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A Process Model of Risk Communication: The Case of Global Climate Change

Fiona Clark, Keith R. Stamm & Paula Reynolds Eblacas *

Global climate change has been associated with different types of risks. Some are more salient than others for different segments of the public. This raises two broad questions: What aspects of this multidimensional problem are of most public concern? Are there links between citizens' concerns and their willingness to act, either by changing their lives or making their views known?

From an individual perspective, "risk" might be defined as a concern because of its actual or potential consequence to something valued. Public risk perceptions frequently include characteristics such as catastrophic potential, threats to future generations, equitable distribution of costs and benefits, and threats to other species and to ecosystems. In contrast, traditional technical assessments generally focus on quantifiable measures, such as annual mortality rates, and ignore this more personal dimension of risk. Often, however, public definitions of risk prove more important than technical definitions.

In a democracy, policy makers and elected officials must acknowledge these public concerns. The main goal of risk communication has been to bring public knowledge into line with expert views. However, researchers increasingly suggest that risk communication should include dialogue about public concerns and values.¹ If scientists, members of the public, and policy makers desire to solve the problems of global climate change together, then the communication process deserves special attention. In addition, many

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¹ See, e.g., Paul Slovic, *Perceived Risk, Trust, and Democracy*, 13 *Risk Anal.* 675 (1993); William Leiss, *Three Phases in the Evolution of Risk Communication*, 545 *Annals of Am. Acad. of Pol. & Soc. Sci.* 85 (1994).

studies show a strong agenda-setting effect from media coverage of environmental issues.² One may assume that media coverage is an important source of public information about global climate change. Therefore, a more exact and comprehensive description of the different risks concerning the public associated with global climate change is important with respect to the question of media effects, both extant and potential.

The necessary behavior to solve an environmental problem is a complex, sequential structure in which we take individual and social steps towards a solution. Accordingly, this study employed a perspective recognizing that global climate change problems require a series of coordinated acts by various actors over time. A series of stages along a path ("stage on the path") beginning with awareness of the situation and ending with a sense of the best solution represents this perspective on global climate change.

To improve our understanding of public concerns about global climate change, our research primarily addressed the following questions:

1. For global climate change, how are people distributed among the stages of the problem-solving path?
2. Does concern about any or all of the risks associated with global climate change vary with stages along the path?
3. Does readiness to act vary with stages along the path?
4. What relationship, if any, is there between the focus of concern (i.e., the type of perceived risk) and the type of action taken?
5. Does media use influence concern about global climate change and/or in willingness to act? If so, which types of media make the most difference?

Method

Trained interviewers surveyed 512 random telephone subscribers in the Seattle metropolitan area in May of 1997.³ The interviewers used random digit dialing to select households and the "last birthday" method⁴ to randomly select respondents from each household. At

² See, e.g., Christine R. Ader, *A Longitudinal Study of Agenda Setting for the Issue of Environmental Pollution*, 72 *Journalism & Mass Comm. Q.* 300 (1995).

³ The sample does not differ significantly from census demographics for the metropolitan population.

least three callbacks were made to each household, resulting in a response rate of 55% (512/934).

To determine the stage on path for each respondent, we measured by agree/disagree responses to a short series of statements, such as "I don't think global warming⁵ is a problem" and "I'm pretty sure what actions need to be taken to solve this problem." Next, we measured the respondents' level of concern for several possible consequences of global climate change (i.e., "perceived risks") by asking them to rate their level of concern for plant and animal extinction, human health problems, water shortages, increased world hunger, sea level rise, heat waves, and social unrest.⁶ We also asked respondents whether they had performed any actions, such as selected energy efficient appliances, carpooled, joined, or donated money to an organization working on global warming issues, and volunteered with this type of organization, out of concern for global warming.⁷ Finally, we asked respondents to choose which possible sources informed them about global warming. Possible sources included newspapers, public radio, television, magazines, books, the Internet, environmental groups, family and friends, and workshops or classes.⁸

Results

Conceptualizing risk as a communication process involving public participation led us to consider the stages the public moves from awareness of a risk to knowledge of specific solutions. In the case of global climate change, we found the public spread out over all six stages

⁴ An interviewer using the "last birthday" method asks to speak to the person in the household, aged 18 or older, who most recently celebrated a birthday.

⁵ Although the term "global climate change" is in many respects preferable to the term "global warming," pre-tests determined that respondents in the Seattle area more readily understood the latter term. We therefore used the term "global warming" throughout the survey.

