

The Roots of Ecological Dominance Orientation: Assessing Individual Preferences for an  
Anthropocentric and Hierarchically Organized World

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## Abstract

Ecological dominance is a central concept in the study of interspecies and species-environment relations. Yet, although theoretical and empirical work on ecological dominance has progressed in many scientific disciplines, the psychology of ecological dominance remains understudied. The present research advances theoretical and empirical inquiry on ecological dominance as a psychological predisposition, examining how and why it influences humans' attitudes and behaviors across different relational domains (i.e., intraspecies, interspecies, human-environment). To this end, we validate a novel measure, the Ecological Dominance Orientation (EDO) scale, based on the popular iconic depiction of ecocentric versus anthropocentric arrangements of the relationship between humans, nonhuman animals, and the natural environment. In five pre-registered studies across two countries ( $N = 2,407$ ), we demonstrate that EDO a) shapes attitudes in a similar fashion both *within* and *between* different relational domains, b) is uniquely predictive of socially consequential attitudes (i.e., modern sexism, speciesism, dehumanization) above established measures of personal ideology, c) is reliable over time, d) relates to a distinct set of personality correlates, and e) uniquely predicts pro-environmental behavior. This research extends classical Social Dominance Theory (Sidanius & Pratto, 1999) by theorizing about the socio-ecological roots of intergroup, interspecies, and human-environment relations as hierarchically structured power relations. Theoretical implications of social and ecological dominance orientations are discussed.

*Keywords:* social dominance orientation, ecological dominance orientation, racism, sexism, anthropocentrism

## **The Roots of Ecological Dominance Orientation: Assessing Individual Preferences for an Anthropocentric and Hierarchically Organized World**

Ecological dominance is a central concept in the study of interspecies and species-environment relations (e.g., Hillebrand et al., 2008; Tivy, 1987). Broadly defined from a biological perspective, ecological dominance “refers to the exertion of a major controlling influence of one or more species upon all other species by virtue of their number, size, productivity or related activities” (United Nations, 1997, p.25). Measured by these criteria, the degree of human ecological dominance, that is, the extent of humans’ control over other species, habitats, and resources impacting all areas and ecosystems of the Earth’s environment far exceeds that of any other well-studied complex organism (e.g., Vitousek et al., 1997). While human’s ecological dominance has greatly accelerated social, cultural, technological, and economic progress (Alexander, 1990; Flinn et al., 2005; Harari, 2014; Lenski & Lenski, 1987), it also has increasingly adverse effects on natural and human systems (e.g., biodiversity loss, climate change, health, social and economic inequality; Díaz et al., 2019; IPCC, 2014; Whitmee et al., 2015).

Yet, although theoretical and empirical work on humans’ ecological dominance and its consequences has progressed in many scientific disciplines, the psychology of ecological dominance remains understudied (cf. [NAME REDACTED]). Previous research indicates a close relationship between social and ecological dominance motives (e.g., Caviola et al., 2019; Costello & Hodson, 2010; Dhont & Hodson, 2014; Graça, 2020; Jylhä & Akrami, 2015; Milfont et al., 2018; Stanley & Wilson, 2019). However, this line of research has solely focused on ecological dominance as downstream consequences of social dominance orientation and related constructs such as Right-Wing Authoritarianism (e.g., Costello & Hodson, 2010; Dhont et al., 2016; Hyers, 2006; Jylhä & Akrami, 2015; Milfont et al. 2013),

but not on ecological dominance as an independent psychological predisposition (cf. [NAME REDACTED]).

The present study attempts to complement previous research by advancing theoretical and empirical inquiry on the causes and consequences of *ecological dominance*, that is, a general preference to establish and maintain an anthropocentric, hierarchical arrangement between humans, nonhuman animals, and the natural environment, examining how and why it influences humans' beliefs, attitudes, and behaviors across different relational domains (i.e., intraspecies, interspecies, human-environment). Building on Social Dominance Theory (SDT; Sidanius & Pratto, 1999) and synthesizing previous work from social, evolutionary, organizational, and environmental psychology, we have proposed an expansion of SDT by introducing the concept of an anthropocentric hierarchical axis and developed a dedicated measure to assess this axis, labelled the Ecological Dominance Orientation (EDO) scale. This measure is designed to assess a general preference for an anthropocentric and hierarchical arrangement between humans, nonhuman animals, and the natural environment. Here, we aim to gauge the EDO scale's psychometric properties in more detail by testing its discriminant, convergent, and incremental validity, its temporal stability, and personality bases and nomological network.

### **A Social and Ecological Dominance Perspective**

Social hierarchies are ubiquitous across nonhuman animal species (e.g., Boehm, 2011; Bronfenbrenner, 1979; Mazur, 2005), such that higher-ranked organisms have privileged access to resources, territory, mates, and ultimately greater reproductive success. Humans adaptively form social hierarchies too (Cummins, 2016; Fiske, 1992; Sidanius & Pratto, 1999). Extensive research has shown that the hierarchical structure of social arrangements has a profound impact on how humans perceive and treat other humans in everyday life (e.g., Buss et al., 2020; Mattan et al., 2017; Kteily & Richeson, 2016). In regard

to hierarchical social arrangements among human animals, Social Dominance Theory (SDT) posits that human societies exhibit a predisposition toward a hierarchical form of social organization since group-based social hierarchies are a ubiquitous feature of all (surplus-producing) human societies (Sidanius & Pratto, 1999). SDT further posits that given this predisposition towards hierarchical social organization, humans will show meaningful individual differences in their endorsement of or opposition to social arrangements where some social groups dominate others as a function of ones' own group position in a given social hierarchy amongst other factors and dynamics. Social dominance orientation (SDO) is the individual difference construct designed to assesses the degree to which individuals generally endorse or oppose hierarchically organized community arrangements (Pratto et al., 1994). In this vein, a plethora of studies have shown that individuals high in SDO are characterized by a general motivation for group-based dominance in which high-status groups control and dominate low-status groups. Specifically, it has been shown that SDO is a relatively stable trait reliably varying in human populations (Fischer et al., 2012; Kunst et al., 2017) and highly predictive of a multitude of antisocial attitudes and behaviors such as sexism, racism, and support for hierarchy enhancing ideologies, intergroup exploitation, and violence (Kleppetø et al., 2020). SDO is furthermore a reliably gendered phenomenon, with males consistently displaying higher average SDO levels than females (Sidanius et al., 2017).

While Social Dominance Theory has been developed primarily with a focus on human-intergroup relations, more recently, a growing number of studies have expanded this large corpus of results by showing that a personal preference for hierarchically organized social arrangements, as captured by SDO, generalizes to human-animal (e.g., Becker et al., 2019; Caviola et al., 2019; Costello & Hodson, 2010; Dhont & Hodson, 2014; Dhont et al., 2016; Hoffarth et al., 2019; Hyers, 2006, Salmen & Dhont, 2021) and human-environment relations as well (e.g., Jylhä & Akrami, 2015; Jylhä et al., 2020; Milfont et al., 2013; Stanley

& Wilson, 2019). To accommodate these findings into the SDT framework, previous researchers have proposed that SDO relates to phenomena such as speciesism and environmentalism via hierarchy-legitimizing myths (e.g., human supremacy beliefs) as an intermediary link between SDO and attitudes towards nonhuman animals and the natural environment. Indeed, SDT posits that individuals scoring relatively high in SDO show increased support for beliefs, ideologies, and policies which bolster their personal standing and relative rank-position in a given social hierarchy (e.g., capitalism, classicism, nationalism, etc.).

We concur with these basic assumptions that SDO generalizes onto the interspecies and human-environment domains via support for hierarchy-legitimizing myths and acknowledge and build upon the insights provided hitherto. However, in contrast to these explanations, in a previous study, we have argued that ecological dominance might represent a psychologically meaningful and distinct entity *in and for itself* ([NAME REDACTED]). More to the point, we have argued that ecological dominance might qualify as an independent predictor of hierarchy-legitimizing myths with downstream consequences. Our theoretical contention is anchored in two distinct lines of reasoning.

First, converging results in paleoanthropology, evolutionary and organizational psychology, and ethnology suggests that social dominance motives seem to have evolved concurrently with and partly in reaction to ecological dominance motives (Flinn et al., 2005; Magee & Galinsky, 2008; Sapolsky, 2005; Tooby & Cosmides, 2010). More specifically, previous research suggests that with humans' increasing ecological dominance (e.g., large-scale flexible cooperation, domestication of nonhuman animals; Alexander, 1990; Handley & Mathew, 2020; Harari, 2014), human social arrangements increasingly tend to more hierarchical forms of organization (Lenski & Lenski, 1987; Sidanius & Pratto, 1999). More hierarchically organized social entities can facilitate group cohesion and productivity (Magee

& Galinsky, 2008), maximize the effectivity of resource allocation (Sapolsky, 2005) and enhance defensive as well as offensive capabilities of human and nonhuman animal groups against potential adversaries (Allen & Jones, 2014; Mitani et al., 2010). As such, more hierarchical forms of social arrangement can be interpreted as a fitness-increasing adaptation that facilitates increased communal stability, agility, and agency (Halevy et al., 2011; Tooby & Cosmides, 2010). Importantly, these findings suggest co-evolution between ecological dominance and more hierarchically organized forms of social arrangements. Consequently, social dominance orientation could be construed as an emerging mechanism by which social hierarchies are enforced and maintained on the psychological level ([NAME REDACTED]).

