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Knowledge and Confidence in Knowledge About Climate Change Among Experts, Journalists, Politicians, and Laypersons

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Knowledge and confidence in one's own knowledge of climate change was investigated among experts, journalists, politicians, and laypersons. Subsamples of 65 experts, 72 environmental journalists, 145 politicians being chairs of environmental committees, and 621 laypersons in Sweden responded to survey questions concerning current climate state, causes, and consequences of climate change. Experts presented the highest level of knowledge, followed by journalists, politicians, and laypersons. In all the groups, knowledge of causes was greater than that of climate state and of future consequences, and among the latter knowledge was less of health consequences than that of weather and sea/glacier consequences. Also, experts expressed the highest level of confidence in their own knowledge, followed by journalists, politicians, and laypersons. Nevertheless, the adjustment of confidence in one's own knowledge to actual knowledge was somewhat higher among journalists than among experts.

Keywords: *knowledge of climate change; confidence in knowledge*

Knowledge is one important prerequisite that facilitates the adjustment to new conditions. Low confidence in one's own knowledge may motivate the search and validation of the prevailing situation by further information

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acquisition (Chaiken, Liberman, & Eagly, 1989). On the other hand, when actual knowledge and confidence of one's own knowledge are not adjusted to each other, individuals may not possess a realistic view of their knowledge.

Global Climate Change

In several respects, global climate change (GCC) represents new conditions. It is not just extreme events and changing rainfall patterns that have started to affect individuals in various parts of the world. There are also discussions in the political community regarding activities of mitigation and adaptation because of climate change. Decisions by others predict effects (by politicians regarding road toll systems, extra taxes on fossil fuel, etc.) even for those who are not personally concerned. Moreover, there is a consensus that future impacts may be much larger if individuals and society fail to learn how to alter their behavior (Intergovernmental Panel on Climate Change [IPCC], 2007; Stern, 2007). Taken together, these considerations call for the development of scientific knowledge concerning GCC, with its accumulation and periodic alteration. However, the question concerning rate of distribution and confidence levels of this knowledge remains an issue.

GCC is a complex phenomenon with widespread affects. The knowledge of GCC covers many disciplines. The availability of both scientific information and the capacity to acquire it varies between individuals. In addition, it is accompanied by uncertainties of various types. Hence, when laypersons learn about scientific uncertainty concerning the facts, they might react with doubts about their own knowledge. On the other hand, as individuals have different roles and tasks in the society, they are likely to experience varying needs of knowledge and needs of confidence in their knowledge.

This study confronts two issues pertaining to knowledge of GCC. The first concerns the extent to which scientific knowledge of climate change has reached important groups in society. Intrinsic to this question is whether or not climate change knowledge varies between knowledge domains, such as causes, state, and consequences of climate change. The second question addresses the confidence that individuals express in their knowledge of climate change. Is less knowledge paired with less confidence, thus indicating that individuals have a realistic view of their knowledge?

Knowledge of Climate Change

When experts share their scientific knowledge with each other and with other groups in society, knowledge may be integrated into a larger picture

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to be used for decisions of various types. Such knowledge leads to a discussion on priorities and political decisions regarding mitigation and adaptation. Factual knowledge is also necessary for citizens to influence political decision making and for politicians in the process of shaping policy instruments. Moreover, politicians need support and acceptance from citizens for their policymaking. A recent study indicated that more knowledge of climate change among citizens increases policy support (Lazo, Kinnell, & Fisher, 2000). Knowledge is also important when citizens form their intention to act in a more proenvironmental manner. According to a U.S. survey (Bord, O'Connor, & Fisher, 2000), accurate knowledge of global warming was the strongest single predictor of behavioral intentions.

Even though individuals may wish to be more knowledgeable about climate change, there are obstacles to the acquisition of such knowledge. One obstacle is the complicated character of GCC. Knowledge of GCC is acquired primarily by learning from experts, not by gaining personal experience. The scientific knowledge about climate change covers many disciplines, such as oceanography, geology, meteorology, and medicine. Hence, knowledge is disseminated in different parts of the scientific community, and even experts may have difficulties in surveying and integrating the knowledge base. Another obstacle concerns the opportunities for obtaining firsthand information about scientific knowledge. Experts have direct access to information in their own discipline. Other groups in society, politicians and laypersons included, are more dependent on information mediated by journalists via mass media.

