The Role of Scientific Worldview in Predicting Climate Change Concern and Mitigation Behaviour

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Abstract: *The purpose of this study was to explore the role of a scientific worldview scale in predicting climate change concern and mitigation behaviour. In a sample of 515 Mandarin speaking Chinese nationals, we first assessed the internal consistency the scientific worldview scale, then explored its association with climate change risk perception and climate change mitigation behavior. The regression analyses revealed the scale explained 2% of the variance in climate change concern, 2 %for expected negative climate change outcomes, 11% for support for climate friendly policy support, but only 3% for climate change mitigation behaviour.*

Keywords: *Scientific worldview, Climate Change Concern, Policy Support, Climate Change mitigation Behaviour*

1. Introduction

Scientific worldviews, which can be characterized as the systematization of knowledge in scientific theories (Tsvtekov, 2014), were proved play an essential role in the risk perception research (Knight, 2007; Knight & Warland, 2005). Knight and Warland (2005) concluded that people's scientific worldview is correlated to their concerns about pesticide residues on vegetables and fruits. It was hypothesized that people who trust science perceived less environmental risks (Biel & Nilsson, 2005), while general technological optimists would show greater encouragement for any technology application (Knight, 2007). Research conducted in environmental psychology and behaviours showed that the worldview is one of the most important predictor in people's environmental risk perception and pro-environmental behavior (Xue, Marks, Hine, Phillips & Zhao, 2016). However, to date, most of the research focused only on environmental worldview and cultural worldview, only a few explored the role of scientific worldview in general environmental risk perception (Biel & Nilsson, 2005) and none in pro-environmental behaviour. Although some research has employed the scientific worldview in risk research models, none of them was administrated in major Asian countries such as a China but all in Western developed countries (e.g., Knight, 2007; Biel & Nilsson, 2005). The use of such kind of scales has been limited. Moreover, of these studies, none has investigated the relation between scientific/technological worldview and climate change concern/ mitigation behaviour.

China currently has the largest population in the world and is characterised by high-speed industrial growth, which has made it one of the largest emitters of carbon dioxide in the world (Copsey et al., 2013; Piao et al., 2010), although it is worth noting that other countries such as the United States and Australia emit substantially more on a per capita basis(Ma, Ren, & Zhao, 2013). Given China's large population and central role in the global economy, it is particularly important to identify factors that encourage pro-environmental behaviours amongst Chinese citizens. One important obstacle to this goal is the lack of validated" Chinese language" measures that assess the motivational drivers of pro- and anti-environmental behaviour in the Chinese population(Chen, Xie, & Huang, 2014).

1.1 Current study

The primary purpose of the current study was to address these gaps by: (1) developing a Chinese translation of scientific worldview scale and administering it to a large urban Chinese sample, (2) assessing its reliability and evaluating its association with respondents' general concern about climate change, expectancies about negative climate change outcomes, support for climate friendly policies, and climate change mitigation

behaviour. In pursuing these objectives, we hoped to provide a solid foundation for future research on scientific worldviews involving Chinese samples.

2. Methods

2.1 Participants

The sample consisted of 515 Mandarin speakers residing in Beijing China. Respondents were members of a Qualtrics online panel, and were aged from 18 to 75 years (M=37.47, SD=14.38). Under half of the respondents were female (48%). For the education level, 20% of participants completed high school education (Year 12) and 66% had at least college education. Comparison with Chinese Census data (2011) indicated that our sample was younger and more highly educated than the Chinese population.

2.2 Procedure

Translation and back translation. We followed the 4-step back translation procedures recommended by Harkness and Schoua-Glusberg (1998). The survey was initially translated into Chinese (Mandarin) by the first author, and then back-translated into English by the second author.The back translation version was compared with the original version. Correspondence between the two versions was very high, (< 5% discrepancy). Differences were discussed by the two translators and revised through consensus. Prior to being administered in China, the survey was pilot tested by 16 native Mandarin speakers residing in Australia. The pilot test resulted in minor re-wording of several items to increase clarity.

Survey administration. Respondents were recruited from a Qualtrics online panel in June and July 2013. To be eligible, they had to be over the age of 18 years, Mandarin speakers, and residing in Beijing. All respondents read an information sheet describing the study prior to providing informed consent to participate. Responses were anonymous.

2.3 Measures

Scientific Worldview. The scientific worldview scale consists of 3 items assessing people's worldviews towards science and technology (Knight, 2007). The scale consists of both positively and negatively worded items, with all assessed on a 5-point Likert scale (1 = *strong disagree*, 5 = *strongly agree*). The Chinese translations of scientific worldview items are presented in Appendix A. The Cronbach's α for this scale was .75.

Validation measures. Four validation measures were used in the study.

