dimensions: the SDO₇.

3. Study 2

Study 2 uses data from a convenience sample of undergraduate students, with the benefit of a reasonably large sample and the use of full-scale measures of each dimension of the SDO₇ (Ho et al., 2012). Study 2 uses the same environment-relevant variables as in Study 1, and we predict that a similar pattern of results will emerge: SDO-E will be a superior predictor of environmentalism.

3.1. Method

3.1.1. Participants and procedure

Participants were 504 students taking introductory psychology at Victoria University of Wellington. Students signed up for this study through their participation online, gaining partial credit towards their required participation hours. Ethical approval was obtained from the School of Psychology Human Ethics Committee before data were collected.

3.1.2. Materials

Measures were embedded in an online study with several unrelated surveys. Each survey was presented in a randomized order, with the

order of each question within each survey also randomized. *Social dominance orientation* was measured using the full Ho et al. (2012) SDO₇ scale. Eight items measured SDO-D (pro-trait: "Having some groups on top really benefits everybody"; con-trait: "No one group should dominate in society"), and eight items measured SDO-E (pro-trait: "We should not push for group equality"; con-trait: "Group equality should be our ideal"). We assessed environmentalism using the same measures of environmental sacrifice, environmental value, and climate change belief as in Study 1.

3.2. Results and discussion

In Studies 2 and 3, we used the SDO₇ and we compared four models following Ho et al. (2015): a one-factor model, a two-factor model composed of substantive factors (SDO-D and SDO-E), a two-factor model composed of method factors (pro-trait and con-trait), and a four-factor model composed of two substantive and two method factors.

The confirmatory factor analysis results for Study 2 are also reported in Table 1. Replicating the findings by Ho et al. (2015), the four-factor model comprising two substantive and two method factors provide the best fit to the data, and provided a significantly better fit to the data than the one-factor model, scaled $\Delta\chi^2(1) = 71.52, p < 0.001$. The findings thus support the separation of SDO into specific sub-dimensions. Table 3 presents the descriptive statistics and correlations between the measures. Cronbach's alphas for each scale demonstrate acceptable reliability.

Again, we constructed our model in Mplus with the latent variables SDO-D and SDO-E predicting our four environmental variables (see Fig. 2).

Table 2
Descriptive statistics, and correlation matrix between mean scores of each variable in Study 1.

	Mean	SD	1.	2.	3.	4.	5.	6.
1. SDO-D	2.43	1.16	α					
	[2.41, 2.46]	[1.13, 1.18]	0.54					
2. SDO-E	2.76	1.19	0.34***	α				
	[2.73, 2.79]	[1.17, 1.22]	[0.32, 0.37]	0.76				
3. Climate belief	5.09	1.49	-0.08***	-0.26***	α			
	[5.05, 5.13]	[1.46, 1.51]	[-0.11, -0.05]	[-0.28, -0.23]	0.70			
4. Made sacrifices	4.69	1.55	-0.12***	-0.18***	0.28***	α		
	[4.85, 4.92]	[1.53, 1.58]	[-0.15, -0.09]	[-0.21, -0.15]	[0.25, 0.30]	0.77		
5. Willing to sacrifice	4.89	1.40	-0.15***	-0.25***	0.38***	0.70***	α	
	[4.85, 4.92]	[1.38, 1.42]	[-0.18, -0.12]	[-0.28, 0.23]	[0.36, 0.41]	[0.68, 0.72]	0.76	
6. Environmental value	5.12	1.55	-0.10**	-0.21***	0.30***	0.39***	0.46***	α
	[5.13, 5.20]	[1.52, 1.58]	[-0.13, -0.08]	[-0.24, -0.19]	[0.28, 0.33]	[0.37, 0.42]	[0.43, 0.48]	N/A

Note. Numbers in square brackets are 95% confidence intervals based on bootstrapping of 1000 iterations. SDO-D = dominance sub-dimension of SDO. SDO-E = anti-egalitarian sub-dimension of SDO. Along the diagonal are Cronbach's alphas for the scales.