Television has been identified as the primary source of knowledge for the public, for instance, in the United States (Wilson's study, as cited in Wilson, 2000). Although journalists use newspapers as their primary source, interviews with scientists and scientific journals are their second and third sources of knowledge (Wilson, 2000). Possibly due to these media, Böhm and Pfister (2001) report that knowledge about climate change among laypersons in the United States, as well as in Europe and South America, is vague and contains misunderstandings. Still, people may not always realize this vagueness. For example, in 2002, the European public stated that they felt well-informed about the climate change (European Opinion Research Group, 2002).

Nevertheless, in spite of reports concerning misunderstandings, it ought not to be concluded that it is a waste to inform laypersons about climate change. For example, in 2002, the Swedish Environmental Protection Agency launched an information campaign on climate change. An assessment showed that due to the campaign the Swedish public had substantially increased their knowledge of this topic (Naturvårdsverket, 2004). In addition, the assessment showed that knowledge varied between domains. The

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respondents had more correct knowledge about causes than of consequences of climate change, both before and after the campaign.

The uncertainty associated with scientific information complicates knowledge of GCC. For example, the statement that half of the Alpine glaciers could disappear by the end of the 21st century, accompanied by a confidence level of 33% to 67% (IPCC, 2001b), may confuse laypersons and influence the perceived status of the knowledge.

Confidence in One's Own Knowledge About Climate Change

Ideally, individuals should be knowledgeable about climate change issues and possess confidence of their own knowledge. It may be reasoned that they may then be more likely to act in a responsible manner and as enlightened citizens be prepared to participate in the political process. An extension of this notion regards the extent to which less knowledgeable individuals will possess lower confidence. According to Chaiken et al. (1989), individuals may perceive that their confidences are insufficient. As a result, they may be motivated to process additional information to raise their confidence (see also Eagly & Chaiken, 1993). However, if confidence levels are high yet knowledge low, individuals are unlikely to be motivated to acquire new knowledge. Findings reported above (Böhm & Pfister, 2001; European Opinion Research Group, 2002) may imply such a risk, that is that European Union citizens regard themselves as well-informed whereas at the same time have misunderstandings about climate change issues.

In general, it is necessary that the level of individuals' confidence in their own knowledge matches their actual knowledge. Previous research concerning confidence in factual statements reported that individuals are overconfident (e.g., Budescu, Wallsten, & Au, 1997; Griffin & Tversky, 1992), that is, they believe they know more than they actually do. Later research has shown that when important methodological problems are controlled for, the overconfidence is reduced (see, e.g., Juslin, Winman, & Olsson, 2000). In short, it can be concluded that, in general, individuals are rather well calibrated, that is, their confidence matches their knowledge.

The actual level of confidence in one's own knowledge is dependent on a number of factors. One factor is the effort that has been used to acquire correct knowledge. Information that is validated by more effort may raise confidence levels (Chaiken et al., 1989). A second factor refers to the source from which the knowledge is acquired and how it is transmitted onwards. Rather than scrutinizing a message, individuals rely on peripheral cues, for instance,

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that a message is presented by an expert. This source reliance may contribute to overconfidence when individuals fall back on a simple decision rule: "experts' statements can be trusted" (Eagly & Chaiken, 1993, p. 327). The resulting increased confidence may be expected to be volatile.

Alternatively, a number of other factors have been claimed to affect both knowledge and confidence, mainly negatively. One of these factors pertains to journalists active in the media. The journalistic norm to balance statements from several sources has been reported to bias coverage of the anthropogenic contribution to climate change. By presenting competing points of view on a scientific issue, as if they had equal scientific status, the viewpoint of a consensus is undermined (Boykoff & Boykoff, 2004). Additional support was provided in a study on assessment of the certainty of global warming (Corbett & Durfee, 2004): Four versions of a newspaper article were presented to different groups of readers. One recent article from a scientific journal reported that a portion of the Antarctic ice sheet was thickening. This was believed to go against current knowledge and create uncertainty. A second article incorporated a paragraph that presented scientists who disagreed with the original message (controversy). The third article included the original message in a wider context of earlier research that had found that the ice sheet was thinning. The fourth article combined controversy and context information. Those who read the first article were least certain about the occurrence of climate change, those in the context condition were most certain, and the other two groups fell in between. The result underscores the importance of providing a context to a single scientific finding. In a similar vein, Cameron (2005) showed that differences among information sources about future annual average temperatures, that is, ambiguity may lead individuals to maintain their personal prior opinions about climate change. As a consequence, they may be less inclined to rely on expert sources.

