

# Influence of social ties to environmentalists on public climate change perceptions

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**An emerging body of research proposes that climate change concern is shaped by one's social ties and cultural milieu<sup>1-3</sup>. This work aligns with findings in the well-established field of social network analysis, whereby individuals are understood as being embedded in social networks, and network position can be used to predict attitudes<sup>4,5</sup>. Here we examine whether having ties to environmental movement organization members is correlated with climate change attitudes amongst the general public. We use data from a nationwide survey of the Canadian public to demonstrate that having social ties to environmental organization members increases the likelihood that an individual member of the public has a plan to deal with climate change. These findings reinforce the value of focusing on social context when examining climate change attitudes, and highlight the role that environmental organization members play in mobilizing climate change responses.**

To understand public support and resistance to climate change action, a large body of research has developed that looks at determinants of climate change attitudes. For the most part, this work examines how individual characteristics (such as knowledge<sup>6</sup>, individual values<sup>7</sup> and risk perceptions<sup>2,8</sup>) shape climate change attitudes and behaviours. However, recent research highlights the fact that climate change attitudes are not formed solely on the basis of individual characteristics. Attitudes are also influenced by an individual's cultural cognition of the issue<sup>1</sup>. Namely, people tend to form ideas about climate change that are consistent with their cultural context.

In this paper, we demonstrate that a mechanism through which this cultural cognition develops is interpersonal relationships, or social networks. Social networks are the relationships and interactions that exist between individuals, groups and societies<sup>4</sup>. Individual attitudes, cultural cognition and social networks are all interlinked—individuals tend to form values and attitudes that are consistent with those in their networks<sup>9</sup>, and tend to form social ties to others who share similar values<sup>10</sup>. Indeed, cultural discourses 'are deeply embedded within networked patterns of social relations. Culture and social relations empirically interpenetrate with and mutually condition one another so thoroughly that it is well-nigh impossible to conceive of the one without the other'<sup>11</sup>. Thus, to appreciate how cultural cognition on climate change develops, it is helpful to explore the social structures in which climate change attitudes are embedded.

Social network analysis has proved to be a powerful tool for examining social structures<sup>4</sup>. Researchers have demonstrated the influence of social ties across a range of domains—for example, network studies have helped to explain the way social ties shape economic disparities<sup>12</sup>, health outcomes<sup>13</sup> and educational achievement<sup>14</sup>. Looking at relationships, rather than just attributes of actors, allows us to see how people, organizations and ideas in

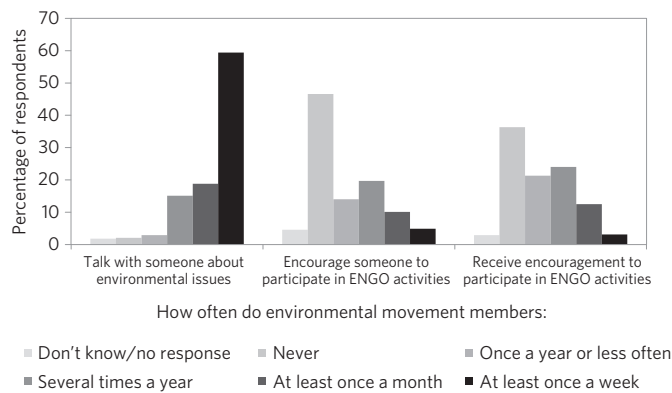
society are connected, and how these social structures influence attitudes and action.

In this study, we expand on this work to look at how climate change attitudes are shaped by network ties. We look specifically at the influence of ties to members of environmental non-governmental organizations (ENGOS). Social network research on ENGOS has tended to focus on recruitment into the environmental movement<sup>15</sup>, and has demonstrated that personal networks affect participation in collective action<sup>16</sup>. However, ENGOS also influence climate change discourse outside the environmental movement. By looking at ties that individuals in the general public have with ENGO members, we situate the development of attitudes on climate change within a social context that includes interactions with the environmental movement.