** $p < 0.01$.

*** $p < 0.001$.

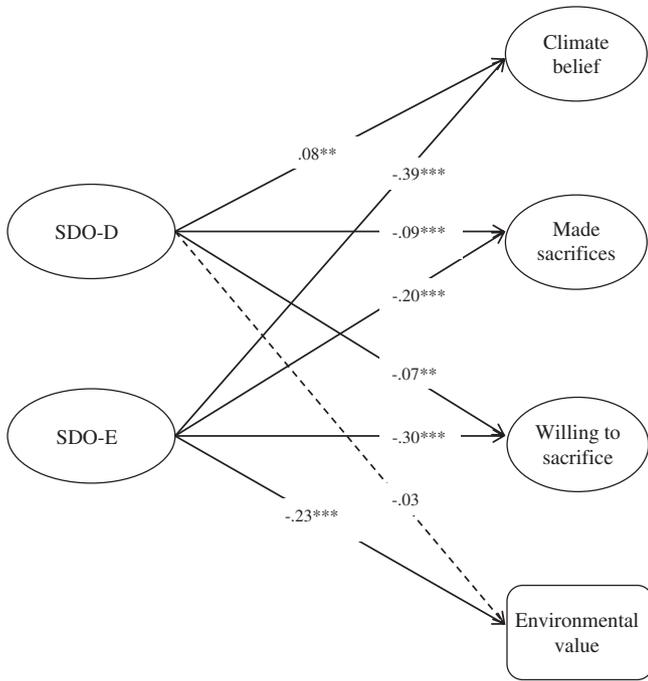


Fig. 1. SDO-D and SDO-E predicting environmental variables in Study 1. Note. Solid lines show significant paths (** $p < 0.01$, *** $p < 0.001$) and dashed lines non-significant paths ($p > 0.01$).

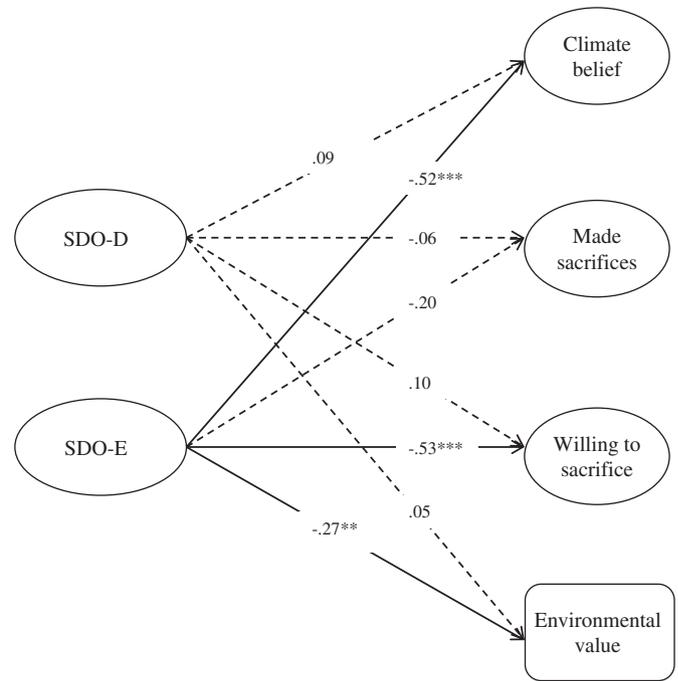


Fig. 2. SDO-D and SDO-E predicting environmental variables in Study 2. Note. Solid lines show significant paths (** $p < 0.01$, *** $p < 0.001$) and dashed lines non-significant paths ($p > 0.01$).

This model demonstrated adequate fit ($\chi^2(216) = 474.55, p < 0.001$, RMSEA = 0.05, CFI = 0.94, SRMR = 0.05). The findings replicate those observed in Study 1, with SDO-E being an overall stronger predictor of environmentalism than SDO-D. In fact, SDO-D does not significantly predict any of our environmental measures. Specifically, SDO-E significantly predicts willingness to sacrifice for the environment ($\beta = -0.53, p < 0.001$, 95% CI [-0.74, -0.32]), endorsement of the value of protecting the environment ($\beta = -0.27, p = 0.007$, 95% CI [-0.47, -0.08]) and climate change belief ($\beta = -0.52, p < 0.001$, 95% CI [-0.72, -0.32]), and is a marginally significant predictor of having made sacrifices for the environment ($\beta = -0.20, p = 0.079$, 95% CI [-0.42, 0.02]). SDO-D was a significantly stronger predictor than SDO-D for willingness to make sacrifices for the environment and climate change belief, but only a marginally better predictor of environmental value, and did not differentially predict having made sacrifices (see Supplementary Material).