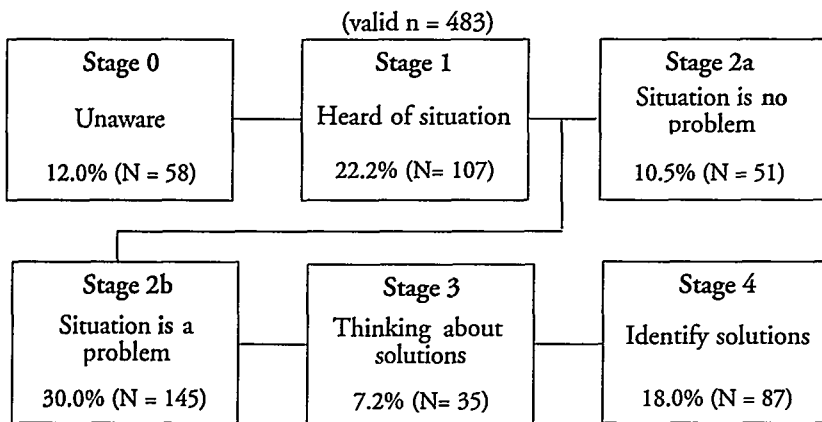
⁶ See United Nations Environment Programme (UNEP), *Climate Change Fact Sheets* (1997) <<http://www.unep.ch/iuc/submenu/infokit/factcont.htm>>; Granger Morgan et al., *Global Warming and Climate Change*, (1994) <<http://gcrio.org/gwcc/toc.html>>; National Safety Council, *Reporting on Climate Change: A Journalists Guide* (1994); Paul Stern, *Global Environmental Change: Understanding the Human Dimensions* (Oran R. Young & Daniel Druckman eds., 1992).

⁷ *Id.*

⁸ *Id.*

of our path model (figure below). 88% of the respondents progressed beyond Stage 0 — awareness of the global climate change problem, but only 25% had moved to Stage 3 and Stage 4 — thinking about solutions (7.2%) and identifying solutions (18.0%), respectively. This result suggests that many respondents were certain about solutions, even though they had not seriously thought about global warming.

Distribution of Respondents on Path from Awareness to Solution
for the Case of Global Warming



The significance of our stage distinctions became more apparent after we considered their relationship with a variety of the risks associated with global climate change (Table 1). The percentage of respondents “very concerned” about each of these seven risks increased linearly through stages 1, 2b, and 3, and then leveled off, or fell slightly, at stage 4. Respondents who decided that global climate change was not a problem were notably less concerned about the consequences of global climate change (Stage 2a). One implication is that concern about multiple sources of risk works in conjunction with movement towards solving environmental problems.

We received further support for the value of our stage model after we related the stages to the actions people reportedly take on behalf of solving global climate change (Table 2). The frequency of taking each action (with the exception of volunteer work) increased through Stages 1, 2b, and 3, but with little or no further increase in Stage 4. Evidence of a three-part process now exists showing both concern and actions increase as individuals move through the stages of our model.

Table 1
Proportion of Respondents within Each Stage "Very Concerned"
about Specified Elements of Global Warming

<i>Perceived Risk</i>	<i>Stage 1</i> Heard about	<i>Stage 2a</i> No problem	<i>Stage 2b</i> Definitely a problem	<i>Stage 3</i> Thought seriously	<i>Stage 4</i> Sure to act	Chi- square	p <
N*	74	38	123	34	80		
Extinct species	51.4%	28.9%	67.5%	88.2%	82.5%	110.4	.001
Heat waves	23.1	5.4	22.2	50.0	55.4	82.22	.001
Health problems	51.6	22.2	71.7	74.2	74.4	69.21	.001
Sea level rise	10.2	10.8	27.1	66.7	58.0	102.13	.001
Social unrest	37.9	5.0	31.6	52.6	53.8	38.39	.001
World hunger	42.2	23.1	61.7	85.2	64.2	47.38	.001
Water shortages	42.9	33.3	61.9	76.7	75.0	51.81	.001
						F	p <
Ave. concern**	1.34	.81	2.37	4.06	3.83	50.00	.001

* Respondents were first asked if they had heard of the specified risks in connection with global climate change. If not, we did not ask them how concerned they were about that risk. Hence, N for each stage may differ from those reported in Figure 2, especially in earlier stages.

