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ABSTRACT

The primary focus of this study is to conceptualize and to develop a series of empirical models testing various mechanisms that might explain how a public information campaign and the resulting media coverage led to changes in the level of importance the public ascribes to air quality. The expressed purpose of the public information campaign was to focus attention on the issue of air quality and to change: (1) the public’s perception of the importance of air quality; (2) attitudes about the social problem; and (3) specific behaviors, such as single occupancy driving. The issue advocates also sought to focus media attention on air quality, with the expectation that media coverage about the social problem would influence public concern. Therefore, public concern may change in response to the issue advocacy or the media coverage.

In each paper of this manuscript, a mechanism or moderator that may account for changes in issue importance was hypothesized. The first paper, entitled “The Mechanism of Transference: Projection and Conformity in the Agenda-Setting Process,” tests two competing theories (projection and conformity) that may mediate the relationship between media coverage and public concern. The second paper, entitled “Testing the Homogeneity Assumption of Public Opinion,” tests two competing theories (heterogeneity and homogeneity) that may moderate the relationship between media coverage and public concern. Finally, the third paper, entitled “Talk Back: The Impact of Social Communications on Media Coverage and Issue Importance,” tests the importance of a mechanism that permits a feedback loop from the public to the media, through social communications. In all cases, the mechanism or moderator was hypothesized at the aggregate or mass level, but the findings shed light on where researchers should look for individual-level effects.
MEDIATING AND MODERATING THE AGENDA-SETTING PROCESS: THREE STUDIES OF THE AIR QUALITY ISSUE

Introduction

Air pollution, specifically ground level ozone (GLO), is a significant social problem\(^1\) affecting most urban areas in the United States. As part of the Clean Air Act, as amended in 1990, the federal government mandated that states could lose federal funds and face significant fines if they fail to improve air quality in their metropolitan areas. Businesses seeking new locations for offices or factories may consider air quality to be an important factor when choosing potential sites. In addition to generic quality of life considerations, the loss of federal highway dollars resulting from not complying with the federal edict may result in longer commute times or federal mandates may limit future economic development in the area increasing the difficulty of expanding operations.

One of the cities that the U.S. Environmental Protection Agency (EPA) defines as a non-attainment zone, meaning that GLO production exceeds the federal standard (“ozone exceedance”), is Atlanta. The EPA expected that metropolitan areas such as Atlanta would work to reduce the number of ozone exceedances during the summer ozone season (May 1-September 30). In addition to demonstrating actual decreases in the rate of GLO, the EPA provided states with credits in their state improvement plans, if the cities enacted voluntary and verifiable reduction plans. The state of Georgia formed a public-private partnership named the Partnership for a Smog-free Georgia (PSG), which worked with Atlanta businesses and governments to reduce GLO levels. One of the mechanisms to increase public awareness of the problem and to change driving

\(^1\) As will be discussed in the Background Section and also in Appendix A, GLO may be a health hazard as well.
behaviors was the introduction of a public information campaign (PIC) announcing that the ozone levels were likely to exceed the federal standard (“ozone alert” or “smog alert”). This PIC was broadcast on television, radio, the local newspaper and on the electronic highway signs located throughout the city.

To measure the effectiveness of the PIC in Atlanta, researchers applied a commonly used survey technique in political campaigns, a tracking poll. Recent work by the researchers showed the effectiveness of the survey methodology and the public information campaign on changing behaviors. In *Public Opinion Quarterly*, Henry and Gordon (2001) demonstrated that political tracking poll methodology could be adapted to study issue attention or public policy-oriented questions. They found that the importance individuals ascribed to a policy issue, specifically personal concern about the importance of air quality, followed a pattern consistent with the issue attention cycle hypothesis (Downs, 1972). In response to the ozone alerts announcing that GLO levels were expected to exceed the federal standard, the public became more concerned about the issue. However, as the alerts continued, public interest in the issue waned.

While the public responded to the alerts by increasing their concern about air quality, did they change their behaviors? In the *Journal of Policy Analysis and Management*, Henry and Gordon (2003) studied the impact of the public information campaign on changing driving behaviors. The purpose of the PIC was two-fold, to raise awareness of the policy issue and to change driving behaviors. Henry and Gordon found that the PIC was successful in both endeavors. The residents of Atlanta became significantly more aware of the ozone problem as a result of the PIC, and subsequently changed their driving behaviors. However, these changes in driving behavior were moderated by employers’ participation in programs designed to lessen driving on days when ground level ozone was expected to exceed the federal standard. Henry and
Gordon found that, while public information campaigns may be successful in focusing attention and changing behaviors, institutional mediation seemed to be a necessary component of the process.

In the current manuscript, the study of this public information campaign is expanded to study the mechanisms that may lead to programmatic success. That is, we look at factors that may mediate or moderate the relationship between the public information campaign and measures of issue importance. In three separate papers, three possibilities are offered, each of which will be discussed in turn.

**Paper 1- The Mechanism of Transference: Projection and Conformity in the Agenda-Setting Process**

Behavioral scientists offer competing theories to explain how people form opinions or policy preferences. In this paper, two hypotheses are tested, projection and conformity. The tenets of the projection hypothesis suggest that, when asked about perceptions of societal level concerns, individuals are apt to project their personal beliefs onto the larger community. That is, individuals believe that their own preference is a good proxy for the broader community. The competing hypothesis is the conformity hypothesis. When asked about perceptions of personal concern, individuals may use their perception of the community’s concern (likely from the media) as a proxy for their own concern. The purpose of this paper is to model the effects of media coverage and public information campaign on two measures of issue salience to test which mechanism (projection or conformity) best explains how individuals form preferences.
Paper 2- Testing the Homogeneity Assumption of Public Opinion

Public opinion researchers sometimes presume that change in public preferences, if it occurs, is invariant across the population. The parallel publics hypothesis states that the public responds generally in a homogenous fashion to news items, focusing events or other types of system shocks. One model could account for all members of the public. There is a competing hypothesis, the heterogeneity hypothesis, which states that sub-groups respond in vastly different ways to the same system shock. This is not to say that some groups simply care more about an issue than other groups. If this were the extent of the heterogeneity, one could model all of the groups in the same analysis and account for group differences by permitting the model to estimate different coefficients for each group. Rather, a traditional linear model is not sufficient to account for how different groups respond to a system shock. According to this hypothesis, there are fundamentally different distributions at work. The purpose of this paper is to test these two competing theories and to determine if the relationship between media coverage and issue importance is moderated by group membership.

Paper 3- Talk Back: The Impact of Social Communications on Media Coverage and Issue Importance

Previous research found modest support for the idea that social communication mediated the relationship between media coverage and the importance the public places on an issue. Furthermore, prior research found modest support for the idea that changes in public concern impacted media coverage. In this study, we test the proposition that the public manages the level of media coverage as a result of conversations that take place in informal social networks. Social communications may be the mechanism connecting changes in public concern to changes in the level of
media concern about the issue. That is, not only do people talk about what they see on
the news, but the news may reflect what people discuss.

**Overview**

The next section begins by placing the study in context and describing the
elements common to all three papers. Following this discussion is the presentation of
the three papers. Each of the three papers has an introduction, literature review, data
and methods section, findings and a conclusion. The data and methods section may be
redundant and the reader is invited to skip those sections. Following the three papers is
a conclusion that draws together the findings from all of the papers.
Background

Issue Development

The mechanisms by which some conditions attract the interest and the attention of the public and subsequently become the focus of public policies have been intensely studied. The enactment of public policy or, at a minimum, the politicization of a social condition, generally necessitates a condition requiring a resolution and a concern on the part of the public both to believe that a problem exists and to desire a governmental solution. People deal with all types of conditions in their lives, which only become social problems after the public, or at least a broad or influential segment of the public, recognizes that a problem exists and espouses a need for a resolution (Cobb & Elder, 1971; Downs, 1972; Kingdon, 1995). Conditions can become problems through other means as well, such as the result of interest group activities or political decisions. When a critical mass of the public, the policy elites or the media defines a condition as being important and relevant, then the condition becomes a social problem (Hilgartner & Bosk, 1988). With substantial media coverage, the problem may become of even greater concern to the public and become a political issue (Dearing & Rogers, 1996), which results in politicians or issue advocates proposing public policies designed to resolve or to alleviate the problem. Then, a policy solution may be enacted into law, or more likely, other problems emerge to compete for and to usurp public concern (Zhu, 1992), displacing or eroding public concern about the former problem.

This function of the growth and the decline of public concern is entitled the issue attention cycle (Downs, 1972; Hilgartner & Bosk, 1988). The amount of media coverage an issue receives results in the issue coming to the fore of public consciousness. Agenda-setting research, as established in the seminal work of McCombs and Shaw (1972), focused on how the mass media altered the public concern about an issue,
which came to be called *issue salience*. The agenda-setting hypothesis suggests that changes in media coverage lead to changes in issue salience. The study of how issues became salient, or why some issues became salient when others failed to register with the mass public, became a predominant focus of political science and communications research.

*An Overview of Research on Public Interest and Agenda-Setting*

Anthony Downs (1972) hypothesized that issue salience rises and falls following a cyclical pattern, the issue attention cycle. Downs divided the issue attention cycle into five parts: a pre-problem baseline; the discovery of the problem; the realization of the potential policy impacts and costs; decline in the public interest; and the post-problem period. Prior to the problem realization, Downs held that public interest in an issue may be low or non-existent; negative social conditions may exist but the public has not paid attention. Once the public begins to focus on a problem, interest rises, issue importance increases, and the public becomes aware of the problem. [This initial stage of problem recognition has also been called emergence (Blumer, 1971).] The publics’ discovery of the problem forces political and policy elites to focus attention on the problem and to propose solutions. Once a solution is adopted or the public and the policy elites come to understand the high cost of resolving the problem, interest in the problem wanes. Interest may also diminish because people and journalists become bored with the issue when it loses its entertainment value, novelty or drama (Naples, 1979; Neuman, 1990). Eventually, the system shock subsides and concern about the social condition returns to its equilibrium level of concern, the post-problem period.

What causes a social problem to become salient to the public? Walter Lippmann (1922) proposed that the media structured and created the public’s conception of reality.
Since the public has little ability to interact with most news stories directly, the public forms its perception of the news from the stories that it reads in the newspapers or watches on television. After World War II, the rise of European fascism led researchers to study how elites, particularly charismatic elites, could manipulate public opinion through the media (Lazarsfeld & Merton, 1948). However, the critical mass of research concluded that the media did not have the ability to form and to manipulate public opinion (Lazarsfeld, Berelson, & Gaudet, 1948). In his study of the media’s coverage of foreign policy, Cohen (1963) observed that the press "may not be successful much of the time in telling people what to think, but it is stunningly successful in telling its readers what to think about. The world will look different to different people, depending on the map that is drawn for them by writers, editors, and publishers of the paper they read" (p. 13).

McCombs and Shaw (1972) named this idea that the media influences what people think about, agenda setting. Agenda setting is about connecting media inputs to political outputs (Dearing & Rogers, 1996; Kiousis, Bantimaroudis, & Ban, 1999), either by influencing voting behavior or by influencing the issue areas on which the public and

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2 Researchers found that media influence had limitations. First, the audience has the intentional or unintentional ability to screen out information that they do not like (Klapper, 1960; McGuire, 1985). The cognitive dissonance literature suggests that individuals, in the pursuit of maintaining cognitive consistency between their preferences, filter out information that they disagree with or that contradicts their pre-existing preferences (Festinger, 1957). Second, the public may pay limited attention to the news (MacKuen, 1984; Neuman, 1986). If the audience does not attend to the news, then what the media broadcasts cannot influence public concern. Third, both personal experience and interpersonal communications can undermine the media effects (Mutz, 1992). People generally believe what they personally see or what their friends and family tell them and may not trust the media to the same extent (see Paper 3). It may be that the public is more willing to trust the media to report what may be the important issues of the day, but may be less willing to accept the media’s viewpoint on the important issues of the day (Funkhouser, 1973a).
policy makers focus their attention. McCombs and Shaw demonstrated that media attention during the 1968 presidential election affected the voting behavior of a sample of Chapel Hill, NC adults. There was a significant rank order correlation between the issues the media discussed and what the public thought were the important issues of the day. Another stream of research connected media attention to issue salience. Researchers found that public concern about a topic such as the energy crisis increased with the amount of media coverage received about the subject (Iyengar, Peters, & Kinder, 1982; Iyengar, Peters, Kinder, & Krosnick, 1984; Kepplinger & Roth, 1979). For reviews of the agenda-setting literature, see Dearing and Rogers (1996), McCombs and Shaw (1993), Rogers and Dearing (1988) and Rogers, Dearing and Bregman (1993).

Defining Salience and Issue Importance

Salience may have a significant impact on public opinion, but what exactly is salience? Political scientists describe salience as the stated or implied relevance of the news content (Manheim, 1986) or the degree to which an issue is prominent among the policy elites or the public (Jacoby & Valentine, 1995). The advertising literature refers to salience in a number of different ways. Hansen (1972) used the term salience to denote ideas or concepts that are active in one’s cognitive structure. If one asked a consumer which brand first comes to mind in a particular product category, the salient product was the one mentioned. Sutherland and Sylvester (2000) refined the definition as the probability that a brand will be in the conscious mind at any given time. The purpose of advertising is to increase the probability that a consumer will think of a specific brand when the consumer is ready to make a purchase (Sutherland & Galloway, 1981). The

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3 People do not have to be actively engaged with the news to be influenced by it; to a large extent people may get the news with only cursory attention.
agenda-setting literature conceptualizes salience in a similar fashion. Dearing and Rogers (1996) defined salience as “the degree to which an issue on the agenda is perceived as relatively important” (p. 8). However, Edelstein (1993), in a review of the literature, found the term salience used to mean, in addition to other usages, “important” (Bowers, 1977), or “concerned about” (Weaver, 1980); or “think about” (Gilbert, Eyal, McCombs, & Nicholas, 1980).

In addition to differing definitions of salience, there are three broad types of salience. First, the most common form of salience is personal salience. Personal salience is conceptualized as the expressed concern an individual has about the importance of an issue. Personal salience is associated closely with the work of Lippmann (1922), who theorized that the media transmits a view of the world that the public themselves cannot experience directly. The media presents the individual with its view of reality and the importance of certain social problems that the media believes is important. Individuals learn about the important issues from the media and change their level of issue salience accordingly. This connection between media coverage and issue salience is closest to the original conceptualization of the agenda-setting hypothesis (McCombs & Shaw, 1972), and became the basis for most agenda-setting studies. In

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4 In the psychology literature, there are two streams of thought about salience. According to Fishbein and Ajzen (1975) salience is about accessibility, that is, something that is salient in one’s mind determines what one’s attitude will be. They believe that attitudes are a function of beliefs that may be accessible or salient at that moment. To change attitudes one must change beliefs, which must be accessible or salient at that point of attitude change. Fazio (1986) defined salience as object-evaluation association, that is, the strength of association between two separate attitude objects and how thinking about one object primes one to think about another object. Salience in this literature is about attitude formation and strength. The strength of association or, the speed of retrieval, between the object and the evaluand, defines the degree of accessibility. If the attitude is highly accessible there is an automatic activation between the object and the evaluand (Bargh, 1982, 1984, 1989; Fazio, 1986; Higgins & Bargh, 1987). The more direct experience someone has with an attitude object, the greater the speed of retrieval (Fazio, Chen, McDonel, & Sherman, 1982).
the aggregate, personal salience is generally considered to be the measure of the importance of a social problem at the community or national level.

Second, community salience is the level of concern that an individual believes is held by the community regarding an issue. Since this salience derives from a perception of community concerns, it is referred to as perceived community salience. However, few agenda-setting studies used this type of salience question (see Takeshita, 1993; Weaver, Graber, McCombs, & Eyal, 1981). Mutz and Soss (1997) studied the effects of a newspaper as it tried to change perceptions of community, but not necessarily personal, concern about low-cost housing. Perceived community salience is associated mostly with the work of Robert Park (1925). Park theorized about how the media structured the views that individuals had about the community in which they lived. His conceptualization of media impact suggested that the media determined what issues individuals think concerned the community at large (Mutz, 1993, 1994) not necessarily what issues were important to an individual. Conformity theories (Asch, 1951, 1955; Sherif, 1935), which suggested that individuals may conform to perceived community values or seek to validate personal preferences to perceived societal preferences (Festinger, 1954), reinforced Park’s theory. In the aggregate, perceived community salience is a measure of the social interactions in a community or nation in that the perceptions are likely to be formed from the media or social discourse.

Third, the topics that people discuss in their interpersonal communications are called interpersonal salience. People may discuss political or policy-oriented issues that are the subject of current media coverage, or people may discuss other topics, including talking about what people observe in their local communities (McLeod, Becker, & Byrnes, 1974). Not surprisingly, interpersonal discussions based on media reports tend to enhance the agenda-setting effect of the media, while discussions focusing on other
topics tend to interfere with the media effect (Lassorsa & Wanta, 1990; Wanta & Wu, 1992). In the aggregate, interpersonal communications is a measure of social communications.

**Operationalizing Salience**

In addition to the number of ways researchers conceptualize salience, and the number of types of salience, there are also a number of ways to operationalize salience. The traditional method of asking a salience question is to use a question such as the Gallup Survey’s Most Important Problem question; “What do you think is the most important problem facing this country today?” Researchers typically use the percent of respondents who name a particular problem, or a particular problem category, as the measure of the social problem. Furthermore, the problems mentioned are typically national in scale. Researchers demonstrated that top-of-the-head responses of public concern followed the media coverage of a topic when one regressed issue salience measures on counts of newspaper (McCombs & Zhu, 1995) or television (Behr & Iyengar, 1985) stories. The original McCombs and Shaw (1972) article used a similar question, but compared the rank order of issues identified in news magazines to the rank order of issues identified by respondents. This non-parametric test is fairly common in agenda-setting research (for discussions of or examples of agenda-setting articles using rank ordering, see Brosius & Kepplinger, 1990, 1992; Kosicki, 1993; Shaw & Martin, 1992; Shaw, McCombs, Weaver, & Hamm, 1999).

Another question format used by researchers, such as Brosius and Weimann’s (1996) study of early recognizers, asks respondents to rate an issue on a scale of relative importance. A typical question is; “On a scale of 1 to 10, where 1 means not at all concerned and 10 means very concerned, how personally concerned are you about
“______?” (see Mutz & Soss, 1997). One of the strengths of issue scales is that issues of relatively low salience would not be included on lists of most important problems, since by definition the issues are not salient to the public. Therefore, researchers using lists of most important problems are limited to studying issues that reached the threshold of significant public attention. While one could analyze a problem once it emerges as a significant issue and reaches a threshold point of national interest, there are few opportunities to study the change from the pre-problem baseline to the discovery of the problem period in depth. While there are problems with issue scales, such as social desirability leading individuals to rate most issues as at least somewhat important, the use of scales permit one to study the agenda-setting process and make inferences about the issue attention cycle. Because these questions tend to ask individuals how important or concerned one is with an issue, we prefer the term issue importance to issue salience.

**Public Information Campaigns**

So far, we discussed the impact of media coverage on public concern as changing the salience of a social problem rather than changing an opinion about a policy alternative. However, the media may play a second function.° Researchers have long noted that salience is a significant component of public opinion (Czudnowski, 1968; Jennings & Zeigler, 1970; Lane & Sears, 1964; Verba & Nie, 1972). As issues become more salient to the public, political leaders find it necessary to act (Monroe, 1998).

° It should be noted that researchers attribute a more active role to the media. More recent agenda-setting work focused on the second level of agenda setting (Jasperson, Shah, Watts, Faber, & Fan, 1998; Lopez-Escobar, Llamas, McCombs, & Lennon, 1998; McCombs, Lopez-Escobar, & Llamas, 2000). Second level agenda-setting research looks at the attributes of the news story and how certain attributes prime individuals to focus on certain aspects of the story and may actually shape what people think, whereas traditional agenda-setting research focused on the media telling people what to think about.
Public officials and policy elites have three means of learning about issues of concern to the public; through talking to people, reading about or commissioning public opinion polls or following the media stories. While informal or formal conversations or public opinion surveys provide significant information, officials and elites generally rely on media coverage to be the indicator of public concern on a daily basis and may be the barometer officials use to determine which policy concerns should be the central focus of the political arena (Linsky, 1986; Linsky, Moore, O'Donnell, & Whitman, 1986).

If the media shapes what people believe are the important issues of the day (McCombs & Shaw, 1972) and shapes the conversations that people have with their colleagues family and friends (Chaffee & Mutz, 1988), and policy elites believe that media coverage, the subject of many interpersonal discussions, reflects the will of the public, public policy may change as a result of the media coverage affecting issue importance. Furthermore, changing issue importance may lead to changes in perceptions of community concern, social norms, or impact the individual audience members' social reality (McLeod et al., 1974), any of which may lead indirectly to changes in public opinion. Page and Shapiro (1983; 1992) and Page, Shapiro and Dempsey (1987) showed that over an extended period, more often than not, public policy changed in the direction of public opinion.

If the media has the ability to influence issue importance or what people think about and public concern can impact the policy areas to which elected officials must respond, then it is rational for policy makers and issue advocates to attempt to influence media coverage and public opinion directly. Interest groups and policy entrepreneurs attempt to couple their policy preferences to existing social conditions (Kingdon, 1995). By elaborating on and amplifying the social conditions indirectly through the media coverage and directly to the public, issue advocates aim ultimately to impact the policy
agenda. If successful, public agencies and issue advocates could use the enhanced public attention on their issue area to propose new laws or regulations (Yanovitzky & Bennett, 1999), seek increased agency funding (Peters & Hogwood, 1985), change public behaviors (Blomberg, 1992; Hingson, 1993; Lund, Pollner, & Williams, 1987; Stewart & Voas, 1994; Weinick & Beauregard, 1997) or talk to other elites (Dearing & Rogers, 1996). One means for issue advocates to promote issue preferences and to focus public attention is through the use of media advocacy (Wallack, 1981). One important means of media advocacy used by interest groups and issue advocates, including public agencies, is a public information campaign (Maibach & Flora, 1993).

Public information campaigns (PIC) are a form of advertising sponsored by a governmental or non-governmental organizations designed to promote a particular cause or socially desirable activity among the public (Garbett, 1981; Henry & Gordon, 2003; Rogers & Storey, 1987; Weiss & Tschirhart, 1994). Public information campaigns are systematic attempts by governmental bodies or policy advocates to influence the public by raising concern about a social problem by educating the public or changing public beliefs, attitudes, or behaviors. As Weiss and Tschirhart (1994) noted, these types of policy instruments are “unusual in that they attempt to produce policy results without altering incentives or authority systems” (pg. 83). While a public information campaign is a well-established tool to promote a social cause, their usefulness has been debated for decades (Bauer, 1964; Hyman & Sheatley, 1947; Lau, Kane, Berry, Ware, & Roy, 1980; Mendelsohn, 1973; Robertson, 1976; Rothschild, 1979; Salmon, 1990; Singer, Rogers, & Glassman, 1991; Wallack, 1981).

There are both practical and methodological problems associated with the potential efficacy of a public information campaign. First, PICs often rely on donated broadcast time (Vingilis & Coultes, 1990), limiting their ability to target the intended
audience. Second, PICs that are not well-conceived have a high likelihood of failure (Weiss & Tschirhart, 1994). Finally, even if the PIC is broadcast frequently and is well-conceived, there are practical difficulties in measuring the effectiveness of a PIC since the issue advocates have little control over the distribution of the PIC.

For a PIC to direct attention and to influence the target audience, the PIC should be substantive and used in a way that will have the greatest likelihood of meeting the policy objective. Weiss and Tschirhart (1994 p.85), in their review of over 100 public information campaigns, stated that a PIC had the greatest probability of success if it adhered to four rules. A PIC should:

1. capture the attention of the right audience;
2. deliver a credible message that audiences understand;
3. deliver a message that influences the beliefs or understanding of the audience;

and

4. create social contexts that lead toward desired outcomes.

One example of a public information campaign that met these standards was the efforts by a public-private partnership, the Partnership for a Smog-free Georgia (PSG)\(^6\) to curb the ground level ozone (GLO) problem in Atlanta. The U.S. Environmental Protection Agency (EPA) defines Atlanta as a non-attainment zone, meaning that ground level ozone production\(^7\) exceeds the federal standard (“ozone exceedance”). PSG was

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\(^6\) The program was originally known as the Voluntary Ozone Action Program (VOAP) and has since merged into the Clean Air Campaign (CAC).

\(^7\) Ground level ozone, chemically known as O\(_3\), is an odorless, colorless gas that is the major component of what is commonly known as smog. GLO results from a chemical reaction of nitrogen dioxide and volatile organic compounds (VOC), which are derived from hydrocarbons in automobile exhaust or vapors from chemical agents. Heated in the summertime sun, this chemical reaction produces ground level ozone. This ozone is the same chemical compound as upper atmosphere ozone, which is beneficial in the atmosphere but potentially detrimental at ground-level.
founded to direct a voluntary program to change driving behaviors, including promoting carpooling, telecommuting and flex hours.\textsuperscript{8} If PSG could demonstrate that residents were reducing their GLO production on ozone alert days, the EPA would grant Georgia credit for estimated reductions in their State Implementation Plans. Former Governor Zell Miller signed an executive order in December 1997, mandating that all state agencies form a partnership with PSG and limit single-occupancy driving on smog days. Local and federal agencies voluntarily complied with the mandate to varying degrees. PSG also made a concerted effort to enlist private partners in the program (e.g., Delta Airlines, Home Depot and UPS).

PSG used a multi-channel, multi-media method to reach the intended audience. Each day, scientists at the Georgia Institute of Technology, under contract from the Environmental Protection Division of Georgia’s Department of Natural Resources (EPD), modeled the subsequent day’s projected GLO level. If the models predicted that GLO levels would exceed the federal standard, a smog alert would be called by noon of the preceding day. On ozone exceedance days, weathercasters informed the public of the potentially high ozone levels during the morning weather television and radio segments, the \textit{Atlanta Journal-Constitution} placed an indicator of the ozone alert on its banner, and on the electronic highway signs encircling Atlanta and in faxes and e-mails both the afternoon before the alert and on the alert day itself, PSG flashed messages and suggested means to change behaviors. The innovative and repeated public information campaign broadcast by PSG met the conditions laid out in the work of Weiss and Tschirhart (1994) as follows:

\textsuperscript{8} While the major focus was on driving behaviors, PSG made efforts to change other types of behaviors including limiting weekday lawn maintenance, barbequing, and the use of industrial solvents, all of which contribute to GLO.
* Capture the attention of the right audience.

Ozone or smog action days were correctly identified by people who either did not work outside of the house or who did not own an automobile 25% of the time, by individuals who were either self-employed or were employed by a private firm 40% of the time and by government employees, for whom most messages were directed during the first year of the program, over 50% of the time (Henry & Gordon, 2003). Commuters, the primary target of the PIC, commuters, were almost twice as likely to report a smog alert on a day when one was called.

* Deliver a credible message that audiences understand.

Simple messages that people can comprehend are critical for one to internalize the message and to make appropriate changes. PSG’s messages let individuals know of a smog alert, and suggested easily understood alternatives such as “Carpool Tomorrow” or “Combine Your Trips.” The public was already primed to accept that driving cars causes air pollution and that air pollution has potentially harmful health effects; this was not a new or unbelievable connection. According to a summer 1998 survey conducted by Georgia State University, almost 80% of the population knew that cars were a primary cause of ground level ozone; and 90% of the public agreed with the statement, “smog has been linked to serious health problems” (Henry & Gordon, 2000).

* Deliver a message that influences the beliefs or understanding of the audience.

Influence is defined by providing information and increasing salience and attention. In the spring of 1998, prior to the first full ozone season, awareness of ozone was almost non-existent. By the end of the ozone season, awareness rose from about 1.3 points to 1.7 points on a four-point scale (see Figure 1), where 1 means that the
public heard almost nothing about ozone/smog and where 4 means that the public heard a great deal. In the second season, awareness stood at 1.8 points at the beginning of the season and rose to 2.3 points by the summer. 

![Bar graph showing quarterly trends in awareness](image)

*Figure 1. Quarterly Trends in the Awareness of Ozone or Smog*

Create social contexts that lead toward desired outcomes.

PSG impacted the social context in a number of ways. In December 1997, the governor issued an executive order for all state agencies, departments and institutions of higher education to reduce their rate of single occupancy vehicle commute on ozone alert days. Each agency was required to prepare and to submit their plans for the summer of 1998. To verify compliance, PSG and EPD counted empty parking spaces in agency lots and surveyed employees about their method of commuting using e-mail.

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9 All differences were statistically significant at the .05 level.
(see Cummings & Walker, 2000; Henry & Gordon, 2003 for a more complete discussion about alternative methods to verify compliance). Federal agencies located in the Atlanta region, including the Centers for Disease Control and Prevention, agreed to develop and implement similar strategies. The commitment of the federal government is particularly significant since it is a major regional employer. PSG recruited local governments as well. The Atlanta metropolitan area encompasses 22 counties and numerous cities, each with their own administrations. Many governmental leaders were especially interested in being recognized as early adopters in the air quality movement. Private sector employers also became partners in the efforts, but for the most part their plans started later and did not contain the specific targets for smog alert day traffic reductions included in the governmental plans. Henry and Gordon (2003) showed that government employees did change their behaviors in response to the public information campaign.

**Theoretical Foundation of Present Study**

So far, we discussed how the public becomes concerned about a social condition through the agenda-setting process and the function of the issue attention cycle. We further discussed that political leaders and policy elites may use the multi-channel, multi-media methods to influence directly or indirectly the public concern about an issue. We turn now to developing the theoretical underpinning of the present study.

The primary focus of this study is to conceptualize and to develop a series of empirical models testing various mechanisms that might explain how a public information campaign and the resulting media coverage led to changes in the level of importance the public ascribes to air quality. The expressed purpose of the public information campaign was to focus attention on the issue of air quality and to change: (1) the public’s perception of the importance of air quality; (2) attitudes about the social
problem; and (3) specific behaviors, such as single occupancy driving. The sponsors also sought to focus media attention on the subject, with the expectation that media coverage about the social problem would influence public concern. Therefore, public concern may change in response to the issue advocacy or the media coverage.

We begin with a traditional agenda-setting model (see Figure 2[a]). According to the agenda-setting hypothesis, changes in media coverage about an issue results in changes in the level of concern the public has about the issue. Earlier, we discussed that issue advocates have an incentive to influence media coverage in order to influence public attention (Albritton & Manheim, 1983, 1985; Bennett, 1983; Gans, 1980; Grunig, 1983; Hess, 1984; Manheim & Albritton, 1984; Sigal, 1973). Policy elites may attempt to affect the media coverage by communicating with journalists and editors (see Roberts & McCombs, 1994 about the effects of political advertising), through op-ed columns and political campaigns or through such means as a public information campaign. Therefore, an indicator of the public information campaign was included in the model and anticipated to influence media coverage.

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10 How the media agenda was set remains one of the unanswered questions of agenda setting (Brosius & Weimann, 1996; Danielian & Reese, 1989; Dearing & Rogers, 1996; Gandy, 1982; Turk, 1985, 1986). One of the functions of journalists are to be the gatekeepers of the news (Brosius & Weimann, 1996; Easton, 1979; Iyengar, 1988; Rogers & Dearing, 1988). While many direct feedback mechanisms are rather crude, cumbersome, or slow (e.g., changes in subscriptions, letters to the editor), one of the responsibilities of journalists is to maintain surveillance on what is important to the public through memberships in informal and formal social networks. Additionally, the social norms instilled in journalists and the personal preferences of journalists and editors may influence the media agenda (McCombs, Einsiedel, & Weaver, 1991).
In addition to influencing media coverage, the issue advocates who designed the PIC also sought to influence the public directly. Therefore, the influence of the PIC on the level of issue importance is both direct and indirect through changes in media coverage. Finally, since some past research suggested that changes in issue importance may influence media coverage, we permitted a feedback loop in the traditional model.

In each of the following papers, we build upon this traditional model by hypothesizing a mechanism or moderator that may account for changes in issue importance. The first substantive paper, entitled “The Mechanism of Transference: Projection and Conformity in the Agenda-Setting Process,” tests two competing theories.
(projection and conformity) that may mediate the relationship between media coverage and public concern. The second substantive paper, entitled “Testing the Homogeneity Assumption of Public Opinion,” tests two competing theories (heterogeneity and homogeneity) that may moderate the relationship between media coverage and public concern. The third substantive paper, entitled “Talk Back: The Impact of Social Communications on Media Coverage and Issue Importance,” tests one mechanism—informal social communication—that may permit a feedback loop from the public to the media. In all cases, the mechanism or moderator was hypothesized at the aggregate or mass level, but the findings shed light on where researchers should look for individual-level effects. Each paper will be discussed in turn.