Taken together, Studies 1 and 2 show that SDO-E is the key facet of SDO that relates to environmentalism. This means that the underlying

social dominance motive related to environmentalism centers on opposition to equality between groups. Although both studies suggest that SDO-E is a more likely driver of the SDO–environmentalism link than SDO-D, these studies are based on cross-sectional data. Study 3 aimed to address this limitation by providing a first examination on how these variables relate over time.

4. Study 3

In Study 3, we extend our initial findings using a short-term longitudinal dataset. This allows us to consider relationships between SDO-D, SDO-E and environmentalism both concurrently and longitudinally within the same dataset. In particular, we investigate the longitudinal relationships between the SDO sub-dimensions and environmentalism with a cross-lagged panel design in which the variables were measured at two points in time. Given that the associations presented in this paper thus far have shown that the two dimensions of SDO differentially

Table 3
Descriptive statistics, and correlation matrix between mean scores of each variable in Study 2.

	Mean	SD	1.	2.	3.	4.	5.	6.
1. SDO-D	2.87	1.04	α					
	[2.78, 2.96]	[0.99, 1.09]	0.83					
2. SDO-E	2.59	1.02	0.74***	α				
	[2.50, 2.68]	[0.96, 1.08]	[0.69, 0.78]	0.85				
3. Climate belief	6.21	0.93	-0.29***	-0.35***	α			
	[6.12, 6.28]	[0.83, 1.04]	[-0.38, -0.20]	[-0.43, -0.27]	0.75			
4. Made sacrifices	4.41	1.44	-0.16***	-0.22***	0.27***	α		
	[4.29, 4.53]	[1.35, 1.52]	[-0.25, -0.06]	[-0.31, -0.12]	[0.19, 0.36]	0.84		
5. Willing to sacrifice	5.24	1.20	-0.28***	-0.39***	0.38***	0.68***	α	
	[5.14, 5.35]	[1.11, 1.30]	[-0.36, -0.19]	[-0.47, -0.30]	[0.28, 0.48]	[0.61, 0.74]	0.86	
6. Environmental value	4.65	1.67	-0.15**	-0.22***	0.28***	0.56***	0.64***	α
	[4.50, 4.80]	[1.57, 1.77]	[-0.23, -0.06]	[-0.30, -0.12]	[0.19, 0.38]	[0.48, 0.62]	[0.56, 0.69]	N/A

Note. Numbers in square brackets are 95% confidence intervals based on bootstrapping of 1000 iterations. SDO-D = dominance sub-dimension of SDO. SDO-E = anti-egalitarian sub-dimension of SDO. Along the diagonal are Cronbach's alphas for the scales.

** $p < 0.01$.
*** $p < 0.001$.

predict environmentalism, we expect to find that SDO-E will exert a longitudinal effect on environmentalism, but SDO-D will not.

4.1. Method

4.1.1. Participants and procedure

Participants were 674 students (77% female; mean age = 18.7 years) taking introductory psychology at Victoria University of Wellington. Participants completed the survey at two time points separated by five months.

4.1.2. Measures

Social dominance orientation was assessed with Ho et al.'s (2012) measure as in Study 2. Environmentalism was measured with two distinct measures. The 12-item New Ecological Paradigm (NEP) Scale assessed general pro-environmental attitudes (Dunlap & Van Liere, 1978). Two items assessed denial of climate change: "Climate change is an entirely natural phenomenon – human action does not contribute importantly to it" and "Any changes in global climate simply reflects naturally occurring variation". These items were highly correlated (Time 1, $r = 0.64$, 95% CI [0.59, 0.70]; Time 2, $r = 0.70$, 95% CI [0.64, 0.75]) and were then averaged to form a denial measure. Participants rated the items of all three measures on a 7-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

4.2. Results and discussion

As shown in Table 1, the four-factor model had better fit to the data and provided a significantly better fit to the data than the one-factor model, scaled $\Delta\chi^2(1) = 58.84$, $p < 0.001$, supporting the view that separating SDO into two sub-dimensions is empirically meaningful. Table 4 presents the descriptive statistics and correlations between the measures and shows that all variables relate in expected directions. Also in Table 4 are Cronbach's alphas for the scales, which demonstrate acceptable reliability.

