Socio-structural and psychological foundations of climate change beliefs

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Using a national probability sample of over 6,000 New Zealanders, this study examines socio-structural and psychological variables underpinning core climate change beliefs—"climate change is real" and "climate change is caused by humans". Analyses focused on four belief profiles: those who believe in the reality of climate change and its human cause (53%), those undecided (30%), the complete skeptics (10%) and those who believe the climate is changing but is not caused by human activity (7%). Results support and extend a "conservative white male" effect in doubts concerning the science of human-caused climate change. Uniformly high beliefs in climate change reality and human cause was observed among respondents who were younger, female, educated, politically liberal, belonged to minority groups and who perceived that they were able to influence environmental outcomes. Belief in climate change was also stronger for those who endorse altruistic and openness values and who were high in personality trait levels of Agreeableness and Openness to Experience. Theoretical and practical implications of the findings are discussed.

Keywords: climate change; beliefs; demographics; values; personality; latent profile analysis

Introduction

More than 100 Nobel laureates have singled out global warming as a danger to world peace in the coming years due to its consequences to the world's dispossessed (Nobel Laureates, 2001).The U.N. Secretary General has stated that climate change is the central challenge of our time (Ki-moon, 2009), and a report by the American Psychological Association stated that climate change is a pressing issue facing our planet and its inhabitants (Swim et al., 2009). Such worrying views about climate change are not limited to political figures or scientists. In the early 90s representative samples from six nations have rated "global warming or the greenhouse effect" as a very serious problem (Dunlap, 1998). More recent public opinion surveys have shown similar results (e.g., Eurobarometer, 2009; The World Bank, 2009). Despite these social markers and the weight of scientific evidence on the current existence and future worsening of climate change as well as its causes and consequences (IPCC, 2014), there is still some denial that the climate is changing and disbelief in human causation (Stoll-Kleemann, O'Riordan, & Jaeger, 2001; Whitmarsh, 2011).

The gap between scientific evidence and public awareness of existing risks is a multifaceted issue and research has identified a number of psychological barriers to perceiving, understanding and acting upon global environmental change (e.g., Milfont, 2010; Pawlik, 1991; Swim et al., 2011). However, such studies have generally not disentangled belief of climate change's existence from belief about its cause. Some people are convinced anthropogenic climate change is occurring and others are not, while others believe climate is changing but do not support the view that humans are driving these changes. Perhaps more importantly, such studies have not examined the core variables underpinning the belief in the reality of climate change and anthropogenic climate change. The level of distinct support to these critical climate change beliefs may influence not only the mitigation actions of a particular individual (Heath & Gifford, 2006), but also his or her views and support for the actions governments and other individuals take regarding climate change (Sibley & Kurz, 2013).

Using a national probability cross-sectional sample of over 6,000 respondents in New Zealand, we examine the foundations of two core climate change beliefs: the reality of climate change ("climate change is real") and anthropogenic climate change ("climate change is caused by humans"). Past studies have used segmentation strategies to identify coherent groups within a population to target and tailor climate change information (e.g., Barnes & Toma, 2012; Maibach, Leiserowitz, Roser-Renouf, & Mertz, 2011). However, to our knowledge no study has examined the extent to which particular demographic and psychological variables can explain these distinct climate change segments. Extending a recent study that used Latent Profile Analysis to segment New Zealand respondents according to their climate change beliefs (Sibley & Kurz, 2013), we assess whether the observed climate change belief profiles can be distinguished in terms of important socio-structural variables (age, gender, ethnicity, employment status, parental status, religiosity, neighbourhood deprivation level, political orientation, level of education, and perceived environmental self-efficacy) and two core psychological constructs (values and personality traits). By providing a demographic and cognitive-motivational analysis of climate change beliefs, this

study helps in the identification of substantive ideological differences between climate change believers and deniers. This investigation starts with a brief review of studies examining the correlates of these socio-structural and psychological variables with respect to environmentally friendly behaviours. Climate change is certainly not limited to environmental issues (United Nations, 2011), but we focus on environmental concern and pro-environmental engagement because this is the subject that has received more emphasis.

Socio-Structural Foundations of Climate Change Beliefs

Sociological and social psychological studies have traditionally examined the demographic variables underpinning pro-environmental engagement (e.g., Buttel, 1987; McFarlane & Hunt, 2006; Van Liere & Dunlap, 1980). Although the associations between socio-structural variables and pro-environmental engagement tend to be weak in terms of effect size (Fransson & Gärling, 1999) and oftentimes yield mixed results (e.g., Hines, Hungerford, & Tomera, 1987), some consistent overall patterns can be identified.

Age. Younger individuals are more likely to hold environmentally friendly positions than older individuals (Fransson & Gärling, 1999; Hines et al., 1987; Van Liere & Dunlap, 1980). However, age has also been found to be positively related to pro-environmental attitudes and behaviour (Korfiatis, Hovardas, & Pantis, 2004; Mayer & Frantz, 2004, Study 4), and with concern for nature across cultures (Schwartz, 2005).

Gender. Research examining the influence of gender has also found some mixed results (e.g., Arcury, Scollay, & Johnson, 1987; McFarlane & Hunt, 2006), but overall females tend to be more environmentally concerned than males (e.g., Korfiatis et al., 2004; Zelezny, Chua, & Aldrich, 2000). That females have stronger pro-environmental engagement may be a result of gender differences in values or personality traits (Borden & Francis, 1978; Dietz, Kalof, & Stern, 2002).

Parental status. Having children may contribute to overpopulation and resulting environmental consequences, which has led some individuals to decide not to reproduce (Arnocky, Dupuis, & Stroink, 2012). At the same time, parents may have a stronger motivation to care about the future of the planet for their offspring, with research showing that parents tend to be more environmentally concerned than non-parents (Dupont, 2004; Hamilton, 1985).That parents tend to have stronger pro-environmental engagement may result from an increase in generativity concerns (Milfont & Sibley, 2011), and research has shown the implication of parental status in relation to climate change (Milfont, Harré, Sibley, & Duckitt, 2012).

Religiosity. White (1967) argued that Christian religious traditions emphasize anthropocentric views of the environment, and a belief in human dominance over nature. Empirical studies have supported this claim with individuals from a Judeo-Christian tradition, and those expressing higher levels of religiosity, religious fundamentalism and literal beliefs in the Bible, having lower levels of pro-environmental engagement than their counterparts (Bulbulia, Troughton,Greaves,Miflont, & Sibley, in press; Gardner & Stern, 2002; Schultz, Zelezny, & Dalrymple, 2000). Higher levels of religiosity, measure by church attendance, has also been shown to be related to climate change denial (McCright & Dunlap, 2011a).

Social-economic status. Research has indicated a positive association between greater personal income and higher levels of pro-environmental engagement (Theodori & Luloff, 2002; Van Liere & Dunlap, 1980). However, negative associations between income and ecological behaviour have also been found (Korfiatis et al., 2004).