Researchers have also found widespread misconceptions in knowledge and in uncertainty among journalists. In one study of U.S. journalists belonging to the Society of Environmental Journalists, only one third correctly acknowledged that the global warming theory is accepted by most atmospheric scientists (Wilson, 2000). Instead of correctly understanding around which issues and why the scientific debate occurs, journalists were confused. They exaggerated disagreements and underplayed consensus. The study indicated that journalists thus increased the level of perceived uncertainty with their information. It is proposed that this is reflected in the knowledge of those who rely on media (Wilson, 2000). However, it is not the case that media always contribute to increased uncertainty. Structured interviews with more than 500 U.S. citizens revealed that both mass media and interpersonal communication make positive contributions to correcting

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misunderstandings as well as to perpetuate misconceptions (Stamm, Clark, & Eblacas, 2000).

Study Aims

We aim at examining the relative levels of knowledge between experts, journalists, politicians, and laypersons. These groups are important in society for development, dissemination, and use of GCC knowledge. Moreover, a matter of concern is whether the groups better absorb some knowledge domains than others. By selecting knowledge statements from several domains (causes, state, and consequences of climate change) that are likely to be true according to experts in the field and test other experts as well as journalists, politicians, and the public on the same items, we expect to be able to compare the groups.

We also want to use the same items to relate the confidence in one's own knowledge to accuracy of knowledge. The specific aims of this study are as follows:

- To assess the relative levels of knowledge about climate change among experts, journalist, politicians, and the public
- To assess the relative levels of confidence in one's own knowledge about climate change among experts, journalists, politicians, and the public
- To investigate whether knowledge and confidence in one's own knowledge vary between knowledge domains
- To assess whether the relation between knowledge and confidence in one's own knowledge differ among the four groups

Method

Participants

A random sample of Swedish laypersons aged between 18 and 75 years was obtained. In comparison with census population figures, men were overrepresented in the sample (62% compared with 51%), but the sample was representative for age (SCB, 2005). Journalists were selected from the register of a special interest organization for environmental journalists, which also included information staff from larger environmental organizations. This selection was complemented with a search in the media published the past 2 years. Experts on climate change were found among professionals at universities and scientific organizations. The environmental network of several universities was also used. Experts from a wide array of disciplines were included, for example, meteorology, geology, and

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ecology. The experts' common denominator was their focus on the causes or consequences of climate change. All experts within access were included in the study. Politicians were selected from the local authorities in Sweden. The chairperson of the environmental committee in each municipality was identified through the Internet. These politicians serve only part-time because they also have ordinary jobs.

The questionnaires reached 1,466 laypersons, 279 politicians, 119 journalists, and 107 experts (in total 1,971 persons) residing all over Sweden. The response rate was 621 (42%) laypersons, 145 (52%) politicians, 72 (61%) journalists, and 65 (61%) experts.

The total sample consisted of 610 (67.6%) men (65.1% for laypersons, 77.2% for politicians, 55.6% for journalists, and 83.1% for experts). The mean age of the participants was 47.8 years (SD = 15.1), with the mean age for laypersons being 45.8 years (SD = 16.2), politicians 56.5 years (SD = 10.2), journalists 49.1 years (SD = 10.6), and experts 47.9 years (SD = 10.6).

Procedure

A questionnaire was mailed out in October 2005. The instructions on the first page asked the participants to decide whether or not they regarded each of a number of statements to be true or false. They were also asked to assess their level of confidence in the veracity of their knowledge of each statement. The participants completed the questionnaire anonymously and were informed that the results would only be reported for the group, but they were not informed about the group categories. No monetary incentive was offered. A prepaid return envelope was enclosed. After 1 week, everyone received a thank-you card that also served as a reminder. After 3 weeks, a new reminder with a new questionnaire was distributed to those who had not yet responded.

Measures

The questionnaire consisted of three parts. The first part assessed the knowledge and confidence level of the three domains states, causes, and consequences of climate change. It consisted of 22 true and 22 false statements (see appendix). The true statements were based on expert reports with a high likelihood of being true. The main source was IPCC (2001a, 2001b). Knowledge about regional Swedish effects was sourced from the Swedish Environmental Protection Agency (2005) and from the Swedish Museum of Natural History (2004). False statements were either contrasts to the true statements or well-known misunderstandings prevalent in

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society. The purpose of the false statements was to counteract a response set to answer true to all statements. The questionnaire was tested in a pilot survey of laypersons. A panel of experts not participating in the study checked the validity of the true and false statements.