Second, in line with SDT reasoning, we have argued that interspecies and human-environment relations satisfy the two main theoretical premises for the potential emergence of hierarchically organized communal arrangements, namely the concomitance of an asymmetric power distribution and associated fitness advantages. Therefore, when viewed through an SDT lens, the theoretical postulates for ecological dominance hierarchies are satisfied. Consequently, we posited that SDO might have developed as an adaptive response to increased ecological dominance. Given the large swath of time in which human-animal and human-environment interactions evolved within co-dependent relational frameworks, we reasoned that ecological dominance might therefore also be deeply ingrained in the human psychology and, therefore, measurable.

Following these lines of thought, we have developed a purpose-built measure to assess ecological dominance orientation as an individual difference variable which we constructed as an independent predictor of attitudes, beliefs, values and behaviors pertaining to interspecies and human-environment relations. More specifically, in order to assess the validity of our proposition, we proposed and tested the concept of Ecological Dominance Orientation (EDO) as an extension of social dominance theorizing. Closely resembling social

dominance orientation, we defined ecological dominance orientation as a general preference to establish and maintain an anthropocentric and hierarchical arrangement between humans, nonhuman animals, and the natural environment. In this vein, we propose that—similar to SDO—preferences for ecological dominance might represent a psychologically meaningful entity *in and for itself*, capturing a broader relational perspective in which different forms of communal arrangements between humans, nonhuman animals, and the natural environment are conceptualized.

To assess our contention that ecological dominance orientation is theoretically meaningful and a statistically distinct phenomenon, we devised a practical measure designed to capture ecological dominance motives by means of a brief, intuitive, and face-valid assessment technique. Our measure, the Ecological Dominance Orientation scale (EDO), uses the popular graphical description of the dichotomy between an ecocentric versus anthropocentric perspective on the relationship between humans, nonhuman animals, and the natural environment (see Figure 1).<sup>1</sup>

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<sup>1</sup> For the development of our measure, we followed Kteily and colleagues in their process of developing their “Ascent of Man” scale, which also utilizes iconic representations to assesses blatant dehumanization (Kteily, Bruneau, Waytz, & Cotterill, 2015). Similar to the Ascent of Man scale, we did not include texture, detail, or color in order to limit low-level association biases (e.g., different human skin tones, particularly colored animal or plant species) into the iconic representations. Moreover, in the anthropocentric and hierarchical pyramid shape, we chose a particular rank-ordering based on previous research indicating that pets and some farm-animals are ranked higher than other animals (e.g., Caviola et al., 2019). Based on these observations, directly below the humans, we present pets and farm animals followed by mammals and smaller birds and insect and finally at the bottom of the pyramid comes plants and ecological niches.



Ideas on how humans, animals, and the natural environment should relate to each other can differ for every person. Using the image below as a guide, indicate which arrangement you personally think represents your own preference. There are no right or wrong answers here: we are simply interested in your personal preference.

The more you move the slider to the right, the more you indicate a preference for a more hierarchical relationship between humans, animals, and the natural environment. The more you move the slider to the left, the more you indicate a preference for a less hierarchical relationship.



**Figure 1.** Ecological Dominance Orientation Scale.

The ecocentric perspective is depicted on the one side in the shape of a non-hierarchical and egalitarian arrangement between humans, nonhuman animals, and the natural environment (circle form). The anthropocentric perspective on the other side is depicted in the form of a clearly recognizable, hierarchically organized arrangement in the form of a pyramid in which humans are situated above nonhuman animals and nature; participants are asked to indicate, with a continuous slider below the image, their preference for a more (anthropocentric) or less hierarchical (ecocentric) arrangement between the different species. Theoretically, our novel measure captures an important characteristic of different forms of communal arrangements. The two images conjure an explicit dichotomy between a more egalitarian arrangement on the one side, with no visible indication of rank-

order between the iconic elements, and a clearly non-egalitarian form of arrangement with an unambiguous visual indication of rank-ordering as depicted in the form of a pyramid on the other side. These visual features are accompanied by sub captions conveying the intended significance linguistically as well.

### **General Hypotheses**

Based on this reasoning, we formulated three overarching hypotheses:

**H1:** Our first hypothesis is that preferences for hierarchical communal arrangements should generalize across relational domains. Specifically, we expect that individuals high in SDO should perceive and prefer the relationship between humans, nonhuman animals, and the broader natural environment as an anthropocentric and hierarchically organized form of arrangement, i.e., an arrangement where humans are at the top of the hierarchy, above and beyond nonhuman animals and the natural environment. We name this preference: Ecological Dominance Orientation (EDO). In turn, we expect individuals high in EDO to display relatively high SDO levels.

**H2:** Second, following SDT and previous research (e.g., parental investment theory, Trivers, 1972), our second hypothesis is that we expect EDO scores to be significantly higher on average for males compared to females.

**H3:** Third, given that ecological and social dominance motives seem to have developed concurrently and partly in interaction with each other, our third hypothesis is that both social and ecological dominance motives should shape perceptions and behaviors across different relational domains, i.e., intraspecies, interspecies, and human-environment relations in a comparable fashion, yet independently from each other. More specifically, we posited that the effects of EDO should generalize across relational domains, such that EDO should predict speciesism and anthropocentrism *as well as* sexism and racism, just as SDO has been shown to predict these variables.

## Preliminary Research

In a set of preliminary studies across two countries (USA & Germany), we have developed the ecological dominance orientation (EDO) scale and analyzed its relationship with social dominance orientation (SDO) as well as its associations with climate change threat perceptions and pro-environmental attitudes and behaviors and found preliminary evidence in support of our hypothesized relationships. More specifically, across two studies, we have shown that SDO and EDO are (a) moderately associated with each other ( $r_{\text{average}} = .45$ ), (b) significantly higher among male participants (vs. females), and (c) uniquely and negatively associated with climate change risk and threat perceptions and support for pro-environmental behavior. Notably, EDO was negatively associated with pro-environmental behavior (e.g., signing ostensibly real online petitions), while SDO showed no such relationship ([NAME REDACTED]).

## Overview of Studies

In sum, previous research has analyzed ecological dominance as a consequence of social dominance orientation and related constructs such as RWA but has not yet analyzed EDO as an independent predictor of socio-ecologically important attitudes across relational domains (i.e., racism, sexism, speciesism, anthropocentrism, dehumanization, and pro-environmental behavior). Addressing this gap in the literature, the goal of this paper is to advance previous research by testing the convergent, discriminant, incremental validity, personality correlates, and nomological network of our novel EDO measure. We tested our overarching hypotheses in five pre-registered studies across two different national contexts (UK and USA;  $N = 2,407$ ). All studies were approved by the Department of Psychology ethics committees at the University of XXXXXXXXX. In Study 1a, we aimed to gauge the EDO scale's psychometric qualities by testing its convergent and incremental validity in regard to a number of well-established measures with a UK sample ( $N = 277$ ). In Study 1b,

we tested whether the accompanying scale instructions influenced ecological dominance orientation and aimed at replicating some of the results from Study 1a (i.e., convergent validity) with an additional UK sample ( $N = 273$ ). In Study 2a, we aimed at replicating the results of Study 1a in another national context (USA,  $N = 549$ ) and additionally employing dehumanization of low-status social groups as a further dependent measure. In Study 2b, we aimed at investigating the temporal stability of the EDO scale by assessing its test-retest reliability over a period of four weeks, for which we re-invited participants from Study 2a for a second time ( $N = 213$ ). In Study 3, we tested the discriminant validity of EDO, by analyzing its personality and individual difference correlates ( $N = 511$ ). In Study 4, we tested the predictive validity of EDO in relation to pro-environmental behavior ( $N = 584$ ). For each study, the required sample sizes were calculated via power analyses individually to meet a 95% chance to observe a hypothesized effect. All pre-registered hypotheses, power analyses, measures, manipulations, quality checks, descriptive statistics, and data exclusions for each study are reported in the respective method sections, the pre-registrations, and in the SOM (S1-S2).