Political orientation. A number of studies have related political orientation to pro-environmental engagement. Research findings indicate that pro-environmental engagement is greater among those who endorse liberal political ideology (e.g., Buttel & Flinn, 1978; Fransson & Gärling, 1999; Kilbourne, Beckmann, & Thelen, 2002; Malka, Krosnick, & Langer, 2009; McCright & Dunlap, 2011b; Milfont, 2012a).

Education level. Schwartz (2005) has suggested that although education may broaden one's intellectual horizons, it does not necessarily increase concern for nature. Research seems to show, however, that more educated individuals are more environmentally concerned and attribute greater importance to biocentric orientations than less educated individuals do (Fransson & Gärling, 1999; Hines et al., 1987; Olofsson & Öhman, 2006).

Self-efficacy. Perceived personal efficacy is an important predictor of pro-environmental engagement (Bamberg & Möser, 2007). Research has also shown that perceived ability (or inability) to influence climate change outcomes impact concern and motivation to act in relation to this issue (Aitken, Chapman, & McClure, 2011; Milfont, 2012a).

To summarize, even though some mixed results have been reported, young and female individuals, the more highly educated, those with children, those with low levels of religiosity, those with higher incomes, people with liberal political ideologies, and those with perceived personal efficacy are more likely to express higher levels of pro-environmental engagement. Similar findings have also been reported in relation to the social-structural bases of climate change concern, with self-identified liberals, non-whites and females being more likely to express climate change concern compared to their politically conservative, white and male counterparts (e.g., Kellstedt, Zahran, & Vedlitz, 2008; Malka et al., 2009; Whitmarsh, 2011). These findings have led to the idea and empirical test of a "conservative white male" effect (McCright & Dunlap, 2011a) in which conservative white males in the USA are disproportionately more likely than are other adults to espouse climate change denial.

However, the socio-structural foundations of particular climate change beliefs might differ. For example, research with a community sample in Canada has shown that age was negatively associated to anthropogenic climate change but not to the belief that climate change is occurring, while income was positively associated with climate change reality but not anthropogenic climate change (Heath & Gifford, 2006). Therefore, here we

examine the social-structural bases of these distinct climate change beliefs. Besides providing an examination of the social-structural bases of these two core climate change beliefs, we also examine particular psychological variables that might underlie these beliefs.

Psychological Foundations of Climate Change Beliefs

A number of psychological theories and constructs have been used to understand pro-environmental engagement (see Bonnes, Lee, & Bonaiuto, 2003; Clayton, 2012). In the present article we focus on two important social psychological variables: values and personality. Since values and personality are a core part of what motivates our beliefs and attitudes, it seems reasonable to expect that basic differences in these constructs should influence climate change beliefs. To illustrate, the role of values in understanding and predicting pro-environmental engagement has been emphasised by both researchers (Schultz & Zelezny, 1999) and environmental NGOs (Crompton, 2008). Personality differences underpinning pro-environmental engagement have also been explored (Borden & Francis, 1978), with a recurrence of studies in the last few years (Hirsh & Dolderman, 2007; Milfont & Sibley, 2012). Below we describe the theoretical models on values and personality used in the present research.

Human Values

Other value models have been considered in the context of pro-environmental engagement (Dunlap, Grieneeks, & Rokeach, 1983), but we focus on the work by Shalom H. Schwartz who has proposed two social psychology theories used in this context. His norm-activation theory (Schwartz, 1977) explains altruistically motivated helping behaviour and has been extensively applied to explain and foster pro-environmental engagement (Heberlein, 1977; Milfont, Sibley, & Duckitt, 2010; Schultz et al., 2005; Van Liere & Dunlap, 1978), even leading to the development of a specific theoretical framework to explain environmentalism (Stern, Dietz, Abel, Guagnano, & Kalof, 1999). Another extension of the norm-activation theory that has been widely used to explain pro-environmental engagement—Schwartz's (1992, 1994) theory of human values.

Schwartz (1992) identified 10 motivationally distinct types of values that individuals in virtually all cultures recognise: achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity, and security. These motivational types are, in turn, grouped into four higher order value clusters: Openness to Change (values favouring change and independent thought and behaviour), Conservation (preservation of traditional practices and stability), Self-Transcendence (concern for the welfare of others), and Self-Enhancement (pursuit of one's own relative success and dominance over others).

The value model proposed by Schwartz (1992) has been widely used to predict pro-environmental engagement (e.g., Coelho, Gouveia, & Milfont, 2006; Karp, 1996; Milfont& Gouveia,2006; Schultz, 2001; Schultz et al., 2005; Schultz & Zelezny, 1999; Stern & Dietz, 1994; Stern, Dietz, Kalof, & Guagnano, 1995). Research has shown that Openness to Change and Conservation values are not consistently related to pro-environmental orientations. Notably, research has shown that Self-Transcendence values correlate positively with pro-environmental engagement, while Self-Enhancement values correlate negatively. Recent reviews of the literature have confirmed these general findings. The motivational underpinnings of pro-environmental attitudes are strongly linked to self-transcendence values (Boer & Fischer, 2013; Diniz, Fischer, Milfont, & McClure, 2012).

Personality

The Big-Five model of personality is one the most used personality models and has been employed to predict a wide range of outcomes (Goldberg, 1990; McCrae & Allik, 2002; McCrae & John, 1992). In brief, the Big-Five model proposes a structure of personality traits formed by the five broad trait dimensions of Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness to Experience. Extraversion includes traits such as being outgoing, energetic and assertive, and reflects an orientation to maximise gains from social relations. Agreeableness includes traits such as being compliant, pleasant and cooperative, and to care strongly about the well-being of family and friends, reflecting a greater investment in reciprocal social arrangements. Conscientiousness includes traits of carefulness, responsibility and organisation, and reflects greater investment in long-term planning. Neuroticism includes traits such as depression, anxiety, anger and insecurity, and reflects investment in close relationships as well as greater monitoring of inclusionary status and signals of rejection from others. Finally, Openness to Experience is characterised by intelligence, imagination and engagement in ideas-related endeavours, and reflects tolerance for all people and investment in seeking novel solutions and gains.

A number of recent studies have examined the associations between the Big-Five personality traits and environmentally-related outcomes. Hirsh and Dolderman (2007) found that greater environmentalism was associated with higher levels of Agreeableness and Openness among Canadian undergraduate students. In two other studies conducted in Canada, Nisbet, Zelenski and Murphy (2009) found that greater perceived relatedness with nature was greater for those participants with higher levels of Agreeableness and Openness. In another study Hirsh (2010) found that greater environmental concern was significantly associated with higher levels of Agreeableness, Openness, Neuroticism and Conscientiousness in a community sample from Germany, but that the associations were much stronger for Agreeableness and Openness. The positive association between pro-environmental engagement and Openness was also observed in undergraduate and community samples in the USA (Markowitz, Goldberg, Ashton, & Lee, 2012). Extending these studies, Milfont and Sibley (2012) examined the associations between the Big-Five personality traits and pro-environmental engagement at the individual level of analyses (using national New Zealand samples)

as well as at the societal level of analyses. They found that across both individuals and nations, Agreeableness, Conscientiousness and Openness were the traits most strongly associated to pro-environmental engagement.