**Paper 1**

Understanding the mechanism connecting changes in media coverage or the advent of a public information campaign to changes in the level of importance that the public ascribes to a social problem has both practical and theoretical implications. By changing the focus of the message from individual responsibility, “carpool on ozone days,” to creating an environment where individuals believe the public cares about the issue and that each individual needs to “get on board,” may have a significant effect on issue importance. When the issue advocate uses messages aimed at individual responsibility, if an individual were asked about the importance of air quality after the advent of the PIC, the response should indicate a rise in issue concern since before the start of the media and public information campaign. If asked about their perception of communal concern, the individual would likely project their personal beliefs onto the larger community (see Figure 2[b]). Individuals may believe that their own preferences are a good proxy for the broader community. When the issue advocate uses messages
aimed at engaging the community, if an individual were asked about the importance of air quality after the advent of the PIC, the response should also indicate a rise in issue concern since before the start of the media and public information campaign. However, in this case, the individual uses their perception of the community’s concern as a proxy for their own concern. The first case is an example of the projection hypothesis. The second case is an example of the conformity hypothesis. The interplay between the projection hypothesis and conformity hypothesis has long been debated in the fields of social psychology and political science. The purpose of this paper is to test the effects of media and public information campaign on indicators of issue importance and perceived community importance to test which mechanism (projection or conformity) best explains changes in issue importance.

*Paper 2*

Paper 2 tests the plausibility of the *homogeneity or parallel publics* hypothesis (Page & Shapiro, 1992) using the agenda-setting model as a framework (see Figure 2[b]). One of the implicit assumptions of the agenda-setting model is that, in the absence of a news story about a particular topic, public concern about the topic is at equilibrium. In response to a media story or external events, such as a public information campaign announcing poor air quality, concern about the topic of air quality may quickly diverge from the long-term equilibrium level of concern. This equilibrium state is similar to Downs’s (1972) pre-problem state or Baumgartner and Jones’s (1991; 1993) values consensus state. A focusing event or system shock punctuates the equilibrium state, causing concern about air quality to rise. Eventually, after the media or the public becomes bored with the issue of air quality, concern returns to an equilibrium level (Downs, 1972; Henry & Gordon, 2001; Neuman, 1990). But, do all
members of the public respond similarly or in the parallel fashion predicted by Page and Shapiro to the system shock? That is, do men and women or do people who are college-educated or not college-educated respond in the same way at the same time to news stories or a public information campaign about air quality? The homogeneity or parallel publics hypothesis suggests that all groups respond similarly. Page and Shapiro extensively researched public opinion data going back decades to support their contention that the public changed opinion in a homogeneous fashion. Similarly, other work, such as Stimson’s (1999) work on policy moods, presuppose homogeneous change.

The alternative hypothesis is the heterogeneity hypothesis. The heterogeneity hypothesis suggests that groups may respond in fundamentally different ways to the same system shock. The response patterns may indicate that public concerns either converges or diverges after a system shock, but certainly does not move in a parallel fashion. The purpose of this paper is to test these two alternative hypotheses.

**Paper 3**

Paper 3 examines whether talking about the issue of air quality mediates the relationship between the media coverage and the importance the public places on the issue and the feedback relationship from public concern to the media. We compare two models: the traditional agenda-setting model connecting media coverage to issue importance (see Figure 2[a]) and a second model incorporating a measure of social communication (see Figure 2[c]) to address three research questions:

1. Does the level of social communication about an issue influence the issue’s importance among the public?
2. Does the level of social communication about an issue influence the media coverage of an issue?

3. Does the relationship between social communication and media coverage change as the drama of an event changes?

*The Challenges of Measuring a Dynamic and Interrelated System*

There are challenges in developing a model of the formation or the change of public concern. In this section, we discuss the potential challenges and the procedures used to mitigate them.

People may respond to the objective indicators of the social problem itself (e.g. ozone levels), the precursors of the problem (e.g., weather conditions that contribute to ozone production), or there may be alternative explanations for the change in public concern (e.g., pollen levels, which may be mistaken for ozone since they both may cause breathing difficulties). Theorists have long argued that real world or objective indicators should be included in agenda-setting models to control for possible spurious findings (Rogers & Dearing, 1988), which Neuman (1990) called the key to proper analyses. However, the findings about real world or objective indicators are decidedly mixed. MacKuen and Coombs (1981) and Erbring, Goldenberg and Miller (1980) found that real world indicators influenced directly public concern while Funkhouser (1973a) found that real world indicators had limited impacts on either public concern or media coverage. The effect size may not be large, but to ensure that statistical findings reflect true responses to the media coverage and the public information campaign, one must account for real world or objective measures of the social problem. In all of the models
in the following three papers, the models include the real world indicators and other control variables.¹¹

A second challenge in modeling the relationships between media coverage, the public information campaign and issue importance concerns whether information flows uni-directionally or bi-directionally. The traditional model displayed in Figure 2[a] shows the effect flowing from the media to the public (ignoring the dotted line). “Logic requires that the media agenda precede the public agenda in time, since the agenda-setting hypothesis asserts that the media agenda causes the public agenda” (Salwen, 1988 p. 100). Generally, the antecedents to the media agenda have been studied separately from the public agenda-setting research (Kosicki, 1993), since many researchers viewed the influence of the public as logically unconnected to the causes of media coverage. However, one could argue that public concern about an issue could influence media coverage or that public boredom with an issue may result in the media’s decision to terminate coverage (Beniger, 1978; Brosius & Kepplinger, 1990; MacKuen & Coombs, 1981; Siune & Borre, 1975; K. A. Smith, 1987b; T. W. Smith, 1987). Conversely, public interest in the news story may lead the media to continue or to expand news coverage. Empirical findings support the contention that the relationship is bi-directional, and a properly estimated model should, at a minimum, permit the possibility of a feedback loop. For instance, Smith (1987a) found that public concern regarding a set of issues impacted the amount of newspaper coverage of those issues at a later point. Yet, most agenda-setting models use traditional time series methods that do not readily permit a test of a feedback loop. These feedback loops are permitted in all of the models tested herein.

¹¹ The only exception is the three period test described in paper 3.
A third challenge is to model the process using a methodology that can capture the dynamic process inherent in the agenda-setting model. What Downs (1972) hypothesized was a dynamic process between the media, issue advocates and the public (Dearing & Rogers, 1992; Shoemaker & Reese, 1991); one that could not be captured accurately with traditional survey and analytical methods. Dearing and Rogers (1996) and Rogers, Dearing and Bregman (1993) argued that to measure the agenda-setting process accurately, three conditions should be met:

* The data collection should match the dynamics of the process.

Media coverage of an issue changes on a daily basis. Therefore, to measures changes in public concern, one should collect information on issue importance daily. Only by matching the unit of analysis (day) could one properly model the dynamic process.

* One should model the process dynamically.

Agenda-setting research is conceptualized in terms of studying changes in media coverage regarding an issue and estimating how the media coverage changes public concern or the level of issue importance. However, while the language is dynamic, most studies of the agenda setting process are quite static. Researchers presumed that changes in the public agenda were linearly dependent upon the level of media coverage. For example, Behr and Iyengar (1985) found that a lead story about energy raised public concern by 1.25 percent, without considering where the issue was on the issue attention cycle. This raises a number of conceptual difficulties. As Brosius and Keplinger (1992) noted, agenda-setting effects are better explained by nonlinear models than the traditional linear models, particularly for new issues, highly salient issues and issues at
the peak of the issue attention cycle. The concept of thresholds (issues not becoming salient until a certain percent of the public defines the issue as important) and boredom (Neuman, 1990) and the issue attention cycle are explicitly nonlinear concepts. Therefore, one should not expect that the process could be captured by a single coefficient based on a linear relationship. Hence, a few researchers studied the process using a survival analysis (McCombs & Zhu, 1995), vector autoregression (Blood & Phillips, 1997) and other types of non-linear models (Brosius and Kepplinger).

* One should control the factors that affect public attention.

To capture the agenda-setting process, the various parts of the agenda-setting model must all be at equilibrium. If one models the agenda-setting process after the initial impetus causing the change, a system shock, then one cannot accurately determine causality. Let us assume a new issue, an issue where there has been no prior media coverage and no pre-existing public concern regarding the issue. At this point, concern about the issue is at an equilibrium point. At some later point, coverage or concern about the issue changes in response to a system shock. Subsequently, both media coverage and public concern changes. If one begins to measure the agenda-setting process after the initial shock, one cannot properly determine causality; one cannot state emphatically that one of the series caused the change in the other series. Measuring the process after the system shock provides no information about the nature of causality in the system. To make that claim would imply an effect backwards in time (Stoel & Wittenboer, 2000). Outside of laboratory environments, one could never properly measure the agenda-setting process; since respondents usually have prior knowledge of the issue under study, researchers almost always measure the process after change has already begun. There are also other immeasurable factors that affect
the agenda-setting process, though there are means by which one could test mechanisms at a point when the processes are at equilibrium.

After establishing the challenges researchers face in making claims of causality, we now address how we responded to these difficulties. We begin by establishing the equilibrium condition, and then turn to the survey and analytical methodology.

Establishing Equilibrium

Researchers do not have the opportunity to measure the agenda-setting process where there has never been a media story or some public opinion or concern about the topic. However, there are some opportunities to measure the agenda-setting process when the processes are at a state of equilibrium. The three papers herein all measure the agenda-setting process prior to the start of the PIC, when the issue advocate attempted to influence public concern about air quality. Conceptually, this is similar to the Mutz and Soss (1997) study on concern about public housing. They worked with an agenda-setting newspaper to study how opinions changed after the newspaper began to run editorials about public housing. They compared the responses of readers of the agenda-setting newspaper to readers of a paper that did not stress the issue to see if there were differences in the level of concern about public housing. In the present study, researchers at Georgia State University (GSU) analyzed whether the public information campaign focused public attention on the issue of air quality and changed attitudes and behaviors about how people drive in metropolitan Atlanta. To study the effectiveness of the campaign, GSU tracked daily responses of public concern prior to the advent of the public information campaign. There is no question that individuals possessed a reservoir of concern about air quality prior to these measurements. It is further true that the media had run stories about air quality prior to these measurements. However, as
will be discussed in the three papers, the evidence supports the contention that the three components of the process -- media coverage, public concern, and the issue advocacy -- were at a state of equilibrium when the data collection began.

If concern about air quality, the media coverage and the PIC, collectively the system under analysis, were all in a state of equilibrium, how does one know that the system shock that we believe accounted for the change in issue importance actually was responsible? Kosicki (1993), in his review of the literature, suggested that researchers follow four steps to determine if media coverage (or the public information campaign) impacted public concern:

* **One should present evidence about the mediated communication that is likely to cause a system shock.**

As discussed earlier (Henry & Gordon, 2001, 2003), the public information campaign constructed by the Partnership for a Smog-free Georgia (PSG) was of sufficient quality to expect that people would respond to the message. The issue advocates met each of the objectives laid out by Weiss and Tschirhart (1994) in constructing a quality campaign and Henry and Gordon found that the public was aware of air quality alerts and the alerts were related to increased concern.

* **One should present evidence that the public was exposed to the information.**

While some drivers may have missed the messages, the messages were so ubiquitous that all should have been exposed to a message at some point. The third paper will show significant evidence of the marked increase in social communications given the advent of the public information campaign, particularly during a period of daily ozone alerts. The increased awareness of smog over the course of the two years of
study was shown in Figure 1. The Atlanta Journal-Constitution carried news stories and
daily reports of the public information campaign; there were stories on the televised
news, radio reports and radio commercials, faxes, e-mails, and the highway traffic signs
encircling Atlanta.

* The researcher should control for other potential factors to guarantee internal
validity.

The models in each of the papers include real world or objective indicators
collected to control for potential alternative causes for changes in issue importance and
social communications. These indicators included measures of the precursors to ozone
(temperature, dew point, rain, wind); the actual ozone levels; alternative hypotheses
(pollen data); control variables (days of week) and measures to account for secular drifts
of salience along the issue attention cycle (centered polynomials).

* Researchers should specify the mechanism (or moderator) involved in the
transfer from media coverage to public concern.

Baron and Kenny's (1986) influential work on defining mediators and moderators
established the means to specify the mechanisms involved in the transfer of public
concern from the media to the public. Beginning with mediation, which is defined as a
mechanism, they stated that a mediator is often an internal, though not necessarily,
psychological variable that affects the relationship between the independent and the
dependent variable. A mediator changes the nature of the relationship between two
variables. The mediator is endogenous to the independent variables and exogenous to
the dependent variable. That is, the mediator comes between the independent and
dependent variables and may define the causal link between the independent and dependent variables.

Baron and Kenny (1986) stated that moderators influence either or both the direction and the strength of the relationship between the independent and the dependent variables. A moderating variable is generally qualitative (sex, level of education) though it may be a quantitative. Methodologically, one uses an interaction term to test moderation. One purpose of studying moderation is to develop a pool of knowledge, from which one could develop a mediation-based theory. In this regard, mediation may be the more important concept, given that it is based upon a theoretically derived model of causality. Moderation indicates that responses vary across individuals; mediation explains why the responses differ.

Previously, we outlined the mechanism to be tested that might lead to changes in issue importance, which are elaborated in each of the papers that follow this background. In Paper 1, the psychological principles of projection and conformity may define the mechanism of issue importance transference from the media to the public. In Paper 2, demographic variables (sex, education) may moderate the relationship between media coverage and issue importance. In Paper 3, social communications may mediate the relationship between media coverage and issue importance and between issue importance and media coverage.

Data Collection and Methodology

We turn to a discussion of the data collect and methodological approach to modeling the agenda-setting process. The data collection includes survey data collected on a daily basis, newspaper reports and indicators of the PIC as well as real world indicators. Following this discussion, we turn to a description of the analytical methods used throughout this manuscript- vector autoregression.
Survey Methodology. Measures of issue importance and perceived community importance come from a set of importance, attitudinal and behavioral questions asked of residents in the thirteen-county Atlanta metropolitan area during the summer of 1998 and 1999. Two tracking surveys measured daily responses to a series of importance, attitudinal and behavioral questions. From May 1, 1998 to September 30, 1998 and from February 2, 1999 to September 30, 1999, GSU surveyed a random sample of Atlanta residents on a daily basis. This daily time series captures the dynamic association of the media coverage, the public information campaign, issue importance, perceived community importance and social communications within the agenda-setting framework.

Political campaigns have long used daily tracking polls to estimate public attitudes in real time. Henry and Gordon (2001) demonstrated the feasibility of using tracking surveys, the Rolling Sample Survey (RSS), to study issue importance. There are numerous advantages to properly administered tracking polls that led to their use in estimating campaign effects (Cantril, 1991; Hugick, Molyneaux, & Norman, 1993; John, 1989). The RSS procedure samples a mix of respondents in a manner that permits each day to be considered an independent sample. On average, one sampling replicate, or block of telephone numbers, was introduced every day and a half with the goal of producing an even flow of interviews over the course of the sampling period. Therefore, sections of the data can be used for analysis independent of the whole

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12 The definition of the Atlanta metropolitan area is not consistent. Some define Atlanta as a four county region, while others define the region as up to 22 counties. We follow the definition of the Atlanta Regional Commission and use 18 counties.

13 A copy of the 1999 survey is attached as Appendix D. The 1998 survey is structured similarly.

14 In 1999, only the data from May 1 to September 30 is used in order to maintain consistency with the 1998 data.
survey, the survey in its entirety can be treated as a cross-sectional design, or it can be aggregated on a daily, weekly or monthly basis and used with time series estimation techniques.

The RSS has a number of beneficial properties. First, tracking polls use rolling samples so that each day has a mix of hard and easy to reach respondents, minimizing the impact of daily differences in sampling bias. Second, the RSS design had the desirable qualities of a higher response rate (54%), significantly larger sample size given the short question format (about seven to ten minutes) and greater predictive validity than a cross-sectional design run simultaneously on the same subject.¹⁵ Third, the RSS permits the measurement of shocks to opinions and behaviors immediately, minimizing the impact of response recall (Sudman & Bradburn, 1982; Tanur, 1992). The results showed dynamic changes in behaviors, attitude and issue importance that may have been missed with standard surveys. It is difficult to document behavioral, attitudinal and importance responses to dynamic events within a cross-sectional survey, as researchers must infer dynamic change using static measures. With the RSS, measures may be taken at intervals prior to and after a system shock, in this case the public information campaign, allowing the magnitude and duration of the shock to be studied. For example, in paper 3, we estimate the relationship between media coverage and social communications under different conditions based on the frequency of the public information campaign. The results will show significant changes in the structure of the relationship between media coverage and talking, something that may be missed using a cross-sectional design (for a specific example, see Henry & Gordon, 2001). In addition, the secular trends of increasing and decreasing issue importance can be

¹⁵ In 1998, GSU sampled the Atlanta population using both a traditional cross-sectional design and the Rolling Sample Survey.
assessed as media coverage waxes and wanes. The RSS design is a feasible method
to study the issue attention cycle since daily, weekly and monthly trends can be plotted.

*Survey Questions.* In order to determine the level of public concern, the following
question was posed to the respondents:

“Now I’d like to find out how personally worried or concerned you are
about a number of issues. If you aren’t really personally concerned about
some of these matters, please don’t hesitate to say so. On a scale of 1 to
10, where 1 means not at all concerned and 10 means very concerned,
how personally concerned are you about ______?”

Respondents rated their concern on five to eight issues that were presented to them in
random order. We define this type of salience question as a measure of issue
importance or public concern, or the relative importance or level of concern that a person
places on an issue since the responses are on an ordinal scale.

To capture how individuals perceived the importance of an issue to the
community, we asked respondents the following question *prior* to asking them how
important the issues were to them personally. The first survey question asked of the
respondents was:

“I would like to know how important you think certain issues are to other
people in the Atlanta metropolitan area,\(^\text{16}\) regardless of how you might
feel personally. How about ______? Leaving aside your own views,
how important do you think this issue is to people in the Atlanta

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\(^{16}\) Different respondents from the various parts of metropolitan Atlanta may view
community concerns quite differently. Some respondents may have localized concerns
while other respondents may regard an issue as important for the community, even if
other members of the community do not share the same concern. The daily sampling
methodology averages over these various beliefs about community concern and permits
the estimation of a daily mean estimate of community concern.
metropolitan area, on a 1-to-10 scale, where 1 means not at all important and 10 means very important?"  

Again, respondents rated their perceived community concern on five to eight issues that were presented to them in random order. We define this type of salience item as perceived community importance, or the perceived relative importance that the community places on an issue.

To estimate the level of social communication, respondents were asked, “In the past week, did you talk about smog or air quality with your family or friends?”

**Newspaper Coverage.** Starting April 1 of both years, 30 days prior to the commencement of the ozone season, the *Atlanta Journal-Constitution* was examined for articles that pertained to the issue of air quality. The period before data collection corresponds to the length of time agenda-setting researchers contend was required for media coverage to impact current realizations of issue importance (Salwen, 1988; Winter & Eyal, 1981). Each article in the *Atlanta Journal-Constitution* was coded for its length, page placement and date. A search was conducted on Lexis-Nexis using the following

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17 In a separate study, we tested whether respondents distinguished between the words worry, important and concerned for the topic of air quality and public schools. The results suggest that for air quality, the public did not distinguish between the words, while for the topic of public schools there was some evidence that the words “worried” and “concerned” may not be synonymous. Results are available upon request.

18 The media data were collected from newspapers instead of television for two reasons. First, previous research has shown that newspapers set the public agenda (Benton & Frazier, 1976) while television plays a more critical role in determining the agenda of the top items (McCombs, 1976). Second, stories about air quality are not visually compelling, so newspapers are more likely to provide detailed information about the air quality campaign in Atlanta. However, during the televised weather reports, GLO information was broadcast daily on all of the major networks in Atlanta.

19 Each article in the Atlanta Journal-Constitution about air quality was weighted using a scheme suggested by Salwen (1988): \([N - (P-1)] / N \)* C, where N is the number of pages in the front section, P is the page number of the story and C is the column inches.
criteria: (1) the article had to be published in the morning edition of the paper; (2) the article had to appear in the front section of the newspaper; (3) the article had to include one of the following phrases or terms—air quality, air pollution, smog or ozone; and (4) the phrase had to be a central focus of the article. Articles that merely mentioned one of the phrases in passing were not included. Furthermore, the article had to be pertinent to the residents of Atlanta.

Public Information Campaign. Each day, scientists at the Georgia Institute of Technology, under contract from the EPD, modeled the subsequent day’s projected GLO level. If the models predicted that GLO levels would exceed the federal standard, a smog alert would be called by noon of the day preceding the estimated GLO exceedance. In 1998, there were 35 ozone action days. Of the 35 alert days, 13 were actual GLO exceedance days and 22 days were false positives, days when GLO remained within acceptable standards. There were also nine false negatives, days that were not designated as ozone alert days but actually were GLO exceedance days. In 1999 there were 67 smog alerts. Twenty thirty-seven days were predicted to be ozone exceedance days; while another 30 days were false positives. Four days were false negatives and 82 days were not called alert days and were not exceedance days. The low overlap between GLO exceedance days and smog alert days in both years permits one to test the separate effects of the PIC and the underlying cause of the PIC, the objective indicators of ozone levels.

A front page story of 5 column inches would receive a weight of 5.00 while a back page story of 5 column inches in a 20 page front section would receive a weight of 0.25.

20 The high number of alerts is due to a change in program implementation. Based on the 1998 standards, there would have been 23 alerts in 1999 (Pierce, 2000). See paper 1 for a more complete discussion of program changes.
**Analytical Methodology.** Researchers use vector autoregression (VAR) when there is either a question of the direction of causality between two or more series or when error terms may be correlated. The primary hypothesis testing herein is to test the interplay of media coverage, perceived community importance (or social communications in paper 3) and issue importance. The critical hypothesis testing in the VAR structure uses the notion of Granger-causality to investigate causality between the series. One series, z, is said to Granger-cause another series, y, if, after controlling for the lagged terms of y, that is \( \{y_{t-1} \ldots y_{t-n}\} \), z or its lags influence significantly the current realization of y. Granger-causality is evaluated by conducting block F-tests for the lagged values. A significant F-test indicates that one series Granger-causes another series (For a further discussion of Granger-causality see Granger, 1969, 1980; Granger & Newbold, 1974).

A traditional agenda-setting model consists of regressing issue importance on its lagged values or the lagged values of the error term and a variable that represents media coverage. Consider a typical transfer function shown in equation 1,

\[
y_t = a_0 + A(L)y_{t-1} + C(L)z_t + \varepsilon_t
\]  

For a more complete discussion of VAR, see Appendix B. The estimator used in this study is seemingly unrelated regression (SUR). The use of SUR permits the different dependent variables in the same model to have different lag lengths or regressors. Each model started with 21 days of lags for personal and perceived community importance (or social communication in paper 3), 30 day lags of the media variable and seven days of lags of the public information campaign and a number of interaction terms. For a discussion of lag lengths, see Appendix C.

The lagged coefficients in an atheoretical VAR are highly correlated with one another, inflating the standard errors, making the t-statistics insignificant. Therefore, researchers generally ignore the individual coefficients and study the series as a whole.
where (L) stands for the lag operator. The A(L) term is an autoregressive coefficient, respectively, and C(L) is the transfer function coefficient. Shocks to the exogenous \( z_t \) variable, or in this example media coverage, are transferred to \( y_t \), or issue importance in this example, by a series of transfer function weights, denoted by \( c_i \). Typically, time series analyses are stochastic (as shown in equation 1) rather than deterministic (as will be shown in equation 2). One would use stochastic analysis if one theorized that changes in the series were a function of the previous realizations of the series since each realization of the series comes from a probability distribution of the underlying population. Brosius and Kepplinger (1990) used this type of model in testing whether the current realization of problem awareness was a function of past problem awareness or did past media coverage add significantly to the model. They tested the significance of lagged \( C(L)z_t \) terms using Granger-causality by comparing a restricted model without media coverage to the full model with media coverage. There are a number of critical assumptions in the transfer function model, which are likely violated by agenda-setting researchers using the model. The most important is that \( z_t \) must be exogenous and the covariance of \( z_t \) and \( \epsilon_t \) must be 0. If there is a feedback loop, then equation 1 is misspecified and \( C(L) \) is no longer an unbiased estimate of the relationship between media coverage and public salience. All the models estimated herein are based on theories that may not be compelling, where the analytical assumptions might be violated. While most researchers presume that media coverage leads issue importance (Salwen, 1988), there is a plausible argument that the media responds to issue importance (Brosius & Kepplinger, 1990; Erbring et al., 1980; MacKuen & Coombs, 1981; Neuman & Fryling, 1985). In a similar fashion, one could credibly argue that issue importance leads perceived community importance, or the reverse, which is the basis for paper 1.
Another traditional method to estimate an agenda-setting model is to regress issue salience on time. Consider a typical function shown in equation 2,

\[ y_t = \sum_{i}^{5} D_i(t) + \epsilon \]  

(2)

where \( D(t) \) are centered polynomials of time. This structure suggests that issue importance (Henry & Gordon, 2001) or the mean number of issues (McCombs & Zhu, 1995) should follow a cycle and one would measure the pattern and number of inflection points in the cycle. If trends are thought to result from changes in society, social movements, technology, social customs, conditions that may be long term, or follow an expected pattern such as the issue attention cycle, then the trends may be deterministic (Farnum & Stanton, 1989; Yaffee & McGee, 2000) and modeled using centered polynomials.\(^{23}\) Note that the significance of the polynomials is a testable hypothesis and, even though the model is deterministic, the model includes an error term.

Both of these time series methods have limitations. If there is any question whether one series is truly exogenous, the proper methodology is vector autoregression (Doan, 1996; Enders, 1995; Hamilton, 1994; Sims, 1980). Consider a first order autoregression such as in equation 3, which is in primitive form.

\[ y_t = b_{10} - b_{12}Z_t + \gamma_{11}y_{t-1} + \gamma_{12}z_{t-1} + \epsilon_y \]  

(3)

\[ z_t = b_{20} - b_{21}y_t + \gamma_{21}y_{t-1} + \gamma_{22}z_{t-1} + \epsilon_z \]

\(^{23}\) Because it is anticipated that issues follow the issue attention cycle, all of the models in Papers 1-3 include centered polynomials, unless otherwise specified.
In this model, one may formally test, using Granger-causality, whether current realizations of issue importance \( (y_t) \) are a function of past media coverage \( (z_{t-1}) \) while controlling for the lags of issue importance \( (y_{t-1}) \) and the simultaneous possibility that media coverage is a function of past issue importance. In these models, the error terms \( (\varepsilon_{y_t}, \varepsilon_{z_t}) \) are permitted to covary. For purposes of testing the Granger-causality, the contemporaneous effects \( (b_{12}z_t, b_{21}y_t) \) are set to zero and one tests the significance of the lagged effects.\(^{24}\)

Why do we rely on Granger-causality to test the causal structure? How to determine causality in the social and behavioral sciences has long been debated. While not definitive, there seems to be a consensus (Asher, 1983; Bagozzi, 1980; Bollen, 1989; Cook & Campbell, 1979; Heise, 1975; James, Mulaik, & Brett, 1982) on the definition of causality that revolves around four concepts:

1. Causality requires that the cause and effect be distinct constructs;
2. The cause and effect covary;
3. The cause must temporally precede the effect; and
4. Causality requires the elimination of all plausible rival hypotheses.

The last condition is generally considered the most difficult to obtain, which is why psychologists generally argue that only experiments can isolate causality (J. R. Edwards & Bagozzi, 2000). Granger-causality is evaluated by conducting block F-tests for the lagged values. As discussed earlier, a significant block indicates that one variable Granger-causes another variable. It should be readily apparent that the first three conditions of causality are met using VAR. Correlations between the terms \( (y_t, z_t) \) of less than unity suggest that condition 1 is met. Similarly, if the correlation between

\(^{24}\) See Appendix B for a complete discussion of why we test the lagged effect of variables instead of the contemporaneous effects. See Appendix C for a discussion about selecting the appropriate lag lengths.
the terms is greater than zero, condition 2 is met. Time series analysis clearly takes into account the temporal relationship; Cook and Campbell (1979) go into great detail about using time series analysis to test causality. The current realizations of $y_t$ and $z_t$ are regressed simultaneously on their lagged realizations. This temporal structure meets the third requirement. Condition 4 is the challenging condition; there is no possible method to establish a random assignment to control for all possible factors given the purpose of the study. Therefore, one uses Granger-causality as an empirically-determined form of causality. Our knowledge of the causal direction comes from the data, with all of the inherent problems associated with the use of sample data. In this study, other potential causes of change in the dependent variables—actual GLO levels, sampling vagaries, pollen, and weather—are controlled. Furthermore, as described in the section on Establishing Equilibrium, we measure change prior to the advent of the public information campaign, meaning that all of the measures—issue importance, perceived community importance, social communications, and media coverage—were at their equilibrium level. It is this structure of this data collection and research design, and our ability to measure the process from start to finish, that strengthens the findings from the Granger-causality.
The importance that the public places on an issue ebbs and flows, sometimes in response to real changes in social and economic conditions and much of the time in response to changes in media coverage (Iyengar et al., 1982; Iyengar et al., 1984). Since people cannot experience most world events for themselves, they rely on the media for information about important events beyond their reach. While the media may not tell people how to think, the evidence suggests that the media tells people what to think about (Cohen, 1963). The phrase thinking about implies that increased coverage about a particular social problem results in increased concern among the public about the social problem. This relationship between media coverage and issue importance, or the importance an individual places on an issue, is the agenda-setting process (McCombs & Shaw, 1972).

The appealing simplicity of the agenda-setting model belies an important and complex transmission of issue importance from the media to the public. This transference of issue importance raises a fundamental question; what is the mechanism by which the public forms opinions about the importance of a social problem? That is, how is issue importance transferred from the media to the public? There is a parallel and related concept regarding public information campaigns (PIC). Public information campaigns are a form of advertising sponsored by a governmental or non-governmental organization, an issue advocate, designed to promote a particular cause or socially desirable activity through the media but occasionally directly to the public. By elaborating on and amplifying the social problem, the issue advocates who develop a PIC aim to raise problem awareness, to increase public interest and, ultimately, to
change behaviors by focusing media and public attention. Well-designed PICs can change public concern (Weiss & Tschirhart, 1994), but like the agenda-setting model, the mechanism is not well understood.

Understanding the mechanism of how changes in media coverage or the advent of a public information campaign changes the level of importance that the public ascribes to a social problem has both practical and theoretical implications. Consider a PIC developed to encourage individuals to change their summertime driving behaviors. The Atlanta metropolitan area is in non-compliance with federal regulations regarding the amount of ground-level ozone\textsuperscript{25} (GLO) in the air, and an issue advocate, the Partnership for a Smog-Free Georgia (PSG), developed messages asking Atlanta residents to curb their driving, particularly single occupancy driving, on days when ozone levels were anticipated to exceed the federal standard. The short-term objective was to increase awareness of GLO among the media and the public. The media picked up on the PIC and wrote a number of articles about air quality problems in Atlanta. This raises the question; how should an issue advocate develop a PIC in order to capture media attention and maximize public concern about a social problem? The messages could target individuals with “carpool on ozone days.” Or, the focus could create a sense of community concern, where individuals believe the mass public cares about the issue and that the individual needs to “get on board” like everyone else. These possibilities lead to the following implications:

\textsuperscript{25} Ground-level ozone is an odorless, colorless gas that is the major component of what is commonly known as smog. GLO comes from a chemical reaction of nitrogen dioxide and volatile organic compounds, which are derived from hydrocarbons in automobile exhaust or vapors from chemical agents. Heated in the summertime sun, this chemical reaction produces ground level ozone, which is the same chemical compound as upper atmosphere ozone. The primary cause of ground-level ozone production in Atlanta is automobiles, which are estimated to account for 50% of all sources (Pierce, 2000).
1. If an issue advocate tailors the message towards individuals, a measure of a successful message would be where an individual’s level of concern about the importance of air quality rose from a level one would have observed prior to the start of the media coverage and public information campaign. When asked about their perception of societal level concerns, how concerned the community appears to be about the issue, the individual would likely project their personal beliefs onto the larger community. Individuals believe that their own preferences are a good proxy for the broader community.

2. If an issue advocate tailors the messages towards creating a sense of communal concern, a measure of a successful message would be one where an individual’s perception of the community’s level of concern about the importance of air quality rose from a level one would have observed prior to the start of the media and public information campaign. When asked about their own level of concern, how concerned they are personally about the issue, the individual would likely conform their personal beliefs to that of the larger community. Individuals use their perception of the community’s concern as a proxy for their own concern.

The former case is an example of the projection hypothesis. The latter case is an example of the conformity hypothesis.

Social psychologists and political scientists have long debated whether people are more likely to project or to conform and the conditions that might bring about one process or the other. The public may learn about social level concerns from the media, which provide cues to the public about what others believe is important (Comstock, 1982; Hawkins & Pingree, 1982; Mutz, 1992, 1994; Tyler, 1980; Tyler & Cook, 1984). These cues may lead people to conform their personal beliefs to these perceived communal preferences (media coverage → perceived communal preferences →
personal preferences) or people to take cues from the media regarding what is important (McCombs & Shaw, 1972) and project these beliefs onto others (media coverage → personal preferences → perceived communal preferences), (Mutz & Martin, 2001).

