Collective Action, Environmental Activism, and Air Quality Policy

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This articleattempts to respond to Ostrom's call for a behavioral model of collective action by generalizing the collective interest model of mass political action to explain citizen policy support and personal behavioral intentions in the context of air quality policy. The collective action problems inherent in air quality policy provide a critical research setting for testing hypotheses of the collective interest model. Key elements of the collective interest model—perceived risk, trust in policy elites, knowledge of the policy problem, and efficacy—are found to be directly, and positively, related to support of government policies and intentions to engage in personal behaviors that might improve air quality. The article discusses the implications for using the collective interest model as general behavioral theory of collective action.

In her presidential address to the American Political Science Association, Elinor Ostrom (1998) argues that social scientists have not yet developed a behavioral theory of collective action that is sufficiently grounded in empirical inquiry. Accomplishing this task requires two critical ingredients. First, the discipline needs a theoretical model that purports to explain collective-action behavior. Second, we need empirical examples of collective-action problems in which to test the hypotheses of the model. This study offers both of these ingredients in order to further develop the behavioral approach to collective action.

Our behavioral theory is adapted from the collective interest (CI) model used to explain protest behavior and social movement participation (Finkel and Muller 1998; Finkel, Muller, and Opp 1989; Gibson 1997; Klandermans 1984). Protest behavior entails a collective-action problem because the benefits of protest are non-excludable, and thus create incentives for individuals to free ride on the efforts of others. The CI model posits that people will participate in a collective endeavor when the expected value of participation is greater than the expected value of not participating. People judge the expected value by assessing the total value of the public good, the probability their participation will affect collective outcomes, and the selective benefits and costs of participation. We feel the CI model deserves more attention from students of collective action, and one aim of this study is to show how the model can be generalized to other types of collective-action problems.

Citizen environmental activism in air pollution policy provides an excellent laboratory for studying collective action behavior. We examine two dimensions of "air policy activism": 1) citizen support for more stringent air pollution policies and 2) expressed willingness to engage in costly personal behaviors that reduce air pollution. These dimensions are linked together psychologically, substantively, and theoretically. Following Ajzen and Fishbein's (1980) theory of reasoned action, we argue that people employ similar considerations to evaluate behaviors and to form attitudes towards policies that target those behaviors (see also Stern and Dietz 1994). Air pollution policy will only succeed if citizens support these policies in a variety of political venues, and are also willing to implement these policies by engaging in recommended conservation behaviors. Air policy activism entails a collective-action problem because the benefits of policy support and environmental behavior are non-excludable. Because individual decisions have only a small influence on collective air policy outcomes, the rational citizen has an incentive to free ride on the efforts of others.

One important goal of our analysis will be to establish the relevance of the CI model as an explanatory framework by linking core concepts of the model to central themes in public and environmental policy research. First, research in other policy subsystems has demonstrated the importance of policy elites in collective dilemmas like taxpaying, where elites not only make decisions that can affect outcomes, but also provide information and opinion cues to citizens (Scholz and Lubell 1998a,b; Zaller 1992). Accordingly, we will argue that trust in policy elites is a key component affecting citizens' evaluations of the expected value of air policy activism. Citizens who trust policy elites are more likely to believe that the policy subsystem will respond to their policy preferences and actions.

Second, research on civic participation has traditionally argued that minority populations face significant inequalities in access to resources for collective action (Brady, Verba, and Schlozman 1995), and several studies have shown minorities are less involved in environmental activism. However, research on environmental justice suggests that minority citizens often face greater environmental risks (Allen 2001; Bullard 1983; Cutter and Solecki 1996; U.S.

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General Accounting Office 1983) and are sometimes mobilized by active local citizens' groups, and therefore may have more motivation for collective action. The CI model can help refine theories of environmental justice by explicitly considering both the costs and benefits of minority activism. Integrating and analyzing these themes of contemporary political science scholarship is an important task for generalizing the CI model to other types of collective dilemmas.[1]

APPLYING THE COLLECTIVE INTEREST MODEL TO AIR POLICY ACTIVISM

The purpose of the CI model is to "incorporate the demand for the public good into an individual's utility calculus without violating the logic of free-riding," (Finkel, Muller, and Opp 1989: 886). The CI model argues people will participate in air policy activism when the subjective expected value of participation is positive. The expected value calculation depends on five factors: (1) the perceived value of the collective good produced by successful environmental action, (2) the increase in the probability of success if the individual participates, (3) the extent to which the actions of the group as a whole are likely to be successful, (4) the selective costs of participation, and (5) the selective benefits of participation. Following Olson (1971), selective benefits/costs are defined as the material, social, or psychological consequences of participation that accrue only to participating individuals. The basic relationships are summarized with the following equation:

$$\text{EV (Air Policy Activism)} = [(p_g * p_i) * V] - C + B$$

EV (Air Policy Activism) is the expected value of participation; p_g is the probability that the group will be successful (group efficacy); p_i is the marginal influence of the individual's contribution on the probability of success (personal influence); V is the value of the collective good; C is the selective cost of participation, and B is the selective benefit available from participation.

Finkel and Muller (1998) refer to the terms in braces (V, p_i, and p_g) as the "collective interest" variables. The collective interest variables incorporate the logic of free riding by acknowledging that the contribution of a single individual only raises the probability of successfully providing a public good by a small amount. From this perspective, how individuals perceive their own personal influence on collective outcomes is the critical value; *ceteris paribus*, the expected value of collective action increases as perceived personal influence (p_i) increases. Olson's (1971) logic of collective action suggests that p_i is close to zero in large groups; when an individual has little chance of influencing collective outcomes, it is rational to free ride on the efforts of others.