The HEXACO model of personality structure (Ashton & Lee, 2007) has extended the Big-Five model by adding a sixth broad dimension representing Honesty-Humility. The honesty aspect of this dimension includes traits such as sincerity and fairness, while the humility aspect includes traits such as modesty and greed-avoidance. The Honesty-Humility dimension reflects a fairness-based reciprocal altruism with investment in mutual help, non-aggression and non-exploitation of others. We also consider this sixth personality dimension in the present study.

The Present Study

The review presented above shows that pro-environmental engagement is underpinned by particular socio-structural variables as well as values and personality traits. Although not many studies have explored the associations between these variables and climate change beliefs, it is expected that the pattern of associations would be overall similar to those for pro-environmental engagement. At the same time, and in line with previous findings (Heath & Gifford, 2006), it is likely that individuals might differ in particular climate change beliefs and that the socio-structural and psychological foundations underpinning these distinct beliefs might also differ.

Using the same dataset considered in the present research, Sibley and Kurz (2013) performed Latent Profile Analysis to segment respondents in terms of their beliefs of climate change reality and anthropogenic climate change. They identified four distinct profiles of climate believers and skeptics in the New Zealand population. More than half of New Zealanders (53%) hold uniformly high beliefs that climate change is both real and caused by humans (labelled Climate Believers), while 30% had neutral or undecided views regarding both these climate change beliefs (Undecided/Neutral). This means that a large majority of the New Zealand public hold neutral-to-high levels of beliefs in the reality of climate change and its anthropogenic cause. Among the smaller proportion of climate skeptics two distinct profiles emerged: those who believe climate change is occurring but not caused by human activity (7%; Anthropogenic Climate Skeptics), and those who are skeptical about both reality and human cause (10%; Climate Skeptics).

Here we extend the Sibley and Kurz (2013) work by examining whether distinct demographic, personal values and personality traits underpin the observed climate change belief profiles. National public opinion surveys have shown that a large proportion of the general New Zealand public agree about the reality of climate change and its human cause (New Zealand Institute of Economic Research, 2008; Stuart, 2009). However, the data reported in this study are the most comprehensive on climate change beliefs of New Zealanders.

Method

Sampling Procedure

Data used in the present study come from the first wave of the New Zealand Attitudes and Values Study (NZAVS) conducted in 2009. The NZAVS-09 questionnaire was posted to 40,500 New Zealanders randomly selected from the 2009 New Zealand electoral roll. Roughly 1.36% of all people registered to vote were contacted and invited to participate. The NZAVS-09 contained responses from 6,518 participants and the overall response rate (adjusting for the address accuracy of the electoral roll and including anonymous responses) was 16.6%. The overall NZAVS project was approved by the University of Auckland Human Ethics Committee.

Participant Details

Our analyses were limited to a total of 6,489 participants (3858 women and 2631 men) who responded to all the relevant measures. The mean age in the sample was 47.97 (SD = 15.76) and about 44% (n = 2814) of the sample identified as religious. Most participants were in some kind of paid employment (72.8%, n = 4724) and 74.9% (n = 4861) had at least one child. In terms of ethnicity 81.9% (n = 5316) identified as New Zealand European. In terms of education 23% (n = 1546) said they had no education or did not report their highest level of education, 29% (n = 1885) reported at least some high school, 15.7% (n = 1022) reported having studied towards a diploma or a certificate, 22.4% (n = 1454) reported having studied at an undergraduate level, and 9% (n = 582) reported having pursued post-graduate study.

Because participants' postal address was included in their contact details, we were able to use this information to identify the level of economic deprivation in the immediate area in which each participant resided based on the New Zealand deprivation index, which reflects the average level of deprivation of different area units across the country (Salmond, Crampton, & Atkinson, 2007). We used the percentile deprivation index, which gives an ordinal score from 1 (most affluent) to 10 (most deprived) for each area unit based on 2006 census data. The mean score on this measure of deprivation in our sample was 5.06 (SD = 2.85).

Questionnaire Measures

Climate Change Beliefs. Two questions were used to assess climate change beliefs. One question focused on the reality of climate change ("Climate change is real") and the second on anthropogenic climate change ("Climate change is caused by humans"). These single items were embedded in a large battery of Likert-type questions and were rated on a scale from 1 (strongly disagree) to 7 (strongly agree).

Socio-structural questions. Relevant demographic measures were assessed within the questionnaire and were included in the analyses as possible socio-structural determinants of the climate change beliefs. These were age, gender (dummy coded as 0 = female, 1 = male), ethnicity (0 = minority group member, 1 = NZ European majority), employment status (0 = unemployed, 1 = employed), parental status (0 = no children, 1 = parent), religious status (0 = not religious, 1 = religious), level of education (the highest level of education reported, recoded to range from -2 to 2), political orientation (1 = very liberal to 7

= very conservative), and neighbourhood deprivation (see Salmond et al., 2007). The NZAVS also measured perceived environmental efficacy using two items (Sharma, 2008): "By taking personal action I believe I can make a positive difference to environmental problems", and "I feel I can make a difference to the state of the environment." These items were rated on a scale from 1 (strongly disagree) to 7 (strongly agree). The two items intercorrelated strongly (r = .70) and were averaged to create a mean scale score.

Values. Schwartz's (1992) value dimensions of Openness to Change, Conservation, Self-Transcendence and Self-Enhancement were assessed using the shortened measure developed by Stern, Diez, and Guagnano (1998). Items were administered with the instructions: "Please circle the number that best represents how important each of the following values is for you as a guiding principle in your life. Use the scale below to rate these items." Items were rated on a scale which ranged from -1 (opposed to my values) to 0 (not important) to 3 (important) to 6 (very important) to 7 (of supreme importance).

Openness to Change value items included "A varied life (filled with challenge, novelty and change)", "An Exciting Life (stimulating experiences)", and "Curiosity (interest in everything, exploring)" (α = .73). Conservation value items included "Family Security (safety for loved ones)", Self-Discipline (self-restraint, resistance to temptation)", and "Honouring of Parents and Elders (showing respect)" (α = .56). Self-Transcendence value items included "Equality (equal opportunity for all)", "A World at Peace (free of war and conflict)", and "Social Justice (correcting injustice, care for the weak)" (α = .71). Self-Enhancement values included "Authority (the right to lead or command)", "Influence (having an impact on people and events)", and "Wealth (material possessions, money)" (α = .61).

Personality dimensions. The Mini-IPIP6 was used to assess the six personality dimensions (Sibley et al., 2011): Extraversion, Agreeableness, Conscientiousness, Neuroticism, Openness to Experience, and Honesty-Humility. The items were administered with the following instructions: "This part of the questionnaire measures your personality. Please circle the number that best represents how accurately each statement describes you." Items were rated on a scale ranging from 1 (very inaccurate) to 7 (very accurate).

