

Climate Change Knowledge and Political Identity in Australia

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Abstract

National data from the 2018 Australian Survey of Social Attitudes show that knowledge of climate change is positively associated with the scientific consensus position on anthropogenic climate change. Responses to factual quiz questions that include climate trigger terms such as “greenhouse gas” or reference to increased ocean temperature and acidification are influenced by one’s political party identification, with Liberal and National party identifiers tending to score lower than Labor partisans on climate knowledge scales. Yet, responses to climate-related factual questions sans trigger terms are not influenced by political partisanship. Climate skeptics tend to score lower on climate knowledge scales than those who accept anthropogenic climate change, although skeptics also tend to have inflated confidence in their factual knowledge of climate change.

Keywords

climate change, climate change skeptics, political divide, Australia, climate change knowledge

Introduction

Several studies have estimated that between 90% and 100% of climate scientists agree that anthropogenic climate change (ACC) is occurring (Anderegg et al., 2010; Cook et al., 2013; Doran & Zimmerman, 2009; Oreskes, 2004; Powell, 2015), while a recent survey administered by Cook et al. (2016) found 97% of peer-reviewed climate scientists agree global warming has mainly anthropogenic causes. Knowledge of the science underpinning global warming is also associated positively with the acceptance of ACC. If citizens accept the scientific consensus on ACC, they are more likely to support action on climate-related issues (Hamilton, 2015; Tranter, 2019). However, the “information-deficit model” of science communication (Suldozsky, 2017) suggests that publics do not “possess a clear understanding of climate science” (Brulle et al., 2012, pp. 174–175), and therefore “educating” the public remains a critical role for science communicators. As Hamilton and Fogg (2019, p. 10) suggest (citing Cook et al., 2016; Farrell et al., 2019; van der Linden et al., 2017), “[E]xperimental studies that find opinions changing after provision of information give support to this view.”

In a survey-based study, Besley and Nisbet (2013, pp. 647–655) found that scientists tend to view “education deficit” as a major barrier to the understanding of science among publics. Yet, scientists and science communicators are not always effective in engaging with the public (Besley & Nisbet, 2013; Besley & Tanner, 2011). This can impact

negatively on scientists’ ability to “persuade the lay public of the correctness of scientific conclusions” (Lewandowsky et al., 2015, p. 9). Failure to communicate effectively may also undermine the voice of scientists in contributing to sound government policy (Leith et al., 2017), as “fake news” can undermine evidence-based arguments. Of course, the “informational deficit” model is not without its critics. For example, Hornsey and Fielding (2017, p. 459) maintain “increasingly, theorists understand there are limits to this approach, and that if people are motivated to reject science, then repeating evidence will have little impact.” Furthermore, Ehret et al. (2017, p. 272) suggest information-deficit models may need to be combined with “ideological consistency” models because “[W]ithout changing the messaging from political elites, simply communicating more about scientific findings will have little effect on partisans.” Nevertheless, addressing the public knowledge deficit remains a dominant goal for science communicators (Peters & Dunwoody, 2016).

Australians exhibit some of the highest levels of climate skepticism among advanced industrialized countries, similar to those found among citizens of the United States (Tranter

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& Booth, 2015). National surveys show that approximately two-thirds of Australians agree climate change has anthropogenic causes (Tranter, 2019), yet deep political divisions are extant over the causes of climate change (Tranter, 2011, 2013). A considerable proportion (approximately 30%) of Australians believe that while climate change is occurring, it is due to natural phenomenon. In the United States, Democrats and Republicans are divided over the veracity of human-caused climate change as are their supporters (e.g., Hamilton, 2016; Hamilton et al., 2015; Jacques et al., 2008; McCright & Dunlap, 2011a, 2011b; Wood & Vedlitz, 2007). Similarly, supporters of the Liberal and National parties are less likely than those who identify with the Australian Greens or the Australian Labor Party to accept the scientific consensus on ACC (Fielding et al., 2012; Tranter, 2013) and are less likely to accept policies designed to address climate change.

In the United States, political divisions over the acceptance of ACC are moderated by education level and knowledge of climate change (e.g., Ehret et al., 2017; Hamilton et al., 2015) although such associations also vary according to political affiliations. For example, Hamilton et al. (2015), found “[A]cceptance of anthropogenic climate change rises with education among Democrats and Independents, but not among Republicans.” Political conservatives in the United States tend to be *less* likely to accept that ACC is occurring as their education and knowledge of climate change increase, while political liberals become more accepting (Hamilton et al., 2015).

