Cultural Models of the Self and Environmentalism: A Cross-Cultural and Experimental Investigation

by

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Maree, you are a ray of light on the poorl . Whether it was your baking, your tap dancing, or your check-ins, you always found a way to make my days better. poorly constructed institution

Manaaki whenua

Manaaki tangata

Haere whakamua

Care for the land

Care for the people

Go forward

— Whakataukī (Māori proverb)

Abstract

Previous research suggests human–nature relations are influenced by human–human relations, particularly those related to the inclusion of others in self. Individuals who construe the self as more interdependent from others are more likely to protect nature than those who construe the self as more independent from others. We conducted cross-cultural and experimental studies to examine this proposition systematically using a recently developed seven-dimension model of self-construal. Study 1 (N = 7,279, k = 55) confirmed that those who saw themselves as more connected and committed to others were more likely to endorse environmental protectionism. Multilevel moderation analysis indicated that the association between commitment to others and environmental protection was stronger in societies that express greater difference to others and have greater self-expression, commitment to others, environmental performance, and societal development. However, experimentally priming interdependent versus independent self-construals in Study 2 (N = 419) did not increase participants' connectedness with nature, but nature connectedness mediated the relationships between connection to others and pro-environmental attitudes. Results indicate that inclusion of others in self translates into inclusion of nature in self and environmental protection but inducing this effect may be challenging.

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Chapter 1: Introduction

Over a century of unchecked industrialisation, deforestation, and agricultural development has left our natural ecosystems reeling. The United Nations (2016) has declared that "Climate Change is the defining issue of our time" (p.1) and The Intergovernmental Panel on Climate Change– who provide scientific information for the development of climate related policies – recommend "rapid, far-reaching and unprecedented changes in all aspects of society" (Masson-Delmotte et al., 2018, p.1) to limit global warming to 1.5°C above pre-industrial levels, which is the goal set out and approved by governments in The Paris Agreement (United Nations, 2015). Yet international opposition to environmental policy is pervasive and the rise of right-wing populist movements around the globe, from Donald Trump in the United States to Jair Bolsonaro in Brazil, pose a serious threat to the development of multilateral environmental solutions.

Although the causes and motivations of these movements are varied and nuanced, the movements clearly indicate that many people around the globe do not perceive climate change to be the urgent issue purported by the United Nations. Hence, understanding why many people are unconcerned about the state of our natural ecosystems has become one of the central motivations for behavioural scientists. A prominent hypothesis is that apathy towards environmental degradation is a symptom of modern human–nature relations (e.g., Kellert, 1995; Leopold, 1968; Wilson, 1984), because the root causes of the climate crisis – industrialization and deforestation – have disconnected modern societies from nature, fueling a belief that humans are separate from nature and can survive without it. At the heart of this idea is a conflict about what constitutes the self – are humans a part of, or separate from, nature?

Psychology has long been concerned with understanding the self, but it was not until the early 2000s that a psychological model of human–nature relations was formalised. Specifically,

Schultz (2002) proposed three components of self–nature relations: cognitive, affective, and behavioural. The model proposes that the more a person believes they are a part of or connected to nature (cognitive), the more they will care for it (affective), and the more they will commit themselves to protecting it (behavioural). Empirical support for this model emerged from research suggesting that the relationship between connection to nature and pro-environmental behaviour is a cultural universal (for a meta-analytical review, see Whitburn et al., 2020). Therefore, finding ways to enhance human connections to nature has become a crucial and timely endeavor for psychologists.

Recently, the psychological model of self–nature relations has been reconceptualised into the Inclusion Model of Environmental Concern (Nolan & Schultz, 2015), which incorporates the effect that self–other relations have on our environmental attitudes and behaviours. Specifically, a growing area of research shows that those who are more concerned about others are more concerned about environmental issues and more likely to participate in pro-environmental behaviours than those who are more self-concerned (e.g., Schultz, 2001; Stern et al., 1993). These findings have been linked to research on views of the self or self-construal – the global distinction between an interdependent and independent construal of the self in relation to other people, where people from Eastern nations are characterized by a more interdependent self-construal and people from Western nations are characterized by a more independent self-construal (Markus & Kitayama, 1991). Those who are more interdependent (connected to others) are more concerned about environmental issues than those who are more independent (separate from others; e.g., Arnocky et al., 2007; Davis & Stroink, 2016). This suggests that those who include others as a part of the self are more likely to include nature as part of the self as well; yet there is a dearth of research on the effects of self-construal on nature connectedness.

Furthermore, the simple contrast between independence and interdependence – as two distinct types of self-construal able to describe the variation in self–other relations across all world regions – has been criticised for oversimplifying the variety of ways that people relate to others, particularly in world regions outside of North America and East Asia where most research has taken place (e.g., Hermans & Kempen, 1998). Fortunately, a more nuanced measure of self-construal that measures variation in seven-dimensions of self–other orientations was recently developed (Vignoles et al., 2016). This self-construal measure has been validated in six world regions and 33 countries (including Aotearoa New Zealand), and proposes seven different ways in which individuals express themselves as either independent or interdependent.

As it stands, this measure has yet to be used to study environmental attitudes and may provide a more nuanced understanding of the relationship between self–other and self–nature relations, particularly in how these may vary across cultures. Moreover, few studies have directly tested the relationships between independence/interdependence and nature connectedness to determine if greater connection to others translates into a greater connection to nature. Therefore, the goals of this thesis are twofold: (1) to explore how seven dimensions of self-construal relate to pro-environmental attitudes across cultures; and (2) to test whether there is a causal relationship between self-construal and nature connectedness. This investigation begins with an overview of the key constructs.

Chapter 2: Literature Review

The Psychology of Human–Nature Relations

Ecologists have long theorised that our connection to the natural world is an important part of our evolution, not only critical for fostering sustainable behaviour (Leopold, 1968), but crucial for our wellbeing (e.g., Capaldi et al., 2014; Kellert, 1995). Nature connectedness has often been defined as an identity construct describing how much people think about or consider themselves a part of nature (e.g., Nisbet et al., 2009; Schultz, 2002). Whilst the idea of environmental identity has existed in psychological research for some time (e.g., Dunlap & Van Liere, 1978), it wasn't until 2002, when Schultz proposed a psychological model of human–nature relations that the concept of nature connectedness gained momentum. The psychological model of human–nature relations proposes that one's commitment to protect the natural environment stems from one's emotional and cognitive connection to the natural world, hence, understanding how people develop and maintain a strong connection to nature became an important motivation for environmental psychologists (e.g., Wells & Lekies, 2006).

Over the years, several different scales have been developed to measure nature connectedness which have been summarized in Table 1. These measures include Schultz's Inclusion of Nature in Self Scale (INS): a single-item pictorial measure assessing self–nature overlap, which was adapted from Aron et al.'s (1992) measure of self–other overlap and measures the extent to which people see nature as a part of the self; and Mayer & Frantz's (2004) connectedness to nature scale: a 14 item measure of a person's emotional connection to the natural world, with items such as '*I often feel a kinship with animals and plants*' and '*I often feel part of the web of life*'. Notably, Schultz et al. (2004) moved beyond self-report measures of nature connectedness and developed an implicit association test to measure the cognitive

association between nature and self, which provided evidence that even our implicit connection to nature can predict our pro-environmental behaviour.

Table 1

Measures of nature connectedness

Name	Description	Authors
Emotional affinity towards nature	11 items, statements	Kals et al., (1999)
Inclusion of Nature in Self (INS)	Single-item, graphical	Schultz (2001)
Environmental Identity (EID)	24 items, statements	Clayton (2003)
Environment Identity (EI)	11 items, statements, bipolar	Stets & Biga (2003)
Self-Nature IAT	Implicit Association Test	Schultz et al. (2004)
Connectedness to Nature (CNS)	14 items, statements	Mayer & Frantz (2004)
Connectivity with Nature (CWN)	5 items, 4 statements and the INS	Dutcher et al. (2007)
Commitment to the natural environment	11 items, statements	Davis et al. (2011)
Nature Relatedness (NR)	21 items, statements	Nisbet et al. (2009)
Love and care for nature	15 items, statements	Perkins (2010)
Disposition to connect with nature	40 items, statements	Brügger et al. (2011)
Nature Relatedness Short Version (NR6)	6 items, statements	Nisbet & Zelenski (2013)
Dispositional empathy with nature	10 items, statements	Tam (2013)
Environmental connectedness	3 items, statements	Beery & Wolf-Watz, (2014)

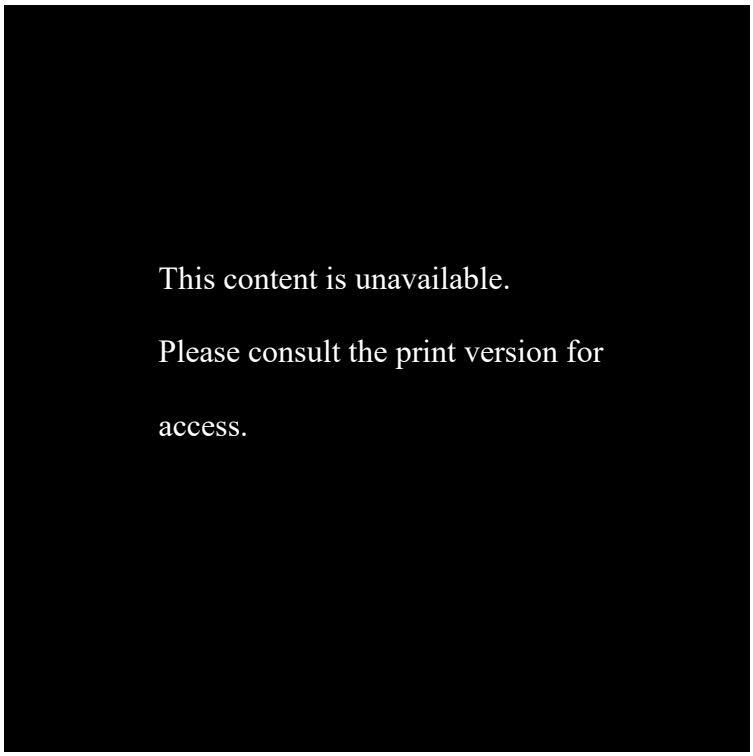
Validating the early claims made by ecologists, researchers using these measures have reported a positive relationship between nature connectedness and pro-environmental behaviour (e.g., Mayer & Frantz, 2004; Schultz et al., 2004). In 2019, two separate meta-analytic reviews were published consolidating two decades worth of empirical research into self–nature relations and environmental behaviour. Mackay and Schmitt (2019) found a strong positive association between nature connectedness and pro-environmental behaviour across correlation research (r = 0.37, k = 75), and a positive effect of nature connectedness on pro-environmental behaviour across experimental research (r = 0.10, k = 17). This suggests that experimentally inducing

nature connectedness may cause pro-environmental behaviour, an idea purported by early theorists (Leopold, 1949). Whitburn, Linklater, and Abrahamse's (2019) review suggested a stronger association between nature connectedness and pro-environmental behaviour ($r = 0.42$, $k = 37$), and found that the relationship between nature connectedness and pro-environmental behaviour was ubiquitous across cultures, indicating that the effect of nature connectedness on pro-environmental behaviour may be a culturally universal phenomenon. Taken together, the extant literature on nature connectedness and pro-environmental behaviour highlights the potential benefit of improving self–nature relations for increasing pro-environmental behaviour and improving environmental conditions.

Notably, in 2015 Schultz and Nolan updated the earlier conceptualisation of human-nature relations into the Inclusion Model of Environmental Concern (see Figure 1). Rather than simply distinguishing between the inclusion of nature in self and a lack thereof, this model incorporates self–other relations as an intermediary between seeing the self as unitary and seeing the self as a part of nature. The model proposes that including others as part of the self leads to a greater concern for the environment, and therefore greater environmental protection behaviours, than seeing the self as separate from others. Although socio-altruistic values had been linked to pro-environmental attitudes in previous research (e.g., Schultz, 2001; Stern, Dietz, & Kalof, 1993), the idea that self-concepts pertaining to other people influence our environmental attitudes was established by several findings grounded in Markus and Kitayama's independent and interdependent self-construals (e.g., Arnocky, Stroink, & DeCicco, 2007; Davis & Stroink, 2016).

Figure 1

Conceptual representation of the Inclusion Model of Environmental Concern



The Psychology of Self–Other Relations

The study of cross-cultural differences in self–other orientations has become central for understanding how self-definition shapes our values and behaviours (e.g., Cross & Madson, 1997; Markus & Kitayama, 1991; Matsumoto, 1999; Singelis, 1994). In their seminal article, Markus and Kitayama (1991) proposed a global distinction between an independent and interdependent construal of the self in reference to Western and Eastern cultural differences, respectively. An independent self-construal represents a view of the self as stable across different contexts, informed by personal characteristics, separated from other people, and promoted in

Western cultures. An interdependent self-construal represents a view of the self that is receptive to context, informed by family relationships, connected to others, and promoted in Eastern cultures. Individuals possess both types of self-construal, but it is thought that socio-cultural processes promote one over the other, which lead to individual differences in motivation, cognition, and values (see e.g., Gardner et al., 1999; Gudykunst et al., 2006; Singelis, 1994). Self-construal is conceptually related to the concepts of individualism versus collectivism, but individualism versus collectivism is a culture-level dimension of cultural variability and used to describe cultures that represent opposite ends of a dichotomy, whereas independence and interdependence are used to describe individuals and are separate, orthogonal constructs (Gouveia, 2002).

Markus and Kitayama (2010) describe the fundamental difference between independence and interdependence as one of agency. Agency in an independent setting is experienced through self-expression, whereas agency in an interdependent setting is experienced through social responsiveness and the maintenance of relationships. Understandably then, one's self-construal can led to different experiences of similar situations and therefore markedly different behaviour patterns. For example, self-construals have explained why North American students are more likely to speak up in classrooms than Korean American students, and why Indians are more likely to help people they do not like than Americans (Markus and Kitayama, 2010). Subsequently, independence and interdependence have become foundational concepts for understanding how sociocultural contexts shape our experiences and understanding of the self, and how these experiences, in turn, reshape cultures. Importantly, self-construal research has questioned the assumptions inherent in numerous psychological theories about what constitutes a universal psychological process, drawing attention to the sociocultural forces that shape

individuals and their behaviours. In almost three decades since Markus and Kitayama's seminal work, the theoretical and empirical scope of self-construal research has expanded, and one particularly important area is the development of self-construal priming.

Self-construal priming was developed as an experimental method for testing the claims made from cross-cultural observations – that differences in self-construal shape our motivation, cognition, and values. Because self-construal is conceptualised as a cultural syndrome (something reinforced or promoted in individuals through cultural context) we cannot simply manipulate an individual's culture to test its effect on different outcome variables. However, because individuals have access to both independence and interdependence, promoting one particular self-construal over another is possible by making that self-construal more accessible within a controlled environment. Although a multitude of self-construal priming tasks have been developed, a meta-analytical review by Oyserman and Lee (2008) highlighted four tasks that have become widely used and effective across several different cultures for priming both independence and interdependence: *Pronoun circling task*, *the Sumerian warrior story*, *the similarities and difference task*, and the *sentence unscrambling task*.

The *pronoun circling task* developed by Brewer and Gardner (1996) presents participants with a paragraph about a person's day and participants are asked to circle all the pronouns in the paragraph. In the independent version, all pronouns are 'I' focused ('I', 'me', 'my'), whereas in the interdependent version, all pronouns are 'we' focused ('we', 'us', 'ours'). Whilst the specific event of the paragraph can be different, the contrast is made between doing something by oneself or within a group, thereby promoting a person to think as an individual (independent) or as part of a group (interdependent).

The *Sumerian warrior story* developed by Trafimow et al. (1991), presents participants with a story to read in which Sostoras (an ancient Sumerian warrior) must choose someone to lead an army into war. In the independent version he chooses someone based on their individual talent and the story highlights the positive effect this will have on Sostoras, whereas in the interdependent version he chooses someone based on their tribal membership and the story highlights the positive effect this will have on Sostoras' family. The motivation to benefit oneself compared to one's family is therefore meant to prime an independent and interdependent self-construal, respectively.

The *similarities and difference task* also developed by Trafimow et al. (1991), asks participants to think for two minutes about their relationship with their friends and family. In the independent version participants are asked to think about how they are different from their friends and family, while in the interdependent version participants are asked to think about how they are similar to their friends and family. Contrasting the self as different or similar to other people is therefore meant to promote independence and interdependence, respectively.

The *sentence unscrambling task* requires participants to assemble a coherent sentence from a series of words. In the independent version the words to choose from emphasise difference and separation from other people (e.g., 'dissimilar', 'autonomy', 'solitude'), whereas in the interdependent version the words to choose from emphasise similarity and togetherness (e.g., 'cooperative', 'partnership', 'support').

These tasks have been used on a multitude of outcome variables to provide support for the causal effect of self-construal on motivation, cognition, and values (Oyserman & Lee, 2008). Table 2 presents the meta-analytic effect sizes reported by Oyserman and Lee (2008) showing

that all four tasks are consistently able to elicit differences in self-construal when compared to a control group.

Table 2

Effect of self-construal priming across different priming tasks

Priming Task	Independence vs. control	Interdependence vs. control
Pronoun circling	.44	.30
Sumerian warrior	.30	.22
Similarities and difference	.42	.13
Sentence unscrambling	.08	.55

Self–Other Relations and Environmentalism

Notably, priming interdependence has shown to increase other-focused values and goal orientations (Gardner et al., 1999), indicating that individuals whose thoughts and behaviours are motivated by their relationships with others are more likely to have self-transcendent values in comparison to those who are motivated by their own self-interest. Interestingly, research also indicates that self-transcendent value orientations are an important predictor of environmental concern (Boer & Fischer, 2013; Stern et al., 1993). Yet psychologists have only recently begun to examine the effect of self-construal on our attitudes and behaviours towards the environment (Arnocky et al., 2007).

Indeed, Schultz's early conceptualisation of self–nature relations proposed that altruistic environmental concern (i.e., concern for other people when considering environmental issues) represents an intermediate level of connection to nature situated between egoistic environmental concern (i.e., concern for oneself when considering environmental issues) which reflects a lower connection to nature, and biospheric environmental concern (i.e. concern for nature as its own entity when considering environmental issues), which reflects a greater connection to nature.

This idea originated from findings that altruistic environmental concern significantly correlated with inclusion of nature in self (r = .18), albeit weaker than biospheric environmental concern (r = .31), whilst egoistic environmental concern was unrelated (Schultz, 2001). Similarly, experimental research has highlighted that increasing a person's self-awareness (i.e., separation from others) can cause them to feel less connected to nature (Frantz et al., 2005), suggesting that those who see the self has separate from others are less connected to nature and therefore less likely to protect it. These findings highlighted how self–other relations impact our perception of environmental issues, opening the door for self-construal research.

At a broader level, in perhaps the first study to look at the relationship between self-construal and environmental outcomes, Gouveia (2002) explored the relationship between national levels of self-construal and a variety of national outcomes across thirty countries, finding that national levels of interdependence positively predicted an index of environmental performance (i.e., lower emissions and municipal waste). This was supported in a more recent study which found that national levels of independence were positively associated with national ecological footprint, such that nations higher in interdependence had a lower ecological footprint (Komatsu et al., 2019). Taken together, these studies illustrate the implications that self-construal can have on environmental outcomes at the national level and compel a greater understanding of self-construal and environmentalism at the individual level.

Yet environmental attitudes were not specifically linked to self-construal at an individual level until Arnocky et al. (2007) investigated the relationship between self-construal and environmental concern. They found that within-cultural differences in self-construal related to differences in environmental concern and behaviours in a commons' dilemma. Independence was associated with egoistic environmental concern (β = .20) and competitiveness in sharing

resources in an environmental commons' dilemma (β = .21), whilst interdependence was associated with resource cooperation (β = .20). These authors also included a third self-construal termed the metapersonal self – representing a view of the self as connected to all living things (i.e., nature connectedness; see DeCicco & Stroink, 2007) – that associated with biospheric environmental concern (β = .21), ecological cooperation (β = .40), and self-reported environmental behaviour (β = .33). Replicating these findings, Davis and Stroink (2016) found that independence associated with egoistic environmental concern (β = .22) and the metapersonal self associated with biospheric environmental concern (β = .21). Interestingly, this study also found that interdependence associated with altruistic environmental concern (β = .39) and connectedness to nature (r = .21), supporting the idea that a greater connection to other people leads to a greater inclusion of nature in self. Moreover, Hwang and Lee (2018) found that those who are more interdependent are more likely to believe in a fundamental connection between humans and nature than those who are more independent. Taken together, these studies provided empirical evidence for the significance of self–other relations in the Inclusion Model of Environmental Concern (Nolan & Schultz, 2015), highlighting that a more expanded view of the self (to include others and/or nature) leads to a greater concern for the environment.