Our empirical evidence used to examine network effects comes from two data sets collected in Canada—a survey of ENGO members, and a survey of the Canadian general public. Data from the latter study (general public sample) are used to test our hypotheses. Data from the former are used to provide context for the general public study. We evaluate whether ties to ENGO members amongst non-ENGO members of the public are associated with a greater climate change concern, and with a greater propensity to plan for climate change. We examine two hypotheses: H1: Concern about climate change is positively associated with number of social network ties to ENGOS, net of ENGO membership and other socio-demographic control variables. H2: Having a personal plan to deal with climate change is positively associated with number of social network ties to ENGOS, net of ENGO membership and other socio-demographic control variables.

The theoretical contention of this paper is that an impact of environmental organizations is social influence by environmentalists on those outside of the movement. Environmental organizations do many things to try to influence public opinion, such as organize demonstrations, press releases, media campaigns and direct mailing. We argue that, in addition to these formal activities, environmentally relevant social influence also occurs through more informal interpersonal interaction. Some of the groups listed on the survey hold public events, whereas others do not. ENGO members become informed about environmental issues partly through internal communications (newsletters, e-mails, blogs, websites, and so on, linked to their ENGO), and partly through meetings. We are not theorizing that most ENGO-member–non-member interactions occur during public events. Rather, we are theorizing that ENGO members communicate about environmental issues with non-members in a variety of contexts, including discussions in the context of their everyday lives with co-workers, friends, family members, neighbours and so on. To support this claim, we first examine data on communication patterns from a study involving the members of nine major ENGOS

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**Figure 1 | Environmental movement members' communication patterns regarding environmental protection. (N=1,227).**

in Canada. Here we present findings regarding the extent to which environmentalists communicate with others about environmental issues, and encourage them to take action on environmental issues.

We asked environmental organization members whether they encourage others to protect the environment, and found that the majority of ENGO members (81%) advocate for environmental protection within their social networks. Environmentalists are not just quietly trying to protect the environment on their own. They are also—in overwhelming numbers—trying to influence others. Figure 1 shows findings about environmentalists' communication patterns with others about environmental issues. Here we show approximately 60% of environmentalists talk with someone about environmental issues at least once a week (including 12% who discuss environmental issues every day). These findings demonstrate that environmentalists talk very frequently about environmental issues with others, and have many opportunities to influence their networks. In terms of encouraging others to participate in ENGO activities, this occurs less often. Approximately 35% of environmentalists encourage someone to participate in ENGO activities at least several times a year. Figure 1 shows this pattern is similar for environmentalists receiving encouragement to participate in ENGO activities.

We have established that there is a considerable amount of communication and social pressure (in terms of encouragement to act) directed from environmentalists to others to protect the environment and participate in pro-environmental behaviours. However, we do not know whether this communication occurs within ENGO networks (preaching to the choir), or if it extends more broadly to those who are not involved in the environmental movement. To examine the influence of ENGO members on those outside the movement, we now turn to survey data from the general public in Canada.

We explored climate change concern amongst non-ENGO members of the Canadian public using data from a representative nationwide survey on environmental attitudes. In general, our research found that there is a high level of concern about climate change amongst non-ENGO members in Canada. Only 2% of our sample were 'not at all concerned' about climate change. The majority of our sample showed concern, varying from 'slightly concerned' (13%), to 'concerned' (28%), 'very concerned' (38%), and 'extremely concerned' (19%). In our analysis, therefore, 'climate change concern' involves variation in levels of concern within a largely concerned population.

To examine whether climate change concern is associated with ties to ENGO members, we undertook an ordered logistic regression analysis (Table 1, Model 1). We found no significant relationship between the number of ties an individual held to ENGOs and their level of climate change concern ( $\beta = -0.019, p = 0.7$ ). Looking at the

effects of the socio-demographic predictors, we found people with higher levels of education ( $\beta = 0.112, p \leq 0.001$ ), and people with more 'biocentric' values (in terms of their New Ecological Paradigm scores<sup>17</sup>;  $\beta = 1.319, p \leq 0.001$ ) expressed greater levels of concern about climate change. Based on this analysis, we reject our first hypothesis that concern about climate change is positively associated with number of social network ties to ENGOs (net of ENGO membership and other socio-demographic control variables).