### **Study 1a: Convergent and Incremental Validity**

Building on our previous results ([NAME REDACTED]), in Study 1a, we aimed at broadening our analytic scope by investigating the psychological correlates and consequences of EDO in more detail. More specifically, we had two main goals in mind. Our first goal was to ascertain whether EDO is merely a facet of SDO or whether EDO is theoretically and statistically distinguishable from SDO. Following our theoretical arguments, we hypothesized that EDO is closely related to SDO because both orientations seem to have developed concurrently and partly in interaction with each other (Flinn et al., 2005; Sidanius & Pratto, 1999; Tooby & Cosmides, 2010). Therefore, we expected and found a substantial association between them in a previous set of studies ([NAME REDACTED]). Yet, we also reasoned

that EDO—due to its more holistic focus on intraspecies, interspecies, and human-environment relations—might represent a psychologically meaningful entity in and for itself. As such, it should also indicate theoretically meaningful independence of SDO. This reasoning would be supported if we found that EDO would (a) significantly and uniquely be associated with different attitudes across relational domains (i.e., sexism, racism, speciesism, anthropocentrism) controlling for the shared variance between EDO and SDO and a given criterion variable and (b) if EDO would significantly and uniquely predict attitudes across relational domains (i.e., sexism, racism, speciesism, anthropocentrism) controlling for the effects of further well-established socio-ideological difference variables, in addition to SDO.

To this end, in Study 1a, we analyzed the convergent, and criterion validity of EDO to gauge its psychometric qualities by including a number of well-established variables expected to correlate with our scale. More specifically, we decided to analyze EDO and SDO in relationship to right-wing authoritarianism (RWA; Altemeyer, 1996), human supremacy beliefs (HSB, Dhont & Hodson, 2014), speciesism (Caviola et al., 2019), modern sexism (Swim et al., 1995), modern racism (McConahay, 1986), the New Environmental Paradigm (NEP; Dunlap et al., 2000), and anthropocentrism (subscale NEP; Dunlap et al., 2000).

Previous research has shown that—comparable to SDO—RWA is one of the most robust predictors of prejudice towards a variety of human social groups (Duckitt, 2020). Moreover, RWA has been shown to significantly relate to SDO (Duckitt, 2001), speciesism, as well as low environmentalism (Caviola et al., 2019; Milfont et al., 2018). Thus, we included an RWA measure (Very Short Authoritarianism [VSA]; Bizumic & Duckitt, 2018) and expected to find a significant positive association between SDO, RWA and our EDO scale as well as with our criterion variables.

Moreover, previous research has shown that human supremacy beliefs (e.g., “Animals are inferior to humans”; Dhont and Hodson, 2014) are associated with both SDO, RWA, and

speciesism (Dhont et al., 2016; Stanley et al., 2019). As discussed in the theoretical part of this paper in more detail, several researchers have proposed that SDO relates to phenomena such as speciesism and anthropocentrism via support for hierarchy-enhancing beliefs as an intermediary link (e.g., Costello & Hodson, 2010; Dhont et al., 2016; Milfont et al., 2013). For example, Dhont and Hodson have proposed and successfully tested human supremacy beliefs (HSB; Dhont & Hodson, 2014) as a mediating link between SDO and speciesism. In contrast to these explanations, we propose that—similar to SDO—ecological dominance is a psychologically meaningful entity in and for itself. As such, we conceptualized EDO as an independent predictor of different attitudes, beliefs, values and behaviors pertaining to the domain of interspecies and human-environment relations. Against this background, we hypothesize that EDO will significantly predict speciesism and anthropocentrism above and beyond SDO while *also* predicting sexism and racism. With this in mind, we expect that EDO would be significantly associated with attitudes *across* relational domains (i.e., sexism, racism, speciesism, anthropocentrism) but more strongly so with attitudes towards nonhuman animals (i.e., speciesism) and nature (i.e., anthropocentrism) controlling for the effects of SDO, RWA, and demographic variables.

## **Methods**

### ***Participants and Procedures***

Study 1a was pre-registered (see <https://aspredicted.org/blind.php?x=q9cv5y>). We recruited 280 participants in the UK using Prolific in June 2020. Participants responded to an attention check question at the beginning of the survey (e.g., “To monitor the quality, please press five on the following scale”). In total three participants were removed due to failing the attention check resulting in a final sample size of 277. The sample consisted of 51.0% women and the average age was 36.97 ( $SD = 11.66$ ). Detailed descriptive statistics, payment modalities, and power analyses are provided in the SOM (S1-S2).

## ***Instruments***

All measures were scored on a seven-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) unless indicated otherwise and were presented to participants in randomized order (except for the consent at the beginning, and demographic variables and debriefing both presented at the end).

**Ecological Dominance Orientation (EDO).** We measured ecological dominance orientation (EDO) using our novel one-item iconographic scale accompanied by guiding instructions (see Figure 1).

**Social Dominance Orientation (SDO).** Social dominance orientation was assessed through the use of the 6-item SDO<sub>6</sub> scale (Pratto et al., 1994; e.g., “Some groups of people are simply inferior to other groups”; “Superior groups should dominate inferior groups”; “No one group should dominate in society” [reverse scored];  $\alpha = .90$ ).

**Right-Wing Authoritarianism (RWA).** Right-wing authoritarianism was assessed through the shortened 6-item version (e.g., “Our society does NOT need tougher government and stricter laws“ [reverse scored]; “What our country needs most is discipline, with everyone following our leaders in unity”;  $\alpha = .86$ ) of the RWA (VSA scale; Bizumic & Duckitt, 2018).

**Human Supremacy Beliefs Scale (HSB).** The Human Supremacy Belief Scale (Dhont & Hodson, 2014) was used to assess beliefs of human superiority above animals with six items (e.g., “It is important that we treat other animal species more equally” [reverse scored]; “Animals are inferior to humans”;  $\alpha = .93$ ).

**Modern Sexism.** To assess contemporary forms of prejudice against women, we used the Modern Sexism Scale (Swim et al., 1995) consisting of 8 items (e.g., “It is rare to see women treated in a sexist manner on television”; “It is easy to understand the anger of women’s groups in America” [reverse scored];  $\alpha = .93$ ).

**Modern Racism.** Contemporary racial prejudice was assessed by the Modern Racism Scale (McConahay, 1986) with seven items (e.g., “Ethnic minorities are getting too demanding in their push for equal rights”; “It is easy to understand the anger of ethnic minority people in America.” [reverse scored];  $\alpha = .94$ ).

**Speciesism.** To assess prejudiced attitudes towards nonhuman animals, we administered the Speciesism measure (Caviola et al., 2019) consisting of six items (e.g., “Morally, animals always count for less than humans”; “Chimpanzees should have basic legal rights such as a right to life or a prohibition of torture” [reverse scored];  $\alpha = .83$ ).

**New Environmental Paradigm (NEP).** As a measure of pro-environmental attitudes, we applied the New Environmental Paradigm Scale (Dunlap et al., 2000), which consists of 15 items in total (e.g., “Humans are severely abusing the environment”; “The balance of nature is very delicate and easily upset”; “The so-called “ecological crisis” facing humankind has been greatly exaggerated” [reverse scored];  $\alpha = .92$ ).

**Anthropocentrism.** Following previous research (Jylhä and Akrami, 2015; [NAME REDACTED]), anthropocentrism was assessed by a subscale (items 2, 7, 12) of the above-mentioned New Environmental Paradigm Scale (Dunlap et al., 2000) consisting of three items in total (i.e., “Humans have the right to modify the natural environment to suit their needs”; “Humans were meant to rule over the rest of nature”; and “Plants and animals have as much right as humans to exist” [reverse scored];  $\alpha = .76$ ).

**Demographic Information and Control Variables.** We have further included the following questions and items as control variables: age, gender, highest education level attainment, household income, current employment status, ethnicity, and political orientation on a seven-point scale ranging from 1 (*very liberal*) to 7 (*very conservative*).

## Results and Discussion

First, to test the convergent validity of our scale, we investigated the EDO scale’s



relationship with well-established criterion variables using correlation and partial correlation analyses. Next, we tested whether both SDO and EDO were more pronounced among male participants compared to female participants by comparing the mean values of the respective variables via one-way ANOVAs. Lastly, to test for the predictive validity of the EDO, we used hierarchical regression analysis by stepwise regressing the five criterion variables (i.e., modern sexism, modern racism, speciesism, anthropocentrism, human supremacy beliefs) on demographic variables, SDO, RWA, and our EDO variable.

### ***Convergent Validity***

Table 1 shows the mean scores, standard deviations, and inter-correlations among the criterion variables and the EDO. All measures showed significant inter-correlations in the expected direction. In line with our expectations and previous findings ([NAME REDACTED]) we found a significant and positive relationship between SDO and EDO (H1;  $r = .46, p < .001$ ).