Extraversion was assessed by the following four items: "Am the life of the party", "Don't talk a lot" (reverse scored), "Keep in the background" (reverse scored), and "Talk to a lot of different people at parties" (α = .71). Agreeableness was assessed by the following four items: "Sympathize with others' feelings", "Am not interested in other people's problems" (reverse scored), "Feel others' emotions", and "Am not really interested in others" (reverse scored) (α = .66). Conscientiousness was assessed by the items: "Get chores done right away", "Like order", "Make a mess of things" (reverse scored), and "Often forget to put things back in their proper place" (reverse scored) (α = .65). Neuroticism included the following four items: "Have frequent mood swings", "Am relaxed most of the time" (reverse scored), "Get upset easily", and "Seldom feel blue" (reverse scored) (α = .64). Openness to Experience was assessed by the items: "Have a vivid imagination", "Have difficulty understanding abstract ideas" (reverse scored), "Do not have a good imagination" (reverse scored), and "Am not interested in abstract ideas" (reverse scored) (α = .67). Finally, Honesty-Humility was assessed using the following four reverse-scored items: "Would like to be seen driving around in a very expensive car", "Would get a lot of pleasure from owning expensive luxury goods", "Feel entitled to more of everything", and "Deserve more things in life" (α = .78).

Results

Estimation and Profiles of Climate Change Beliefs

We conducted a Latent Profile Analysis with a three-step distal approach investigating socio-structural and psychological differences in the profiles first identified by Sibley and Kurz (2013). Analyses were conducted in Mplus 7.11. This analysis thus extended the preliminary model proposed by Sibley and Kurz (2013) by exploring the individual difference covariates of the distinct profiles they described. The covariates (or auxiliary variables) that we examined included the socio-structural variables, the four value dimensions, and the six personality dimensions. This approach allowed us to conduct univariate tests of the differences in terms of these auxiliary variables across the latent profiles of climate change beliefs. The descriptive statistics and bivariate correlations for all relevant variables are presented in Table 1. As reported by Sibley and Kurz (2013) and reviewed above, the four profiles and their respective proportion of participants were: Climate Believers (52.9%), Undecided/Neutral (30.5%), Climate Skeptics (9.9%), and Anthropogenic Climate Skeptics (6.7%). Extending their findings, we then examined whether the four climate change belief profiles statistically differ in terms of socio-structural and psychological variables.

Socio-Structural Differences

Age. There were significant differences in mean age across the four profiles of climate change beliefs as presented in Figure 1 ($\chi 2(3, 6455) = 157.633$, $p < .001$). The results showed that Climate Skeptics and Anthropogenic Climate Skeptics were the oldest, with comparable mean age (M = 52.461, SE = .624; and M = 54.238, SE = .751, respectively). Both of these profiles had significantly higher mean age than the Climate Believers and Undecided/Neutral profiles (M = 46.373, SE = .265; and M = 47.914, SE = .352, respectively). These results suggest that skepticism in terms of climate change reality or its human causes is associated with older age which support findings showing that younger individuals are more likely to hold environmentally friendly positions than older individuals (Fransson & Gärling, 1999; Hines et al., 1987; Van Liere & Dunlap, 1980).

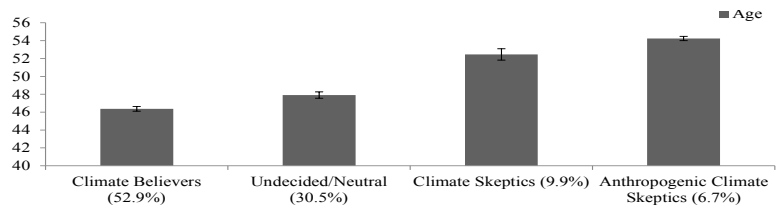

Figure 1. Mean age of people across the four climate change belief classes

Gender. Significant differences in the proportions of men and women in each profile were observed ($\chi2(3, 6489) = 67.604$, $p < .001$). The weighted proportion of men and women in each profile are presented in panel a) of Figure 2. As shown, men are overrepresented only in the Climate Skeptics profile (54.2% men). Conversely, women constituted the majority of the participants of the other three profiles: Climate Believers (63.4%), Undecided/Neutral (58.4%), and Anthropogenic Climate Skeptics (53.5%). This suggests that those individuals who are skeptics in terms of climate change reality and its human causes are more likely to be male, while those classified in the other three climate change belief profiles are more likely to be women. This supports previous findings showing that females tend to be more environmentally concerned than males (e.g., Korfiatis et al., 2004; Zelezny et al., 2000)..

Ethnicity. Significant differences were also observed in the proportion of people identifying with a majority (NZ European) versus minority ethnic group across the four profiles ($\chi2(3, 6489) = 123.157$, $p < .001$). As shown in panel b) of Figure 2, majority group members were overrepresented in all of the four profiles; however, they constituted the largest proportion of the Climate Skeptics profile (91%), and the smallest proportion of the Climate Believers profile (77.4%).

As such, given the mean proportion of majority group members in the sample of 81.9%, Climate Skeptics are more likely to be members of the majority ethnic group while Climate Believers are by comparison less likely. These results are somewhat similar to previous findings showing that whites are less likely to express climate change concern compared to non-whites (Malka et al., 2009).

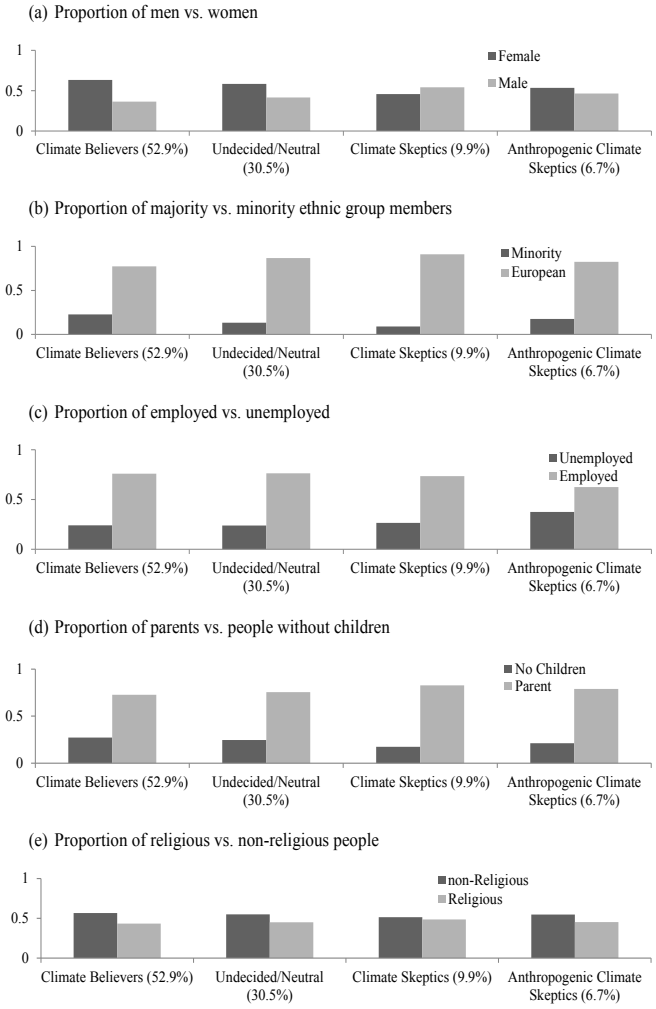

Figure 2. Weighted proportional differences in a) gender, b) ethnicity, c) employment, d) parental status, and e) religious status across the four climate change belief classes