** Scores calculated using a constructed "concern" index.

Table 2
Proportion of Respondents within Each Stage Who Have Taken Specified Action

<i>Actions</i>	<i>Stage 1</i> Heard about	<i>Stage 2a</i> No problem	<i>Stage 2b</i> Definitely a problem	<i>Stage 3</i> Thought seriously	<i>Stage 4</i> Sure to act	Chi- square	p <
N*	103	50	143	35	87		
Energy efficiency	39.8%	30.0%	49.0%	77.1%	66.7%	32.23	.001
Encourage others	15.4	12.0	23.1	57.1	52.9	56.50	.001
Join/donate money	16.3	14.0	18.9	42.9	41.4	29.06	.001
Alt. transport.	42.7	30.0	43.4	60.0	70.1	27.87	.001
Volunteer work	8.7	6.0	7.7	14.3	14.9	5.10	ns
Voting consid.	26.0	22.0	38.5	68.6	72.4	62.58	.001
						F	p <
Ave. action**	1.43	1.11	1.77	3.20	3.18	41.9	.001

* N may differ from those in stage diagram due to missing data.

** Scores calculated using a constructed "action" index.

To further elucidate this three-part process, we examined the relationship between concern about global climate change risks and actions taken toward a solution (Table 3). Overall, we expected that

those most concerned would be more likely to take action. The results confirmed our general expectation, but the relationship varied considerably depending upon the source of concern and the kind of action taken. For example, four sources of concern: animal extinctions; heat waves; sea level rise; and social unrest — conspicuously made a positive distinction in all or most of the actions taken. Two actions — encouraging others to act and considering global climate change when voting — were also positively related to most or all sources of concern. Two of the more important actions — choosing energy efficient appliances and doing volunteer work — were not strongly related to any of the concerns except animal extinctions and heat waves. The perceived risks impact whether a respondent took action, but the source of risk and the kind of action make a tremendous difference.

Table 3
Actions Taken by Concern for Specific Consequences

<i>Sources of Concern</i>	<i>Actions Taken</i>					
	<i>Energy efficient</i>	<i>Encour. others</i>	<i>Join/donate</i>	<i>Altern. transp.</i>	<i>Volunt. work</i>	<i>Voting consid.</i>
Animal extinctions [†]	9** (.17)	22*** (.23)	24*** (.21)	15*** (.25)	15 (.07)	14*** (.21)
Heat waves	22** (.18)	58*** (.29)	29** (.18)	18** (.22)	44** (.20)	39*** (.26)
Health problems	0 (.03)	22*** (.20)	12 (.10)	920* (.12)	8 (.13)	(.10)
Sea level rise	14 (.13)	50*** (.27)	41*** (.23)	24*** (.24)	34 (.09)	29*** (.23)
Social unrest	1045*** (.12)	37** (.27)	14** (.23)	25 (.24)	21* (.09)	(.20)
World hunger	6 (.09)	16* (.15)	12 (.11)	7 (.10)	11* (.16)	13* (.16)
Water shortages	-2 (.05)	23** (.20)	17* (.14)	6 (.11)	17 (.10)	13* (.19)

† Row 1: Percent difference between whole sample and those most concerned. In cell 1, for example, "very concerned" taking action was 58.1%, for whole sample 53.3%. $58.1 \div 53.3 = 1.09$, or 9% greater. Significance of chi square: * $p < .05$, ** $p < .01$, and *** $p < .001$.

Row 2: Correlation calculated as Cramer's V.

The significant relationships between perceived risks and encouraging others to take action suggest the role of interpersonal communication. Other findings confirm this suggestion (Table 4). For

example, over half the respondents had reportedly obtained information about global climate change from family and friends, while a significant minority gained information from workshops and classes.

Table 4
Information Sources for Global Warming

<i>Medium</i>	<i>Percentage of Information from a Particular Source</i> N = 425*
Newspapers	84.9
Television	75.5
Magazines	60.2
Family and friends	57.9
Public radio	46.1
Environmental groups	42.6
Books	28.9
Workshops & classes	22.8
Internet	9.4

* Excludes those who said they had not heard of global warming or whose stage could not be determined.

Mass media, however, also seems to play a significant role in providing information about global climate change to the public. Survey respondents reported newspapers, television, and magazines as the dominant sources of information about global climate change (Table 4). This remained the case for respondents across the problem-solution path (Table 5). However, a higher proportion of people in the later stages of the path received their information from books and other interpersonal sources.