Furthermore, three known experiments support the role of self–other relations in the Inclusion Model of Environmental Concern, showing that interdependence directly increases environmental attitudes and behaviours (see details in Table 3). Using self-construal priming, Gibson et al. (2014) showed that people primed to feel more interdependent had greater sustainability attitudes than those in a control group. Similarly, across two studies, Chuang et al. (2016) showed that those primed to feel more interdependent were more willing to make pro-environmental choices at a personal cost than those primed to feel more independent.

Ultimately though, these three experiments highlight a substantial lack of experimental work in this field and a focus on environmental attitudes as they relate to economic choices rather than more general environmental orientations. Moreover, there are significant methodological concerns across these experiments that warrant further inquiry. Namely, these studies either lacked control conditions, did not report effect sizes, did not use manipulation checks, did not use unvalidated priming methods, or over relied on North American and East Asian samples. Thus, there is a significant gap in the literature for further experiments, particularly examining how self-construal priming influences more general environmental attitudes and connection to nature.

Table 3

Details of experiments using self-construal priming on environmental outcomes

Author's	Location	*N*	Priming Method	Outcome Measure	Manipulation Check?	Effect size	Control Condition?
Gibson et al. (2014)	USA	224	Writing task	Sustainability attitude	None	Not reported	Yes
Chuang et al. (2016, Study 1b)	China	54	Sumerian warrior story	Eco-friendly behaviour choice	Piloted manipulation	0.67	None
Chuang et al. (2016, Study 2)	China	121	Sumerian warrior story	Eco-friendly behaviour choice	Piloted manipulation	0.41	None

Although much of the research supports the Inclusion Model of Environmental Concern and the idea that interdependence leads to greater environmentalism than independence, it is worth noting that several findings contradict this. In Davis and Stroink's (2016) replication of the effect of self-construal on environmental concern, connectedness to nature and biopsheric environmental concern were more strongly associated with independence than interdependence, and Gibson et al. (2014) showed that priming independence can also increase environmental

attitudes when compared to a control group. Moreover, the theoretical implications of previous research rely on North American and Chinese samples as universal representations, questioning the cross-cultural applicability of these findings in more diverse populations. However, conceptual and empirical issues in the measurement of self-construal may explain how both independence and interdependence can predict pro-environmental attitudes and behaviours (e.g., (Cross et al., 2011; Milfont, 2005), and a more nuanced measure of self-construal has been developed that may be able to explain the meaning of these inconsistencies and provide further support for the Inclusion Model of Environmental Concern across broader world regions.

Cultural Models of Selfhood

Though Markus and Kitayama's (1991) theory of self-construal had a major influence on psychological research, the two-dimensional structure of self-construal – independence and interdependence – has been questioned by several inconsistent findings (see, e.g., Hardin et al., 2004; Killen & Wainryb, 2000; Milfont, 2005). Scholars have also raised concerns about the overreliance on Eastern (e.g., China, Japan) and Western (e.g., North American, European) samples in the self-construal literature that has led to a tendency to dichotomise cultures along an east-west continuum, failing to represent how self-construal may be conceptualised in other world regions (Vignoles et al., 2016).

In response to these challenges, Vignoles et al. (2016) conducted an exploratory analysis of self-construal across 55 cultures in six world regions and found strong convergent validity for seven distinct dimensions of self-construal. These seven bipolar dimensions of self-construal identify multiple ways people may act or represent themselves 'independently' or 'interdependently' across cultures; allowing people to have expressions of both an independent

and interdependent self-construal. Table 1 presents each bipolar dimension with an example of an item in each domain.

Table 4

The seven dimensions of self-construal

Domain of functioning	Independent ⟷	Interdependent
Defining the self *(e.g. you see yourself as unique and different from others)*	Difference	Similarity
Experiencing the self *(e.g. your happiness is unrelated to the happiness of your family)*	Self-containment	Connectedness to others
Making decisions *(e.g. you prefer to do what you want without letting your family influence you)*	Self-direction	Receptiveness to influence
Looking after oneself *(e.g. you prefer to rely completely on yourself rather than depend on others)*	Self-reliance	Dependence on others
Moving between contexts *(e.g. you behave the same way at home and in public)*	Consistency	Variability
Communicating with others *(e.g. you show your inner feelings even if disturbs the harmony of your group)*	Self-expression	Harmony
Dealing with conflicting interests *(e.g. your own success is very important to you, even if it disrupts your friendships)*	Self-interest	Commitment to others

Each dimension in this model represents an aspect of personal or social functioning that can be experienced or expressed by an independent or interdependent orientation. Each dimension is mutually exclusive, so that one cannot be both independent and interdependent within a dimension but can express independent and interdependent orientations across different

dimensions. For example, a person cannot be self-reliant and dependent on others, but could be self-reliant and variable across contexts. Furthermore, Vignoles et al. (2016) measured cultural-level models of selfhood, showing that cultures within different world regions vary in their normative orientations of independent and interdependent self-construals across each dimension. Importantly, independence and interdependence were not supported as distinct higher order dimensions of self-construal, further highlighting the importance of adopting a more nuanced measure of self-construal in research. Vignoles et al.'s (2016) model of selfhood provides a more nuanced and sensitive explanation of the role of culture in defining the self, showing patterns of variation across regions of the world that go beyond the simpler independent-interdependent, and west-east dichotomy. Moreover, their validated self-construal measure allows a more refined investigation of how cultural variation in self-other orientations affect environmental attitudes and behaviours.

The Current Research

In summary, the extant literature on self-construal and environmentalism has been essential for the development of the Inclusion Model of Environmental Concern and an understanding of how self–other relations shape our environmental attitudes and behaviours. However, this research is inconsistent and has seldom explored a direct relationship between self-construal and nature connectedness, particularly across cultures and in experimental research. Moreover, the current literature has often relied on North American and East Asian samples which poses serious questions about the universality of these findings. Fortunately, a new seven-dimension model of self-construal has been recently developed that may explain previous inconsistencies in the literature and provide more nuance in understanding the

relationship between self-construal and environmentalism. Therefore, we conducted two preregistered studies: (1) a cross-cultural exploration of the relationship between seven-dimensions of self-construal and an endorsement for environmental protection; and (2) an investigation of the effect of self-construal priming on nature connectedness and environmental attitudes.

Chapter 3 (Study 1): Self-Construals and Environmental Values in 55 Cultures

Rationale

Whilst previous research shows correlations between self-construal and environmental attitudes (see, e.g., Arnocky et al., 2007; Davis & Stroink, 2016), the model of selfhood proposed by Vignoles et al. (2016) provides an opportunity for greater nuance in understanding which aspects of selfhood are most consequential to environmentalism. Furthermore, although views of the self vary across cultural groups, the associations between self-construal and environmental attitudes has not been investigated across nations. Hence little is known about possible variability in this association across cultural groups and the extent to which national context (e.g., societal development, environmental performance) may influence this relationship. The present study contributes to this literature by exploring the relationship between seven dimensions of self-construal with endorsement of environmental protection within 55 cultures, across 33 nations and six world regions. We also employ multilevel techniques to examine the variability in these relationships and test whether observed variability is explained by societal variables.

Based on previous research, we had a few expectations. First, we expected that the dimensions self-containment (vs. connectedness to others), self-interest (vs commitment to others), and self-reliance (vs. dependence on others) would correlate reliably negatively with environmental protection across cultures. That is, those who are more connected, committed, and dependent on others (express interdependence in these dimensions) should have a greater inclusion of others in self and therefore, should be more willing to endorse environmental protection. Second, we expected that the relationship between each of the seven dimensions of self-construal and environmental protection would vary across cultures, and that this may be

partly explained by cultural models of selfhood moderating the relation between individual-level self-construal dimensions and environmental protection. We predicted that these possible cross-level interactions might be particularly relevant for the dimensions of difference (vs. similarity) and/or self-direction (vs. receptiveness to influence), as those who are more self-directed and/or different from others might be more likely to depart from the normative environmental attitude in their cultural setting. Finally, we predicted that cross-cultural variation in the relationship between self-construal and environmental protection may be partly explained by national metrics of human development and environmental performance. Although these expectations are theoretically sound and we pre-registered the main analysis in the Open Science Framework (https://osf.io/ephvg/), the expectations were not treated as confirmatory hypotheses and we conducted this study as exploratory. This study aims to lay the foundations for future research by establishing how a more nuanced measure of selfhood can highlight previously undifferentiated aspects of the self that are related to our environmental attitudes.

Method

Participants

We used Study 2 data from Vignoles et al. (2016). Participants were 7,279 adults from 55 cultural groups in 33 nations (see Table 5). Non-student adult samples were collected using snowballing from researchers' social networks, community groups and non-governmental organizations, as well as relatives of university students. Data were collected from nations in six world regions as part of a multinational study on culture and identity processes (Becker et al., 2012, 2014; Owe et al., 2013; Vignoles & Brown, 2011): Western and Eastern Europe, Sub-Saharan Africa, Southeast Asia, the Middle East, and South America. Where applicable, cultural groups were targeted within nations based on geographic (e.g., Eastern and Western Chinese), ethnic (e.g., US Hispanics and Whites), religious (Lebanese Christians and Muslims), or economic (Belgium high and low SES) differences.

Individual (Level 1) Measures

Predictor Variable: Self-Construal Scale. This scale measures the preferences of individuals to act or express themselves as either independent or interdependent across seven domains. The seven dimensions of self-construal are: *self-direction (vs. receptiveness to influence)*, *self-reliance (vs. dependence on others)*, *difference (vs. similarity)*, *consistency (vs variability)*, *self-containment (vs connection to others)*, *self-interest (vs. commitment to others)*, and *self-expression (vs. harmony)*. We used data for the 22 self-construal items that best represented the seven dimensions of self-construal across cultures in Study 2 of Vignoles et al. (2016). Table 4 presents examples of items for each dimension. Participants were asked: "How well does each of these statements describe you?" Items were worded with "you" to make the items seem more natural, and research assistants helped semi-literate participants read the items when needed. To reduce the influence of within-group comparisons, participants were asked to compare each item with the other items rather than comparing themselves to others within their cultural setting. Participants rated each item on a 9-point response scale ranging from 1 (*not at all like me*) to 9 (*exactly like me*), with the intermediates 3 (*a little*), 5 (*moderately*), and 7 (*very well*).

For this study, we used the latent factor scores saved from the multi-level measurement model from Study 2 of Vignoles and colleagues (2016). The scores were created from ipsatised items to remove acquiescent response styles so that scores represent a participant's relative endorsement across each item rather than their absolute endorsement. Thus, positive scores indicate a relatively higher preference for an 'independent' view of the self and negative scores

indicate a relatively higher preference for an ‘interdependent’ view of the self, within each dimension.

Outcome Variable: Environmental Protection Measure. Environmental protection was measured with a single item taken from the Portrait Values Questionnaire (PVQ) used in the European Social Survey (Schwartz, 2007). The item reads: *“It is important to [him/her]to protect the environment.”* Participants were asked to rate this item on a 6-point response scale from 1 (*very much like me*) to 6 (*not at all like me*) based on how much the person in the description was like themselves. Gender of the statement was matched to the participant. Before analysis, item scores were ipsatised using the participants average response across the 20 other PVQ items to reduce the effect of acquiescent response styles (see Schwartz, 2007; Smith et al., 2016). Scores were reversed so that higher scores indicate greater endorsement for environmental protection relative to other human values.

Cultural (Level 2) Measures

Cultural Models of Selfhood. We used the saved cultural-level scores for each dimension of self-construal from the measurement model in Study 2 of Vignoles and colleagues (2016) to test whether cultural models of selfhood would moderate the individual-level relationship between each of the seven dimensions of self-construal and endorsement of environmental protection. Cultural scores were created through variance decomposition for each item across both levels of analysis (individual and cultural). Age and gender were used as predictors in the individual-level seven-factor model, and random intercepts were used for each culture, which were then used as the indicator for each factor of self-construal at the cultural level.

Nation (Level 3) Variables

We tested if two nation-level variables would moderate the individual-level relationship between the seven self-construal dimensions and environmental protection. The Human Development Index (HDI; United Nations Development Programme, 2018) is a measure of a nation's average achievement in respect to three dimensions of human development: Life expectancy, education, and standard of living. We retrieved the 2017 HDI values for the 33 nations from which participants were recruited from. Where 2017 values were not available for nations, we used the most recent HDI measurement for that nation. The Environmental Performance Index (EPI) ranks nations on two domains of environmental performance: protection of ecosystems and protection of human health. The indicators for these domains measure a nations performance relative to internationally established standards or comparative performance to other nations. EPI scores were taken from the 2016 report: Global Metrics for the

Environment (Hsu et al., 2016). We selected these two nation-level indicators because prior work has shown they moderate individual-level associations in the environmental domain (e.g., Milfont et al., 2018).

Table 5

Description of cultural samples

Culture	N	Language	M_{age} (SD_{age})	Female %
Belgium: High SES	185	French	43.78 (8.17)	48
Belgium: Low SES	178	French	28.75 (9.25)	47
Brazil: Central	185	Portuguese	33.60 (13.77)	44
Brazil: North East	150	Portuguese	38.95 (11.66)	73
Brazil: South	165	Portuguese	25.97 (9.67)	56
Cameroon: Bafut	100	English	26.07 (6.10)	67
Chile: Majority	148	Spanish	44.97 (12.46)	58
Chile: Mapuche	149	Spanish	38.16 (14.83)	55
China: East	125	Chinese	31.66 (8.27)	69
China: West	135	Chinese	31.15 (8.70)	68
Colombia: Rural	150	Spanish	35.23 (13.37)	62
Colombia: Urban	149	Spanish	38.72 (11.52)	60
Egypt	164	Arabic	31.12 (9.98)	52
Ethiopia: Highlanders	150	Amharic	33.11 (9.23)	38
Ethiopia: Urban	150	Amharic	35.02 (9.00)	46
Georgia: Baptists	81	Georgian	44.85 (17.27)	75
Georgia: Orthodox	138	Georgian	39.16 (12.08)	45
Germany: East	153	German	40.26 (14.73)	58
Germany: West	104	German	39.71 (15.74)	58
Ghana	116	English	28.58 (5.09)	23
Hungary: Majority	151	Hungarian	36.83 (12.78)	46
Hungary: Roma	92	Hungarian	33.37 (11.70)	48
Iceland	121	Icelandic	35.19 (13.30)	69
Italy: Rural	90	Italian	40.30 (13.69)	72
Italy: Urban	83	Italian	37.59 (12.42)	69
Japan: Hokkaido	73	Japanese	50.87 (12.50)	63
Japan: Mainland	211	Japanese	41.43 (15.51)	60
Lebanon: Christian	137	Arabic	35.45 (13.28)	53
Lebanon: Muslim	123	Arabic	34.76 (14.74)	42
Malaysia	150	Malay	28.05 (7.92)	63
Namibia: Damara	69	English	25.14 (6.40)	61
Namibia: Owambo	135	English	24.34 (5.30)	68
New Zealand: Pākehā	204	English	34.91 (13.06)	49
Norway	102	Norwegian	37.01 (13.54)	57
Oman	160	Arabic	25.12 (4.99)	45
Peru: Rural	73	Spanish	41.31 (13.47)	62
Peru: Urban	81	Spanish	30.65 (14.64)	52
Philippines: Christian	151	English/Tausug	32.01 (12.23)	52
Philippines: Muslim	154	English/Tausug	24.97 (8.82)	50
Romania: Rural	162	Romanian	37.02 (15.04)	59
Romania: Urban	318	Romanian	35.18 (12.12)	58
Russia: Caucasian	139	Russian	32.06 (11.75)	81
Russia: Russian	122	Russian	29.43 (12.33)	76
Singapore	110	English	34.95 (12.74)	54
Spain: Rural	75	Spanish	38.61 (16.14)	47
Spain: Urban	105	Spanish	41.16 (13.39)	55
Sweden	101	Swedish	45.18 (16.01)	65
Thailand	71	Thai	27.99 (6.71)	69
Turkey: Alevi	114	Turkish	38.88 (11.02)	64
Turkey: Majority	134	Turkish	40.62 (9.94)	57
Uganda: Baganda	151	English	34.45 (6.31)	58
UK: Rural	95	English	51.82 (16.50)	72
UK: Urban	133	English	43.92 (17.43)	62
US: Colorado	92	English	36.77 (13.74)	59
US: Hispanics	122	Spanish	23.49 (5.34)	71

Results

Meta-Analytic Results

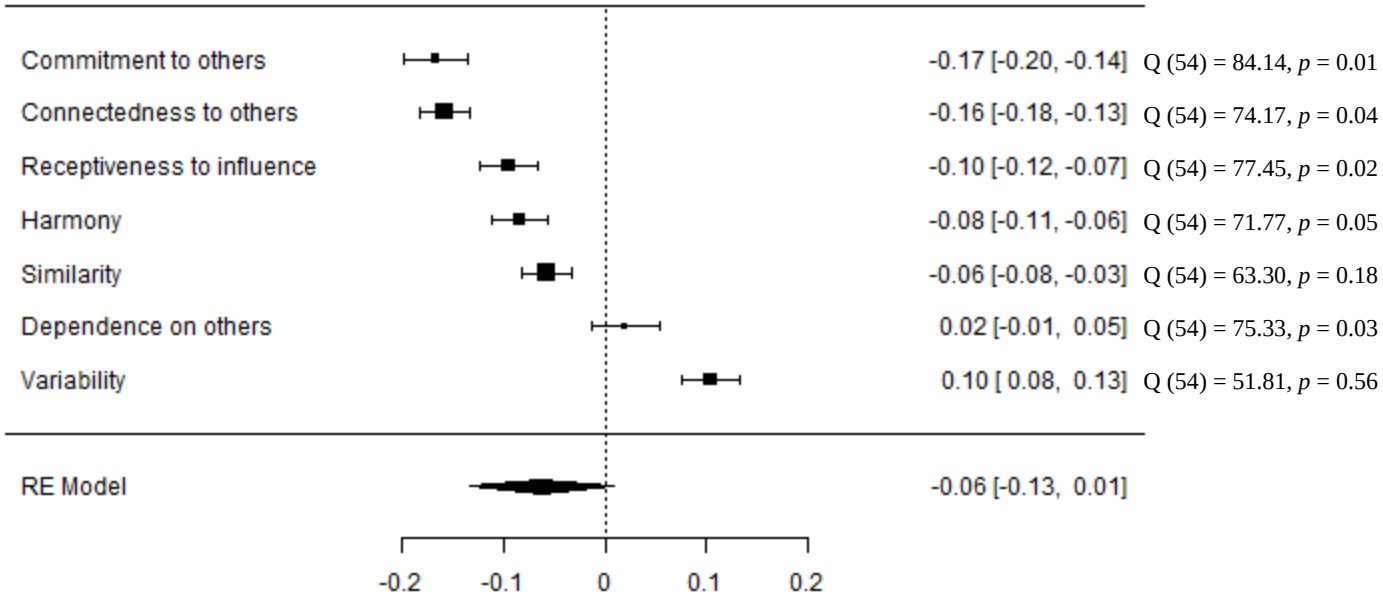
We calculated the correlations between each dimension of self-construal and environmental protection within each culture in R Studio (R Core Team, 2013) using the package "tidyverse" (Wickham, 2017). These correlations were then used to produce meta-analytic effect sizes for the correlation between each self-construal dimension and environmental protection across cultures, using Jamovi software (The Jamovi Project, 2019) with restricted maximum likelihood estimation for random-effects and Fisher's r-to-z correlation transformation. The correlations for each culture and the meta-analytic results are presented in the Supplementary Material.

Figure 2 presents a forest plot with the meta-analytical summary of the seven dimensions. As can be seen, the meta-analytical results indicate an overall negative correlation indicating that an independent view of the self is associated with lower environmental protection, but the associations varied markedly for each of the seven dimensions. The meta-analytic results showed that six dimensions reliably correlated with environmental protection. We predicted that *self-containment (vs. connectedness to others)*, *self-interest (vs. commitment to others)*, and *self-reliance (vs. dependence on others)* would correlate reliably negatively with environmental protection across cultures. Supporting our predictions, *self-containment (vs. connectedness to others)* ($r_{z'}$ = -.16, 95% CI [-.18, -.13], p < .001) and *self-interest (vs. commitment to others)* ($r_{z'}$ = -.17, 95% CI [-.20, -.14], p < .001) correlated reliably negatively with endorsement for environmental protection across cultures. Contradicting our predictions, though, *self-reliance (vs. dependence on others)* showed no reliable effect ($r_{z'}$ = .02, 95% CI [-.01, .05], p = .168). Additionally, we found that *self-direction (vs. receptiveness to influence)* ($r_{z'}$ = -.10, 95% CI [-

.12, -.07], $p < .001$), *difference (vs. similarity)* ($r_{z'} = -.06$, 95% CI [-.08, -.03], $p < .001$), and *self-expression (vs. harmony)* ($r_{z'} = -.08$, 95% CI [-.11, -.06], $p < .001$) correlated reliably negatively; whilst *consistency (vs. variability)* ($r_{z'} = .10$, 95% CI [.08, .13], $p < .001$) correlated positively with environmental protection across cultures. Age ($r_{z'} = .15$, 95% CI [.12, .18], $p < .001$) and gender ($r_{z'} = .05$, 95% CI [.03, .08], $p < .001$) also had a positive relationship with environmental protection across cultures, supporting previous research that both older people and women were more likely to endorse environmental protection across cultures (e.g., Milfont et al., 2018).