Employment Status. In terms of employment, we observed significant differences in proportions of unemployed and employed people across the four profiles ($\chi2(3, 6310) = 22.073$, $p < .001$). As presented in panel c) of Figure 2, the majority of people in all four profiles were employed, with comparable proportions of unemployed participants across the Climate Believers (24.1%), the Undecided/Neutral (23.8%) and the Climate Skeptics (26.6%) profiles. However, the Anthropogenic Climate Skeptics profile showed slightly higher levels of unemployment compared to the three other profiles (37.5% unemployed). The results suggest that, in comparison to the other three climate change belief profiles, those who believe in the reality of climate change but not on its human cause are slightly more likely to be unemployed.

Parental Status. There were significant differences in the proportion of people with children and those without across the four profiles ($\chi2(3, 6489) = 33.350$, $p < .001$). As can be seen in panel d) of Figure 2, parents were overrepresented in all four profiles. People with children constituted the majority of Climate Believers (72.7%), the Undecided/Neutral profile (75.4%), the Anthropogenic Climate Skeptics (78.8%), as well as the Climate Skeptics; however, at slightly greater proportions (82.7%). As such, Climate Skeptics are more likely to have children in comparison to the other three climate change belief profiles, which contradicts

Table 1. Descriptive statistics and bivariate correlations between the relevant variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Climate Change Reality	—																					
2. Climate Change Human Cause	.536*	—																				
3. Extraversion	.018	-.005	—																			
4. Agreeableness	.096*	.031*	.210*	—																		
5. Conscientiousness	.027*	.009	.006	.149*	—																	
6. Neuroticism	.055*	.069*	-.081*	-.025*	-.117*	—																
7. Openness to Experience	.110*	.032*	.251*	.246*	.013	-.015	—															
8. Honesty-Humility	-.022	-.044*	-.096*	.152*	.095*	-.187*	.023	—														
9. Gender (0 female, 1 male)	-.091*	-.060*	-.056*	-.295*	-.116*	-.120*	.012	-.119*	—													
10. Ethnicity (1 Maj., 0 Min.)	-.126*	-.122*	.007	.081*	-.019	-.029*	.048*	.174*	-.032*	—												
11. Employment (0 no, 1 yes)	-.012	.034*	.078*	.005	-.010	-.009	.109*	-.078*	.050*	-.001	—											
12. Parent (0 no, 1 yes)	-.059*	-.046*	-.021	.002	.083*	-.093*	-.141*	.095*	.002	.014	-.133*	—										
13. Religious (0 no, 1 yes)	-.030*	-.024	-.004	.090*	.056*	-.030*	-.068*	.048*	-.055*	-.142*	-.084*	.096*	—									
14. Age	-.081*	-.105*	-.127*	-.015	.089*	-.172*	-.188*	.253*	.088*	.092*	-.359*	.431*	.191*	—								
15. Deprivation (NZDep2006)	.099*	.073*	-.023	-.060*	-.055*	.063*	-.022	-.099*	.004	-.245*	-.100*	-.008	.040*	-.049*	—							
16. Education (from -2 to 2)	.084*	.048*	.039*	.128*	.016	-.017	.219*	.091*	-.090*	.091*	.210*	-.075*	-.016	-.145*	-.189*	—						
17. Political Conservatism	-.185*	-.147*	-.129*	-.081*	.083*	-.028*	-.218*	.025	.014	.039*	-.029*	.093*	.143*	.083*	-.068*	-.090*	—					
18. Environmental Efficacy	.239*	.194*	.111*	.160*	.084*	-.060*	.135*	.061*	-.073*	-.078*	.055*	.025*	.100*	.027*	-.008	.123*	-.141*	—				
19. Openness to change values	.092*	.059*	.262*	.114*	.035*	-.043*	.250*	-.116*	.026*	-.053*	.092*	-.062*	-.044*	-.082*	-.017	.074*	-.182*	.226*	—			
20. Conservation values	.037*	.018	.020	.164*	.219*	-.090*	-.053*	.043*	-.082*	-.126*	-.087*	.199*	.217*	.191*	.042*	-.154*	.121*	.163*	.295*	—		
21. Self-Transcendence values	.194*	.165*	.032*	.271*	.108*	-.016	.069*	.094*	-.163*	-.069*	-.078*	.070*	.103*	.135*	.057*	-.047*	-.168*	.237*	.324*	.467*	—	
22. Self-Enhancement values	.021	.031*	.180*	-.026*	.095*	.010	-.029*	-.383*	.074*	-.188*	.034*	.040*	.090*	-.010	.029*	-.090*	.044*	.101*	.424*	.373*	.208*	—
M	5.38	4.79	4.04	5.24	5.07	3.44	4.76	5.04	.41	.82	.75	.75	.44	47.97	5.06	-.36	3.75	4.82	4.78	5.74	5.69	3.72
SD	1.68	1.74	1.16	.99	1.08	1.09	1.13	1.35	.49	.39	.43	.43	.50	15.76	2.85	1.30	1.23	1.36	1.33	1.0	1.22	1.39

Note. $N = 6{,}489$. *$p<.05$.

previous findings (Dupont, 2004).

Religiosity. The analyses revealed that there were no significant overall differences across the climate change belief profiles in the proportions of religious to non-religious people ($\chi 2(3, 6332) = 5.702$, $p = .127$). As can be seen in panel e) of Figure 2, comparable proportions of religious individuals were observed in the Climate Believers (43.3%), Undecided/Neutral (45%), Anthropogenic Climate Sceptics (45.2%) and Climate Sceptics (48.5%) profiles. These results seem to contradict previous findings showing that higher levels of religiosity is associated to lower levels of pro-environmental orientations (Gardner & Stern, 2002) and climate change denial (McCright & Dunlap, 2011a). Here we speculate two possible explanations for these contradictories findings that could be explored in further research. First, we used a crude measure of religious status (i.e., "Do you identify with a religion and/or spiritual group?") and more nuanced measures of religiosity as well as religious and spiritual beliefs might provide a better examination of the associations between this important variable and climate change beliefs. Second, New Zealand is one of the most secular countries in the world and the number of non-religious individuals has risen in recent years (Heather, 2013), so associations between religiosity and climate change beliefs observed in more religious countries such as the USA might not be observable in this non-religious context.