Some have suggested that mass media has dampened concern and action on global climate change by giving equal coverage to both proponents of the problem, and to skeptics and/or industry critics.⁹ However, our survey found that in almost all cases, exposure to media coverage of global climate change associated with greater concern and taking more actions (Table 6). Television, the second most important media source for acquiring information about global climate change,

⁹ See, e.g., Bob Burton & Sheldon Rampton, *Thinking Globally, Acting Vocally: The International Conspiracy to Overheat the Earth*, 4 PR Watch (1997) <<http://www.prwatchl.org/97-Q4/warming.html>>; Ross Gelbspan, *The Heat is On: The High Stakes Battle over Earth's Threatened Climate* (1997); David Helvarg, *Energy Companies Try 'Tobacco Approach' to Evidence of Global Warming: The Greenhouse Span*, *The Nation* (1996); Willett Kempton, *Lay Perspectives on Global Climate Change*, 1 *Global Env'tl. Change* 183 (1991).

was the only medium for which differences in indexes of concern and actions taken were not statistically significant.

Table 5
Percent Use of Media to Learn about Global Warming by Stage

<i>Percentage Use</i>	<i>Stage 1</i> Heard about	<i>Stage 2a</i> No problem	<i>Stage 2b</i> Definitely a problem	<i>Stage 3</i> Thought seriously	<i>Stage 4</i> Sure to act	Chi- square	p <
N*	107	51	145	35	87		
Newspapers	83.8%	91.8%	90.1%	88.2%	90.5%	.35	ns
Television	77.0	73.9	81.0	75.8	85.4	3.48	ns
Magazines	56.0	65.3	58.9	84.4	71.6	12.11	.01
Env'l groups	36.4	48.9	36.5	74.2	62.8	27.62	.001
Public radio	54.5	51.0	42.8	58.8	50.7	4.79	ns
Internet	6.1	12.5	8.4	12.5	15.0	4.90	ns
Books	1.6	32.6	25.7	54.3	40.5	18.06	.001
Family & friends	49.5	58.0	56.9	67.6	75.6	14.41	.01
W'shops & classes	14.3	26.5	21.1	38.2	33.8	25.08	.01
Ave. no. media	3.82	4.35	4.12	5.41	4.93	F 8.5	p< .001

* Excludes those who have not heard about global climate change or those whose stage could not be determined.

Table 6
Concern and Actions Taken by Selected Media Used

<i>Ave. score</i>	Newspapers		Television		Magazines		Public radio		Books	
	<i>used</i>	<i>not used</i>	<i>used</i>	<i>not used</i>	<i>used</i>	<i>not used</i>	<i>used</i>	<i>not used</i>	<i>used</i>	<i>not used</i>
N*	361	46	321	82	256	147	198	199	123	274
Concerns**	<u>2.50</u>	1.65	2.44	2.21	<u>2.59</u>	2.00	<u>2.59</u>	2.15	<u>2.90</u>	2.17
Actions	<u>2.16</u>	1.37	2.09	2.06	<u>2.19</u>	1.7	2.23	1.73	<u>2.76</u>	1.71

* Excludes those who said they had not heard of global warming or whose stage could not be determined.

** Underlined values denote significant difference at $p < .05$ between users and non-users of medium as a source of information about global climate change.

We conducted multivariate analyses to follow-up on the significant main effects of media use reported in Table 6 (Table 7). Use of books, magazines, and newspapers, but not television, was positively related to concern and action across most stages of the problem-solution path, but each medium tended to make more of a difference for individuals at

certain stages on the path. Differences between media users and non-users are represented in the table as index values to more clearly show this variation. Although the between-stage variation in index values seems large, only a few statistically significant (media x stage) interactions were found due to the small size of many of the subsamples. We also pursued the question of media effects via stepwise multiple regression by entering media use variables after controlling for stage. This allows us to separate media effects from potential confounding with stage due to stage differences in media use as well as sort out overlapping effects among different media. The regression showed that use of books and newspapers added significant increments to concern (newspaper: $\beta=.11$, $p<.01$) and taking action (books: $\beta=.18$, $p<.001$; newspapers: $\beta=.11$, $p<.01$).

