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MIT Center for Collective Intelligence

MIT Center for Collective Intelligence Working Paper No. 2015-02

June 2015

A shorter version of this paper was presented at the
Collective Intelligence 2015 Conference
Santa Clara, CA, May 31 – June 2, 2015

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Broad Participation in Online Problem Solving Can Influence Participants and Lead to Better Solutions: Evidence from the MIT Climate CoLab

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1. INTRODUCTION

The MIT Climate CoLab is crowdsourcing the problem of what humanity can do about global climate change. It thus seeks to harness the collective intelligence of thousands of people around the world in a form of very large-scale collective problem solving. Here, we offer the first comprehensive picture of the characteristics and behavior of the Climate CoLab community. Through online surveys and analysis of web activity, we find that the CoLab community is geographically diverse, highly educated, and highly experienced with climate issues. We also find that people who are outside the usual conversations about climate change are influenced by and contribute effectively to this collective problem solving effort. More specifically, members who don't have graduate education, don't have previous climate-related experience, and/or don't live in the United States report significantly higher levels of learning, belief change, and increase in climate-related activity as a result of their CoLab participation. And, more importantly, we find that these members—in addition to women—are at least as likely as others to submit high quality proposals.

1. The MIT Climate CoLab

The MIT Climate CoLab software platform (www.climatecolab.org) allows individuals and teams of people from all over the world to develop proposals for what we should do about climate change [Figure 1; Malone and Klein 2007, Introne, Laubacher and Malone 2011, Introne et al. 2011, Introne et al. 2013]. The proposals can include any ideas users have for technical, economic, political, or other changes that should be made, as well as discussions of how the changes could be

made, why they are feasible, and why they are desirable. Each proposal has an associated discussion forum in which other users can comment on the proposal, and all proposals have a wiki-like editing capability. In addition, the original creators of a proposal can decide whether to make the proposal open (i.e., editable by anyone, as in Wikipedia articles) or closed (i.e., editable only by members of the team selected by the original creators).

In order to keep the proposals grounded in the actual physical and economic reality we face, some proposals also include computer simulation models to calculate the potential impacts the proposals may have. All Climate CoLab proposals at the global level, for instance, required that users include with their proposals some quantitative assumptions about the emission reductions that would result from their proposed actions. Based on these assumptions, built-in computer simulation models automatically



Figure 1: Home page of the Climate CoLab

compute likely impacts of these emission reductions on things like temperature change, sea level rise, and various kinds of economic costs as shown in Figure 2 [Figure 2; Sewin et al. 2009, Sterman 2008, 2011, Sterman et al. 2012, 2013].

As of January 2015, more than 275,000 people from virtually every country in the world have visited the CoLab, over 33,000 have registered as members, and over 950 have contributed to at least one proposal. The primary driver of activity in the CoLab has been a series of four progressively more elaborate annual contests. The most recent annual contest included 18 different sub-contests on topics like how to reduce emissions in the transportation sector and how to change public attitudes about climate change. Some of these contests were run in conjunction with organizations such as the Union of Concerned Scientists (www.ucsusa.org) and Carbon War Room (www.carbonwarroom.com). Each contest had advisors and judges, including experts from organizations like NASA, the World Bank, MIT, and Stanford, as well as one former US Secretary of State (Shultz), two former US Congress members (Inglis and Sharp), and two former heads of state (Robinson and Bruntland).

After members submit proposals, judges select the most promising entries to be finalists and provide feedback on how they can be improved. After the finalists revise their proposals, the judges select the Judges' Choice Awards and the community votes for the Popular Choice Awards. The Climate CoLab offers a cash award to one Grand Prize winner and all the Popular and Judges' Choice winners receive opportunities to present their ideas to top experts and potential implementers, most recently at the Crowds & Climate Conference at MIT in November 2014.

2. METHODS

We designed a brief 16-item survey to explore how the CoLab has affected both the beliefs and behavior of registered members. In order to benchmark our sample, we started with two questions that had been asked in a recent well-known study of the American public's beliefs about climate change [Leiserowitz et al. 2014]. Next we asked nine questions about the



Figure 2: Model results for a proposal in the CoLab

respondents' attitudes and behaviors before and after joining the CoLab and, finally, five general demographic questions. A total of 12,713 e-mail invitations were sent to CoLab members who were registered as of July 2014. This is substantially less than the 33,000 current members because the community has grown rapidly in recent months. A total of 1,082 members responded to the survey, and we analyzed the data for all but the 60 respondents who answered three or fewer questions.