The purpose of this paper is to test the effects of media coverage and issue advocacy on indicators of personal and perceived societal level concern. The intent is to examine the mechanisms leading to changes in personal concern with two competing hypotheses:

*Projection Hypothesis.* Individuals decide how important they think a social problem is from external sources (media and the public information campaign) and project their personal levels of concern about the issue onto the community at large.

*Conformity Hypothesis.* Individuals use external sources (media and public information campaign) of information as indicators of the community’s concern about the social problem and then conform their own personal beliefs to match the societal preferences.

We begin with the development of a model to test the competing hypotheses using the agenda-setting framework. We then turn to a discussion of the outcome variables and how they fit into the projection versus conformity debate. Finally, we discuss one

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26 There are two other possibilities. Personal and social level concerns may be separate concepts where people do not make inferences about personal concern from perceptions of perceived social concerns. Tyler and Cook (1984) found in their study of various social risks that personal and societal level judgments were “always clearly distinct and usually independent” (p. 705). In this case, one would expect to find no relationship between personal preferences and perceived social cues. Second, a sophisticated interplay may exist between social and personal level concerns; the two work in tandem (Bartels, 1985). Bartels found that primary voters projected their personal preferences (expectations) onto others while simultaneously conforming their preferences to the expectations about which candidate would be nominated. In this case, one would expect that personal and social level concerns would influence one another.
factor that may have a significant impact on the debate, the novelty or drama of an issue.

*Developing the Elaborated Model Using the Agenda-Setting Framework*

The agenda-setting framework is the basis for testing the competing hypotheses of projection versus conformity. Consider a basic agenda-setting model as shown in Figure 3[a] where media coverage directly impacts the level of issue importance an individual ascribes to a social problem; the greater the media coverage, the greater the individual concern about the social problem. McCombs and Shaw (1972) demonstrated that media attention during the 1968 presidential election affected significantly the political issues important to a sample of Chapel Hill, NC adults. Agenda setting is about connecting media inputs to political outputs (Dearing & Rogers, 1996; Kiousis et al., 1999), either by influencing voting behavior or by influencing the issue areas on which the public and policy makers focus their attention. Public concern about a social problem has been found to increase with the amount of media coverage (Brosius & Kepplinger, 1990; Funkhouser, 1973a; McCombs & Zhu, 1995; Zhu, 1992). For example, Zhu, Watt, Synder, Yan and Jiang (1993) studied the impact of the media on public concern about issues such as inflation, foreign policy and the economy and found that issue importance was determined by both media coverage and social interaction.
The traditional model is elaborated to include the public information campaign and a second outcome measure, perceived community importance. One goal of an issue advocate may be to influence media coverage as a means of increasing awareness and changing normative attitudes. Another goal is to influence directly individual concern about the topic in order to bring about behavioral change. The elaborated model permits the public information campaign to affect individual perceptions of issue importance both directly and indirectly through media coverage.

The primary outcome measure in the agenda-setting literature is an issue importance term, which measures how important an issue is to an individual. A

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The typical outcome measure in most agenda-setting work is called salience. Some research studied salience based on the rank ordering of issues (McCombs & Shaw, 1972), while others have looked at the percent of the public concerned with a single
prototypical agenda-setting study includes the Gallup Survey's Most Important Problem ("What do you think is the most important problem facing this country today?"), which asks about individual expressions of social problems. The second measure added to the elaborated model is a measure of the perceived importance of an issue to the community at large. The perceived community importance measure, like the issue importance measure, is expected to be an outcome of media coverage and the public information campaign. People's perception of how concerned the community may be about an issue is expected to be affected by media coverage and the PIC. The critical hypothesis testing in this paper is the relationship between the issue importance and perceived community importance measures. If changes in issue importance lead to changes in perceived community importance, one would find support for the projection hypothesis. If changes in perceived community importance lead to changes in issue importance, one would find support for the conformity hypothesis.

**Principles of Conformity and Projection**

In the current study, we discuss the possibility of the population conforming to or projecting their preferences onto the community. The hypothesized relationships occur at the aggregate level. However, much of the work in conformity and projection comes from individual-level analyses. In order to better understand these terms, we turn to a brief discussion of the psychological processes that lead to conformity and projection.

*Conformity.* People conform to societal preferences in order to be liked or accepted by the larger community — a psychological attachment to the group — or as a shortcut to collecting information themselves. Theorists used the conformity principle to explain findings in fields such as political science, advertising and psychology. For
instance, Stone and Abramowitz (1983), Bartels (1985) and Nadeau, Niemi and Amato (1994) studied the impact of political polls, which are objective indicators of who is winning a political campaign, and found that they drove political preferences in certain circumstances. The need for psychological attachment can be so great that some voters preferred a particular candidate solely because they wanted to go with the winner (Lazarsfeld et al., 1948). Advertising rests heavily on the conformity hypothesis; advertisers speak of their dominant market position (e.g., "the world's favorite airline") or how most people like their product (e.g., “four out of five dentists recommend”) as a way to market their products by transmitting information about community preferences (Sutherland & Friedman, 2000; Sutherland & Sylvester, 2000). Darke, Chaiken, Bohner and Einwiller (1998) found that consensus cues had a significant impact on personal attitudes and preferences by simply giving over the cues without any supporting arguments.

Public opinion or issue preference may change because individuals believe that other peoples’ preferences have formed or changed and individuals do not want to deviate from mass preferences (Gerbner & Gross, 1976; Noelle-Neumann, 1973, 1974, 1977). Therefore, people may state a preference because they believe that others have expressed this preference.

There are two types of conformity: normative and informational (Deutsch & Gerard, 1955; E. E. Jones, 1967; Kelley, 1952). Regarding normative conformity, Sherif (1935) and Asch (1951; 1955; 1956) demonstrated that individuals were willing to forgo their perceptions of objective reality in order to maintain consistency with the social group. Hovland (1954) said that the majority provides a cue for individuals as to the preferences an individual should have in order to receive the reward of social acceptance. Regarding informational conformity, individuals conform to the perceived social preferences as a heuristic or a shortcut to collecting the information themselves. One does not have to research the topic oneself; one assumes that others have done the work and their expressed preferences or behaviors provide the necessary information. The perceived community preference becomes the source of information.
Projection. People project their own preferences onto others based on their own predispositions (Bartels, 1985). That is, people believe their own attitudes, opinions or preferences are the same as other people in the community. This social psychological phenomenon (Felson, 1981; Jussim & Osgood, 1989; G. Marks & Miller, 1987) has been studied extensively regarding substance abuse (G. Marks, Graham, & Hansen, 1992), political psychology (Krosnick, 1991), and voting studies and finds that people project their personal political preferences onto the body politic (Berelson, Lazarsfeld, & McPhee, 1954; Lazarsfeld et al., 1948; Mendelsohn & Crespi, 1970). Projection may be so strong that people may project even in situations where objective or real world indicators clearly indicate the opposite (Bartels, 1987). As Nadeau, Niemi and Amato (1994) found, people expect that political outcomes will move in the direction of one’s own preferences. Only when the British elections were imminent and the polls conclusive were voters willing to forgo projection in favor of the objective indicators of the likely outcome. People are likely to form expectations about community preferences even if objective information should lead people to reach a different conclusion. Since people believe others are more like themselves than they really may be, individual preferences become a proxy for the preferences of others so personal issue importance should be a good proxy for perceived community importance.  

Support for the projection hypothesis rests largely on three psychological mechanisms: selective attention; wishful thinking; and false consensus. Festinger (1957) posited that individuals would selectively seek out information congruent with their own beliefs and filter out information incongruent with their beliefs (see also Abelson & Rosenberg, 1958; Heider, 1958; Katz, 1981; Osgood & Tannenbaum, 1955). Therefore, when making an inference about the population, the information used to make the inference was biased; weighted heavily with one’s own predispositions. Iyengar’s work on the accessibility hypothesis (Iyengar, 1990) showed that individuals used their own predispositions in making political judgments (see also Tversky & Kahneman, 1974). People may seek guidance from their social networks to understand the new or nonconforming information (Chaffee & McDevitt, 1997), though the homogeneous social networks (Huckfeldt, Beck, Dalton, & Levine, 1995; Huckfeldt & Sprague, 1987, 1988; Mutz & Martin, 2001) may not provide unbiased guidance. This
The Outcome Variables

We now turn to a more complete discussion of the two outcome variables, issue importance and perceived community importance, and how they fit into the projection and conformity framework.

Walter Lippmann (1922) and Robert Park (1925) developed competing theories about the role of the media, a disagreement that not only influenced perceptions of how media influence worked, but also the types of measures needed to capture the influence. Lippmann theorized that the media transmit a world view to the public that they cannot experience directly. The media presents individuals with its view of reality and transmits information about social problems that the media believes are important. Individuals learn which issues are important from the media and change their concern about the social problem accordingly. This conceptualization of the media became the established paradigm in communications research and is closest to the original conceptualization of the agenda-setting hypothesis.

A less-studied type of public concern is termed perceived community importance. Only a handful of studies focused on perceived community importance as the outcome of the agenda-setting model (Mutz & Soss, 1997; Takeshita, 1993; Weaver et al., 1981). Perceived community importance is associated mostly with the work of Park (1925), who studied how the media structured the views that individuals had about the community in which they lived. By focusing on community concern as the outcome of media influence, bias is supported further by the false consensus hypothesis, which suggests that individuals are likely to make errors in perceiving greater inter-personal agreement than is actually the case (Fabrigar & Krosnick, 1995; Krueger & Clement, 1994; Mutz & Martin, 2001) or are likely to overestimate the likelihood that the other person would place the same weight on an issue (Ross, Greene, & House, 1977). People expect that others will come to form preferences like them (Crandall, Solomon, & Kelleway, 1955; Irwin, 1953; R. W. Marks, 1951; Pruitt & Hoge, 1965). This partially explains voter preferences for candidates or parties that are objectively behind in the polls and anticipated to lose.
Park implied that the media determined what issues individuals thought concerned the community at large (Mutz, 1993, 1994). Consistent with conformity theory, these perceptions of community concern may structure how individuals think about these issues (Festinger, 1954). In contrast to an issue importance question, which gauges personal importance (“how concerned are you about…?”), a perceived community importance question might read, “Leaving aside your own views, how important do you think this issue is to the people of this county?” (Mutz & Soss, 1997 pg. 449).

The original McCombs and Shaw (1972) work on agenda setting focused on an outcome variable that they called salience. They asked respondents “what are you most concerned about these days?”. In agenda-setting research using time series analysis, the quintessential agenda-setting question became the Gallup survey’s most important problem question, which addressed national problems of concern to an individual. For this type of question, the media plays an important role in constructing personal concern about social problems since the public has few ways to learn about national issues other than through the media.

Furthermore, this question contains an implied assumption that shapes how theorists view the relationship of individuals to their social environment. Consider Figure 2[b] where media coverage and the PIC impact both measures of issue importance and measures of perceived community importance. If one only measures issue importance (such as in Figure 2[a]), then one assumes that: (1) media coverage and the PIC do not affect perceived community importance, and (2) perceived community importance does not affect issue importance. Assume that perceived community importance and issue importance are correlated as previous studies have shown (Weaver et al., 1981).

The question continued, “That is, regardless of what politicians say, what are the two or three main things which you think the government should concentrate on doing something about?” (italics in the original).
Further assume that media coverage (or the PIC) influences community importance. Researchers find that media coverage is more likely to impact perceived community importance than issue importance (Comstock, 1982; Hawkins & Pingree, 1982; Mutz, 1992, 1994; Tyler, 1980; Tyler & Cook, 1984) since people may presume that other members of the community are concerned about the issue discussed in the media. An agenda-setting model that does not include perceived community importance as an outcome will be biased in that the influence of media coverage (or the PIC) on issue importance will be inflated. Moreover, if perceived community importance mediates the relationship between media coverage (or the PIC) and issue importance, then omitting perceived community importance from the model will produce biased estimates. In order for the model not to be biased, issue importance must perfectly mediate the relationship between media coverage (and the PIC) and perceived community importance. That is, people must project their preferences onto the community.

**Novelty**

One additional factor that may influence the model is the novelty or drama of an issue. Downs’s (1972) hypothesis about the issue attention cycle suggested that issues needed to be novel or interesting in order to capture the public attention. A significant body of research supports this as researchers have found that the agenda-setting process is different for novel issues (Brosius & Kepplinger, 1992; Leff, Protess, & Brooks, 1986; Protess et al., 1987; Protess, Leff, Brooks, & Gordon, 1985; Watt, Mazza, & Synder, 1993; Zhu et al., 1993). Brosius and Kepplinger (1992) found that an acceleration model, where problem awareness changed faster than changes in media coverage (nonlinear model), accounted for more explained variance for novel issues than a traditional linear model. Some have held that agenda-setting effects are stronger for issues that are new on the agenda-setting process (Leff et al., 1986; Protess et al.,
1987; Protess et al., 1985) since the public necessarily must rely on the media for information (Brosius & Kepplinger, 1990; Downs, 1972; Erbring et al., 1980; Iyengar & Kinder, 1987; Neuman, 1990; Zucker, 1978). People may not have pre-existing stores of information about the issue that may interfere with the media effect. Interpersonal social networks may not be informative since new issues may be more difficult to understand and to conceptualize because they do not fit into well-established patterns. Therefore, there may be a tension within the public between novelty (drama) and the inability to easily categorize a problem, making information processing more difficult. One might expect that during periods of novelty people are reacting to the information from the media, gauging how others might be reacting to the news (conformity), and projecting their concerns onto others.

**Data and Methods**

To test the elaborated model, we use a unique opportunity to model information flows from a public information campaign to the media and then directly and indirectly to the public while taking into account the real world indicators of the social problem. The Partnership for a Smog-free Georgia (PSG), the issue advocate, developed a public information campaign with the goal of reducing ground-level ozone (GLO) production on days when GLO was expected to exceed the federal standard. The GLO levels are monitored on an hourly basis throughout the summer. When levels were expected to exceed the federal standard, PSG issued a public information campaign alerting the public about the upcoming ozone exceedance day. Through the newspaper, television reports, highway signs on the major interstates intersecting the city of Atlanta, faxes and

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31 It should be noted that people may use prior information in a situation where it may not be particularly relevant (Bostrom, Morgan, Fischhoff, & Read, 1994; Gentner & Stevens, 1983). This information may interfere with the media effects, attenuating the effects of novelty.
e-mails, PSG alerted the residents of Atlanta about the forthcoming ozone exceedance day. The alerts promoted the use of alternative work schedules, carpooling and mass transit.

In the present study, we test the relationship between projection and conformity while the novelty of the public information campaign changes. Importantly, we capture the initial change or system shock. That the PIC is predictable and serves as a shock to the equilibrium level of concern about air quality permits us to overcome weaknesses in other studies where the researchers have little control over the stimulus. The present study is similar to a study conceived by Mutz & Soss (1997) where they worked with an agenda-setting newspaper to study how opinions changed after that agenda-setting newspaper began to run editorials about public housing.

To study the effectiveness of the campaign, we tracked daily responses of public concern prior to the advent of the public information campaign and continued through the end of the ozone season. While there is no question that individuals possessed a reservoir of concern about air quality and that the media had run stories about air quality prior to these measurements, the evidence suggests that public concern about air quality was at an equilibrium level prior to the start of the ozone season (Henry & Gordon, 2001, 2003).

Since the ozone alert may or may not be broadcast on any given day, and since the media may or may not write articles about the air quality issue on any given day, it is important that information on public concern match the daily changes in the inputs that may affect issue preferences. A daily time series is necessary to capture the dynamic association of the media, the public information campaign, issue importance and perceived community importance within the agenda-setting framework. We begin with a discussion of the survey methodology and then turn to a discussion of the other data.
collection, including information about the PIC, newspaper articles, and real world indicators. Each will be discussed in turn.

**Survey Data.** Political campaigns have long used daily tracking polls to estimate public attitudes in real time. Henry and Gordon (2001) demonstrated the feasibility of using tracking surveys, the Rolling Sample Survey (RSS) to study issue importance. There are numerous advantages to properly administered tracking polls that led to their use in estimating campaign effects (Cantril, 1991; Hugick et al., 1993; John, 1989). The RSS procedure samples a mix of respondents each day in a manner that permits each day to be considered an independent sample. On average, one sampling replicate or block of telephone numbers was introduced every day and a half with the goal of producing an even flow of interviews over the course of the sampling period. Therefore, sections of the data can be used for analysis independent of the whole survey, the survey in its entirety can be treated as a cross-sectional design, or it can be aggregated on a daily, weekly or monthly basis and used with time series estimation techniques. The RSS has a number of beneficial properties. First, tracking polls use rolling samples so that each day has a mix of hard and easy to reach respondents, minimizing the impact of daily differences in sampling bias. Second, the RSS design had a higher response rate (54%), a significantly larger sample size given the short question format (about seven to ten minutes) and greater predictive validity than a cross-sectional design run simultaneously on the same subject. Third, the RSS measures shocks to opinions and behaviors immediately, minimizing the impact of response recall, and captures priming effects (Sudman & Bradburn, 1982; Tanur, 1992). The results showed dynamic changes in behaviors, attitude and issue importance that may have been missed with

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\(^{32}\) In 1998, GSU sampled the Atlanta population using both a cross-sectional design and the Rolling Sample Survey.
standard surveys. It is extremely difficult to document behavioral, attitudinal and importance responses to episodic events with a cross-sectional survey. With the RSS, measures may be taken at intervals prior to and after a system shock allowing the magnitude and duration of the shock to be studied. In addition, the secular trends of increasing and decreasing issue importance can be assessed as media coverage waxes and wanes. The RSS design is a feasible method to study the issue attention cycle since daily, weekly and monthly trends can be plotted.

To measure the responsiveness of the importance series to the media coverage and the PIC and to test the competing hypotheses of projection and conformity, the estimated levels of issue importance and perceived community importance were calculated on a daily basis.\(^3^3\) Two tracking surveys measured daily responses to a series of importance, attitudinal and behavioral questions. From May 1, 1998 to September 30, 1998 and from February 2, 1999 to September 30, 1999, Georgia State University surveyed a random sample of Atlanta residents on a daily basis.\(^3^4\) The level of issue importance that individuals place upon the issue of air quality was measured on a 1-10 scale by asking,

“Now I’d like to find out how personally worried or concerned you are about a number of issues. If you aren’t really personally concerned about some of these matters, please don’t hesitate to say so. On a scale of 1 to

\(^3^3\) To account for missing data common to survey research, NORM (Schafer, 2000) was used to impute missing values using a multiple imputation algorithm using all available data. After aggregating the individual data, missing values were imputed for days when surveys were not taken (e.g. July 4\(^{th}\), Memorial Day) or days that appeared to be outliers (Enders, 1995). Approximately 6% of the data was imputed.

\(^3^4\) To maintain consistency between the analyses for 1998 and 1999 only the May 1-September 30 data for both years was analyzed. Approximately 36 residents a day were sampled in 1998 and about 65 residents per day in 1999.
10, where 1 means not at all concerned and 10 means very concerned, how personally concerned are you about ______?

The measure of perceived community importance or how important the individual perceived the air quality issue to be to the community at large was measured by asking people how important they believed issue of air quality was to the larger community. Prior to asking about how important the issue was to them personally, we asked respondents, “I would like to know how important you think certain issues are to other people in the Atlanta metropolitan area, regardless of how you might feel personally. How about ______? Leaving aside your own views, how important do you think this issue is to people in the Atlanta metropolitan area, on a 1-to-10 scale, where 1 means not at all important and 10 means very important?”

Figure 4 shows a five day centered moving average of the importance individuals ascribe to air quality for 1998 and 1999 with the days that the public information campaign occurred overlaid. The results show that, prior to the first ozone alert in 1998, interest in the air quality issue was relatively low. After the first set of ozone alerts, interest peaked and fell, generally rising in response to the alerts and falling in their absence. The pattern is consistent with the expectations of the issue attention cycle (IAC; Downs, 1972). During 1999, the concern people had about air quality meandered between 8.00-8.25 prior to the start of the daily exceedance period around July 20th. Once the daily exceedances commenced, concern dropped sharply followed by a significant rise. As the ozone season started to wind down, the importance individuals ascribed to air quality went through another cycle before ending the season with averages approaching the seasonal lows.
The importance that the public attributed to the community at large similarly moved in response to the ozone alerts, which are overlaid (see Figure 5). Comparing Figures 4 and 5, it is apparent that people generally believed that they were more concerned about air quality than the rest of the community. Additionally, looking at the first ozone alerts in 1998, the public did not start believing that others were concerned until after the first set of ozone alerts ended; even then, the perception that others were concerned waned quickly. The first issue attention cycle for issue importance lasted approximately six weeks from nadir to nadir compared to about 3½ weeks for perceived community importance. During 1999, the perception of others’ interest slowly fell until the start of the long period of daily smog alerts. As the alerts continued, people began to believe that the community was more concerned about the issue, though the perception
of others’ interest never approached their own level of concern nor did the levels of concern exceed the levels seen before the start of the daily alerts.

![Figure 5. Five Day Moving Average of the Perceived Community of Importance of Air Quality for 1998 and 1999](image)

**Newspaper.** Starting April 1 of each year, 30 days prior to the first day of data collection, the *Atlanta Journal-Constitution* was systematically examined for articles about air quality. Each article in the *Atlanta Journal-Constitution* was coded for its

35 The media data was collected from newspapers instead of television for two reasons. First, previous research showed that newspapers set the public agenda while television plays a more critical role in determining the agenda of the top items (McCombs, 1976). Second, stories about air quality are not visually compelling, so newspapers are more likely to provide detailed information about the air quality campaign in Atlanta. However, during the televised weather reports, GLO information was broadcast each day on all of Atlanta’s major networks.
length, page placement and date. 36 A search was conducted on Lexis-Nexis using the following criteria. The article had to: (1) be published in the morning edition of the paper; (2) appear in the front section of the newspaper; (3) include one of the following terms—air quality, air pollution, smog or ozone; and (4) be pertinent to the residents of Atlanta meaning that articles merely mentioning air quality in passing were not included. The period before data collection corresponds to the length of time agenda-setting researchers contend that media effects accumulate on present salience, that is, media effects take approximately four weeks to impact today’s salience (Salwen, 1988; Winter & Eyal, 1981).

Public Information Campaign. Each day, scientists at the Georgia Institute of Technology, under contract from the EPD, modeled the subsequent day’s projected ground level ozone level (GLO). If the models predicted that GLO levels would exceed the federal standard (“ozone exceedance”), a smog alert would be called by noon of the day preceding the estimated GLO exceedance. In 1998, there were 35 ozone action days. Table 1 shows the distribution of ozone alert days and actual GLO exceedance days. Of the 35 alert days, 13 were actual GLO exceedance days and 22 days were false positives, days when GLO remained within the standard. There were also nine false negatives, days that were not designated as ozone alert days but actually were GLO exceedance days. In 1999 there were 67 smog alerts, though the standards were different.37 Thirty-seven days were predicted to be ozone exceedance days and were, while another 30 days were false positives (see Table 2). Four days were false

36 Each article in the Atlanta Journal-Constitution about air quality was weighted using a scheme suggested by Salwen (1988): 
$$\left(\frac{\text{N} - (\text{P} - 1)}{\text{N}}\right) \times \text{C}$$
where N is the number of pages in the front section, P is the page number of the story and C is the column inches. A front page story of 5 column inches would receive a weight of 5.0 while a back page story of 5 column inches in a 20 page front section would receive a weight of 0.25.

37 Based on the 1998 standards, there would have been 23 alerts in 1999 (Pierce, 2000).
negatives and 82 days were not called alert days and were not exceedance days. The changes in the program between 1998 and 1999 permit one to test the effects of a public information campaign that focused on episodic alerts, as occurred in 1998, versus a seasonal change, as occurred in 1999. Furthermore, the low overlap between GLO exceedance days and smog alert days permits one to test better the effects of the PIC and the underlying cause of the PIC, the objective indicators of ozone levels.

Table 1.
Ozone Alert Days Compared with Actual Violation Days -- 1998

| Days when Ground-level Ozone exceeded Standards |
| Days Standards |
| Violation Days | were Met | Total |
| Alert Days | Alert Days | 13 | 22 | 35 |
| (predicted to exceed standards) | Non-Alert Days | 9 | 109 | 118 |
| Total | | 22 | 131 | 153 |

Note: Figures indicate the number of such days during the ozone season in 1998.

Source: Adapted from Henry and Gordon (2003)

Table 2.
Ozone Alert Days Compared with Actual Violation Days -- 1999

| Days when Ground-level Ozone exceeded Standards |
| Days Standards |
| Violation Days | were Met | Total |
| Alert Days | Alert Days | 37 | 30 | 67 |
| (predicted to exceed standards) | Non-Alert Days | 4 | 82 | 86 |
| Total | | 41 | 112 | 153 |

Note: Figures indicate the number of such days during the ozone season in 1999.
The first year of the public information campaign, 1998, became a novel event in Atlanta. The second year of the campaign, 1999, was marked by diminished novelty. Consider how the media treated air quality during 1998 and 1999. From April 1 until the first alert day in 1998 (May 15), the Atlanta Journal-Constitution contained 112.4 weighted column inches about air quality. One day after the first ozone alert in 1998, the Atlanta Journal Constitution contained 12.3 weighted column inches about air quality. During the similar period in 1999, from April 1 until the first alert day (May 10), the Atlanta Journal Constitution contained 21.5 weighted column inches of articles about air quality. After the first alert day in 1999, there was a delay of five days before the Atlanta Journal-Constitution contained a significant amount of news about air quality, with 18 weighted column inches.

There were two meaningful changes in the program administration subsequent to the 1998 ozone season. First, the alerts in 1999 no longer referred to ozone, a specific pollutant, but to smog, a more general but better understood descriptive term. The issue advocates were concerned that the public was confusing GLO with upper atmosphere ozone. Second, the 1998 program was based on a 1-hour standard, and the 1999 program on an 8-hour standard. The change in standards meant that in 1998, the program was essentially episodic and in 1999 the program was primarily seasonal. The issue advocates issued 35 ozone alerts in 1998 using the one-hour standard and issued 69 smog alerts in 1999 using the eight-hour standard. However, the average ozone level was virtually identical during the two years, .082ppm in 1998 and .085ppm in 1999. Therefore, while there was no meaningful difference in the objective indicator of

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38 The two are the same chemical compound. While ozone is necessary in the upper atmosphere, it may be unhealthy at ground level.

39 The standard deviation was 0.028 in 1998 and 0.030 in 1999.
the social problem between 1998 and 1999, the frequency of the public information campaign was much greater in 1999, increasing the likelihood that people would become bored with the alerts. Furthermore, since the public information campaign was a novelty in 1998, one would expect greater public responsiveness to the alerts and media coverage (Brosius & Kepplinger, 1990; Downs, 1972; Erbring et al., 1980; Funkhouser, 1973a, 1973b; Iyengar & Kinder, 1987; Neuman, 1990; Rogers & Dearing, ; Watt & van den Berg, 1981; Zucker, 1978).

Real World Indicators. Many agenda-setting theorists contend that modeling objective indicators of the social problem is necessary to specify properly the agenda-setting model (Iyengar, 1988; Kingdon, 1995; Neuman, 1990; Rogers et al., 1993). If individuals respond to real world conditions and the media is simply reporting on the real world conditions, then findings that media coverage directs public concern is spurious; real world conditions are setting both agendas. We included a number of measures that might impact the model. Measures of the precursors to ozone production (e.g. temperature, wind, dew point, rain), the actual ozone level, indicators of days of the week (to control for exposure to messages and survey effects), and polynomial trend variables ⁴⁰ (to account for the secular trends) were all included in both estimated models.

Methodology. The elaborated model has two outcome variables, issue importance and perceived community importance, and lacks a compelling theory to suggest a particular causal structure. One could plausibly argue that people project their

⁴⁰ The centered polynomials were created by generating a new series where the midpoint of the series equaled zero. From the midpoint of the study (July 16), a series was generated by adding or subtracting one for each day from July 16. This was the first centered polynomial. The next four series were created by squaring the new series, taking the cube of the new series and so forth through the fifth centered polynomial. Centering the polynomials mitigates problems associated with multi-collinearity.
preferences onto others or people may conform to the perceived communal concerns. Additionally, the elaborated model permits possible feedback loops from the issue and perceived community importance items back to the media coverage. Past researchers (Beniger, 1978; Brosius & Kepplinger, 1990; MacKuen & Coombs, 1981; Siune & Borre, 1975; K. A. Smith, 1987b; T. W. Smith, 1987) suggested that the level of media coverage of a topic may be influenced by public concern. Brosius and Kepplinger (Brosius & Kepplinger, 1990) found that television coverage of public security and pensions influenced problem awareness, but in turn, the increased problem awareness of these issues Granger-caused changes in television coverage.

With multiple outcome variables, the lack of strong theory and the possibility of feedback loops, vector autoregression (VAR) is the appropriate method. Researchers use VAR either when there is a question of the direction of causality between two or more series or when error terms may be correlated (Doan, 1996; Enders, 1995; Hamilton, 1994; Sims, 1980). The critical hypothesis testing in the VAR structure uses Granger-causality to test causality between the series (Granger, 1969, 1980; Granger & Newbold, 1974). One series, $z_t$, is said to Granger-cause another series, $y_t$, if, after controlling for the lagged terms of $y_t$, that is $\{y_{t-1} \ldots y_{t-n}\}$, $z_t$ or its lags significantly influence the current realization of $y_t$. Granger-causality is evaluated by conducting

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41 The estimator used in this study is seemingly unrelated regression (SUR), which permits each series to have different lag lengths and different independent variables. The initial model included 21 days of lags for personal and perceived community importance, 30 day lags of the media variable and seven days of lags of the public information campaign and a number of interaction terms. All two and three day alerts through the third day, such as indicators marking the occurrence of a public information campaign yesterday and today or today, yesterday and the day before. Variables were dropped from the model, and lag lengths shortened based on the results of likelihood ratio tests and the AIC and SBC information criteria. See Appendix C for a complete discussion of lag lengths.
block F-tests for the lagged values. A significant F-test indicates that one series Granger-causes another series. For example, assume that the projection hypothesis explains the relationship between issue importance and perceived community importance; that is, changes in issue importance lead to changes in perceived community importance. Changes in issue importance are said to Granger-cause changes in perceived community importance if, after controlling for the lags of perceived community importance, the block of lags of issue importance have a significant impact on the current realization of perceived community importance. The results of the block F-tests are not affected by the ordering of the variables; it does not matter which series is entered into the equation first.

Results

Prior to the first ozone alert in 1998, concern about the social problem of air quality was relatively low (see Table 3). During the first two weeks of May 1998, prior to any ozone alert, the average level of issue importance was 7.90. Issue importance rose sharply after the initial ozone alerts; the one week average after the first day of the ozone alerts was 8.52. Issue importance remained in the mid 8.40 range through August and then fell modestly in September (p < .10), as people began to focus on other issues. The initial level of issue importance in 1999 averaged about 8.15 and during the first week after the first smog alerts issue importance fell slightly. Between May and July, the monthly average level of concern about air quality varied by no more than 0.06 points. The mean level of issue importance was consistently higher in 1998 than 1999.

The lagged coefficients in an atheoretical VAR are highly correlated with one another, inflating the standard errors, making the t-statistics insignificant. Therefore, researchers generally ignore the individual coefficients and study the series as a whole.

The stable monthly averages belie the changes that were occurring daily (Henry & Gordon, 2001).
with two notable exceptions. In the first weeks of May 1998, before people became aware of the public information campaign, average concern was lower than in the first weeks of May 1999. Unlike the 1998 series, where the average level of issue importance fell over the course of the ozone season, issue importance grew significantly in the second half of the 1999 ozone season ($p < .001$). One factor that may account for this increase in 1999 was a long string of daily smog alerts that occurred during late July through most of August. Whereas people seemed to respond to the ozone alerts in 1998, the evidence suggests that people required accumulated coverage of daily alerts in 1999 to raise their level of personal concern.

Table 3.  

**Average Level of Issue Importance in 1998 and 1999**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to 1st Alert</td>
<td>7.90</td>
<td>8.15</td>
<td>0.25</td>
<td>.050</td>
</tr>
<tr>
<td>First Week after Alert</td>
<td>8.52</td>
<td>8.06</td>
<td>(0.46)</td>
<td>.010</td>
</tr>
<tr>
<td>May</td>
<td>8.44</td>
<td>8.14</td>
<td>(0.30)</td>
<td>.050</td>
</tr>
<tr>
<td>June</td>
<td>8.47</td>
<td>8.09</td>
<td>(0.38)</td>
<td>.001</td>
</tr>
<tr>
<td>July</td>
<td>8.39</td>
<td>8.15</td>
<td>(0.24)</td>
<td>.050</td>
</tr>
<tr>
<td>August</td>
<td>8.40</td>
<td>8.33</td>
<td>(0.07)</td>
<td>ns</td>
</tr>
<tr>
<td>September</td>
<td>8.27</td>
<td>8.42</td>
<td>0.17</td>
<td>ns</td>
</tr>
</tbody>
</table>

**Multivariate Analysis**

The purpose of this paper is to test the effects of media coverage and the public information campaign on indicators of public concern, with the intent of understanding
how issue importance and perceived community importance interact. We tested two competing hypotheses. The projection hypothesis predicts that changes in issue importance would result in changes in perceived community importance. That is, individuals would project their beliefs onto the community. The conformity hypothesis predicts that changes in perceived community importance would result in changes in issue importance. People conform their own concerns about the issue to what they perceived the community concern to be.