We have established that the public is concerned about climate change, but the question remains, do they intend to act to mitigate climate change? Our study found that a majority of the Canadian general public plan to take personal actions to address climate change. When asked 'Do you personally plan to do anything in response to climate change?' 86% responded yes, and 14% said no. To provide context regarding these plans, we gathered qualitative data on the types of action respondents planned to take. Three thematic areas dominated participants' discussions about what they are doing, or plan to do, to deal with climate change. These were: transportation (54% of strategies), waste reduction (51%) and energy use (43%). Strategies were predominantly focused around mitigating climate change (by reducing emissions) rather than taking actions to adapt to a changing climate. Actions included behaviours such as buying a more fuel efficient car, walking instead of driving, recycling and improving home insulation. Many respondents weren't simply thinking about a single response or action, but were engaged in trying to make changes in a number of areas simultaneously. In the subsequent quantitative analyses we did not focus on these individual categories, but rather on whether the respondent had a plan in general to respond to climate change.

To look at the influence of social ties to ENGO members on climate change planning, we undertook a multiple logistic regression analysis (Table 1, Model 2). We found that individuals with a greater number of ENGO ties were more likely to have a plan to deal with climate change, net of the influence of other variables ( $\beta = 0.353, p \leq 0.001$ ). We also find that respondents with greater levels of concern about climate change ( $\beta = 0.963, p \leq 0.001$ ) were more likely to report having a climate change plan. Based on this analysis, we can accept our second hypothesis that having a personal plan to deal with climate change is positively associated with number of social network ties to ENGOs (net of ENGO membership and other socio-demographic control variables).

The major finding of this study is that among non-ENGO members of the general public, the number of ENGOs that one has ties to increases the likelihood that one has a personal plan to deal with climate change. Surprisingly, we did not find similar effects regarding concern about climate change. There are several potential reasons for these divergent outcomes. First, climate change concern and planning may develop in response to slightly different social processes. For example, people may hear about an issue through the media, but only internalize it and develop solutions through interactions with their networks<sup>18</sup>. Second, climate change concern and planning represent different types of 'frames', and thus the effects of network ties may operate differently. Concern is a diagnostic frame (focused on understanding the problem) whereas planning is a prognostic frame (focused on suggesting strategies or solutions)<sup>19</sup>. Research shows that different types of frames lead to different social movement outcomes<sup>19</sup>. Finally, climate change concern and planning may develop at different stages of a temporal trajectory, with individuals first becoming concerned about climate change, then later developing plans about how to tackle the issue. Our research may have missed earlier instances of network effects on climate change concern. We invite other scholars to explore these ideas further and, in particular, we welcome studies in regions where climate change concern is more polarized than in the Canadian context.

We have established that there is a considerable amount of communication and social pressure directed from

**Table 1 | Regression models from the Canadian general public sample (non-ENGO members) explaining climate change concern and whether an individual has a plan to deal with climate change.**

	Model 1: Concern about climate change	Model 2: Having a plan to deal with climate change
Concern about climate change	—	0.963*** (7.10)
Network ties to ENGOs	−0.019 (−0.36)	0.353*** (3.81)
New ecological paradigm scores	1.319*** (11.82)	0.375 (1.92)
Education	0.112*** (3.21)	0.067 (1.32)
Income	−0.000* (−2.01)	−0.000 (−0.66)
Gender (Female = 1)	0.289 (1.93)	−0.158 (−0.61)
Age	0.003 (0.53)	−0.027** (−2.66)
Youth (Under 30 = 1)	−0.363 (−1.41)	−0.083 (−0.17)

Models are the combined result of thirty multiple imputations. Reported values represent beta coefficients from: an ordered logistic regression model for Model 1; a logistic regression model for Model 2. *t* statistics are given in parentheses. \* $p \leq 0.05$ , \*\* $p \leq 0.01$ , \*\*\* $p \leq 0.001$ .  $N = 860$ .