Deprivation Level. There were significant differences in deprivation across the four profiles ($\chi 2(3, 6367) = 68.842$, $p < .001$). As can be seen in Figure 3, highest levels of deprivation were observed for the Climate Believers and the Anthropogenic Climate Skeptics, with the Undecided/Neutral and Climate Skeptics profiles showing comparably higher levels of affluence. These findings suggest that belief in the reality of climate change is real is associated with lower socioeconomic status as measured by higher neighbourhood deprivation, and contradicts previous findings suggesting a positive association between income and pro-environmental orientations (Theodori & Luloff, 2002; Van Liere & Dunlap, 1980).

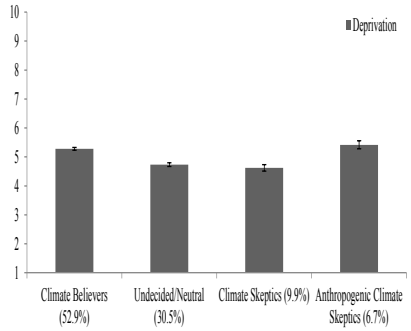

Figure 3. Mean levels of socio-economic deprivation across the four climate change belief classes

Political Orientation. Significant differences in political orientation were also observed across the four profiles ($\chi 2(3, 6068) = 222.344$, $p < .001$). As shown in Figure 4, Undecided/Neutral and Climate Skeptics showed higher average levels of self-reported political conservatism, with Climate Believers and Anthropogenic Climate Skeptics showing higher levels of self-reported political liberalism. These findings suggest that belief in the reality of climate change is associated with a more liberal political orientation, which is in line with past research (e.g., Fransson & Gärling, 1999; McCright & Dunlap, 2011b).

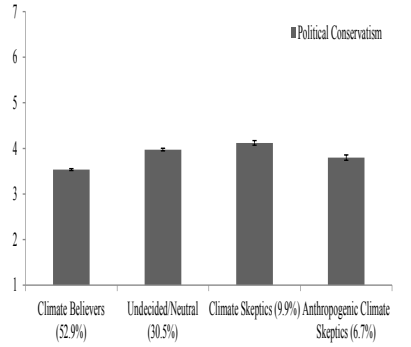

Figure 4. Mean levels of political conservatism across the four climate change belief classes

Education Level. Levels of education attainment also differed across the four profiles of climate change beliefs ($\chi 2(3, 6489) = 78.031$, $p < .001$). Figure 5 presents the levels of education for the four profiles, recalculated for presentation purposes so that 0 indicates no education (or not reported) and 4 indicates post-graduate level education (highest code in the sample). As can be seen in this figure, highest levels of education were associated with the Climate Believers, followed by the Undecided/Neutral profile. Climate Skeptics and Anthropogenic Climate Skeptics had comparably lower levels of education. This indicates that those who hold uniformly high beliefs that climate change is both real and caused by humans tend to be more educated than those form the other three climate change belief profiles.

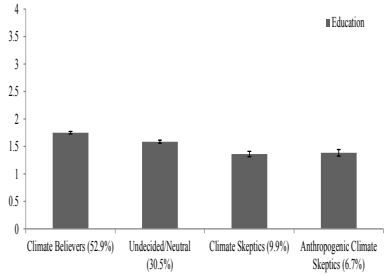

Figure 5. Education level across the four climate change belief classes (0 = no education/unreported and 4 = post-graduate education)

Environmental Efficacy. Significant differences in environmental efficacy were also observed across the four profiles ($\chi 2(3, 6473) = 432.984$, $p < .001$). As can be seen in Figure 6, Climate Skeptics had the lowest levels of self-reported environmental efficacy ($M = 4.262$, $SE = .055$), significantly lower than the levels associated with the Undecided/Neutral profile ($M = 4.513$, $SE = .031$; $p < .001$), the Anthropogenic Climate Skeptics ($M = 4.527$, $SE = .065$; $p = .002$), and the Climate Believers ($M = 5.135$, $SE = .021$; $p < .001$). Climate Believers reported the highest levels of environmental efficacy out of all the profiles ($p < .05$), while those classified as Undecided/Neutral and Anthropogenic Climate Skeptics did not differ in the levels of environmental efficacy reported ($p = .843$). These findings suggest that climate change belief is associated with higher levels of perceived environmental efficacy.

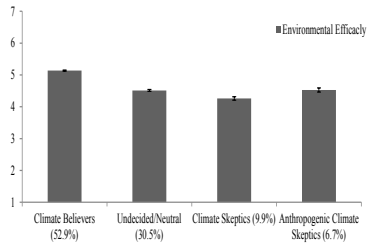

Figure 6. Mean levels of environmental efficacy across the four climate change belief classes

Anthropogenic Climate Skeptics showed higher levels of Self-Transcendence values than the Climate Skeptics ($p = .024$). These findings indicate that compared to skeptics and undecided, climate believers tend to hold greater levels of Openness to Change and Self-Transcendence values. These findings support previous results showing that greater pro-environmental orientation is associated to Self-Transcendence values (e.g., Coelho et al., 2006; Milfont et al., 2010; Schultz et al., 2005).

levels of Agreeableness compared to the other three profiles ($p < .05$). Climate Believers and Undecided/Neutral belief profiles showed comparable levels of Neuroticism ($M = 3.491$, $SE = .019$; $M = 3.461$, $SE = .025$, respectively; $p = .335$). Climate Skeptics and Anthropogenic Climate Skeptics had comparable levels of Neuroticism ($M = 3.205$, $SE = .042$; $M = 3.307$, $SE = .052$, respectively, $p = .126$), but lower levels than that shown by Climate Believers and Undecided/Neutral profiles ($p < .05$).

Psychological Differences

Values. Figure 7 presents the average levels of each of the value dimensions across the four profiles of climate change beliefs. Significant differences were observed in Openness to Change ($\chi2(3, 6444) = 67.744$, $p < .001$), Conservation ($\chi2(3, 6449) = 31.384$, $p < .001$), and Self-Transcendence values ($\chi2(3, 6448) = 314.440$, $p < .001$), with no significant differences in Self-Enhancement values across the four profiles. As can be seen in Figure 7, Climate Believers ($M = 4.906$, $SE = .022$) and Anthropogenic Climate Skeptics ($M = 4.811$, $SE = .063$) had comparable levels of Openness to Change values ($p = .158$). Similarly, Climate Skeptics and the Undecided/Neutral profile had comparable levels of Openness to Change values ($M = 4.637$, $SE = .054$; $M = 4.616$, $SE = .031$, respectively; $p = .740$), but lower levels than that shown by Climate Believers and Anthropogenic Climate Skeptics ($p < .05$).