Knowledge of climate state was assessed by 8 statements, causes by 12 statements, and consequences by 24 statements. Knowledge of 3 different types of consequences was assessed: weather consequences (6 statements), sea and glaciers consequences (12 statements), and health consequences (6 statements).

For each statement, there was one box for true and one for false to be checked by the participants. Confidence was assessed on a six-point rating scale with verbally defined alternatives: (1) very uncertain, (2) fairly uncertain, (3) more uncertain than certain, (4) more certain than uncertain, (5) fairly certain, and (6) very certain.

The second and third parts of the questionnaire consisted of 25 questions also referring to climate change. Those parts are not reported here.

There were six demographic questions concerning gender, whether participants were parents or not, age, level and type of education, and as well as type of residence.

Statistical Analyses

Missing values were replaced with the value closest to the means for the group to which the individual belonged. One of the intended true statements (#35) turned out to be false and was excluded from the analysis. Knowledge scores were calculated as the average number of correct answers to the true statements. For each domain, a mean proportion of accuracy of knowledge was calculated. Confidence scores were calculated as the average confidence ratings for both correct and incorrect answers to the true statements. The false statements were not included in the group analyses because they were not directly comparable with the true statements.

The relationship between knowledge and confidence levels was calculated as Pearson correlations between knowledge scores and average of confidence ratings.

Results

Knowledge

The groups in the sample had acquired correct knowledge about climate change, although in varying degrees. The mean proportion of correct answers

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Table 1
Mean Proportion of Correct Answers by Each Group for State, Cause, and Consequence of Climate Change

	State		Cause		Consequence	
	M	*SD*	*M*	*SD*	*M*	*SD*
Experts ($n = 65$)	0.83	0.22	0.89	0.14	0.75	0.16
Journalists ($n = 72$)	0.78	0.21	0.81	0.17	0.70	0.16
Politicians ($n = 145$)	0.69	0.25	0.79	0.17	0.68	0.16
Laypersons ($n = 621$)	0.66	0.25	0.77	0.20	0.62	0.16

for all groups exceeded chance level (.50). Experts were the most knowledgeable, followed by journalists, politicians, and laypersons. Mean proportions were as follows: for experts 0.81 ($SD = 0.13$), for journalists 0.75 ($SD = 0.13$), for politicians 0.71 ($SD = 0.13$), and for laypersons 0.67 ($SD = 0.14$).

Table 1 shows that the general level of knowledge varied between domains. For all groups, knowledge was highest for causes, followed by state and consequences. The state domain had the largest difference in knowledge between the groups.

A 4 (Group: experts vs. journalists vs. politicians vs. laypersons) × 3 (Domain: state vs. cause vs. consequence) analysis of variance (ANOVA) with repeated measure on the last factor yielded a significant main effect of group, $F(3, 899) = 24.32$, $p < .001$, a significant main effect of domain, $F(2, 1798) = 58.30$, $p < .001$, Greenhouse–Geisser $\varepsilon = .92$, but no significant interaction effect. Comparisons employing Helmert contrasts showed that experts had significantly more accurate knowledge than the other three groups ($p < .001$), that journalists had significantly more accurate knowledge than politicians and laypersons ($p = .001$), and that politicians had significantly more accurate knowledge than laypersons ($p = .003$). Separate Bonferroni-corrected t tests showed that all pair-wise differences between domains were significant ($p < .001$).

The assessment of knowledge for the consequences weather, sea/glacier, and health revealed a similar pattern with experts being most knowledgeable followed by journalists, politicians, and laypersons. The largest difference to the experts was found for weather (see Table 2). An additional 4 (Group: experts vs. journalists vs. politicians vs. laypersons) × 3 (Consequence: weather vs. sea/glacier vs. health) ANOVA with repeated measure on the last factor revealed no significant main effect of type of consequence, a main effect

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Table 2
Mean Proportion of Correct Answers by Each Group for the Consequences Weather, Sea/Glacier, and Health of Climate Change

	Weather		Sea/Glacier		Health	
	M	*SD*	*M*	*SD*	*M*	*SD*
Experts	0.81	0.22	0.72	0.20	0.72	0.33
Journalists	0.69	0.25	0.69	0.22	0.72	0.31
Politicians	0.67	0.18	0.71	0.19	0.63	0.35
Laypersons	0.63	0.21	0.65	0.22	0.57	0.34

of group, $F(3, 899) = 18.55$, $p < .001$, and no significant interaction effect. Comparisons employing Helmert contrasts revealed again that experts had significantly more accurate knowledge than the other three groups ($p < .001$), that journalists had significantly more accurate knowledge than politicians and laypersons ($p = .007$), and that politicians had significantly more accurate knowledge than laypersons ($p < .001$).