Climate change concern was assessed using six items assessing respondents' threat perceptions about climate change, using a climate change risk perception index developed by Leiserowitz (2003). Representative items include: *How concerned are you about global warming? How serious a threat is global warming to the world today?* All items were assessed on a 4-point scale ranging from 1 (*low concern*) to 4 (*very high concern*). Scale scores were created by computing the mean across items. Cronbach's α was .88, indicating a high level of internal consistency.

Negative climate change expectancies were assessed using three items focusing on perceived likelihood of negative climate change outcomes: *Global food shortages and starvation will occur. Globally, many people's standard of living will decrease. Global rates of serious disease will increase.* All items were assessed on a 5-point scale (1 = *very unlikely*, 5 = *very likely*). A total score was computed by the computing the mean of the individual items (Cronbach's α =.80).

Support for climate friendly government policies was measured using five items, adapted for the Chinese context, based on a policy support index developed by Carlisle and Smith(2005):*"Gasoline taxes should be increased in China to get people to drive their cars less than they do now; Fuel, carbon, and gasoline should be replaced by green energy sources, such as solar power, wind, and hydroelectric power.*All items were assessed

on a 4-point scale (1 = *strongly disagree*, 4 = *strongly agree*), with scale scores computed as the mean. Cronbach's α *was* .72.

Climate change mitigation behaviours were assessed using a 20-item carbon footprint scale developed by Reser, Bradley, Glendon, Ellul and Callagan (2012). Respondents indicated how often (1 = *never*, 4 = *most of the time*) they engaged in a range of behaviours associated with reduced carbon emissions (e.g., *Use compact florescent light bulbs, reduce air travel, purchase energy efficient appliances, etc).* Cronbach's α *was* .89.

Demographics. Respondents' gender, age and education levels were all assessed using single items.

3. Results

Data analysis proceeded in two stages. The first stage evaluated the factor structure of the climate change mitigation behaviour scale. The second stage involved assessing the validity of the measure through a series of correlational and multiple regression analyses.

3.1 Exploratory Factor Analysis

We firstly conducted an exploratory factor analysis for the mitigation behaviour scale, by using principal axis factor analysis strategy. Kaiser's (1960) eigenvalues-greater-than-one rule indicated that 4 factors should be retained, whereas the Scree plot clearly suggested a 2-factor scale. Solutions of between 2 and 4 factors were then subjected to direct oblimin rotation (Δ = 0) and assessed for interpretability. The most parsimonious solution was one of 2-factors, which explained 37.06% of the variance in the scale items.

TABLE I: Exploratory Factor Analysis of the Climate Change Mitigation Behaviour Scale

Item Number	Item	Factor 1 α = .85	Factor 2 α = .82
2	Use compact florescent light bulbs	.78	
3	Use less water	.76	
12	Recycle	.75	
1	carbon footprint: Use less electricity	.73	
11	Use trains/buses/subways/other public transport/mass transit	.65	
17	Buy energy efficient appliances	.62	
18	Keep your air-conditioning at 26°C in the summer or use a fan instead	.61	
16	Buy recycled or FSC paper products	.59	
9	Walk/bicycle/scooter	.55	
8	Carpool	.53	.45
7	Buy/use smaller/more fuel efficient car		.76
4	Buy energy from renewable sources/hydro/wind/solar power		.69
20	Eat less meat		.62
10	Reduce travel/vacation travel		.61
19	Insulate your house		.60
6	Use less petrol		.59
15	Reduce air travel		.54
14	Buy carbon offsets	.52	.52
5	Drive less		.52
13	Buy local food/organic food/growing own food		.50

Note. Subscale scores were computed by taking the mean of the items loading above .45 on each factor.

Nine high loading items on Factor 1 reflected those actions of people's daily curtailment, and they are easy to apply. Nine high loading items on Factor 2 reflected advanced mitigation behaviours, in which new technology should be accessible (e.g., buy renewable energy); or it is more difficult to engage in those behaviours than daily curtailment (e.g., insulate your house). Details of items and their factor loadings are shown in Table 1. Subscale scores were computed by taking the mean of all items that loaded .45 or above on each factor.

3.2 Regression Analyses

Four regression analyses were conducted to assess the associations of the Chinese scientific worldview scale and climate change variables. For each analysis, respondents' scores on the scientific worldview served as predictor. Climate change concern, climate change negative expected outcomes, support for climate friendly government policies, and climate change mitigation behaviour subscales were dependent variables. Descriptive statistics for all predictors and dependent variables are provided in Table 2, and the results of the regression analyses are presented in Table 3.