Similarly, Lewandowsky and Oberauer (2016, p. 217) have shown that “general education and scientific literacy do not mitigate rejection of science, but, rather, increase the polarisation of opinions along partisan lines.” A study by Kahan (2015, p. 27) also found that for Democrat party identifiers with progressive positions on climate change, higher levels of “ordinary climate science” knowledge was associated with acceptance of global warming as mainly caused by the burning of fossil fuels, but greater knowledge of science was associated with higher levels of *skepticism* among conservative Republicans. In recent research, Smith and Mayer (2019) found the moderating influence of education upon climate change attitudes to be stronger in Anglophone countries than elsewhere. However, although education is positively associated with public knowledge of climate in Australia, Tranter (2019) found that the relationship between climate knowledge and climate attitudes also varies according to gender and political partisanship.

One reason posited for the moderating role of political partisanship on the acceptance of ACC is that knowledge questions that refer to “climate change” and “global warming” trigger terms that elicit partisan-aligned responses. For example, in a survey-based U.S. study, Hamilton (2015, p. 89) found “responses to climate linked factual questions, such as whether Arctic sea ice area has declined compared with 30 years ago, are politicized as if we were asking for climate change opinions.” Hamilton (2015, p. 100) maintains

that factual questions that do not refer directly to “climate change” or associated trigger terms but do measure knowledge of processes that *influence* climate change and tend to avoid politicized responses. Such questions refer to *scientific facts* “such as whether the North Pole is on land or sea ice.” For example, Hamilton (2015, p. 100) argues that “awareness of geography or the sea/land ice distinction, unlike other basic facts such as ice decline, appears unrelated to respondents” politics or climate change beliefs.

Yet, in the most recent work of both Hamilton and Fogg (2019) in the United States and Tranter (2019) in Australia, even responses to these polar knowledge questions appear to be politicized. Hamilton and Fogg (2019) found a significant interaction between polar knowledge and republican party identification on acceptance of ACC. That is, Republicans’ acceptance of ACC did not increase at higher levels of polar knowledge, while for Democrats, higher polar knowledge was associated with greater acceptance of ACC. In a partial replication of Hamilton’s U.S. research, Tranter (2019) found a similar association between *climate-related* polar knowledge and acceptance of ACC in Australia. He found that

Greens, Labor Party identifiers and politically un-affiliated Australians align more closely with the scientific consensus on climate change as their climate knowledge increases. However, climate knowledge has no effect on the climate change attitudes of Liberal and National party identifiers. (Tranter, 2019, p. 12)

It is important to note that in these studies, acceptance of ACC among conservative partisans was significantly influenced by *indirect* or *climate-related* knowledge, which according to Hamilton (2015) should not be politically divisive. However, the findings of both Hamilton and Fogg (2019) and Tranter (2019) seem to suggest that measures of climate-related knowledge that were designed to be apolitical may also now be politicized. The influence of partisanship on polar knowledge is examined in this research using new national data from the Australian Survey of Social Attitudes to establish whether Tranter’s (2019) Australian findings can be replicated. This case also extends previous Australian research on climate change by examining *direct* measures of climate change knowledge, that is, knowledge questions that contain potentially politicizing trigger terms. This research focuses on three research questions:

Research Question 1: To what extent is *climate-related* knowledge and *direct knowledge* of climate change mediated by political party identification in Australia?

Research Question 2: How is climate change knowledge associated with acceptance of ACC?

Research Question 3: To what extent are Australians *overconfident* of their knowledge of climate change, and how does this vary according to beliefs regarding ACC?

Table 1. Polar Knowledge and Raising Sea Levels (%).

Question	All	Coalition	Labor	Greens	None
Which of these best describes the North Pole?					
Ice a few meters thick floating over a deep ocean	49	47	51	58	48
Ice more than a kilometer thick over land	26	28	26	26	25
A mainly rocky, mountainous landscape	2	3	2	3	3
Don't know	23	22	20	14	24
<i>n</i>	(1,265)	(311)	(222)	(74)	(582)
Which of these best describes the South Pole?					
Ice a few meters thick floating over a deep ocean	15	16	17	9	15
Ice more than a kilometer thick over land	56	57	55	70	54
A mainly rocky, mountainous landscape	7	6	8	7	7
Don't know	22	21	20	14	23
<i>n</i>	(1,265)	(311)	(222)	(74)	(582)
Which of the following changes to the world, would, if it happened, do the most to raise sea levels?					
Melting of land ice in Greenland and the Antarctic	45	43	49	62	43
Melting of Glaciers in the Himalayas and Alaska	3	1	5	3	2
Melting of Sea ice on the Arctic Ocean	16	14	16	15	18
Don't know	35	41	30	20	36
<i>n</i>	(1,260)	(309)	(223)	(74)	(578)

Source. Australian Survey of Social Attitudes (Evans et al., 2018). Correct Responses in bold font.