Figure 2

Forest plot of the average correlation between seven-dimensions of self-construal and environmental protection across 55 cultures.



Note. Each dimension has been labelled by the interdependent orientation.

Testing Robustness of Correlations and Moderation Hypotheses

Confirming our expectation that the relation between self-construal and environmental protection would vary across cultures, the meta-analytic summary indicated heterogeneity for the association between five dimensions of self-construal and environmental protection: *self-containment (vs. connectedness to others)*; *self-interest (vs. commitment to others)*; *self-reliance (vs. dependence on others)*; *self-direction (vs. receptiveness to influence)*; *self-expression (vs. harmony)* (see significance of Q-statistics in Figure 2). To investigate possible explanations for variance in these dimensions, we used multilevel modeling. First, we estimated independent multi-level models (MLMs) for each dimension of self-construal predicting environmental protection (seven separate models) using random-slope intercepts for each culture (or nation; in the case of nation-level predictors). These analyses were run in R Studio (R Core Team, 2013) using the package "lmerTest" (Kuznetsova, Brockhoff, & Christensen, 2017) and restricted likelihood maximum estimation. Each MLM was first run without any predictors.

These models replicated the trends of the meta-analytic findings, *self-containment (vs. connectedness to others)* (γ = -.209, SE = .019, $\tau(54)$ = -11.03, $p < .001$), *self-interest (vs. commitment to others)* (γ = -.185, SE = .017, $\tau(54)$ = -11.04, $p < .001$), *self-direction (vs. receptiveness to influence)* (γ = -.094, SE = .014, $\tau(54)$ = -6.60, $p < .001$) and *difference (vs. similarity)* (γ = -.080, SE = .018, $\tau(54)$ = -4.37, $p < 0.001$) and *self-expression (vs. harmony)* (γ = -.124, SE = .021, $\tau(54)$ = -5.92, $p < .001$) all negatively correlated with environmental protection, whilst *consistency (vs. variability)* (γ = .100, SE = .011, $\tau(54)$ = 8.99, $p < .001$) positively correlated with environmental protection. Also supporting the meta-analytic findings, the strength of the correlations between each dimension of self-construal and environmental protection varied across cultures (see random effects in Table 6). To test whether age or gender

moderated the relationship between self-construal and environmental protection, we added age and gender separately as individual-level predictors of environment protection and the interaction terms between these predictors and the self-construal predictor in each MLM. Table 6 shows that both age and gender had main effects on all seven dimensions predicting environmental protection, indicating that women and older people were more likely to endorse environmental protection. Age also moderated the relationship between *self-direction (vs. receptiveness to influence)* and environmental protection; simple slopes confirmed that the negative relationship between *self-direction (vs. receptiveness to influence)* and environmental protection was stronger in younger people (γ = -.097, τ = -5.76, $p < .001$) than older people (γ = -.036, τ = -2.12, p = .03) (see Supplementary Figure 1 for a graphical representation of this interaction).

Table 6

Independent Multilevel Models showing random and fixed effects for each dimension of self-construal predicting endorsement for environmental protection

	Fixed effects			Random effects	
Predictor variables	γ	*SE*	τ	σ^2_μ	χ^2
Self-direction vs. receptiveness to influence (S-D vs. RTI)					
Level 1 predictors					
Intercept	.474	.040	11.728***	.078	228.804***
S-D vs. RTI	-.094	.014	-6.596***	.003	
Age	.015	.001	12.763***	.003	162.260***
Age x S-D vs. RTI	.003	.001	3.187**		
Gender	.102	.029	3.522***	.003	12.448*
Gender x S-D vs. RTI	.003	.025	.145		
Self-reliance vs. dependence on others (S-R vs. DO)					
Level 1 predictors					
Intercept	.476	.042	11.350***	.085	243.863***
S-R vs. DO	.032	.020	1.560	.006	
Age	.015	.001	13.625***	.006	182.540***
Age x S-R vs. DO	<.001	.001	.579		
Gender	.127	.029	4.407***	.006	19.450***
Gender x S-R vs. DO	.004	.036	.123		

Difference vs. similarity (D vs. S)					
Level 1 predictors					
Intercept	.473	.041	11.578***	.080	231.791***
D vs. S	-.080	.018	-4.368***	.003	
Age	.015	.001	12.690***	.001	160.460***
Age x D vs. S	.001	.001	.945		
Gender	.116	.029	4.011***	.003	16.228***
Gender x D vs. S	.012	.034	.347		
Consistency vs. variability (C vs. V)					
Level 1 predictors					
Intercept	.475	.041	11.650***	.080	225.501***
C vs. V	.100	.011	8.994***	<.001	
Age	.014	.001	11.880***	<.001	144.270***
Age x C vs. V	<.001	<.001	.517		
Gender	.108	.029	3.751***	<.001	14.376***
Gender x C vs. V	-.012	.023	-.512		
Self-containment vs. connectedness to others (S-C vs. CTO)					
Level 1 predictors					
Intercept	.470	.039	12.150***	.071	215.926***
S-C vs. CTO	-.209	.019	-11.030***	.005	
Age	.013	.001	10.869***	.006	116.670***
Age x S-C vs. CTO	.002	.001	1.436		
Gender	.017	.030	.585	.005	.504
Gender x S-C vs. CTO	-.015	.034	-.437		
Self-interest vs. commitment to others (S-I vs. CTO)					
Level 1 predictors					
Intercept	.471	.040	11.840***	.076	234.285***
S-I vs. CTO	-.185	.017	-11.040***	.006	
Age	.013	.001	11.728***	.005	136.840***
Age x S-I vs. CTO	<.001	<.001	-.454		
Gender	.075	.029	2.633**	.005	7.132*
Gender x S-I vs. CTO	-.015	.027	-.538		
Level 2 predictors					
Level 2 D vs. S	.194	.073	2.646*	.004	8.578*
Level 2 D vs. S x Level 1 S-I vs. CTO	-.065	.031	-2.068*		
Level 2 S-I vs. CTO	-.158	.086	-1.851	.005	5.811
Level 2 S-I vs. CTO x Level 1 S-I vs. CTO	.074	.036	2.019*		
Level 2 S-E vs. H	.215	.107	2.012*	.005	6.249*
Level 2 S-E vs. H x Level 1 S-I vs. CTO	-.089	.044	-2.044*		

Level 3 predictors					
HDI	.351	.355	.991	.005	4.667
HDI x Level 1 S-I vs. CTO	-.327	.149	-2.190*		
EPI	.005	.004	1.308	.004	8.197*
EPI x Level 1 S-I vs. CTO	-.005	.002	-3.021**		
Self-expression vs. harmony (S-E vs. H)					
Level 1 predictors					
Intercept	.475	.041	11.643***	.080	228.908***
S-E vs. H	-.124	.021	-5.924***	.005	
Age	.015	.001	12.548***	.006	156.460***
Age x S-E vs. H	<.001	.001	.587		
Gender	.111	.029	3.860***	.005	14.941***
Gender x S-E vs. H	.005	.037	.127		

Note. Level 2 and Level 3 predictors have only been presented where statistically significant cross-level interactions were found. The results for all Level 2 and Level 3 predictors for each dimension are provided in the Supplementary Material. Sample size for each level: Level 1 N = 7,069; Level 2 N = 55; Level 3 N = 33. *p < .05. **p < .01. ***p < .001.

We then investigated whether cultural-level dimensions of self-construal moderated the individual-level relationship between each dimension of self-construal and environmental protection. We added cultural-level scores for each dimension of self-construal as well as the interaction term between each cultural-level score and the independent-level self-construal dimension for each MLM. For parsimony, we provide only the cases of statistically significant cross-level interactions in Table 3 and a summary of all these analyses is provided in the Supplementary Material. Three cross-level interactions were found at the cultural-level on the individual-level negative association between *self-interest (vs. commitment to others)* and environmental protection.

Cultural-level *self-interest (vs. commitment to others)* had a suppressing effect on the individual-level relation between *self-interest (vs. commitment to others)* and environmental protection. Simple slopes confirmed that the association between *self-interest (vs. commitment to others)* and environmental protection was stronger in cultures that express greater commitment to others (γ = -.222, τ = -11.58, p < .001) compared to cultures that express greater self-interest (γ =

-.161, τ = -8.43, p < .001) (see Figure 2). In contrast, cultural-level *difference (vs. similarity)* had an enhancing effect on this relationship, with simple slopes confirming that the individual-level negative association between *self-interest (vs. commitment to others)* and environmental protection was stronger in cultures that express greater difference to others (γ = -.227, τ = -11.88, p < .001) compared to cultures that express greater similarity to others (γ = -.156, τ = -8.26, p < .001) (see Figure 3). Cultural-level *self-expression (vs. harmony)* also had an enhancing effect on this relationship. Simple slopes confirmed that the individual-level negative association between *self-interest (vs. commitment to others)* and environmental protection was stronger in cultures with greater self-expression (γ = -.226, τ = -11.78, p < .001) compared to cultures with greater harmony (γ = -.159, τ = -8.49, p < .001) (see Figure 4). These findings indicate that the strongest endorsement for environmental protection occured in those who were more commited to others, within cultures with greater levels of commitment to others, difference to others and self-expression.

Figure 3

Slopes for the association between *self-interest (vs. commitment to others)* and endorsement for environmental protection at difference levels of cultural *self-interest (vs. commitment to others)* scores (*N* = 7,069, *k* = 55).

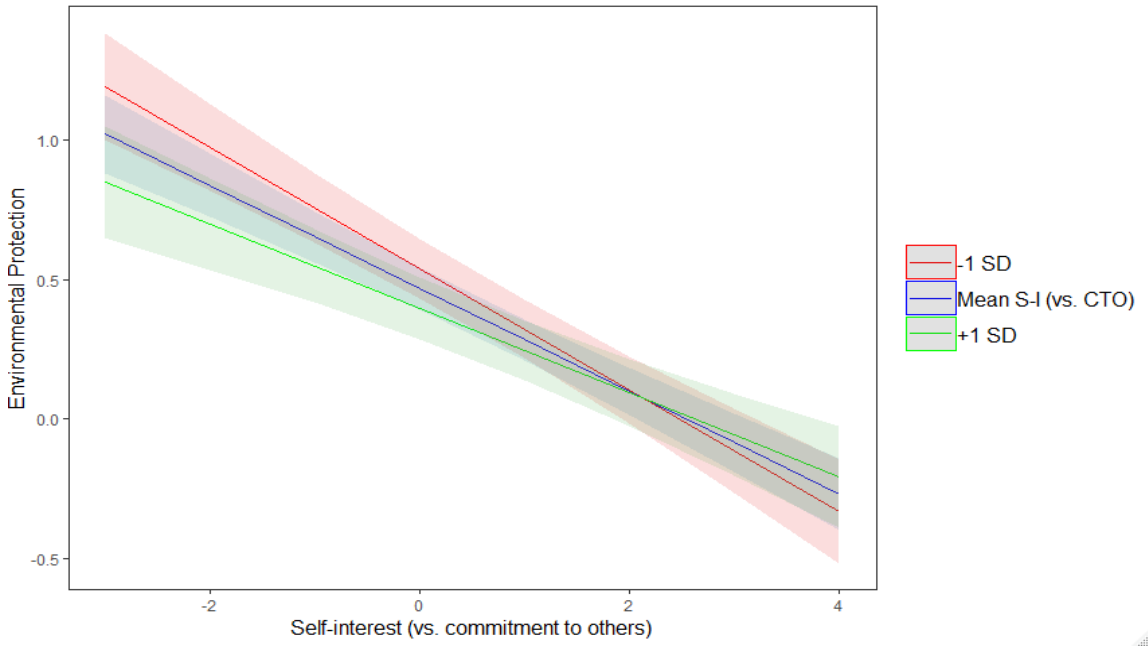


Figure 4

Slopes for the association between *self-interest (vs. commitment to others)* and endorsement for environmental protection at difference levels of cultural *difference (vs. similarity*) scores (*N* = 7,069, *k* = 55).

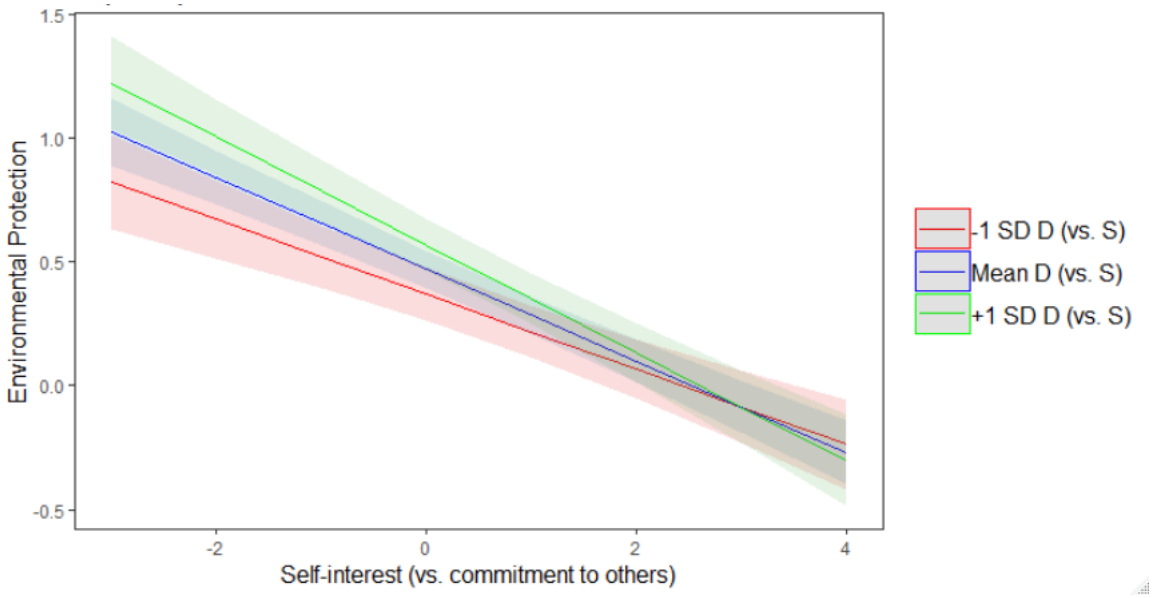
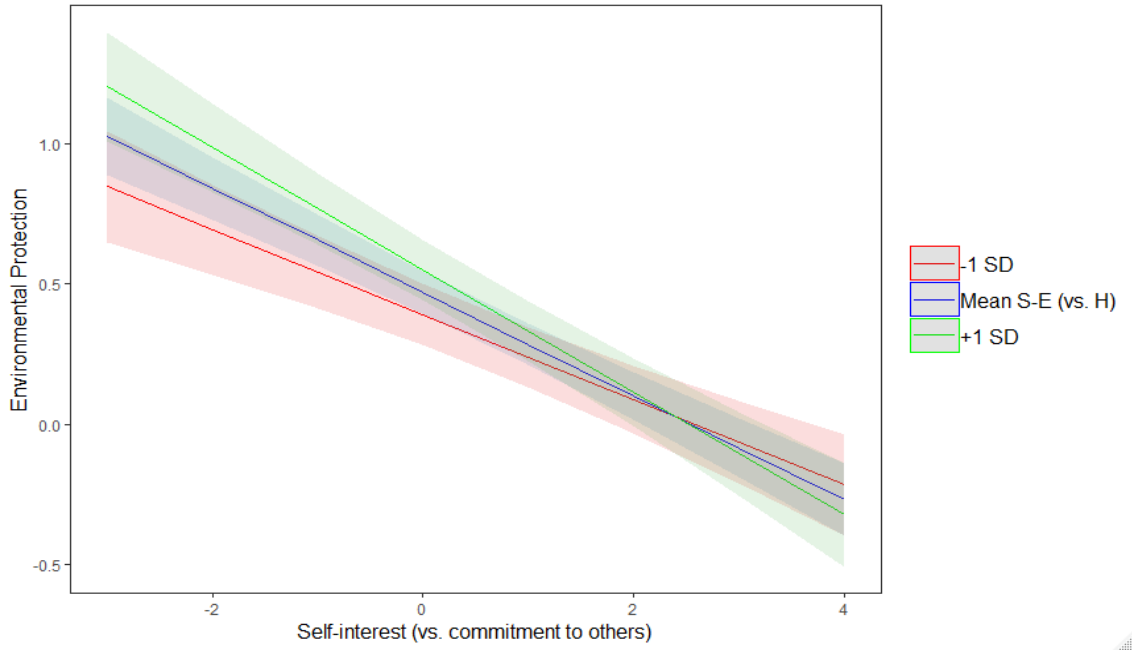


Figure 5

Slopes for the association between *self-interest (vs. commitment to others)* and endorsement for environmental protection at difference levels of cultural *self-expression (vs. harmony)* scores (N=7,069, k= 55)



We also tested whether two nation-level variables (HDI and EPI) could explain variance in the individual-level relationship between each dimension of self-construal and environmental protection across cultures. HDI and EPI were added separately as third-level predictors and the interaction term between each third-level predictor and the individual-level self-construal dimension in each MLM. Again, we only report the cases of statistically significant cross-level interactions (see Table 4). Both HDI and EPI had an enhancing effect on the association between *self-interest (vs. commitment to others)* and environmental protection. Simple slopes confirmed that the individual-level negative association between *self-interest (vs. commitment to others)* and environmental protection was stronger at higher levels of HDI (γ = -.237, τ = -12.28, p < .001) than at lower levels (γ = -.152, τ = -8.16, p < .001) (see Figure 5). Similarly, simple slopes confirmed that the individual-level association between *self-interest (vs. commitment to others)* and environmental protection is stronger at higher levels of EPI (γ = -.246, τ = -12.80, p

< .001) than at lower levels (γ = -.144, τ = -7.83, p < .001) (see Figure 6). The strongest endorsement for environmental protection occured in those who were more commited to others, within nations with greater human development and greater environmental performance.

Figure 6

Slopes for the negative association between *self-interest (vs. commitment to others)* and endorsement for environmental protection at different levels of Human Development Index (N = 7,069, k = 33).

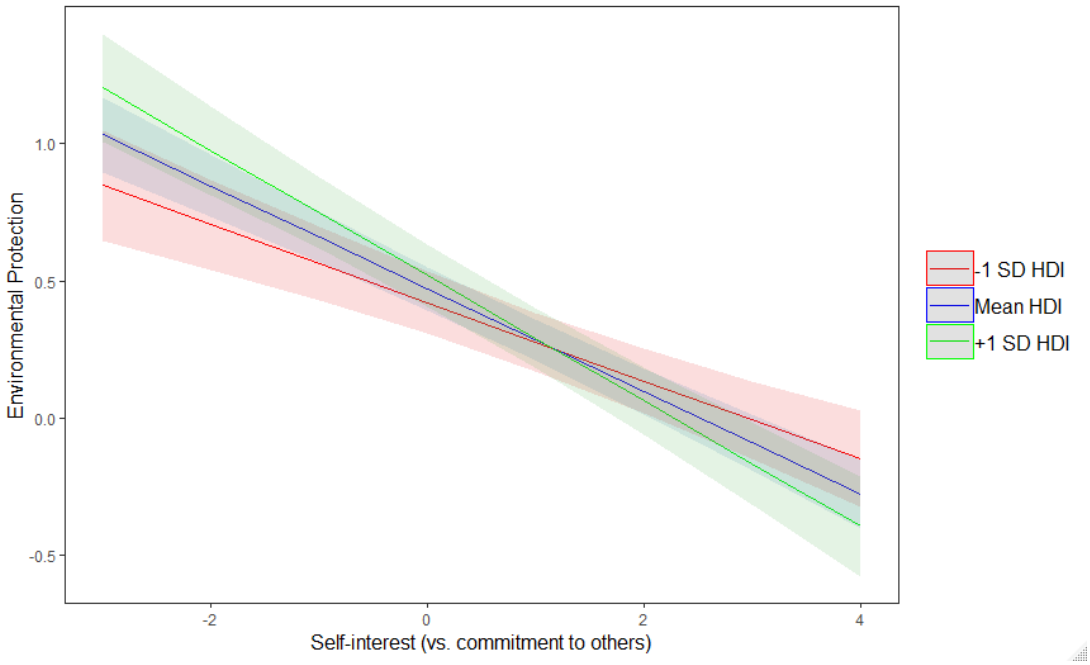
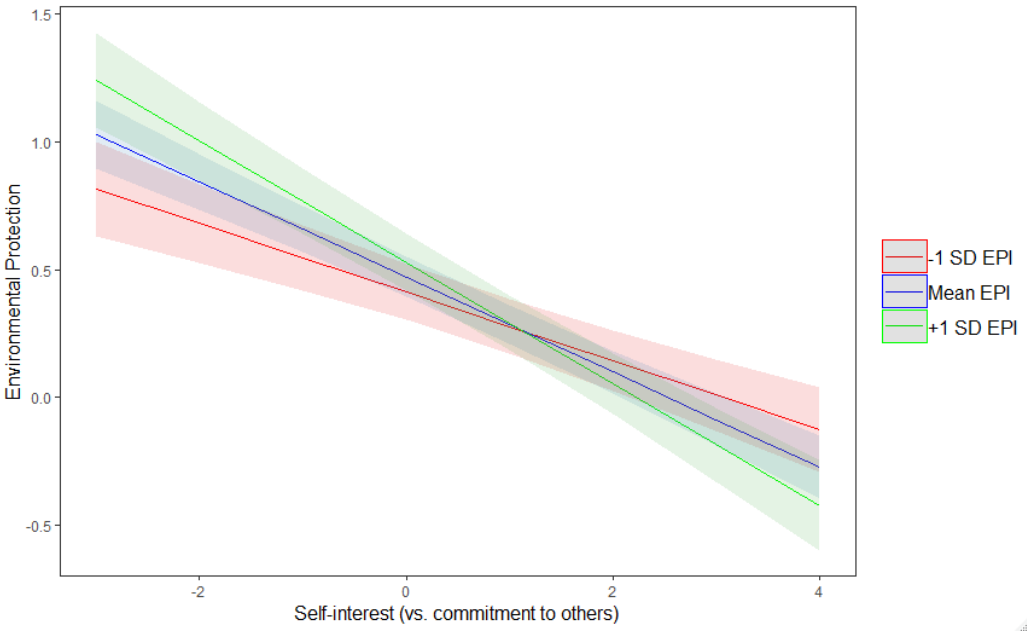


Figure 7

Slopes for the association between *self-interest (vs. commitment to others*) and endorsement for environmental protection at difference levels of EPI scores (N = 7,069, k = 33).