The CI model relies on two "useful fictions" (Finkel, Muller, and Opp 1989: 886) that distinguish it from a model of pure rational self-interest. First, people systematically overestimate their personal influence, and thus are more likely to engage in collective action than Olsonian logic would predict. Second, individuals consider the probability the group will succeed (p_g) when making decisions, because it is not rational to contribute to an ineffective group.

To support the group efficacy hypothesis, Finkel, Muller, and Opp's (1989) CI model appeals to a "unity" principle where the group will be successful only if every person cooperates. The unity principle plays a key theoretical role by linking individual and group actions. If the individual believes that group unity is necessary for success, then the individual expected value of collective action is *conditional* on the behavior of the other group members. It is clear that perceptions of group efficacy are an important empirical predictor in tests of the CI model, and also rational models of public participation (Godwin and Mitchell 1982).

However, given the empirical rarity of perfect unity, we feel the unity principle is a strong assumption. Thus, we prefer to link group efficacy to the notion of expected reciprocity—that is, individuals will participate in collective action if they believe others will reciprocate their efforts, and policy elites will translate group actions into policy outcomes. Note that our conceptualization of group efficacy, in linking individual and group action, plays a similar role to the unity principle, but is more consistent with rational choice theory. While rational choice theory may disagree in particular with the unity principal, rational choice analyses of repeated games are consistent with the idea of expected reciprocity (Axelrod 1984).

By placing primary emphasis on the individual's subjective beliefs about the costs and benefits of collective action, the CI model suggests an analytical strategy of developing hypotheses concerning what types of individual beliefs and attitudes, demographic characteristics, and situational/institutional variables will raise or lower the expected value of air policy activism. Table 1 lists the major empirical variables we use to operationalize the concepts of the CI model. The signs in parentheses indicate the expected direction of influence for each variable on the level of air policy activism.

COLLECTIVE BENEFITS OF AIR POLICY ACTIVISM

The expected value of air policy activism is an increasing function of the individual's valuation (V in the above equa-

[1] The CI model also provides a theoretical approach that can integrate the diverse findings about environmental activism explored in many disciplines. The majority of these studies ignore the logic of collective action, and hence theories that relate environmental activism to perceived environmental threats, socio-demographic characteristics, and environmental values do not provide an adequate behavioral explanation of why these variables matter (Elliott, Seldon, and Regens 1997; Jones and Dunlap 1992; Mohai 1985; Pelletier, Legault, and Tuson 1996; Rohrschneider 1990; Samdahl and Robertson 1989; Seguin, Pelletier, and Hunsley 1998). Even those studies that do consider collective action do not include a general model to predict individual behavior (Diekmann and Preisendörfer 1998; Everett and Peirce 1992; Gutierrez Karp 1996; Walsh and Warland 1983). By explicitly addressing the link between collective action and individual behavior, our adaptation of the CI model encompasses many of the variables from the laundry list considered by other environmental researchers and integrates them more coherently.

TABLE 1
VARIABLES HYPOTHESIZED TO INFLUENCE CITIZEN AIR POLICY ACTIVISM

Collective Interest Variables	(B) Selective Benefits	(C) Selective Costs
• (V) Government Priority (+) • (V) Perceived Risk (+) • (p_i) Outcome Influence (+) • (p_g) Expected Reciprocity (+) • (p_g) Government Trust (+) • (p_g) Industry Trust (+/–) • (p_g)Environmental Group Trust(+)	• At-Risk Family (+) • Environmental Values (+)	• Income (+) • Education (+) • Age (+) • Female (+) • Minority (+/–) • Environmental Knowledge (+)

tion) of the collective benefits of successful action. In the original formulation of the CI model (Finkel, Muller, and Opp 1989), the collective benefits of protest were positively related to citizen dissatisfaction with government policies. Hence, we measure the degree to which citizens are dissatisfied with the government's current priority on air pollution. However, for environmental policy, we argue that perceived risk of environmental degradation is an even more important measure of the expected collective benefits of environmental activism. When people believe environmental conditions pose substantial risks, they are more likely to support policies or take actions designed to reduce those risks. We hypothesize that citizens who believe the risk to human health posed by air pollution is very high will be more likely to participate in air policy activism.

This hypothesis explicitly links the CI model to the many other studies that demonstrate a positive correlation between perceptions of environmental threats and environmental behavior (Mohai 1985; Rohrschneider 1990; Samdahl and Robertson 1989; Seguin, Pelletier, and Hunsley 1998). The advantage of the CI model over frameworks that focus mainly on perceived risk is that it simultaneously considers the benefits of environmental actions along with perceived ability to make a difference and other selective costs.

PERCEIVED PERSONAL INFLUENCE, GROUP EFFICACY, AND POLICY ELITE TRUST

Perceived personal influence refers to the belief that individual participation in environmental activism will increase the probability of supplying the collective good. Finkel, Muller, and Opp (1989) find personal influence to be one of the strongest predictors of protest behavior. Mohai (1985) reports similar findings regarding environmental activism, where people who believe they have an ability to influence the political system have higher levels of environmental concern. Consistent with these findings, we hypothesize that people with higher levels of perceived personal influence (p_i) are more likely to participate in air policy activism. Our measure of personal influence emphasizes the classic social movement rhetoric of "you can make a difference," which is largely consistent with the traditional view on internal political efficacy that refers to beliefs about one's own competence to understand and effectively participate in politics (Niemi, Craig, and Mattei 1991).

Our adaptation of the CI model links group efficacy (p_g) to perceptions about the likely behavior of other citizens, and the trustworthiness of policy elites. The literature on the evolution of cooperation and social capital suggests that collective action is more likely to succeed when members of the group are playing reciprocal strategies across a network of social interactions (Axelrod 1984; Putnam 2000). The strategic nature of the situation creates a more realistic link between personal influence and group efficacy; individuals are more likely to make a difference when the group will respond to their actions. The survey directly asks whether respondents think others will reciprocate their own air policy activism.