The Undecided/Neutral profile of climate change beliefs had the lowest level of Conservation values ($M = 5.640$, $SE = .024$), significantly lower than those of Climate Believers ($M = 5.782$, $SE = .017$; $p < .001$), Climate Skeptics ($M = 5.756$, $SE = .039$; $p = .011$), and Anthropogenic Climate Skeptics ($M = 5.863$, $SE = .045$; $p < .001$); Climate Skeptics and Climate Believers did not differ in levels of Conservation values. Climate Believers showed the highest level of Self-Transcendence values ($M = 5.939$, $SE = .018$), significantly higher than shown by Undecided/Neutral ($M = 5.410$, $SE = .030$; $p < .001$), Climate Skeptics ($M = 5.330$, $SE = .055$; $p < .001$) and Anthropogenic Climate Skeptics ($M = 5.516$, $SE = .062$; $p < .001$). However,

Figure 7. Sample weighted mean levels of value dimensions across the four climate change belief classes

The association with Openness to Change values seems related to a broader orientation favouring cognitive exploration, perhaps linked to the liberal political orientation observed above and Openness traits described below.

Personality dimensions. Figure 8 shows the average levels of each of the six personality dimensions across the four profiles of climate change beliefs. Significant differences across the four profiles were observed in levels of Agreeableness ($\chi2(3, 6447) = 61.418$, $p < .001$), Neuroticism ($\chi2(3, 6445) = 45.765$, $p < .001$), Openness to Experience ($\chi2(3, 6443) = 77.399$, $p < .001$), and Honesty-Humility ($\chi2(3, 6443) = 29.545$, $p < .001$). There were no significant differences in the levels of Extraversions or Conscientiousness across the four profiles.

As can be seen in Figure 8, the Climate Skeptics showed lower levels of Agreeableness ($M = 5.073$, $SE = .040$) compared to the Climate Believers ($M = 5.331$, $SE = .017$, $p < .001$) and Anthropogenic Climate Skeptics ($M = 5.207$, $SE = .048$, $p = .033$), but comparable levels with the Undecided/Neutral profile ($M = 5.153$, $SE = .023$, $p = .085$). On the other hand, Climate Believers had the highest

Figure 8 also shows that Climate Believers and Anthropogenic Climate Skeptics had comparable levels of Openness ($M = 4.870$, $SE = .019$; $M = 4.816$, $SE = .054$, respectively; $p = .348$). Similarly, Climate Skeptics and the Undecided/Neutral profile had comparable levels of Openness ($M = 4.649$, $SE = .045$; $M = 4.605$, $SE = .025$, respectively; $p = .391$), but by comparison lower than those associated with the Climate Believers and Anthropogenic Climate Skeptics ($p < .05$). Finally, Climate Skeptics had the highest levels of Honesty-Humility ($M = 5.269$, $SE = .051$), relatively higher than those of Climate Believers ($M = 5.035$, $SE = .023$; $p < .001$), Anthropogenic Climate Skeptics ($M = 5.104$, $SE = .064$; $p = .044$), and the Undecided/Neutral profile ($M = 4.951$, $SE = .031$; $p < .001$). The Undecided/Neutral profile of climate change beliefs was associated with the lowest levels of Honesty-Humility ($p < .05$).

Climate believers tend to have greater levels of Agreeableness and Openness to Experience compared to skeptics and undecided. These findings are in line with previous research showing that Agreeableness and Openness are related to pro-

environmental orientation (e.g., Hirsh, 2010; Milfont & Sibley, 2012). At the same time, we also observed the novel

The results suggest that particular socio-structural and psychological variables underpin the observed profiles

more likely than are their counterparts to espouse skepticism in the reality of climate change and its anthropogenic

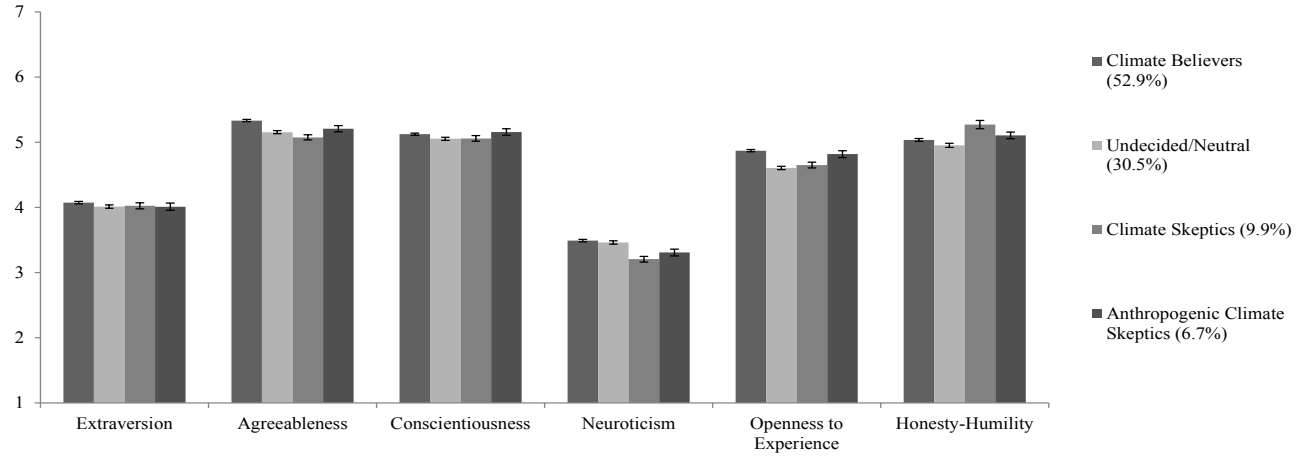

Figure 8. Sample weighted mean levels of the Big-Six personality dimensions across the four climate change belief classes

findings that climate believers and undecided tend to have greater levels of Neuroticism, while climate skeptics tend to have greater levels of Honesty-Humility.

Discussion

Climate change is regarded as one of the most serious challenges of our time. The reciprocal relations between human activity and climate change, in creating and being affected by it, means psychology can help understand and tackle this issue (e.g., Milfont, 2010; Pawlik, 1991; Swim et al., 2011). As stated in the report by the American Psychological Association: "a psychological perspective is crucial to understanding the probable effects of climate change, to reducing the human drivers of climate change, and to enabling effective social adaptation" (Swim et al., 2009, p. 165). Perhaps one first step is to provide an in-depth examination of distinct climate change beliefs and core socio-structural and psychological variables that might explain these beliefs. Beliefs about the reality of climate change and its anthropogenic cause were examined in a large national probability sample of New Zealanders, and the overarching goal of this study was to identify substantive socio-demographic and psychological differences between climate change believers and deniers.

of climate believers and skeptics reported by Sibley and Kurz (2013). Stronger beliefs in the reality of climate change and its anthropogenic cause were observed for younger individuals, female, members of minority ethnic groups, who endorse liberal political views, the more highly educated and who perceive he or she has the ability to influence environmental outcomes. Regarding the psychological variables, belief that the climate is changing and its human cause was higher among those who hold higher levels of Self-Transcendence (altruistic) and Openness to Change values, and the personality traits of Agreeableness and Openness to Experience.