We first examined the cross-sectional associations between the variables at each time point using the same model-building approach as in Studies 1 and 2. The detailed results are reported in the Supplementary Material. Overall, both cross-sectional models showed good fit to the data and confirmed our previous findings. At the same time, there were some distinctions worth noting regarding the environmentalism measures. For pro-environmental attitudes, SDO-E was a stronger and statistically significant predictor than SDO-D in both time points, but predicted climate change denial only at Time 2. SDO-D did not significantly predict either environmental variable at either time point.

Given that the measure used to index pro-environmental attitudes (the NEP Scale) comprised several items tapping human dominance over nature, it is perhaps surprising that SDO-E and *not* SDO-D is a significant predictor. On closer inspection, the measure also includes items that relate more to equality between humans and non-humans (e.g., "Plants and animals have as much right as humans to exist"), which high SDO-E would likely strongly disagree with.

We then examined the longitudinal associations between all variables across time points. The cross-lagged model shown in Fig. 3 yielded appropriate fit ($\chi^2(1652) = 3445.55$, $p < 0.001$, RMSEA = 0.04, CFI = 0.87, SRMR = 0.06). The first finding of this model is that each variable remains significantly stable over time as indicated by the auto-regressive paths—SDO-D: $\beta = 0.85$, $p < 0.001$, 95% CI [0.69, 1.01]; SDO-E: $\beta = 0.32$, $p < 0.001$, 95% CI [0.15, 0.50]; Denial $\beta = 0.60$, $p < 0.001$, 95% CI [0.50, 0.69]; NEP: $\beta = 0.73$, $p < 0.001$, 95% CI [0.65, 0.81]. This suggests that people mostly retain their levels of ideology and environmentalism over the five-month interval.

It is worth noting that SDO-E exhibits the weakest stability coefficient based on its auto-regression in Fig. 3; however, without accounting for shared variance with SDO-D, SDO-E at Time 1 is strongly correlated to SDO-E at Time 2 ($r = 0.63$). Indeed, when a similar cross-lagged model was run considering SDO-E and the environmentalism measures but removing SDO-D, the auto-regressive path for SDO-E was strong: $\beta = 0.60$, $p < 0.001$, 95% CI [0.53, 0.68]. These results suggest that the stability of SDO-E in the longitudinal model depicted in Fig. 3 is accounted for by SDO-D and the covariance between SDO-E and SDO-D. This is evident in the cross-lagged relationships, where SDO-D predicts change in SDO-E ($\beta = 0.34$, $p < 0.001$, 95% CI [0.17, 0.51]), yet SDO-E does not predict change in SDO-D ($\beta = -0.10$, $p = 0.269$, 95% CI [-0.27, 0.08]).

Contrary to the concurrent associations and our predictions, neither facet of SDO exhibits longitudinal effects on environmentalism. Instead, environmentalism predicts change in SDO: higher levels of climate change denial were related to higher levels of SDO-E at a later point in time ($\beta = 0.09$, $p = 0.039$, 95% CI [0.01, 0.17]), and higher levels of pro-environmental attitudes were related to lower levels of SDO-D at a later point in time ($\beta = -0.10$, $p = 0.017$, 95% CI [-0.18, -0.02]). This is surprising as SDO is expected to be more stable and trait-like, and precede attitudes and beliefs, and could have been due to the large stability coefficients for most of the variables.

To further examine this surprising finding, we run separate path models, one with the SDO sub-dimensions measured at Time 1 predicting the environmentalism measures at Time 2 and another with the Time 1 environmentalism measures predicting the SDO sub-dimensions at Time 2. We also investigated the cross-lagged model

Table 4
Descriptive statistics, and correlation matrix between mean scores of each variable in Study 3.

	Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.
1. SDO-D T1	2.99	1.04	α							
	[2.90, 3.07]	[0.99, 1.09]	0.78							
2. SDO-E T1	2.59	0.99	0.71***	α						
	[2.51, 2.67]	[0.93, 1.04]	[0.66, 0.75]	0.81						
3. NEP T1	5.24	0.75	-0.23***	-0.29***	α					
	[5.27, 5.30]	[0.72, 0.79]	[-0.32, 0.15]	[-0.38, -0.20]	0.78					
4. Denial T1	2.89	1.39	0.25***	0.24***	-0.33***	α				
	[2.78, 3.01]	[1.30, 1.46]	[0.16, 0.33]	[0.16, 0.32]	[-0.41, -0.25]	0.78				
5. SDO-D T2	3.06	1.08	0.72***	0.61***	-0.28***	0.27***	α			
	[2.97, 3.15]	[1.03, 1.13]	[0.67, 0.76]	[0.56, 0.67]	[-0.36, -0.20]	[0.19, 0.34]	0.83			
6. SDO-E T2	2.71	1.04	0.59***	0.63***	-0.27***	0.27***	0.76***	α		
	[2.63, 2.80]	[0.99, 1.09]	[0.52, 0.64]	[0.57, 0.68]	[-0.35, -0.18]	[0.18, 0.36]	[0.73, 0.80]	0.86		
7. NEP T2	5.27	0.86	-0.27***	-0.31***	0.71***	-0.32***	-0.39***	-0.38***	α	
	[5.20, 5.34]	[0.83, 0.90]	[-0.35, -0.19]	[-0.38, -0.23]	[0.66, 0.75]	[-0.40, -0.25]	[-0.46, -0.32]	[-0.46, -0.29]	0.85	
8. Denial T2	2.76	1.36	0.24***	0.22***	-0.35***	0.58***	0.37***	0.37***	-0.47***	α
	[2.65, 2.87]	[1.28, 1.44]	[0.16, 0.32]	[0.13, 0.30]	[-0.43, -0.28]	[0.50, 0.65]	[0.29, 0.44]	[0.29, 0.45]	[-0.53, -0.41]	0.82

Note. Numbers in square brackets are 95% confidence intervals based on bootstrapping of 1000 iterations. SDO-D = dominance sub-dimension of SDO. SDO-E = anti-egalitarian sub-dimension of SDO. NEP = new environmental paradigm scale. Along the diagonal are Cronbach's alphas for the scales.

*** $p < 0.001$.

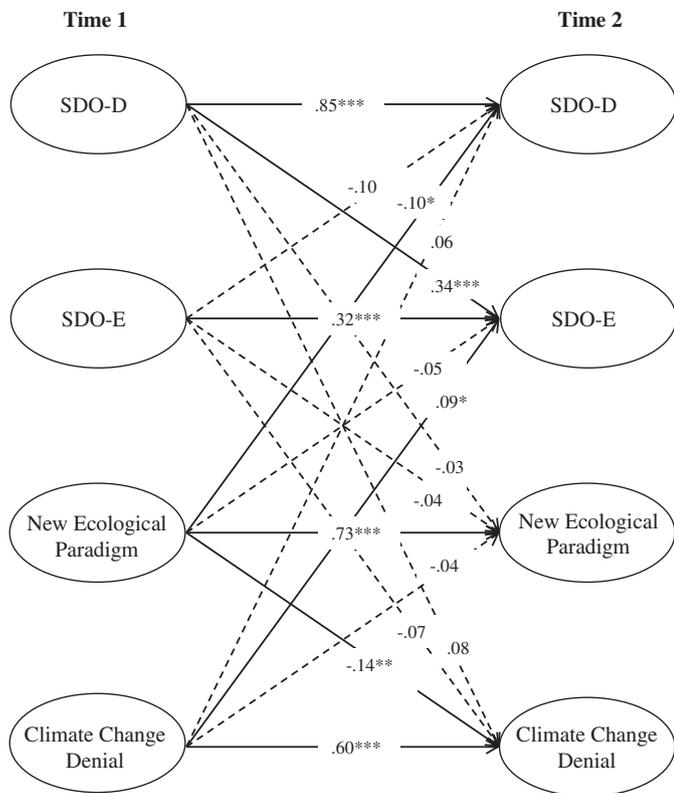


Fig. 3. Longitudinal associations between SDO-D and SDO-E and environmentalism in Study 3. Note. Solid lines show significant paths ($*p < 0.05$, $**p < 0.01$, $***p < 0.001$) and dashed lines non-significant paths ($p > 0.05$).

mentioned above with SDO-D excluded. The results from these additional analyses confirmed that the environmental measures longitudinally predicted the SDO sub-dimensions (see Supplementary Material). That the SDO dimensions were longitudinally influenced by environment-relevant variables, and not the other way around, should be examined in further longitudinal studies, but we provide ad hoc interpretations of these findings in the general discussion.