Separate vector autoregression models were run for 1998 and 1999. The Granger-causality results are shown in Table 4. In 1998, the lagged values of issue importance impacted significantly the current realization of perceived community importance (F=2.93, p<.001), meaning that changes in issue importance resulted in changes in perceived community importance. This finding supports the projection hypothesis. However, current realizations of issue importance were affected significantly by lagged values of perceived community importance (F=3.27, P<.001). This finding that perceived community importance impacted issue importance suggested a conformity process; people conformed to the perception of communal concerns. The dual findings suggest that a more complex process was at work; people were both projecting and conforming.

The 1999 results were more straightforward. Perceived community importance was impacted significantly by past realizations of issue importance (F=2.46, p<.001), but lagged values of perceived community importance did not impact issue importance (F=1.35, p=ns). The significant effect of issue importance on the current realization of perceived community importance suggests that people projected their own personal

44 In all cases, the lagged series explained the current realization of the same series. That is, \( \{y_{t-1}, \ldots, y_{t-n}\} \) significantly explained \( y_t \). Since this is not of theoretical interest, the results are not discussed.
beliefs onto the larger society. The insignificant effect of perceived community importance on the current realization of issue importance suggests that projection was the only process at work in 1999.

Table 4.

Results of the Granger Causality Test for the Issue Importance, Perceived Community Importance and Media Coverage Vector Autoregression Model

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Independent Variable</th>
<th>1998</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>P&lt;</td>
<td>F</td>
</tr>
<tr>
<td>Perceived Community Importance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PIC</td>
<td>6.56</td>
<td>0.001</td>
<td>2.46</td>
</tr>
<tr>
<td>Issue Importance</td>
<td>2.93</td>
<td>0.001</td>
<td>2.25</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>1.92</td>
<td>0.010</td>
<td>2.96</td>
</tr>
<tr>
<td>PIC</td>
<td>3.00</td>
<td>0.001</td>
<td>2.89</td>
</tr>
<tr>
<td>Issue Importance</td>
<td>3.27</td>
<td>0.001</td>
<td>1.35</td>
</tr>
<tr>
<td>PIC</td>
<td>3.58</td>
<td>0.001</td>
<td>3.55</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>3.04</td>
<td>0.001</td>
<td>1.82</td>
</tr>
<tr>
<td>PIC</td>
<td>3.99</td>
<td>0.001</td>
<td>1.65</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>1.82</td>
<td>0.050</td>
<td>1.34</td>
</tr>
<tr>
<td>Issue Importance</td>
<td>2.33</td>
<td>0.050</td>
<td>1.76</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>1.77</td>
<td>0.050</td>
<td>0.74</td>
</tr>
<tr>
<td>PIC</td>
<td>2.48</td>
<td>0.010</td>
<td>2.12</td>
</tr>
</tbody>
</table>

The results from the Granger-causality analysis have further implications for the agenda-setting model. Media coverage impacted significantly all four series, that is the perceived community importance in 1998 (F=1.92, p<.01) and 1999 (F=2.96, p<.001) and the issue importance series for both 1998 (F=3.04, p<.001) and 1999 (F=1.82, p<.01). These results are expected within the agenda-setting framework. The public information campaign also impacted significantly three of the four series. In 1998, both
perceptions of community importance (F=3.00, p<.001) and issue importance (F=3.99, p<.001) about the issue of air quality were affected significantly by the public information campaign. In 1999, levels of perceived community importance about the issue also changed with the advent of the public information campaign (F=2.89, p<.01). Consistent with the boredom hypothesis, the public information campaign did not affect issue importance (F=1.65, p=ns) in 1999. While people became bored themselves, the evidence suggests that people believed that the PIC was still of interest to others.

The elaborated model permitted issue importance and perceived community importance to impact media coverage. As prior research suggested, modeling the reciprocal relationship is important to insure that models are not mis-specified (Weaver, 1980). In 1998, when the PIC was novel, perceived community importance (F=1.82, p<.05), issue importance (F=2.33, p<.05) and the public information campaign (F=2.84, p<.01) all impacted media coverage. That is, the media seemed to respond to the heightened interest by running more stories about air quality. In 1999, once the PIC became commonplace, only the PIC influenced media coverage (F=2.12, p<.05). The public had little influence on media coverage of the air quality issue in 1999. In both years, however, the issue advocate appeared to have been successful in their attempt to influence media coverage about the air quality issue.

The vector autoregression model for 1998 explained more of the variance than the 1999 model (Table 5). The percent of variance explained for each of the three series -- perceived community importance, issue importance, media coverage -- was higher in 1998 than in 1999. These findings support the notion of greater interest in 1998 than in 1999 regarding the social problem.45

45 To control for other factors that might explain changes that occurred, indicators that might impact the development of ground-level ozone, the actual ozone level, indicators of days of the week, and polynomial trend variables were included in the analysis. If
Table 5.

*Results of the F-Test and R2 for the Issue Importance, Perceived Community Importance and Media Coverage Vector Autoregression Model*

<table>
<thead>
<tr>
<th>Equation</th>
<th>R2</th>
<th>F-Test</th>
<th>p &lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Community Importance</td>
<td>0.87</td>
<td>3.41</td>
<td>0.001</td>
</tr>
<tr>
<td>Issue Importance</td>
<td>0.83</td>
<td>3.32</td>
<td>0.001</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>0.64</td>
<td>1.42</td>
<td>0.050</td>
</tr>
<tr>
<td>1999</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Community Importance</td>
<td>0.78</td>
<td>2.58</td>
<td>0.001</td>
</tr>
<tr>
<td>Issue Importance</td>
<td>0.56</td>
<td>1.55</td>
<td>0.010</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>0.23</td>
<td>1.94</td>
<td>0.050</td>
</tr>
</tbody>
</table>

**Conclusion**

What is the mechanism by which the public forms opinions about the importance of a social problem? That is, how is issue importance transferred from the media and the PIC to the public? The results of the analyses are more consistent with the hypothesis that individuals project their own personal beliefs about the issue of air quality onto the larger community. This was true for both 1998 and 1999. However, in 1998, when the PIC was most novel, the analysis suggested a second route to change. Individuals respond to real world conditions and the media is simply reporting on the real world conditions, then findings that media coverage directs public concern is spurious; the real world conditions are setting both agendas. Did individuals respond to real world conditions? Minimally. In 1998, all three series were impacted weather conditions. Days of the week also significantly impacted perceived community importance. In 1999, issue importance and perceived community importance were both impacted by the weather conditions. In no case did the actual level of ozone have any impact on the model. Since the outcome variables may follow a pattern like the issue attention cycle, centered polynomials of order one through five were estimated to account for a possible deterministic trend. Each of the three series – issue importance, perceived community importance and media coverage – followed some deterministic trend in 1998, such as described in Henry and Gordon (2001). For the results of the covariate relationships, see Appendix E.
Changes in media coverage led to changes in perceived community importance, which led in turn to changes in issue importance. This finding is consistent with the conformity hypothesis. Therefore, while the evidence suggests that projection was the primary mechanism in 1999, the evidence for 1998 suggests an interplay of projection and conformity.

Theories about the nature of projection and conformity generally presume that one of the processes is at work at any one time. In group settings, people are likely to conform lest they feel isolated from the rest of the group. Or, group preferences may provide informational shortcuts that permit individuals to state preferences without having to do the research themselves. On the other hand, people may make attributions such as presuming that other people are like them and therefore they have the same preferences. However, evidence from this paper and others (Bartels, 1985) seems to suggest that both processes work simultaneously. Bartels found “that projection is a quite persistent behavioral phenomenon” (p. 813), while expectations, a measure of the social environment, conversely impacted personal preferences. The likelihood is that there are times when just one process is at work and there are times when they interplay. A critical step in the theory development is to understand the context that brings about the different results.

To understand a possible cause of different findings regarding projection and conformity, one should look at programmatic and contextual differences between 1998 and 1999. While there are a number of possible causes including changes in the smog program, the most plausible explanation for the differences was that GLO alerts were novel in 1998 but not in 1999. This explanation is consistent with a body of literature that has found that novelty plays an important role in issue importance. The agenda-setting effect may be stronger with novel issues because the public necessarily must rely
on the media for information. With novel issues, everyone is reacting to the new issue and no one has a chance to lead (Brosius & Weimann, 1996). In 1998, all aspects of the model impacted every other aspect of the model. While people are familiar with smog, ground level ozone was a new concept and people may not have had the pre-existing stores of information that they could rely upon to easily categorize the PIC. One example of this was the confusion people had with ground level ozone and upper atmosphere ozone that led the issue advocates to change the focus of the program to smog in 1999. With novelty, people projected and conformed. Without novelty, people projected.

There is some evidence of a second effect that may provide additional insights into the processes at work. Anecdotal evidence suggests that people talked a great deal about air quality, particularly in early summer of 1998 when the issue was most novel. If talking did occur to a significant degree in the early part of 1998 or during the long period of daily ozone alerts in 1999, then talking may mediate (or moderate) the processes between issue importance and perceived community importance. Since conversations carry information about issues of concern to others, then talking may provide a basis for a conformity process if individuals in social networks learn about issue importance from others and take that level of concern as a proxy for their own.

Another factor may explain the lack of a conformity effect in 1999. Researchers discuss two types of conformity: normative and informational (Deutsch & Gerard, 1955; E. E. Jones, 1967; Kelley, 1952). Did people learn about the problem from others (informational conformity) or did people change their level of concern so as not to be out of step with others (normative conformity). If the former, then people might have gained the requisite knowledge about air quality in 1998 to carry them into 1999, which might explain the null finding for the conformity hypothesis in 1999. People did not need to
conform since they collected the requisite information in 1998. If the latter, then the model should have a significant conformity result for 1999. One possibility is that air quality is not a compelling issue, one that might compel people to feel the need to conform. While the novelty in 1998 provided the social environment that might result in people conforming, the lack of novelty in 1999 did not.

The idea that personal and social level judgments were independent (Tyler & Cook, 1984) was not found in either year. Rather, the processes were highly related (see also the residual correlations in Appendix E). It is possible that since air quality is of relatively lower salience that individuals commingle personal and social level judgments. With higher salient issues, they may be distinct constructs.

The public information campaign was an important aspect of this overall study. The PIC provided an explanation for the media coverage, and also had a direct bearing on the level of issue importance ascribed to air quality by the public. Furthermore, novelty and boredom appear to play significant roles in mediating the effect between the public information campaign and the other components of the model. In 1998, the public information campaign not only impacted the importance items but also media coverage. By 1999, the impact of the public information campaign on issue importance was not significant. After an alert, there were immediate changes in the levels of personal and perceived community importance, but the effects waned after a few days. Consistent with the boredom hypothesis (Henry & Gordon, 2001; Neuman 1990), once the alerts were out of people’s immediate minds, the level of issue importance ascribed to air quality diminished. The series seemed to be constantly reverting to their equilibrium levels.

This raises an interesting question, what is needed to maintain levels of interest above the equilibrium level? Is a constant burst of publicity necessary to maintain
interest or does each burst of publicity have to be novel? This question is addressed in
the advertising literature. Traditional views of advertising suggest that advertising works
by changing attitudes about brands (Miller & Berry, 1998), focusing consumer interest in
the brand advertised with an appealing ad (Dyson, Farr, & Hollis, 1996; J. P. Jones,
1990; Joyce, 1967). The copy write is the critical component of the ad. New (novel) and
dramatic ads and copy act to focus interest in the advertised brand. Others suggest that
advertising works by maintaining knowledge of the brand in consumers’ minds (Miller &
Berry, 1998; Moran, 1990; Sutherland & Friedman, 2000; Sutherland & Galloway, 1981;
Sutherland & Sylvester, 2000). Advertisers need to maintain brand awareness so that
when a consumer is ready to make a purchase, the consumer thinks first of the
advertised brand. This is similar to the constant burst of publicity. The PIC provided
regular, but not a constant burst, of publicity. Interest waned consistently after these
bursts, except during a period in late 1999, when there were daily alerts. Conversely,
the greatest increase in issue concern came after the first set of alerts in 1998, when the
issue was most novel. What is required to motivate and to maintain increased interest in
a PIC is still an open question.
Public opinion and voting research has been dominated by analyses that implicitly or explicitly model the processes by which members of the public reach opinions, conclusions, and decisions as being basically invariant across the population. Virtually all that we know of the way the public thinks and act politically has come from research grounded in this approach (Richard Brody writing in a special edition of Public Opinion Quarterly Bogart, 1987 p. S175).

A significant body of political science and public opinion theory and research contends that change in mass opinion is homogeneous, meaning that people respond to news or events at the same time and in the same direction. This is not to say that all groups care about a particular issue to the same degree; rather, the over-time change of concern between different groups is constant. While different groups may have absolute differences in their policy preferences, changes in preferences over time in response to news or events tend to move together. Page and Shapiro termed this harmonized movement parallel publics.

Public opinion research relies extensively on aggregated time series data such as The Gallup Survey and regression-based methods that implicitly assume that the aggregate response is reasonably homogeneous across all respondents consistent with the hypothesis of Page and Shapiro (1992). In a typical regression-based equation, the error term denotes that there is one underlying distribution that exists for the population. The methods and the data drive researchers to assume that all groups and people respond similarly to a system shock. There may be differences in the absolute level of
policy or opinion preferences between two or more groups, but these groups are presumed to respond similarly to the system shock.\(^{46}\)

Is the homogeneity assumption warranted? Critics of the homogeneity assumption and evidence that publics do not move in unison suggest that people may not respond similarly to the same news. We will define this non-parallel process, where public preferences do not move in unison, heterogeneity. Some groups may have more access to the news and have a higher likelihood of responding to news stories (Price & Zaller, 1993). Differential rates of news acceptance (Graber, 1984), may lead people to change their level of issue concern, policy preferences or expectations at different speeds (Granato & Krause, 2000; Krause, 1997), suggesting that change is not parallel. For these reasons, researchers began to develop models to understand the process that led different groups to reach different conclusions. Many researchers started to analyze heterogeneous responses to system shocks; that is, studying whether sub-populations responded similarly in different situations to news or events or if there were systematic differences based on situations such as life experiences (Erbring et al., 1980; McCombs, 1981; McLeod et al., 1974; Shaw, 1976; Shaw & Martin, 1992).

The purpose of this paper is to test the plausibility of the homogeneity assumption using the agenda-setting framework (Erbring et al., 1980; McCombs & Shaw, 1972). An implicit assumption of agenda-setting research is that in the absence of a news story about a particular topic, such as air quality, public concern about the topic is at equilibrium or the long term level of concern. In response to a media story or external events, such as a public information campaign informing people that smog levels may exceed the federal standard and asking drivers to alter their driving behavior, concern

\(^{46}\) Researchers who use individual analyses and cross-sectional surveys may find absolute differences in opinions and policy preferences, but these studies are not designed to measure heterogeneous change over time
about the topic of air quality may quickly diverge from the long-term equilibrium level of concern. A focusing event or system shock punctuates the equilibrium state, causing concern about a social problem to rise. Eventually, after the media or the public becomes bored with the issue, concern returns to its equilibrium (Downs, 1972; Henry & Gordon, 2001; Neuman, 1990). This change in the level of concern about an issue in response to a system shock such as a news story or focusing event raises a fundamental question: do all members of the public respond similarly to the system shock? That is, do men and women or do people who are college-educated and not college-educated respond in the same way at the same time to news stories or a public information campaign about a social problem such as air quality? The homogeneity hypothesis suggests that groups respond similarly. The heterogeneity hypothesis suggests that groups may differ in responding to a system shock.

This study provides a unique opportunity to model information flows from a shock to the equilibrium by the public information campaign and the media to the public while accounting for possible heterogeneity of responses. One advantage of the public information campaign is that it is predictable and serves as a shock to the equilibrium level of concern about air quality. The present study is similar to one conducted by Mutz and Soss (1997), who worked with an agenda-setting newspaper to study how opinions changed after the agenda-setting newspaper began to run editorials about public housing. Similarly, Kepplinger and Roth (1979) collected polling data before and after the Arab oil boycott of 1973 to study the effect of media coverage on public attention during a crisis.

We offer three means of testing which of the two competing hypotheses (homogeneity or heterogeneity) best explains change in public concern about air quality:

1. correlating the series mean and variance- does the variance change
systematically as concern about an issue changes?;

2. modeling the series variance- can one systematically model changes in variance?;

3. modeling the sub-populations- can one model differences in response to system shocks using the agenda-setting framework?

These three tests rely on the beneficial attributes of the Rolling Sample Survey (RSS, Henry & Gordon, 2001). As will be discussed in the data section, the RSS permits researchers to model daily changes in the mean level of public opinion as well as model the daily variance. In the next section, we discuss the homogeneity and heterogeneity hypotheses in greater detail. Afterwards, we provide more detail on the study data and methods while developing the models to be tested.

Response to News, Focusing Events or System Shocks

Anthony Downs (1972) hypothesized that issue salience rises and falls following a cyclical pattern, the issue attention cycle. Downs divided the issue attention cycle into five parts: a pre-problem baseline; the discovery of the problem; the realization of the potential policy impacts and costs; decline in the public interest; and the post-problem period. Prior to the problem realization, Downs contended that public interest in an issue may be low or non-existent; negative social conditions may exist but the public has not paid attention (see also Baumgartner and Jones’s, 1991; 1993 discussion of punctuated equilibrium). Once the public begins to focus on a problem, interest rises, issue importance increases, and the public becomes aware of the problem. The publics’ discovery of the problem forces political and policy elites to focus attention on the problem and to propose solutions. Once a solution is adopted or the public and the policy elites come to understand the high cost of resolving the problem, interest in the problem wanes (Peters & Hogwood, 1985). Eventually, concern about the social
condition returns to its equilibrium level of concern, the post-problem period. The reaction to the system shock subsided.

In conceptualizing a system of public opinion, the equilibrium level of concern for an issue should be relatively low compared to the level of concern after a system shock. After a system shock, the mean level of concern about the issue should rise, followed by an eventual descent to the equilibrium state. This leads to a fundamental question, do all groups respond similarly to the system shock or do systematic differences exist in how groups respond?

There are two possible models of the public’s reaction to a system shock. The first is entitled the parallel publics or homogeneity hypothesis and the second is entitled the heterogeneity hypothesis.

Parallel Publics/Homogeneity Hypothesis. Page and Shapiro (1992) concluded that "practically all Americans are exposed to the same facts and ideas" (p. 319), which leads Americans "to change [opinions] in the same direction and by the same amount" (p. 318, see also Stimson, 1999). Most members of the public respond similarly to a system shock, what we describe as the homogeneity hypothesis. In tracking 3000 sub-group trends over the course of decades, Page and Shapiro found that almost no difference existed in the over-time policy preferences. While the absolute level of policy preferences may differ, the rate of change did not. For two prototypical sub-populations, sex and education, Page and Shapiro found that the policy preferences of men and women diverged in less than one percent of the cases studied. Difference in the over-time policy preferences of more and less educated individuals diverged in less than five

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47 This presumes a response to the system shock. The public and the media may ignore the shock in which case there would be no effect.
percent of the cases studied. These were respectively, the first and third demographic
groups least likely to differ in their over-time trends.

Stimson (1999) similarly considered public opinion to move in a parallel fashion, though not necessarily to the same degree as Page and Shapiro (1992). The thrust of his argument is that public opinion moved toward liberal or conservative moods as a result of the success or failure of government policies. As the public comes to perceive government as being either beneficial or problematic, the policy mood of the country changes to the left or right. While Stimson may not argue that everyone changes to the same degree at the same time, clearly large segments of the public must change in the same way at the same time in order to shift the public mood.

Homogeneity also occurs because of stability in preferences. While absolute differences exist in the level of preferences, over time change in preferences may be small. Sears and Funk (1999), using a longitudinal design spanning almost 40 years, found long-term persistence in individuals’ partisan and ideological preferences. While differences in partisan preferences existed at the beginning of the study, they rarely changed over the 40 years. This is similar to other findings about the stability of partisan identification (but see Box-Steffensmeier & Smith, 1996; Green, Palmquist, & Schickler, 1998; MacKuen, Erikson, & Stimson, 1989). Parallel change in policy preferences or stability in partisan or ideological preferences suggest an underlying stability in public opinion. Change, if it occurs, moves in a synchronized fashion.

*Heterogeneity Hypothesis.* Different groups may respond in inherently dissimilar fashion to the same news or focusing event, what we describe as the heterogeneity hypothesis. According to Page and Shapiro (1992), this type of movement rarely occurs (p. 319). If two groups start at roughly the same level of concern and one group reacts to a system shock while the other does not, then heterogeneity is occurring. This is the
phenomenon found by Krause (1997) in his study of economic expectations. Only the better-educated responded to economic news and information in forming expectations about the future, in which these differential expectations led to different, and non-homogeneous electoral outcomes.

Differences in the acceptance of media messages may occur for a variety of reasons, such as educational differences (Brosius & Weimann, 1996; Krause, 1997; Krause & Granato, 1998), life experiences (Erbring et al., 1980), group perspectives (Shaw & Martin, 1992) or differential rates of getting the news (Price & Zaller, 1993). Researchers looking at attitudinal, behavioral and salience heterogeneity found that people do not react in the same way to news stories (Brosius & Weimann, 1996; Erbring et al., 1980). Some people are more attuned to certain news stories that are pertinent to their group or are of interest to them (Downs, 1972; Krosnick, 1990; Krosnick & Kinder, 1990), such as union members primed to react to certain economic news (Erbring et al., 1980). These groups or interested people would either be the first or only to respond to the news stories producing heterogeneity of opinion. Additionally, social communications may cause some conditions to rise in importance among members of the social network (McLeod et al., 1974), whereas those not involved in the discussions would not change their preferences. Issue importance may not change at the same rate across all groups, or at least not initially.

A significant body of theoretical work concluded that the agenda-setting process should produce social consensus (Graber, 1984; McCombs & Shaw, 1993; Page & Shapiro, 1992; Shaw & Martin, 1992), resulting in a convergence of opinions. Shaw, McCombs, Weaver and Hamm (1999) believed that one of the purposes of the media is to provide a common agenda. Since people were motivated to reduce social dissonance (Festinger, 1954, 1957) and isolation (Noelle-Neumann, 1977), individual and group
differences should meld into the common media agenda. This is what Shaw and Martin (1992) found when they looked at response patterns based on race, sex, education, income and age.

If opinion leaders move preferences, the impact on aggregated results may not be apparent until long after their preferences change and others follow. MacKuen, Erickson and Stimson (1989) found that public opinion was driven by the most informed members of the electorate (see also Krause, 1997). Brosius & Weimann (1996) found support for the old notion of the two-step flow of communication (Berelson et al., 1954; Katz, 1987; Katz & Lazarsfeld, 1965; Lazarsfeld et al., 1948), that a change in preferences among whom they termed opinion leaders result in changed public salience across the public. Schneider, Teske, Marschall and Roch (1998) found that a small group of informed parents were sufficient to produce better outcomes in public schools. Economists recognized that a subset of consumers could lead to competitive outcomes (Claxton, Fry, & Portis, 1974; Katona & Meuller, 1955; Newman & Staelin, 1972; Rhoads, 1985; Thorelli & Engledow, 1980). In these cases, subsets of the population drove either public opinion or markets to a new equilibrium. The opinion leaders may inform other members of the population about reasonable choices through interpersonal conversations or by their behaviors. The public may rely on these leaders to collect the information instead of spending the time themselves collecting the relevant information (Ferejohn, 1990; Iyengar, 1990; Krause, 1997; Krosnick & Kinder, 1990; Kuklinski, 1990; Schneider et al., 1998). Alternatively, people may conform to group preferences in order to belong (Asch, 1951, 1955, 1956; Sherif, 1935). In all cases, the differential rates of change suggest that the parallel publics hypothesis is not compelling. Public opinion may be heterogeneous in that some groups change first and lead other groups to change their opinions later.
Data and Methods

The measures used to test the competing hypotheses of homogeneity and heterogeneity come from a set of importance, attitudinal and behavioral questions asked of a random sample residents in the thirteen-county Atlanta metropolitan area (collectively “Atlanta”). As part of a study of the Partnership for a Smog-free Georgia’s (PSG) public information campaign (PIC), designed to limit driving on days ozone levels were expected to exceed the federal standard., From May 1, 1998 to September 30, 1998 and from February 2, 1999 to September 30, 1999 telephone surveys were administered daily. 48 This daily time series captures the dynamic association of the media, the public information campaign, issue importance and perceived community importance within the agenda-setting framework. As part of the data collection, information about the PIC, newspaper articles, real world indicators and survey data were collected. Each will be discussed in turn.

Survey Data. Political campaigns have long used daily tracking polls to estimate public attitudes in real time. Henry and Gordon (2001) demonstrated the feasibility of using tracking surveys, the Rolling Sample Survey (RSS) to study issue importance. There are numerous advantages to properly administered tracking polls that led to their use in estimating campaign effects (Cantril, 1991; Hugick et al., 1993; John, 1989). The RSS procedure samples a mix of respondents each day in a manner that permits each day to be considered an independent sample. On average, one sampling replicate or block of telephone numbers was introduced every day and a half with the goal of producing an even flow of interviews over the course of the sampling period. Therefore,

48 To maintain consistency, we only use the May 1- September 30 data for both years. Approximately 36 residents a day were sampled in 1998 and about 65 residents per day in 1999.
sections of the data can be analyzed independent of the whole survey, the survey in its entirety can be treated as a cross-sectional design, or it can be aggregated on a daily, weekly or monthly basis and analyzed with time series estimation techniques. The RSS has a number of beneficial properties. First, tracking polls use rolling samples so that each day has a mix of hard and easy to reach respondents, minimizing the impact of daily differences in sampling bias. Second, the RSS design had a higher response rate (54%), a significantly larger sample size given the short question format (about seven to ten minutes) and greater predictive validity than a cross-sectional design run simultaneously on the same subject. Third, the RSS measures shocks to opinions and behaviors immediately, minimizing the impact of response recall, and captures priming effects (Sudman & Bradburn, 1982; Tanur, 1992). The results showed dynamic changes in behaviors, attitude and issue importance that may have been missed with standard surveys. It is difficult to document behavioral, attitudinal and importance responses to episodic events with a cross-sectional survey. With the RSS, measures may be taken at intervals prior to and after a system shock allowing the magnitude and duration of the shock to be studied. In addition, the secular trends of increasing and decreasing issue importance can be assessed as media coverage waxes and wanes. The RSS design is a feasible method to study the issue attention cycle since daily, weekly and monthly trends can be plotted.

We used two measures, issue importance and perceived community importance to test the competing hypotheses of homogeneity and heterogeneity. The level of issue

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49 In 1998, GSU sampled the Atlanta population using both a cross-sectional design and the Rolling Sample Survey.
importance that individuals place upon the issue of air quality was measured on a 1-10 scale by asking,\textsuperscript{50}

“Now I’d like to find out how personally worried or concerned you are about a number of issues. If you aren’t really personally concerned about some of these matters, please don’t hesitate to say so. On a scale of 1 to 10, where 1 means not at all concerned and 10 means very concerned, how personally concerned are you about ______?”

The measure of perceived community importance or how important the individual perceived the air quality issue to be to the community at large was measured by asking people how important they believed issue of air quality was to the larger community. Prior to asking how important the issue was to them personally, we asked respondents,

“I would like to know how important you think certain issues are to other people in the Atlanta metropolitan area, regardless of how you might feel personally. How about ______? Leaving aside your own views, how important do you think this issue is to people in the Atlanta metropolitan area, on a 1-to-10 scale, where 1 means not at all important and 10 means very important?”

In addition to modeling the daily mean of the issue importance and perceived community importance items, the RSS also permits one to model the daily variance of the two series. Each day was an independent sample, which permits one to estimate both a daily mean and an estimate of the daily variance, which is unique to this type of survey. This daily variance is the basis for the first two tests.

\textsuperscript{50}To account for missing data common to survey research, we used NORM (Schafer, 2000) to impute missing values using a multiple imputation algorithm using all available data. After aggregating the individual data, missing values were imputed for days when surveys were not taken (e.g. July 4\textsuperscript{th}, Memorial Day) or days that appeared to be outliers (Enders, 1995). Approximately 6% of the data was imputed.
Newspaper. Starting April 1 of each year, 30 days prior to the first day of data collection, the *Atlanta Journal-Constitution* was systematically examined for articles that pertained to the issue of air quality. Each article in the *Atlanta Journal-Constitution* was coded for its length, page placement and date. A search was conducted on Lexis-Nexis using the following criteria: 1) the article had to be published in the morning edition of the paper; 2) the article had to appear in the front section of the newspaper; 3) the article had to include one of the following terms—air quality, air pollution, smog or ozone; and 4) air quality had to be a central focus of the article. Articles that merely mentioned air quality in passing or were not pertinent to residents of Atlanta were not included. The period before data collection corresponds to the length of time agenda-setting researchers contend that media effects accumulate on present salience, that is, media effects take approximately four weeks to impact current realizations of issue importance (Salwen, 1988; Winter & Eyal, 1981).

Public Information Campaign. Each day, scientists at the Georgia Institute of Technology, under contract from the EPD modeled the subsequent day’s projected GLO level. If the models predicted that GLO levels would exceed the federal standard

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51 The media data was collected from newspapers instead of television for two reasons. First, previous research has shown that newspapers set the public agenda while television plays a more critical role in determining the agenda of the top items (McCombs, 1976). Second, stories about air quality are not visually compelling, so newspapers are more likely to provide detailed information about the air quality campaign in Atlanta. However, during the televised weather reports, GLO information was broadcast each day on all of the major networks in Atlanta.

52 Each article in the *Atlanta Journal-Constitution* about air quality was weighted using a scheme suggested by Salwen (1988): \((N - (P-1)) / N \times C\), where \(N\) is the number of pages in the front section, \(P\) is the page number of the story, and \(C\) is the column inches. A front page story of 5 column inches would receive a weight of 5.0 while a back page story of 5 column inches in a 20 page front section would receive a weight of 0.25.

53 Ground-level ozone is an odorless, colorless gas that is the major component of what is commonly known as smog. GLO comes from a chemical reaction of nitrogen dioxide and volatile organic compounds, which are derived from hydrocarbons in automobile
("ozone exceedance"), a smog alert would be called by noon of the day preceding the estimated GLO exceedance. In 1998, there were 35 ozone action days. Table 1 shows the distribution of ozone alert days and actual GLO exceedance days. Of the 35 alert days, 13 were actual GLO exceedance days and 22 days were false positives, days when GLO remained with acceptable standards. There were also nine false negatives, days that were not designated as ozone alert days but actually were GLO exceedance days. In 1999 there were 67 smog alerts, though the standards were different.\textsuperscript{54} Thirty seven days were predicted to be ozone exceedance days and were while another 30 days were false positives (see Table 2). Four days were false negatives and 82 days were not called alert days and were not exceedance days. The differences in the programs permits one to test the effects of a public information campaign that focuses on particular events, that is the episodic alerts of 1998, or a seasonal change in general, that is the program change to a seasonal reduction in driving during 1999. Furthermore, the low overlap between GLO exceedance days and smog alert days permits one to test better the effects of the PIC and the underlying cause of the PIC, the objective indicators of ozone levels.

\textit{Real World Indicators.} To control for factors that may impact the relationship between the PIC, the media, and the two importance measures, we included in the models a number of measures that might relate to ozone production. Measures of the precursors to ozone production (e.g. temperature, wind, dew point, rain), the actual ozone level, indicators of days of the week (to control for exposure to messages and exhaust or vapors from chemical agents. Heated in the summertime sun, this chemical reaction produces ground level ozone, which is the same chemical compound as upper atmosphere ozone. The primary cause of ground-level ozone production in Atlanta is automobiles, which are estimated to account for 50% of all sources (Pierce, 2000).

\textsuperscript{54} Based on the 1998 standards, there would have been 23 alerts in 1999 (Pierce, 2000).
survey effects), and polynomial trend variables 55 (to account for the secular trends) were all included in all of the estimated models.

**Methodology.** We offer three tests of the two competing hypotheses (homogeneity or heterogeneity) to determine which theory best explains the publics’ reaction to the PIC and media coverage about air quality.

The first test is to correlate the series mean and variance. Recall that the survey methodology permits us to measure a daily mean and variance for the issue importance and perceived community importance series. A null correlation between the series mean and variance supports the homogeneity assumption. Consider a news event about air quality that changes the mean level of issue importance. If everyone is equally impacted by the system shock, that is, the parallel public hypothesis is accurate, the series mean will change but the series variance will remain constant. Therefore, the correlation between the mean and variance will be zero.