**Table 1***Means, Standard Deviations, Scales, and Intercorrelations Between all Variables (N = 277, Study 1a)*

Variable	<i>M</i>	<i>SD</i>	<i>α</i>	1	2	3	4	5	6	7	8
1. Social dominance orientation	2.33	1.34	.90	–							
2. Ecological dominance orientation	4.01	1.92	–	.46***							
3. Right-wing authoritarianism	3.22	1.42	.86	.54***	.49***						
4. Human supremacy beliefs	3.52	1.59	.93	.39***	.68***	.40***					
5. Modern sexism	3.13	1.69	.93	.67***	.49***	.65***	.36***				
6. Modern racism	3.24	1.79	.94	.65***	.51***	.64***	.38***	.52***			
7. Speciesism	3.41	1.22	.83	.39***	.62***	.41***	.75***	.37***	.37***		
8. New environmental paradigm	4.96	1.10	.92	-.34***	-.50***	-.29***	-.61***	-.26***	-.26***	-.62***	
9. Anthropocentrism	3.16	1.48	.76	.56***	.65***	.54***	.74***	.52***	.52***	.72***	-.69***

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

Next, we examined the convergent validity of our EDO scale in regard to our criterion variables. More specifically, using Hittner et al.'s (2003) approach for comparing the strength of two dependent correlations, we tested whether EDO would show a stronger association to speciesism and anthropocentrism compared to modern racism and modern sexism. In line with our expectations, EDO showed a stronger association ( $z = 2.49$ ,  $df = 274$ ,  $p = .006$ ) with speciesism ( $r = .62$ ,  $p < .001$ ) compared to modern sexism ( $r = .49$ ,  $p < .001$ ) and a stronger association ( $z = 2.14$ ,  $df = 274$ ,  $p = .016$ ) with speciesism compared to modern racism ( $r = .51$ ,  $p < .001$ ). Similarly, EDO showed a stronger association ( $z = 3.52$ ,  $df = 274$ ,  $p < .001$ ) with anthropocentrism ( $r = .65$ ,  $p < .001$ ) compared to modern sexism ( $r = .49$ ,  $p < .001$ ) and a stronger association ( $z = 3.11$ ,  $df = 274$ ,  $p < .001$ ) with anthropocentrism compared to modern racism ( $r = .51$ ,  $p < .001$ ). Conversely, SDO showed a stronger association ( $z = 5.30$ ,  $df = 274$ ,  $p < .001$ ) with modern sexism ( $r = .67$ ,  $p < .001$ ) compared to speciesism ( $r = .39$ ,  $p < .001$ ) and a stronger association ( $z = 2.56$ ,  $df = 274$ ,  $p = .005$ ) with modern sexism compared to anthropocentrism ( $r = .56$ ,  $p < .001$ ). Similarly, SDO showed a stronger association ( $z = 4.85$ ,  $df = 274$ ,  $p < .001$ ) with modern racism ( $r = .65$ ,  $p < .001$ ) compared to

speciesism ( $r = .39, p < .001$ ) and a stronger association ( $z = 2.06, df = 274, p = .019$ ) with modern racism compared to anthropocentrism ( $r = .56, p < .001$ ). Moreover, as hypothesized (H2), both SDO and EDO were significantly higher among male participants compared to females (see Table 2).

**Table 2**

*ANOVAs SDO and EDO as a Function of Sex (N = 277, Study 1a)*

Sex	SDO	EDO
Male	$M = 2.54, SD = 1.34$	$M = 4.27, SD = 1.83$
Female	$M = 2.11, SD = 1.32$	$M = 3.77, SD = 1.97$
ANOVA	$F(1, 275) = 7.36, p = .007,$ $\eta^2_{\text{partial}} = .03, 90\% \text{ CI } [.00, .06]$	$F(1, 275) = 5.30, p = .022,$ $\eta^2_{\text{partial}} = .02, 90\% \text{ CI } [.00, .05]$

### ***Convergent Validity***

Next, we examined the convergent validity of the EDO Scale in relation to all criterion variables. More specifically, to test our contention that EDO is uniquely associated with attitudes across relational domains and associated individual difference variables (H3), we analyzed the partial correlation of a number of criterion variables (i.e., RWA, HSB, modern sexism, modern racism, speciesism, anthropocentrism) with EDO while controlling for the effects of SDO on both EDO and the respective criterion variable. This approach allowed us to test whether the relationship between EDO and a given criterion variable is significant after partialing out the shared variance between SDO, EDO and the respective criterion variable. Due to the multiple correlation analyses, we applied a Bonferroni adjusted  $\alpha$  level of .006 per test (.05/8) as an indicator for statistical significance. The results indicate that EDO was significantly and uniquely associated with all criterion variables in the expected direction (see Table 3).

**Table 3**

*Correlations Between Ecological Dominance Orientation and Criterion Constructs and Partial Correlations Controlling for SDO (N = 277, Study 1a)*

<b>Criterion variable</b>	<b><i>r</i></b>	<b><i>Part r</i></b>
Social dominance orientation	.46***	
Right-wing authoritarianism	.49***	.32***
Human supremacy beliefs	.68***	.61***
Modern sexism	.49***	.27***
Modern racism	.51***	.31***
Speciesism	.62***	.54***
New environmental paradigm	-.50***	-.41***
Anthropocentrism	.65***	.53***

*Note.* *r* = zero-order correlation; *Part r* = partial correlation; degrees of freedom = 275.

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ . Bonferroni adjusted  $\alpha$  level was .006.

### ***Incremental Validity***

Next, we regressed the five criterion variables on SDO, RWA, demographic variables, and EDO in a series of hierarchical multiple regression analyses. This enabled us to test the incremental validity of our scale while controlling for predictors expected to be related to the criterion variables (see Table 4). In the first step, we entered some demographic variables (e.g., age, gender) and the individual difference variables SDO and RWA. In the second step, we entered our EDO scale into the model (see Table 4).

Consistent with our expectation (H3), EDO was a significant and unique predictor of all criterion variables, controlling for the effects of all the remaining measures, and explained an additional 2% of the total variance in modern sexism and modern racism and between 12-24% of the total variance in speciesism, anthropocentrism, and human supremacy beliefs, above and beyond the well-established measures in the model (see Table 4).

**Table 4***Regression Analysis With Criterion Variables (N = 277, Study 1a)*

Predictor variables	Modern sexism		Modern racism		Speciesism		Anthropocentrism		Human supremacy beliefs	
	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2	Step 1	Step 2
Age	.03	.03	.05	.05	-.05	-.05	-.00	.00	.03	.04
Gender	-.04	-.03	.00	.01	-.22***	-.18***	-.17***	-.14*	-.12*	-.07
Education	-.03	-.05	-.03	-.05	.16**	.10*	.10*	.05	.14**	.07
Household income	-.03	-.03	-.05	-.05	-.00	.00	.00	.01	.06	.06
Social dominance orientation	.45***	.42***	.44***	.39***	.19**	.06	.34***	.23***	.21***	.07
Right-wing authoritarianism	.40***	.36***	.41***	.35***	.30***	.13*	.35***	.20***	.27***	.07
Ecological dominance orientation	–	.12*	–	.17***	–	.49***	–	.42***	–	.59***
<b>Adjusted <math>R^2</math></b>	.57	.58	.55	.57	.28	.45	.43	.55	.24	.48
<b>Change in adjusted <math>R^2</math></b>	–	.02	–	.02	–	.17	–	.12	–	.24
<b>Standard error of estimate</b>	1.26	1.15	1.21	1.18	1.04	0.92	1.13	1.01	1.40	1.16
<b>Significant <math>F</math> change</b>	–	$p < .001$	–	$p < .001$	–	$p < .001$	–	$p < .001$	–	$p < .001$

*Note.* Values reflect standardized  $\beta$  coefficients. Gender: 1 (Male) – 2 (Female); Education: 1 (low) – 11 (high); Household income: 1 (low) – 11 (high). All constructs were entered stepwise in a two-step hierarchical regression model.

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$

SDO and RWA were significantly associated with all except the human supremacy beliefs criterion variable, controlling for EDO. For speciesism, only RWA remained a significant predictor, once EDO was entered into the regression model. In line with previous research, we found that for speciesism and anthropocentrism, gender had a significant negative effect (Milfont & Sibley, 2016). Education was a significant and positive predictor of speciesism in the full model.

### **Study 1b: EDO Scale Instructions' Influence on Relationships Between EDO and Criterion Variables**

To determine whether the accompanying scale instructions influenced the relationship between ecological dominance orientation and our criterion variables, we ran an additional pre-registered study (see: <http://aspredicted.org/blind.php?x=wa67p4>) to collect an independent sample (Study 1b) of 273 UK participants ( $M_{age} = 38.15$ ,  $SD = 11.67$ ; 43.3% female). Due to space limitations, we present these findings in the SOM (see S3). The EDO measure was presented with minimal instructions (i.e., 'Please indicate your preference using the slider below the image') and also excluded the sub-captions below the images (e.g., "less vs. more hierarchical"). Moreover, we administered measures of human supremacy beliefs (Dhont & Hodson, 2014), modern racism (McConahay, 1986), speciesism (Dhont et al., 2014) and New Environmental Paradigm (Dunlap et al., 2000) as criterion variables as well as an SDO measure to further scrutinize the convergent validity of EDO. The results are similar to the main findings of Study 1a, showing a significant and positive correlation between EDO and SDO ( $r = .41$ ,  $p < .001$ ). Moreover, EDO showed significant associations (partial correlation) with all criterion variables controlling for the effects of SDO (see SOM Table S3c). These findings indicate that the associations between ecological dominance orientation and the criterion variables are independent of the instructions and sub-captions as well as independent of the effects of SDO.