The translation of citizen preferences and actions into policy outcomes depends heavily on the decisions and actions of policy elites. This is certainly the case in US air policy, where decisions by agencies like the Environmental Protection Agency, state agencies, elected officials, competing industry and environmental groups, and technical information from science all combine to determine policy outcomes. If a citizen trusts policy elites and believes they are competent, they are more likely to believe the policy subsystem will be responsive to their policy preferences and therefore group actions will be successful. It is important to note that our measures of air policy activism focus on attitudes and behaviors that operate in the context of existing government institutions, as opposed to protest behavior designed to overthrow distrusted governments. Hence, we expect people who trust the policy elites in the air policy subsystem will exhibit more air policy activism.[2]

[2] The reasoning parallels Scholz and Lubell (1998a, b), who show that trust in government is an important predictor of tax compliance, and also studies of external political efficacy, which emphasize the importance of government competence and responsiveness to broader forms of political participation (Niemi, Craig, and Mattei 1991).

However, industries often produce promotional material that highlights their efforts to reduce air pollution, and environmental groups are famous for their public relations campaigns. The cue-giving function of policy elites may lead to differences in how trust influences air policy activism. Because environmental groups and industry try to provide different messages about the severity of air pollution and the necessity of policy, the cue-giving hypothesis predicts that trust in environmental

SELECTIVE BENEFITS AND COSTS OF AIR POLICY ACTIVISM

Air policy activism may also provide material, social, and psychological selective benefits (B) and costs (C). Citizens with strong environmental values are more likely to receive psychological benefits from expressing their preferences through air policy activism, or enjoy the social benefits of participating with like-minded citizens (Olson 1971; Stern and Dietz 1994; Stern 2000). Because children are generally more susceptible to the negative effects of air pollution, citizens are more likely to receive material benefits from air policy activism if they belong to a household with children.[3]

The ability to pay the selective costs of air policy activism is related to the availability of the money, time, and civic skills necessary for effective participation (Brady, Verba, and Schlozman 1995). In turn, the availability of money, time, and civic skills is linked to the many demographic variables that are traditionally considered in research on environmental behavior. The general consensus in the literature is that better educated, higher income, younger, and female citizens are more likely to support environmental protection, and that pattern has remained relatively stable over time (Jones and Dunlap 1992; Samdahl and Robertson 1989). The costs of environmental activism should be lower for educated citizens because they have more civic skills. Environmentally knowledgeable citizens will also face lower costs of environmental activism, because they are better able to target their activities (Gale 1986). The flexible budget constraints of higher income individuals allow them to absorb the costs of environmental activism better. Younger people may have more time available to devote to environmental activism, or have stronger preferences for environmental quality (Jones and Dunlap 1992; Mohai and Twight 1987).[4] Despite changing attitudes towards gender roles, the persistent "household division of labor" still observed in modern societies may provide women more time to pursue environmental activism (South and Spitze 1994; Steel 1996).[5] All of these demographic variables fit neatly into the CI model because they reflect differences across individuals in their ability to pay the selective costs of environmental activism.

We also argue that race and ethnicity may be related to the selective costs of air policy activism. While the environmental literature has achieved some consensus on the other demographic variables, it is far from consensus on the influence of race (Mohai 1990). The CI model would predict that minority populations would engage in less environmental activism if they face higher selective costs of collective action due to institutionalized discrimination, deficits in human capital, or lack of access to political and cultural resources (Musick, Wilson, and Bynum 2000; Wilson 1991). This hypothesis is supported by some important studies of environmental activism (Dunlap and Jones 2002; Parker and McDonough 1999), as well as demographic analyses of national environmental organizations that reveal members and activists are more likely to be white, college educated, and high income individuals (Morrison and Dunlap 1986). Lubell et al. (2002) also show that local watershed groups are less likely to emerge in racially heterogeneous watersheds.

However, the environmental justice literature has fairly conclusively demonstrated that minority populations bear a disproportionate share of environmental risks (Hamilton 1995; Pastor, Sadd, and Hipp 2001; Ringquist 1999). Locally unwanted land uses and exposure to harmful pollutants are concentrated in politically disadvantaged, poor, and minority communities (Asch and Seneca 1978; Gelobter 1987; Gianessi, Peskin, and Wolff 1979; Ringquist 1997). These increased environmental risks may increase the selective and collective benefits of environmental activism for minority populations. The rise of Not-In-My-Backyard (NIMBY) groups in minority neighborhoods, which often link environmental problems to racial injustice, provides some evidence of collective action in the environmental arena. There are also a substantial number of public opinion studies showing that minority populations have the same or even higher level of environmental concern than whites, and that may be increasing over time (Jones 1998; Mohai 1990). The environmental justice perspective suggests that minorities may be more likely to engage in environmental activism.

RESEARCH DESIGN AND ANALYSIS: TEXAS AIR POLICY SURVEY

Two statewide telephone surveys of the general public were conducted with random samples of all Texas residents over the age of 18.[6] A random-digit dialing sampling frame

groups would lead to a higher level of air policy activism, while trust in industry would lower the level.

3 It is possible to think about at-risk families in terms of the V component of the CI model, because children with families may also free-ride on the provision of air quality by other citizens. While there is some conceptual ambiguity on this point, the important thing is for the empirical model not to double count that particular benefit.