Data and Method

Data from the 2018 Australian Survey of Social Attitudes (AuSSA) are analyzed. The AuSSA is a national survey first administered in 2003, with participants selected at random from the Australian Electoral Roll to be representative of the Australian adult population (Evans et al., 2018). The sample of 5,000 people were selected, and the questionnaire was administered in four waves by mail (i.e., 1,250 surveys in each wave). The response rate for the 2018 AuSSA was 26% ($n = 1,287$). The author commissioned climate change questions for the AuSSA, replicating some of Hamilton's (2015) questions on climate change attitudes and climate-related facts.

Two scale-dependent variables measure respondent knowledge of climate change. Each is constructed by summing correct answers to a set of quiz questions. As Hamilton (2015) points out, some questions designed to measure knowledge of climate change are politically divisive. Terms such as "climate change" or "global warming" or "greenhouse" tend to elicit responses influenced by partisan identity, rather than measuring knowledge of these phenomenon in an unbiased manner (Hamilton, 2015, p. 100). I examine the extent that knowledge of climate-related facts is associated with political identifications in Australia using a scale replicating three of Hamilton's (2015) polar knowledge questions (after minor changes to the original items to account for the metric measurement system in Australia). Responses to the polar items are presented in Table 1. The polar knowledge questions are not a comprehensive measure of climate change knowledge although the scale "provides a limited but analytically useful marker for knowledge" (Hamilton, 2015, p. 100).

Three questions were also included in the 2018 AuSSA to model direct knowledge of climate change. These questions

refer to the hole in the ozone layer, to greenhouse gas emissions, and to ocean acidity (see Table 2). These issues were expected to elicit higher levels of politicized responses. The first two questions ("ozone" and "greenhouse") are replicated from a CSIRO report published in 2011 (Ashworth et al., 2011). The third question ("oceans") was developed by the author. Each of these three questions refers to phenomena that are expected to elicit responses influenced based on political identification. They measure phenomenon that respondents may identify as related to climate change (ozone hole, greenhouse gas, warming, and more acidic oceans), with the aim of gauging the extent that climate change knowledge is politicized in Australia.

Self-assessed knowledge of climate change is also measured as a dependent variable using the question "How much do you feel that you understand about climate change—would you say a great deal, a moderate amount, only a little, or nothing at all?" (scored 1 = *nothing at all* to 4 = *a great deal*).

Beliefs regarding the causes climate change are also examined as dummy independent variables. These variables measure attitudes toward ACC based upon a question that has appeared in several AuSSA: "Which of the following statements do you personally believe" with the response categories:

- *climate change is happening now and mainly caused by humans* (reference scored 0)
- *climate change is happening now but has mainly natural causes* (scored 1 or 0)
- *climate change is not happening now* (scored 1 or 0)
- *don't know* (scored 1 or 0)

Comparing responses on the self-assessed knowledge variable to those on the polar and climate knowledge scales enables

Table 2. Please Tell Us Whether You Think the Following Statements Are True or False (%).

Question	All	Coalition	Labor	Greens	None
The hole in the ozone layer contributes to climate change					
True	60	54	66	68	62
False	15	19	13	23	12
Don't know	25	27	20	9	26
<i>n</i>	(1,251)	(304)	(225)	(74)	(578)
Per person, Australians produce more greenhouse gas emissions per head than most other people in the world					
True	31	27	36	58	27
False	33	43	27	22	32
Don't know	36	30	37	20	41
<i>n</i>	(1,240)	(299)	(221)	(74)	(576)
Oceans around Australia have become warmer and more acidic due to climate change					
True	55	42	66	88	55
False	10	21	5	—	7
Don't know	35	37	29	12	38
<i>n</i>	(1,238)	(301)	(221)	(74)	(570)

Source. Australian Survey of Social Attitudes (Evans et al., 2018). Correct Responses in bold font.

comparisons to be made of how much Australians *believe* they understand about climate change to how much they actually *know*. Once again, similar to Hamilton (2015, p. 93), I operationalize a fourth dependent variable by combining responses to the polar and self-assessed climate change knowledge. Those who score 0 or 1 on the polar knowledge scale (that ranges 0-3), and claim to have a great deal or moderate amount of understanding of climate change, are deemed *overconfident* (scored 1). All remaining responses are scored 0. A fifth dependent variable measures overconfidence in a similar manner based upon the climate change knowledge scale (also ranging 0-3) and self-assessed climate change knowledge scale (similarly scored 1/0). Again, those who score 0 or 1 on the climate knowledge scale (that ranges 0-3), and claim to have a great deal or moderate amount of understanding of climate change, are deemed *overconfident* (scored 1), with remaining responses scored 0.