Finally, higher levels of pro-environmental attitudes were related to lower levels of climate change denial at a later point in time ($\beta = -0.14$, $p = 0.004$, 95% CI $[-0.24, -0.05]$), but not vice versa. This indicates that broader environmental orientations predict change in more specific environment-relevant measures, and that pro-environmental attitudes could be an entry point in reducing denial of anthropogenic climate change.

5. General discussion

An increasing number of studies have indicated the important role of social dominance orientation in predicting support for nature exploitation and climate change denial (e.g. Jackson et al., 2013; Jylhä et al., 2016; Milfont et al., 2013). A parallel development within social dominance theory is the separation of SDO into the sub-dimensions of dominance (SDO-D) and anti-egalitarianism (SDO-E) (Bergh et al., 2015; Ho et al., 2012; Ho et al., 2015). While SDO-D is better represented by a preference for group-based dominance hierarchies and support for overt oppression and aggressive intergroup behaviours, SDO-E is better represented by anti-egalitarianism, preference for unequal intergroup relations and opposition to attempts to increase equality between groups.

Studies considering the distinct SDO dimensions have provided indication of discriminant and convergent validity. For example, SDO-D was a stronger predictor of old-fashioned racism and Machiavellianism while SDO-E was a stronger predictor of political conservatism and social conformity (Ho et al., 2015). This emerging literature has so far examined

how the SDO sub-dimensions are meaningfully and differentially related to intergroup attitudes and behaviour, and personality variables. We contribute to this literature and expand the nomological network on the SDO sub-dimensions by examining their associations with environmentalism. In particular, the present research reports three studies providing an empirical examination of the extent to which the SDO sub-dimensions differentially predict environmentalism measures.

Consistent with previous studies, we confirmed that the two components of SDO reliably form two separate scales. Importantly, these dimensions differentially predict environmentalism. In line with empirical evidence and theoretical arguments, SDO-E is a superior predictor of environment-relevant measures than SDO-D, which is either a weaker or non-significant predictor. Surprisingly, our short-term longitudinal findings showed that environmentalism predicts change in the SDO sub-dimensions but not the other way around. We review the key findings of the present research and elaborate on the implications below.

5.1. Factor structure of SDO₇

The results of all three studies showed that the two-factor structure underlying the SDO items provided a better fit to the data when compared to the unidimensional (and traditional) structure of SDO, in a context other than the United States. The present research also provides further evidence of the psychometric properties of the new SDO scale that was developed to measure the two distinct sub-dimensions (Ho et al., 2012; Ho et al., 2015) by testing the factor structure of the new SDO₇ in Studies 2 and 3. Replicating the findings reported by Ho et al. (2015), the four-factor model composed of substantive (SDO-D and SDO-E) and method (pro-trait and con-trait) factors showed good fit to the data and was better fitting than competing models. The SDO-D and SDO-E sub-dimensions measured with the SDO₇ also showed adequate scale reliabilities, with Cronbach's alpha above the recommended 0.70 threshold, and similar to the values reported by Ho et al. (2015, Table 10). Moreover, the mean scores and standard deviation of the sub-dimensions were within the range observed for community samples from the US, even though our samples were undergraduate students. Finally, we provide further psychometric evidence for the short-form version of the SDO₇ comprising eight items (see Supplementary Material).

Ho et al. (2015) recommends the use of the SDO₇ instead of the SDO₆ in future studies, as this new scale comprises a balanced measure of the SDO sub-dimensions. Extending their recommendations, we suggest the use of the SDO₇ by researchers interested in the SDO–environmentalism link because it affords the proper assessment of each sub-dimension of SDO, and subsequently how each dimension relates to environment-relevant variables. In saying this, it is true that our findings converged to find that SDO-E is the stronger predictor of environmentalism across studies using both the old and new measure of SDO. This is important, as it means that although the SDO₇ has addressed issues with the SDO₆, this does not suggest the rejection of existing data collected using the SDO₆ (see Ho et al., 2015).