## Study 2: Replication and Temporal Stability

In Study 2a, we had two goals in mind. First, we aimed at replicating our findings from Study 1a in a different national context (USA). Moreover, we also employed an additional dependent variable, that is, blatant dehumanization (Kteily et al., 2015). Humans dehumanize other humans by referring to members of human social groups as various types of (low-status) nonhuman animals for example (for overviews see, Haslam & Loughnan, 2014; Kteily et al., 2015). This specific form of outgroup derogation is commonly found in intergroup conflicts (e.g., mass killings, genocide, war) and is associated with negative consequences, including discrimination, sanctioning of violence, and enabling engagement in mass killings (e.g., Costello & Hodson, 2010; Goff et al., 2008; Leidner et al., 2010; Viki et al., 2013; Zimbardo et al., 1999). From an ecological dominance perspective, the endorsement of the idea that certain species are superior to other species (with humans on top) might represent a precursor to the idea that there should also be a hierarchy *within* the human species (i.e., SDO). In regard to dehumanization, this would mean that if indeed humans seeing themselves as superior to nonhuman animal species represents the *first* mental hierarchy, then it stands to reason that humans would resort to dehumanization of conspecifics to justify oppression, exploitation, and violence. Thus, dehumanization can be seen as an (conscious or unconscious) act of putting other human groups on the lowest ranks of existence—the first hierarchical differentiation—further outside the sphere of compassion and empathy, which in turn can facilitate aggression, exploitation, and subjugation. Therefore, we posit that individuals high in EDO, who prefer an anthropocentric hierarchy between the human's species and nonhuman animals and nature, will show a stronger tendency to dehumanize low-status human outgroups.

In Study 2b, we wanted to test the temporal stability of EDO by investigating its test-retest reliability. We hypothesized that EDO is a psychological construct analogous to SDO

and found initial support for our contention in Study 1a. As such, we would expect EDO to be a relatively stable construct that persists over time. While we theorize that EDO should show context- and situational dependence (e.g., cultural, social, economic, ecological) variation, we expect that EDO should constitute a relatively stable feature within a given socio-cultural-ecological context—analogueous to SDO.

Study 2a and Study 2b were pre-registered and consisted of two stages (see <https://aspredicted.org/blind.php?x=8ze3ha>). In the first stage (Study 2a), we recruited 549 participants in the US using Prolific in August 2020. In the second stage (Study 2b), 213 participants from stage 1 completed our survey. Detailed descriptive statistics and power analyses are provided in the SOM (S1-S2). Due to space limitations, we present more detailed results of Study 2a in the SOM (see S4).

### **Study 2a: Replication Study 1a**

We used the same instruments as in Study 1a. These were Ecological Dominance Orientation (EDO; [NAME REDACTED]), Social Dominance Orientation (SDO, Pratto et al., 1994;  $\alpha = .89$ ), Right-wing Authoritarianism (VSA scale; Bizumic & Duckitt, 2018;  $\alpha = .86$ ), Human Supremacy Beliefs (HSB, Dhont & Hodson, 2014;  $\alpha = .92$ ), Modern Sexism (Swim et al., 1995;  $\alpha = .93$ ), Modern Racism (McConahay, 1986;  $\alpha = .93$ ), Speciesism (Caviola et al., 2019;  $\alpha = .83$ ), New Environmental Paradigm (NEP, Dunlap et al., 2000;  $\alpha = .76$ ), and Anthropocentrism (subscale of the NEP, Dunlap et al., 2000;  $\alpha = .92$ ). Additionally, in Study 2, we further administered a measure of blatant dehumanization using the Ascent of Man scale (Kteily et al., 2015).

The results of Study 2a replicate our main findings of Study 1a, showing a significant and positive correlation between EDO and SDO (H1;  $r = .45, p < .001$ ). Also replicating our previous findings (see SOM Table S4b), males showed significantly higher SDO ( $M = 2.49, SD = 1.34; F(1, 547) = 8.88, p = .002, \eta_p = .02, 90\% \text{ CI } [.00, .04]$ ), and EDO levels ( $M =$



4.17,  $SD = 1.88$ ;  $F(1, 547) = 8.51$ ,  $p < .001$ ,  $\eta_p = .02$ , 90% CI [.01, .04]) compared to female participants ( $M = 2.15$ ,  $SD = 1.27$ ;  $M = 3.71$ ,  $SD = 1.97$ , respectively) (H2). As in Study 1a, EDO showed significant associations (partial correlation) with all criterion variables controlling for the effects of SDO (see SOM Table S4c). Consistent with our expectations and replicating the results from Study 1a, EDO was a significant and unique predictor of all criterion variables, controlling for the effects of SDO, RWA, and demographic variables, and explained an additional 1% of the total variance in modern sexism and modern racism and between 18-31% of the total variance in speciesism, anthropocentrism, and human supremacy beliefs, above and beyond the well-established measures in the model (see SOM Table S4d). In Study 2a, we also included a dehumanization measure and expected to see a significant and unique association with EDO. Indeed, EDO significantly and positively predicted dehumanization (aggregated across groups), explaining an additional 1% of the total variance. SDO and RWA were significantly associated with all except the human supremacy beliefs criterion variable (see SOM Table S4d).

### **Study 2b: Temporal Stability and Test–Retest Reliability**

In the second stage of Study 2, a subsample of participants ( $n = 213$ ) completed our EDO scale four weeks after completion of stage 1. The retest analysis with the 213 cases yielded a test–retest correlation coefficient of  $r = .81$ ,  $p < .001$ . That is, participants' scores on the EDO scale were strongly, positively, and significantly correlated with their scores on the same scale four weeks later. The high test–retest reliability is an important part of establishing EDO as a temporally stable psychological construct and demonstrates that EDO—similar to SDO—is not just a short-term belief, but a stable, trait-like feature that persists over time.

### **Study 3: Personality Bases of EDO and SDO**

The results of our previous Studies supported the psychometric validity of our EDO measure regarding its convergent and predictive validity as well as its temporal stability (4 weeks interval). To further test EDO's construct validity, in Study 3, we set out to explore the personality correlates and individual differences associated with EDO, as a means of testing its discriminant validity and exploring its nomological network. Based on our reasoning about the co-evolution of EDO and SDO, we expected to find EDO to share some of the personality correlates that have been found to correlate with SDO (Ho et al., 2015). We also tested our previous hypotheses regarding the relationship between SDO and EDO as well the gender differences we expected and found previously (H1-H2).

## **Methods**

### ***Participants and Procedures***

We used *CloudResearch* (formerly *TurkPrime*) to recruit a representative sample of 856 participants from the United States (US) with census-based quota for ethnicity, gender, and age.<sup>2</sup> The data was collected between 16 December 2020 and 25 December 2020. We excluded cases where a participant failed one or more attention checks, resides outside the US, was underage, was a second-time participant, or did not fully complete the study. This resulted in a final sample size of 511 participants. The sample consisted of 55.88% female participants and the average age was 49.19 ( $SD = 16.96$ ). Detailed descriptive statistics are provided in the SOM (S1-S2). The incentives and payment of participants was managed by CloudResearch.

### ***Instruments***

As the purpose of this study was to increase our understanding of the nomological net of SDO and EDO, and to explore the personality bases of these measures, participants

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<sup>2</sup> The data collected was part of a separate project on the development of a misinformation susceptibility test (Maertens, Götz, et al., 2021), which was preregistered on AsPredicted at <https://aspredicted.org/b59lind.php?x=4v9eq7>. However, the original study did not focus on the SDO and EDO measures.

completed a wide range of measures assessing personality and individual differences. More specifically, after a briefing and informed consent to participate in the study, participants completed a survey containing the following measures.

**Ecological Dominance Orientation (EDO).** We measured ecological dominance orientation using our novel iconographic scale as in the previous Studies including the scale instructions (see Figure 1).

**Social Dominance Orientation (SDO).** Social dominance orientation was assessed through use of the 8-item short SDO scale (Ho et al., 2015;  $\alpha = .81$ ).

**Personality.** The Big-Five Inventory 2 (BFI-2-S; Soto & John, 2017) was used to assess the personality traits Openness ( $\alpha = .66$ ), Extraversion ( $\alpha = .72$ ), Agreeableness ( $\alpha = .73$ ), Neuroticism ( $\alpha = .87$ ), and Conscientiousness ( $\alpha = .80$ ).

**Moral Foundations.** We assessed individual differences with the short Moral Foundations Questionnaire (MFQ-S; Graham et al., 2011) in Purity ( $\alpha = .69$ ), Harm ( $\alpha = .60$ ), Fairness ( $\alpha = .64$ ), Loyalty ( $\alpha = .59$ ), and Authority ( $\alpha = .61$ ).

**Dark Tetrad.** The Short Dark Tetrad (SD4; Paulhus et al., 2020) scale was employed to assess individual differences in Machiavellianism ( $\alpha = .76$ ), Sadism ( $\alpha = .82$ ), Narcissism ( $\alpha = .84$ ), and Psychopathy ( $\alpha = .84$ ).

**Self-Esteem.** The Single-Item Self-Esteem Scale (SISES; Robins et al., 2001) was employed to assess individual differences in self-esteem.