The regression analyses indicated that higher scores on the scientific worldview scale predicted higher level of climate change concern, greater expected negative outcomes associated with climate change, greater support for climate friendly government policies and higher self-reported engagement in climate change mitigation behaviours linked to daily curtailment. However, higher scores on the scientific worldview scale did not explain a significant amount of unique variance in the advanced climate change mitigation behaviour.

TABLE II: Descriptive statistics for Scientific Worldview Scale and Validation Measures

	M	*SD*	*Observed Min/Max*	*Theoretical Min/Max*
Scientific Worldview	3.95	.61	1.00 to 5.00	1.00 to 5.00
Climate change concern	3.32	.47	1.00 to 4.00	1.00 to 4.00
Climate change negative expected outcomes	3.16	.57	1.00 to 4.00	1.00 to 4.00
Support for climate friendly policies	3.13	.54	1.20 to 4.00	1.00 to 4.00
Climate change mitigation behaviour 1	3.43	.44	1.30 to 4.00	1.00 to 4.00
Climate change mitigation behaviour 2	3.07	.53	1.20 to 4.00	1.00 to 4.00

TABLE III: Scientific Worldview Scale Predicting Climate Change Concern and Mitigation Behaviours

Model	R^2	*Adj* R^2	β	*B*	*r*	sr^2
Climate change concern	.02**	.02	.13**	.17	.13**	.02
Climate change negative expected outcome	.02**	.02	.13**	.14	.13**	.02
Climate change mitigation behaviour 1	.03**	.03	.14**	.19	.14**	.02
Climate change mitigation behaviour 2	.002	.001	.05	.06	.05	.003
Policy support	.11***	.11	.26***	.23	.23***	.05

****p<.001, **p< .01, *p< .05*

4. Discussion

The aim of current study was to develop a Chinese scientific worldview scale, and assess its reliability and validity in a large urban Chinese sample. The reported Cronbach's α suggested a good internal consistency

(α> .70). The worldview scale explained a significant amount of variance in climate change concern, climate change negative expected outcomes and support for climate friendly policies. However, only the applicable mitigation behaviour was shown a significant variance predicted by the scientific worldview.

4.1 Scientific Worldviews and Climate Change Concern or Mitigation Behaviour

This is the first study to investigate the scientific worldview scale in Chinese language using a large urban sample. We conducted a set of regression analyses predicting respondents' concerns and negative expectancies about climate change, policy preferences, and climate change mitigation behaviours. Higher scores on respondents' scientific worldview were significantly associated with increased concern, more negative expectancies, greater support for climate-friendly policies, and higher levels of daily curtailment. Effect size was substantially larger for the policy support variable (11 % variance explained) than for the climate change belief and for the daily curtailment (only 2% each). This result shows that holding positive scientific worldview is consistent with one's climate change policy support, that is, those who believe "*science and technology provide the human race with its best hope for the future"* are more likely to support eco-friendly public policy (e.g., "*using energy efficiently"*) to reduce the climate change risk.

Interestingly, the correlation between advanced mitigation behaviours and scientific worldview was not significant (r = .05). This reflects a well-established "gap" between beliefs and behavior. It is much easier to hold policy preferences that are consistent with one's worldviews than to overcome the obstacles that challenge our abilities to transform those beliefs into action (Xue, Hine, Marks, Phillips, & Zhao, 2015). Future research should explore such "gap" in the Chinese population, and how the result compared with other cultures/ societies. It would also be interesting to investigate the differences across different countries and cultures.

4.2 Limitations

Several limitations should be kept in mind when assessing the results of this study. First, although the study employed a large, diverse urban sample, the sample was not representative of the Chinese population. Younger and more educated respondents were overrepresented in our sample, and no attempt was made to survey respondents living in rural areas. Further research is needed to determine if our results generalise beyond our sample, particularly given that there is evidence to suggest that education level is positively correlated with environmental concern (e.g.,Tranter, 1997, 2011). Second, our regression analyses imply that scientific worldview is not the most important driver of concern and behaviours related to climate change. This suggested that further experimental work is required to determine the whether other worldview dimensions, such as social/cultural worldviews, are related to climate change concern and mitigation behaviours.

4.3 Conclusion

To date, little research has been conducted on scientific worldviews in Chinese samples associated with climate change concern. In this study, we developed and evaluated a new Chinese translation of the scientific worldview, which predicted a broad range of responses to climate change. It is hoped that the measure will provide the foundation for future climate change research in a country with the world's largest population and one of the fastest emerging economies. Understanding how these worldviews evolve over time and guide policy development, household decision-making, and pro-environmental behaviour will be essential for encouraging shifts towards sustainability.

5. References

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Appendix A. *Chinese Translation of the Scientific Worldview*

1. 科学技术迅速的提高了我们的生活水平。
2. 科学技术为人类的将来提供了最好的希望。
3. 只有采用先进的科学技术我们的经济才能更具竞争力。