Theoretical and practical implications

The socio-structural foundations of climate change beliefs are overall similar to those observed in relation to pro-environmental engagement (e.g., Fransson & Gärling, 1999; Hines et al., 1987; Milfont, 2012b; Schultz et al., 2000; Zelezny et al., 2000). In particular, our findings support and extend the "conservative white male" effect (McCright & Dunlap, 2011a) to the New Zealand context. We found that conservative white males—but also older individuals with high levels of socioeconomic status and less educated—are disproportionately

cause. This suggests that concern for environmental problems as well as concern for climate change can be characterised as a "sectarian" phenomenon (cf. Tognacci, Weigel, Wideen, & Vernon, 1972). The widespread consequences of climate change mean that overall belief and concern has to be broadened to a larger segment of the population if mitigation and adaptation are to be achieved.

It is important to highlight, however, that our results show that a large proportion of the New Zealand population hold neutral-to-high levels of beliefs in both the reality of climate change and its anthropogenic cause. Other public surveys also show that over half of the New Zealand populations support mitigation actions by the government and the public (Horizon Poll, 2012; Scoop Media, 2009). Overall these findings suggest that, although climate change believers and deniers differ in particular socio-demographic and psychological variables, there are high levels of climate change beliefs and support for action among the New Zealand population. This is particularly important because belief in climate change is intrinsically linked to pro-environmental action.

In the present study we only focused on beliefs and did not examine climate change mitigation and adaptation, but previous research has shown that

climate change beliefs are related to mitigation behaviour. In particular, research has shown that belief in the reality of climate change seems to be more strongly associated with pro-environmental engagement than belief in its human cause (Heath & Gifford, 2006; Sibley & Kurz, 2013).

Using the same data set reported in this study, Sibley and Kurz (2013) found that beliefs in the reality of climate change was a much stronger predictor of self-reports of having made sacrifices to one's standard of living, one's daily routine, and more general levels of support for government regulation of carbon emissions. Complementing these findings, they also observed that the two beliefs interacted so that belief in climate change reality was a stronger predictor of these actions when belief in anthropogenic climate change was also high. Caring for the environment and taking action is thus related to higher levels of both types of climate change beliefs but more so to the belief that the climate is changing. Other recent New Zealand research has shown that climate change mitigation and adaptation are intrinsically linked, with willingness to mitigate increasing after people have considered possible local adaptations to climate change (Evans, Milfont, & Lawrence, 2014).

It is also worth noting the observed associations with values and personality traits. As reviewed above, greater pro-environmental engagement has been shown to be associated with higher endorsement of Self-Transcendence values (e.g., Milfont et al., 2010; Schultz & Zelezny, 1999) and the personality traits of Agreeableness and Openness (Hirsh, 2010; Milfont & Sibley, 2012). Similarly, the present research showed that greater belief in climate change was associated with higher levels on these same values and personality traits. Therefore, the cognitive-motivational foundations and behavioural regularities underpinning climate change beliefs are similar to those observed in relation to pro-environmental engagement.

The associations between climate change beliefs with personal values and personality traits suggest that beliefs about the reality of climate change and its anthropogenic cause are stronger among individuals who are guided by altruistic values (i.e., equality, a world at peace, social justice), and by individuals who generally have positive social interactions and favour cooperation and social harmony (Agreeableness traits) and who generally have a wider range of interests and favour variety and intellectual curiosity (Openness values and traits). Recent cross-cultural work has also shown that "care for nature" is strongly associated to values and traits related to benevolence, self-actualization and tolerance of diversity (Donewall & Rudnev, 2014). The cognitive-motivational foundations and behavioural regularities underpinning pro-environmental engagement as well as climate change beliefs seem to centre on a selflessness orientation, inclination to act pro-socially, and openness to new and/or unconventional ideas. This is a very positive finding because tackling climate change will require consideration of novel social and technological solutions as well as recognition that climate change is certain and will affect people like oneself in our region and lifetime (Milfont, Evans, Sibley, Ries, & Cunningham, 2014).

The findings also have implications to the broad psychology literature relating values and personality. The Self-Transcendence value cluster is formed by the motivational types of universalism (understanding, appreciation and tolerance for all people and ideas) and benevolence (preservation and enhancement of the welfare of people with whom one has personal contact) (Schwartz, 1994). Research has shown that universalism is more strongly related to Openness whereas benevolence is more strongly related to Agreeableness (Roccas, Savig, Schwartz, & Knafo, 2002). That these values and traits have been found to be consistently associated to both pro-environmental engagement and climate change beliefs support research showing that environmentally friendly orientations are rooted in traits of being empathetic, tolerant, caring and concerned for others (Milfont, Richter, Sibley, Wilson, & Fischer, 2013). The available literature thus provides strong evidence for the cognitive-motivational bases of climate change beliefs and pro-environmental engagement.

Since other studies reporting segmentations related to climate change did not find systematic demographic differences among the identified profiles (Leiserowitz, Maibach, Roser-Renouf, Feinberg, & Howe, 2012; Leiserowitz, Thaker, Feinberg, & Cooper, 2013), it will be important to try and replicate the present findings in other contexts with representative samples. However, the pattern of associations between the climate change belief profiles and demographic and psychological determinants largely mirror findings of studies examining the socio-structural and psychological foundations of pro-environmental engagement. In other words, research findings suggest that climate change beliefs are thus related to overall pro-environmental orientation, and that both have similar associations to socio-demographic and psychological variables. Research findings thus suggest that climate change beliefs are related to overall pro-environmental orientation, and that both have similar associations to socio-demographic and psychological variables. In other words, climate change beliefs and overall pro-environmental orientation share the same nomological network (i.e., same interrelationships among and between them with other variables).

Future studies could also explore the extent to which climate change beliefs have motivational potency and behavioural significance to influence mitigation and adaptation actions. Such research could focus on those individuals who already have stronger beliefs regarding the reality of climate change and its human cause and would perhaps be more prone to act, but could also target skeptics. Recent research has shown that willingness to act can be fostered among individuals who might not be initially prone to act by using particular ideological or moral messages (Bain, Hornsey, Bongiorno, & Jeffries, 2012; Feinberg & Willer, 2013; Feygina, Jost, & Goldsmith, 2010). We believe these are very interesting avenues for future work.

Concluding Remarks

The present study identified socio-structural and psychological characteristics of climate change belief profiles. By and large, the ideologies underpinning climate change beliefs

are similar to those for general pro-environmental engagement, and seem to be linked with specific traits and moral foundations (Boer & Fischer, 2013; Feinberg & Willer, 2013; Milfont et al., 2013). Our findings show meaningful demographic and cognitive-motivational differences that characterise people who believe (or not) that the climate is changing and that such change is caused by human activity, suggesting a coherent ideological belief system for climate change believers and skeptics. This study contributes to the understanding of the ideological roots of climate change beliefs.

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Mplus syntax for the models reported here, including full syntax documenting the model constraint commands implemented in our analysis, is available on the NZAVS website (http://www.psych.auckland.ac.nz/uoa/NZAVS).

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None declared.