A range of social background variables that are known correlates of acceptance of ACC and environmental knowledge questions are included in regression models as controls. These include respondent sex, age, education level, location, income, and (non-) religious affiliation (e.g., Hamilton, 2016; Hayes, 2001; McCright, 2010; Tranter, 2011, 2019; Zelezny et al., 2000). Descriptive statistics are shown in Appendix Table A1.

Binary and ordinal logistic regression analyses are performed using STATA version 16. Binary regression is used to examine the individual items that comprise the polar and climate knowledge scales (see Appendices III and IV), while ordinal logistic regression is employed to examine the two climate knowledge scales and self-assessed climate knowledge.

Climate Change Knowledge

Table 1 presents responses to the three “polar” questions, where the results are not expected to vary substantially by political party identification (correct answers signified by bold

text), while Table 2 shows the three climate change knowledge items. Australian respondents appear to have less difficulty answering questions about the South Pole compared to the North Pole or rising sea levels, with 56% correctly answering that the South Pole consists of a thick layer of ice over land. Slightly fewer (49%) knew that the North Pole consists of a much thinner layer of ice floating on the ocean, while 45% correctly responded that melting land ice from Greenland and the Antarctic would have the greatest impact upon rising sea levels.

Political partisanship had only minimal impact on responses to these questions as expected. While Greens are more likely to answer correctly, there is little difference between major party identifiers for either the North and South Pole questions or between the major parties compared to nonpartisans on these questions. The exception for the polar questions is that Labor identifiers are slightly more likely than Coalition identifiers and nonpartisans to correctly answer the sea-level question. These AuSSA results are generally in line with Hamilton's (2015) findings, as, like the United States, polar knowledge responses are not influenced substantially by partisanship in Australia.

Turning to the three climate change knowledge questions in Table 2, it is clear Australians have less difficulty in answering the “oceans” question correctly (55%) compared to the “greenhouse” (31%) or “ozone” (15%) questions. Greens are more likely than Labor, Coalition, or non-partisans to answer the climate change knowledge questions correctly, although this is perhaps not surprising, given the strong focus of the Australian Greens' on climate change issues. Are Australians divided along political lines on these direct measures of climate change knowledge as Americans are (Hamilton, 2015)? Green identifiers score consistently higher than other Australians on direct knowledge questions, but as political power rests primarily with the major parties, I concentrate mainly upon differences between Coalition and Labor partisans.

Both the “greenhouse” and “oceans” items show evidence of partisan influences, with Coalition identifiers far less likely than Labor identifiers to select correct responses to either question. In all, 36% of Labor identifiers selected the correct answer to the “greenhouse” question, compared to 27% of Coalition identifiers. The difference is even greater for the “oceans” item, with 66% of Labor identifiers answering correctly, compared to 42% of Coalition partisans. However, an interesting exception is apparent for the “ozone” item. “Ozone” is clearly the most difficult question, as only 15% of the whole sample correctly answered this question by stating the hole in the ozone layer *does not* contribute to climate change (Ashworth et al., 2011). Yet when responses are broken down by party identification, Coalition identifiers (19%) are slightly *more likely* than Labor identifiers (13%) to answer correctly. The fact that 68% of Greens answered *incorrectly* (the largest incorrect response) indicates that while Greens have the highest levels of polar knowledge, many got the ozone question very wrong. A possible explanation is that some respondents confuse “ozone hole” with the greenhouse effect and consequently believe that the ozone hole does contribute to climate change.

Political influences are apparent in responses to the “ozone” question, with this topic also appearing to confound respondents. Previous research (Tranter, 2017, 2019) and analyses of the 2018 AuSSA data (not shown here) indicate that Coalition identifiers are far more likely than Labor partisans to believe climate change is a natural phenomenon or to reject climate change altogether. While speculative, it is conceivable that many Coalition supporters answered the “ozone” question correctly because they mistakenly believed that the response was consistent with *rejecting* ACC (i.e., climate skeptics believe that those who accept ACC would answer that ozone *does* impact climate change, so they answered that the ozone hole *does not* cause climate change). Consistent with their political allegiances and worldviews, many Coalition supporters therefore selected the “false” (i.e., correct) response on “ozone.” In other words, worldview and party influence led many respondents to answer the ozone question *correctly*.

There is some evidence for this reasoning, as 59% of those who reject ACC and 20% who believe climate change is “natural” answered correctly, compared to only 12% of those who accept that climate change has anthropogenic causes (see Appendix B). Given the low percentage of correct responses overall (15%) on the ozone question, it appears that only a small proportion of respondents actually knew the correct answer, answering correctly regardless of their perceived party position on climate change or their own climate change beliefs (also see Appendix C).