If everyone is not impacted equally by the system shock, both the series mean and variance will change. There are two possible forms of non-parallel change that may result from a reaction to the public information campaign; what we will call convergent heterogeneity or divergent heterogeneity (see Page & Shapiro, 1992 who discuss this terminology). Assume that the series mean rises in response to a system shock. The variance could rise or fall depending on how groups react to the news. Under the convergent heterogeneity hypothesis, the public converges in their policy preferences. Irrespective of the actual level of concern prior to the PIC, all groups converge at a similar level of concern after the system shock. A rise in the series mean corresponds

55 The centered polynomials were created by generating a new series where the midpoint of the series equaled zero. From the midpoint of the study (July 16), a series was generated by adding or subtracting one for each day from July 16. This was the first centered polynomial. The next four series were created by squaring the new series, taking the cube of the new series and so forth through the fifth centered polynomial.
with a decrease in the series variance and a negative correlation between the mean and variance. Under the divergent heterogeneity hypothesis, the public diverges in their policy preferences. Irrespective of the actual level of concern prior to the PIC, groups diverge to an even greater level after the system shock. A rise in the series mean corresponds with a rise in the series variance and a positive correlation between the mean and variance.

According to the heterogeneity hypothesis, both the mean and the variance will change in response to a system shock in a systematic way. Modeling the variance would provide further evidence that different parts of the population are responding differently, but systematically, to the system shocks. If the variances cannot be adequately modeled, this may indicate that all members of the population are responding similarly (so there are no meaningful changes in the variance) to a system shock or the daily variances are random. Traditional time series techniques with deterministic trends will be used to model the series variance.56

The third test compares group responses to a population model using the agenda-setting framework. Different groups, such as men and women, the college-educated and the not college-educated, may respond either to a system shock by changing their level of concern by roughly the same amount and at roughly the same time (Carmines & Stimson, 1989; Page & Shapiro, 1983, 1992; Page et al., 1987; Stimson, 1999) or there may be distinctly different response patterns. If group response patterns mimic the population model then there is evidence of homogeneity, if they differ, there is evidence of heterogeneity.

A traditional agenda-setting model (Figure 3[a]) is elaborated to include the impact of the public information campaign (PIC) and the perceived community

56 See Appendix F.
importance series (Figure 3[b]). One goal of the issue advocate who developed the PIC was to influence media coverage as a means of increasing awareness and changing normative attitudes (Pierce, 2000). Another goal was to influence individual concern about the topic as a means to cause behavioral change. The elaborated model permits the public information campaign to affect individual perceptions of issue importance both directly and indirectly through media coverage. Perceived community importance is a measure of a respondent’s perception of how important the issue of air quality seems to be to the community at large. The perceived community importance measure, like the issue importance measure, is expected to be an outcome of media coverage and the public information campaign. People’s perception of how concerned the community may be about an issue is expected to be affected by media coverage and the PIC.

If the homogeneity premise holds, members of major demographic cleavages such as males and females, college-educated and non college-educated should respond similarly to a system shock. Previous agenda-setting researchers studied sub-populations by partitioning their samples into sub-populations in order to study effects below the aggregate levels (McCombs & Weaver, 1973; McLeod et al., 1974). Following in this tradition, estimated daily means of the 1999 perceived community and issue importance series were created for two sets of sub-populations and compared to the population means. Series were created for individuals who were not college-educated and a second series for individuals who were college-educated. Second, separate series for males and females were calculated. The two sub-populations tested herein were selected for three reasons. First, along with age, income and race, the sex and education variables represent common cleavages that researchers consider to be important. Second, due to limitations of sample size, we selected series where there
were a minimum of 30 responses per day per series.\textsuperscript{57} Third, as reported earlier, Page and Shapiro (1992) reported that sex and education represented two of the three cleavages least likely to diverge.\textsuperscript{58}

\textit{Results}

\textit{Test 1- Correlation.} Figure 6 shows five-day centered moving average plots of the perceived community and issue importance air quality series for 1998 and 1999. Both the daily means and variances are displayed. The means are plotted with darker lines and the variances are plotted with lighter lines. One of the most apparent features of the figures is that the series do not move together. Changes in the series seem to move in opposite fashion. For instance, consider the surge in the perceived community importance of air quality in 1998 that occurred between May 17\textsuperscript{th} and June 2\textsuperscript{nd}. Corresponding to this sharp rise in perceived community importance was a significant fall in the variance. Most members of the population appeared to agree that the importance of air quality was rising amongst the public.

We correlated the mean of each series with its variance. That is, the 1998 perceived community importance series mean was correlated with the 1998 perceived community importance series variance. This was done for the other three series as well. In every case, the correlation was highly significant ($p < .0001$) and negative (see Table 6).\textsuperscript{59} One possible explanation is that one group believes that air quality is an important issue and shows little change in their response pattern across time. A second group appears to be responsive to system shocks; their importance levels increase in response

\textsuperscript{57} The third test, which uses a vector autoregression model, only uses the 1999 series. The sample size was too small to partition the 1998 series.

\textsuperscript{58} Our intent is to test the plausibility of the homogeneity assumption, not to develop a theory of agenda-setting or priming for these specific sub-populations.

\textsuperscript{59} The results were virtually identical if one controlled for survey effects (number of daily responses, number of attempts to reach a respondent).
to system shocks and then returns to the equilibrium level. As groups converge, the mean rises and the variance falls. These findings support the convergent heterogeneity hypothesis.

Table 6.

Correlations of the Mean and Variance of the Issue Importance and Perceived Community Importance Series for 1998 and 1999

<table>
<thead>
<tr>
<th></th>
<th>Perceived community importance</th>
<th>Issue importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>-0.52</td>
<td>-0.77</td>
</tr>
<tr>
<td>1999</td>
<td>-0.34</td>
<td>-0.64</td>
</tr>
</tbody>
</table>

Test 2- Modeling the Variance. The second test models the four importance series’ variances using traditional time series techniques (see Table 7).\(^{60}\) The logged\(^{61}\) average daily change of the four variance series (perceived community and issue importance in 1998 and 1999) were calculated and regressed on the five centered polynomials using time series techniques.\(^{62}\) In all cases, the variance series were

\(^{60}\) We tested the series for unit roots and that the series did not have unit roots. The implication of a series having a unit root is that the series would be not convergent, implying that the series would grow infinitely large in response to a system shock. Whether any variables in a VAR system must be stationary is a matter of dispute. Sims (1980) and Doan (1996) favor modeling the undifferenced values, while many other researchers require stationarity (Enders, 1995). The argument put forth by Sims (1980) is that the goal of VAR is not to determine parameter estimates, but to understand the relationship between variables. In the event of a co-integrating relationship, one can use a VAR error correction model. By differencing one may lose valuable information such as the possibility of cointegrating relationships. The VAR models estimated in Test 3 are undifferenced.

\(^{61}\) The natural log of the variance was used in order to create a series that was not bounded on the lower end by zero.

\(^{62}\) If the interest was to model the series in order to better predict responses to a system shock, modeling the volatility with an autoregressive conditional heteroskedastic (ARCH)
modeled by some underlying process. The perceived community importance model in 1998 was modeled only by an ARMA process (5,[8,9]), while the 1999 perceived community importance series was modeled with an ARMA (12,1) process with the trend variables of 1, 3 and 5 days. The two issue importance series were modeled with an MA(10) process, though the 1999 series also had a MA(12) process. In both series, the second and fourth order polynomials were significant, which is consistent with the finding of Henry and Gordon (2001) regarding the change in the mean of the series, though in the 1998 variance series the first order was significant as well. These results provide evidence that the variance series do not move randomly, rather they follow some type of systematic process.

model would be more appropriate. However, the interest is in the ability to show that the variance changes systematically, not in precisely predicting its change.

To see the results of the full model, see Appendix E.
Figure 6. Trends in the Means and Variances of the Issue and Perceived Community Importance Variables
Table 7.

ARIMA Model of the Daily Variances for the Issue Importance and Perceived Community Importance Series with Five Centered Polynomials

<table>
<thead>
<tr>
<th></th>
<th>Perceived Community Importance</th>
<th>Perceived Issue Importance</th>
<th>Perceived Community Importance</th>
<th>Perceived Issue Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>1.728</td>
<td>1.519</td>
<td>1.751</td>
<td>1.627</td>
</tr>
<tr>
<td>Lags</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR</td>
<td>5</td>
<td>-0.172</td>
<td>-0.170</td>
<td>0.142</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>0.142</td>
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<tr>
<td>MA</td>
<td>1</td>
<td>0.143</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>0.207</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>-0.219</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>-0.174</td>
<td>-0.246</td>
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<tr>
<td></td>
<td>12</td>
<td>-0.181</td>
<td></td>
<td></td>
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<tr>
<td>Polynomial</td>
<td>1</td>
<td>0.002</td>
<td>0.006</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>-0.018</td>
<td>-0.016</td>
<td>-0.016</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>-0.036</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0.031</td>
<td>0.032</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>0.051</td>
<td></td>
<td>0.051</td>
</tr>
<tr>
<td>σ</td>
<td>0.310</td>
<td>0.380</td>
<td>0.219</td>
<td>0.342</td>
</tr>
<tr>
<td>Final LL</td>
<td>-38.34</td>
<td>-69.14</td>
<td>14.90</td>
<td>-53.36</td>
</tr>
<tr>
<td>χ²</td>
<td>12.04</td>
<td>29.21</td>
<td>28.24</td>
<td>22.59</td>
</tr>
<tr>
<td>p &lt;</td>
<td>0.010</td>
<td>0.001</td>
<td>0.001</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Note: Coefficients shown only if p < .05

Test 3- Modeling Group Changes. The third test is to analyze the agenda-setting model for the population and a set of sub-populations based on sex and education.

Figure 7 displays the five day centered moving averages of the means for the perceived community and issue importance series for the two demographic groups. Looking first at the issue importance series, it appears that the education series is more likely to move in tandem than the sex series. While males and females started the
ozone season with similar levels of issue importance, by the end of May the series took dramatically different paths. Women increased their level of concern over the course of the summer while the level of concern among men seemed to decrease. Turning to the perceived community importance series, the sex and education series seemed to move in similar directions, but not at the same time. The series seem to follow markedly different paths in response to system shocks.
Figure 7. Trends in the Levels of Perceived Community and Issue Importance by Sex and Level of Education

We correlated the male and female and the college-educated and not-college educated series for both issue importance and perceived community importance to see if
they moved in parallel fashion (see Table 8). The correlations between the male and female series for issue importance \( (r = -0.04) \) and perceived community importance \( (r = 0.07) \) were insignificant. The results for the education model were similarly small, \( r = -0.09 \) for the issue importance model and \( r = 0.14 \) for the perceived community importance series. Since the daily series may have higher fluctuations due to the smaller daily sample size, we estimated a seven day moving average for each series, which would have a minimum of 210 responses for each period and for each series.

The correlations between the male and female series for issue importance \( (r = -0.20) \) was significant and divergent, while perceived community importance \( (r = 0.08) \) remained insignificant. The results for the education model, while significant, \( r = 0.16 \) for the issue importance model and \( r = 0.45 \) for the perceived community importance series, were still far from a level that would suggest that they moved in a parallel fashion.

Table 8.

One and Seven Day Correlations for the Issue Importance and Perceived Community Importance Series with the Male and Female and the College-Educated and not College-Educated Sub-populations

<table>
<thead>
<tr>
<th></th>
<th>Issue Importance</th>
<th>Perceived Community Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>College-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Educated</td>
</tr>
<tr>
<td>Female</td>
<td>-0.04</td>
<td>One day</td>
</tr>
<tr>
<td></td>
<td>-0.20**</td>
<td>Seven day</td>
</tr>
<tr>
<td>Not College</td>
<td>One day</td>
<td>-0.09</td>
</tr>
<tr>
<td>Educated</td>
<td>Seven day</td>
<td>0.16**</td>
</tr>
</tbody>
</table>

\* \( p < .10 \), \** \( p < .05 \), \*** \( p < .01 \)
To compare the agenda-setting model for the demographic groups with the population model, we start with the findings of the population model. The population model is shown in the first column of Table 9 and in Figure 8[a] and Figure 9[a]. Subsequently, we modeled the agenda-setting process for the college-educated (the second and third columns of Table 9, also see Figure 8) and for men and women (the fourth and fifth columns of Table 9, also see Figure 9). Only the significant effects are shown in the figures. In the population model, media coverage, issue importance and the public information campaign all Granger-caused perceived community importance. Issue importance was only Granger-caused by media coverage and issue importance. Finally, media coverage was Granger-caused only by the public information campaign.

The models for the sub-populations were much less straightforward. While all of the results are shown, in the interest of space, we will focus on the two education series, though the results of the male and female models were quite similar. Turning to the not college-educated series (see Figure 8[b]), all of the series Granger-caused issue importance while perceived community importance and the media series Granger-caused perceived community importance. The media coverage series was Granger-caused by issue importance and the public information campaign. The biggest difference between the not college-educated model and the aggregate model was that the perceived community importance series not being Granger-caused by the issue importance series and the public information campaign. Rather, issue importance was Granger-caused by perceived community importance and media was Granger-caused by the issue importance series. The college-educated results show that each of the importance series Granger-caused the other series (see Figure 8[c]). Additionally, the public information campaign Granger-caused each of the three outcome series. That is, perceived community importance, issue importance and media coverage all Granger-
caused changes in perceived community importance, issue importance and media coverage. The differences between the population model and the college-educated model was perceived community importance and the public information campaign Granger-caused issue importance, and perceived community importance, issue importance and the media series Granger-caused the media series in the college-educated model.64

Figure 8. Results of the Vector Autoregression Analysis for 1998 and 1999 Showing the Significant Findings for the College Educated and the not College Educated
Figure 9. Results of the Vector Autoregression Analysis for 1998 and 1999 Showing the Significant Findings for Men and Women
Table 9.

Results of the Population and Sub-population Granger Causality Tests for the Issue Importance, Perceived Community Importance and Media Coverage Vector Autoregression Model

<table>
<thead>
<tr>
<th>Population</th>
<th>College-Educated</th>
<th>College-Not-Educated</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Community Importance</td>
<td>2.46**</td>
<td>4.88**</td>
<td>2.23**</td>
<td>1.91*</td>
</tr>
<tr>
<td>Issue importance</td>
<td>2.25**</td>
<td>2.30**</td>
<td>1.58</td>
<td>3.78**</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>2.96**</td>
<td>3.67**</td>
<td>1.96**</td>
<td>3.87**</td>
</tr>
<tr>
<td>PIC</td>
<td>2.89**</td>
<td>5.47**</td>
<td>1.67</td>
<td>10.94**</td>
</tr>
<tr>
<td>Issue Importance</td>
<td>1.35</td>
<td>1.87*</td>
<td>2.11**</td>
<td>2.52**</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>3.55**</td>
<td>3.00**</td>
<td>3.81**</td>
<td>3.25**</td>
</tr>
<tr>
<td>PIC</td>
<td>1.65</td>
<td>2.70**</td>
<td>2.97**</td>
<td>3.21**</td>
</tr>
<tr>
<td>Media Coverage Importance</td>
<td>1.34</td>
<td>3.92**</td>
<td>1.36</td>
<td>1.41</td>
</tr>
<tr>
<td>Issue importance</td>
<td>1.76</td>
<td>3.37**</td>
<td>5.39**</td>
<td>2.05*</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>0.74</td>
<td>1.98**</td>
<td>0.73</td>
<td>1.33</td>
</tr>
<tr>
<td>PIC</td>
<td>2.12**</td>
<td>4.03**</td>
<td>2.25*</td>
<td>2.06*</td>
</tr>
</tbody>
</table>

* p < .05, ** p < .01
The percentage of variance explained was higher for each of the sub-models than for the aggregated models as a whole (see Table 10). While the aggregated model explained 78% of the variance of the perceived community importance series, the college educated series explained 91% of the variance, while the not college-educated series explained 82%. Similarly, while the aggregated model explained 56% of the variance of the issue importance series, the female series explained 86% of the variance and the male series explained 89% of the variance. The media series had the greatest diversity, ranging from 83% of the variance explained in the college-educated model to 35% for the not college-educated. This may suggest that journalists, who are predominately college-educated, may have picked up cues from their social networks that the air quality issue was one that people were discussing (see paper 3). There was little difference in the variance explained of the media model by sex, though in both cases the F-test were insignificant.
Table 10.

Results of the Population and Sub-population F-Tests and R2 for the Issue Importance, Perceived Community Importance and Media Coverage Vector Autoregression Model

<table>
<thead>
<tr>
<th>Equation</th>
<th>R2</th>
<th>F-Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population Model</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived community importance</td>
<td>0.78</td>
<td>2.58</td>
<td>0.001</td>
</tr>
<tr>
<td>Issue importance</td>
<td>0.56</td>
<td>1.55</td>
<td>0.010</td>
</tr>
<tr>
<td>Media</td>
<td>0.23</td>
<td>1.94</td>
<td>0.050</td>
</tr>
<tr>
<td><strong>College Educated</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Community Importance</td>
<td>0.91</td>
<td>4.29</td>
<td>0.001</td>
</tr>
<tr>
<td>Issue importance</td>
<td>0.84</td>
<td>2.30</td>
<td>0.001</td>
</tr>
<tr>
<td>Media</td>
<td>0.83</td>
<td>1.91</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>High School Educated</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Community Importance</td>
<td>0.82</td>
<td>2.16</td>
<td>0.001</td>
</tr>
<tr>
<td>Issue importance</td>
<td>0.81</td>
<td>2.17</td>
<td>0.001</td>
</tr>
<tr>
<td>Media</td>
<td>0.35</td>
<td>1.83</td>
<td>0.050</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Community Importance</td>
<td>0.89</td>
<td>4.00</td>
<td>0.001</td>
</tr>
<tr>
<td>Issue importance</td>
<td>0.84</td>
<td>2.37</td>
<td>0.001</td>
</tr>
<tr>
<td>Media</td>
<td>0.63</td>
<td>1.02</td>
<td>ns</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Community Importance</td>
<td>0.86</td>
<td>2.75</td>
<td>0.001</td>
</tr>
<tr>
<td>Issue importance</td>
<td>0.86</td>
<td>3.30</td>
<td>0.001</td>
</tr>
<tr>
<td>Media</td>
<td>0.71</td>
<td>1.23</td>
<td>ns</td>
</tr>
</tbody>
</table>
Recall from Figure 8 and Table 9 that the public information campaign Granger-caused changes in issue importance in the both the college-educated (F=2.70, p<.01) and not college-educated (F=2.97, p<.01) models as well as in the male (F=3.21, p<.01) and female (F=3.32, p<.01) models, but not in the population model (F=1.65, ns). In order to investigate this seemingly contradictory finding, we simulated the impact of the public information campaign on issue importance for the college-educated and not college-educated series. Figure 10 displays the results of the simulation for the two education sub-populations by varying the structure of the public information campaigns. That is, we estimated the impact of a single alert day on changes in issue importance, two consecutive alert days on issue importance through five consecutive alert days. The not college-educated model shows that the public information campaign led to sharp drops in levels of issue importance, up to a 1.4 point drop seven days later. On the other hand, the college-educated model showed generally positive results. One day after the campaign generally produced a 0.6 point increase in levels of issue importance, followed by a sharp decrease and then a sharp increase. From days 4 through 8, importance levels were elevated by about one point, before reverting to the equilibrium level. While the college-educated and not college-educated models showed results that contradicted the population model, the simulations show that the groups were reacting in demonstrably different ways making the aggregate effect appear as though there was no relationship between the PIC and issue importance.

65 The results are similar for the male and female models.
Figure 10. Simulated Effect of the Public Information Campaign on the College Educated and the Not College Educated

Conclusion

There is an ongoing debate in many disciplines about whether populations under study should be modeled in the aggregate or whether greater effort should be made to model individual or group differences (Page & Shapiro, 1992; Stimson, 1999). Are researchers only interested in macro-level measures because evidence for individual-level (or group-level) rationality appears to be elusive (Bartels, 1996) or because mass opinion moves policy (Erikson, Wright, & McIver, 1993)?

The results from the models tested in this paper provide strong evidence that the homogeneity or parallel publics assumption may be untenable. The initial analysis, test 1, correlating the aggregate means and variances, gave strong indication that there were different processes at work. The negative correlations provided support for the
convergent heterogeneity hypothesis. Not only did the mean and variances change, but the changes in the variance were systematic and measurable (test 2). The average daily means and variances moved systematically and in a fashion that suggested different sub-populations were influenced in different ways by the media and public information campaign (test 3). We used the unique features of the Rolling Sample Survey, that each day was an independent sample, to model processes of certain definable groups. The results of the VAR analysis show significant differences in response patterns to the media coverage and public information campaign. We also simulated the effects of the PIC to demonstrate that different groups responded in systematically different ways to the system shock.

The results of test 1 suggest that public concern about air quality followed a path consistent with the convergent heterogeneity hypothesis. The negative correlation implied that the variance of responses fell as the mean level of concern about air quality rose. Most members of the public became more concerned about air quality in response to the public information campaign. This coalescing of concern suggests that, when broad stretches of the public become concerned with a problem, people may want to conform to the perceived public concern. In all of the sub-population models, the evidence suggests a conformity process where people adjust their levels of issue importance based on the perception about the concern other people have about the issue. This aligns with the findings of Asch (1951; 1955; 1956), Festinger (1954; 1957), and Sherif (1935). While this effect was not found at the population level, the analysis that followed Figure 10 showed that the effects of the public information campaign, or any system shock, may cancel each other out. If the effects of the system shock do not align, that is, conformity processes are not occurring simultaneously amongst the sub-
populations, the overall effect may be too diminutive to be uncovered statistically with
the existing sample size and noise.

The Page and Shapiro (1992) study looked at the breadth of public opinion
research stretching over decades, while this study clearly looked at the short-term.
While Page and Shapiro argued that divergence in public opinion was rare, men and
women clearly moved in opposite directions over the course of the five months studied
herein. Maybe because of differences in surplus compassion (Hilgartner & Bosk, 1988)
or because of the zero-sum nature of issue salience (Zhu, 1992), air quality did not
become a salient issue for men in 1999. While women became more concerned about
air quality as the ozone season wore on, the issue of air quality failed to register strongly
with men. Despite the ongoing public information campaign, the level of concern for
men fell and seemed to find a new, lower level of equilibrium concern. Among men, the
air quality issue evidently did not usurp other issues that may have been on their
agenda. These findings suggest that researchers need to follow issues for an extended
period to see, after a system shock and after all coverage has effectively ended, if
preferences return to their pre-existing level of equilibrium. MacKuen et al. (1989) found
that changes in party identification due to changes in presidential approval were abrupt,
but fleeting, while changes in party identification due to changes in economic conditions
were slow, but lasting. It may be that different groups respond to shocks differently over
the short-term, but over the long term change is similar.

What are the implications of these findings for the agenda-setting model? While
this paper did not hypothesize a mechanism that led to changes in issue importance, the
findings support the idea that the public information campaign and the media coverage
that followed led to a convergence of concern among the public. This finding supports
the notion of agenda melding. According to Shaw, McCombs, Weaver and Hamm
(1999), issues, in this case the public information campaign and the concern about air quality, are the basis for a community. People coalesce around issues important to them and develop networks that share these same concerns. While the term *communities* may be overly broad for the air quality issue, it is likely that the public information campaign and concern about air quality may have entered interpersonal social networks as a source of conversation. If so, informal social networks may be a precursor to communities forming around issues making social communications the mechanism that melds people into one agenda. While the old notion of the two-step flow of communication (Katz, 1957; Katz & Lazarsfeld, 1965; Katz & Lazarsfeld, 1955; Lazarsfeld et al., 1948; Lazarsfeld & Menzel, 1963; Lazarsfeld & Merton, 1948) was dismissed, recent research suggested that information flows may move between *opinion leaders* and the general population (Brosius & Weimann, 1996). Social communications may permit people to place information in front of their peers that they gleaned from the media for approbation (MacKuen, 1984; McLeod et al., 1974). The degree of acceptance by the social network may lead to the sub-population responsiveness to the system shock and convergent heterogeneity. The impact of social communications on the convergence of concern needs further investigation.

One way to investigate the contingent conditions of agenda setting (McCombs & Shaw, 1993) is to study the moderators that might affect the outcomes. In this study, we tested the moderating effects of sex and education and found substantial differences in how different groups respond to the news and public information campaign. Baron and Kenny (1986) believed that one of the purposes in studying moderating effects is to develop a pool of knowledge that may lead to testable hypotheses about the mediating mechanism that might underlie the moderation. Shaw and Martin (1992) believed that the mediating mechanism was the amount of interaction with the daily news. They found
the more different groups interacted with the news, the more these different groups converged into a common agreement about the important stories of the day. However, while the college-educated reported higher levels of daily newspaper reading ($F=52.74$, $p<.001$) when compared to the non college-educated, men also reported significantly higher rates of daily newspaper reading ($F=30.64$, $p<.001$) when compared to women. Yet, women responded to the news and men did not.

A second potential mediating mechanism was the public information campaign. Men were more likely to work outside of the home ($p<.001$) and drive farther distances ($p<.001$), and not surprisingly, more likely to be aware of the public information campaign ($p<.005$). Using the F-Tests as a means to discuss the relative strength of relationships, the issue importance of men ($F=3.21$) and women ($F=3.32$) seemed to be equally influenced by the public information campaign, as were the college-educated (2.70) and the not college-educated (F=2.97). However, men (F=10.94) seemed to use the public information campaign as a proxy for communal concerns to a much greater degree than women (2.70). Similarly, the college-educated (F=5.47) used the public information campaign as a proxy for communal concerns more so than the non college-educated (F=1.67). Why women (F=4.06) changed their personal issue importance in response to news coverage to a greater degree than men (F=3.03), while men and the college-educated used the public information campaign as a proxy for communal concerns to a greater degree than women is an open issue.

The results of this study are suggestive, and leave open a fundamental question. Why do some groups who report higher levels of media interaction (e.g., men) not respond to the news as predicted by the agenda-setting process, yet use the precursor to the news, the PIC, as a basis for forming impressions of communal concern? Conversely, why do some groups (e.g., women), who report lower levels of interaction
with the news seem to be more responsive to the agenda-setting nature of the media? In order to understand the mechanisms leading to the formation of preferences, one must develop theories to account for these findings. The nature of the mechanism remains elusive.
Paper 3- Talk Back: The Impact of Social Communications on Media Coverage and Issue Importance

Traditional models looking at the derivation of political or policy preferences, such as the agenda-setting model, presume that media coverage has an unmediated or direct effect on the level of importance that the public ascribes to an issue; the higher the level of media coverage, the greater the level of issue importance (Erbring et al., 1980; McCombs & Shaw, 1972). The media leads the public by informing them about news, focusing events or social conditions that they have no other way to learn about (Lippmann, 1922). However, the social processes that are triggered by media coverage, such as talking about the issues, are the likely mechanisms through which issues are legitimated (Lazarsfeld & Merton, 1948), salience is increased, and additional information is obtained.

Previous agenda-setting research considered the role of social communications or talking about an issue to be an important function connecting media coverage to public concern (Brosius & Weimann, 1996). Social communications may be the “key intervening variable” linking media coverage to public concern (Ball-Rokeach, 1985 p. 502). However, informal conversations about issues may also have consequences for media coverage of those issues. Downs (1972 p. 43), referring to the work of Marshall McLuhan, proposed that the public might manage the news by the level of interest they show in issues, indicating that media coverage and public interest in issues are tightly interwoven in his theory of an issue-attention cycle. The necessity of this interconnection is reinforced by the forces of a competitive media market. Media organizations compete to increase or maintain market share, which means their coverage must attract and hold mass interest. Increases in the social communication
about particular issues may indicate heightened public interest that, in turn, triggers more media coverage, a feedback mechanism that has previously eluded empirical investigation.

Factors that may moderate the influence of media coverage on issue importance are the issue’s novelty or drama. Downs (1972 p. 43) hypothesized that issues needed to be novel or dramatic in order to capture the public’s attention, which is supported by a significant body of research (Brosius & Kepplinger, 1992; Leff et al., 1986; Protess et al., 1987; Protess et al., 1985; Watt et al., 1993; Zhu et al., 1993). For instance, Brosius and Kepplinger found that an acceleration model, where changes in problem awareness move more than changes in media coverage, accounted for more explained variance for novel issues than a traditional linear model. For novel issues, a little news may have a significant impact on issue importance.

Similarly, social communications may change as a result of novel or dramatic issues. During a period when an issue fails to capture the public attention, social communications may have little impact on issue importance. However, when an issue becomes dramatic and the public attends to the issue, social communications may have a powerful impact on the agenda-setting process. And, if journalists have their ear to the ground (Brosius & Weimann, 1996; Easton, 1979; Iyengar, 1988; Rogers & Dearing, 1988) and learn what is important to the public through their involvement in informal social networks, social communications may be a way for the public to manage the news. If people talk about an issue, the media should attend to the issue. Therefore, social communications may be the mechanism by which issue importance impacts media coverage.

In this paper, we test whether the level of social communication about air quality mediates the relationship between the media and the importance the public places on an
issue and the feedback relationship from public concern to the media. We will do this comparing by two models: a traditional agenda-setting model connecting media coverage to issue importance and a second model incorporating a measure of social communication. In a second analysis, we test whether social communication impacts media coverage, moderated by the level of drama in which the discussions took place. Our data combine daily independent surveys of the public’s perception of issue importance, indicators of the underlying social problem, and measures of media coverage, using summer air quality alerts in the Atlanta metropolitan area as an exogenous shock that creates a natural experiment. The Partnership for a Smog-Free Georgia (PSG) issued a public information campaign (PIC) informing local citizens about impending ground level ozone (GLO) alerts. The natural experiment occurred as a result of predictable violations of the ground level ozone standard (“ozone exceedance”) that triggered local air quality alerts, which have been shown to increase the public’s perception of the importance of air quality issues (Henry & Gordon, 2001). The daily surveys tapped not only issue importance, but provided an estimate of the percent of the population talking about air quality. These unique data allow us to use vector autoregression and Granger-causality to connect media coverage, public perceptions of issue importance and social communications in a dynamic model. While the data are limited to a single, large and diverse metropolitan area, they offer a test of Granger causality within a defined social context (Huckfeldt et al., 1995) without the attenuation of effects that is possible when examining national issues across multiple localities. In the next section, we discuss how talking is expected to affect importance of the issues and media coverage, then we provide more detail on the study data and methods.
Literature Review

Agenda-setting research seeks to explain the development of issue importance. According to the agenda-setting hypothesis, most people cannot experience most events in the world for themselves so they rely on the media for news (Lippmann, 1922). While the media may not tell people how to think, the evidence suggests that the media tells people what to think about (Cohen, 1963). The phrase *thinking about* implies that changes in media coverage, specifically increasing the amount of coverage about a particular social problem or issue, results in increased concern amongst the public about that social problem. This relationship between media coverage and issue importance is the agenda-setting process (McCombs & Shaw, 1972). For a review of the literature see McCombs and Shaw (1993), Rogers and Dearing (1988) Rogers, Dearing and Bregman (1993) and Dearing and Rogers (1996).

Individuals have two ways of learning about the world outside of their personal experiences, through the media or through social communications. Press coverage clearly relates to the public’s heightened interest in an issue, as experiments (Iyengar & Kinder, 1987) and numerous studies using survey data and content analyses of the media coverage found (Brosius & Keplinger, 1990; McCombs & Zhu, 1995). The agenda-setting hypothesis and the empirical results that changes in issue importance were a function of media coverage presume that the media drives what the public believes is important. While the media may have a key role in informing the public about the important issues of the day, the talking people do in their social interactions may also affect issue importance.

Conversations people have play a significant role in the judgments they form and are a meaningful way for citizens to participate in the democratic process. People generally trust social communications more than the media (Erbring et al., 1980; Wright,
Therefore, when individuals talk about an issue, the issue may be legitimated (Lazarsfeld & Merton, 1948) and interest in the issue increased. Furthermore, social communications may help people sort out and understand the news content (Erbring et al., 1980). Individuals acquire information from their social interactions, drawing on the cues available in their social contexts to construct meaning and to develop their attitudes about issues of the day (Huckfeldt, 2001; Huckfeldt & Sprague, 1995). Social communications may be critical for the diffusion of ideas through acquaintances (Huckfeldt et al., 1995; Rogers & Dearing, 1988), by making the news real and increasing the importance of the topic.

When social communications are exogenous or separate from media influence, the range of discussions must be limited to the personal experience of the members of the social network. Since most individuals do not like to participate in discussion with which they disagree, social networks for political information tend to be conformist (Huckfeldt & Sprague, 1987, 1988, 1990) and homogeneous (Mutz & Martin, 2001). People who disagree with the topic of conversation either conform or remain silent (MacKuen, 1990; Noelle-Neumann, 1973, 1974). However, discussions about topics that are not seen as threatening, such as a public information campaign about GLO, may travel farther in the social networks because the information may be communicated through weaker social ties (Granovetter, 1973); people are more willing to discuss non-threatening issues in informal social networks than to engage an acquaintance in a controversial discussion.