Confidence in One's Knowledge

The level of confidence varied between the groups in a similar way as did knowledge. The experts were more confident in their knowledge than the journalists, and the journalists were more confident than politicians, who were more confident than laypersons. The mean for the experts was 4.66 ($SD = 0.71$), for journalists 4.22 ($SD = 0.92$), for politicians 4.10 ($SD = 0.74$), and for laypersons 3.73 ($SD = 0.88$). Laypersons were slightly more confident than the midpoint of 3.5, all other groups seemed to be rather confident as the confidence level of four is *more certain than uncertain* and five is *fairly certain*. As can be seen in Table 3, the confidence levels varied between the domains, with confidence being highest for causes among experts, journalists, and politicians. Laypersons were most confident in knowledge of consequences, followed by confidence in knowledge of causes.

A 4 (Group: experts vs. journalists vs. politicians vs. laypersons) × 3 (Domain: state vs. cause vs. consequence) ANOVA with repeated measure on the last factor was performed on the confidence ratings. The main effect of group was significant, $F(3, 899) = 39.71$, $p < .001$, as was the main effect of domain, $F(2, 1798) = 24.11$, $p < .001$, Greenhouse–Geisser $\varepsilon = .97$, and

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Table 3
Mean Confidence Ratings by Each Group for State, Cause, and Consequence of Climate Change

	State		Cause		Consequence	
	M	*SD*	*M*	*SD*	*M*	*SD*
Experts	4.87	0.79	5.03	0.68	4.38	0.85
Journalists	4.10	1.12	4.50	1.00	4.13	1.00
Politicians	4.00	0.93	4.23	0.89	4.09	0.83
Laypersons	3.65	1.05	3.73	0.99	3.76	0.99

the group × domain interaction, $F(6, 1798) = 9.36$, $p < .001$, Greenhouse–Geisser $\varepsilon = .97$. Comparisons employing Helmert contrasts showed that experts had significantly higher confidence than the other three groups ($p < .001$), that journalists had significantly higher confidence than politicians and laypersons ($p = .002$), and that politicians had significantly higher confidence than laypersons ($p < .001$). Separate Bonferroni-corrected *t* tests revealed that confidence in knowledge of state was significantly less than confidence in knowledge of cause ($p < .001$), and confidence in knowledge of cause was significantly higher than confidence in knowledge of consequences ($p < .001$), but confidence in knowledge of state and consequences did not differ significantly.

The ratings of confidence for the consequences weather, sea/glacier, and health showed a similar pattern with experts revealing the highest confidence being followed by journalists, politicians, and laypersons (see Table 4). A 4 (Group: experts vs. journalists vs. politicians vs. laypersons) × 3 (Consequence: weather vs. sea/glacier vs. health) ANOVA with repeated measure on the last factor yielded a significant main effect of group, $F(3, 899) = 13.19$, $p < .001$, of consequence type, $F(2, 1798) = 12.98$, $p < .001$, Greenhouse–Geisser $\varepsilon = .95$, and of the group × consequence type interaction, $F(6, 1798) = 4.35$, $p < .001$, Greenhouse–Geisser $\varepsilon = .95$. Comparisons employing Helmert contrasts revealed that experts had significantly more confidence in knowledge than the other three groups ($p = .007$), that journalists did not have significantly more confidence than politicians and laypersons, and that politicians had significantly more confidence than laypersons ($p < .001$). Separate Bonferroni-corrected *t* tests revealed that confidence in knowledge of weather did not differ significantly from confidence in sea/glacier, but was significantly higher than confidence in

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Table 4
Mean Confidence Ratings by Each Group for the Consequences Weather, Sea/Glacier, and Health of Climate Change