**Table 2 | Descriptive statistics for the Canadian general public sample (non-ENGO members).**

Variables	Description	%	Min.	Max.	Mean	s.d.
Concern about the effects of climate change	Response to question: 'On a scale of 1 to 5 with 1 being 'Not concerned at all' and 5 being 'Extremely concerned', how concerned are you about the effects of climate change?'		1	5	3.58	1.00
Plan to deal with climate change	Response to question: 'Do you personally plan to do anything in response to climate change?'					
	Yes = 1 No = 0	86 14				
Network ties to ENGOs	Total number of ENGOs (from a list of 15 organizations) to which the respondent held personal ties		0	10	1.07	1.57
New Ecological Paradigm (NEP) scores	Index created from responses to seven statements about the natural environment. Lower scores = more anthropocentric value orientation; Higher scores = more biocentric value orientation		1.14	5	3.61	0.66
Education	Years of education		3.5	18	14.03	2.31
Income	Annual personal income*		0	145,000	43,400	32,587
Gender	Female = 1 Male = 0	61 39				
	Age	Age in years		19	90	47.54
Youth	Under 30 = 1 30 and older = 0	13 87				

\*Income in Canadian dollars.

environmentalists towards others to protect the environment. We suggest that this is the 'social influence' mechanism<sup>9</sup> through which environmental organization members help to shape the attitudes of the general public on climate change, although we intend to conduct more research to test this claim thoroughly. Recent developments in longitudinal network analysis using stochastic actor-based modelling<sup>20</sup> allow researchers to tease out social influence effects (where attitudes and behaviours are transmitted through networks)<sup>9</sup> from social selection processes (the tendency of individuals to form social ties to similar others)<sup>10</sup>. We intend to gather additional waves of survey data from our study population in the future to explain these mechanisms.

Finally, our findings suggest that individual-level activism plays an important role in shaping climate change perceptions. In recent years, formal environmental organizations have been implicated in the 'death of environmentalism' debate, which posits that increased bureaucratization and the narrowly focused efforts of many ENGOs has led to declining public concern on environmental issues<sup>21–23</sup>. Moreover, scholars have questioned the impact of environmentalism, arguing that ENGO members are increasingly serving as donors rather than engaged participants in the movement<sup>24</sup>. Contrary to the 'death of environmentalism' thesis, our research bolsters

arguments that ENGO members are still influencing environmental outcomes through interpersonal engagement<sup>25–27</sup>. Although it is surely the case that environmental organizations should continue to be involved at the policy level, and continue to work on pressuring governments for change—they should, or at least some organizations should, continue to foster the involvement and activism of individual members. In particular, events and activities that involve interactions with the general public should be encouraged.

## Methods

This paper draws on data from two social surveys: a survey of environmental organization (ENGO) members in Canada and a survey of the Canadian general public. The ENGO data came from a random sample of Canadian environmental organization members. Data were gathered using a mailed survey between July and November 2007 ( $N = 1,227$ ). The general public data came from a random sample of the Canadian population (stratified in proportion to the population by province). Data were gathered using a telephone survey between May and June 2007 ( $N = 1,007$ ). Further details of sampling methods can be found in the Supplementary Information.

**Environmental organization (ENGO) members.** We used the study of Canadian environmental organization members to explore the communication patterns of environmental movement members. The main national and large regional organizations in Canada participated in this survey. The participating

environmental groups were the Canadian Wildlife Federation, the David Suzuki Foundation, Équiterre, Greenpeace Canada, Ecojustice Canada, the Sierra Club of Canada, the Sierra Youth Coalition, the Wilderness Committee, and the World Wildlife Fund of Canada.

Survey participants were asked: 'Do you actively encourage friends, family, or co-workers to participate in helping to protect the environment?' Respondents were also asked about their frequency of communication with others about environmental issues through three related questions: 'About how often do you talk with someone about conservation and other environmental issues?', 'About how often do you encourage SOMEONE ELSE to participate in [ENGO NAME] activities, or contribute in some other way?', and 'About how often does someone encourage YOU to participate in [ENGO NAME] activities, or contribute in some other way?'. Responses were reported as descriptive statistics.