5.2. SDO dimensions and environmentalism

Previous studies showing a negative association between SDO and environmentalism suggest that higher levels of SDO translate to more environmental apathy. The SDO scale was developed to assess hypotheses about social and intergroup relationships and that is why the SDO items specifically refer to groups. Hence, it should not be assumed that SDO should be a strong predictor of environment-relevant variables. Correlations between SDO and environmentalism are weaker than correlations between SDO and intergroup variables (e.g., compare our correlations to those reported by Ho et al., 2015). At the same time, the fact that SDO generalizes to non-human relationships is of great importance. It suggests that the implications of social dominance theory for understanding group-based social hierarchies and relations between

individuals can be broadened to the hierarchical relations between humans and the natural environment (see Milfont et al., 2013).

Our findings provide a more nuanced account of this association by showing that a particular *profile* of SDO best predicts negative attitudes and behaviours towards the environment. Our findings show that SDO-E is a stronger predictor of environment-relevant measures compared to SDO-D. Individuals who are less supportive of group equality are less inclined to make changes to their behaviour to benefit the environment, less convinced that climate change is real, and less likely to see environmental protection as an important principle.

Interestingly, although individuals who more strongly endorse dominance aspects of SDO might seem more threatening, as they are more likely to be outwardly prejudiced and discriminatory (Ho et al., 2015), our results suggest they are *not* actually especially threatening to the environment. Instead, it is the anti-egalitarian aspects of SDO that might lead to negative consequences for the environment as relatively high SDO-E individuals are less inclined to make personal sacrifices for the environment, less likely to value environmental protection, endorse belief in climate change, or harmonious relations with nature. A desire for dominance per se, on the other hand, is either not related, or merely weakly related, to anti-environmentalism. Our findings suggest that the environmental apathy that is characteristic of high-SDO is motivated more by a desire to maintain inequality than to establish hierarchy.

The Hierarchy Enforcement Hypothesis of Environmental Exploitation (Milfont & Sibley, 2014) provides some hints on why SDO-E (and not SDO-D) is the main predictor of environment-relevant variables. According to this hypothesis, SDO predicts willingness to exploit the environment to the extent that resources gained by doing so help sustain and widen the gap between groups because of the disproportionate allocation of resources gained from exploiting the environment to the dominant group. This is intrinsically linked to the description of individuals high on SDO-E, who “prefer hierarchies where resources are inequitably distributed, and which can be defended by anti-egalitarian ideologies” (Ho et al., 2015, p. 1022). Individuals relatively high on SDO-E are thus supportive of environmental exploitation because this can lead to inequitably distributed resources, a contention experimentally supported using mining scenarios by Milfont and Sibley (2014).

To provide some preliminary test of this argument, we re-analysed data from both studies reported in Milfont and Sibley (2014). As expected, we observed that SDO-E interacted with the experimental condition to predict support for the mining operation in both datasets; however, the SDO-D \times condition interaction was also statistically significant in Study 1. In this dataset, the simple slope estimates showed that both SDO-E and SDO-D predicted mining support in the hierarchy-enhancing condition that benefits already high-status groups in society. Hence, these re-analyses did not provide strong evidence for differential effects of the sub-dimensions. Further research is thus needed to confirm that SDO-E is the main predictor of environment-relevant variables, and to better understand *why* this is the case.

It is worth noting, however, that SDO-D might be a stronger predictor of environmentalism depending on the particular environmental issue or group context. The group-based dominance indexed by SDO-D is achieved via overt oppression and aggressive intergroup behaviour (Ho et al., 2015), and it might be the main SDO sub-dimension driving environmental exploitation when oppression between high and lower status groups is more salient than resource allocation between the groups. Although not explicitly examining overt oppression and/or aggression, the findings observed by Jackson et al. (2013, Study 4) in the context of directing environmental hazards to countries with low economic standing illustrate this possibility, which should be explored in future studies.

5.3. Longitudinal findings

Study 3 was the first to look at the longitudinal relations between each facet of SDO and environmentalism. The concurrent associations

within this dataset generally replicated the pattern of SDO-E as the stronger predictor; however, the longitudinal analysis did not show that either facet of SDO predicts change in environmentalism as we expected. Instead, we found that environmental variables appear to precede SDO in a unidirectional fashion. Furthermore, the two environmental variables differentially predicted the two dimensions of SDO, thus again indicating a qualitative difference between dimensions: denial of climate change predicted change in SDO-E, while scores on the NEP Scale, a measure of harmonious human-nature relations, predicted change in SDO-D. The direction of the cross-lagged associations indicate that higher levels of climate change denial and pro-environmental attitudes are related, respectively, to higher levels of SDO-E and lower levels of SDO-D at a later point in time. These surprising findings suggest that environmentalism drives dominance ideology, and not the other way around.