Discussion

Previous research has highlighted that self—other relations are important for how we perceive environmental issues (Arnocky et al., 2007; Chuang et al., 2016; Davis & Stroink, 2016; Dogan & Ozmen, 2019). Self-construal is a conceptual tool that has been used to model differences in self–other orientations across cultures (Markus and Kitayama, 1991) and a newly developed seven-dimension model of self-construal was recently published (Vignoles et al., 2016). To our knowledge, the seven dimensions of self-construal had yet to be integrated into the environmental literature and provided the motivation for this study – to explore how these seven dimensions of self-construal relate to environmental attitudes across cultures. In support of our expectations and the Inclusion Model of Environmental Concern (Nolan & Schultz, 2015), we found that a greater connection and commitment to others was associated with greater endorsement for environmental protection. Extending previous conceptions, we also found that those who are more receptive to influence and who seek harmony when communicating with others, consistency between contexts, and similarity to others, endorse greater environmental protection. In contrast to our expectations, *self-reliance vs. dependence on others* was the only dimension to not correlate with environmental protection. Multilevel analysis highlighted that the relationship between domains of self-construal and environmental protection varied significantly across cultures and that some of this variance can be explained by the normative expressions of self-construal within a culture and the level of societal development and environmental performance, supporting previous research about the effect of social context on environmental attitudes (e.g., Milfont et al., 2018; Milfont & Schultz, 2016). The contributions of these findings to the literature are explored in Chapter 5.

Chapter 4 (Study 2): The Effect of Self-Construal Priming on Nature Connectedness

Rationale

In Study 1 we provided cross-cultural support for the Inclusion Model of Environmental Concern, showing that across a large sample (N = 7,279) from 55 societies those who are more connected and committed to others are more likely to have pro-environmental attitudes. Expanding on these findings, the goal of Study 2 was to investigate whether experimentally manipulating a greater inclusion of others in self directly leads to a greater inclusion of nature in self. Previous studies have indicated that priming interdependence can increase environmental attitudes and behaviour (e.g., Chuang et al., 2016; Gibson et al., 2014), but there is little research about whether self-construal priming can elicit changes to self–nature relations. Furthermore, previous experiments compared interdependent priming to a control group (Gibson et al., 2014) or interdependent versus independent priming (Chuang et al., 2016) but have yet to compare interdependent priming to both an independent priming and control group in the same experiment. Hence, the present study contributes to experimental research on self-construal and environmentalism by investigating whether priming an interdependent self-construal can increase nature connectedness when compared to priming an independent self-construal and a control group. We also tested whether self-construal priming would have a direct effect on environmental attitudes and behaviour intention in line with previous experimental studies, and if any observed changes to environmental attitudes or behaviour intention were mediated by changes to nature connectedness.

Participants completed an online experiment, where they were randomly assigned to one of three experimental conditions: independent, interdependent, or control. Participants performed

a self-construal priming task – the Similarities and Difference from Friends and Family task (Trafimow et al., 1991) – that created experimental priming conditions eliciting either an independent or interdependent view of the self. We then measured participants' connection to nature using implicit measures (Schultz et al., 2004) and explicit (Nisbet et al., 2009; Schultz, 2001), as well as their general environmental attitudes (Milfont & Duckitt, 2010) and environmental behaviour intention (Bain et al., 2016).

The focus of this experiment was to investigate the relationship between self-construal and nature connectedness; hence, we had one confirmatory hypothesis and one exploratory hypothesis for nature connectedness. We pre-registered the experiment and hypotheses in the Open Science Framework (https://osf.io/q5v6t/). We have no evidence to suggest that priming effects will be stronger for explicit or implicit measures of nature connectedness, particularly because we are unaware of any previous self-construal priming studies that have used implicit environmental measures. For this reason, both explicit and implicit nature connectedness are equally considered in our hypotheses detailed below.

H1: Participants primed to think interdependently will exhibit higher levels of nature connectedness (implicit and explicit) than those primed to think independently and those in the control group.

E1: Participants in the control group will exhibit higher levels of nature connectedness (implicit and explicit) than those primed to think independently.

However, we were also interested in the possible effects of priming on environmental attitudes and behaviour intentions, so we had three other exploratory hypotheses:

E2: Participants primed to think interdependently will exhibit greater general environmental attitudes and greater environmental behaviour intention than those primed to think independently and those in the control group.

E3: Participants in the control group will exhibit greater general environmental attitudes and greater environmental behaviour intention than those primed to think independently.

E4: Implicit and explicit nature connectedness will mediate any changes to environmental attitudes and intentions between the experimental conditions and control group.

We employ the seven-dimensional measure of self-construal used in Study 1 primarily as a manipulation check but also to explore priming effects on the self-construal dimensions; we have limited evidence to suggest how priming effects will differ for any particular dimension, so these distinct effects will also be explored. Ethics was granted by the School of Psychology Human Ethics Committee on the 24th April 2019 under delegated authority of the VUW Human Ethics Committee (Application number: 0000027222).

Method

Participants

A G*Power analysis (Erdfelder et al., 1996) using a predicted moderate effect size of 0.5 based on a review of the SDFF literature (see Oyserman & Lee, 2008) recommended 70 participants in each of the three groups, 210 in total. We collected data from 436 students (*M* age = 18.94, 81% female) in a first-year psychology course in two waves, over two trimesters at Victoria University of Wellington. Participants were recruited through the Introduction to Psychology Research Programme – a system at the university that allows first-year psychology students to participate in research for course credit. The first wave of data collection was from 9th to 30th May 2019, whilst the second wave was collected from 16th July to 10th August 2019. Participants were not able to complete the study twice.

Procedure

Participants completed the experiment online where they were randomly assigned to one of three experimental conditions (independent prime, interdependent prime, and no prime). Participants completed their assigned priming task and completed three counterbalanced measures of nature connectedness to test our confirmatory hypothesis. Next, participants completed two counter balanced measures of environmental attitudes to test our exploratory predictions. Lastly, participants completed a seven-dimension measure of self-construal as a manipulation check for the effectiveness of the priming manipulation. The Supplementary Material presents all measures used in the study.

Experimental manipulation

Self-Construal Priming Task. The Similarities and Difference from Friends and Family task (SDFF) is a reliable and valid self-construal priming task developed by Trafimow et al. (1991). It has two conditions: the first promotes an independent self and the second promotes an interdependent self (for a review see Oyserman & Lee, 2008). Participants are first asked to think for two minutes about their friends and family without writing anything. In the independent prime, participants are asked: "Please think of what makes you different from your family and friends. What do you expect yourself to do?". In the interdependent prime, participants are asked: "Please think of what you have in common with your family and friends. What do they expect you to do?". After two minutes, participants are then asked to write down what makes them different or similar (independent and interdependent conditions, respectively) from their friends and family. Qualitative responses given by the participants were coded and categorised as either idiocentric (responses that pertain to personal qualities, attitudes, and beliefs) or allocentric (responses that pertain to demographic, relational, and group qualities), and these coded responses were used as another manipulation check for our two priming conditions (Trafimow et al., 1991). It is expected that participants in the interdependent prime will express more allocentric responses and fewer idiocentric responses than participants in the independent prime. For the control group, there is no priming or writing task.

Measures of nature connectedness

Implicit Association Test - Nature. The Implicit Association Test – Nature (IAT-Nature; (Bruni & Schultz, 2010; Schultz et al., 2004) is an adapted version of the Implicit Association Test (IAT) developed by Greenwald et al. (1998). The IAT measures the strength of a person's cognitive associations between mental representations of objects/concepts in memory. The IAT-Nature uses a computerised test that measures the response time needed to classify words associated with 'built' and 'natural' environments, as well as words associated with 'me' and 'not me'. Specifically, the IAT-Nature measures the strength of association between mental representations of self with nature.

The test is administered in seven blocks, each with 10 trials. Each trial presents a word with a set of categories. The participants must correctly identify the category for each word by pressing '*E*' or '*I*' (on a keyboard) to select the category on the left or right of the screen, respectively. The test uses four categories: nature, built, me, not me; and each category has five associated words presented in Table 7.

Table 7

Categories and words used to measure connectedness to nature (IAT-Nature)

Categories	Nature	Built	Me	Not me
Words	Animals	Building	I	It
	Birds	Car	Me	Others
	Plants	City	Mine	Their
	Whales	Factory	Myself	Them
	Trees	Street	Self	They

Before beginning the IAT-Nature, participants are informed that the test involves matching words with categories and that they should go as quickly as possible (keeping their hands on the keyboard). The test is then administered, and the block order is as follows:

- Block 1: Nature-Built
- Block 2: Me-Not me
- Block 3: Nature/Me-Built/Not me
- Block 4: Nature/Me-Built/Not me
- Block 5: Built-Nature
- Block 6: Built/Me-Nature/Not me
- Block 7: Built/Me-Nature/Not me

Blocks 1, 2 and 5 are practice trials, blocks 3 and 4 are "compatible" trials, and blocks 6 and 7 are "incompatible" trials. To limit the likelihood of ordering effects, two versions of the IAT-Nature are used to counter-balance the compatible and incompatible trials. For the second version, the "Built/Me" trials (Block 6 and 7) and the "Nature/Me" trials (Block 3 and 4) are switched. Participants are randomly assigned to one of these two versions.

Implicit connection to nature is the ability to correctly complete the compatible trials (Nature/Me), relative to the incompatible trials (Built/Me). Thus, a person with a strong association between self and nature will show faster response times to compatible trials than to incompatible trials. Alternatively, a person with a strong association between self and built environments would show the opposite trend.

Response times are measured in milliseconds for each trial and are averaged across each block. Prior to averaging the scores, responses are screened for outliers and errors, with any score that is greater than three standard deviations from the participants' mean removed. Additionally, participants are removed if they show markedly higher than average error rates

across their trials (>20%; see Schultz et al., 2004). The IAT-Nature effect is represented by D-scores, produced by subtracting the average response time from compatible trials for each participant (Blocks 3 and 4) from the average response time for the incompatible trials (Blocks 6 and 7). A positive D-score score indicates a preference for natural environments and a negative D-score indicates a preference for built environments, whilst a D-score of zero indicates no preference. Higher scores are interpreted as a greater association between self and nature and therefore, a greater implicit connection to nature. We used iatgen survey software to create and implement the IAT-Nature, and we used the R package "iatgen" to calculate IAT-Nature D-scores (Carpenter et al., 2019).

Inclusion of Nature in Self scale. The Inclusion of Nature in Self (INS) scale is a single-item pictorial measure assessing self–nature overlap. Adapted by Schultz (2001) from the Aron et al. (1992) Inclusion of Other in Self (IOS) scale, participants are presented with seven pairs of overlapping circles; each pair consists of a circle labelled as "self" and "nature". The seven circle pairings range from 1 (where the circles touch but do not overlap) to 7 (where the circles are entirely overlapping). Participants are asked to pick the one that best represents their relationship with the natural environment. Therefore, higher scores represent a higher level of explicit inclusion of nature in self.

Nature Relatedness Scale. The Nature Relatedness Scale (Nisbet et al., 2009) is a 21-item scale that measures three facets of nature relatedness: self (e.g., "*I am very aware of environmental issues*"), experience (e.g., "*I take notice of wildlife wherever I am*"), and perspective (e.g., "*Animals, birds and plants have fewer rights than humans*"). Participants rate how well each item describes them on a 5-point Likert scale, ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). Nature relatedness scores are determined by the average score across the 21 items, with higher scores indicating greater affective, cognitive, and experiential connection to nature.

Measures of environmental attitudes

Environmental Attitudes Inventory – Brief Version. The brief version of the Environmental Attitudes Inventory is a 24-item balanced scale that measures preservation and utilisation environmental attitudes (EAI-24; Milfont & Duckitt, 2010). Examples of items are: Preservation: "*It makes me sad to see forests cleared for agriculture*", "*I would like to join and actively participate in an environmentalist group*"; Utilization: "*Human beings were created or evolved to dominate the rest of nature*", "*Protecting peoples' jobs is more important than protecting the environment*". Participants indicate their level of agreement with each statement on a 7-point Likert scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). General environmental attitudes are calculated by reversing the 10 utilisation items and then averaging all 24 items. Therefore, higher scores indicate greater pro-environmental attitudes.

Environmental behaviour intention.

The Personal Environmental Behaviour Intention scale used by Bain and colleagues (2016) is a 12-item scale that measures attitudes towards engaging in personal sphere pro-environmental activities. Activities represent a range of pro-environmental behaviours from recycling to reducing car travel. Participants indicate how likely they are to engage in each activity in the next 12 months on a 5-point Likert-type scale, ranging from 1 (*not at all likely*) to 5 (*very likely*). Scale scores are calculated by averaging responses; therefore, higher scores indicate a greater intention to act pro-environmentally.

Measure of Self-Construal

Self-Construal Scale. This is the same measure used in Study 1 – a 22-item scale that measures the preferences of individuals to act or express themselves as either independent or interdependent across seven domains of self-construal (Vignoles et al., 2016). The seven dimensions of self-construal are: *self-direction (vs. receptiveness to influence)*, *self-reliance (vs. dependence on others)*, *difference (vs. similarity)*, *consistency (vs variability)*, *self-containment (vs connection to others)*, *self-interest (vs. commitment to others)*, and *self-expression (vs. harmony)*. Participants are asked: "*How well does each of these statements describe you*." Participants rate each item on a 9-point response scale, ranging from 1 (*not at all like me*) to 9 (*exactly like me*), with intermediates: 3 (*a little*), 5 (*moderately*), and 7 (*very well*). Example items are "*You like being different from other people*" and "*You value good relations with the people close to you more than your personal achievements*". Dimension scores represent the average response of each item within that dimension. Scores above five indicate a preference for independence within that dimension, whilst scores below five indicate a preference for interdependence; and a score of five indicates no preference. This scale will be used as a manipulation check for the priming conditions (see details below).

Socio-demographic information

Age, gender, and ethnicity were recorded through open-ended responses. These questions were included simply to provide a more detailed description of the sample.

Results

Manipulation Check

We checked the effectiveness of the priming manipulation in two stages. First, we compared the responses from the writing task for participants in the independent and interdependent experimental condition in accordance with Trafimow et al. (1991), coding responses based on two conditions: Idiocentric (personal qualities, beliefs, and attitudes) and allocentric (group membership, relational qualities). Participants in experimental conditions were asked to provide four responses to the SDFF writing task; therefore, each participant was given a score from zero to four for both idiocentrism and allocentrism based on their specific responses. Coding was conducted by a single researcher and Table 8 provides specific examples of idiocentric and allocentric responses from participants. Seventeen participants failed to complete the writing task and were excluded from all subsequent analyses, leaving 419 participants: Interdependent $N = 141$, independent $N = 128$, control $N = 150$.

Table 8

Examples of participants responses to SDFF writing task.

Idiocentric responses	Allocentric responses
I am creative	I aspire to provide for my family
I am energetic	I value my family and friends
I have a different way of thinking about things	I am family orientated
I am outgoing	I respect my friends and family
I have a unique view of the world	I have 3 older brothers
I am very extraverted	I am Jewish
I sing beautifully	I am Māori
I have a passion for performance	I have a kiwi accent

Note. Responses have been presented as 'I' statements for easier interpretation.

T-tests on the writing task responses showed that participants in the independent condition (M = 3.51, SD = .73) were more likely to give idiocentric responses to the writing task

than those in the interdependent condition (M = 3.23, SD = .92), $t(262) = 2.80$, $p = .006$, $d = .34$. Similarly, participants in the interdependent condition (M = .64, SD = .82) were more likely to give allocentric responses than those in the independent condition (M = .39, SD = .65), $t(262) = -2.75$, $p = .006$, $d = .33$. This was interpreted as a successful manipulation in line with Trafimow et al. (1991) as participants in the interdependent condition were more likely to use relational qualities and group membership to describe themselves, and less likely to use personal qualities to describe themselves than those in the independent condition.

Considering recent developments in the self-construal literature we added a seven-dimension measure of self-construal as a manipulation check at the end of the experiment. This allowed an investigation in how the SDFF priming tasks related to a more nuanced measure of self-construal and allowed us to compare self-construal in experimental conditions to those in the control condition. Additionally, this task was completed last by all participants to provide evidence that priming lasted the length of the experiment, approximately 15-20 minutes.

We predicted that the SDFF would have the strongest effect on *self-expression (vs. harmony)*, as the only previous research (that we are aware of) to use the SDFF with a seven-dimension self-construal scale showed this dimension to be specifically effected in European contexts (Yang, 2018). In contrast to this prediction, ANOVAs for each dimension of self-construal showed that two dimensions of self-construal were marginally different across conditions (see Table 9): *self-containment (vs. connection to others)*, $F(2) = 2.899$, $p = .056$, $\omega^2 = .009$; and *self-interest (vs. commitment to others)*, $F(2) = 3.012$, $p = .050$, $\omega^2 = .01$; whilst *self-expression (vs. harmony)* showed no differences across conditions, $F(2) = .232$, $p = .793$, $\omega^2 = -.004$. Tukey's post hoc comparisons showed that participants in the interdependent condition scored lower ($M = 3.52$, SD = 1.51) in *self-containment (vs. connectedness to others)* compared

to those in the control condition (M = 3.97, SD = 1.65, p = .048, d =.28) but not those in the independent condition and (M = 3.83, SD = 1.65, p = .261, d = .19), whilst participants in the independent condition scored marginally higher (M = 4.02, SD = 1.28) in *self-interest (vs. commitment to others)* than those in the control condition (M = 3.66, SD = 1.38, p = .060, d = .27) but not those in the interdependent condition (M = 3.96, SD = 1.27, p = .902, , d = .05). These findings indicate that participants in the interdependent condition reported greater connection to others than those in the control group, and participants in the independent prime reported greater self-interest than those in the control group.

Although these were not the dimensions we predicted would be different across conditions, the findings provide further evidence that the SDFF was successful in manipulating participants self-construal in both experimental conditions, albeit only when compared to the control group. Furthermore, that the independent and interdependent priming tasks effected different dimensions of self-construal, suggests these tasks may not be equivalent opposites for priming self-construal – an issue discussed in greater detail in the General Discussion.

Table 9

Mean, standard deviation, and Tukey's test for self-construal dimensions across conditions.

Self-Construal Dimensions	Interdependent	Independent	Control	Interdependent vs. Control		Interdependent vs. Independent		Independent vs. Control	
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	Mean Difference	*p*	Mean Difference	*p*	Mean Difference	*p*
Self-Direction (vs. receptiveness to influence)	5.16 (1.90)	5.32 (1.70)	5.25 (1.85)	-.094 [-.60, .41]	.899	-.160 [-.68, .36]	.752	.066 [-.45, .58]	.951
Self-Reliance (vs. dependence on others)	6.16 (1.62)	5.86 (1.47)	5.80 (1.58)	.365 [-.07, .80]	.114	.304 [-.14, .75]	.249	.061 [-.38, .50]	.953
Difference (vs. similarity)	5.90 (1.43)	5.66 (1.33)	5.70 (1.33)	.202 [-.17, .58]	.417	.237 [-.15, .63]	.331	-.034 [-.42, .35]	.975
Consistency (vs variability)	4.60 (1.60)	4.64 (1.38)	4.94 (1.63)	-.336 [-.76, -.09]	.155	-.036 [-.48, .41]	.980	-.300 [-.74, .14]	.242
Self-Containment (vs connection to others)	3.52 (1.51)	3.83 (1.65)	3.97 (1.65)	-.445* [-.89, -.01]	.048	-.307 [-.77, .15]	.261	-.134 [-.59, .32]	.755
Self-Interest (vs. commitment to others)	3.96 (1.27)	4.02 (1.28)	3.66 (1.38)	.291 [-.07, .65]	.145	-.070 [-.45, .31]	.902	.360 [-.01, .73]	.060
Self-Expression (vs. harmony)	4.54 (1.46)	4.45 (1.31)	4.44 (1.37)	.102 [-.28, .48]	.804	.091 [-.31, .50]	.852	.011 [-.38, .40]	.997

Note. * = $p < .05$.