More likely than relying on personal experiences for news, the interpersonal networks rely upon the media to provide information about the world beyond the personal experiences of the members of the social network. Social networks may play

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66 The media is likely to be more important than social communications in exposing people to views different from their own (Mutz & Martin, 2001).
an important function in the development of issue importance, bridging personal level concerns and the social level concerns of an issue. Social communications make people aware that others share their own problems (Mutz, 1992; Weaver, Zhu, & Willnat, 1992) and may also make ideas learned about in the media more personal. Similar to the diffusion of innovations theory (Rogers, 1996), the mass media may make people aware of an idea, but the social communications are an integral part of making the idea more tangible and acceptable to people.

The transmission of useful and meaningful information in social networks requires that people, or at least a meaningful subset of people, be knowledgeable and well-informed. However, on most issues, the public is neither attentive nor informed (Campbell, Converse, Miller, & Stokes, 1980; Converse, 1964, 1990; Kuklinski, 1990; Neuman, 1986). Therefore, Bereleson, Lazarsfeld and McPhee (1954) and Katz and Lazarsfeld (Katz & Lazarsfeld, 1955) believed that the flow of information moved from the relatively attentive and informed, those who most closely attend to the media coverage, to the public. Members of the public are either part of the social network of the well-informed or, if the issues were non-threatening, may be part of a casual social network that included the well-informed (Brosius & Weimann, 1996; Huckfeldt et al., 1995). Alternatively, people may pick up on cues from the relatively more informed. Schneider et. al (1998) found that explicit social networks were not needed to transmit pertinent information; rather the decision-making or actions of a few well-informed led to the efficient transmission of information (see also Claxton et al., 1974; Katona & Meuller, 1955; Newman & Staelin, 1972; Rhoads, 1985; Thorelli & Engledow, 1980). The flow of information from the well informed to the public was known as the two-step flow model.
The flow of information in social networks, whether as described by the two-step model or simply discussions among people, may strengthen or weaken the transference of issue importance from the media coverage to the public. Some researchers found that issues discussed in the media became more salient after social communications about the issues took place (McLeod et al., 1974; Weaver et al., 1992). Social communications could reinforce and enhance the media message increasing the issue’s importance (Wanta & Wu, 1992) or people could use the interpersonal networks to make sense of the news (Erbring et al., 1980). These studies suggested that interpersonal discussion moderated the relationship between the media coverage and issue salience; the influence of the media coverage changed based on the level of the social communications. Conversely, a number of researchers found that social communications interfered with the agenda-setting effect (Atwater, Salwen, & Anderson, 1985), particularly if the topic that people were talking about was not the focus of media coverage (Lassorsa & Wanta, 1990; Wanta & Wu, 1992).

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67 The two-step model was subjected to a number of criticisms. First, the theory ignored the possibility that opinions may be shared within social networks rather than merely given over from the well-informed to the uninformed (Troldahl & Van Dam, 1965). The flow of information may be reciprocal, including from the uninformed to the most informed (Robinson, 1976). Therefore, instead of information flowing vertically, the flow may be horizontal. Second, the theory rested on the assumption that the media was the sole source of information; this assumption ignored the possibility of other sources of information (Robinson, 1976). Personal experiences clearly play an important role in social communications, particularly regarding local issues (Palmgreen & Clarke, 1977). Finally, one of the premises of the theory was that people selectively attended to information that was supportive of their existing preferences. However, Sears and Freedman (1967) found that there was no evidence to support a psychological preference for supporting information and there was no evidence of a de facto selectivity. Many people might seek information contrary to their stated positions.
Social communications may not only assist in (or detract from) the transference of issue importance from the media to the public, but may lead to more media stories, hence providing a feedback loop from issue importance to the media. One of the functions of journalists is to be the gatekeepers of the news (Brosius & Weimann, 1996; Easton, 1979; Iyengar, 1988; Rogers & Dearing, 1988). While many direct feedback mechanisms are rather crude, cumbersome, or slow (e.g., changes in subscriptions, letters to the editor), one of the responsibilities of journalists is to maintain surveillance of what is important to the public through memberships in informal and formal social networks. The media is a profit-oriented endeavor and it is incumbent upon media organizations to write about what is of interest to the public (Manheim, 1986; Mutz & Soss, 1997). If a topic is of interest to the public, journalists are inclined to write about it. Therefore, what people talk about in informal social networks may drive media coverage.68

However, given the dynamic nature of information transmission and the potential bi-directional relationship between the media and the public that may occur with such quickness, it may be difficult to capture and to measure the interplay of media coverage, social communications and public concern with traditional survey data. During the initial phase of the issue-attention cycle when interest in an issue rises from its equilibrium level of concern, an issue receives increased attention from the public and media alike, sometimes spiraling upwards in a matter of days. With interest rising, peeking and falling over the course of two hours (Funkhouser & McCombs, 1971); a day (Rhee, 1996), week (Brosius & Kepplinger, 1990, 1992; Kepplinger & Roth, 1979; Zhu, 1992), month (Brosius & Weimann, 1996; Demers, Craff, Choi, & Pessin, 1989; Krause, 1997; 68 News coverage may also reflect editorial preferences or other non-profit maximizing decisions made by the editors or publishers (Altheide, 1976; Epstein, 1973; Gans, 1980).
Krause & Granato, 1998; McCombs & Zhu, 1995; Neuman, 1990; Watt et al., 1993; Winter, Eyal, & Rogers, 1982; Zhu et al., 1993; Zucker, 1978) or year (Funkhouser, 1973a, 1973b; Winter & Eyal, 1981) due to boredom or message fatigue (Henry & Gordon, 2001; Neuman, 1990) traditional methods of data collection may not suffice. Cross sectional designs of public concern about the importance of an issue cannot account for the potential dynamic relationship between the media and the public. In turning to address the research question, we will posit a dynamic relationship between media coverage and issue importance where social communications may mediate the relationship in both directions using a survey methodology that permits the capturing of the effect.

The traditional expectation for unobtrusive issues, issues that people generally cannot experience directly, is that people are more dependent upon the media for information than they are for obtrusive issues such as pocketbook issues. Therefore, an unobtrusive issue, such as the environment, may have a quicker issue attention cycle (McCombs & Zhu, 1995), since public and journalistic interest and informal conversations about these issues may be short lived. However, dramatic events, even regarding unobtrusive issues or novel issues, which are by definition unobtrusive (Watt et al., 1993; Weaver et al., 1981), may increase or sustain interest (Downs, 1972), as awareness of the problem increases, the problem is framed, and solutions are proffered. Still, interest in the story tends to revert to its equilibrium.

To capture this dynamic interplay between the media and the public using an issue that may have a quicker issue attention cycle requires a means of data collection that matches the dynamic association. The Random Sample Survey (RSS) is one such means (Henry & Gordon, 2001). The measures of issue importance and social communications come from a set of importance, attitudinal and behavioral questions
asked of residents in the thirteen-county Atlanta metropolitan area during the summer of 1998 and 1999. These surveys, administered on a daily basis, capture the dynamic association of the media coverage, the public information campaign, issue importance, and social communications within the agenda-setting framework.

Research Questions and Design

The Rolling Sample Survey methodology permitted us to test three research questions that follow from the elaboration of the traditional agenda-setting model:

1. Does the level of social communication about an issue influence the issue’s importance among the public?
2. Does the level of social communication about an issue influence the media coverage of an issue?
3. Does the relationship between social communication and media coverage change as the drama of the issue changes?

We begin by testing a traditional agenda-setting model that includes the PIC (Figure 11[a]). Specifically, an increase in the weighted column inches (Salwen, 1988) of stories, the measure of media coverage, about air quality should increase the importance people place on the issue. However, the impetus to both the media coverage and the public’s concern about the topic is likely to be the public information campaign alerting people to potentially excessive levels of ozone. Therefore, a measure of the PIC is added to the traditional model, and is expected to impact directly both media coverage and issue importance and issue importance indirectly through media coverage.
In the mediated model, we elaborate on the basic model in two important ways as shown in Figure 11[b]. First, to control for a possible mis-specified model, we relaxed the assumption of one-way causality between the media coverage and issue importance and permit issue importance to impact media coverage (Beniger, 1978; Brosius & Kepplinger, 1990; MacKuen & Coombs, 1981; Siune & Borre, 1975; K. A. Smith, 1987b; T. W. Smith, 1987). Second, we introduced a measure of social communications, the percentage of people talking to friends and family about air quality. This measure was anticipated to mediate (Baron & Kenny, 1986) the relationship between media coverage and issue importance in both directions (media coverage → social communications → issue importance; issue importance → social communications → media coverage).
These hypotheses are similar to those suggested by previous researchers (Brosius & Weimann, 1996), but which have not been tested directly. The PIC may also have a direct impact on social communications; the public information campaign leads people to talk more about the social problem above and beyond the impact of the PIC on media coverage or issue importance. In both models, we control for alternative explanations (e.g., actual ozone levels, precursors to ozone production, survey effects) that may account for the possible findings as suggested by other researchers (Kingdon, 1995; Neuman, 1990; Rogers et al., 1993).

While social communications may mediate the relationship between media coverage and issue importance, the relationship between social communications and media coverage may be moderated by the level of drama in which they interact. We define the level of drama by the frequency of the ozone alerts. As will be discussed, prior to mid-July, the alerts were broadcast infrequently. From mid-July through the end of August, the alerts were broadcast daily. Finally, from the end of August until the end of September, the alerts were broadcast approximately one-half of the time. During a period when an issue fails to capture the public attention, social communications may have little impact on the other outcomes. However, when an issue becomes dramatic and the public attends to the issue, social communications may have a powerful impact on the agenda-setting process including influencing media coverage. Finally, as interest in a topic wanes, social communications and the media may need to work together to maintain a semblance of interest in the topic.

In the next section of the paper, a more detailed description of the sample, data and analytical methods.
Data and Methods

The measures of issue importance and social communications come from a set of importance, attitudinal and behavioral questions asked of residents in the thirteen-county Atlanta metropolitan area (collectively “Atlanta”) during the summer of 1999 as part of an evaluation of the public information campaign of the Partnership for a Smog-free Georgia (PSG), which was designed to limit driving on ozone alert or smog action days. This daily time series captures the dynamic association of the media, the public information campaign, issue importance and social communications within the agenda-setting framework. As part of the data collection, information about the PIC, newspaper articles, real world indicators and survey data were collected. Each will be discussed in turn.

Survey Data. Political campaigns have long used daily tracking polls to estimate public attitudes in real time. Henry and Gordon (2001) demonstrated the feasibility of using tracking surveys, the Rolling Sample Survey (RSS), to study issue importance. There are numerous advantages to properly administered tracking polls that led to their use in estimating campaign effects (Cantril, 1991; Hugick et al., 1993; John, 1989). The RSS procedure samples a mix of respondents each day in a manner that permits each day to be considered an independent sample. On average, one sampling replicate, or block of telephone numbers, was introduced every day and a half with the goal of producing an even flow of interviews over the course of the sampling period. Therefore, sections of the data can be used for analysis independent of the whole survey, the survey in its entirety can be treated as a cross-sectional design, or it can be aggregated on a daily, weekly or monthly basis and used with time series estimation techniques. The RSS has a number of beneficial properties. First, tracking polls use rolling samples so that each day has a mix of hard and easy to reach respondents, minimizing the
impact of daily differences in sampling bias. Second, the RSS design had the desirable qualities of a higher response rate (54%), significantly larger sample size given the short question format (about seven to ten minutes) and greater predictive validity than a cross-sectional design run simultaneously on the same subject.\textsuperscript{69} Third, the RSS measures shocks to opinions and behaviors, minimizing the impact of response recall (Sudman & Bradburn, 1982; Tanur, 1992). The results showed dynamic changes in behaviors, attitude and issue importance changes that may have been missed with standard surveys. It is extremely difficult to document behavioral, attitudinal and importance responses to episodic events within a cross-sectional survey. With the RSS, measures may be taken at intervals prior to and after a system shock allowing the magnitude and duration of the shock to be studied. For example, Henry and Gordon (2001) measured the length of the issue attention cycle of the air quality issue in response to a system shock. In addition, the secular trends of increasing and decreasing issue importance, the issue attention cycle, can be assessed as media coverage waxes and wanes.

To measure the impact of social communications on the flow of information between the media and the public, the average values of the importance item and the percent of the public talking to their family and friends about air quality were calculated on a daily basis using the RSS.\textsuperscript{70} The specific issue importance question was,

“Now I’d like to find out how personally worried or concerned you are about a number of issues. If you aren’t really personally concerned about

\textsuperscript{69} In 1998, GSU sampled the Atlanta population using both a cross-sectional design and the Rolling Sample Survey.

\textsuperscript{70} To minimize the bias that may result from missing data that is common to survey research, NORM (Schafer, 2000) was used to impute missing values using a multiple imputation algorithm using all available data. After aggregating the individual data, missing values were imputed for days when surveys were not taken (e.g. July 4th, Memorial Day) or days that appeared to be outliers (Enders, 1995). Approximately 6% of the data was imputed.
some of these matters, please don’t hesitate to say so. On a scale of 1 to 10, where 1 means not at all concerned and 10 means very concerned, how personally concerned are you about ______?“

Figure 4 shows a five day centered moving average of the importance individuals ascribe to air quality for 1999. Measured on a 1-10 scale, the results show that, on average, the expressed concern about air quality meandered between 8.0-8.3 prior to the start of the daily exceedance period. Once the period of daily exceedances started, concern initially dropped sharply followed by a significant rise and then fall. As the ozone season started to wind down, the importance individuals ascribed to air quality went through another cycle before ending the season with averages approaching the seasonal lows.

In addition to the importance question, individuals were asked if they had talked to family or friends about air quality in the past week. The specific measure of social communications was,

“In the past week, did you talk about smog or air quality with your family or friends?”

This is in contrast to previous studies that asked about general political communications (Erbring et al., 1980) or discussions about a basket of issues discussed in the media (Wanta & Wu, 1992). The daily percentage of respondents who reported talking to family or friends about smog is the measure of social communications. Figure 12 shows a five day centered moving average of the percent of the population who reported talking about smog with the days that a public information campaign occurred overlaid. At the

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71 It is important that the measure of the amount of conversations be specific to the issue and not more generally related to public affairs or politics. Interest in public affairs or conversations about politics may indicate a greater band width for social conversations but may not indicate the building or sustaining of interest in a particular issue.
beginning of the ozone season, about 35% of the public reported talking to family or friends about smog. The level of social communications about smog fell steadily through May, reaching its nadir of 14% at the end of the month. During a series of ozone alerts in early June the percent of the public that reported talking about air quality increased to about 30%. Over the next month, in a period of limited ozone alerts, the percent of the public talking about smog drifted down to about 20%. From July 18th to August 23rd, a period of daily ozone alerts, the percent of the public talking doubled from 23% to 46%. This contrasts with the level of issue importance, which initially drifted down during the start of the string of ozone exceedance alerts. As the number of ozone alerts waned, the percent of the public talking fell from 41% back to 26%.

![Figure 12. Percent of the Population Who Reported Talking about Air Quality with Family or Friends](image-url)
Newspaper. Starting April 1, 1999, 30 days prior to the start of the ozone season, the *Atlanta Journal-Constitution* was examined for articles that pertained to the issue of air quality. The 30 day period corresponds to the length of time agenda-setting researchers suggest is required for media coverage to impact current realizations of issue importance (Salwen, 1988; Winter & Eyal, 1981). Each article in the *Atlanta Journal-Constitution* was coded for its length, page placement and date. A search was conducted on Lexis-Nexis using the following criteria: 1) the article had to be published in the morning edition of the paper; 2) the article had to appear in the front section of the newspaper; 3) the article had to include one of the following terms—air quality, air pollution, smog or ozone; and 4) air quality had to be a central focus of the article. Articles that merely mentioned one of the phrases in passing were not included in the data collection. Furthermore, the article had to be pertinent to residents of Atlanta.

Public Information Campaign. Each day, scientists at the Georgia Institute of Technology, under contract from the Environmental Protection Division of Georgia’s Department of Natural Resources (EPD) modeled the subsequent day’s projected GLO level. If the models predicted that GLO levels would exceed the federal standard (“ozone exceedance”), an ozone alert would be called by noon of the day preceding the event.

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72 The media data was collected from newspapers instead of television for two reasons. First, previous research has shown that newspapers set the public agenda while television plays a more critical role in determining the agenda of the top items (McCombs, 1976). Second, stories about air quality are not visually compelling, so newspapers are more likely to provide detailed information about the air quality campaign in Atlanta. However, during the televised weather reports, GLO information was broadcast each day on all of the major networks in Atlanta.

73 Each article in the Atlanta Journal-Constitution about air quality was weighted using a scheme suggested by Salwen (1988): \( (N - (P-1)) / N \) * C, where N is the number of pages in the front section, P is the page number of the story and C is the column inches. A front page story of 10 column inches would receive a weight of 10.0 while a back page story of 10 column inches in a 20 page front section would receive a weight of 0.5.
estimated GLO exceedance. In 1999 there were 67 ozone alerts.\textsuperscript{74} Thirty seven days were predicted to be ozone exceedance days and were while another 30 days were false positives (see Table 2). Four days were false positives and 82 days were not called alert days and were not exceedance days. The low overlap between GLO exceedance days and ozone alert days permits one to test the separate effects of the PIC and the underlying cause of the PIC, the objective indicators of ozone levels.

\textit{Real World Indicators.} Theorists contend that modeling objective indicators of the social problem is necessary to specify properly the agenda-setting model (Iyengar, 1988; Kingdon, 1995; Neuman, 1990; Rogers et al., 1993). If individuals respond to real world conditions and the media is simply reporting on the real world conditions, then findings that media coverage directs public concern is spurious; real world conditions are setting both agendas. To control for other factors that may impact media coverage or the importance measures, we included in the models a number of measures including the precursors to ozone production (e.g. temperature, wind, rain, dew point), the actual ozone level, indicators of days of the week (to control for message exposure and survey effects), and polynomial trend variables\textsuperscript{75} (to account for the secular trend of the issue attention cycle) were all included in the traditional agenda-setting and mediated models.

\textit{Analytical Methodology.} Researchers use vector autoregression (VAR) either when there is a question of the direction of causality between two or more series or

\textsuperscript{74} The high number of alerts is due to a change in program implementation. Based on the 1998 standards, there would have been 23 alerts in 1999 (Pierce, 2000).

\textsuperscript{75} The centered polynomials were created by generating a new series where the midpoint of the series equaled zero. From the midpoint of the study (July 16), a series was generated by adding or subtracting one for each day from July 16. This was the first centered polynomial. The next four series were created by squaring the new series, taking the cube of the new series and so forth through the fifth centered polynomial.
when error terms may be correlated (Doan, 1996 136; Enders, 1995 125; Hamilton, 1994 138; Sims, 1980 137). The present study looks at how social communications may mediate the relationship between issue importance and media coverage in both directions, while simultaneously permitting media coverage and issue importance to impact one another. The critical hypothesis testing in the VAR structure uses the notion of Granger-causality to test causality between the series. One series, \( z_t \), is said to Granger-cause another series, \( y_t \), if, after controlling for the lagged terms of \( y_t \), that is \{\( y_{t-1} \ldots y_{t-n} \)\}, \( z_t \) or its lags significantly influence the current realization of \( y_t \). Granger-causality is evaluated by conducting block F-tests for the lagged values. A significant F-test indicates that one series Granger-causes another series. For a further discussion of VAR, see Doan (1996); Enders (1995); Greene (1999); Hamilton (1994); Sims (1980), and for Granger-causality see Granger (1969; 1980) or Granger and Newbold (1974).

**Partitioning Models.** We use three periods defined by the frequency of the ozone alerts to develop a better understanding of the effects of drama on the relationship between talking and media coverage. The first period runs 78 days, from May 1st.

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76 The estimator used in this study is seemingly unrelated regression (SUR). The initial model included 21 days of lags for personal and perceived community importance, 30 day lags of the media variable and seven days of lags of the public information campaign and a number of interaction terms. See Appendix C for a more complete discussion.

77 The lagged coefficients in an atheoretical VAR are highly correlated with one another, inflating the standard errors, making the t-statistics insignificant. Therefore, researchers generally ignore the individual coefficients and study the series as a whole.

78 Because the length of the phases is relatively short, lags were restricted to seven days or less and estimated with OLS. A case can be made for the importance of longer lag lengths to register the full impact of social communication because the time from picking up on the conversations to producing media coverage could be more than a week. Providing tests of these relationships are important for building accurate theories about the agenda-setting process. The models are limited to two variables, which may lead to mis-specified equations and attribution of effects that actually arise from omitted variables. The public information campaign is omitted from the analysis because it is
through July 17th, when 16 alerts were sporadically issued. During the second period, from July 18th through August 23rd, alerts sounded daily. The third period ran 38 days, from August 24th though September 30th, when 14 alerts were announced. During these periods, the level of social communications averaged 25 percent, 40 percent, and 35 percent, respectively. If, as others have hypothesized, media directs public attention and discourse when issues emerge and social communication sustains and augments media coverage, then one should expect different relationships between these variables during the first and second phases. The third phase has been less heavily theorized about except for the likelihood for the same messages to produce issue fatigue (Neuman, 1990) and boredom (Henry & Gordon, 2001) and therefore greatly reduced levels of issue importance.

Results

To understand the impact of interpersonal communication on the agenda-process, we start with a more traditional agenda-setting model. Table 11 and Table 12 show the result of a seeming-unrelated regression estimation of issue importance and media coverage.79 As expected, the traditional agenda-setting hypothesis is supported.

79 To control for other factors that might explain changes that occurred, indicators that might impact the development of ground-level ozone, the actual ozone level, indicators of days of the week, and polynomial trend variables were included in the analysis. If individuals respond to real world conditions and the media is simply reporting on the real world conditions, then findings that media coverage directs public concern is spurious; the real world conditions are setting both agendas. Did individuals respond to real world conditions? In the traditional agenda-setting model, media coverage was impacted by weather conditions and ozone levels. In the mediated model (to be discussed), issue importance and media coverage were impacted by weather conditions, pollen levels and ozone levels. The social communications series was impacted solely by temperature. Since the series may follow a pattern like the issue attention cycle, centered polynomials of order one through five were estimated to account for a possible deterministic trend.
Current realizations of issue importance are Granger-caused by lags of issue importance, media coverage and the public information campaign. Media coverage is Granger-caused by the public information campaign suggesting that the media wrote stories in response to the PIC. For both series, the lagged variables accounted for about one-third of the variance explained.

Table 11.
Results of the F-Test and R2 for the Traditional Agenda-Setting Model using Vector Autoregression Model

<table>
<thead>
<tr>
<th>Equation</th>
<th>R2</th>
<th>F-Test</th>
<th>p &lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issue importance</td>
<td>0.31</td>
<td>2.23</td>
<td>0.005</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>0.33</td>
<td>0.99</td>
<td>ns</td>
</tr>
</tbody>
</table>

Table 12.
Results of the Granger Causality Test for the Traditional Agenda-Setting Model using Vector Autoregression Model

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Independent Variable</th>
<th>F</th>
<th>df</th>
<th>df</th>
<th>P&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issue importance</td>
<td>Issue importance</td>
<td>4.73</td>
<td>186</td>
<td>3</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>Media Coverage</td>
<td>2.14</td>
<td>186</td>
<td>10</td>
<td>0.050</td>
</tr>
<tr>
<td></td>
<td>PIC</td>
<td>2.41</td>
<td>186</td>
<td>5</td>
<td>0.050</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>Media Coverage</td>
<td>0.55</td>
<td>186</td>
<td>29</td>
<td>ns</td>
</tr>
<tr>
<td></td>
<td>PIC</td>
<td>3.93</td>
<td>186</td>
<td>3</td>
<td>.010</td>
</tr>
</tbody>
</table>

Social communications are an important source of information. While most people prefer to talk to others with whom they agree (Huckfeldt et al., 1995; Huckfeldt &

Both issue importance and social communications – followed some deterministic trend in 1998, such as described in Henry and Gordon (2001). To see the results of significant covariate relationships, see Appendix E.
Sprague, 1995; Mutz & Martin, 2001), air quality is a non-threatening issue where people may freely discuss the issue with social acquaintances. These discussions about the issue might lead to an increase in the stated importance of air quality. Furthermore, it is likely that the public information campaign would cause an increase in the level of social communications, which would cause a further increase in the level of issue importance. What is less certain is the relationship between the level of discourse and media coverage. Some researchers have argued that journalists have their ear to the ground and the news reflects what people are talking about. Conversely, changes in media coverage are likely to cause changes in the level of social communications. Since we found that the traditional agenda-setting model held, without a feedback loop from issue importance to media coverage, it is possible that the feedback from issue importance to media coverage is mediated through changes in the level of social communication. To address these questions, we developed a VAR model with issue importance, media coverage and the percent of the public who report talking about air quality to their friends and family (see Figure 11[b]).

Table 13 and Table 14 show the results of the mediated VAR model. Most striking is the percent of variance explained when the measure of social communications is added to the model. In Table 11, without the addition of the talking series in the model, the percent of variance explained for the issue importance model was .31 and for the media coverage model, .33. The addition of the talking series increased the variance explained for the issue importance series to .77 and for the media coverage series to .69. These drastic increases in the variance explained suggest that the traditional model was not specified properly. The variance explained for the social communications model was .90.
Table 13.

Results of the F-Test and R2 for the Mediated Model with the Issue Importance, Social Communication and Media Coverage Series using Vector Autoregression Model

<table>
<thead>
<tr>
<th>Equation</th>
<th>R2</th>
<th>F-Test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issue importance</td>
<td>0.77</td>
<td>1.79</td>
<td>0.001</td>
</tr>
<tr>
<td>Social Communications</td>
<td>0.90</td>
<td>4.19</td>
<td>0.001</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>0.69</td>
<td>1.82</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Table 14.

Results of the Granger Causality Test for the Mediated Model with the Issue Importance, Social Communication and Media Coverage Series using Vector Autoregression Model

<table>
<thead>
<tr>
<th>Dependent</th>
<th>Independent Variable</th>
<th>F</th>
<th>df</th>
<th>df</th>
<th>P&lt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issue importance</td>
<td>Issue importance</td>
<td>3.11</td>
<td>130</td>
<td>16</td>
<td>0.001</td>
</tr>
<tr>
<td>Social Communications</td>
<td>Issue importance</td>
<td>3.01</td>
<td>130</td>
<td>21</td>
<td>0.001</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>Issue importance</td>
<td>2.40</td>
<td>130</td>
<td>29</td>
<td>0.001</td>
</tr>
<tr>
<td>PIC</td>
<td>Issue importance</td>
<td>3.08</td>
<td>130</td>
<td>10</td>
<td>0.005</td>
</tr>
<tr>
<td>Social Communications</td>
<td>Social Communications</td>
<td>2.22</td>
<td>130</td>
<td>19</td>
<td>0.005</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>Social Communications</td>
<td>2.44</td>
<td>130</td>
<td>17</td>
<td>0.005</td>
</tr>
<tr>
<td>PIC</td>
<td>Social Communications</td>
<td>2.04</td>
<td>130</td>
<td>30</td>
<td>0.005</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>PIC</td>
<td>1.92</td>
<td>130</td>
<td>11</td>
<td>0.050</td>
</tr>
<tr>
<td>Social Communications</td>
<td>Media Coverage</td>
<td>1.29</td>
<td>130</td>
<td>18</td>
<td>ns</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>Media Coverage</td>
<td>3.34</td>
<td>130</td>
<td>21</td>
<td>0.001</td>
</tr>
<tr>
<td>PIC</td>
<td>Media Coverage</td>
<td>1.75</td>
<td>130</td>
<td>25</td>
<td>0.050</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>PIC</td>
<td>2.02</td>
<td>130</td>
<td>2</td>
<td>ns</td>
</tr>
</tbody>
</table>

In the traditional model, issue importance was Granger-caused by issue importance, media coverage and the public information campaign. These relationships
held in the mediated model (see Table 14) with the percent of the public talking also impacting issue importance. In the traditional model, media coverage was Granger-caused by the public information campaign. In the mediated model, changes in media coverage were Granger-caused by the lags of media coverage and the percent of the public talking. Finally, the percent of the public talking, like the issue importance series, was Granger-caused by all of the series in the model.

Figure 13 graphically displays the direction of Granger-causality for the two models, the traditional agenda-setting model (Figure 13[a]) and the mediated model (Figure 13[b]). Most striking is the absence of a significant Granger-causal path from the public information campaign to media coverage in the mediated model. In the traditional model, the amount of media coverage was only Granger-caused by the public information campaign. In the mediated model, the relationship between the public information campaign and the level of media coverage is non-existent. Instead, the public information campaign Granger-causes the level of social communications, which in turn Granger-causes the level of media coverage. This is the definition of perfect mediation (Baron & Kenny, 1986). Social communications partially mediates the relationship between the public information campaign and issue importance and from

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80 Baron and Kenney laid out four conditions necessary in order to determine mediation. First, there must be a significant relation when a dependent variable (media coverage) is regressed upon an independent variable (public information campaign) in the first equation. Second, there must be a significant relation when the mediator (percent of public talking) is regressed upon the independent variable (public information campaign) in the second equation. Third, the mediator (percent of public talking) affects the dependent variable (media coverage) while controlling for the independent variable (public information campaign). Finally the effect of the independent variable (public information campaign) on the dependent variable (media coverage) in the second equation was reduced from the first equation when the effect of the mediator (percent of public talking) was controlled in the second equation. If the effect from the independent variable to the dependent variable is zero in the second equation, one has perfect mediation. If the effects are attenuated in the second equation, one has partial mediation.
media coverage to issue importance. Both of those paths were significant in the traditional agenda setting model and remain so in the mediated model.

![Diagram of Traditional Model including the Public Information Campaign](image1)

![Diagram of Mediated Model of Agenda Setting with Social Communications](image2)

Figure 13. Results of the Traditional Agenda-Setting and Mediated Models

Next, social communications provides the feedback mechanism from issue importance to media coverage. The amount of media coverage is Granger-caused by the percent of the public talking about air quality while the percent of the public talking about air quality is Granger-caused by changes in issue importance. Therefore, while social communications did not mediate the traditional agenda-setting model (media coverage → issue importance), social communications did mediate the feedback loop (issue importance → social communications → media coverage). In the mediated model, the media was found to Granger-cause changes in issue importance and social
communications; the media was not responsive to the public information campaign. Rather, the media responded to the fact that people were talking about the public information campaign. Once the topic became interesting to the public, it became interesting to the media.

This is most evident when looking at one period during the summer of 1999. We estimated separate simple VAR models for three periods, the results of which are shown in Table 15. In the first period, when the public information campaign started with relatively few broadcasts, the level of social communications was low. The results in Table 15 show that the media coverage Granger-caused changes in social communications with no feedback. In the second period, when every day had an ozone alert, the results were reversed. Changes in social communications drove changes in the media coverage with no feedback. Notice also the large increase in the percentage of the variance explained from Period 1 to Period 2, from ten percent or less to forty percent or more for the two series. Finally, Period 3, when almost half of the days were ozone exceedance days, the relationship between the social communications and the media coverage was reciprocal. Both series were Granger-caused by the other series.
Table 15.

Results of the Vector Autoregression Model with Media Coverage and Social Communication for Three Periods Defined by the Frequency of the Public Information Campaign

<table>
<thead>
<tr>
<th></th>
<th>Period 1:</th>
<th>Period 2:</th>
<th>Period 3:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sporadic PICs,</td>
<td>Daily PICs,</td>
<td>Sporadic PICs,</td>
</tr>
<tr>
<td></td>
<td>Season Start</td>
<td>7/18 – 8/23</td>
<td>Season End</td>
</tr>
<tr>
<td></td>
<td>5/1 – 7/17</td>
<td>8/24 – 9/30</td>
<td></td>
</tr>
<tr>
<td>DV</td>
<td>IV</td>
<td>χ²-Test</td>
<td>P-Value</td>
</tr>
<tr>
<td>Media Coverage</td>
<td>% Talking</td>
<td>1.43</td>
<td>ns</td>
</tr>
<tr>
<td>% Talking Media</td>
<td>Media</td>
<td>6.83</td>
<td>0.030</td>
</tr>
<tr>
<td>R²</td>
<td>Media</td>
<td>0.03</td>
<td>0.44</td>
</tr>
<tr>
<td>% Talking Coverage</td>
<td>% Talking</td>
<td>0.13</td>
<td>0.40</td>
</tr>
</tbody>
</table>

Conclusion

This study finds support for the idea of social communication as an integral component of the relationship between the public and the media. As other studies demonstrated, the media leads the public in making events accessible by informing the social networks about real world events that may become personally important. During the first days of the ozone alerts, when the importance of the issue was relatively stable, the media coverage influenced the public with no evidence of feedback. However, with the increased drama of daily ozone alerts, social communication influenced media coverage, with no feedback. The most surprising finding of the mediated model was that
talking about air quality perfectly mediated the effects of the ozone alerts on media coverage. In one sense, this supports the idea that talking about a social problem or its solution is an attempt at social sense-making that is grounded in real world events, but which takes on a life of its own. When the drama waned, media coverage and social communications fed off of one another. Media coverage and social communications are directly and intimately connected. In a side analysis, to calculate the effect sizes of the increases in media coverage, we find that a one standard deviation increase in the percentage of the public talking about air quality produced an increase of 3.95 weighted column inches of media coverage over the course of the following week, an effect equal to the median article on air quality during the study period. Talking plays a significant role in the agenda-setting process.