Logistic Regression Results

Although the bivariate results in Tables 1 and 2 illustrate differences between partisans on knowledge questions, a more rigorous assessment is provided by analyzing knowledge scales as dependent variables, using ordinal logistic regression

analysis. Odds ratios (ORs) are presented in Table 3 to reflect the associations between social background control variables and political party identification dummy variables. Odds >1 indicate positive associations between predictor and dependent variables, while odds <1 indicate negative associations.

A range of social background variables are included in the models, as several of these have previously been found to be associated with climate-related knowledge. Similar to previous studies by Hamilton (2015, p. 98), men tend to score higher than women on all three knowledge-dependent variables. There are also positive associations between higher education and climate knowledge, particularly among those with a tertiary degree. For example, the odds of men answering the polar scale correctly are 70% larger than they are for women (Model 2; OR 1.7).

Yet of primary interest here are the estimates for political party identification and the climate change dummy variables. First, Greens identifiers tend to score higher than Coalition identifiers (reference category), otherwise political party identification dummy variables have no significant association at the 95% level for the polar knowledge scale. However, the effects of party identification are stronger for the climate knowledge scale. Labor identifiers score higher than Coalition partisans on climate change knowledge and on self-assessed climate knowledge (Models 3 and 5).

To test whether the association between political partisanship and climate change knowledge is associated with attitudes on ACC, three dummy variables measure those who believe climate change is “natural,” those who disagree climate change is occurring at all (i.e., climate change skeptics), and those who “don’t know” in Models 2, 4, and 6. Those who do not know whether climate change is happening or not were far less likely than those who accept ACC (the reference category), to answer correctly on each of the 3 knowledge scales. Controlling for social background, those who agree that climate change is happening but has “natural” causes score lower than the reference group (i.e., accepting ACC).

For all party identification variables, when beliefs about climate change are controlled, the magnitude of the associations with climate knowledge decreases, and results for Labor partisans become nonsignificant although Greens (Model 4; OR 2.6) score significantly higher than Coalition identifiers on the climate knowledge scale. The results also show that climate change deniers are more likely than those who accept ACC to answer the ozone question correctly but less likely to answer the oceans question correctly (Appendix D). A similar pattern of responses is apparent for those who believe climate change is a natural phenomenon. Yet climate change deniers are *more* likely than those who accept ACC to self-rate their climate knowledge highly. These findings provide evidence of the partisan divide over climate knowledge in Australia. Importantly, differences between major party supporters on climate knowledge evaporate when acceptance of ACC is controlled in these models. Kahan (2015, p. 10) suggests ideology, party identification, and climate beliefs appear to be measuring the “latent (unobserved) disposition that causes different groups of people to adopt coherent sets of opposing stances on

Table 3. Ordered Logit Regression of Polar and Climate Knowledge Scales and Self-Assessed Climate Knowledge on Respondent Social and Political Background (Odds Ratios).

Model	Polar scale	Polar scale	CC knowledge	CC knowledge	Self-assessed	Self-assessed
	1	2	3	4	5	6
Men	1.6***	1.7***	1.3**	1.4**	1.8***	1.9***
Age (years)	1.008*	1.009**	1.008*	1.011**	1.008*	1.009*
Degree	2.6***	2.3***	2.8***	2.2***	2.7***	2.3***
Diploma	1.9***	1.9***	1.6**	1.6**	1.4*	1.4*
Income \$100K+	1.4*	1.3	1.5**	1.4**	1.1	1.02
Live in Big City	0.9	0.9	1.05	1.2	0.99	1.04
No religious affiliation	1.2	1.2	1.6***	1.6***	1.1	1.1
Green party ID	1.7*	1.4	3.7***	2.6**	2.0**	1.7
Labor party ID	1.1	0.9	1.6**	1.2	1.5*	1.2
No party ID	0.9	0.8	1.1	0.9	1.1	1.1
Coalition party ID (reference category)	1	1	1	1	1	1
Which do you believe. . .						
CC happening now mainly caused by humans (reference)	—	1	—	1	—	1
CC happening but mainly natural causes	—	0.7*	—	0.4***	—	0.7*
CC is not happening	—	0.5*	—	0.6*	—	2.4**
Don't know	—	0.4***	—	0.1***	—	0.1***
McFadden R ²	.03	.04	.05	.09	.04	.09
N	(1,254)	(1,254)	(1,287)	(1,287)	(1,269)	(1,269)

Source. Australian Survey of Social Attitudes (Evans et al., 2018).

Note. CC = climate change.

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

political matters.” It seems that the situation in Australia is similar to the United States, as I find both climate change beliefs and political party identification compete to “explain” the variance in the knowledge-dependent variables.