The Effect of Self-Construal Priming on Environmentalism

We conducted a series of ANOVAs to determine whether environmental outcomes varied as a result of the experimental manipulation using self-construal priming (see Table 10). We predicted that participants in the interdependent condition would have higher scores for explicit nature connectedness than those in both the independent and control conditions (H1 and E1). The analyses revealed no significant differences in inclusion of nature in self, $F(2) = 1.43$, $p = .240$, $\omega^2 = .002$, and nature relatedness, $F(2) = 1.54$, $p = .215$, $\omega^2 = .003$, across conditions, indicating that the observed changes in self-construal across the conditions did not result in direct changes to participants explicit nature connectedness.

We also predicted that participants in the interdependent condition would have higher scores for implicit nature connectedness than those in both the independent and control conditions. We used the R package "iatgen" (Carpenter et al., 2019) to screen for outliers and errors for IAT trial responses (in accordance with Greenwald et al., 2003) and to calculate IAT-Nature D-scores (Carpenter et al., 2019). Mean IAT D-scores across all conditions were positive ($M = .377$, SD = 0.34) indicating most participants had a positive association between self and nature. However, IAT-Nature D-scores across conditions showed no significant differences, $F(2) = .56$, $p = .571$, $\omega^2 = -.002$, indicating that self-construal priming had no direct effect on implicit connection to nature. Together with the results for explicit nature connectedness, these results do not provide support for H1 and E1.

Next, we tested for group differences in environmental attitudes and behaviour intention across conditions. Again, we predicted that participants in the interdependent condition would have greater general environmental attitudes and intention than participants in the independent condition and control group (E2 and E3). General environmental attitudes were marginally

different across conditions, $F(2) = 2.60$, $p = .075$, $\omega^2 = .008$. Tukey's post hoc comparisons showed that participants in the interdependent condition ($M = 5.07$, SD = .68) had marginally greater general environmental attitudes than those in the independent condition ($M = 4.90$, SD = .74, $p = .093$, $d = .25$) but there were no differences between the interdependent condition and control group ($M = 4.93$, SD = .65, $p = .162$, $d = .22$).

We also explored whether lower order dimensions of general environmental attitudes – utilization and preservation – varied across conditions. Utilization attitudes were not significantly different across conditions, $F(2) = 2.05$, $p = .13$, $\omega^2 = .005$, but preservation attitudes were marginally different, $F(2) = 2.60$, $p = .075$, $\omega^2 = .008$. Tukey's post hoc comparisons showed that participants in the interdependent condition ($M = 4.97$, SD = .78) had marginally greater preservation attitudes than those in the independent condition ($M = 4.79$, SD = .76, $p = .111$, $d = .23$) and those in the control group ($M = 4.80$, SD = .67, $p = .131$, $d = .23$). The findings provide evidence for a trend indicating that interdependent priming increased environmental preservation attitudes, though these effects were not statistically significant and should be interpreted with caution.

Lastly, we explored whether self-construal priming elicited changes to participants intentions to behave pro-environmentally. We expected participants in the interdependent condition would have a greater intention to behave pro-environmentally than participants in the independent and control condition. However, there were no differences in environmental behaviour intention across conditions, $F(2) = 0.466$, $p = .628$, $\omega^2 = -.003$ indicating that the experimental priming had no effect on intentions to behave pro-environmentally. Except for a trend supporting parts of E2, these findings indicate that self-construal priming did not influence pro-environmental attitudes and behavioural intentions.

Table 10

Means, Standard Deviation and Tukey's pairwise comparisons for environmental outcome measures across conditions.

Outcome Variables	Interdependent	Independent	Control	Interdependent/ Control		Interdependent/ Independent		Control/ Independent	
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	Mean Difference	*p*	Mean Difference	*p*	Mean Difference	*p*
Nature Connectedness									
Inclusion of Self in Nature	4.23 (1.16)	4.16 (1.08)	4.01 (1.08)	.217 [-.09, .52]	.222	.073 [-.25, .39]	.854	.144 [-.17, 46]	.529
Nature Relatedness Scale	3.68 (.57)	3.58 (.51)	3.59 (.50)	.088 [-.06, .23]	.331	.103 [-.05, .25]	.247	-.015 [-.16, .13]	.970
Implicit Nature Connectedness	.40 (.36)	.35 (.34)	.38 (.33)	.019 [-.08, .11]	.888	.045 [-.05, .14]	.542	-.026 [-.12, .07]	.807
Environmental Attitudes									
General Attitudes	5.07 (.68)	4.90 (.74)	4.93 (.65)	.148 [-.04, .34]	.162	.176 [-.02, .37]	.093	-.028 [-.22, .17]	.939
Preservation Attitudes	4.97 (.78)	4.79 (.76)	4.80 (.67)	.167 [-.04, .37]	.131	.181 [-.03, .39]	.111	-.014 [-.22, .20]	.987
Utilization Attitudes	2.83 (.73)	3.00 (.80)	2.96 (.69)	-.173 [-.33, .07]	.286	-.173 [-.38, .04]	.134	0.042 [-.17, .25]	.883
Behaviour Intention	3.84 (.67)	3.76 (.69)	3.81 (.70)	.029 [-.16, .22]	.932	.080 [-.12, .28]	.605	-.051 [-.25, .14]	.809

The Indirect Effect of Self-construal Priming on Environmentalism

Altogether, the results from the ANOVAs did not support our hypotheses that participants in the interdependent condition would score higher on environmentally relevant measures than those in the control and independent condition. However, our findings did provide some evidence that interdependent priming resulted in greater general environmental attitudes than independent priming. Hence, to examine the final exploratory hypothesis (E4), we tested the indirect effect of self-construal priming on general environmental attitudes with implicit and explicit nature connectedness as separate mediating variables. As general environmental attitudes were greater in the interdependent condition when compared to the independent condition, we used experimental condition as a dichotomous variable, with the dummy-code 1 for interdependent priming and 0 for independent priming. This meant that we excluded the control condition and model parameters and indirect effects were assessed against the independent condition (Hayes & Preacher, 2014). Path models were created and run using the package "lavaan" in R Studio and indirect effects were tested through bootstrapped confidence intervals (bootstrapping = 5000) in accordance with Zhao et al. (2010).

First, we examined the mediating role of inclusion of nature in self on the relationship between self-construal priming and general environmental attitudes. In support of the ANOVA results, the total effects model showed that interdependent priming resulted in greater environmental attitudes than independent priming (b = .17, SE = .09, z = 1.92, p = .054) and that priming condition had no effect on inclusion of nature in self (b = .07, SE = .14, z = .52, p = .600). With both variables in the model, inclusion of self in nature positively predicted environmental attitudes (b = .30, SE = .04, z = 7.65, p = <.001), however, there was no mediation effect (b = .02, SE = .04, 95% LL = -.056, 95% UL = .111).

Next, we examined the mediating role of nature relatedness on the relationship between self-construal priming and general environmental attitudes. Again, the total effects model showed that interdependent priming resulted in greater environmental attitudes than independent priming (b = .18, SE = .09, z = 2.05, p = .041) and that priming condition had no effect on nature relatedness (b = .10, SE = .07, z = 1.56, p = .118). With both variables in the model, nature relatedness positively predicted environmental attitudes (b = .98, SE = .05, z = 18.82, p = <.001), but again, there was no mediation effect (b = .10, SE = .06, 95% LL = -.031, 95% UL = .222).

Lastly, we examined the mediating role of implicit nature connectedness on the relationship between self-construal priming and general environmental attitudes. The total effects model showed that interdependent priming resulted in greater environmental attitudes than independent priming (b = .18, SE = .09, z = 2.08, p = .037) and that the priming condition had no effect on implicit nature connectedness (b = .05, SE = .04, z = 1.06, p = .286). With both variables in the model, implicit nature connectedness positively predicted environmental attitudes (b = .35, SE = .14, z = 2.60, p = .009), but again, there was no mediation effect (b = .02, SE = .02, 95% LL = -.011, 95% UL = .057). Overall, these findings did not support E4 as the effect of interdependent priming on environmental attitudes was unrelated to implicit and explicit nature connectedness.

The Indirect Effect of Connectedness to Others on Environmentalism

Finally, in accordance with Lench et al.'s (2014) recommendations to use manipulation checks as mediating variables in experimental design and to incorporate a more nuanced measure of self-construal into the analyses, we conducted a series of sequential mediation models to test

whether the observed changes to *self-containment vs. connection to others* between the interdependent and control condition had mediated priming effects on environmental measures. These analyses were not preregistered and are therefore presented in the Appendices in detail (See. However, they did provide some interesting insights. Sequential mediation analysis showed that interdependent priming had an indirect effect on general environmental attitudes and environmental behaviour intention through a greater *connection to others (vs. self-containment)* and both a greater inclusion of nature in self and a greater nature relatedness. Despite these effects being very weak (in the range of 0.01 to 0.04), they provided partial support for E4, suggesting that interdependent priming increased connection to others, which increased explicit connection to nature, which in turn, increased environmental attitudes and behaviour intentions.

Discussion

After establishing the relationship between each of the seven dimensions of self-construal and environmental attitudes cross-culturally in Study 1, Study 2 employed a preregistered experimental design testing whether a greater inclusion of others in self leads to a greater inclusion of nature in self. We hypothesized that those who were primed to think more interdependently would score higher in measures of implicit and explicit nature connectedness than those in a control group and those primed to think more independently. Despite a successful manipulation, H1 and E1 were unsupported and there were no differences in nature connectedness across groups. Hence, E4 was also unsupported as nature connectedness did not mediate the relationship between self-construal priming and environmental attitudes. We also explored whether self-construal priming had a direct effect general environmental attitudes (E2) and environmental behaviour intention (E3), but again there were no significant differences between groups; although we did find a marginal trend that interdependent priming increased environmental preservation attitudes compared to independent priming and the control group. These findings suggest that successfully inducing greater interdependence in the lab does not cause a greater inclusion of nature in self or have a direct impact on environmental attitudes and behaviours (compared to independent and control groups), despite previous research reporting that priming interdependence increases pro-environmental economic choices (Chuang et al., 2016; Gibson et al., 2014). A possible explanation for this inconsistency with previous research is that the relationship between self-construal and environmentalism is relatively weak, hence sampling of participants based on a moderate effect size of 0.5 from previous self-construal priming studies may have resulted in under sampling.

Using a seven-dimension measure of self-construal as a manipulation check allowed us to explore the effect of the SDFF on seven dimensions of self-construal. Despite previous research indicating that *self-expression vs. harmony* is specifically primed by the SDFF in European participants (Yang, 2018), we found that interdependent priming increased feelings of *connection to others (vs. self-containment)* whilst independent priming increased *self-interest (vs. commitment to others)*. These differences were only observed when interdependent and independent conditions were compared to the control group, suggesting that the SDFF may not be an equivalent priming task of independence and interdependence for the same dimension of self-construal.

Lastly, the seven-dimension measure of self-construal allowed us to run exploratory sequential mediation analyses which indicated that the marginal effect of interdependent priming on environmental attitudes was mediated by an increased connection to others and greater explicit nature connectedness. This supports Schultz's (2001) previous claim that a greater inclusion of others in self is associated with a greater inclusion of nature in self; although this effect is relatively weak. In summary, a greater connection to others appears to relate to a greater inclusion of nature in self and a greater relatedness to nature, but experimentally inducing a greater connection to nature by manipulating self-construal appears to be difficult. These findings and their theoretical implications are discussed further in the following chapter.

Chapter 5: General Discussion

If climate change is the defining issue of our time as has been claimed by scientists and important public figures (e.g., The Prince of Wales, World Economic Forum, January 22, 2020; United Nations, 2016), it is imperative that we understand ways to address the human causes of environmental degradation. There are many individual, contextual and cultural factors that influence pro-environmental attitudes and behaviours (for reviews, see Gifford, 2014; Milfont & Markowitz, 2016; Milfont & Schultz, 2016; Schultz & Kaiser, 2012) and previous research has indicated that how we define ourselves is an important factor (e.g., Arnocky et al., 2007; DeCicco & Stroink, 2016), which was the focus of the present research. Those who see themselves as more interdependent and connected to others tend to be more concerned about the natural environment and more likely to engage in pro-environmental actions than those who see themselves as more independent and separated from others.

In a preregistered large cross-cultural study and a preregistered experimental priming study, we have broadened the understanding of the effect of self-construal on environmental attitudes beyond a two-dimensional view of self-construal, providing more nuanced empirical evidence of the influence of self–other relations on the psychology of self–nature relations. Our results confirmed the relationship between self-construal and environmental attitudes, reinforcing the importance that socio-cultural processes have on our relationship with and attitudes towards nature. In support of previous theoretical models that those who are more connected to others are more willing to protect nature (Nolan & Schultz, 2015), greater interdependence across different domains of self-construal generally predicts greater environmentalism; however, independence in some aspects of self-construal can predict environmentalism, while other domains are unrelated. Moreover, some evidence suggests that the reason that self-construal affects our

attitudes towards the environment is because how we define ourselves in relation to others affects our relationship with nature, yet experimentally inducing changes to our relationship with nature through self-construal may be difficult. The theoretical implications of these findings and the opportunities for future research are discussed in the following sections.

Self-Construal and Environmental Attitudes Across Cultures

Study 1 found that interdependence in five of the dimensions of self-construal predicted greater environmental protection in samples (N = 7,279) from 55 cultural groups, consistent with previous research that those who are more interdependent are more pro-environmental than those who are more independent (see, e.g., Arnocky, Stroink, & DeCicco, 2007; Chuang, Xie, & Liu, 2016; Dogan & Ozmen, 2017; Gibson & Reysen, 2014). Going beyond two dimensions of self-construal, environmental attitudes seem to be most influenced by how the self is experienced (*self-containment vs. connectedness to others*) and how individuals deal with conflicting interests (*self-interest vs. commitment to others*) relative to other domains of self–other orientations. That is, those who see themselves as more connected and committed to others are more likely to endorse environmental protection, and this was replicated in Study 2 with more comprehensive measures of environmental attitudes and environmental behaviour intention.

That connectedness to others reliably predicted environmental protection across cultures supports previous claims that an expanded view of the self predicts greater environmentalism (Arnocky et al., 2007). Further, The Inclusion Model of Environmental Concern (Nolan & Schultz, 2015) posits that a greater inclusion of others in self leads to a greater willingness to protect the environment because those who include others in the self are more likely to include nature in the self as well, and we have provided cross-cultural support for this model. These

findings may also explain the national-level relationship between interdependence and national predictors of environmental performance (Gouveia, 2002; Komatsu et al., 2019), suggesting that connected to others at the individual-level may translate into better societal environmental performance that connection to others may have significant implications on the ecological footprint of nations.

Moreover, our findings indicate that connectedness to others is just one aspect of self-construal that leads to greater environmentalism. Equally significant is the commitment one feels to others over their own self-interest, which is linked to the well-established relationship between self-transcendent values and environmentalism (e.g., Boer & Fischer, 2013; Milfont et al., 2010; Schultz et al., 2005). Furthermore, commitment to others may be related to self-control, which has been evidenced as a mediator of the relationship between self-construal and environmentalism in previous research (Chuang, Xie, & Liu, 2016). Steinmetz and Mussweiler (2017) suggested that those who are more interdependent may have greater self-control because they have a more concrete construal of the future. Hence, we speculate that those who are more committed to others may have greater self-control when it comes to environmental behaviours because the effects of climate change on future generations are more salient to them. Although connectedness to others and commitment to others are theoretically and empirically related constructs (yet distinct; see Vignoles et al., 2016), they appear to have distinct effects on environmental attitudes.

Study 1 also highlighted that other aspects of self-construal – previously undifferentiated in environmental research – are also important for how we perceive environmental issues. Correlations were found for interdependent orientations in how individuals make decisions, define the self, and communicate with others, indicating that these dimensions are also relevant

to pro-environmental attitudes. In other words, those who are more receptive to influence, see themselves as more similar to others and are more harmonious when communicating with others are more likely to endorse environmental protection. These findings provide the opportunity for further theoretical development of the Inclusion Model of Environmental Concern. Perhaps the increased coverage of environmental issues in the media has had a greater impact on the environmental attitudes of those who are more receptive to the influence of others. Likewise, those who are more self-directed may be less influenced by the increased presence of climate change in the media or may be more likely to discount scientific evidence of climate change. Additionally, those who see themselves as more similar to others may be less likely to approve of hierarchies and inequalities in society and have stronger equalitarian beliefs, which is a significant predictor of pro-environmental attitudes (Milfont et al., 2018). Harmony has previously been linked to environmental indicators (Gouveia, 2002) and may be related to empathy, which is has been shown to help explain gender differences in environmental attitudes and behaviour (Arnocky & Stroink, 2010; Graça et al., 2018; Milfont & Sibley, 2016), therefore differences in self-construal may also explain differences in environmentalism between men and women. Although these ideas are purely speculative, they highlight the potential for future research to incorporate these findings with well-established ideas within the environmental literature.

Interestingly and in support of previous research, we also found that an independent self–other orientation related to environmental attitudes (e.g., Davis & Stroink, 2016; Gibson & Reysen, 2014; Mancha & Yoder, 2005; Zhou, Huang, & Wei, 2017) – those who are more consistent across contexts seem to have stronger environmental protectionism than those who are more variable across contexts. This may explain some of the inconsistencies in previous

research, that both interdependence and independence can positively predict environmental attitudes and behaviours (e.g., Mancha & Yoder, 2005). Considering the depth and seriousness of the global environmental crisis, it seems that consistency in one's own thoughts and actions across different contexts is an important aspect of environmentalism. Further, consistency may play an important role in environmental identity as stability in one's self is an important part of identity processes across cultures (Becker et al., 2017). Alternatively, consistency in oneself across contexts may play a role in the pathway between egoistic values and pro-environmental attitudes and behaviours that has been demonstrated in previous research (De Dominicis et al., 2017).

Contrary to our expectations, environmental protection was unrelated to *self-reliance vs. dependence on others* across cultures. We predicted that those who expressed a greater dependence on others would be more likely to see themselves as more dependent on nature and therefore would have greater environmental protection attitudes, but this does not appear to be consistent across cultures. Rather, the relationship between how one looks after the self and environmentalism appears to be culturally relative, indicating that social context may affect how *self-reliance vs. dependence on others* relates to environmental attitudes.

Taken together, we have shown that there is cross-cultural validity to the idea that a greater connection to others leads to a greater willingness to protect nature as conceptualised by Schultz and Nolan (2015) in the Inclusion Model of Environmental Concern, but that contrasting a connection to others and lack thereof is not the only way that self–other relations influence environmental attitudes. Indeed, as self-construal is more nuanced than once conceived, so too are its effects on environmental attitudes. Whilst there appear to be general trends in these relationships across cultures, social context seems to play an important role as discussed next.

Variability in Self–Other Relations and Environmentalism

To our knowledge, Study 1 was the first study to look at the multilevel relationship between self–other relations and environmentalism. We predicted that the strength of the relationship between dimensions of self-construal and environmental protection would vary across cultures and that some of this variance might be explained by social context (i.e. cultural models of selfhood and economic and environmental indicators). Despite cross-cultural evidence that a more expanded view of the self predicts environmental attitudes, the strength of the associations between each dimension of self-construal and environmental protection varied across cultures. Notably, commitment to others has a stronger relationship with environmental attitudes in cultures that are more self-expressive, committed to others and express greater difference to others, and nations that have greater environmental performance and economic development; providing further evidence of the relationship between social context and environmental attitudes (see e.g., Eom et al., 2016; Milfont et al., 2018; Milfont & Markowitz, 2016; Milfont & Schultz, 2016; Tam & Chan, 2017).

These findings are consistent with the idea that environmental attitudes are more prominent in wealthier and more developed societies (e.g., Diekmann & Franzen, 1999), once again highlighting the interdependence between solving global economic disparities and environmental issues. However, societies with greater self-expression and economic development may show a stronger relationship between commitment to others and environmental attitudes because the relationship between attitudes and behaviours is greater in these societies, whereas in other societies social norms are more predictive of environmental behaviour (Chan, 2019). Furthermore, much of the cross-cultural variance in the relationship between the other dimensions of self-construal and environmental protection was unexplained

within the data; therefore, there is a need to look at other societal variables that may explain these variances.