**Personal Religious Identification.** The Single-Item Religious Identification Scale (SIRIS; Norenzayan & Hansen, 2006) was employed to assess individual differences in personal religious identification.

**Narcissism.** The Single-Item Narcissism Scale (SINS; Konrath et al., 2014) was employed to assess individual differences in Narcissism.

**Demographic Information and Control Variables.** As demographic information the

following information was assessed: age, gender, highest education level attainment, ethnicity, employment situation, political party, and political orientation on a seven-point scale ranging from 1 (*very liberal*) to 7 (*very conservative*).

## Results and Discussion

### *Descriptive Statistics*

Table 5 shows the mean scores, standard deviations, and inter-correlations among all criterion variables and EDO/SDO. A table showing the inter-correlations among all variables in available in the SOM (see Table S5a).

Table 5

*Means, Standard Deviations, and Intercorrelations Between EDO/SDO and Criterion Variables (Study 3).*

Criterion	<i>M</i>	<i>SD</i>	<i>α</i>	Correlation with	Correlation with
				EDO	SDO
EDO	4.74	1.68	–	–	.23***
SDO	2.83	1.17	.81	.23***	–
<b>Demography</b>					
Age	49.19	16.98	–	.04	-.08
Gender	0.44	0.50	–	.18***	.14**
Education	3.54	1.47	–	.05	.02
Political Orientation	4.07	1.83	–	.18***	.41***
<b>Personality</b>					
Openness	4.65	1.03	.66	-.06	-.15***
Conscientiousness	5.06	1.15	.80	.10*	-.10*
Extraversion	4.00	1.15	.72	.23***	.09
Agreeableness	5.23	0.99	.73	.09	-.28***
Neuroticism	3.53	1.43	.87	-.17***	.00
<b>Dark Tetrad</b>					
Machiavellianism	4.34	1.09	.76	.05	.23***
Narcissism	3.63	1.32	.84	.20***	.24***
Psychopathy	2.80	1.28	.84	.13**	.29***
Sadism	3.01	1.29	.82	.13**	.31***

**Moral Foundations**

Harm	3.77	0.85	.60	-.07	-.23***
Fairness	3.80	0.85	.64	.02	-.28***
Loyalty	3.55	0.86	.59	.28**	.26**
Authority	3.49	0.84	.61	.33**	.27**
Purity	3.60	0.88	.69	.19**	.09*

**Single-item criteria**

Religiosity	0.41	0.49	–	.24***	.03
Self Esteem	0.63	0.48	–	.18***	.06
Narcissism	2.12	1.72	–	.09*	.21***

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\* $p < .01$ . \*\* $p < .05$ . \*\*\* $p < .001$ .

Replicating our findings from our previous Studies, SDO and EDO were positively and significantly correlated with each other ( $r = .23, p < .001$ ) (H1). Also replicating our previous findings, males showed significantly higher SDO ( $M = 3.02, SD = 1.18; F(1, 506) = 10.04, p = .002, \eta_p = .02, 90\% \text{ CI } [.00, .04]$ ), and EDO levels ( $M = 5.09, SD = 1.56; F(1, 506) = 17.04, p < .001, \eta_p = .03, 90\% \text{ CI } [.01, .06]$ ) compared to female participants ( $M = 2.69, SD = 1.14; M = 4.48, SD = 1.74$ , respectively) (H2).

Next, we analyzed the shared and distinct personality correlates of EDO and SDO via correlation analysis (see Table 5). In terms of shared criteria, we found that both EDO and SDO share a positive correlation with the Narcissism, Psychopathy, and Sadism sub-scales of the Dark Tetrad scale; the Loyalty, Authority, and Purity sub-scales of the Moral Foundations scale; with political orientation (conservative); and with the single-item Narcissism scale. Interestingly, regarding the remaining criterion variables, EDO and SDO showed distinct profiles. More specifically, in line with previous research (e.g., Ho et al., 2015), we found that SDO was negatively correlated with the Big 5 personality traits of Conscientiousness, Agreeableness, and Openness. In contrast, EDO was positively correlated with Conscientiousness, Extraversion, and negatively correlated with Neuroticism.

Moreover, in line with previous research (e.g., Ho et al., 2015), SDO was negatively correlated with the Moral Foundations subscales Harm and Fairness. In contrast to SDO, EDO was not significantly associated with these Moral Foundation dimensions. Lastly, we further found EDO to be positively correlated with self-esteem and personal religiosity scales, but not SDO.

#### **Study 4: Predicting Pro-Environmental Behavior**

The results of Studies 1-3 supported the psychometric qualities of our EDO measure regarding its convergent, discriminant, and predictive validity as well as indicating temporal stability. So far, however, we only utilized attitudinal measures as criterion variables. To further test EDO's construct validity, in Study 4, we aimed to test the predictive validity of EDO, using a more behavioral measure as a dependent variable. Our hypothesis was that EDO should predict pro-environmental behaviors directly (H4) as well as indirectly via anthropocentrism (NEP-subscale; Dunlap et al., 2000) (H5) and Human Supremacy Beliefs (Dhont & Hodson, 2014) (H6) while controlling for SDO and demographic variables (H7). We also tested our previous hypotheses regarding the relationship between SDO and EDO as well the gender differences we expected and found previously (H1-H2).

#### **Methods**

##### ***Participants***

We collected another US sample to complete our pre-registered study (see: [https://aspredicted.org/5LW\\_1YT](https://aspredicted.org/5LW_1YT)). We recruited 600 participants in the USA using Amazon MTurk in December 2021. Following the same procedure as in the previous Studies and in line with our pre-registration specifications, a total of 16 participants were removed due to a failed attention check resulting in a final sample size of 584. The sample consisted of 43.70% female participants and the average age was 38.09 ( $SD = 11.41$ ). Detailed descriptive statistics and power analyses are provided in the SOM (S1-S2).

### *Instruments*

Study 4 was mainly aimed at testing EDO's incremental validity regarding a behavioral measure thus, we included such a variable (see below). We used some of the the same instruments as in Study 1a. These were Ecological Dominance Orientation (EDO; [NAME REDACTED]), Social Dominance Orientation (SDO, Pratto et al., 1994;  $\alpha = .89$ ), Human Supremacy Beliefs (HSB, Dhont & Hodson, 2014;  $\alpha = .92$ ), and Anthropocentrism (subscale of the NEP, Dunlap et al., 2000;  $\alpha = .76$ ).

**Signing of Pro-Environmental Online Petitions.** As a more behavioral measure of pro-environmental behavior, we assessed climate-change-mitigation support by using a measure from a previous study ([NAME REDACTED]). This measure is a multi-item behavioral measure in which participants are asked whether they agree to be added as a signatory in different (realistic, but fictional) online petitions via their associated MTurk ID. Participants were provided with three options: support, non-support, or non-inclusion (e.g., "Add my MTurk ID to the petition", scored as 3, "Add my MTurk ID in opposition to the petition", scored as 1, or "Do not add my MTurk ID to the petition", scored as 2, respectively). The content of the petitions pertains to urging members of parliament to enact measures to mitigate climate change related negative consequences for either humans, non-human animals, or nature (e.g., "Urge members of parliament to increase federal spending on combating global climate change for the protection of the natural environment [animals, humans]"). The results of an EFA with the measured items yielded one factor which explained 80.04% of the variance (eigenvalue = 5.60) in total (see S6 in SOM), representing signing online petitions related to climate change mitigation policies across all relational domains ( $\alpha = .96$ ). Following these results, we computed one construct.

**Demographic Information and Control Variables.** The same demographic information as in the previous Studies was assessed for Study 4: age, gender, highest

education level attainment, household income, current employment status, and ethnicity.

## Results and Discussion

### *Descriptive Statistics*

Table 6 shows the mean scores, standard deviations, and inter-correlations among all variables assessed in Study 4.