4 Younger people may also have more "post-material values" and awareness of environmental issues, which would suggest they enjoy more benefits from environmental activism. However, the theoretical effect of age is not entirely clear. Older people may have more civic skills and experience with political action, therefore reducing the costs of environmental activism. These balancing factors may cause age to have no influence on levels of environmental activism. While the overall influence of age may be non-linear, the CI model furthers our conceptual understanding by explicitly considering the shifting balance of benefits and costs for both life-cycle (e.g., the idealism of the young) and cohort effects (e.g., generational increases in post-material values and technology reducing costs of participation).

5 Like with age, some researchers have argued women care more about the environment and hence would receive more benefits from environmental activism (Davidson and Freudenburg 1996). The CI model predicts women are more likely to participate regardless of whether gender is conceptualized as related to benefits or costs.

6 The 2001 survey conducted 870 interviews between August 10 and September 9, with a response rate of 43 percent. The 2003 survey conducted 665 interviews between August and October of 2003, with a response rate of 38 percent. The majority of survey participants are

was used for both. The first survey was conducted in August of 2001 and the second in August of 2003. Both surveys were designed to gather information on public attitudes toward air quality in the state, the perceived risks of not meeting air quality standards, awareness and acceptance of current and proposed policy solutions, and willingness to change behaviors to meet air quality standards as well as basic demographic information. For the purposes of this analysis, we merged the respondents from both waves to form a larger dataset.[7]

Variable Measurement

The dependent variables are two measures of air policy activism: *air policy support* and *behavioral intentions*. The *policy support* scale (alpha = .85) averages ten questions (7-point Likert scales;1 = strongly oppose, 7 = Strongly support) that measure respondent support for different air quality policies ranging from tax incentives to requiring low emission vehicles. The *behavioral intentions* scale (alpha = .72) averages five questions (11-point Likert scales; 0 = Not at all likely, 10 = Extremely likely) that measure the respondent's willingness to perform specific behaviors to reduce air pollution (including car pools, public transportation, reducing speed, maintaining vehicle better and telecommuting), plus one question on the broad willingness to take generic action (specific survey question wording is available from corresponding author).[8] The positive Pearson's correlation ($r = .49$; $p < .05$) between the two dependent variables empirically supports our contention that these dimensions of air policy activism are conceptually and psychologically linked.

Government priority is a 7-point Likert scale (1 = too high of a priority; 7 = too low of a priority) that asks whether or not the government places too low or too high of a priority on air pollution. Given the pro-environmental direction of the dependent variable, people who feel the government places too low a priority are more likely to engage in environmental activism, while those who feel the priority is too high will engage in less. *Local air pollution risk* (alpha = .89) averages four questions (11-point Likert scales; 0 = no risk; 11 = extreme risk) about perceptions of local risk from air pollution to human health, natural resources, economic activity, and overall community image. *Personal influence* (p_i) is a 4-point scale (1 = disagree, 4 = agree) measuring the extent to which the respondent believes their own actions influence the level of air pollution in their community. *Expected reciprocity* (p_g) is a 4-point scale (1= disagree, 4= agree) measuring the extent to which the respondent believes other people in the community will reciprocate the air policy activism of the respondent. The policy elite trust scales average questions that ask the respondent whether or not they trust (4-point Likert; 1 = never, 4 = most of the time) a particular set of groups to do what is right. *Industry trust* (alpha = .72) averages the trust items for the oil, electric utility, and automobile industry. *Environmental group trust* is a single-item measure that asks specifically about environmental groups. *Government trust* (alpha = .79) averages the trust items for the federal government, Texas Department of Transportation, Texas Commission on Environmental Quality, U.S. Environmental Protection Agency, and local elected officials.

We measure two selective benefit variables. The *environmental values* scale (alpha = .82) averages three questions measuring how worried the respondent is about threats to the global environment, with higher values indicating higher perceived threat. The environmental values scale taps a much broader level of environmental concern than the very specific questions about risk from local air pollution. The a*t-risk families* variable subtracts the total number of adults over 18 in the respondent's household from the total household size.

We measure a range of demographic variables that should affect the ability of the respondent to absorb the selective costs of air policy activism. *Income* is an 11-category measure of annual household income that is truncated at greater than $100,000. *Education* is a six-category scale ranging from elementary school to post-graduate degree. *Age* is self-reported. Gender is a dummy variable coded [1 = male, 0 = female]. Race is coded with five dummy variables: Asian, black, Hispanic, Native American, and other minority; Caucasian (non-Hispanic white) is the excluded category. *Environmental knowledge* is the proportion of correct answers to three questions about air pollution in Texas. The validity of the environmental knowledge variable is supported by a positive and significant correlation with education (Pearson's $r = .12$; $p < .05$).

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female (57.2 percent versus 42.8 percent male), with an average age of 43.75. In terms of educational attainment, 35.3 percent of respondents possess a college or post-graduate degree, and 8.0 percent have no high school diploma. The ethnicity of the participants is white non-Hispanic (60 percent), followed by Hispanic (15.3 percent), African American (7.1 percent), American Indian (2.7 percent), and Asian American (1.7 percent). Comparing our sample to the adult over 18 population in Texas (2000 U.S. Population Census) shows some coverage biases. Our sample is older in terms of average age (43.75 versus 32.3), and undercounts males (42.8 percent versus 49 percent), African Americans (7.1 percent versus 11.1 percent), Hispanics (15.3 percent versus 28.6 percent), and people without a high school degree or equivalent (8 percent versus 24 percent).

[7] Chow tests of structural differences between the two samples are insignificant in all but the restricted behavioral intentions model in Table 2, where the Chow test is barely significant at the .10 level (see Table 2 for exact statistics). Separate analyses of Wave 1 and Wave 2 for the behavioral intentions model shows that government trust is positive and significant in Wave 1 but insignificant in Wave 2.