In summary, the idea that self-construal influences pro-environmental attitudes appears to have cross-cultural validity, specifically, connection and commitment to others positively predicts environmental attitudes across cultures, even though the strength of this relationship varies. However, the way that other aspects of self-construal relate to environmentalism is largely influenced by social context, meaning that self–other relations can have different and even contradictory impacts on environmental attitudes across different cultures.

Implications for the Psychology of Self–Nature Relations

After establishing the relationship between seven dimensions of self-construal and environmental attitudes cross-culturally, the purpose of Study 2 was to test the direct relationship between self-construal and self–nature relations experimentally. We preregistered our hypotheses that those who were primed to think more interdependently would elicit a greater connection to nature than those in a control group and those primed to think more independently. Study 2 was effective in inducing changes to participants self-construal, as evidenced by results from both manipulation checks, but these changes did not have any significant effects on self–nature relations or environmental attitudes as predicted. This suggests that successfully inducing greater interdependence in the lab does not cause a greater inclusion of nature in self or have a direct impact on environmental attitudes and behaviours (compared to independent and control groups), despite previous research reporting that priming interdependence increases environmental economic choices (Chuang et al., 2016).

Still, when putting aside the control group and comparing only the two priming groups, we found that inducing greater interdependence did elicit a marginally significant increase in environmental attitudes consistent with previous experiments (Gibson et al., 2014); however, this change was not mediated by any changes to nature connectedness as predicted. This indicates that self-construal priming can influence environmental attitudes even without affecting self–nature relations, although the lack of statistical significance for these findings makes this a precarious conclusion. Additionally, the lack of direct effects on environmental outcomes may be due to methodological issues with self-construal priming that are discussed in a later section.

We also incorporated a seven-dimension measure of self-construal as a manipulation check to understand how the experimental priming used (i.e., the Similarities and Difference to Friends and Family task) relates to a more nuanced understanding of self-construal. Although previous research had shown that the SDFF uniquely primes *self-expression (vs. harmony*) in European samples (Yang, 2018), we found that the interdependent version of the SDFF increased *connection to others (vs. self-containment)*, whilst the independent version increased *self-interest (vs. commitment to others)*. This allowed us to run sequential mediation analyses which indicated that interdependent priming had an indirect effect on environmental attitudes and behaviour intention through an increased connection to others and an increased connection to nature. Despite a very small effect, this suggests that a greater inclusion of others in self does lead to a greater inclusion of nature in self as suggested by Schultz (2001), but that this association is relatively weak and therefore hard to induce. Moreover, as there was no relationship between connection to others and implicit connection to nature, the effect of self-construal on self–nature relations does not appear to effect one's cognitive relationship between self and nature but rather represents how they explicitly self-identify with nature. However, it is important to note that

these analyses were not preregistered and were conducted to explore trends that emerged in the data.

Overall, the combined findings of Study 1 and Study 2 have important implications for our understanding of the psychology of human–nature relations. In Schultz's (2002) original conceptualization of self–nature relations, willingness to protect nature was predicted by one's emotional and cognitive connection to nature. In 2015, Nolan and Schultz developed the Inclusion Model of Environmental Concern to show that connectedness to others also predicts a greater willingness to protect nature. Schultz (2001) suggested that connection to others may represent an intermediate level of inclusion of nature in self and our research has provided some empirical evidence to support this. We have shown that although the strength of the relationship varies across cultures, connection to others consistently predicts environmental attitudes and positively predicts a greater inclusion of nature in self and nature relatedness, suggesting that this may be a universal phenomenon across cultures. Furthermore, these findings support the idea that an expanded view of the self leads to greater environmental attitudes and behaviours (Arnock, Stroink, & DeCicco, 2007), but also expand the Inclusion Model of Environmental Concern by showing that other ways of being interdependent and independent also appear to affect our relationship with nature.

Whilst commitment to others predicts environmental attitudes with similar strength as connection to others, commitment to others appears to have a weaker but still significant relationship with a greater connection to nature. Similarity to others, harmony when communication with others, receptiveness to influence and consistency across contexts, appear to have a positive influence on our relationship with nature. Perhaps those who define themselves as similar to others are more likely to include nature as part of the self as they as they are more

likely to see other species and nature as similar to themselves as well. Previously we suggested that harmony when communicating with others as opposed to self-expression may represent a greater level of empathy; furthermore, this may extend to a greater affective or emotional connection to nature. Likewise, those who are more receptive to others when making decisions may also be more likely to consider the effect of their decisions on nature. Lastly, it would seem plausible that a consistent sense of self across contexts is conducive to a greater inclusion of nature in self as a more universalistic self-definition is less dependent on social context and more informed by an omnipresent natural environment. Once again, although these are speculations, they provide the opportunity for further theoretical development of the Inclusion Model of Environmental Concern, and present novel directions for future research.

Potential Implications for Environmental Policies

One of the more significant implications of this research is that it highlights one way that sociocultural processes influence environmentalism. Perhaps the biggest challenge of the global climate crisis is that climate change is experienced differently across the globe – from rising sea-levels in the Pacific Islands to intensified bush fires in Australia – requiring localised and culturally responsive solutions. Vignoles et al. (2016) showed that cultural models of selfhood vary markedly across different world regions, and we have shown that this may partially explain cross-cultural differences in environmental attitudes. Yet, our findings suggest that there is some consistency across cultures in how our relationship to others affects our relationship with nature; hence, at a broad level, focusing on improving social connectedness and community cohesion may have positive implications for human–nature relations across different cultures, and may help to reduce the apathy and indifference many people express towards the climate crisis.

Moreover, past research has indicated that improving self–nature relations should focus directly on increasing the time people spend in nature (Wells & Lekies, 2006). Community-based environmental solutions have become a commonly used tool by governments and our research highlights that these sorts of programs may be able to improve self–nature relations as well. With evidence that community engagement is linked to a range of other positive outcomes (O'Mara-Eves et al., 2015) as well as improvements to environmental behaviours (McKenzie-Mohr, 2000), community-based environmental policies may be able to tackle multiple social issues. Likewise, community-based policies and programs aimed at promoting the amount of time people spend in nature may lead to exponential improvements to human–nature relations as well as improving people's wellbeing (Capaldi et al., 2014).

Limitations and Future Directions

The main purpose of this research was to explore how a more nuanced model of selfhood could extend previous conceptualisations of the relationship between self-construal and environmentalism, and to test the claim that greater interdependence leads to a greater inclusion of nature in self. Our findings provide evidence for the relationship between self-construal and environmentalism that go beyond an independent/interdependent dichotomous view of the self, showing that a range of self-construal domains relate to environmental attitudes and that although greater connection to others is related to a greater inclusion of nature in self, experimentally inducing this effect is challenging. However, there are some notable limitations to these studies that should be addressed.

First, the findings from Study 1 are based on a single item outcome measure, meaning that there are no reliability scores for environmental protection. Although the applicability of this

item has received empirical support in cross-cultural studies by Schwartz (Cieciuch & Schwartz, 2012; Krystallis et al., 2008; Verkasalo et al., 2009), reliance on this single-item measure presents a significant limitation to these conclusions. Furthermore, environmental protection was measured relative to a person's other values to account for cultural response biases; hence, absolute endorsement for environmental protection may yield different conclusions. Yet, we believe this was the most defendable practice to provide the most accurate expression of environmental protection cross-culturally (Schwartz, 2007), and the main findings from Study 1 were supported with more comprehensive measures of environmental attitudes in Study 2.

Second, the meta-analytic effect sizes for all self-construal associations in Study 1 (in the range of .06 to .17) and the coefficients in Study 2 (in the range of .04 to .11) for predicting environmental attitudes were small, indicating that the influence of self–other relations on self–nature relations is perhaps negligible. Yet the meta-analytic results from Study 1 represent the average effect across six world regions and hence these small effects are of a large scale and should not be discounted. The relatively weak effect of self-construal on environmental measures may also explain why Study 2 was unable to experimentally induce changes to nature connectedness. Therefore, inducing changes to self–nature relations may require more effective priming techniques and running similar experiments with different self-construal priming tasks in future research will help to further understand these issues. Moreover, and as noted before, there are many individual and contextual factors influence one's decision to engage in environmental protection (for reviews, see Gifford, 2014; Milfont & Markowitz, 2016; Milfont & Schultz, 2016; Schultz & Kaiser, 2012) and self-construal is just another factor.

Similarly, previous research has indicated that the SDFF influences feelings of *self-expression (vs. harmony)* within European participants (Yang, 2018), but in Study 2 the

independent and interdependent priming tasks effected different dimensions of self-construal – increasing *connection to others (vs. self-containment)* in the interdependent condition and increasing *self-interest (vs. commitment to others)* in the independent condition – suggesting that these tasks may not be equivalent opposites for priming self-construal, which raises some concerns about the effectiveness of the SDFF priming task. Furthermore, these differences were only observed when experimental conditions were compared to the control group, and even though experimental conditions showed differences in how people defined themselves in terms of idiocentric and allocentric concepts, there was no difference between experimental conditions for a particular dimension of self-construal. This may be because the SDFF is more effective for priming self-construal in Chinese rather than European populations as evidenced in previous research (Yang, 2018). However, previous research has shown that other self-construal priming tasks, such as the Sumerian Warrior Story, can be effective in manipulating environmentally relevant attitudes (Chuang et al., 2016) and these other priming tasks can influence different aspects of self-construal in European samples (Yang, 2018). Therefore, using alternative priming tasks in future experiments may have different effects on different dimensions of self-construal and provide insight into potential direct relationships between other dimensions of self-construal and environmentalism. Additionally, the results from Study 2 are based on a relatively small sample of first-year psychology undergraduates and therefore represent a relatively homogenous population, and future experimental research should use more generalizable samples from world regions outside of the East-West dichotomy.

Lastly, this thesis focused on the effects that self-construal has on environmental attitudes and there is a dearth of research on actual environmental behaviour. Although we have shown that interdependence in a range of different dimensions of self-construal can predict greater pro-

environmental attitudes, previous research has highlighted that environmental attitudes are less predictive of environmental behaviours in more interdependent populations (Chan 2019; Eom et al., 2016; Mancha & Yoder, 2015). Therefore, understanding whether these findings are consistent with a seven-dimension model of self-construal is important for grasping the effect of self–other relations on self–nature relations and environmental behaviour. Specifically, there is a need for more experimental and longitudinal research to provide evidence of the causal and temporal effect of self-construal on environmental behaviour. To this end, the Inclusion Model of Environmental Concern suggests that that a greater connection to others leads to a greater connection to nature, however an alternative conclusion from these results is that a greater connection to nature leads to a greater connection to others, and this idea should be explored in future research.

Furthermore, we previously suggested that there appears to be some conceptual cross-over in the relationship between seven dimensions of self-construal and other individual difference variables that have been established as predictors of environmental attitudes and behaviours. Therefore, an important avenue for future research is to integrate self-construal theory into other areas of environmental research, namely, egalitarianism and social dominance (Milfont et al., 2018), and empathy and gender differences (Arnocky & Stroink, 2010; Graça et al., 2018; Milfont & Sibley, 2016). Throughout this thesis we have endeavored to be transparent with our research methods and analysis by preregistering this project – while also acknowledging when the research deviated from these plans – in support of the open science movement. Hence, we hope that future research that stems from these findings will continue this commitment and contribute to a more open, transparent and accessible study of human psychology.

Concluding Remarks

Altogether, our findings suggest that across cultures those who are more connected and committed to others also are more willing to endorse environmental protection, providing cross-cultural support for the Inclusion Model of Environmental Concern. Notably, the strength of this relationship is influenced by social context, where this relationship is stronger in cultures that are more developed, have better environmental performance, are more self-expressive, are more committed to others, and express greater difference to others. However, the exact nature of this relationship is still unclear and experimental findings suggest that a greater inclusion of others in self may be related to a greater inclusion of nature in self but that inducing this effect may be difficult. Many have claimed that we must reexamine our relationship with nature to address the climate crisis, but perhaps equally important is improving human interactions. It would seem to be no coincidence that the growing popularity of right-wing populist movements, which spout anti-immigration sentiments, are equally disinterested in addressing the causes of the climate crisis. Governments, NGOs, and policymakers should be looking at ways to improve social connectedness, whilst also promoting the protection of ecosystems and reduction in global inequality. Combating climate change requires not only a commitment to improve our natural ecosystems but a foundation of solidarity towards others in our shared efforts to change the way we live.

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Appendices

Appendix A: Supplementary Table 1

Correlations between each of the seven self-construal dimensions and environmental protection by cultural sample at the individual-level (including age and gender as separate correlates).

Cultures	*N*	Self-direction (vs. reception to influence)	Self-reliance (vs. dependence on others)	Difference (vs. similarity)	Consistency (vs. variability)	Self-containment (vs. connectedness to others)	Self-interest (vs. commitment to others)	Self-expression (vs. harmony)	Age	Gender (1 female, 0 male)
Belgium High SES	185	-.08	.02	-.13	.12	-.19	-.30	-.09	.01	.06
Belgium Low SES	178	-.13	-.12	-.01	-.04	-.11	-.14	-.17	.02	.09
Brazil Central	185	-.09	.06	-.11	.18	-.19	-.15	-.07	.22	.11
Brazil North East	150	-.23	-.13	-.27	.11	-.28	-.28	-.07	.33	.01
Brazil South	165	-.12	-.04	-.01	.17	-.18	-.16	.03	.02	.12
Cameroon Bafut	100	-.12	-.09	-.15	.25	-.04	-.04	.02	.09	.01
Chile Majority	148	-.10	-.06	-.03	-.01	-.22	-.33	-.15	.07	.14
Chile Mapuche	149	-.13	.07	-.04	.13	-.15	-.07	-.03	.12	-.09
China East	125	-.17	.07	.01	.14	-.23	-.24	-.17	.15	.20
China West	135	-.18	.09	-.08	.15	-.25	-.15	-.11	.25	.11
Colombia Rural	150	-.07	-.05	-.04	.18	-.10	-.17	-.03	.36	-.01
Colombia Urban	149	-.05	.02	.08	.21	-.10	-.10	.03	.15	.12
Egypt	164	-.08	.07	.02	.09	-.11	.01	-.01	.06	.17
Ethiopia Highlanders	150	.05	.11	.04	.03	.05	.03	.06	.07	-.14
Ethiopia Urban	150	.06	.04	-.14	.04	.01	-.01	-.08	.17	-.10
Georgia Baptists	81	-.16	-.04	-.17	-.18	-.15	-.23	-.23	.14	.03

Georgia Orthodox	138	-.24	-.20	-.23	.04	-.24	-.20	-.25	.30	.13
Germany East	153	-.14	.09	-.09	.21	-.20	-.25	-.11	.35	.06
Germany West	104	-.25	-.07	-.13	.01	-.29	-.30	-.15	.29	.13
Ghana	116	-.14	.12	-.02	.26	-.22	-.05	-.08	-.13	.18
Hungary Majority	151	-.23	.09	-.08	.08	-.34	-.34	-.12	.19	.14
Hungary Roma	92	-.08	.07	-.07	.08	-.19	-.19	-.14	-.02	.20
Iceland	121	-.04	.02	.04	.17	-.10	-.19	-.07	.34	-.07
Italy Rural	90	-.06	.04	-.16	.19	-.22	-.38	-.12	.28	-.04
Italy Urban	83	-.23	-.16	-.15	.07	-.33	-.43	-.10	.16	.03
Japan Hokkaido	73	.01	-.07	.01	.06	-.10	-.07	-.04	.08	.15
Japan Mainland	211	.06	.12	.01	.14	-.11	-.21	.01	.11	.03
Lebanon Christian	137	-.02	.05	-.13	.03	-.12	-.16	-.13	.25	.09
Lebanon Muslim	123	-.03	-.07	-.19	.05	-.03	-.16	-.10	.11	.02
Malaysia	150	-.08	.15	-.06	.02	-.17	-.22	-.22	.07	.08
Namibia Damara	69	-.18	.06	-.01	.11	-.15	-.14	.01	.07	-.21
Namibia Aawambo	135	-.18	.09	.01	.06	-.24	-.11	-.08	.12	.11
New Zealand	204	.06	-.05	.03	.06	-.02	-.07	.07	.22	.05
Norway	102	-.15	.14	.01	.14	-.18	.01	-.01	.38	-.19
Oman	160	-.06	-.14	-.06	.04	.02	.03	.06	.19	-.12
Peru Rural	73	-.20	-.01	-.11	-.04	-.20	.02	-.25	.15	-.03
Peru Urban	81	-.19	.16	-.09	.13	-.32	-.24	-.20	.25	.15
Philippines Christian	151	-.22	.01	-.16	.26	-.25	-.23	-.28	.16	.09
Philippines Muslim	154	-.15	-.03	.09	.10	-.17	-.26	-.07	-.08	.18
Romania Rural	162	-.27	-.08	-.23	.07	-.30	-.25	-.23	.11	-.06

Romania Urban	318	-.03	.01	-.05	.17	-.10	-.17	.01	.12	.06
Russia Caucasians	139	-.07	.21	.03	.06	-.17	-.20	-.12	-.08	.02
Russia Russians	122	-.15	-.03	-.15	.20	-.21	-.15	.02	.23	.10
Singapore	110	-.04	.11	-.02	.16	-.16	-.22	-.09	.03	.02
Spain Rural	75	-.33	-.01	-.19	-.01	-.34	-.32	-.33	.22	.17
Spain Urban	105	-.32	-.13	-.19	-.12	-.31	-.31	-.32	.15	.19
Sweden	101	.09	.24	.16	.24	-.01	-.04	.02	.14	-.02
Thailand	71	.08	.07	.05	.16	-.08	-.12	.02	.03	-.01
Turkey Alevi	114	.01	.30	.12	.05	-.19	-.20	-.07	.16	.11
Turkey Majority	134	-.07	-.08	-.13	.11	-.06	-.07	-.10	.27	.21
Uganda Baganda	151	-.15	-.18	-.15	.01	-.16	-.17	-.25	-.07	-.02
UK Rural	95	-.03	.02	-.06	.27	-.12	-.20	-.08	.32	.07
UK Urban	133	.07	.15	.05	.10	-.06	-.16	.04	.10	.01
US Colorado	92	.08	.11	.14	.13	.02	-.03	.04	.07	.03
US Hispanics	122	.13	.09	.06	.05	.08	.07	.03	.28	-.12
Average Correlations	7,279	-.10***	.02	-.06***	.10***	-.16***	-.17***	-.08***	.15***	.05***
95 % CI		[-.12, -.07]	[-.01, .05]	[-.08, -.03]	[.08, .13]	[-.18, -.13]	[-.20, -.14]	[-.11, -.06]	[.12,.18]	[.02, .08]
Q(54)		77.454*	75.326*	63.300	51.810	74.170*	84.136**	71.766*	102.762***	65.672

Note. Meta-analytic correlations are based on random-effects models using restricted maximum-likelihood estimation and Fisher's r-to-z transformation. *$p < .05$. **$p < .01$. ***$p < .001$.