Overconfidence in Climate Knowledge

The final regression models in Table 4 operationalize two additional dependent variables. The first replicates Hamilton’s (2015, p. 93) measure of overconfidence in polar knowledge, while the second is a new measure of overconfidence based on the ozone, greenhouse, and oceans questions that form the climate knowledge scale. The results indicate that Australians are less confident than Americans regarding their knowledge of climate change, with 30% of Australians overconfident compared to 47% of Americans (Hamilton, 2015, p. 101). For the new climate change knowledge measure, 47% of Australians can be classified as *overconfident*.

When modeled using binary logistic regression, demographic variations in overconfidence are not apparent for either polar knowledge or climate knowledge. Australians who do not know whether climate change is happening or not tend to be the least confident in their knowledge of polar and climate change knowledge, providing a face validity check. However, similar to Hamilton (2015, p. 101), I find that those who reject ACC are more likely than those who

accept the scientific consensus on ACC to be *overconfident* about their polar knowledge. As Hamilton (2018, p. 151) put it, “high self-assessed understanding reflects confidence in political views, rather than knowledge about the physical world.” In addition, Australians who reject ACC are also overconfident about their climate change knowledge, an effect that remains after holding constant social and political background variables.

Discussion

Analysis of data from the 2018 Australian Survey of Social Attitudes (Evans et al., 2018) indicates that approximately two-thirds of Australians accept the scientific consensus on ACC (e.g., see Cook et al., 2016) consistent with the findings of earlier studies (Tranter, 2017, 2019). Similar to the situation in the United States, the strongest determinants of rejecting human-caused climate change in Australia are one’s political affiliations. Those who identify with the Liberal or National parties are far less likely than Labor identifiers or Greens to accept that climate change has mainly human causes (Tranter, 2019). The “information-deficit model” of science communication (Suldovsky, 2017) suggests that those who are more knowledgeable regarding climate change should be more willing to accept that climate change has human causes. Previous research has found that acceptance of human-caused climate change is related to one’s climate

Table 4. Binomial Logit Regression of Overconfidence in Polar and Climate Change Knowledge on Respondent Social and Political Background (Odds Ratios).

Model	Polar	Climate
Men	0.96	0.99
Age (years)	0.99	0.99
Degree	0.9	0.96
Coalition party ID (referent)	1	1
Green ID	0.8	0.5*
Labor ID	1.2	0.9
No ID	1.4*	1.01
Accept ACC (referent)	1	1
CC Natural	1.3	1.5*
CC not occurring	2.4**	3.1**
Don't Know if CC occurring	0.5**	0.4***
Nagelkerke R ²	.02	.03
N	(1,252)	(1,269)

Source. Australian Survey of Social Attitudes (Evans et al., 2018).

Note. ACC = anthropogenic climate change.

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

change knowledge; the more people understand about climate change, the more likely they are to accept that it has mainly human causes (e.g., Hamilton, 2015; Tranter, 2019).

However, previous research conducted in other countries has shown that the climate knowledge/acceptance of ACC relationship tends to vary according to one's political affiliations. For example, Kahan (2015, p. 27) found climate science knowledge in the United States is linked with acceptance of global warming caused by burning fossil fuels among Democrat party identifiers, but increasing science knowledge among conservative Republicans was not associated with higher levels of climate skepticism. A key focus in this research is to examine the extent that one's political leanings are associated with knowledge of climate change in Australia. I find Coalition identifiers to be less likely than Labor supporters to correctly answer measures of climate change knowledge, although there were no substantive differences between major party identifiers on *climate-related* knowledge responses.

Hamilton and Fogg (2018) and Tranter (2019) found evidence that climate-related measures of climate knowledge—geographic knowledge of the North and South poles and the implications of ice melt for rising sea levels—were significantly associated with political partisanship in the United States and Australia, respectively. However, the current Australian research finds that the influence of political identity on climate change knowledge responses are mixed. Although Tranter (2019) found that the polar knowledge/acceptance of ACC association was mediated by political partisanship, that finding was not replicated here. Yet how one scores on measures of climate change knowledge—questions that refer to the causes of climate change, such as the “greenhouse effect”—is influenced by

political affiliations in Australia as it is in the United States (Kahan, 2015). My findings demonstrate the importance of how climate change knowledge is measured because certain terms (e.g., “greenhouse”) trigger different response patterns based on ideological leanings and political party affiliations (Hamilton, 2015). Political conservatives tend to reject some scientific facts relating to climate change when these conflict with strongly held world views (Poortinga et al., 2011), such as valorizing free market and rejecting regulations imposed by government. This also appears to be the case in Australia. For example, Coalition identifiers are less likely than Labor identifiers to agree that the oceans around Australia have warmed and become more acidic due to climate change or that Australians produce more greenhouse gas emissions per capita than most other people in the world.