Table 7
Indexed Differences in Awareness, Concern and Action by Stage & Media Used

<i>Dependent</i>	<i>Stage 1</i> Heard about	<i>Stage 2a</i> No problem	<i>Stage 2b</i> Definitely a problem	<i>Stage 3</i> Thought seriously	<i>Stage 4</i> Sure to act	F*	p <
Concern**							
books	276	145	99	165	115	1.96	ns
magazines	75	188	86	128	103	1.27	ns
newspapers	—	239	98	141	205	1.56	ns
television	157	183	76	99	131	1.56	ns
Action							
books	404	229	109	162	117	2.60	.05
magazines	175	141	104	118	103	.27	ns
newspapers	—	271	154	122	168	.24	ns
television	152	123	78	108	92	.67	ns

* F values are for media X stage interaction. Main effects previously reported in Table 6.

** An index of 100 indicates identical mean scores for media users and non-users, less than 100 indicates a lower mean for users than non-users, and over 100 indicates a higher mean for users. In 71 of 95 comparisons, index values are higher for media users.

Books appear to be the most significant source in alerting the public of a situation (Stage 1) and encouraging thoughts towards a solution (Stage 3). Interestingly, newspapers and books were the media with the most apparent influence on respondents who have decided global warming is not a problem (Stage 2a). Newspapers also had the most influence on respondents who are fairly sure how to solve the problem

(Stage 4). In addition, newspapers were the only medium making much difference in Stage 2b, which would seem to be a pivotal stage. Similarly, television appeared to make most of its difference in the early stages. An inference may be drawn from Table 7 that magazines, newspapers, and perhaps even television are helpful in getting people to acknowledge that problems exist (Stage 2b), but it is not clear how people are moving from acknowledging a problem (Stage 2b) to thinking about solutions (Stage 3).

Discussion and Implications

In the wake of the landmark agreement signed at Kyoto in December 1997, nations throughout the world currently consider policy responses that will reduce the emissions of the greenhouse gases thought to cause global climate change. In democratic nations, the public can theoretically play an important role in this process by providing pressure and support for, as well as consultation over, policy initiatives. Public understanding and support fuels the political will to enact the necessary laws to combat global environmental problems.¹⁰ Individual members of the public can also contribute to the solution by making individual changes in energy consumption habits.

An analysis of the relationships between media use and stage of the path generates a less pessimistic view of mass media's role in creating public understanding than a number of other researchers recognize.¹¹ The shortcomings of media coverage of global climate change and other environmental problems are well-documented. Coverage has tended to be superficial, episodic, and frequently presented in terms of scientific conflict and controversy. Despite this, use of certain media appears to enhance public awareness of causes, effects, and solutions in the level of concern about the consequences of global climate change, and even in the actions people have taken. We recognize that the evidence from this survey regarding media effects is correlational and needs to be interpreted with caution. Although conceivable that being

¹⁰ See Willett Kempton et al., *Environmental Values in American Culture* (1993).

¹¹ See, e.g., Jamie Haveri, *Comprehensiveness of Coverage of the 1988 Yellowstone Area Fires by Local and Regional Newspapers* (1991) (Master's Thesis, U. Washington); Kempton, *How the Public Views Climate*, 39 *Environment* 12 (1997); Kenneth Novic & Peter M. Sandman, *How Use of the Mass Media Affects Views on Solution to Environmental Problems*, 51 *Journalism Q.* 448 (1974).

aware, concerned, and active also encourages media use, it should also be borne in mind that numerous experimental studies have documented the ability of media to produce effects on knowledge, opinions, and behavioral intentions.¹²

Our more detailed analyses of the relationship between media use and actions also suggest that there is a relationship between media use and an individual's involvement in the democratic process. For example, users of print media (books, magazines, and newspapers) were significantly more likely to consider global climate change when voting than non-users ($p < .05$).

Our study has provided additional evidence regarding the importance of including public concerns and values when conceptualizing risk in a democratic society. Four sources of concern — species extinctions, heat waves, sea level rise, and social unrest — increased Seattle-area respondents' willingness to take action. The apparently high value placed on species survival echoes earlier findings about concern for ecological systems and species.¹³ However, it is likely that the types of risk that generate the most concern may vary from region to region. For example, sea level rise may be less salient for residents of inland regions than it was for Seattle residents.

Our findings clearly reinforce suggestions that policy initiatives are more likely to succeed if they address what the public, rather than some narrower, technical definition, sees as the problem. Therefore, further research into how policy makers, experts, and the public together could utilize the communications process to address the problem of global climate change would be fruitful.



¹² See, e.g., Jeffres W. Leo & Richard M Perloff, *Mass Media Effects* (1997).

¹³ See Timothy McDaniels et al., *Characterizing Perceptions of Ecological Risk*, 15 *Risk Anal.* 575 (1995).