	Weather		Sea/Glacier		Health	
	M	*SD*	*M*	*SD*	*M*	*SD*
Experts	4.41	0.95	4.58	0.99	4.03	1.05
Journalists	4.14	1.14	4.09	1.15	4.17	1.34
Politicians	4.20	0.95	4.07	0.92	4.01	1.06
Laypersons	3.93	1.10	3.81	1.19	3.49	1.23

Table 5
Correlations for True Statements Between Average Knowledge Scores and Mean Confidence Ratings

	Experts ($n = 65$)	Journalists ($n = 72$)	Politicians ($n = 145$)	Laypersons ($n = 621$)
State	.28*	.44**	.11	.06
Cause	.25*	.34**	.28**	.11**
Consequences whereof	.16*	.34**	.11	.14**
Weather	.30*	.19	.05	.11**
Sea/glacier	.07	.12	.04	.07
Health	.10	.42**	.09	.13**

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

knowledge of health ($p < .001$), and that confidence in knowledge of sea/glacier also was significantly higher than confidence in knowledge of health ($p < .001$).

Relation Between Knowledge and Confidence

For each group and domain, the correspondence between actual knowledge and self-reported confidence was assessed by calculating product moment correlations between mean knowledge scores and mean confidence ratings. As presented in Table 5, the match between knowledge and confidence was better for journalists and experts than among politicians

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and laypersons, but journalists tended to be better calibrated than experts. Statements about state of GCC were more in accordance among both these groups than statements about causes and consequences. Politicians were best calibrated for causes, whereas laypersons showed their best match for consequences. Among consequences, experts were better calibrated for weather consequences than the other types, whereas journalists, politicians, and laypersons were better calibrated for health consequences.

Discussion

Experts showed more accurate knowledge of climate change issues than the other three groups investigated: Environmental journalists were more knowledgeable than were environmentally qualified politicians and laypersons, whereas politicians possessed more accurate knowledge than laypersons. There were also systematic differences in knowledge between the domains. All the groups had the highest proportion of correct answers with regard to causes of climate change, followed by the present state, and with least knowledge about future consequences. It is puzzling that knowledge of causes was more widespread than knowledge of present state because knowledge of causes is more associated with theoretical propositions, whereas state knowledge probably relies on verified observations. One explanation may be that state knowledge is more difficult to convey, being often represented by numbers, which may be hard to memorize, whereas knowledge of causes may be more easily represented as narratives, thereby facilitating learning (Bartlett, 1932). In addition, state knowledge may be expected to vary compared with knowledge of causes, which is relatively robust. Hence, knowledge about the state of the climate may be confusing and individuals may be less motivated to integrate it. In addition, the selection of questions in the state domain may have resulted in more difficult questions than those about causes. Unsurprisingly, knowledge of consequences was least, given that knowledge of consequences refers to the uncertain future.

Among the three types of consequences, knowledge of the weather induced the largest difference between experts and the other three groups. This was probably due to the selection of many meteorologists as experts. Furthermore, knowledge of health consequences was least developed, in particular, among laypersons relative to their knowledge of other consequences. Possibly, society has given less attention to these issues, and as a result, knowledge of health consequences is less advanced compared with knowledge of weather and sea/glacier consequences.

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Levels of confidence in one's own knowledge produced similar results as for knowledge. Confidence was highest among experts, followed by journalists, politicians, and laypersons. The participants showed most confidence in their knowledge about causes of climate change but were less confident in their knowledge of state and consequences. In all four groups, confidence in knowledge matched factual knowledge. The more knowledge one possessed, the more confident one was. These results indicate that individuals, at a group level, are well calibrated. Given that media is the main source of scientific knowledge about climate change, our results do not support the conclusion (see Wilson, 2000) that journalists increase perceived uncertainty among those relying on the media, that is, politicians, the general public, and journalists themselves. In addition, the results do not support a source reliance effect and an increased confidence in messages because they emanate from experts.

Both the group of journalists and of politicians who participated in the study were professionally specialized in environmental issues. Hence, they can be expected to have more and other knowledge than journalists and politicians in general.

There were differences between the groups in the correlations between self-reported confidence in one's own knowledge and actual knowledge. Somewhat unexpectedly, journalists were the best-calibrated group of respondents. Even though experts were most knowledgeable, they did not have a relatively higher confidence in their own knowledge. One explanation may be that experts, compared with the other three groups of participants, apply stricter criteria in their confidence ratings. Calibration was lowest among politicians and laypersons. One interpretation pertains to these groups relying on a higher rate of guesswork. Their answers were sometimes correct and sometimes incorrect whereas their confidence was relatively low, resulting in the reduced correlation between self-reported confidence and actual knowledge.