Appendix B: Supplementary Table 2

Independent Multilevel Models showing random and fixed effects for each dimension of self-construal predicting endorsement for environmental protection (Full analyses)

	Fixed effects			Random effects	
Predictor variables	γ	*SE*	τ	σ^2	χ^2
Self-direction vs. receptiveness to influence (S-D vs. RTI)					
Level 1 predictors					
Intercept	.474	.04	11.728***	.078	228.804***
S-D vs. RTI	-.094	.014	-6.596***	.003	
Age	.015	.001	12.763***	.003	162.26***
Age x S-D vs. RTI	.003	.001	3.187**		
Gender	.102	.029	3.522***	.003	12.448*
Gender x S-D vs. RTI	.003	.025	.145		
Level 2 predictors					
Level 2 S-D vs. RTI	-.165	.230	-.718	.003	3.699
Level 2 S-D vs. RTI x Level 1 S-D vs. RTI	.149	.080	1.855		
Level 2 S-R vs. DO	.451	.245	1.846	.003	7.205*
Level 2 S-R vs. DO x Level 1 S-D vs. RTI	.143	.092	1.554		
Level 2 D vs. S	.200	.074	2.699**	.004	8.571*
Level 2 D vs. S x Level 1 S-D vs. RTI	.020	.028	.696		
Level 2 C vs. V	.108	.101	1.062	.003	1.434
Level 2 C vs. V x Level 1 S-D vs. RTI	.013	.036	.362		
Level 2 S-C vs. CTO	-.135	.141	-.961	.004	1.259
Level 2 S-C vs. CTO x Level 1 S-D vs. RTI	-.021	.051	-.403		
Level 2 S-I vs. CTO	-.172	.086	-1.994*	.003	5.913*
Level 2 S-I vs. CTO x Level 1 S-D vs. RTI	-.032	.032	-1.014		
Level 2 S-E vs. H	.223	.108	2.069*	.004	4.398
Level 2 S-E vs. H x Level 1 S-D vs. RTI	<.001	.040	.015		
Level 3 predictors					
HDI	.377	.359	1.050	.006	1.961
HDI x Level 1 S-D vs. RTI	.104	.150	.698		
EPI	.005	.004	1.353	.006	2.031
EPI x Level 1 S-D vs. RTI	<.001	.002	.162		
Self-reliance vs. dependence on others (S-R vs. DO)					
Level 1 predictors					
Intercept	.476	.042	11.350***	.085	243.863***
S-R vs. DO	.032	.020	1.560	.006	
Age	.015	.001	13.625***	.006	182.540***
Age x S-R vs. DO	<.001	.001	.579		
Gender	.127	.029	4.407***	.006	19.450***
Gender x S-R vs. DO	.004	.036	.123		

Level 2 predictors					
Level 2 S-D vs. RTI	-.177	.239	-.741	.007	.671
Level 2 S-D vs. RTI x Level 1 S-R vs. DO	.049	.117	.418		
Level 2 S-R vs. DO	.458	.254	1.801	.007	4.036
Level 2 S-R vs. DO x Level 1 S-R vs. DO	.084	.136	.623		
Level 2 D vs. S	.208	.077	2.698**	.007	7.981*
Level 2 D vs. S x Level 1 S-R vs. DO	.021	.041	.517		
Level 2 C vs. V	.105	.105	1.002	.007	1.041
Level 2 C vs. V x Level 1 S-R vs. DO	-.002	.052	-.029		
Level 2 S-C vs. CTO	-.135	.146	-.923	.007	.932
Level 2 S-C vs. CTO x Level 1 S-R vs. DO	-.008	.072	-.114		
Level 2 S-I vs. CTO	-.190	.089	-2.131*	.006	6.215*
Level 2 S-I vs. CTO x Level 1 S-R vs. DO	-.042	.046	-.926		
Level 2 S-E vs. H	.234	.112	2.095*	.007	4.676
Level 2 S-E vs. H x Level 1 S-R vs. DO	.012	.056	.215		
Level 3 predictors					
HDI	.427	.367	1.164	.004	2.056
HDI x Level 1 S-R vs. DO	.118	.179	.659		
EPI	.006	.004	1.416	.004	3.581
EPI x Level 1 S-R vs. DO	.002	.002	1.009		
Difference vs. Similarity (D vs. S)					
Level 1 predictors					
Intercept	.473	.041	11.578***	.080	231.791***
D vs. S	-.080	.018	-4.368***	.003	
Age	.015	.001	12.690***	.001	160.460***
Age x D vs. S	.001	.001	.945		
Gender	.116	.029	4.011***	.003	16.228***
Gender x D vs. S	.012	.034	.347		
Level 2 predictors					
Level 2 S-D vs. RTI	-.183	.233	-0.787	.003	1.097
Level 2 S-D vs. RTI x Level 1 D vs. S	.088	.105	.843		
Level 2 S-R vs. DO	.460	.247	1.861	.003	3.602
Level 2 S-R vs. DO x Level 1 D vs. S	-.019	.123	-.153		
Level 2 D vs. S	.201	.075	2.682**	.003	10.781**
Level 2 D vs. S x Level 1 D vs. S	.036	.037	.972		
Level 2 C vs. V	.109	.103	1.067	.003	1.729
Level 2 C vs. V x Level 1 D vs. S	.019	.046	.423		
Level 2 S-C vs. CTO	-.139	.142	-.975	.003	1.440
Level 2 S-C vs. CTO x Level 1 D vs. S	.060	.066	.901		
Level 2 S-I vs. CTO	-.177	.087	-2.032*	.003	5.708
Level 2 S-I vs. CTO x Level 1 D vs. S	-.024	.041	-.595		
Level 2 S-E vs. H	.224	.109	2.055*	.003	8.049*
Level 2 S-E vs. H x Level 1 D vs. S	.061	.052	1.183		

Level 3 predictors					
HDI	.386	.363	1.065	.004	2.665
HDI x Level 1 D vs. S	.146	.168	.869		
EPI	.005	.004	1.342	.004	3.473
EPI x Level 1 D vs. S	.002	.002	.837		
Consistency vs. variability (C vs. V)					
Level 1 predictors					
Intercept	.475	.041	11.65***	.080	225.501***
C vs. V	.100	.011	8.994***	<.001	
Age	.014	.001	11.880***	<.001	144.270***
Age x C vs. V	<.001	<.001	.517		
Gender	.108	.029	3.751***	<.001	14.376***
Gender x C vs. V	-.012	.023	-.512		
Level 2 predictors					
Level 2 S-D vs. RTI	-.208	.232	-.893	<.001	1.733
Level 2 S-D vs. RTI x Level 1 C vs. V	.058	.064	.902		
Level 2 S-R vs. DO	.451	.247	1.830	<.001	4.045
Level 2 S-R vs. DO x Level 1 C vs. V	-.049	.074	-.657		
Level 2 D vs. S	.195	.075	2.596*	<.001	6.607*
Level 2 D vs. S x Level 1 C vs. V	.008	.022	.370		
Level 2 C vs. V	.105	.102	1.025	<.001	3.822
Level 2 C vs. V x Level 1 C vs. V	-.045	.029	-1.587		
Level 2 S-C vs. CTO	-.144	.142	-1.017	<.001	1.228
Level 2 S-C vs. CTO x Level 1 C vs. V	.013	.039	.334		
Level 2 S-I vs. CTO	.174	.087	-1.997*	<.001	4.029
Level 2 S-I vs. CTO x Level 1 C vs. V	<.001	.025	.033		
Level 2 S-E vs. H	.216	.110	1.978	<.001	4.002
Level 2 S-E vs. H x Level 1 C vs. V	-.004	.031	-.136		
Level 3 predictors					
HDI	.378	.357	1.058	<.001	1.173
HDI x Level 1 C vs. V	.010	.095	.105		
EPI	.005	.004	1.351	<.001	3.028
EPI x Level 1 C vs. V	.001	.001	1.208		
Self-containment vs. connectedness to others (S-C vs. CTO)					
Level 1 predictors					
Intercept	.470	.039	12.150***	.071	215.926***
S-C vs. CTO	-.209	.019	-11.030***	.005	
Age	.013	.001	10.869***	.006	116.670***
Age x S-C vs. CTO	.002	.001	1.436		
Gender	.017	.030	.585	.005	.504
Gender x S-C vs. CTO	-.015	.034	-.437		

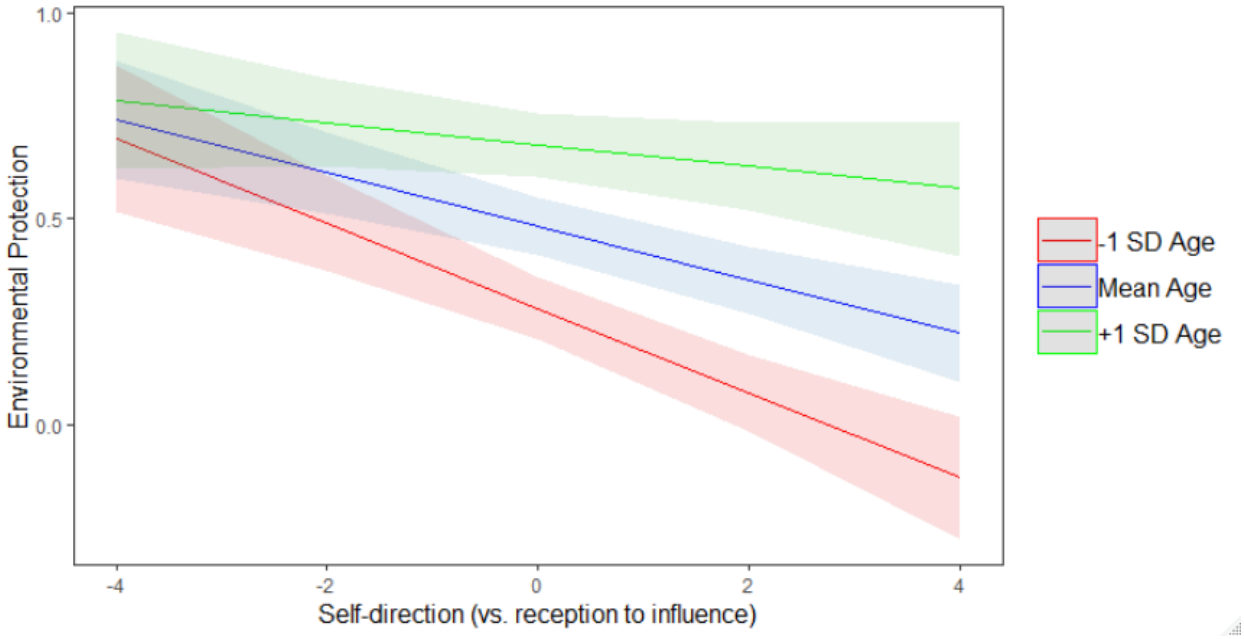
Level 2 predictors					
Level 2 S-D vs. RTI	-.196	.220	-.887	.005	1.025
Level 2 S-D vs. RTI x Level 1 S-C vs. CTO	.078	.109	.718		
Level 2 S-R vs. DO	.437	.234	1.868	.005	6.498*
Level 2 S-R vs. DO x Level 1 S-C vs. CTO	.106	.121	.873		
Level 2 D vs. S	.185	.072	2.582*	.005	6.524*
Level 2 D vs. S x Level 1 S-C vs. CTO	-.038	.037	-1.048		
Level 2 C vs. V	.113	.097	1.164	.005	2.152
Level 2 C vs. V x Level 1 S-C vs. CTO	.021	.049	.424		
Level 2 S-C vs. CTO	-.140	.135	-1.037	.005	2.079
Level 2 S-C vs. CTO x Level 1 S-C vs. CTO	-.035	.067	-.531		
Level 2 S-I vs. CTO	-.148	.083	-1.780	.006	3.214
Level 2 S-I vs. CTO x Level 1 S-C vs. CTO	.022	.043	.511		
Level 2 S-E vs. H	.205	.104	1.977	.005	4.279
Level 2 S-E vs. H x Level 1 S-C vs. CTO	-.064	.051	-1.251		
Level 3 predictors					
HDI	.309	.349	.887	.009	.950
HDI x Level 1 S-C vs. CTO	-.126	.191	-.660		
EPI	.005	.004	1.236	.008	2.514
EPI x Level 1 S-C vs. CTO	-.003	.002	-1.365		
<u>Self-interest vs. commitment to others (S-I vs. CTO)</u>					
Level 1 predictors					
Intercept	.471	.040	11.840***	.076	234.285***
S-I vs. CTO	-.185	.017	-11.040***	.006	
Age	.013	.001	11.728***	.005	136.840***
Age x S-I vs. CTO	<.001	.001	-.454		
Gender	.075	.029	2.633**	.005	7.132*
Gender x S-I vs. CTO	-.015	.027	-.538		
Level 2 predictors					
Level 2 S-D vs. RTI	-.200	.227	-.882	.005	2.935
Level 2 S-D vs. RTI x Level 1 S-I vs. CTO	-.104	.096	-1.080		
Level 2 S-R vs. DO	.457	.240	1.902	.006	4.684
Level 2 S-R vs. DO x Level 1 S-I vs. CTO	.032	.107	.302		
Level 2 D vs. S	.194	.073	2.646*	.004	8.578*
Level 2 D vs. S x Level 1 S-I vs. CTO	-.065	.031	-2.068*		
Level 2 C vs. V	.111	.100	1.113	.006	1.530
Level 2 C vs. V x Level 1 S-I vs. CTO	.005	.043	.113		
Level 2 S-C vs. CTO	-.141	.139	-1.014	.006	1.767
Level 2 S-C vs. CTO x Level 1 S-I vs. CTO	-.026	.059	-.436		
Level 2 S-I vs. CTO	-.158	.086	-1.851	.005	5.811
Level 2 S-I vs. CTO x Level 1 S-I vs. CTO	.074	.036	2.019*		
Level 2 S-E vs. H	.215	.107	2.012*	.005	6.249*

Level 2 S-E vs. H x Level 1 S-I vs. CTO	-.089	.044	-2.044*		
Level 3 predictors					
HDI	.351	.355	.991	.005	4.667
HDI x Level 1 S-I vs. CTO	-.327	.149	-2.190*		
EPI	.005	.004	1.308	.004	8.197*
EPI x Level 1 S-I vs. CTO	-.005	.002	-3.021**		
Self-expression vs. harmony (S-E vs. H)					
Level 1 predictors					
Intercept	.475	.041	11.643***	.08	228.908***
S-E vs. H	-.124	.021	-5.924***	.005	
Age	.015	.001	12.548***	.006	156.460***
Age x S-E vs. H	<.001	.001	.587		
Gender	.111	.029	3.860***	.005	14.941***
Gender x S-E vs. H	.005	.037	.127		
Level 2 predictors					
Level 2 S-D vs. RTI	-.177	.232	-.762	.005	2.481
Level 2 S-D vs. RTI x Level 1 S-E vs. H	.168	.120	1.399		
Level 2 S-R vs. DO	.456	.247	1.850	.005	4.604
Level 2 S-R vs. DO x Level 1 S-E vs. H	.119	.137	.868		
Level 2 D vs. S	.202	.075	2.698**	.006	8.679*
Level 2 D vs. S x Level 1 S-E vs. H	.039	.042	0.928		
Level 2 C vs. V	.110	.102	1.076	.006	1.294
Level 2 C vs. V x Level 1 S-E vs. H	-.020	.053	-.387		
Level 2 S-C vs. CTO	-.135	.142	-.951	.006	.941
Level 2 S-C vs. CTO x Level 1 S-E vs. H	.012	.075	.162		
Level 2 S-I vs. CTO	-.175	.087	-2.010*	.006	4.054
Level 2 S-I vs. CTO x Level 1 S-E vs. H	.003	.047	.064		
Level 2 S-E vs. H	.228	.109	2.094*	.006	4.421
Level 2 S-E vs. H x Level 1 S-E vs. H	.003	.059	.045		
Level 3 predictors					
HDI	.388	.362	1.072	.010	1.384
HDI x Level 1 S-E vs. H	.063	.214	.296		
EPI	.006	.004	1.372	.010	2.087
EPI x Level 1 S-E vs. H	<.001	.002	.193		

Note. Sample size for each level: Level 1 N = 7,069; Level 2 N = 55; Level 3 N = 33. *p < .05. **p < .01. ***p < .001.

Appendix C: Supplementary Figure 1

Slopes for the association between *self-direction (vs. receptiveness to influence*) and endorsement for environmental protection at difference ages (N = 7069, k = 55).



Appendix D: Supplementary Table 3

Correlation matrix for environmental outcomes and self-construal dimensions

	INS	NRS	IAT-Nature	EAI	BI	S-D vs. RTI	S-R vs. DO	D vs. S	C vs. V	S-C vs. CTO	S-I vs. CTO
NRS	.59***										
IAT-Nature	0.08	.13**									
EAI	.46***	.74***	.16**								
BI	.44***	.62***	.12*	.59***							
S-D vs. RTI	0.01	0.07	-0.09	0.04	-0.06						
S-R vs. DO	0.09	.11*	0.02	.16***	.16**	.29***					
D vs. S	.11*	.16**	-0.03	.12*	.17***	-0.05	0.07				
C vs. V	0.06	0.06	0.03	0.03	.10*	-.13**	-.12*	.30***			
S-C vs. CTO	-.13**	-.23***	-.14**	-.20***	-.24***	.37***	0.05	-0.05	-0.05		
S-I vs. CTO	-0.03	-.17***	0.01	-.18***	-.12*	0.08	.13**	-0.06	-.15**	.23***	
S-E vs. H	0.03	-0.04	-0.03	-0.06	-0.01	0.02	-.09*	.29***	.41***	0.05	0.05

Note. NRS = Nature Relatedness Scale; EAI = Environmental Attitudes Inventory; BI = Environmental Behaviour intention; S-D vs. RTI = Self-direction vs receptiveness to influence; S-R vs. DO = Self-reliance vs dependence on others; D vs. S = Difference vs similarities; C vs. V = Consistency vs variability; S-C vs. CTO = Self-containment vs connection to others; S-I vs. CTO = Self-interest vs commitment to others; S-E vs. H = Self-expression vs harmony. *$p < .05$. **$p < .01$. ***$p < .001$.

Appendix E: The Indirect Effect of Connectedness to Others on Environmentalism

We tested the indirect effect of interdependent priming on environmental measures using sequential mediation models, with *self-containment (vs. connection to others)* as a primary mediator and implicit and explicit nature connectedness as separate successive mediators of the total effect of interdependent priming on environmental attitudes and behaviour intention. This resulted in six separate path models (see Supplementary Figure 2). As *self-containment (vs. connection to others)* was only lower for interdependent condition when compared to the control group, we used experimental condition as a dichotomous variable, with the dummy-code 1 for interdependent priming and 0 for the control group. This meant that we excluded the independent condition and model parameters and indirect effects were assessed against the control condition (Hayes & Preacher, 2014). Path models were created and run using the package "lavaan" in R Studio and indirect effects were tested through bootstrapped confidence intervals (bootstrapping = 5000) in accordance with Zhao, Lynch, and Chen (2010). The coefficients for the paths between variables in each model are reported in Supplementary Table 4.

First, we examined the indirect effect of *self-containment (vs. connection to others)* and inclusion of nature in self on the relationship between interdependent priming and environmental attitudes (Model 1). The confidence interval for the indirect effect of interdependent priming on environmental attitudes through *self-containment (vs. connection to others)* and inclusion of nature in self indicated a significant mediation effect (b = .013, SE = .008, 95% LL = 0.001, 95% UL = 0.031). We then ran the same model with environmental behaviour intention as the outcome variable (Model 2). Similarly, the confidence interval for the indirect effect of interdependent priming on environmental behaviour intention through *self-containment (vs. connection to others)* and inclusion of nature in self indicated a mediation effect (b = .012, SE = .008, 95% LL = 0.001, 95% UL = 0.031). These findings

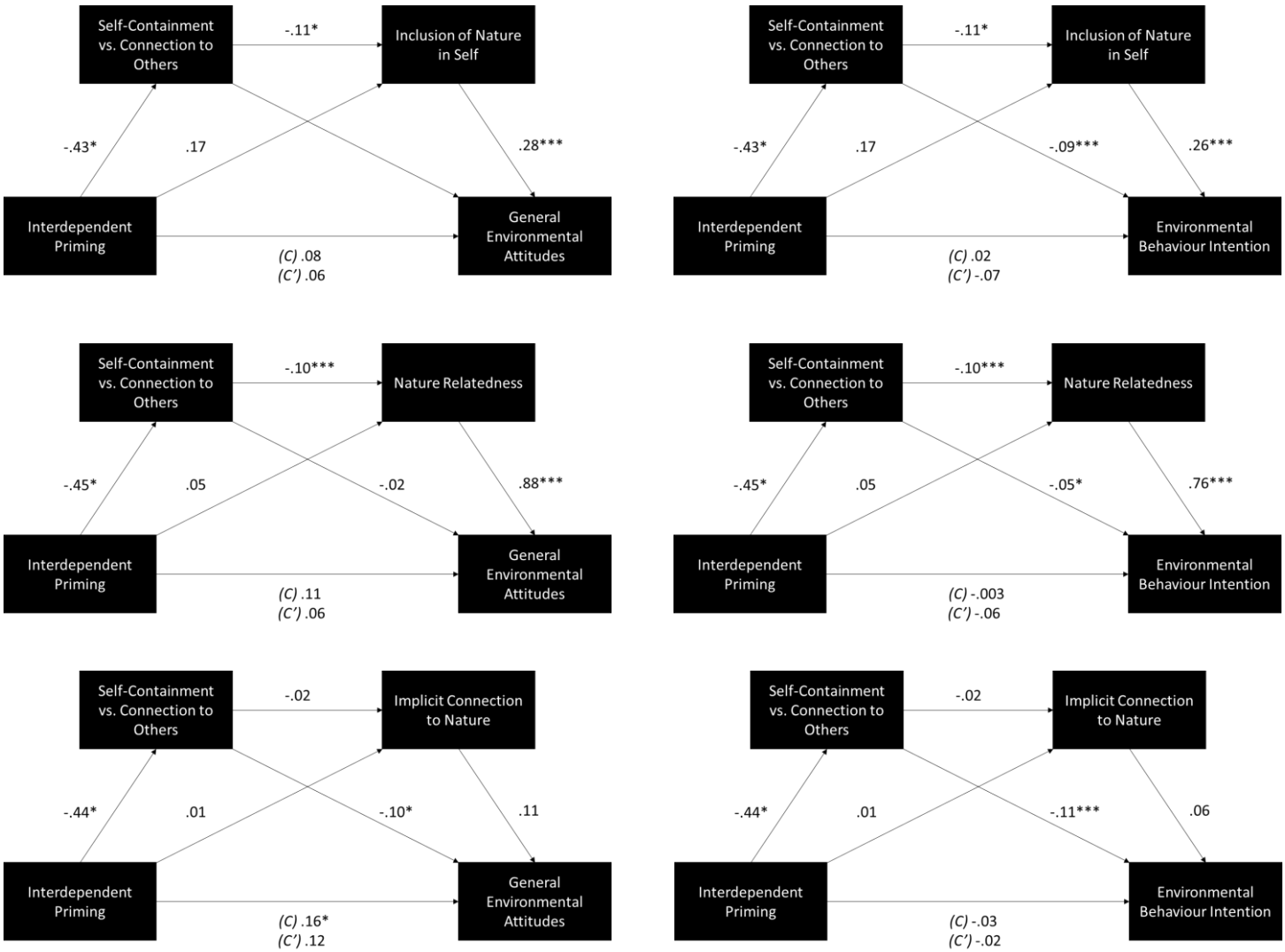
indicate that interdependent priming increased connection to others which increased inclusion of nature in self, which in turn, increased environmental attitudes and behaviour intention.