Shaw, McCombs, Weaver and Hamm (1999) found that people were likely to select interpersonal or media routes of information depending on the nature of the problem. Wanta and Wu (1992) and Brosius and Weimann (1996) suggested that social communications may act to bridge personal concerns with those of the larger community. The findings herein tend to suggest that social communications may do more than act as a bridge between personal and social level concerns. Under certain circumstances, social communications may drive media coverage to match personal levels of concern. This finding supports previous research that suggested that social communications may be more powerful than media coverage in determining levels of issue importance in local communities (Palmgreen & Clarke, 1977). The relationship between social communications and media coverage may be more pronounced at the local level because individuals are better able to observe directly the problems that people are talking about (Mutz, 1992; Weaver et al., 1992).
As Zhu (1992) found, coverage must be maintained in order to keep the agenda-setting process going. People did respond to media coverage, but what was necessary to move salience was to get people talking about the problem. What motivated people to talk were the on-going alerts that sensitized people to the problem and propelled them to talk. This talking, in turn, led to further media stories. Without the interaction of a number of parties in the agenda-setting process, it does not appear as though interest can be sustained in this issue. The media must cover the topic and people must be interested in the topic, but the existence of an exogenous event stimulated interest in the problem area. Cobb, Keith-Ross and Ross (1976) suggested that without a policy entrepreneur or issue advocate the agenda-setting process may fade. Institutional support helps to move an issue along the issue attention cycle (Henry & Gordon, 2003). This may explain why some issues stay on the issue attention cycle for longer periods of time than other issues (Hilgartner & Bosk, 1988). Issues that have a coupling of the media coverage, public interest, and motivation on the part of the policy elite to motivate institutional change are more likely to remain on the issue attention cycle longer than issues where one of the three legs of the agenda-setting process is weak or non-existent.

However, the nature of the relationship between the media and social communications may be a function of the context in which the data is being collected. Consider what conclusions we would have arrived at had we only sampled the population during one of the three periods discussed in Table 15. In the first period, prior to the daily occurrence of alerts, media coverage directed the amount of social communications. In the second period, the reverse was found; the amount of social communications directed media coverage. Only in the final period, when interest began to wane did we find that the relationship between media coverage and social
communications was bi-directional as was found in the full model. Understanding the context, in this case by changing the level of drama in which the agenda-setting process is taking place, may be the key to understanding how the news media directs public attention.

Downs’s (1972) theory of the issue attention cycle focused attention on issue importance or salience. According to Downs, public attention was galvanized around an issue, mainly in response to media coverage (McCombs & Shaw, 1972). Since the media competes with entertainment and lifestyle issues for public attention, when news is no longer interesting, public attention wanes. The media has to attend to new problems in order to capture public attention. This suggests that the issue attention cycle for issue importance is shorter than the issue attention cycle for news coverage since media coverage precedes changes in issue importance and the public is more apt to change focus. While this may be true, McCombs (1997) theorized that the attention span of journalists is even shorter than that of the public. Journalists may have an incentive to find the newer, more interesting stories in order to make a name for themselves. While the public may still want to follow a story, the media may prefer to focus on new stories. These stories that captured the public attention may be picked up and maintained in the informal social networks. Theories of diffusion of innovation (Rogers, 1996) and empirical findings (Erbring et al., 1980; McLeod et al., 1974) suggest that social networks may continue stories long after media coverage wanes resulting in a longer issue attention cycle for the public than the media. The media coverage is the impetus to awareness, but the interpersonal networks are necessary to expand awareness and keep topics alive. Journalists may pick up on the continued public interest in the topic and may decide to refocus attention on the topic. And if policymakers use the media as an indicator of what the public thinks is important, and
the public can manage the news through its social communications, then democratic accountability is enhanced.
CONCLUSION

The purpose of this study was to test three mechanisms or moderators that might explain why the public or certain segments of the public, became more concerned about air quality during the summers of 1998 and 1999. The natural experiment provided by the ozone alerts in Atlanta and the use of the Rolling Sample Survey permitted the testing of three extensions to the agenda-setting model: (1) the inclusion of two measures of salience, issue importance and perceived community importance as well as a test of their interaction; (2) the partitioning of the agenda-setting model to look at the separate effects of media coverage and the public information campaign on issue importance and perceived community importance separately for men and women and college- and not college-educated groups; and (3) the impact of social communication, not just mediating the effects of media coverage on issue importance, but also explaining changes in media coverage. This conclusion is divided into three parts. We begin with a discussion of the methodology, looking at both the analytical and the sampling methodology used in this study and its importance to this type of research. In the second section, we turn to a discussion of the findings from the three papers. In the third section, we integrate what has been learned from these individual studies, discuss possible extensions to the research and look at what might be fruitful avenues of further research.

Analytical and Sampling Methodology

How should one collect data on an episodic event over a period of months such as the PIC? Three methods have been used frequently. First, one could use administrative data such as Cummings and Walker’s (2000) use of traffic data to estimate if people curtailed their driving on ozone alert days using the same ozone
abatement program studied in this manuscript. They measured the number of cars passing monitoring stations located throughout Atlanta. As common with administrative data, there were problems of measuring the right outcomes, noisy data, and the inability to study the mechanisms leading to behavioral change. Second, one could use traditional cross-sectional studies, but they are fraught with other problems. Starting a survey at one time and not another may cause one to miss the effect of the policy intervention. The simulations of Henry and Gordon (2001) demonstrated that by changing the start date of a new cross-sectional survey by as little as a week could result in significantly different inferences being made about the success of the intervention. Cross-sectional designs also face the problem of recall (Sudman & Bradburn, 1982; Tanur, 1992). In cross-sectional surveys, respondents are frequently asked to recall their behaviors before and after an intervention. The farther back in time one must go to recollect a behavior, the less accurate the estimate. Additionally, for reasons of social desirability, respondents are likely to over-estimate the effects of an intervention. Third, one could use a panel study. In addition to the significant cost in terms of time and money of recruiting and retaining panel members, there are problems of instrument reactivity. Panel members may become overly familiar with the instrument, limiting the effectiveness of the instrument to analyze the intervention. Hedeker and Gibbons (1997) demonstrated the problems of panel study attrition, specifically when the attrition is related to the outcome under study.

*Sampling Methodology.* In response to these concerns, Henry and Gordon (2001; 2003) suggested that the independent daily sampling design of the Random Sample Surveys (RSS) was one means to study a policy intervention. The RSS permits one to measure swings in policy preferences, the issue attention cycle, boredom, or serendipitous events. This type of data collection is not merely limited to political or
policy analyses; advertisers (Miller & Berry, 1998), marketers, and others could use the methodology to assess the effectiveness of their activities. In this study, we used the methodology to study the impact of a predictable, recurring event, ozone alerts, on issue concern. Using the agenda-setting process as the framework for testing the research questions, we modeled the effects of the policy intervention and subsequent media coverage using the RSS. We demonstrated that the survey methodology is an appropriate means to test the mechanisms leading to public preferences.

Can the RSS methodology be used to answer the individual-level mechanism questions so prominent in many fields? Krosnick and Kinder (1990) used a serendipitous event, the Iran-Contra scandal, that occurred during the course of collecting data for the National Election Study in order to study the effects of priming. One of the major weaknesses of their findings was that the samples taken before and after the news of the scandal were not random. Easy to reach respondents were over-represented in the pre-scandal period and under-represented in the post-scandal period. If each period were random samples, the inferences from their findings would be stronger. Both predictable and unpredictable events occurred during the two years of data collection using the RSS, which would permit one to study the type of question addressed by Krosnick and Kinder. One could study the effects of expected and unexpected economic news on perceptions of jobs and the economy or unexpected events such as the Columbine School shootings on perceptions of public schools. Samples taken before and after the events are independent, random samples, strengthening the inferences made. Another potential use of the RSS is to create a series of data sets, such as combining weekly data sets, and estimate a type of pooled time series analysis. Studying the changes in regression coefficients may lend insights into processes that are occurring at the individual level.
There are limitations to the RSS method. Potentially the most consequential is the brevity of the interview. While a short interview is not a necessary component of the RSS, response rates and interview completions tend to rise significantly with shorter interviews. The short interviews make it necessary to hone in on the questions of interest, which limits one’s ability to take advantage of serendipitous events. Second, over the course of 12 months of data collection in 1998 and 1999, over 20,000 interviews were completed. While the short interviews are much less expensive per interview than traditional cross-sectional designs, the RSS design is nevertheless, expensive. Finally, the RSS survey is management intensive. In cross-sectional designs, phone numbers are dumped into the call queue immediately and interviewers keep working the numbers until the survey is completed. Political tracking polls tend to add new telephone numbers quickly and limit call-backs to five or less (Roper Center Symposium, 1997) before dumping the numbers and adding new ones. This procedure tends to produce a sample of too many easy-to-reach respondents. The RSS procedures used in this manuscript required close supervision of the number of easy- and hard-to-reach respondents so that each day was representative. New samples were added as needed to maintain the balance. Further research is needed to fully understand the implications of having too many easy to reach respondents.

Analytical Methodology. This study is not the first to use vector autoregression (VAR) to test the possibility of multiple outcomes and feedback loops using the agenda-setting process (for other studies using VAR see Blood & Phillips, 1997; G. C. Edwards, III & Wood, 1999). As discussed in the beginning of this study, VAR is appropriate when testing theories about causal mechanisms. Not only can multiple outcomes be analyzed, but feedback loops from conceived outcomes (e.g., issue importance) to
presumed inputs (e.g., media coverage) can also be tested to determine if the effects are one way or nonrecursive.

In the atheoretical VARs used in this manuscript, the only structure imposed was making the PIC exogenous to the other parts of the model—public preferences and social communications. This structuring suggests that attitudes about salience are not likely to reduce the frequency of ozone alerts. If one were to study behavioral change, it is plausible that changes in behavior may lead to changes in the frequency of ozone alerts. The phrase, atheoretical VAR, does not imply that the VARs are without a theoretical foundation. Rather, we based the models on existing theory and tested if the theories were compelling or lacking. By not imposing a structure on the data, one can test empirical propositions that may lead to future theory development. What we learned can aid future researchers by permitting them to impose structure on the VARs leading to more compelling theories.

**Integrating the Studies**

Understanding how and why certain issues garner public attention has important theoretical and practical implications. In the present study, we considered two mechanisms that might explain how elites and the media may focus public attention on an important social problem. This knowledge may assist elites in determining how to communicate most effectively with the public. Additionally, we considered a factor that might moderate how salience is transferred from the elites and media to the public. This knowledge may demonstrate both the limitations of broad-based communications but also demonstrates that seemingly ineffective programs may work for some important groups.
What are the implications of these findings for the agenda-setting model? The original conceptualization, changes in media coverage leads to changes in public salience, has been broadened in a number of important ways. This may be the first study to capture the process of issue development from its infancy, follow the issue as it develops into an important community issue and then falls back to obscurity, only to be replicated in the following year. Importantly, we include the precursor to both the media coverage and the outcomes under study. The plural use of outcomes is a critical aspect of this study; we consider the outcome not solely to be a measure of personal salience – what we called issue importance – but also a measure of the perceptions individuals have about the community at-large and the social interactions people had about air quality. Finally, we considered that the agenda-setting process may be different for different groups. Recent research suggests that the media transcends demographic differences and brings about a coalescing of issue concern based on the amount of media usage (Shaw & Martin, 1992). We hypothesized that fundamentally different processes may be at work for different demographic groups.

It is not that these issues have not been considered previously. For instance, many researchers theorized about the role that social communications plays in the agenda-setting process. It is not uncommon to find studies that suggest that social communications may enhance the agenda-setting effect, provided that issues discussed in the social networks are the same as the ones discussed by the media. If they are not, then social communications may interfere with the agenda-setting effect. Rather, what we hypothesized is that social communications may play a more fundamental role. Social communications may not just be another means for media coverage to influence the public, but instead, social communications may be a way for the public to manage
the news. We now turn to a discussion about each of these extensions to the agenda-setting model.

![Diagram](image)

**Figure 14. Results of the Vector Autoregression Models from the Three Papers**

*Public Information Campaign.* The public information campaign played an important role in all of the studies (see Figure 14). The PIC was a unique effort to influence attention, interest and behaviors on a broad level using different channels (e.g., electronic highway signs) to reach the intended audience. As expected, people responded to the media coverage, but what was necessary to stimulate media and public interest was the PIC. Specifically, what was necessary, after the initial burst of publicity, was a continued cycle of public information campaigns that sensitized people to the issue and propelled them to discuss the issue. As Chaffee and Mutz (1988)
found, media coverage may stimulate social communications and influence perceptions of community norms and expectations. However, what we found was that the PIC was more likely to affect the process. It should be further stressed that the PIC caused the media to pay attention to the issue. This occurred in every case with one important exception, the finding from paper 3 that talking mediated the relationship between the PIC and media coverage. We will return to this important finding shortly.

Without the interaction of a number of parties in the agenda-setting process, it does not appear as though interest can be sustained in an issue. The media must cover the topic, people must be interested in the topic, and there must be a policy elite who also stimulate interest in the subject area. Cobb, Ross and Ross (1976) suggested that, without a policy elite propelling the issue forward, the issue is likely to fade. While most issues will not be resolved in the political domain, without a policy elite to willing to couple policy positions with the public interest in the topic, there is not likely to be a resolution and a continuation of interest. This may explain why some issues stay on the issue attention cycle for longer periods of time than other issues (Hilgartner & Bosk, 1988). Issues that have a coupling of the media coverage, public interest, and motivation on the part of the policy elite to motivate institutional change are more likely to remain on the issue attention cycle longer than issues where one of the three legs of the agenda setting process is weak or non-existent.

Low Salient Issues. One of the strengths of the present study is the ability to test the agenda-setting effects of the media and a public information campaign in a controlled environment using a relatively low salient issue. People are concerned about air quality and have preconceived notions about the importance of the issue. However, beyond the reflexive belief that pollution is bad, people generally do not consider air quality to be an important issue. Certainly, on a daily basis, air quality does not
generate as much public concern as public schools, drugs and crime, or jobs and the economy.

Yet, it may be precisely because the issue is of relatively low salience that one may learn the most about how the agenda-setting process may work. Highly salient issues come with a history; people have information and opinions about the issue. Therefore, a public information campaign may not have the same influence with a highly salient issue as it did with air quality. The novelty of the PIC, or perhaps the continued broadcasting of the PIC, compelled people to seek information and cues in order to put the issue in perspective. We saw from the results in paper 1 that the public sought cues from the media, the public information campaign and used perceived community concerns in updating their level of personal concern when the issue was new, in 1998. In the subsequent year, we saw that the public only used the media coverage to update their levels of personal concern.

**Novelty and Drama.** Novel issues can be dramatic as well. They capture public attention because they are unanticipated. Downs (1972) argued that issues should have entertainment value, drama or novelty, to compete successfully with other entertainment topics for public attention. The first ozone alert in 1998 focused individual attention on the air quality issue in dramatic fashion. Further, this novel event had a similar effect on the perceptions people had about the importance of air quality for others in the community. However, as may be common for novel events, the novelty faded, as did interest in air quality. At no other time did interest in air quality change as quickly or become as important an issue as it did during the one month period after the first ozone alert. Similar to the discussion above about low salience issues, this novelty seemed to compel people to seek cues about the issue from all of the available sources we studied.
– perceived community importance, media coverage and the public information campaign.

The public information campaign offered one other dramatic period. During another one month stretch, the air quality in Atlanta was such that everyday was called an ozone exceedance day. While not as sharp, and certainly not as dramatic, interest in air quality rose significantly. Again, this rise in interest was across both individual concern as well as the perceived concern of others in the community. Furthermore, the rise and eventual fall in interest to the equilibrium level was not as sharp as the novel period. From the height of individual concern in 1999 to the equilibrium level took over one month. All told, the rise and fall of issue importance during the dramatic segment of 1998 required over 75 days.

Potentially, the most important finding was that the response to the drama was not led by the media. During the first week and a half of the extended alerts that occurred in late summer 1999, the Atlanta Journal-Constitution published one article on air quality. During the second week and a half of the extended alerts, the Atlanta Journal-Constitution published articles on air quality five times. During the comparable period, the percent of the public talking about air quality rose almost 50% during the first week and a half of the extended alerts (from 21% to 31%) and another 16% during the second week and a half of the extended alerts (from 31% to 36%). As the third paper showed, increases in talking about the ozone alerts drove media coverage during the dramatic period in 1999.

Perceived Community Importance. Few studies considered the role that community concerns may play in the formation of public concern about an issue. The first two papers in this study suggest that this may be problematic. For this relatively low salient issue, we found that measures of perceived community importance played a
significant role in determining levels of issue importance when the air quality issue was most novel. To not include the perceived community salience measure would have resulted in a mis-specified model that would led to an overestimation of the effect of media coverage on issue importance. Furthermore, in 1998, there were feedback loops from the two importance items to media coverage, which would have also resulted in mis-specified model had one only modeled the process one-way from the media coverage to issue importance. These results suggest that agenda-setting researchers must include both multiple forms of importance in their models as well as permit feedback loops from importance to media coverage.

While we have no evidence to support this conjecture, it may be that with enduring issues or issues of greater salience, where pressures to conform to community standards may be greater, that measures of perceived community importance may play an important role. This role may be one of mediating the relationship between the media and the public. If perceived community importance mediates the relationship between the media and the public, or if perceived community importance mediates a means for the public to influence media coverage, a feedback loop, then the agenda-setting model requires substantial rethinking. Media coverage may influence directly public concern only some of the time and under some conditions. What the media may be doing is influencing community concern, which in turn influences public concern. And, the media may decide to continue coverage of an issue because the journalists are picking up community cues, which suggest that the public is interested in the topic.

Partitioning the Data. In paper 1, we found that all aspects of the model were influencing the other aspects of the model in 1998, but not in 1999. In 1999, we found that only media coverage and lagged values of issue importance influenced current realizations of issue importance. In paper 2, we re-estimated the model from paper 1,
but asked a different question; are the findings from paper 1 invariant across different demographic groups based on sex and education? The results provide strong evidence that, when compared to the population model, different demographic groups responded to the media coverage, public information campaign and community cues in remarkably different fashions (see Figure 14[b] that contrasts the group findings to the population finding from paper 1). The most interesting trend was for men and women. Though men and women started the 1999 ozone season with similar levels of concern about the issue, the level of concern for men fell throughout the season while the level of concern for women rose throughout the season; even though they were reacting to the same media coverage and PIC (see Figure 7). These findings of different responses to the same stimuli were reinforced with the other analyses used in that paper. This includes correlating the aggregate means and variances and modeling the daily variances.

The results from the second paper had an unexpected result. While the public information campaign did not impact issue importance at the population level in 1999, each of the four sub-population models suggested that a significant effect did occur. In an attempt to explain the disparate findings between the population and sub-group models, we simulated the effects of the PIC on issue importance to demonstrate that different groups responded in systematically different ways to the system shock minimizing the overall effect (see Figure 10). This simulation provides a cautionary tale for researchers; null findings might indicate that different groups respond to the same stimuli in fundamentally different ways, not that the stimuli did not have an effect. We believe that time series analysis is the best way to model the agenda-setting process. Agenda setting occurs across time and one of the drawbacks of individual-level analyses or pooled time series analyses is that time is arbitrary. However, time series analysis homogenizes the findings across the population. The results of paper 2 show both a
methodology and a reason to partition the data and look for groups that are more
responsive to the stimuli that might change salience. However, demographic groupings
may only be a proxy for the underlying reason that causes differential change in
response to the stimuli. What we need is both a better understanding of the underlying
mechanism and better measures to capture the mechanism.

*Talking.* In the third paper, we expanded the agenda-setting model in a different
way from the first two papers. While past researchers tested models looking at whether
social communications mediated the relationship between media coverage and issue
importance, paper 3 expanded this idea of mediation as not just between the media and
the public, but also between the public and the media. That is, talking about a social
problem may lead to the media maintaining or increasing coverage about the issue. The
findings in paper 3 support this contention that social communication is an integral
component of the relationship between the public and the media. The media may lead
the public in making events accessible by informing the social networks about real world
events. However, with the increased drama of daily smog alerts, social communication
influenced media coverage. In fact, talking about air quality completely mediated the
effects of the alerts on media coverage during this time. The public *managed* the news
coverage. When the drama waned, media coverage and social communications
influenced each other in an attempt to maintain interest. Yet, for both the media and the
public, interest in the topic eventually reverted to its equilibrium level of concern. Media
coverage and social communications are directly and intimately connected.

In the mediated model of paper 3, we showed that social communications
influenced the level of media coverage and was the mechanism for individual levels of
concern about air quality to impact the media coverage. Furthermore, social
communications completely mediated the relationship between the PIC and the media
coverage. Media coverage did not impact directly social communications; rather, the level of issue importance mediated the relationship between media coverage and social communications. These findings may have significant implications for the earlier findings and for agenda-setting research in general.

Consider the findings from the elaborated model for 1999 found in paper 1 (see Figure 14[a]). One sees that, leaving aside the perceived community importance series, the traditional agenda-setting model held. Media coverage impacted issue importance. While the model in paper 1 permitted a feedback loop from issue importance to media coverage the relationship was weak and insignificant. Furthermore, we permitted a feedback loop from perceived community importance to media coverage. This too was insignificant. Since the feedback loop in paper 3 from social communications to media coverage was significant, this suggests that talking may have an impact on media coverage apart from any perception that journalists have about the importance an issue may have to the public. People may talk about an issue that they have yet to form strong opinions about; the talking is an effort at sense-making. These conversations may be suggestive to journalists that others are similarly attempting to understand the issue. Though strong opinions have yet to be formed, people are, nevertheless, interested in the issue. However, it is conceivable that the impact of the issue’s importance was attenuated in the elaborated model of paper 1 by having two feedback loops, one from issue importance to media coverage and a second from perceived community importance to media coverage.

The findings from paper 3 about the importance of social communications may provide more insight into the perceived community importance series. In the elaborated model for 1999, issue importance impacted perceived community importance without any reciprocal influence. We concluded that this relationship was one of projection. In
the elaborated model, the only means that individuals had to form opinions of the community’s concern about air quality was through the media coverage, which impacted both issue importance and perceived community importance. However, the findings from paper 3 show that people had a second way to assess the community’s concern, through social communications. While there are not sufficient degrees of freedom to estimate the elaborated model with the inclusion of social communications, it is an interesting exercise to hypothesize the relationship between issue importance and perceived community importance, given the inclusion of social communications. The likelihood is that talking would impact perceived community importance; people are likely to learn what is important to the community by talking to others. Whether this changes the relationship between issue importance and perceived community importance may be explained in part by the findings from paper 2.

In paper 2, we showed that the relationship between issue importance and perceived community importance was moderated by demographic groups. Using the F-test as a basis for comparison, we found that women and the not college-educated were somewhat more likely to conform, while men and the college-educated were somewhat more likely to project (see Table 9). Women were significantly more likely to report talking about air quality than men (F=17.35, p < .001), as were the college-educated (F=10.28, p < .001). As reported in paper 2, the college-educated reported higher levels of daily newspaper reading (F=52.74, p< .001) when compared to the non college-educated, and men also reported significantly higher rates of daily newspaper reading (F=30.64, p< .001) when compared to women. The two groups that reported higher levels of reading about air quality tended to project, while the two groups that reported lower levels of reading about air quality tended to conform.
The findings do not lend themselves to easy interpretation. Men generally did not respond to either the public information campaign or the media coverage (see Figure 9). Despite the higher levels of newspaper reading, the topic was not of interest. Possibly projection dominated the process because men were not sufficiently concerned with the issue and therefore presumed that others were not as well. Women, who were more likely to engage in discussions about air quality, presumed that others were interested and took cues from them about how important the issue of air quality was. This would account for findings of conformity. However, these suggestions would not account for differences based on education. The college-educated talked about the issue more and reported reading the newspaper to a greater degree than the non college-educated. Yet, the findings suggest that the college-educated projected and the not college-educated conformed. As Baron and Kenny (1986) alluded, moderating models do not lend themselves easily to developing theories of mediating relationships. The evidence suggests that talking plays a fundamental role in how people form preferences, and the findings from paper 2 suggest demographic differences, but the mechanism driving the formation of preferences remains elusive.

**Forming a Public Information Campaign.** The findings discussed so far raise an important question; what is needed to maintain levels of interest above the equilibrium level? This study, and an earlier one by Henry and Gordon (2003), suggests three means of increasing interest. First, a novel event captures public attention. Of course, events cannot maintain their novelty, but they can remain dramatic. Repeating a consistent message is not likely to work with a public information campaign. While the marketing literature suggests that consistent messages will keep an advertised brand salient (Miller & Berry, 1998; Moran, 1990; Sutherland & Friedman, 2000; Sutherland & Galloway, 1981; Sutherland & Sylvester, 2000) and political campaigns work to keep
politicians on message and repeating the campaign mantra, the same mechanism does not appear to work with the public information campaign. What moved public attention and focused media attention was the novelty of the first alerts and the drama from the consecutive days of ozone alerts in July and August of 1999. Yet, the drama of the consecutive alerts in 1999 moved only after the public started talking about the issue. People largely did not respond to the media or the PIC; rather people responded to conversations they were having with their friends and family. Without the social communications driving attention, it is not likely that people would have cared about the issue. Whereas the first alerts of 1998 led to changes in public salience, the drama in 1999 required people talking about the issue. Still, after some time, public attention began to wane again. Ultimately what led to behavioral change was the institutional support brought to bear on the problem. Without the executive order signed by Governor Zell Miller, there is some question whether people would have responded to the alerts and change their behaviors.

Conclusion.

The ability of the theory of agenda setting to predict future issue importance based on media coverage is still a long way off. The agenda-setting process is an outcome of a long list of inputs: issue advocates; the media; social communications; real world indicators; demographics and individual preferences. In this manuscript, we showed that a policy instrument, the public information campaign, and a policy entrepreneur, the Partnership for a Smog-free Georgia, succeeded in informing the public about a social problem. The PIC increased awareness and talking about the social problem, which led to the public becoming more concerned about the issue of air
quality. The PIC led to increased media coverage of the issue, which further led to more interest in the topic. Critically, the PIC got people talking.

Using a research design that matched the data collection with the dynamic nature of the environment, modeling a system while it was at equilibrium prior to the known and predictable system shocks, and estimating a series of competing hypotheses with a methodology that does not impose a potentially artificial and incorrect structure on the data, the findings shed light on a number of critical aspects of the development of public opinion. People respond strongly to social communications, probably more strongly to talking than they do to media coverage of a topic. These social communications are driven, not just by interest, but by drama and novelty. And it is not just interest among the public that is driven by talking; the media learns from the public about what are the meaningful topics. And if policymakers use the media as an indicator of what the public thinks is important, and the public can manage the news through its social communications, then democratic accountability is enhanced.
APPENDICES

Appendix A- The Public Information Campaign

Background of Social Problem

Atlanta is defined by the U.S. Environmental Protection Agency (EPA) as a non-attainment zone meaning that ground level ozone production exceeds the federal standard ("ozone exceedance"). Ground level ozone, chemically known as $O_3$, is an odorless, colorless gas that is the major component of what is commonly known as smog. GLO comes about from a chemical reaction of nitrogen dioxide and volatile organic compounds (VOC), which are derived from hydrocarbons in automobile exhaust or vapors from chemical agents. Heated in the summertime sun, this chemical reaction produces ground level ozone. This ozone is the same chemical compound as upper atmosphere ozone.

GLO is only one of seven compounds that the EPA regularly regulates through the air quality monitoring systems. The production of these seven compounds is monitored daily at 12 stations located throughout the thirteen-county Atlanta metropolitan area. Throughout Georgia, there are 83 monitoring stations in 57 locations across 29 counties. GLO is monitored only during the spring, summer and early fall, while other compounds are monitored year round. Table 16 displays the seven compounds and the EPA standard for an exceedance. As the right most columns show, Atlanta has a serious non-attainment problem only with regard to GLO. In 1998 and 1999, there were 11 and 13 exceedances of the one-hour standard, respectively. On these days, the level of GLO exceeded the federal standard of 0.125 ppm for at least one hour sometime during the day. The EPA is phasing out the one-hour standard and is replacing it with an eight-hour standard, which measures the total ground level ozone production over eight hours. Based on this standard, Atlanta recorded 41 GLO
exceedances in both 1998 and 1999 during the 153 day ozone season, which runs from May 1 to September 30.

Some research suggests that GLO has potentially harmful effects on people, animals and plants. The potential acute effects of GLO exposure may include: coughing, irritation of the nose and throat and decreased lung function (Dormans, van Bree, Boere, Marra, & Rombout, 1999; Foster, Brown, Macri, & Mitchell, 2000; Jorres, Nowak, & Magussen, 1996; Korrick et al., 1998; Scannell et al., 1996), increased asthmatic symptoms (Scannell et al., 1996) including more emergency room visits (Tolbert et al., 2000), and increased risk for individuals with heart disease or lung disease (Hoek, Brunekeef, Verhoeff, Wijnen, & Fischer, 2000; Superko, Adams, & Daly, 1984). Potential chronic effects include: problems with lung function (Frischer et al., 1999; Gold et al., 1999; Kopp et al., 2000) including increases in risk for asthma (Greer, Abbey, & Burchette, 1993; McDonnell, Abbey, Nishino, & Lebowitz, 1999; Ramadour et al., 2000) or lung cancer (Abbey et al., 1999; Beeson, Abbey, & Knutsen, 1998), and increased school absence (Gilliland et al., 2001). The evidence suggests that children, the elderly and minorities face the greatest risk from GLO exposure. Other potential adverse effects of GLO include damaging plant life by interfering with plant’s ability to produce and store food and killing fish in sensitive waterways.
## Table 16.

### Summary Table of Atlanta Ambient Air Standards

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Ozone</td>
<td>0.125</td>
<td>1 Hour</td>
<td>Colorless reactive gas, which is the major component of smog</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>0.85</td>
<td>8 Hour</td>
<td></td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>0.50</td>
<td>3 Hour</td>
<td>Colorless reactive gas</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0.14</td>
<td>24 Hour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.03</td>
<td>Annual Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Particulate (PM-2.5) (New in 1999)</td>
<td>15.0 Annual Mean</td>
<td>Small solid particles and liquid droplets (soot, dust)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Particulate (PM-10)</td>
<td>50.0 Annual Mean</td>
<td>Larger solid particles and liquid droplets (soot, dust)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Carbon</td>
<td>35.0</td>
<td>1 Hour</td>
<td>Odorless, colorless gas, which is the by-product of incomplete burning</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MoGLOide</td>
<td>9.0</td>
<td>8 Hour</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>0.05</td>
<td>Annual Mean</td>
<td>Light brown gas</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lead</td>
<td>1.5</td>
<td>Quarter Average</td>
<td>Metal</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: US Environmental Protection Agency, 1994; Environmental Protection
Atlanta is classified as a serious non-attainment site because of the excessive levels of ground level ozone. Failure to alleviate the problem of excessive GLO may cause Atlanta to face both punitive damages from the federal government as well as other economic costs. These costs include: (1) the loss of federal transportation dollars if GLO levels do not fall and stay within acceptable boundaries; (2) large polluters facing increased regulations and manufacturing growth slowing as Atlanta must offset between 1.3 tons and 2.0 tons of emission for every one ton added; (3) potentially increased levels of mortality; and (4) new businesses or residents choosing to relocate to other cities, which are not confronting problems related to non-attainment.

**PIC Background**

GLO is the major component of what people commonly call smog. The primary cause of GLO production in Atlanta are automobiles (Pierce, 2000), which are estimated to account for 50% of all sources. The high-growth and low-density development in Atlanta generated urban sprawl, which results in some of the longest commute times in the nation, contributing to GLO production. In a recent report, Schrank and Lomax (2001) found that the national average for rush hour lasts six hours a day, costing $78 billion, 4.5 billion hours of additional time and 6.8 billion gallons of wasted fuel. The average person spent 36 hours per year in delayed traffic. Employees in Los Angeles, Atlanta, Seattle and Houston spent on average more than 50 hours a year in delayed traffic. The potential solutions to the problem of traffic congestion are adding more lane miles, increasing the use of mass transit or staggering or decreasing the amount of people who use the existing transportation system. The Partnership for a Smog-free Georgia (PSG) worked to alleviate commutes on anticipated GLO exceedance days by promoting alternative work schedules, carpooling or the use of mass transit.
PSG was founded to direct a voluntary program to change driving behaviors including promoting carpooling, telecommuting and flex hours. If PSG could demonstrate that residents were reducing their GLO production on smog days, the EPA would grant Georgia credit for estimated reductions in their State Implementation Plans. Former Governor Zell Miller signed an Executive Order in December 1997, mandating that all state agencies form a partnership with PSG and limit single-occupancy driving on smog days. Local and federal agencies voluntarily complied with the mandate to varying degrees. PSG also made a concerted effort to enlist private partners in the program (e.g. Delta Airlines, UPS).