**Canadian general public.** We used the survey of the Canadian public to investigate how network ties to environmental organization members influence climate change concern and planning. Study hypotheses were tested using multivariate regression analysis<sup>28</sup>. An ordinal logistic regression model was used to examine the determinants of climate change concern, and a logistic regression model was used to examine whether respondents had a plan to deal with climate change. We chose to limit our analysis to members of the public who were not themselves members of an environmental organization, because we were interested in understanding how ENGO members shape the perceptions of non-ENGO members of the public (for non-ENGO members  $N=915$ ). Furthermore, as is frequently the case with social surveys, we had a number of survey non-responses and missing values. To address non-response biases, the data were weighted by province, gender and age, based on census information for the same period. To compensate for missing values in our data, we used a multiple imputation approach<sup>29</sup>. We did not include cases with imputed values for our dependent variables. Therefore, in our final analysis  $N=860$ . Full details of our weighting and multiple imputation strategies can be found in the Supplementary Information.

The two key dependent variables used in our analysis of the general public data set were concern about climate change, and whether the respondent had a plan to deal with climate change. We measured respondents concern about climate change by asking the question 'On a scale of 1 to 5 with 1 being 'Not concerned at all' and 5 being 'Extremely concerned', how concerned are you about the effects of climate change?', and treated responses as an ordinal variable. We measured whether respondents had a plan to deal with climate change by asking 'Do you personally plan to do anything in response to climate change?', and treated responses as a binary variable. We also gathered qualitative responses to this question, to provide some context regarding the sorts of plans interview subjects had developed.

The key explanatory variable of interest was the number network ties to ENGO members. Respondents were provided with a list of 15 environmental organizations, and for each were asked whether they knew a member of each group (see Supplementary Table 1 for a list of these organizations). Each response was coded 0 for no, and 1 for yes, and the total number of responses were summed, giving a measure of the number of different environmental groups to which each respondent held network ties. In the social network analysis literature, this measure is referred to as 'network range'<sup>30</sup>.

To account for the possible influence of an environmental value orientation on climate change concern and planning, we included a variable for New Ecological Paradigm scores<sup>17</sup>. This is a scale that sums responses to seven statements about environmental issues (see Supplementary Table 1). This measure has been extensively used and tested in past research in environmental sociology<sup>17</sup>. It assesses the extent to which people have a pro-environmental (biocentric) value orientation versus a more anthropocentric orientation. A set of socio-demographic-economic control variables were also included in the multivariate analyses: specifically education, income, gender, age and youth (a separate measure for youth was included to capture a possible generational difference in environmental attitudes). Descriptive statistics and coding for variables are outlined in Table 2.

Received 22 December 2013; accepted 5 March 2015;  
published online 6 April 2015

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## Acknowledgements

Research for this paper was financially supported by several research grants from the Social Sciences and Humanities Research Council of Canada. G.P. received a fellowship from the Pacific Institute of Climate Solutions while working on this study. We would like to thank M. Stoddart, J. Robinson, T. Malinick and A. Streilein for their assistance with the survey of environmental organization members; and also R. Wilkes, N. Guppy, M. Diani, D. Fisher, S. Sheppard and J. Broadbent for their helpful advice on this project, and earlier versions of this paper. We would like to thank Venture Market Research Corporation—and, in particular, B. Killip and I. Darling—for their assistance with the survey of the general public.

## Author contributions

D.B.T. contributed to all aspects of this paper, including study design, data collection, statistical analysis and writing. G.P. contributed to statistical analysis and writing.

## Additional information

Supplementary information is available in the online version of the paper. Reprints and permissions information is available online at [www.nature.com/reprints](http://www.nature.com/reprints). Correspondence and requests for materials should be addressed to D.B.T.

## Competing financial interests

The authors declare no competing financial interests.