What are the broader implications of this research? First, although “deficit models” of science communication certainly have their detractors (see for example, Ehret et al., 2017; Hornsey & Fielding, 2017), the current research suggests many people are not convinced by climate science (or perhaps do not trust climate scientists). If science communication was highly effective, with information regarding the causes of global warming conveyed to, and absorbed by “the public” in a transmitter/receiver fashion, acceptance of ACC should be higher than it is. Yet, although recent research indicates 97% of peer-reviewed climate scientists agree climate change has anthropogenic causes (Cook et al., 2016), only 64% of Australians agreed that climate change has anthropogenic causes in 2018/2019. Although the acceptance of ACC is far higher among Greens (97%) and Labor (81%) identifiers, less than half of all Coalition identifiers (43%) accept the scientific consensus position on climate change.

Similar partisan differences over climate change are apparent among adolescents in Australia (Tranter, 2014), while levels of climate knowledge among younger Australians are similar to those in the general adult population (Tranter et al., 2020). Stevenson et al. (2014, p. 293) argue that “worldview rather than scientific understanding largely drives climate change risk perceptions.” However, adolescents appear more receptive to the influence of educational initiatives on climate change, as among young people “education efforts specific to climate change may counteract divisions based on worldviews” (Stevenson et al., 2014, p. 294). Climate change education is particularly effective if it is framed to focus upon the “local scale, impact on humans, and connections to social, economic and political processes” (Busch, 2016, p. 137). Educating children on climate change also has the benefit of influencing their parents, so they too become more concerned about climate change (Lawson et al., 2019).

Second, as has been shown in other contexts (e.g., Hamilton, 2015 in the United States), increased knowledge of climate change is associated with acceptance of ACC

across the political divide, but this finding holds only for *climate-related* measures of knowledge (e.g., polar knowledge), where politically divisive trigger terms are absent from the survey quiz questions. In Australia, like the United States, scores on climate change quiz questions that contain climate trigger terms are influenced by political identification. Third, those who accept that climate change is anthropogenic score higher than those who do not on both climate change knowledge and climate-related knowledge scales. Yet, I also show that climate skeptics *believe* themselves to be knowledgeable than others about climate change. Australians who reject ACC outright are much more likely to be overconfident of their level of climate change knowledge, than those who accept ACC, although these climate skeptics score lower on factual climate change quiz questions. This disconnect with reality is consistent with a tendency among climate change deniers to support conspiracy theories in general (Lewandowsky et al., 2013) and disregard evidence that does not fit with their world views (Kahan et al., 2012).

However, again, targeting younger people with educational initiatives to enhance scientific literacy seems to be a promising strategy going forward, given findings that increasing knowledge of climate change results in greater acceptance of ACC among adolescents who hold individualist or communitarian worldviews (Stevenson et al., 2014).

The absence of partisan influences upon responses to measures of climate-related facts suggests that attempts by science communicators to inform the public regarding climate science are not a lost cause. Although partisan differences in accepting ACC is well established (McCright & Dunlap, 2011a, 2011b; Tranter, 2011, 2017, 2019), the absence of partisan influences on indirect measures of climate knowledge implies that political identity *per se* is not necessarily a barrier to improving public knowledge on climate change. Whether increased knowledge of climate change leads to positive *behavioral* changes in the form of climate change adaptation and mitigation should be the subject of future research.

Appendices

Appendix A

Table A1. Descriptive Statistics.

	M	SD	Range	N
Dependent Variables				
Anthropogenic CC happening now	0.64	0.48	1/0	1,259
Self-assessed climate knowledge	2.84	0.71	1-4	1,269
Polar knowledge scale	1.51	1.05	0-3	1,254
Climate knowledge scale	0.97	0.88	0-3	1,287
Overconfidence polar	0.30	0.46	1/0	1,252
Overconfidence climate	0.47	0.50	1/0	1,269
Independent Variables				
Men	0.48	0.50	1/0	1,287
Aged (years)	54.76	17.5	1/0	1,287
Degree	0.37	0.48	1/0	1,287
Diploma	0.34	0.47	1/0	1,287
Income \$100K+	0.25	0.43	1/0	1,287
Live country village/farm	0.16	0.37	1/0	1,287
No religious affiliation	0.53	0.50	1/0	1,287
Generally trust other people	0.59	0.49	1/0	1,287
Green Party ID	0.06	0.23	1-4	1,287
Labor Party ID	0.18	0.38	0-3	1,287
No Party ID	0.46	0.50	1/0	1,287
Climate change 'natural'	0.21	0.40	1/0	1,287
Climate change no happening	0.04	0.19	1/0	1,287
Don't know about climate change	0.10	0.30	1/0	1,287
Survey Waves				
Wave 1	0.25	0.30	1/0	1,287
Wave 2	0.24	0.43	1/0	1,287
Wave 3	0.26	0.44	1/0	1,287
Wave 4	0.25	0.43	1/0	1,287

Source. Australian Survey of Social Attitudes (Evans et al., 2018).