Next, we reran this path model substituting nature relatedness for inclusion of nature in self (Model 3). The confidence interval for the indirect effect of interdependent priming on environmental attitudes through *self-containment (vs. connection to others)* and nature relatedness indicated a mediation effect (b = .037, SE = .018, 95% LL = 0.006, 95% UL = 0.077). We then ran the same model with environmental behaviour intention as the outcome variable (Model 4). Similarly, the confidence interval for the indirect effect of interdependent priming on environmental behaviour intention through *self-containment (vs. connection to others)* and nature relatedness indicated a mediation effect (b = .032, SE = .015, 95% LL = 0.005, 95% UL = 0.065). The findings indicate that interdependent priming increased connection to others, which increased nature relatedness, which in turn, increased environmental attitudes and behaviour intention.

We then examined the indirect effect of *self-containment (vs. connection to others)* and implicit nature connectedness on the relationship between interdependent priming and environmental attitudes (Model 5). The confidence interval for the indirect effect of interdependent priming on behaviour intention through *self-containment (vs. connection to others)* and implicit nature connectedness indicated no mediation effect (b = .001, SE = .001, 95% LL = -0.002, 95% UL = 0.004). Likewise, no mediation was found with environmental behaviour intention as the outcome variable (Model 6; b = .001, SE = .001, 95% LL = -0.002, 95% UL = 0.003). The findings show that the indirect effect of *self-containment (vs. connection to others)* on environmental attitudes and behaviour intention observed in the other models was not related to implicit connection to nature.

Appendix F: Supplementary Figure 2

Sequential mediation models for the indirect effect of interdependent priming on environmental attitudes and behaviour intention



Note. Top left: Model 1. Top right: Model 2. Middle left: Model 3. Middle right: Model 4. Bottom left: Model 5. Bottom right: Model 6. Values represent unstandardized regression coefficients. *** = $p < .001$, ** = $p < .01$, * = $p < .05$.

Appendix G: Supplementary Table 4

Coefficients for individual paths in each sequential mediation models

Mediation Models	*b*	SE	*Z*	*p*
Model 1				
Inter → S-C vs. CTO	-.43*	.19	-2.29	.022
Inter → INS	.17	.13	1.29	.196
Inter → EAI	.06	.07	.952	.341
S-C vs. CTO → INS	-.11*	.04	-2.53	.012
S-C vs. CTO → EAI	-.08**	.02	-3.33	.001
INS → EAI	.28***	.04	7.74	<.001
Model 2				
Inter → S-C vs. CTO	-.43*	.19	-2.27	.023
Inter → INS	.17	.13	1.31	.192
Inter → BI	-.07	.07	-.99	.322
S-C vs. CTO → INS	-.11*	.04	-2.56	.011
S-C vs. CTO → BI	-.09***	.02	-3.93	<.001
INS → BI	.26***	.03	7.63	<.001
Model 3				
Inter → S-C vs. CTO	-.45*	.19	-2.41	.016
Inter → NRS	.05	.06	.751	.453
Inter → EAI	.06	.02	1.16	.247
S-C vs. CTO → NRS	-.10***	.02	-4.61	<.001
S-C vs. CTO → EAI	-.02	.02	-.97	.332
NRS → EAI	.88***	.05	17.76	<.001
Model 4				
Inter → S-C vs. CTO	-.45*	.19	-2.39	.017
Inter → NRS	.05	.06	.74	.460
Inter → BI	-.06	.06	-.95	.344
S-C vs. CTO → NRS	-.10***	.02	-4.63	<.001
S-C vs. CTO → BI	-.05*	.02	-2.19	.028
NRS → BI	.76***	.06	12.68	<.001
Model 5				
Inter → S-C vs. CTO	-.44*	.19	-2.29	.022
Inter → IAT	.01	.04	.27	.787
Inter → EAI	.12	.07	1.56	.119
S-I vs. CTO → IAT	-.02	.01	-1.31	.189
S-I vs. CTO → EAI	-.10***	.03	-3.58	<.001
IAT → EAI	.11	.12	.87	.382
Model 6				
Inter → S-I vs. CTO	-.44*	.19	-2.34	.019
Inter → IAT	.01	.04	.27	.789
Inter → BI	-.02	.08	-.30	.768
S-I vs. CTO → IAT	-.02	.01	-1.34	.179
S-I vs. CTO → BI	-.11***	.03	-4.48	<.001
IAT → BI	.06	.11	.58	.566

Note. Inter = Interdependent condition; S-C vs. CTO = Self-containment vs. connectedness to others; INS = Inclusion of nature in self; NRS = Nature relatedness; IAT = Implicit nature connection; EAI = Environmental Attitudes Inventory; BI = Environmental behaviour intention. *p < .05. **p < .01. ***p < .001.

Appendix H: The Nature Relatedness Scale (Nizbet, Zelenski, & Murphy, 2009)

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Appendix I: Cultural Model of Selfhood Scale (Vignoles et al., 2016)

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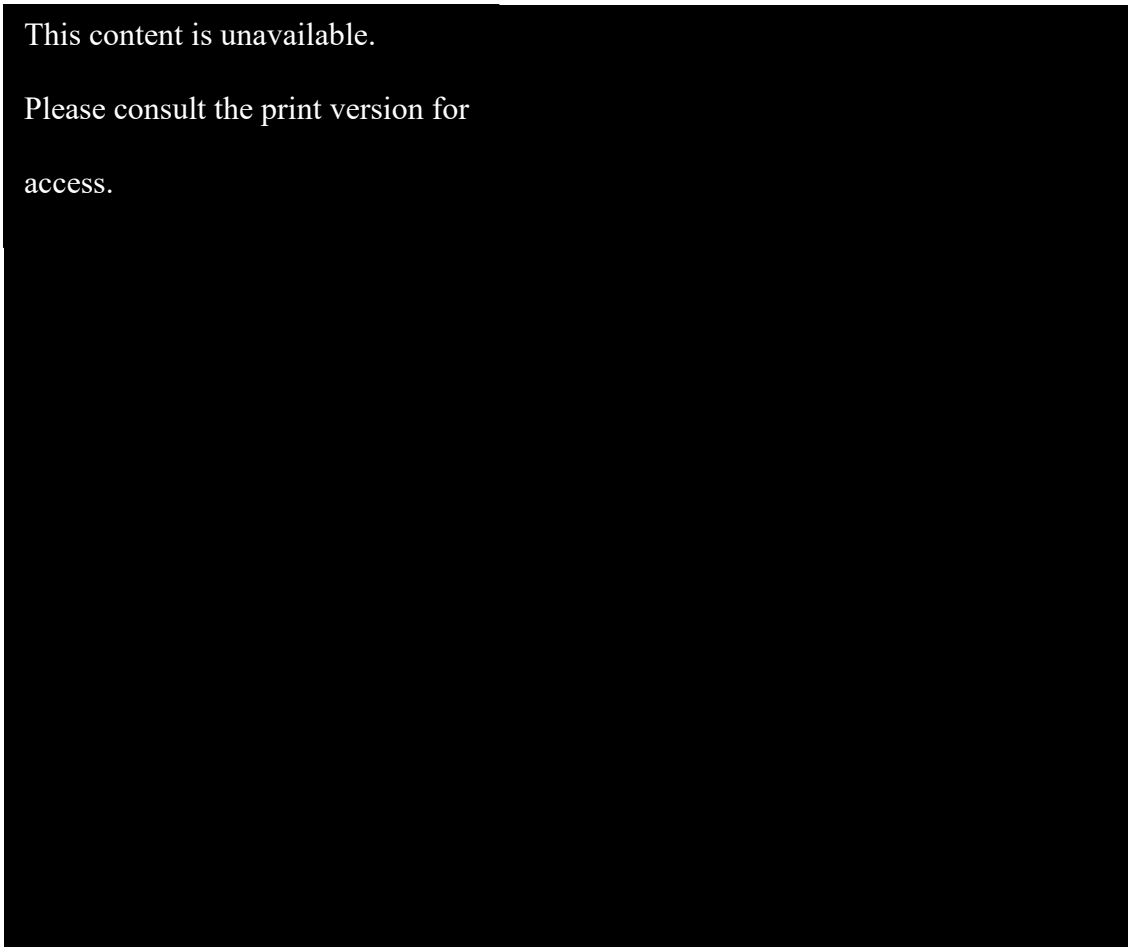
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Appendix J: The Inclusion of Nature in Self Scale (Schultz, 2001)

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Appendix K: Environmental Attitudes Inventory (Milfont & Duckitt, 2010)

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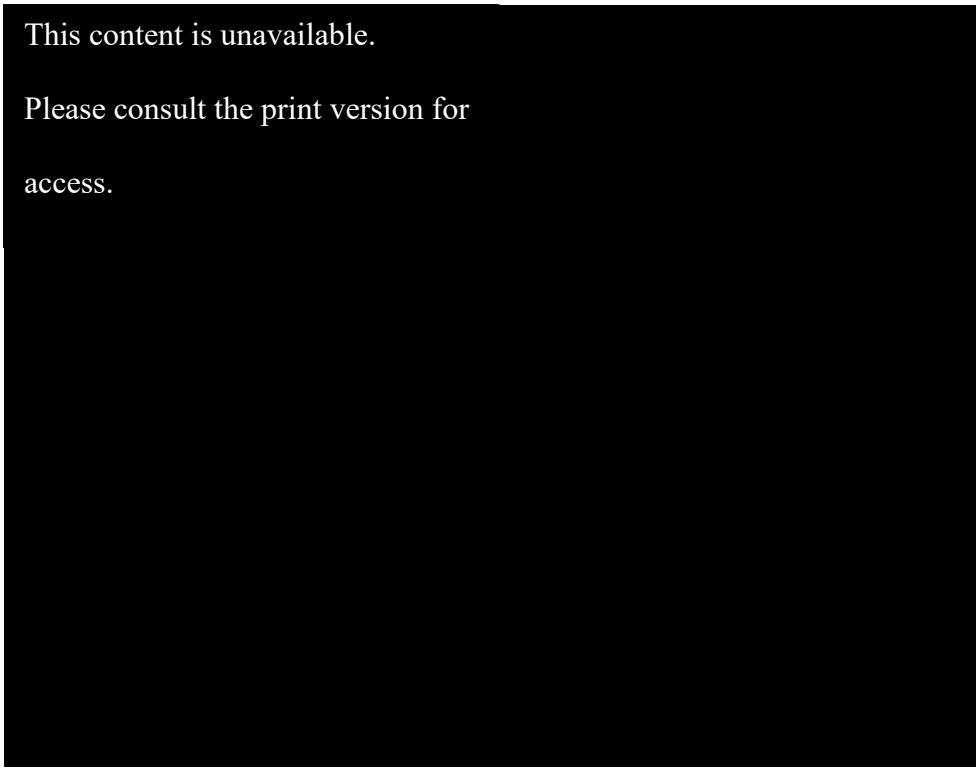
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Appendix L: Personal Sphere Behaviour Intention (Bain et al., 2015)

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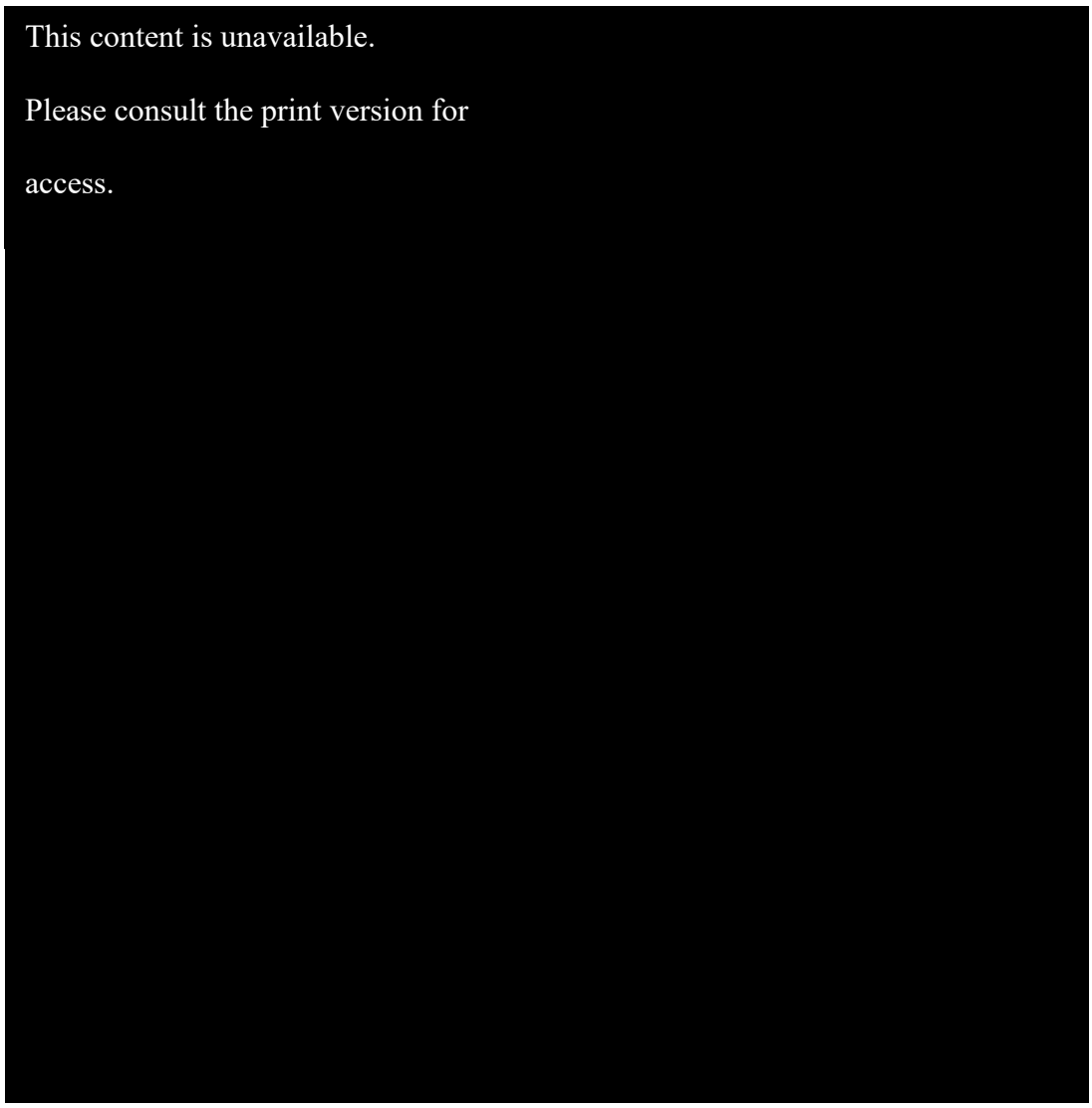
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Appendix M: Study 2 Participant Information Sheet

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

[redacted]

Environmentalism and the self

Welcome.

What is the purpose of this research?

- This online experiment study is part of a Master's thesis investigating the role of culturally patterned selfhood in environmentalism. We are aiming to collect responses from approximately 300 participants. Participation in this study is voluntary and your responses will be anonymous.
- This research will examine the connections between your views of yourself and different values related to environmentalism.

Who is conducting the research?

- Hamish Duff (MSc student) and AProf Taciano Milfont at Victoria University of Wellington
- This research has been approved by the School of Psychology Human Ethics Committee under delegated authority of the VUW Human Ethics Committee (Application number: 0000027222).

What is involved if you agree to participate?

- If you agree to participate in this experiment, you may be asked to think about your relationship with your friends and family.
- For example, "*please think of what makes you different from your friends and family*"
- You will then be asked to complete a word categorisation task along with a series of surveys that will ask you about your feelings towards the environment, climate change, and your attitudes towards yourself.
- This may include items such as: "*Humans are severely abusing the environment*", or "*I think a lot about the suffering of animals*"
- The entire study takes most people up to 0.25 hours to complete (or 0.25 IPRP credits). You must complete the experiment in one sitting.
- You can withdraw at any time before completing the experiment by closing the browser window. We will then remove any of your obtained data from inclusion in the study.
- During the research you are free to withdraw at any point before the experiment has been completed.

- There are no known risks associated with this research. Neither your grades, nor your academic relationships with the School of Psychology (or its staff members), will be affected by whether or not you chose to participate.

Privacy and confidentiality

- Your identity will never be revealed and your data will be reported in a manner that makes it impossible for others to identify your responses.
- You will never be identified in this research project or in any other presentation or publication. The information you provide will be coded by number only.
- We will keep the de-identified data indefinitely. This data will not have any identifying information and so cannot be linked back to you in any way, and the data will be shared on repositories in accordance with open science principles.
- The primary data set will be kept indefinitely for the greater scientific good, and the de-identified data will be made available to researchers beyond the research team in an open science repository (e.g., Open Science Framework). Open science is movement to make scientific research (including research hypothesis, materials used and data collected) accessible to all members of society.

What happens to the information that you provide?

- The overall findings may be submitted for publication in a scientific journal, and/or presented at scientific conferences.
- If you would like to know the results of this study, they will be posted at https://www.milfont.com/ once the research has been completed. If you have any further questions regarding this study, please contact us via email.

If you have any ethical questions or considerations regarding this study, you can contact convener of the VUW Human Ethics Committee, [redacted]

Informed Consent

I understand the information that has been provided to me about this study, including the storage, access, and use of my data. Any question that I have asked has been answered. By continuing with this experiment, I am giving consent to be a participant in this study.

Appendix N: Study 2 Participant Debrief Information Sheet

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

Thank you for participating in this experiment.

The main topic of this study was environmentalism, which would have been clear in the information sheet you were given prior to the experiment. Specifically, we are looking at whether manipulating people's connectedness to their friends and family can influence their environmental attitudes and connectedness to nature. Previous research shows that cultural differences in how people define themselves and relate to others is associated with differences in environmental concern (Arnocky, Stroink, & DeCicco, 2007), which suggests an expanded view of the self (to include others and nature) leads to greater concern for the environment as it is seen as part of oneself (Nolan & Schultz, 2010).

This study consisted of an experimental manipulation, called priming, used to highlight the similarities or differences between you and your friends and family members (Oyserman & Lee, 2008). The goal of this priming is to temporarily promote either an independent (differences) or interdependent (similarities) view of the self to see if this influences your survey responses. This selfhood manipulation started by dividing participants into three random groups and presenting each group with a different task. Participants in one group were asked to think about how they are <u>similar</u> to their friends and family, whilst those in another group were asked to think about how they are <u>different</u> to their friends and family; the third group comprised the 'control group' and were not presented with the selfhood manipulation.

All participants completed a variety of tasks designed to measure different types of environmental values. The word categorisation task you completed – known as an Implicit Association Test – estimated your association between self and nature by comparing reaction times to categorise words about nature and self with words about nature and others. We also used surveys to measure nature connectedness (e.g., 'my relationship to nature is an important part of who I am'; 'please choose the picture below which best describes your relationship with the natural environment'), environmental attitudes (e.g., 'I would like to join and actively participate in an environmentalist group'), and personal environmental behaviour intention (e.g., 'how often do you buy environmentally-friendly products'). Additionally, we used a measure of selfhood to confirm the effectiveness of the selfhood manipulation (e.g., 'you like being different from other people'; 'your happiness is unrelated to the happiness of your family').

Each measure will be compared between the three groups to see if the selfhood manipulation induced changes to your environmental values. We expect that participants in the similarity condition should score higher in all environmentalism measures compared to participants in the difference and control conditions. That is, the selfhood manipulation focusing on similarities with others should expand one's view of themselves to include others, making them feel more connected to, and concerned for, nature. In

contrast, the manipulation focusing on differences from others should reduce inclusion of others in the self, which could also reduce inclusion of nature in the self.

As we stated in the information sheet, we hope that the results of this study can be used to help inform strategies to build resilience to climate change in Aotearoa New Zealand. Any publications using data from this survey will be posted at: www.milfont.com.

Additionally, if you would like to learn more about this topic, we have provided some related papers below.

Once again, thank you for your time! This research would not have been possible without you.

Further Reading

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