[8] A potential limitation of this analysis is that we are not measuring actual activism steps taken, but a willingness to take such actions. This limitation does not significantly reduce the utility of our dependent variable. We argue that the calculus of collective action influences the formation air policy attitudes and intentions, and those attitudes and intentions are positively correlated enough with actual behaviors to insure the relevance of our analysis. Research in social psychology and environmental behavior supports this argument. Ajzen and Fishbein (1980) have convincingly demonstrated a link between attitudes, intentions, and behavioral acts. The attitude-behavior relationship appears to generalize to the case of environmental issues (Steel 1996; Weigel and Newman 1976; Stern 1992), although the strength of the relationship can be constrained by contextual factors such as high costs, or vary across different types of environmental behavior (Stern 2000; Tarrant and Cordell 1997).

OLS REGRESSION ANALYSIS: TESTING THE COLLECTIVE INTEREST MODEL

We use ordinary least squares (OLS) regression to test the CI model. The linear, additive functional form of OLS regression does not directly represent the mathematical structure of the CI model. Inconsistency between theoretical structure and empirical estimation is not new; Finkel (personal communication 2005) argues that no existing operationalization of the CI model strictly adheres to the structure of the theory. For example, Finkel and Muller (1998) attempt to capture the multiplicative structure of the CI model using a "mixed" log-log regression model, which logs the dependent and CI variables and introduces linear measures of selective costs and benefits. Both the introduction of regression slope coefficients, and the conflation of logged and linear terms, create a gap between the theory and empirical structure. Analyses of political participation sometimes use the alternative strategy of including a multiplicative scale that combines the relevant probability and collective benefit variables (Whiteley 1995).

The log-log variants and multiplicative strategies have empirical drawbacks. Regression estimates of logged and multiplicative variables are sensitive to rescaling (e.g., Finkel, Muller, and Opp 1989 and Whiteley 1995 rescale 4-point Likert scales to a 0-1 probability to measure personal influence). The multiplicative measures make it impossible to tell which variables are most important; is it the V term, or the p_i term? From a behavioral standpoint, it is important to know which attitudes/beliefs are the driving factors. We prefer OLS models because they avoid both pitfalls, and the simpler mathematical structure is more parsimonious. Nevertheless, we did estimate alternative mixed log-log and multiplicative scale models. None of these models performed better than OLS, and lead to parallel substantive conclusions (model results and more extensive discussion available from corresponding author).

Table 2 presents the results of the regression models using policy support and behavioral intentions as dependent variables. Income and at-risk families are insignificant in the models and also contribute a substantial amount of missing data; therefore we focus our discussion on the "restricted" models without those variables (columns 2 and 4). To avoid the evils of listwise deletion (King et al. 2001), we replaced all missing data on the attitude variables (non-attitude variables are not imputed) using Schafer's (1999) NORM software for multiple imputation under a normal model.[9]

All attitude measures, including the dependent variables, are linearly transformed to the [0,1] range (unlike the log and multiplicative models, this does not change the significance of the estimates). Hence, when multiplied by 100, the coefficients for the attitude variables are interpreted as the change in the expected value (expressed as an absolute percentage of the range of the dependent variable in the sample) of perceived effectiveness moving across the entire range of the explanatory variable. For example, if the expected value of policy support = .10 when perceived risk = 0 and the regression coefficient for local risk = .17, then ceteris paribus the expected value of policy support when perceived risk = 1 (maximum value) will be .27 (.10 +.17 = .27, or an absolute change of 17 percent). Another way to interpret the coefficients for the attitude variables is as the maximum possible effect of the variable.

The results support the expectations of the CI model. Of the collective interest variables (V, p_g, p_i), perceived environmental risk is the strongest predictor of both policy support (17 percent increase) and behavioral intentions (16 percent increase). The government priorities variable is in the right direction, but has a much smaller coefficient that is only significant in the behavioral intentions model. For environmental collective action problems, the main collective benefits are derived from reducing the risk of environmental harms. Environmental group trust also has a large positive effect, increasing policy support by 7 percent and behavioral intentions by 5 percent. Government trust increases the expected value of both dependent variables by about 8 percent, but is more stable in the policy support analysis. The empirical evidence suggests that air policy is characterized by both cue giving and baseline expectations about policy elite behavior, with environmental groups being the most important actor. Government actors play a more consistent role in policy support, where they arguably have a more direct influence on outcomes.

The potential cue-giving role of environmental groups is supported by historical data on air pollution and other environmental opinion studies. According to EPA measurements of criteria air pollutants, air quality has dramatically improved over the last twenty years (U.S. Environmental Protection Agency 2004a). At the same time, public concern for the environment and air pollution has been high and relatively stable over time (Dunlap and Jones 2002; Mohai and Bryant 1998). This suggests public concern and individual willingness to engage in air quality activism is at least partially independent of environmental deterioration. The effect of cue giving by environmental groups may explain the incongruence between air quality status and air quality concern.

Outcome influence is significant in both models, but the effect is stronger (12 percent versus 7 percent) for the behavioral intentions model. Expected reciprocity is also significant in both models, but the coefficients are smaller than for outcome influence in all cases. Both collective interest variables matter, but perceptions about the ability to make a difference are more important than expectations of reciprocity in influencing air policy activism, and similar to

[9] The multiple imputation procedure assumes all data in the imputation model is missing at random and jointly normally distributed. Based on these assumptions, the procedure uses iterative Markov Chain Monte Carlo procedures to produce multiple data sets, where missing data is replaced by simulated imputations. All statistical results reported in this paper combine the estimates from each of the imputed data sets into a single result using Rubin's (1987) rules for scalar estimands, which take uncertainty into account by using the variance both within and between imputed datasets to compute standard errors for the model coefficients.