Note. CC = climate change.

Appendix B

Table B1. Climate Knowledge Questions by Acceptance of Anthropogenic Climate Change (%).

Question	All	ACC	Natural	Denier	D.K.
The hole in the ozone layer contributes to climate change					
True	60	72	44	15	31
False	15	12	20	59	8
Don't know	25	15	36	26	61
N	(1,251)	(798)	(262)	(46)	(123)
Per person, Australians produce more greenhouse gas emissions per head than most other people in the world					
True	31	38	18	22	13
False	33	27	47	61	37
Don't know	36	35	36	17	50
N	(1,240)	(790)	(259)	(46)	(123)
Oceans around Australia have become warmer and more acidic due to climate change					
True	55	71	35	4	13
False	10	3	19	74	12
Don't know	35	26	46	22	75
N	(1,238)	(301)	(221)	(74)	(570)

Source. Australian Survey of Social Attitudes (Evans et al., 2018).

Note. ACC = anthropogenic climate change.

Correct answers in bold font.

Appendix C

Table C1. Binary Logit Regression of Polar Knowledge Items on Respondent Social and Political Background (Odds Ratios).

Model	North pole	North pole	South pole	South pole	Sea level	Sea level
	1	2	3	4	5	6
Men	1.5***	1.5***	1.4**	1.4**	1.5***	1.6***
Age (years)	1.003	1.005	1.009*	1.010*	1.006	1.007
Degree	2.4***	2.2***	2.0***	1.9***	1.9***	1.7**
Diploma	1.8***	1.7***	1.7**	1.7***	1.5**	1.5**
Income \$100K+	1.2	1.2	1.6**	1.5**	1.2	1.1
Live in Big City	0.8	0.8	0.9	0.9	1.1	1.1
No religious affiliation	1.1	1.1	1.4**	1.4**	0.99	0.97
Green party ID	1.2	0.99	1.5	1.3	1.9*	1.6
Labor party ID	1.1	0.9	0.9	0.9	1.2	1.03
No party ID	0.9	0.9	0.9	0.8	0.99	0.9
Coalition party ID (reference category)	1	1	1	1	1	1
Which do you believe. . .						
CC mainly human caused (reference)	—	1	—	1	—	1
CC happening but mainly natural causes	—	0.6**	—	1.01	—	0.7*
CC is not happening	—	0.6	—	0.7	—	0.5*
Don't know	—	0.5**	—	0.5**	—	0.5***
McFadden R ²	.03	.04	.04	.04	.03	.04
N	(1,265)	(1,265)	(1,265)	(1,265)	(1,260)	(1,260)

Source. Australian Survey of Social Attitudes (Evans et al., 2018).

Note. CC = climate change.

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

Appendix D

Table D1. Binary Logit Regression of Climate Change Knowledge Items on Respondent Social and Political Background (Odds Ratios).

Model	Ozone	Ozone	Greenhouse	Greenhouse	Oceans	Oceans
	1	2	3	4	5	6
Men	1.8***	1.6**	1.3*	1.4*	0.9	1.04
Age (years)	1.008	1.006	1.009*	1.011**	1.004	1.011*
Degree	1.9**	2.4***	2.4***	2.0***	2.1***	1.5*
Diploma	1.7*	1.9**	1.4*	1.4	1.3	1.2
Income \$100K+	1.5*	1.6*	1.4*	1.3	1.3	1.1
Live in Big City	1.1	1.003	1.1	1.2	0.96	1.1
No religious affiliation	1.3	1.5*	1.7***	1.6***	1.3*	1.2
Green party ID	1.1	1.6	2.6***	1.8*	7.0***	3.5***
Labor party ID	0.6*	0.9	1.4	1.04	2.4***	1.4
No party ID	0.6**	0.7	0.9	0.8	1.5**	1.1
Coalition party ID (reference category)	1	1	1	1	1	1
Which do you believe. . .						
CC mainly human caused (reference)	—	1	—	1	—	1
CC happening but mainly natural causes	—	2.3***	—	0.4***	—	0.3***
CC is not happening	—	12.3***	—	0.5	—	0.02***
Don't know	—	0.8	—	0.3***	—	0.07***
McFadden R ²	.05	.10	.06	.09	.06	.18
N	(1,251)	(1,251)	(1,240)	(1,240)	(1,238)	(1,238)

Source. Australian Survey of Social Attitudes (Evans et al., 2018).

Note. CC = climate change.

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

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