We note these findings as surprising because the expectation that SDO precedes attitudes has theoretical grounding. The Dual-Process Motivational Model (Duckitt, 2001) proposes that those who endorse SDO see the world as a competitive jungle and are therefore prejudiced against social groups of low power and status (see Cantal et al., 2015). Because of this competition, people high in SDO are motivated to seek a state of affairs where resource and power distributions favour their social group. This conceptualisation of SDO implies causality: SDO is the motivating factor behind intergroup prejudice. Indeed, Asbrock, Sibley, and Duckitt (2010) showed that SDO predicts aspects of prejudice over time, supporting causal predictions of the dual process model.

At the same time, other studies have argued that SDO does not necessarily precede attitudes. For example, Kteily, Sidanius, and Levin (2011) showed that while there might be some evidence that SDO causes prejudice, SDO may also be an effect of prior levels of prejudice. Moreover, and according to the asymmetry hypothesis (Sidanius & Pratto, 1999), SDO does not necessarily predict attitudes for people in hierarchy-attenuating environments. Such environments include students studying psychology (see Jetten & Iyer, 2010), potentially explaining the lack of longitudinal association from initial SDO to pro-environmental attitudes measured at a later date. More generally, Hatemi and McDermott (2016) argue that it is attitudes that direct thoughts, feelings and reasoning, ultimately governing moral choices, rather than the reverse direction. In fact, there is little evidence that moral foundations predict change in attitudes over time (Smith, Alford, Hibbing, Martin, & Hatemi, 2016).

Taken together, there is some theoretical support for the directional relationship found in Study 3, with some findings questioning the causal role of SDO in predicting attitudes (e.g., Kteily et al., 2011; Turner & Reynolds, 2003), especially given a context of hierarchy-attenuation conditions (Jetten & Iyer, 2010). If the order of causality our results imply does reflect the true temporal association between SDO and environmentalism, then perhaps we should remain agnostic about the causal order of these variables. Instead of viewing SDO as a main predictor of people's environmental attitudes, an assumption based on previous cross-sectional findings, future studies should consider the possibility that SDO is instead a consequence of these attitudes. This is a very interesting avenue for future studies.

Yet, an alternative explanation of this directional finding is that the results are spurious, which is possible due to some limitations of our study. For example, we used a student sample and as such our participants were likely more pro-environmental than a random sample of the general population. Despite this, there was sufficient variation in our variables to test our predictions. We also used reliable, full-scale measures to assess each target variable in Study 3. It is possible that pro-environmental attitudes are influencing SDO by way of a third variable; however, candidates for such a third-variable status are not obvious given that our two environmental variables predicted different aspects of SDO. One further limitation of this study is that the gap between measurement points only comprised 5 months. Given these limitations and the fact that these relationships are weak and somewhat

unexpected, these findings warrant follow up with a more powerful longitudinal dataset.

Another interesting finding of our longitudinal results is that SDO-D appears to be more stable than SDO-E. SDO as a unitary construct is relatively stable, with Sidanius, Levin, Van Laar, and Sears (2008) finding the test-retest stability of SDO to be 0.84 after one year, and still very reliable after five years (0.74). While we found that SDO-D was comparatively stable, both when stability is indexed by its correlation between Time 1 and Time 2 scores and its auto-regression in the cross-lagged model, SDO-E was stable only in its correlation and not in the cross-lagged model. This is likely due to the stability of SDO-E being accounted for by its association with SDO-D, and the finding that SDO-D predicts change in SDO-E over time but not vice versa.

6. Conclusion

Notwithstanding some limitations in our studies, the overall pattern of findings is clear. Across three studies, we showed that the separation of SDO into two distinct sub-dimensions is empirically and theoretically meaningful and that SDO-E is a superior predictor of environmental variables than SDO-D. This research contributes to the growing psychological literature trying to identify key individual differences that could help us understand who and why certain individuals are more prone to endorse environmental exploitation than others. Finally, our finding that environmental attitudes influence SDO over time but not vice versa provides a starting point for considering the possibility that SDO may also be an effect of prior levels of environmentalism.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.paid.2016.11.051>.

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