TABLE 2
TESTING THE COLLECTIVE INTEREST MODEL

	Policy Support Unrestricted (N = 824)	Behavioral Intentions Restricted (N = 1326)	Unrestricted (N = 824)	Restricted (N = 1326)
Collective Interest Variables				
Government Priority	–.023 (.027)	–.031 (.022)	–.037 (.026)	–.043 (.023)^
Local Air Pollution Risk	.183 (.034)*	.170 (.026)*	.183 (.033)*	.162 (.026)*
Outcome Influence	.074 (.037)*	.065 (.031)*	.092 (.037)*	.122 (.030)*
Expected Reciprocity	.068 (.033)*	.056 (.026)*	.056 (.044)	.056 (.031)^
Environmental Group Trust	.098 (.030)*	.067 (.024)*	.072 (.030)*	.047 (.023)*
Industry Trust	–.064 (.042)	–.051 (.034)	–.001 (.041)	.016 (.035)
Government Trust	.013 (.052)	.083 (.043)*	.067 (.051)	.075 (.045)^
Selective Benefits				
Environmental Values	.301 (.038)*	.316 (.029)*	.155 (.037)*	.177 (.031)*
At-Risk Families	.010 (.059)	—	.005 (.006)	—
Selective Costs				
Income	.002 (.002)	—	.002 (.002)	—
Education	.009 (.005)	.012 (.004)*	–.004 (.005)	.002 (.003)
Age	.0002 (.0004)	.0001 (.0004)	.002 (.0005)*	.001 (.0003)*
Male	–.064 (.013)*	–.054 (.012)*	–.047 (.013)*	–.043 (.011)*
Asian	.085 (.048)^	.090 (.042)*	.125 (.047)*	.128 (.042)*
Black	.017 (.027)	.005 (.012)	.083 (.027)*	.063 (.022)*
Hispanic	.060 (.019)*	.068 (.016)*	.048 (.019)*	.052 (.017)*
Native American	.036 (.041)	.024 (.034)	.029 (.041)	–.007 (.034)
Other Minority	.022 (.020)	.026 (.017)	.027 (.020)	.029 (.016)^
Environmental Knowledge	.071 (.023)*	.075 (.018)*	.041 (.023)^	.042 (.018)*
Constant	.331 (.052)*	.315 (.040)*	.352 (.053)*	.375 (.045)*
Model Fit	F = 21.77* Adj R^2 = .324	F = 35.67* Adj R^2 = .308	F = 13.56* Adj R^2 = .225	F = 23.06* Adj R^2 = .221
Chow (F) Test of Structural Stability for Waves 1 and 2	F(20, 784) = 921	F(18, 1290) = 1.18	F (20, 784) = 1.37	F (18, 1290) = 1.66^

Entries in cells are unstandardized OLS regression coefficients, with standard errors in parentheses. Hypothesis tests of coefficient = 0, ^ $p < .10$, *$p < .05$.

Lubell (2002), personal influence seems to have the largest effect on behavior. Further research is required to untangle the links between these variables, for example, whether observations of a neighbor's air-friendly behavior or cues from policy elites leads to more positive beliefs about influencing outcomes.

Of the potential selective benefits, the expressive benefits of articulating environmental concern appear to be particularly powerful. The effect of environmental concern on policy support is the largest in the analysis (32 percent increase). The effect of environmental concern is smaller for behavioral intentions (17 percent increase), but still about equal in size to the risk perception coefficient. One possible interpretation of this finding is that the effect of environmental values decreases as one moves closer to actual behaviors that incur real costs.

With one notable exception, the demographic variables that reflect selective costs perform as expected in light of previous findings. Relative to respondents who score a zero on the environmental knowledge test, respondents with perfect scores have a 7 percent higher level of policy support and 4 percent higher level of behavioral intentions. Better-educated respondents report higher levels of policy support (1 percent increase for each education category), while older respondents have higher levels of behavioral intentions (1 percent increase for each ten years of age). Men are less likely to express both measures of air policy activism, with the negative effect slightly stronger for policy support (5 percent decrease versus 4 percent decrease for behavioral intentions). Counter to the CI model, but consistent with the environmental justice literature, our analysis finds that blacks (for behavioral intentions only), Asians, and Hispanics are significantly *more* likely to engage in air policy activism than whites. Even controlling for other demographic variables, this important result suggests there may be some meaningful differences between ethnic groups that override inequalities in access to collective-action resources. We will explore this question in the next section.

Four factors, important to the core concepts of the CI model, stand out as predictors of air policy activism: people who believe local risk is high (V), believe they can make a difference (p_i), trust environmental groups (p_g), and subscribe to environmental values (B) are more likely to express support for air policies, are more willing to take action. With the exception of race, the demographic factors that predict civic engagement in other social arenas have similar effects in the air policy subsystem. These findings, combined with previous analyses (Lubell 2002), clearly demonstrate the usefulness of the CI model as a behavioral theory of collective action.

There are some interesting differences between the policy support and behavioral intentions models. Both models explain a satisfactory amount of variance for survey data, but the policy support model has a higher adjusted $R^2 = .31$ versus the behavioral intentions model with adjusted $R^2 = .22$. Simply put, attitudes are easier to explain than behavioral intentions, most likely because unmeasured costs become more important. The greater stickiness of behavior presents a challenge to environmental policy, because actual environmental outcomes are the product of behavioral change, and policy effectiveness cannot be judged on the basis of attitude change alone. In the next section, we present supplementary analyses that explore the environmental justice implications of our findings about non-whites.