Finally, the revealed low knowledge levels of consequences among laypersons may have important implications. Sjöberg (2000) concluded that beliefs about consequences are more important determinants for policy attitudes than are probability estimates of unwanted events or perceived risks of activities leading to such events. Hence, the mere existence of risk consequences is more important than whether the probability is high or low. Similarly, Böhm and Pfister (2001) emphasized that proenvironmental behavior is guided by worries about future consequences of global environmental change and, in particular, negative consequences for humans. Thus, knowledge of the consequences ought to have a positive effect on

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intentions to change behavior. In the present study, knowledge of consequences, and especially health consequences, was low among all the groups of participants. Hence, prospects for behavioral changes seem to be poor. Nevertheless, the heuristic–systematic model of persuasion (Chaiken et al., 1989) suggests that when personal relevance of a topic is high, yet actual confidence in knowledge is low, individuals will engage in systematic processing of information. The driving force is to acquire sufficient confidence in their attitudinal judgments, for instance, their attitude toward GCC. Because confidence in knowledge of health consequences was low in the present study, yet of high relevance (Böhm & Pfister, 2001), individuals ought to be motivated to process additional information. Consequently, such processes may result in that both knowledge and confidence will increase. As a result, behavioral changes may occur.

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Appendix
Questionnaire Statements (Part 1)

The 21 statements intended to be true are numbers 2, 4, 6, 8, 9, 12, 14, 15, 16, 18, 21, 24, 25, 27, 30, 31, 33, 36, 39, 40, and 41. This English version is translated from Swedish for the purpose of the article.

The opening statements relate to the climate	True	False	Very Uncertain	Fairly Uncertain	More Uncertain Than Certain	More Certain Than Uncertain	Fairly Certain	Very Certain
1. The global average temperature in the air has increased approx. 3.1 °C the past 100 years.	○	○	☐	☐	☐	☐	☐	☐
2. The global average temperature in the air has increased approx. 0.6 °C the past 100 years.	○	○	☐	☐	☐	☐	☐	☐
3. The global average temperature in the air has been approx. stable the past 100 years.	○	○	☐	☐	☐	☐	☐	☐
4. The 1990s was the warmest during the past 100 years.	○	○	☐	☐	☐	☐	☐	☐
5. The 1990s had a normal average temperature compared to other decades the past 100 years.	○	○	☐	☐	☐	☐	☐	☐
6. The global change in temperature the past 100 years is the largest during the past 1,000 years.	○	○	☐	☐	☐	☐	☐	☐
7. It is not possible globally to establish if the past 100 years had a divergent temperature compared to the previous 1,000 years.	○	○	☐	☐	☐	☐	☐	☐
8. The precipitation has increased during the past 100 years in most areas in the middle and northern part of the northern hemisphere.	○	○	☐	☐	☐	☐	☐	☐

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Appendix (continued)

The following sentences relate to the causes of possible climate changes	True	False	Very Uncertain	Fairly Uncertain	More Uncertain Than Certain	More Certain Than Uncertain	Fairly Certain	Very Certain
9. The climate change is mainly caused by increased concentration of greenhouse gases.	○	○	☐	☐	☐	☐	☐	☐
10. The climate change is mainly caused by the ozone hole.	○	○	☐	☐	☐	☐	☐	☐
11. The climate change is mainly caused by a natural variation in sunbeam and volcanic eruption.	○	○	☐	☐	☐	☐	☐	☐
12. The carbon dioxide concentration has increased more than 30% in the atmosphere during the past 250 years.	○	○	☐	☐	☐	☐	☐	☐
13. The carbon dioxide concentration has increased between 20% and 30% in the atmosphere during the past 250 years.	○	○	☐	☐	☐	☐	☐	☐
14. Methane has increased more than 20% in the atmosphere during the past 250 years.	○	○	☐	☐	☐	☐	☐	☐
15. Carbon dioxide is responsible for approximately 80% of the emissions of greenhouse gases.	○	○	☐	☐	☐	☐	☐	☐
16. Carbon dioxide is emitted in the use of fossil fuels.	○	○	☐	☐	☐	☐	☐	☐
17. Methane is emitted mainly from the use of fossil fuels.	○	○	☐	☐	☐	☐	☐	☐
18. The increase of greenhouse gases is mainly caused by human activities.	○	○	☐	☐	☐	☐	☐	☐
19. The increase of greenhouse gases is mainly caused by a surplus of heat from tempered buildings.	○	○	☐	☐	☐	☐	☐	☐
20. The increase of greenhouse gases is mainly caused by air pollutions from the industry.	○	○	☐	☐	☐	☐	☐	☐