We also sent a brief additional survey to all finalists and winners of CoLab contests who did not respond to the initial survey in order to oversample these members on key questions of interest. An additional 17 members responded to this follow-up survey, bringing our total sample to 1,039 members, but our sample sizes for questions in the next sections vary from 945 to 1018 because not all respondents answered every question.

The behavior of all registered members on the Climate CoLab site is logged, including whether a person's proposal is selected as a finalist or a winner. Thus, using e-mail addresses, we were able to link the survey responses to the activity profiles for 990 of the 1,039 survey respondents.

3. RESULTS

3.1. Demographic Characteristics of CoLab Members

Respondents were 63% male, median age of 30-39 (Table 1), highly educated (58% attend or completed graduate or professional school, Table 2), and from all over the world (48% from outside the United States, Table 3).

Table 1: Age distribution of survey respondents

	N	%
20 or less	19	2.1
21-29	244	26.9
30-39	212	23.4
40-49	131	14.5
50-64	204	22.5
65 or more	96	10.6
TOTAL	888	

	N	%
High school or less	13	1.4
Attending college/university	94	9.9
Graduated from college/university	289	30.6
Attending graduate or professional school	109	11.5
Completed graduate or professional school	440	46.6
TOTAL	945	

Table 2: Education distribution of survey respondents

	N	%
North America	561	60.3
Europe	131	14.1
Latin America	58	6.2
Asia	129	13.9
Africa	51	5.5
TOTAL	930	

Table 3: Geographic distribution of survey respondents (Categories collapsed from original survey to show simpler summary)

3.2. Climate Change Beliefs and Activity of CoLab Members

While only 64% of Americans believe that global warming is happening and 60% of those think that it is at least partially caused by human activities [Leiserowitz et al. 2014], almost all of our respondents believe these things (97.2% and 97.5%, respectively, Table 4). Members were also highly engaged in activities related to climate change prior to joining the CoLab. Almost half (48.4%) of respondents reported that they were

previously engaged in activities related to climate change on at least a weekly basis (Table 5).

	2014 American population Survey	2014 Climate CoLab Survey
<i>Do you think that global warming is happening?</i>	%	%
Yes	64	97.2
No	19	1.3
Don't know	17	1.5
TOTAL	(1013)	(1018)
<i>Assuming global warming is happening, do you think it is ...</i>		
Caused mostly by human activities	52	63.9
Caused mostly by natural changes in the environment	32	0.9
None of the above because global warming isn't happening	8	0.0
Caused by both human activities and natural changes	8	33.6
Other	1	1.6
TOTAL	(1013)	(1018)

Table 4: Comparison of American population survey [Leiserowitz et al. 2014] and Climate CoLab survey results on beliefs about climate change

	N	%
Very large time commitment (at least weekly)	491	48.4
Moderate time commitment (at least monthly)	238	23.4
Occasional activity (less than monthly)	208	20.5

No activity	78	7.7
TOTAL	1015	

Table 5: Respondents' self reports on how much climate change activity they engaged in before joining

3.3. The Effects of Membership on Learning, Beliefs, and Activity on Climate Change Issues

Broadly speaking, respondents reported high levels of *learning* since joining the site (71% said they learned “A lot” or “Some” about climate change, Table 6), substantial changes in *beliefs* (40% said that they now think it is “more important for humans to take actions to reduce the bad effects of climate change,” Table 7), and substantial increases in *activity* related to climate change (46% reported that the CoLab has had a moderate or considerable influence, Table 8).

	N	%
A lot	138	14.3
Some	538	56.7
Very little	275	29.0
TOTAL	951	

Table 6: Respondents' self-reports on how much they learned about climate change since joining the CoLab

It is very important for humans to take actions to reduce the bad effects of climate change		
More likely / important	389	40.0
Less likely / important	42	4.3
No change in my beliefs	542	55.7
TOTAL	973	

Table 7: CoLab Respondents' Self-Reported Level of Change in Beliefs about Climate Change

	N	%
Considerable influence, I am much more involved	104	10.6

Moderate influence, I have done a few more things	346	35.4
No influence, my level of other activity is about the same	524	53.6
Negative influence, my level of other activity has decreased	3	0.3
TOTAL	977	

Table 8: Respondents’ self-reports of how their level of climate change related activity has changed since joining the CoLab

More interestingly, these changes were all greater for people who *did not have graduate school experience* ($t(815) = 2.86, p < .01; t(792) = 4.69, p < .01$; and $t(810) = 2.93, p < .01$, respectively), had *little or no previous involvement with climate issues* ($t(488) = 1.80, p < .10, t(446) = 5.33, p < .01, t(455) = 1.99, p < .05$, respectively), and who *were from outside the United States* ($t(832) = 5.55, p < .01, t(861) = 8.75, p < .01, t(868) = 9.60, p < .01$, respectively). For instance, while less than 40% of respondents who were previously very active said that they now think it is “more important for humans to take actions to reduce the bad effects of climate change,” over 70% of people who were not previously active said this (Figure 3).