Table 6

*Means, Standard Deviations, and Intercorrelations Between all Variables (Study 4).*

	<i>M</i>	<i>SD</i>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
1. Ecological dominance orientation	3.98	1.93	–			
2. Social dominance orientation	2.35	1.32	.46***			
3. Human supremacy beliefs	3.58	1.59	.73***	.41***		
4. Anthropocentrism	3.15	1.48	.69***	.53***	.74***	
5. Online petition signing	2.30	0.54	-.34***	-.33***	-.32***	-.39***

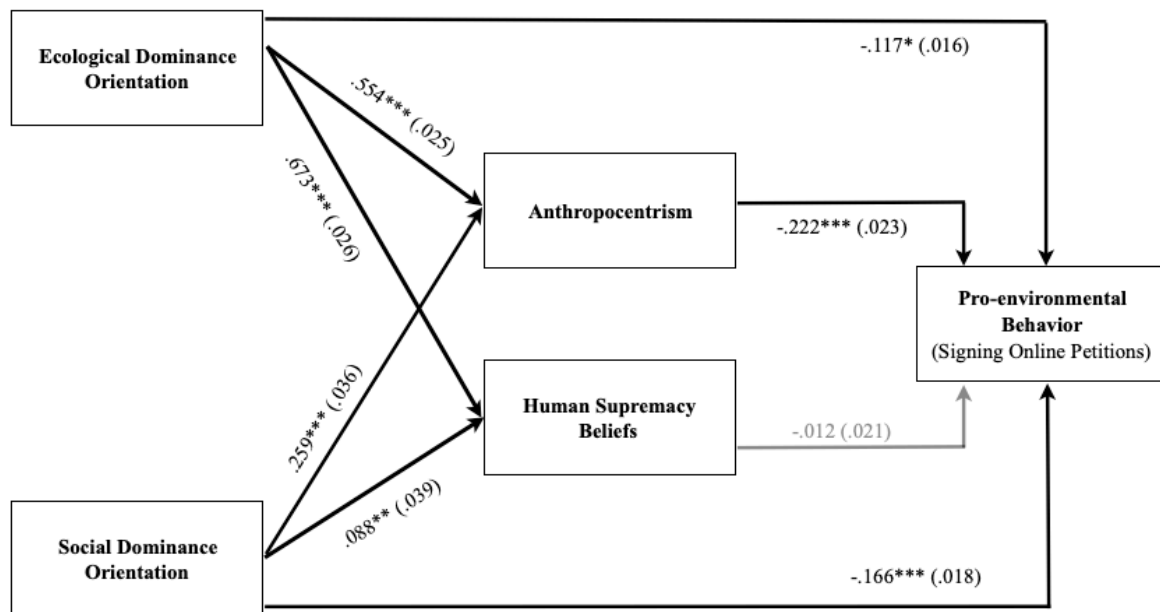
\*\*\* $p < .001$ .

Replicating our findings from our previous Studies, SDO and EDO were positively and significantly correlated with each other ( $r = .46, p < .001$ ) (H1) and both positively correlated with Human supremacy beliefs and Anthropocentrism and negatively correlated with online petition signing (H5-H6). As expected, both Human supremacy beliefs and Anthropocentrism were negatively and significantly associated with online petitions signing (see Table 6). Also replicating our previous findings, males showed significantly higher SDO ( $M = 2.50, SD = 1.34; F(1, 582) = 9.50, p = .002, \eta_p = .02, 90\% \text{ CI } [.00, .04]$ ), and EDO levels ( $M = 4.20, SD = 1.86; F(1, 582) = 10.83, p = .013, \eta_p = .02, 90\% \text{ CI } [.01, .04]$ ) compared to female participants ( $M = 2.16, SD = 1.27; M = 3.69, SD = 1.99$ , respectively) (H2).



### Mediation Model

Next, we tested our hypotheses (H5-H7) that the effects of EDO on our behavioral dependent variable, i.e., signing of online petitions would be mediated via Human supremacy beliefs and Anthropocentrism. We conducted a path-model analysis with SDO and EDO as predictors, Anthropocentrism and Human supremacy beliefs as mediators, and signing of online petitions as dependent variable (see Figure 2). Predictors were centered around the mean, and participants' gender, age, education, and household income were entered as control variables.



**Figure 2.** Path diagram model with estimated standardized coefficients (direct effects) with standard errors in parentheses. Continuous predictors were mean-centered. Age, education, household income, and gender were entered as covariates (not displayed in figure). Non-significant paths are marked grey.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

In line with our expectations, EDO was positively associated with Anthropocentrism ( $B = .554, SE = .025, p < .001, 95\% \text{ CI } [0.374, 0.471]$ ) and positively associated with Human

supremacy beliefs ( $B = .673, SE = .026, p < .001, 95\% CI [0.502, 0.606]$ ). As expected, EDO also showed a significant direct association with our behavioral dependent variable ( $B = -.117, SE = .016, p = .046, 95\% CI [-0.065, -0.001]$ ). Moreover, SDO was positively associated with Anthropocentrism ( $B = .259, SE = .036, p < .001, 95\% CI [0.219, 0.362]$ ) and positively associated with Human supremacy beliefs ( $B = .088, SE = .039, p = .006, 95\% CI [0.031, 0.183]$ ). SDO also showed a significant association with our behavioral dependent variable ( $B = -.166, SE = .018, p < .001, 95\% CI [-0.104, -0.032]$ ).

Regarding the control variables, age was positively associated with Human supremacy beliefs ( $B = .092, SE = .004, p = .001, 95\% CI [0.005, 0.021]$ ) but not with the remaining variables (see Table 7). Gender was negatively associated with Anthropocentrism ( $B = -.078, SE = .086, p = .008, 95\% CI [-0.219, -0.362]$ ) and negatively associated with signing of online petitions ( $B = -.079, SE = .042, p = .040, 95\% CI [-0.167, -0.004]$ ). Education was negatively associated with signing of online petitions ( $B = -.098, SE = .016, p = .011, 95\% CI [-0.073, -0.009]$ ) but not with the other variables. Household income showed no significant effect on any variable (see Table 7).

To assess the mediating role of Anthropocentrism and Human supremacy beliefs on the relationships between the predictor variables and the dependent variable, the total effects of the predictors were further decomposed into direct and indirect effects.

Table 7

*Decomposition of Standardized Direct, Indirect, and Total Effects on Signing Online Petitions, With Standard Errors in Parentheses (Study 4).*

Variables	Direct effects			Total effects
	Anthropocentrism	Human supremacy beliefs	Signing online petitions	Signing online petitions
EDO	.554*** (.025)	.673*** (.026)	-.117* (.016)	-.248*** (.012)

SDO	.259*** (.036)	.088** (.039)	-.166*** (.018)	-.225*** (.018)
Age	.009 (.004)	.092** (.004)	.002 (.002)	-.002 (.002)
Gender	-.078** (.086)	-.045 (.092)	-.079* (.042)	-.061 (.042)
Education	.007 (.034)	.035 (.036)	-.098* (.016)	-.100* (.016)
Household income	.005 (.030)	.033 (.032)	.029 (.014)	.028 (.015)
Anthropocentrism	–	–	-.222*** (.023)	–
Human supremacy beliefs	–	–	-.012 (.021)	–
Model summary	$F(6, 576) = 108.80,$ $p < .001, R^2 = .53$	$F(6, 576) = 114.79,$ $p < .001, R^2 = .54$	$F(8, 574) = 17.29,$ $p < .001, R^2 = .19$	$F(6, 576) = 19.62,$ $p < .001, R^2 = .17$

*Notes.* Values reflect standardized beta values and bootstrapped errors. Gender was coded as

1 = Male, 2 = Female

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

In line with our expectations (H5), in the full model,  $R^2 = .17$ ,  $F(6,576) = 19.62$ ,  $p < .001$ , Anthropocentrism partially mediated the relationship between both SDO and EDO and signing online petitions in the expected direction. Specifically, for EDO, the indirect pathway through Anthropocentrism ( $B = -.123$ ,  $SE_{Boot} = .038$ , 95%  $CI_{Boot}$  [-0.198, -0.049]) was significant indicating partial mediation. Contrary to our hypothesis (H6), no significant mediation was indicated for HSB ( $B = -.008$ ,  $SE_{Boot} = .044$ , 95%  $CI_{Boot}$  [-0.093, 0.078]). Resembling the results for EDO, for SDO, the indirect pathways through Anthropocentrism ( $B = -.059$ ,  $SE_{Boot} = .017$ , 95%  $CI_{Boot}$  [-0.098, -0.023]) was significant also indicating partial mediation (see Table 7). No significant mediation was indicated for HSB ( $B = -.001$ ,  $SE_{Boot} = .006$ , 95%  $CI_{Boot}$  [-0.014, 0.012]).

In line with our hypothesis (H7), our results indicate that the effects of EDO on SDO on signing online petitions via Anthropocentrism held, controlling for age, education,

household income, and gender. Removing the covariates did not substantially change the direction nor the significance of the presented results.

### **General Discussion**

Although humans are the most ecologically dominant species on Earth (Vitousek et al., 1997), research on the psychology of ecological dominance is still in its infancy. Across five studies, we sought to establish the psychometric qualities and theoretical importance of Ecological Dominance Orientation (EDO) beyond established measures of ideological orientation and domain-specific belief scales that have dominated research on the topic. The EDO measure is designed to assess ecological dominance motives as a general preference to establish and maintain an anthropocentric and hierarchical arrangement between humans, nonhuman animals, and the natural environment.

Despite the documented importance of ideological orientations (captured by SDO and RWA) and associated perceptions and beliefs (e.g., anthropocentrism and human supremacy beliefs) for explaining anti-environmental attitudes and behaviors, we reasoned that understanding and explicitly measuring ecological dominance motives provides utility over and above said measures. In testing this claim, we provided a comprehensive comparison of the effects of EDO as an overarching factor spanning across relational domains versus the more established measures of domain-specific motivations and beliefs (see Jylhä & Akrami, 2015, Feygina, 2013, and Milfont et al., 2013, for exceptions).