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Appendix (continued)

The following sentences relate to consequences from possible climate changes	True	False	Very Uncertain	Fairly Uncertain	More Uncertain Than Certain	More Certain Than Uncertain	Fairly Certain	Very Certain
21. The blanket of snow in the Northern hemisphere has decreased approximately 10% since the 1960s.	○	○	☐	☐	☐	☐	☐	☐
22. The blanket of snow in the Northern hemisphere is currently approximately the same as in the 1960s.	○	○	☐	☐	☐	☐	☐	☐
23. The number of storms and floods has increased prominently in the past 100 years.	○	○	☐	☐	☐	☐	☐	☐
24. It is not possible to establish globally if the number of storms and floods currently are more or fewer than during the past 100 years.	○	○	☐	☐	☐	☐	☐	☐
25. The global precipitation will increase the next 100 years.	○	○	☐	☐	☐	☐	☐	☐
26. The global precipitation will decrease the next 100 years.	○	○	☐	☐	☐	☐	☐	☐
27. The global sea level has risen approximately 0.2 meters the past 100 years.	○	○	☐	☐	☐	☐	☐	☐
28. The global sea level has risen approximately 1.1 meters the past 100 years.	○	○	☐	☐	☐	☐	☐	☐
29. The global sea level has been stable the past 100 years.	○	○	☐	☐	☐	☐	☐	☐
30. A cause of the rising sea level is the melting of glaciers and snow.	○	○	☐	☐	☐	☐	☐	☐
31. A cause of the rising sea level is the increasing temperature of the seawater.	○	○	☐	☐	☐	☐	☐	☐
32. In 100 years from now the sea level rise will be less than what is possible to measure.	○	○	☐	☐	☐	☐	☐	☐
33. In 100 years from now the sea level rise will be approximately one meter.	○	○	☐	☐	☐	☐	☐	☐

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Appendix (continued)

The following sentences relate to consequences from possible climate changes	True	False	Very Uncertain	Fairly Uncertain	More Uncertain Than Certain	More Certain Than Uncertain	Fairly Certain	Very Certain
34. In 100 years from now the sea level is expected to rise approximately 3-5 meters.	○	○	☐	☐	☐	☐	☐	☐
35. The ice mass of the Artic is expected to increase in the next 100 years.	○	○	☐	☐	☐	☐	☐	☐
36. If the Greenland ice will melt down completely in the future, the sea level will rise approximately 6 meters.	○	○	☐	☐	☐	☐	☐	☐
37. If the Greenland ice will melt down completely in the future, the sea level will rise approximately 12 meters.	○	○	☐	☐	☐	☐	☐	☐
38. If the sea ice in the North pole will melt down completely in the future, the sea level will rise approximately 3 meters.	○	○	☐	☐	☐	☐	☐	☐
39. It is probable that an increasing number of mosquitoes and ticks within 50 years will cause more cases of human diseases in Sweden, due to the climate change.	○	○	☐	☐	☐	☐	☐	☐
40. The climate change will increase the risk in Sweden for diseases transferred by water (i.e., diarrhea) during the next 100 years.	○	○	☐	☐	☐	☐	☐	☐
41. It is probable that the mortality by lung oedema and heart problems during heat waves in Sweden will increase during the next 50 years.	○	○	☐	☐	☐	☐	☐	☐

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Appendix (continued)

The following sentences relate to consequences from possible climate changes	True	False	Very Uncertain	Fairly Uncertain	More Uncertain Than Certain	More Certain Than Uncertain	Fairly Certain	Very Certain
42. Negative health impacts caused by climate change will globally affect humans on the countryside more than humans living in cities.	○	○	☐	☐	☐	☐	☐	☐
43. An increasing amount of greenhouse gases increases the risk of more UV-radiation and therefore a larger risk for skin cancer.	○	○	☐	☐	☐	☐	☐	☐
44. The health effect that might come up due to climate change during the next 50 years only concerns humans who stay in tropical areas.	○	○	☐	☐	☐	☐	☐	☐

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