IMPLICATIONS FOR ENVIRONMENTAL JUSTICE

The regression analysis shows that Hispanics, African Americans, and Asian Americans are significantly more likely than whites to participate in air quality activism. The simple descriptive statistics categorized by race presented in Table 3 reinforce the findings: Asians have the highest level of policy support (.70), followed by Hispanics (.64), Native Americans (.63), African Americans (.63), and whites (.59). The same pattern occurs with behavioral intentions, with whites expressing lower willingness to engage in behaviors that mitigate air pollution than all minority groups. This result contradicts the CI model's (and more generic perspectives on public participation) usual prediction about minorities having higher selective costs of participation due to racial differences in access to human, social, and political capital. However, our data do show that African-American, Hispanic, and Native American respondents have significantly lower levels of income, education, and environmental knowledge. Thus, the higher levels of air policy activism among minorities present an interesting empirical challenge to the CI model.

As we discussed in the theory section, the environmental justice literature suggests that minorities face higher risks of environmental harm, thereby increasing the benefits of air policy activism. At least one aspect of this argument is clearly observable in our data: all of the minority respondents believe more than whites that air pollution poses a large risk to their local communities. This finding is consistent with Mohai and Bryant's (1998) argument that whites are generally more concerned about national environmental issues such as protection of land and wildlife habitat, whereas minority groups express greater concern over local environmental problems like air pollution and the built environment. The main link between the CI model and the environmental justice literature is that minorities' higher perceptions of local risk seem to motivate them to higher levels of air policy activism.

What accounts for this striking difference in risk perception? The environmental justice perspective would argue that the belief differences stem from objective differences in air quality between minority and non-minority neighborhoods. Robert Bullard's (1983) study of exposure to hazardous waste suggests that this general pattern of environmental injustice extends at least to large metropolitan areas in Texas. Bullard discovered that 21 of Houston's 25 hazardous waste facilities were located in predominantly minority communities. Similar discoveries have been made in Dallas (Bullard 1990), and in predominately Hispanic communities straddling the Texas-Mexico border (Colquette and Robertson 1991).

To see if differences exist between racial/ethnic groups on residential air quality, we matched several measures of objective air quality data from the survey years at the level of the respondent's Zip Code or county: EPA's Toxic Release Inventory (U.S. Environmental Protection Agency 2004b), the percentage of "bad" air quality days according to the EPA Air Quality Index (AQI), the average median AQI, the average maximum AQI, and county population density (U.S. Environmental Protection Agency 2004c). The TRI, measured in pounds per year, is the most comprehensive national source of information on air emissions from stationary sources. The AQI, which ranges from 0 to 500, reflects mobile sources and in Texas is largely determined by the more visible air pollutants like ground-level ozone and particulate matter. The AQI indicators are fairly highly correlated with population density, which is also a good predictor of asthma cases. We also create a relative risk index by normalizing all of the objective risk indicators to range between zero and one, and then taking the average (alpha = .65). We believe these measurements of objective risk do a good job of capturing the signals about air pollution that might be received by citizens in a low information environment.

Table 3 shows that the environmental justice hypothesis has some merit. African American and Native American respondents have significantly higher levels of objective risk than whites for all measures. With the exception of TRI air emissions, the same is true for Asians. However, the case is less clear for Hispanics, who experience about the same number of bad air quality days and also on average live in counties with the same level of urbanization as whites. Table 4 shows the correlations between perceived risk and the objective risk indicators. All of the AQI measures have a moderate, positive correlation with perceived risk. The TRI is least relevant, reflecting the importance of mobile sources of air pollution as drivers of citizen risk perceptions. In a regression analysis (full results available from authors) with

TABLE 3
DESCRIPTIVE STATISTICS BY RACE/ETHNICITY

	White (N = 750)		African American (N = 89)		Hispanic (N = 191)		Native American (N = 34)		Asian (N = 21)	
Dependent Variables										
Policy Support	.59	(.22)	.63	(.22)	.64	(.19)	.63	(.23)	.70	(.21)
Behavioral Intentions	.55	(.21)	.65	(.23)	.71	(.19)	.56	(.26)	.69	(.19)
Collective Interest Variables										
Government Priority	.38	(.32)	.54	(.37)	.45	(.33)	.53	(.39)	.44	(.30)
Local Air Pollution Risk	.42	(.22)	.57	(.24)	.53	(.25)	.52	(.28)	.52	(.19)
Outcome Influence	.43	(.23)	.47	(.28)	.42	(.23)	.54	(.25)	.44	(.22)
Expected Reciprocity	.50	(.24)	.47	(.28)	.36	(.24)	.47	(.23)	.48	(.25)
Environmental Group Trust	.45	(.25)	.45	(.27)	.54	(.27)	.49	(.33)	.55	(.22)
Industry Trust	.38	(.19)	.36	(.23)	.44	(.22)	.36	(.27)	.32	(.18)
Government Trust	.45	(.15)	.42	(.20)	.48	(.19)	.38	(.23)	.47	(.16)
Selective Benefits										
Environmental Values	.54	(.21)	.62	(.21)	.63	(.20)	.65	(.22)	.58	(.17)
At-Risk Families	.88	(1.10)	1.47	(1.41)	1.53	(1.29)	.92	(1.19)	1.39	(1.14)
Selective Costs										
Income	6.49	(3.08)	4.70	(2.49)	4.66	(2.49)	4.83	(2.81)	8.11	(2.56)
Education	4.04	(1.41)	3.43	(1.49)	3.32	(1.51)	3.32	(1.51)	4.76	(1.22)
Age	45.78	(15.79)	39.24	(12.76)	35.82	(13.19)	42.71	(14.45)	35.85	(10.05)
Environmental Knowledge	.46	(.29)	.39	(.29)	.41	(.28)	.33	(.30)	.43	(.31)
Objective Risk Indicators										
TRI Air Emissions (1000 Lbs)	60.63	(274.31)	209.12	(677.46)	58.03	(352.35)	99.01	(294.40)	3.85	(6.27)
Percent Bad AQI	30.30	(14.94)	37.60	(12.42)	30.46	(16.22)	35.38	(18.98)	35.57	(16.40)
Average Median AQI	41.14	(8.43)	44.45	(5.60)	44.32	(15.54)	44.45	(15.37)	45.87	(15.96)
Average Maximum AQI	168.27	(68.26)	198.68	(77.89)	186.54	(107.14)	201.18	(120.20)	190.4	(98.00)
County Population Density	795.69	(829.61)	1280.14	(960.20)	795.45	(782.37)	837.97	(931.11)	1035.56	(848.19)
Relative Risk Index	.19	(.16)	.28	(.17)	.21	(.17)	.21	(.20)	.24	(.17)