Through this work, we also aimed to provide an intuitive, theoretically grounded, face-valid, and economic empirical tool to assess EDO, which has thus far been lacking. Using the novel EDO measure, across six samples, we demonstrate that EDO a) shapes attitudes in a similar fashion both *within* and *between* different relational domains (i.e., intergroup, interspecies, human-environment relations), b) is uniquely predictive of numerous socially consequential attitudes across relational domains (i.e., modern sexism, modern

racism, speciesism, anthropocentrism, dehumanization) over and above established measures of ideology, c) is reliable over time, d) relates to a distinct set of personality correlates and nomological network, and e) predicts pro-environmental behavior above and beyond related constructs.

### **Social and Ecological Dominance Orientations: Two Sides of the Same Coin?**

The EDO scale was very effective at predicting a variety of outcome measures across different relational domains, from modern sexism to pro-environmental behavior. The measure is also intuitive, efficient, brief, and reliable. Together, these characteristics establish the EDO measure as a practically useful tool in the study of ecological dominance motives specifically, and intergroup, inter-species, and human-environment relations more generally. At the same time, our results highlight a number of *theoretically* important aspects of EDO.

First, previous research has investigated phenomena associated with human ecological dominance (e.g., speciesism, anthropocentric beliefs, low environmentalism) solely as downstream consequences of political ideology (e.g., SDO, RWA; Costello & Hodson, 2010; Dhont et al., 2016; Hyers, 2006; Jylhä & Akrami, 2015; Milfont et al. 2013) but not as a consequence of individual preferences for ecological dominance in itself (c.f. [NAME REDACTED]). Here, we sought to complement this line of research by investigating the psychology of ecological dominance as an *independent* predictor of attitudes and perceptions across relational domains. In line with our reasoning, we have shown that EDO is indeed a distinct and reliable psychological construct that is uniquely associated with numerous social and environmental outcome variables across relational domains. In line with our hypothesizing, across studies, we found that while EDO was significantly associated with all criterion variables across relational domains, it showed stronger associations with speciesism, human supremacy beliefs, and anthropocentrism compared to modern racism and modern sexism. Conversely, SDO showed stronger associations with modern racism and

modern sexism compared to speciesism and anthropocentrism. Overall, these findings, support our hypotheses that preferences for hierarchical communal arrangements generalize across the human, nonhuman animal, and the natural environment relational domains.

Importantly, EDO was not merely a proxy for Social Dominance Orientation (SDO) or Right-wing Authoritarianism (RWA). Across the studies, we examined the predictive validity of EDO after controlling for SDO and RWA (Study 1a and 2a). Although EDO was, as expected, significantly associated with SDO and RWA, it remained a significant outcome predictor in each study even after SDO and RWA were controlled for. When examining modern sexism, modern racism, speciesism, and dehumanization, the EDO measure consistently predicted all outcome measures after accounting for both SDO, RWA, and relevant demographic variables. These findings are supportive of our notion that attitudes towards nonhuman animals and nature can be explained by SDO and RWA and yet might be more closely predicted by hierarchical preferences explicitly pertaining to these relational domains. Although future work will be necessary to unpack the psychological mechanisms underlying ecological dominance motives on the one hand and social dominance motives and right-wing authoritarianism on the other, the data reported here illustrate an important divergence between these three constructs. It is noteworthy that while we propose an overarching perspective across relational domains to analyze the common and shared psychology of social and ecological dominance motives, it is equally important to bring one's analytical focus to more nuanced and fine-grained differences within and between specific relational domains, i.e., within human and non-human animal relations and human-environmental relations more specifically. The general overarching and more specific perspectives are not mutually exclusive but rather complementary and ultimately guided by specific research interest.

Second, as expected, the EDO measure was also highly associated with Anthropocentrism (as assessed by the anthropocentrism sub-scale of the NEP; Dunlap et al., 2000) and Human supremacy beliefs (HSB, Dhont & Hodson, 2014). Previous research has analyzed both anthropocentrism and HSB as downstream consequences of SDO and RWA showing that a substantial amount of variance in these variables was accounted for by SDO and RWA (e.g., Dhont et al., 2016). Here, we demonstrated that EDO was predictive of these variables above and beyond SDO and RWA, uniquely explaining between 12-31 % of variance.

It is worth noting that although EDO was related to both Anthropocentrism and HSB, EDO predicted pro-environmental behavior after accounting for both anthropocentrism and HSB while controlling for SDO (see Study 4). These findings corroborate our notion of considering EDO as an independent psychological factor beyond anthropocentrism, HSB, SDO and RWA.

Finally, in line with our reasoning, we found that ecological and social dominance orientations have both shared as well as clearly distinct personality correlates. EDO and SDO shared a set of common correlates, namely, a positive correlation with the Narcissism, Psychopathy, and Sadism sub-scales of the Dark Tetrad scale; the Loyalty, Authority, and Purity sub-scales of the Moral Foundations scale; the single-item Narcissism scale; and with political orientation (conservative). Aside from the shared correlates, EDO and SDO showed clearly distinct correlates. Specifically, in line with previous research (e.g., Ho et al., 2015), we found that SDO was *negatively* correlated with the Big 5 personality traits of Conscientiousness, Agreeableness, and Openness. In contrast, EDO was *positively* correlated with Conscientiousness, Extraversion, and negatively correlated with Neuroticism. Moreover, also in line with previous research (e.g., Ho et al., 2015), SDO was negatively correlated with the Moral Foundations subscales Harm and Fairness. In contrast to SDO, EDO was not

significantly associated with these two Moral Foundation dimensions. Lastly, we further found EDO to be positively correlated with self-esteem and personal religiosity scales, but not SDO. Future research could further analyze the shared and distinct personality correlates and differences in nomological network of both constructs.

Overall, our results are encouraging and indicate that EDO represents an economic and practical way to assess a general preference for an anthropocentric, hierarchical arrangement between humans, nonhuman animals and the broader environment, which is predictive of socially and ecologically relevant attitudes and behavior over and above established, multi-item measures.

### **Limitations and Future Directions**

However, we must also mention some important caveats. First, while our results support our reasoning on the generalizing nature of EDO, more research on its correlates in personality, ideology, environmental attitudes, and behaviors are needed to further establish its psychometric properties and validity. Particularly the relationship between EDO and other conceptually related measures such as the Environmental Attitudes Inventory and the Ecocentric and Anthropocentric Attitudes Toward the Environment Scale need further examination (Milfont & Duckitt, 2010; Thomson & Barton, 1994). Second, given the cross-sectional and correlational nature of the study design, no causal inferences can be made, and we do not claim to do so at any point. Future research will need to employ experimental and longitudinal study designs to advance our understanding of the relationship between social and ecological dominance orientations. Third, our focus was on the individual difference measures SDO, RWA, HSB, and anthropocentric beliefs as validation criteria. However, more research investigating EDO in relationship to other relevant constructs such as System Justification (Feygina et al., 2010) and authoritarianism more generally should be addressed in future research. Fourth, our present focus on EDO and SDO is not meant to imply that all



phenomena related to social and ecological dominance can be solely understood or reduced to individual differences. In fact, social dominance theory posits that personal preferences for hierarchy and power (SDO) as well as other individual difference variables must be considered within their socio-ecological contexts because individual psychological mechanisms and socio-ecological structures are dynamic and entangled processes. Future research should analyze both SDO and EDO in conjunction with macro-structural factors (e.g., Gelfand et al., 2011) and undertake cross-cultural comparisons (for SDO see, e.g., Fischer et al., 2012; Kunst et al., 2017). Fifth, while our focus was largely on the phylogenesis of social and ecological dominance motives, research on the ontogenesis of social and ecological dominance motives will help to disentangle the effects of socialization versus inheritance on the prevalence and development of SDO and EDO (for SDO, see Kleppetø et al., 2019; Thomsen et al., 2011). Sixth, while we believe that the cross-national approach taken in this study is a strength, the results should also be interpreted in light of some limitations. For example, although Prolific and MTurk samples are arguably more representative than traditional social psychological samples, these samples are not nationally representative. Seventh, while we propose EDO as an enduring psychological trait—similar to SDO—much more research is needed to test this assumption more rigorously (Nettle, 2006; Penke et al., 2007). To this end, testing the test-retest reliability of EDO over a longer period of time (e.g., a number of months/years) will be one way of providing stronger empirical testing than the four weeks timeframe we could provide here. Eighth, we are especially intrigued by connecting our work to cultural and anthropological research concerned with explaining individual and cultural differences in regard to the mental representations and conceptualizations of the “living world”, i.e., understanding differences in how humans perceive themselves in relation to nonhuman animals and the broader natural environment, particularly in non-WEIRD settings (e.g., Bang et al., 2007; Carey, 1985;

Herrmann et al., 2010; Ross et al., 2003). Lastly, despite the obvious advantages of a brief, intuitive, and face-valid measure of ecological dominance orientation such as the one proposed here, a well-validated, multi-item measure which taps into the more complex nomological network of attitudes and beliefs associated with preferences for (or opposition to) a hierarchical arrangement between humans, non-human animals, and the broader natural environment is clearly needed.

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