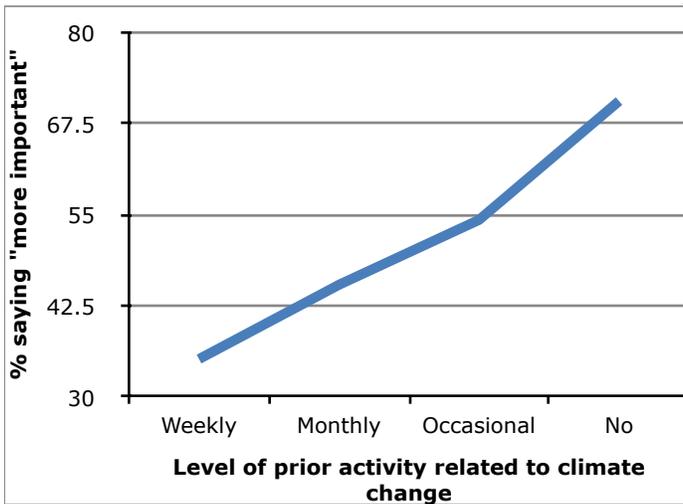


Figure 3: Self-reported increase in belief that humans need to change their behavior about climate change as a function of prior climate change-related activity

3.4. Characteristics of CoLab Contest Entrants and Finalists

We model a CoLab member’s decision to exert effort and submit a proposal to a CoLab contest as a function of the characteristics of that member. Specifically we estimate the equation:

$$\text{Pr (Submit Proposal)} = \beta_0 + \beta_1\text{Experience} + \beta_2\text{Education} + \beta_3\text{Gender} + \beta_4\text{American} + \varepsilon$$

where **Experience** is a dummy variable indicating whether a member was engaged in activities related to climate change on a weekly or monthly basis prior to joining the CoLab, **Education** indicates whether a member has graduate school experience, and **Gender** and **American** indicate whether members are male and from the United States, respectively. We find that the probability of submitting a proposal increases with prior climate-related experience ($\beta_1 = .094, SE = .029, t(887) = 3.29, p < .01$) being male ($\beta_3 = .094, SE = .027, t(887) = 3.54, p < .01$), and being from outside the United States ($\beta_4 = -.057, SE = .026, t(887) = -2.18, p < .05$). Education had no significant effect.

We also use the same variables to model the probability that a member was selected as a finalist, *conditional on having submitted a proposal*. There are far fewer finalists ($n = 54$) than proposal authors and several of these authors did not respond to all key questions of interest in the survey, so none of the variables in this model are found to have a significant effect on the probability that a proposal is selected as a finalist. However, we note that each of the regression coefficients is negative. This suggests that contest entrants without previous climate-related experience, without graduate school experience, who are women, and who are from outside of the United States are no less likely (and perhaps more likely) to become finalists. Specifically, the regression estimates that the probability of an author being selected as a finalist increases by 5.4% when the author is female (95% confidence interval: -9% to +20%), by 5.0% when the author has no graduate school experience (95% confidence interval: -8% to +18%), by 2.8% if the author has no previous climate-related experience (95% confidence interval: -13% to +19%), and by 4.7% if the author is not from the United States (95% confidence interval: -8% to +18).

4. CONCLUSION

The Climate CoLab is clearly succeeding in its goal of crowdsourcing the problem of what to do about climate change insofar as it has attracted a large, global community that is already highly educated and active with climate issues. Additionally, by encouraging broad participation from individuals not previously involved in climate issues, those without postgraduate education, and those from outside the U.S., the CoLab has fostered high levels of learning and attitude change. Finally, and perhaps most importantly, we find suggestive evidence that these users—as well as women—are at least as likely as others to submit high quality proposals. In other words, people who might otherwise be less likely to be included in conversations about climate issues are at least as likely to make useful contributions in this online community.

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