Notes: Entries are mean values for each variable, with standard deviations in parentheses. One-way ANOVA tests for all variables reject the null hypothesis that differences in means are jointly equal to zero.

perceived local risk as a dependent variable, the relative risk index is positive and significant, even controlling for the demographic measures of selective costs and benefits. However, the race variables remain significant and positive. The race variables retain the same significance when entering the relative risk index in the original policy support and behavioral intentions models, although the coefficients for the relative risk measure are not significant.

In summary, the environmental justice hypothesis is the most likely explanation for racial differences in air policy activism. The nexus between the CI model and environmental justice is a causal chain from racial inequities in objective risk, to differences in perceived risk, to more frequent expressions of air policy activism. However, because controlling for objective air conditions does not eliminate racial differences, the environmental justice hypothesis is only part of the story. This is especially true for Hispanic populations, who are not significantly different from white respondents on some important measures of objective risk. There must be some unmeasured quality of these minority populations that is being captured by the dummy variables.

We assume that the explanation does not rest with some inherent difference among racial groups in their preferences for environmental public goods. One possibility is that minority communities may be more responsive to cues from policy elites. Zaller (1992) suggests that respondents with lower levels of political awareness are more responsive to political messages, and the lower levels of environmental

TABLE 4
CORRELATIONS BETWEEN PERCEIVED RISK AND OBJECTIVE RISK INDICATORS

	Perceived Local Risk	TRI Air Emissions	Percent Bad AQI	Average Median AQI	Average Maximum AQI	County Population Density	Relative Risk Index
Perceived Local Risk	1.00						
TRI Air Emissions (Lbs)	.06*	1.00					
Percent Bad AQI	.23*	.05	1.00				
Average Median AQI	.18*	.02	.82*	1.00			
Average Maximum AQI	.18*	.13*	.66*	.71*	1.00		
County Population Density	.26*	.02	.76*	.49*	.25*	1.00	
Relative Risk Index	.29*	.19*	.95*	.81*	.70*	.02*	1.00

Cell entries are pairwise Pearson's correlation coefficients between row and column variables. *Reject null hypothesis of correlation = 0, $p < .05$.

knowledge (and education, except for Asians) exhibited by our minority respondents may reflect political awareness in the air policy subsystem. Demonstrating this point would require understanding how minority communities are exposed to political messages, especially given the fact that minorities are less likely to join mainstream environmental groups. There may also be cultural differences in how minority respondents respond to the task characteristics of surveys, leading them to answer questions in ways they believe will please the researcher. For example, Sanchez-Burks, Nisbett, and Ybarra (2000) find that Hispanics are more likely than Caucasians to use an interpersonal "relational style" designed to maintain social harmony. These alternative explanations of racial differences await further research.

CONCLUSION

The main contribution of this analysis is to demonstrate the usefulness of the CI model for understanding collective-action behavior in the context of air policy activism. Citizens who perceive a high risk from air pollution, trust environmental groups, have environmental values, and believe they can make a difference in air quality are more likely to support stricter air quality polices and express willingness to engage in air-friendly behaviors. As with other policy areas, understanding citizen behavior in the air policy subsystem requires examination of the links between citizens and policy elites. Citizen perceptions of the likely success of collective-action are driven in part by their trust in the policy elites who are crucial shapers of policy outcomes.

In addition to providing a substantive understanding of air policy activism, our analysis serves two broader epistemological goals. First, we are responding to Ostrom's (1998) call for a behavioral model of collective action by demonstrating the generalizability of the CI model. The CI model is not only useful for political protest; it can potentially be applied to any type of collective dilemma. The theory may apply differently depending on the structure of cooperative behavior, for example, the "contribution" framework of public goods versus the "restraint" framework of common-pool resources. Furthermore, the relevant benefits and costs of collective action may be derived from different factors in different situations (e.g., local risk from air pollution versus dissatisfaction with government policies). Second, the CI model provides a theoretical framework that knits together the many diverse studies in the environmental activism literature.

An important remaining task is to understand better the links between environmental justice and collective action. Clearly, environmental justice is less likely to be a normative problem if minority or other disadvantaged communities are able to engage in collective action to resist new or change existing harmful policies, or to simply clean up the environment in their own neighborhoods. The CI model improves our understanding of collective action in minority communities, and our analysis suggests that higher perceptions of risk from air pollution are a vital motivation for air policy activism among minorities. In turn, racial differences in perceived risk are at least partly attributable to differences in objective risk circumstances. However, objective risk circumstances do not offer a complete explanation, and therefore cannot reconcile the disagreements about race found in the environmental activism literature. The link between environmental justice and the CI model deserves further theoretical and empirical work, which must be done with a clear eye on the behavioral implications of the collective nature of environmental problems.

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