The program underwent a significant change between 1998 and 1999. First, the alerts no longer referred to ozone, a specific pollutant, but to smog, a more general but better understood descriptive term. The issue advocates became concerned that the public was confusing GLO with upper atmosphere ozone. While they are chemically the same, upper atmosphere ozone is beneficial to protect the earth from harmful UV rays, while ground level ozone may have harmful health effects. The EPA based the 1998 program on a 1-hour standard, and the 1999 program on an 8-hour standard. The change in standards meant that in 1998, the program essentially was episodic and in 1999 the program primarily was seasonal. PSG called thirty five ozone alerts in 1998 using the one-hour standard and 69 smog alerts in 1999 using the eight-hour standard. In 1998, PSG asked employers to change work schedules and driving habits during each ozone alert. In 1999, PSG asked employers to change work schedules and driving behaviors throughout the season.

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81 While the major focus was on driving behaviors, PSG made efforts to change other types of behaviors including limiting weekday lawn maintenance, barbequing, and the use of industrial solvents, all of which contribute to emissions.

82 The GLO season runs from May 1 to September 30, which is 153 days.
Each day, scientists at the Georgia Institute of Technology, under contract from the Environmental Protection Division of Georgia’s Department of Natural Resources (EPD) modeled the subsequent day’s projected GLO level. If the models predicted that GLO levels would exceed the federal standard, a smog alert would be called by noon of the day preceding the estimated GLO exceedance. In 1998, there were 35 ozone action days. Table 1 shows the distribution of ozone alert days and actual GLO exceedance days. Of the 35 alert days, 13 were actual GLO exceedance days and 22 days were false positives, days when GLO remained with acceptable standards. There were also nine false negatives, days that were not designated as ozone alert days but actually were GLO exceedance days. In 1999 there were 67 smog alerts, though the standards were different.\footnote{Based on the 1998 standards, there would have been 23 alerts in 1999 (Pierce, 2000).} Thirty seven days were predicted to be ozone exceedance days and were while another 30 days were false positives (see Table 2). Four days were false positives and 82 days were not called alert days and were not exceedance days. The program change permits one to test the effects of a public information campaign that focuses on particular events, that is the episodic alerts of 1998, to a seasonal change in 1999. Furthermore, the low overlap between GLO exceedance days and smog alert days permits one to test better the effects of the PIC and the underlying cause of the PIC, the objective indicators of ozone levels.

\textit{Establishing the Quality of the Public Information Campaign}

Weiss and Tschirhart (1994 p.85), in their review of over 100 public information campaigns, stated that a PIC had a greater probability of success if it adhered to four rules. A PIC should:

1. capture the attention of the right audience;
2. deliver a credible message that audiences understand;
3. deliver a message that influences the beliefs or understanding of the audience; and
4. create social contexts that lead toward desired outcomes.

For the remainder of this section, we intend to demonstrate that the PIC met the four conditions listed above. The PIC was of sufficiently high quality to serve as an effective test to understand the mechanism that relates a public information campaign to changes in media coverage, issue salience and interpersonal discussions.

*Capturing the attention of the right audience.* The primary message targeted by the issue advocacy was to automobile drivers, particularly single occupancy vehicle drivers. While the public information campaign encouraged individuals to modify their behavior, particularly driving habits, to achieve this objective the public in general and the driving public specifically needed to be aware of the problem of air quality in Atlanta on days when excessive GLO was expected. Increasing the salience of air quality was seen as an important step in the process leading to behavioral changes (Pierce, 2000). Without increasing concern about GLO, changes in driving behavior were not likely to occur. Thus, issue salience was a critical link in the chain of events necessary to influence behaviors.

Weiss and Tschirhart (1994) identified three requirements necessary to capture the attention of the right audience. First, one had to define the target audience. PSG had two audiences that it was trying to influence. PSG worked with large scale employers, both private and public, and attempted to use a top-down model to encourage issue attention and behavioral changes (see Henry (2003). Employers were asked to: (1) inform employees of smog alerts; (2) to encourage employees to use alternative work schedules; (3) to commute by mass transit or carpools; and (4) to
telecommute. PSG worked with the regional transportation agency to offer heavily discounted monthly mass transit cards.

Second, one had to use the right channels to reach the audience. PSG used traditional mediated messages, both free and paid-for, as well as highway signs, and messages to employees and employers. The major thoroughfares throughout Atlanta have electronic highway signs informing drivers about highway conditions and smog alerts. These highway signs increased the awareness and salience of air quality and were used to suggest ways motorists could help minimize GLO production. Once again, these messages were broadcast in a timely fashion, both the afternoon prior to the anticipated GLO exceedance day as well as the morning of the expected GLO exceedance day. Finally, the messages must attract attention. The vehicle for raising awareness and stimulating behavioral change was the “ozone [smog] alert day” or “ozone [smog] action days”. The messages included specific recommendations for action, such as “Carpool Tomorrow” or “Combine Your Trips.”

The public information campaign did seem to capture the attention of those to whom it was aimed. Of the public who either did not work outside of the house or did not own an automobile, 25% correctly identified an ozone [smog] action day when one was called. This figure rose to almost 40% for individuals who were either self-employed or employed by a private firm and over 50% for government employees. Government employees received the most messages during the first year of the program (Henry & Gordon, 2003). Therefore, the primary target of the PIC, commuters, was almost twice

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84 While receiving a smog alert in the morning on the day that is expected to be a GLO exceedance day may seem to be too late to affect behavioral change, there are ways that motorists could still lessen GLO production. Specifically, by not driving to lunch, by postponing some planned afternoon errands or combining errands, or by commuting at some time other than rush hour may help to lessen GLO production. Furthermore, drivers could put off trips to gas stations or not top off gas tanks. Minimizing quick starts also helps minimize ozone production.
as likely to report a smog alert on a day when one was called. Of those who heard a message, television, the highway signs and radio received the most attribution. About 70% of the public who identified a smog alert day said that they had heard about it from one source, while the rest heard about the alert from multiple sources. The average person reported hearing from about 1.3 sources. The individuals who heard about the smog alert from employers, or from faxes, e-mails or the website of PSG reported that they heard the announcement through three to seven channels (Henry & Gordon, 2000). PSG did seem to be successful at reaching the targeted audience with a blanketed message.

The distribution of sources of information regarding the public information campaign is displayed in Figure 15. Television was said to be the primary source of information, followed closely by newspapers and radio. The most noticeable feature of the responses is the sharp rise in people mentioning highway signs as a source of information. These were the signs located on the major interstates throughout Atlanta. In the spring, less than 15% of the respondents mentioned highway signs as a source of information; the figure rose to almost 50% during the summer of 1999.
Delivering a credible message that audiences understand. The second criterion that Weiss and Tschirhart (1994) stressed was delivering a credible message that the audience understands. Simple, comprehensible messages that people can comprehend are critical for people to internalize the message and to make appropriate changes. PSG’s messages let individuals know of a smog alert, and suggested easily understand alternatives such as “Carpool Tomorrow” or “Combine Your Trips.” The public was already primed to accept that driving cars causes air pollution and that air pollution has potentially harmful health effects; this was not a new or unbelievable connection. According to a 1998 summer survey conducted by Georgia State University, almost 80%
of the population knew that cars were a primary cause of ground level ozone.\textsuperscript{85} 90\% of the public agreed with the statement, “smog has been linked to serious health problems” (Henry & Gordon, 2000).

The message should also come from a credible source; while many messages did not have an identifier, the ones that did were attributed to PSG. The Georgia Institute of Technology, under contract from the EPD, provided PSG with the GLO exceedance projections. PSG ran some campaigns in 1998 using the endorsement of the highly popular then governor, Zell Miller. During weather forecasts and news broadcasts, newscasters informed the public of the smog alert.

\textit{Delivering a message that influences the beliefs or understanding of the audience.} The third criterion mentioned by Weiss and Tschirhart (1994) was to deliver a message that influenced the audience. Influence is defined by providing information, increasing salience and increasing attention. As Figure 1 showed, awareness of ozone/smog increased steadily over time. In spring 1998, before the first full ozone season, awareness of ozone was almost non-existent. By the end of the ozone season, awareness rose from about 1.3 points to 1.7 points on a four-point scale. In the second season, awareness stood at 1.8 points at the beginning of the season and rose to 2.3 points by the summer. A four on this scale indicated that a respondent knew a great deal about the subject, so general awareness increased significantly from Spring 1998 to Summer 1999.

Similarly, personal salience increased from the spring to summer in both 1998 and 1999 (see Figure 16). From summer to fall, the measure fell slightly. The most

\textsuperscript{85} Please answer true or false to the following statements about ozone… Emissions from cars are major causes of ozone pollution.
significant increase was in the perception that other people in the community saw ozone/smog as a salient issue. From spring 1998 to summer 1999, the mean of this measure rose almost two full points. With the scale ranging from 1 to 10, where 10 meant highly concerned about the topic, the scores in the mid-seven range generally indicate moderate concern about the topic. The highest salience item measured was personal concern about public schools, which average in the mid-eight range.

![Figure 16. Quarterly Trends in the Levels of Issue Importance for Air Quality, Public Schools and Jobs and the Economy](image)

The distribution of responses for the issue importance and perceived community importance variables displayed little variation between 1998 and 1999. The results from Figure 17 suggests that respondents were somewhat more likely to say that they were more concerned about air quality in 1998 than 1999. This would support the notion that
the novelty of the public information campaign helped to focus public attention on the social problem. The virtually identical distributions in 1998 and 1999 for the perceived community importance variable (Figure 18) suggest that while the public information campaign may have influenced personal concern, respondents were not as likely to believe that the public responded to the messages and the novelty to the same degree. However, this stability in both distributions belie the daily changes that occurred in response to the public information campaign.

Figure 17. Distribution of Responses to the Issue Importance Question in 1998 and 1999
Creating social contexts that lead toward desired outcomes. The last criterion suggested by Weiss and Tschirhart (1994) was that one should impact the social context that leads towards the desired outcome. This was accomplished on a number of fronts. In December 1997, the governor of Georgia issued an Executive Order for all state agencies, departments and institutions of higher education to reduce their rate of single occupancy vehicle commute on smog alert days. Each unit affected was required to prepare and submit their plans for the summer of 1998. When the plans were implemented, several monitoring efforts were enacted to increase compliance (Waterman and Wood, 1993), including checking empty parking spaces in agency lots and surveying employees about the method of commuting using e-mail (see Cummings
& Walker, 2000; Henry & Gordon, 2003 for a more complete discussion about alternative methods to verify compliance). Federal agencies located in the Atlanta region, including the Centers for Disease Control and Prevention, agreed to develop and implement similar strategies for reducing commuting. Their commitment is particularly significant because the federal government is a major employer in the region. Local governments were recruited as well. Many governmental leaders were especially interested in being recognized as early adopters in the air quality movement. Private sector employers also became partners in the efforts, but for the most part their plans were begun later and did not contain the specific targets for smog alert day traffic reductions included in the governmental plans.

Substantial evidence suggests that the public information campaign did lead to inter-personal discussions about ground level ozone, an important prerequisite for established changed social norms and salience. During the summer of 1998, inter-personal discussion about ground level ozone increased substantially ($F=8.49, p< .005$) from the levels recorded in the spring of 1998. Figure 12 shows the percentage of respondents reporting that they talked with family or friends about smog during the 1999 year. Relatively few people discussed air quality between May and July, with lower levels defined as less than 40% of the population saying they were talking about the issue. Until late July, reported rates of discussion with family and friends about air quality stayed below 30% and dipped as low as the low teens. In mid-to-late July, reported rates of discussion began to increase from about 15% to about 40%. During August, reported rates of discussion rose to above 70% at one point, and generally remained above 50% for the month. From early September to the end of the month, reported rates of discussion with family and friends about smog fell sharply. These
levels of inter-personal discussion corresponded closely to the monthly levels of smog alerts. Eight alerts were called in June, 16 in July, 25 in August and 12 in September.

**Public Information Campaign Data**

Each smog alert was announced by a public information campaign. When EPD anticipated an ozone exceedance for the subsequent day, PSG informed the various media outlets and used their other means of communication for providing information to employers or the public about the impending exceedance day. The highway signs flashed messages about the impending ozone exceedances, television and radio broadcasts included information about the alerts and the *Atlanta Journal-Constitution* published news of the alert. So the alert day became the public information campaign. For our study, each day was coded as to whether it was a smog alert day. Furthermore, since people may react to past public information campaigns, we coded lagged public information campaigns from period one to seven. Additionally, we coded all interactions from the present period to three days prior.\(^{86}\) All told, there were fifteen measures of the public information campaign included in the base model.

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\(^{86}\) All lags were interacted up to day three. For instance, a lag today and yesterday was interacted as was a PIC today and two days ago. Only lags that skipped more than one day were excluded.
Appendix B- Overview of the Methodology

This appendix expands upon the discussion of vector autoregression (VAR) found in the background section. The discussion begins with the example used in there, but delves much more into the VAR methodology.

A traditional method to estimate an agenda-setting model is to regress issue salience on its lagged values or the lagged values of the error term and a variable that represents some type of media coverage. Consider a typical transfer function equation shown in equation 1,

\[ y_t = a_0 + A(L)y_{t-1} + C(L)z_t + B(L)e_t \]  

(1)

where \(L\) stands for the lag operator. The \(A(L)\) and \(B(L)\) terms are autoregressive and moving average coefficients, respectively, and \(C(L)\) is the transfer function coefficient. Shocks to the exogenous \(z_t\) variable, or in this example media coverage, are transferred to \(y_t\), or salience in this example, by a series of transfer function weights, denoted by \(c_i\). The total effect of media coverage on salience is given by the equation: \(C(L)/[1-A(L)]\).

There are a number of critical assumptions in the transfer function model, which must be violated by agenda-setting researchers using this type of model. The most important are that \(z_t\) must be exogenous and the covariance of \(z_t\) and \(e_t\) must be 0. If there is a feedback loop, that is, media coverage changes in response to changes in issue salience, then equation 1 is mis-specified and \(C(L)\) is no longer an unbiased estimate of the relationship between media coverage and public salience. All the models estimated herein are based on theories, which may not be compelling regarding the necessary assumption. While many researchers presume that media coverage directs public concern (Salwen, 1988), there is a plausible argument that the media
responds to public salience (Beniger, 1978; Brosius & Kepplinger, 1990; Erbring et al., 1980; MacKuen & Coombs, 1981; Neuman & Fryling, 1985; Siune & Borre, 1975; K. A. Smith, 1987b; T. W. Smith, 1987). Similarly, there is no compelling reason to specify a one-way relationship between issue importance and perceived community importance. Furthermore, we argued that social communications may impact media coverage and media coverage may impact social communications. All of these tests violate the assumptions of the transfer function model.

If there is any question whether one series is truly exogenous, the proper methodology is vector autoregression (Doan, 1996; Enders, 1995; Hamilton, 1994; Sims, 1980). Using the same two variables in the previous example, public salience and media coverage, consider a first order autoregression such as in equation 2, which is in primitive form.\(^7\)

\[
y_t = b_{10} - b_{12}z_t + \gamma_{11}y_{t-1} + \gamma_{12}z_{t-1} + \epsilon_{yt}
\]

\[
z_t = b_{20} - b_{21}y_t + \gamma_{21}y_{t-1} + \gamma_{22}z_{t-1} + \epsilon_{zt}
\]  

Since the error terms may be correlated, equation 2 is not in reduced form. Rewriting equation 2 in matrix form, and rearranging the terms, results in equation 3.

---

\(^7\) We formally tested the variables in the dataset for unit roots and all of the dependent variables to be used in this study appear to be stationary. Stationarity may be defined as the stochastic properties of a variable in a Gaussian process being invariant with respect to time, that is, the mean and variance of a variable and the covariance of the two variables are not related to time. Testing for the presence of unit roots is the operationalization of stationarity. Whether \(y\) and \(z\), or any variables in a VAR system must be stationary is a matter of dispute. Sims (1980) and Doan (1996) both favor modeling the undifferenced values, while many other researchers require stationarity (Enders, 1995). The argument put forth by Sims (1980) is that the goal of VAR is not to determine parameter estimates, but to understand the relationship between variables. In the event of a co-integrating relationship, one can use a VAR error correction model. By differencing one may lose valuable information such as the possibility of cointegrating relationships. For purposes of exposition, we assume that the variables are stationary.
$$\begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix} \begin{bmatrix} y_t \\ z_{t-1} \end{bmatrix} = \begin{bmatrix} b_{0} \\ b_{20} \end{bmatrix} + \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix} \begin{bmatrix} y_{t-1} \\ z_{t-1} \end{bmatrix} + \begin{bmatrix} e_{yt} \\ e_{zt} \end{bmatrix}$$

(3)

If we set

$$B = \begin{bmatrix} 1 & b_{12} \\ b_{21} & 1 \end{bmatrix}, \quad x_t = \begin{bmatrix} y_t \\ z_t \end{bmatrix}, \quad \Gamma_0 = \begin{bmatrix} b_{0} \\ b_{20} \end{bmatrix},$$

$$\Gamma_1 = \begin{bmatrix} \gamma_{11} & \gamma_{12} \\ \gamma_{21} & \gamma_{22} \end{bmatrix}, \quad e_t = \begin{bmatrix} e_{yt} \\ e_{zt} \end{bmatrix},$$

and premultiply by $B^{-1}$, we obtain the atheoretical VAR in standard form as shown in equation 4.

$$x_t = A_0 + A_1 x_{t-1} + e_t$$

(4)

where $A_0 = B^{-1} \Gamma_0$; $A_i = B^{-1} \Gamma_i$; and $e_t = B^{-1} e_t$.

The terms in equation 4, when written out in equation format, have error terms where $\text{VAR}(e_t) = \sigma_i^2$ and are serially uncorrelated. Ordinary least squares (OLS) estimates are, therefore, consistent and asymptotically efficient. However, one important goal of this manuscript is to model the effects of the public information campaign. Since the ozone alert is exogenous to the outcome variables, one should estimate a near-VAR.\textsuperscript{88} In a near-VAR, seemingly unrelated regression (SUR) may be

\textsuperscript{88} In truth, one cannot discount the possibility that ozone production, and hence the generation of an ozone alert and the manifestation of the public information campaign, may be endogenous to behavioral changes. However, it is not likely that the PIC will be impacted similarly by changes in public concern about air quality. The PIC, which is based on estimated ozone levels, is separate from the policy itself, which is exogenous to the daily shifts in ozone levels.
the more appropriate estimator. Furthermore, the use of different lag lengths or regressors for different dependent variables in the same model results in a near-VAR (see Appendix C). Theil (1971) found that the gain in efficiency for SUR over OLS occurs only when the residuals were correlated across equations and the regressors were not the same in each equation. While the expected gain in efficiency with SUR is probably small, and to quote Doan (1996), “not worth the trouble” (pg. 8-5), all estimations in this manuscript use SUR, except if otherwise noted.

Continuing with the model development, the estimated model contains nine coefficients while the primitive model shown in equation 2 contains ten parameters. Placing a restriction on the primitive model, such as $b_{21}=0$, permits an estimation and recovery of the values from the structural VAR. In this case, the estimates of $\varepsilon_y$ and $\varepsilon_z$ can be recovered and decomposed using a Cholesky decomposition or the Sims (1986) and Bernanke (1986) decomposition. Equation 2 is re-written as equation 5 above with $b_{21}=0$, which means that:

$$
B^{-1} = \begin{bmatrix} 1 & -b_{12} \\ 0 & 1 \end{bmatrix}
$$

so that when one pre-multiplies by $B^{-1}$, the reduced form equations are shown in equation 6.

---

89 A symmetric and positive definite matrix can be transformed into an upper and lower triangle matrix. If matrix $A$ is symmetric and positive definite, then $A=SS'$ where $S$ can be thought of as the square root of $A$ and is a lower triangle, positive definite matrix. To solve $A=xb$, one solves $Sy=b$ for $y$ and then $S'x=y$ for $x$. 

183
\[ y_t = a_{10} + a_{11}y_{t-1} + a_{12}z_{t-1} + e_{1t} \]
\[ z_t = a_{20} + a_{21}z_{t-1} + a_{22}y_{t-1} + e_{2t} \]  \hspace{1cm} (6)

Where:
\[ a_{10} = b_{10} - b_{12}b_{20} \]
\[ a_{11} = \gamma_{11} - b_{12}\gamma_{21} \]
\[ a_{12} = \gamma_{12} - b_{12}\gamma_{22} \]
\[ a_{20} = b_{20} \]
\[ a_{21} = \gamma_{21} \]
\[ a_{22} = \gamma_{22} \]
\[ \text{VAR}[e_1] = \sigma_y^2 + b_{12}^2\sigma_z^2 \]
\[ \text{VAR}[e_2] = \sigma_z^2 \]
\[ \text{COV}[e_1,e_2] = -b_{12}\sigma_z^2 \]

Estimating equation 6 provides estimates of all of the parameters in equation 2, except for the contemporaneous effect of regressing \( z_t \) on \( y_t \). Notice that \( \text{VAR}[e_2] \) does not contain the term \( b_{21}^2\sigma_y^2 \), which is in the \( \text{VAR}[e_1] \) term. The correlation of \( \varepsilon_{yt} \) and \( \varepsilon_{zt} \) can be recovered since \( e_{2t} \) is an estimate of \( \varepsilon_{zt} \) and \( e_{1t} = \varepsilon_{yt} - b_{12}\varepsilon_{zt} \) so by rearranging the terms one can estimate \( \varepsilon_{yt} \). The ordering of the variables matters greatly, since both \( \varepsilon_{yt} \) and \( \varepsilon_{zt} \) can influence \( y_t \), but only \( \varepsilon_{zt} \) can influence \( z_t \). By altering the order, making \( b_{12} = 0 \) instead of \( b_{21} = 0 \), one would estimate the contemporaneous effect of regressing \( y_t \) on \( z_t \). The importance of the ordering solely depends upon the correlation between \( e_{1t} \) and \( e_{2t} \); the higher the correlation the greater the effect of ordering. A correlation of 0 means that the ordering is irrelevant while a correlation of 1 implies that one cannot attribute the
shock to any single source.\footnote{Correlations of greater than \(|.2|\) means that one should alter the ordering and re-test the model. If the new model suggests a vastly different conclusion, additional investigation is necessary.} This being said, nothing prohibits \(y_t\) influencing \(z_{t+1}\), which is the next subject.

\[
\begin{bmatrix}
  y_t \\
  z_t
\end{bmatrix} =
\begin{bmatrix}
  a_{10} \\
  a_{20}
\end{bmatrix} +
\begin{bmatrix}
  a_{11} & a_{12} \\
  a_{21} & a_{22}
\end{bmatrix}
\begin{bmatrix}
  y_{t-1} \\
  z_{t-1}
\end{bmatrix} +
\begin{bmatrix}
  e_{1t} \\
  e_{2t}
\end{bmatrix}
\]  

(7)

The coefficients in a VAR are highly correlated and are generally ignored. Furthermore, the nature of the coefficients do lend themselves to defining a specific functional form. However, the VAR can be represented as a vector moving average (VMA), which permits one to visually examine the interaction between the dependent variables. The plotting of an impulse response function is the normal way of representing the relationship between \(z_t\) and \(y_t\) in response to a shock to the system. By re-writing equation 6 in matrix form, as shown in equation 7, and setting \(\mu_y\) and \(\mu_z\) to be the mean value of \(\{y_t\}\)\footnote{{} indicates a series.} and \(\{z_t\}\), respectively, one can iterate backwards, which results in equation 8.

\[
\begin{bmatrix}
  y_t \\
  z_t
\end{bmatrix} =
\begin{bmatrix}
  \mu_y \\
  \mu_z
\end{bmatrix} +
\frac{1}{1-b_{12}b_{21}} \sum_{i=0}^{\infty}
\begin{bmatrix}
  a_{11} & a_{12} \\
  a_{21} & a_{22}
\end{bmatrix}
\begin{bmatrix}
  1 & -b_{12} \\
  -b_{21} & 1
\end{bmatrix}
\begin{bmatrix}
  e_{1t} \\
  e_{2t}
\end{bmatrix}
\]

(8)

By defining the 2 X 2 matrix \(\phi\) as:

\[
\phi_i = \frac{A_i^i}{1-b_{12}b_{21}}
\]

\[
\begin{bmatrix}
  1 & -b_{12} \\
  -b_{21} & 1
\end{bmatrix}
\]

and letting \(\mu = [\mu_y \ \mu_z]'\), one can generate the VMA as shown in equation 8 as:
\[ x_t = \mu + \sum_{i=0}^{\infty} \phi_i \varepsilon_{t-i} . \]

The effects of a shock to the system are captured in the \( \phi_i \) coefficients. The combined elements of \( \phi_{jk}(0) \), where the number in parentheses indicates the time lag, are the impulse response functions used to plot the \( \{y_t\} \) and \( \{z_t\} \) series in response to a one standard deviation shock to the system. Again, the ordering of the variables matters as it is necessary to restrict either \( b_{12} \) or \( b_{21} \) equal to 0.

For a further discussion of VAR, see Doan (1996); Enders (1995); Greene (1999); Hamilton (1994); Sims (1980), and for Granger-causality see Granger (1969; 1980) and Granger and Newbold (1974).
Appendix C- Lag Lengths

Critical to successfully estimating a vector autoregression is the choice of the proper number of lags. Too few lags, and the model may be mis-specified (Enders, 1995; Hamilton, 1994). Too many lags and numerous degrees of freedom are spent unnecessarily. Generally, there are three ways to select a model, all fraught with difficulties. One common way of model selection is to begin with a one lag model and continue to add lags until the Akaike Information Criterion (AIC) or the Schwartz Bayesian Criterion (SBC) no longer decreases. The AIC and the SBC are information criteria used to choose between competing non-nested models. Both criteria rely upon the log likelihood function with a penalty for additional parameters.\(^{92}\) The problem with starting with one lag and adding additional lags is that one may hit a local minimum for the AIC and SBC. In this case, the true lag length will be some number in excess of the one selected by relying upon the AIC and the SBC. A second method is to start with the greatest conceivable number of lags and begin to place restrictions on the lags. As one restricts the number of lags, the AIC and SBC may begin to approach a local maxima, thus suggesting to the researcher that the appropriate number of lags has been found. The true lag length may be some number with fewer lags. Additionally, the AIC and SBC may not vary over different lag lengths, making the information criteria methods unsuitable for determining the appropriate lag length.

Another common method to determine the appropriate lag length is to use prior experience or theory. Researchers may have a theoretical or empirical reason for choosing a particular number of lags. Researchers using macroeconomic data, which is regularly analyzed using vector autoregression, select a number of lags consistent with

\(^{92}\) The AIC has been shown to select models with too many lag lengths (Enders, 1995).
the periodic frequency of the data. For monthly data, researchers normally test 12 or 24 lags to determine the appropriate lag length, while for quarterly data, 4 or 8 lags will be tested. Both methods cover up to two years worth of data.

The final method is a modified likelihood ratio test. As discussed, the lagged coefficients in a VAR are correlated with one another, which inflates the standard errors and tends to make the t-statistics insignificant. Therefore, to test whether a single variable or a block of lagged variables can be removed from the model, one could estimate a model with and without the variables in question. Model comparisons are based on a likelihood ratio test of the difference between the restricted and unrestricted matrix. The statistic follows a $\chi^2$ distribution with degrees of freedom equal to the number of restrictions.\footnote{Sims (1980) proposed a modification of the likelihood ratio test that accounts for the parameters in the model.} The principle of parsimony dictates that the shortest lag length possible be used, provided that there is no significant degradation of model fit in comparison to longer lags. The likelihood ratio test is not limited to testing lagged independent variables; any other independent variable in the model can also be tested using a likelihood ratio test.

We developed the models herein as follows: all series deriving from the Rolling Sample Surveys (e.g. issue importance, talking) were lagged 21 days. The media series were lagged 30 days media researchers argue regularly for a one month lagged media effect. The additional lags for the media series did not shorten the usable data in the analysis since we could go back and collect additional newspaper data. The RSS data collection started May 1 and any lags of the variables shortened the usable series. The various indicators of the public information campaign, including a seven day lag and all interactions through day 3, were included. Finally, the real world indicators (e.g. smog, weather), control variables (days of week) and five centered polynomials (deterministic
trend variables) were included. Based on the results of the likelihood ratio test, variables were removed from the analysis in the following order:

1. Real world indicators and control variables
2. Deterministic trend variables
3. Rolling Sample Survey series and media information
4. Public information campaign

This was the primary order of data removal. We began with the longest lags (21 or 30) and moved towards lag 1. Lags were removed in order and always from the furthest back in time to the present. If, after removing lags of the public information campaign, the results suggested that real world indicators should be removed, then we went back and tested other lags and variables. Lags and variables were removed unless the coefficient was significant at the $p < .10$ level or the block of variables to be removed was significant at the $p < .10$ level. We selected the .10 level for two reasons. First, in a VAR coefficients are correlated raising the standard errors. Second, our preference was to retain all variables that contributed at least some to the likelihood function. We erred on the side of retaining some information at the expense of additional degrees of freedom.
Appendix D - 1999 Survey (Stems Only)

I would like to know how important you think certain issues are to other people in the Atlanta Metro Region, regardless of how you might feel about them personally. Leaving aside your own views, how important is the following issue to the people in the Atlanta Metro Region on a scale from 1 to 10 where 1 is not at all important and 10 means very important?

Now I'd like to find out about how personally worried or concerned you are about these same issues. If you aren't really concerned, please don't hesitate to say so. On a scale from 1 to 10 where 1 means not at all concerned and 10 means very concerned, how personally concerned are you about...

Do you own or have access to a car that you drive frequently?

Are you currently working outside of the home?

Please think back carefully over the past 24 hours, that is starting about the same time yesterday, count how many trips you drove. For this purpose, count each time you started and drove your car someplace as one trip. If you drove to the grocery store, parked the car, and drove home count that as two trips.

Did you drive or ride to or from work or school in the past 24 hours between the hours of 7:30 and 9:30 am?
Did you drive or ride to or from work or school in the past 24 hours between the hours of 4:30 and 6:30 pm?

Please think back carefully over the past 24 hours. Starting about this time yesterday, and continuing forward until right now, please carefully estimate how many miles you have driven in the past 24 hours.

During the last week, have you put gas in your car on a weekday during the day?

In the last twenty-four hours how did you get to work? Did you drive alone, use mass transit such as MARTA, carpool, ride a bike, walk, or did you work at home?

In the last week did you use any of the following during the daytime hours on a weekday...

Is the company that you work for a member of the Partnership for a smog free Georgia?

In Atlanta, many people are NOT aware of issues about air pollution while other people have heard about them. How much have you heard about air pollution in Atlanta? Would you say you have heard a great deal, heard a fair amount, heard a little or heard almost nothing?

Many people are not aware of smog action days while others are. Have you personally heard about a smog action day?
Have you heard about a smog action day in the past 24 hours?

Where did you hear about a smog action day?

Can you name any activity or activities that you changed in response to this smog action day?

I am now going to read a set of statements. Please tell me whether you strongly agree, agree, are neutral, disagree, or strongly disagree with each one.

Please indicate whether you strongly agree, agree, are neutral, disagree, or strongly disagree with each of the following statements:

Some people feel that smog affects them personally on a day-to-day basis, while others feel that it has no effect. I am going to read a list of possible outcomes of smog. Please rate each on a 10 point scale, where 1 represents no effect and 10 represents a great personal effect.

How frequently do you do the following: almost all the time, frequently, occasionally, or almost never?

On how many days in the past week did you watch the local news on TV?

On how many days in the past week did you read the local daily newspaper, such as the Atlanta Journal-Constitution?
In the past week, did you talk about smog or air quality with your family or friends?

Do you think that public support for voluntary action to improve air quality in Metro Atlanta is gaining ground, losing ground, or staying about the same?

Do you think that public support for government action to improve air quality in Metro Atlanta is gaining ground, losing ground, or staying about the same?

According to our selection procedure, I need to know how many people are living in your household age 18 years old or older. Could you please give me that information?

How many different telephone numbers will reach this household?

With which racial/ethnic group do you most strongly identify?

Are there any children 18 years old or younger living in your household?

Do you own your residence, does some member of your household own your residence or do you rent it?

INTERVIEWER: ENTER THE GENDER OF THE RESPONDENT. ASK ONLY IF YOU ARE NOT ABSOLUTELY SURE.
In which of the following groups did your total family income fall last year before taxes? I will read a number of income ranges, please stop me at the one that best describes your family's income ...

Finally we need to get a little more information about your work status. Are you . . .

Do you work for a state agency, county or city government, the federal government, the private sector, or are you self-employed?

Where is the place that you work located--downtown, inside or outside the perimeter?

What location?

What is your current marital status?

What is the highest level of education that you have completed?

In what year were you born?
Appendix E- Influence of the Control Variables on the Models

Table 17.

Residual Correlations from All of the Estimated Models

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1998 Projection-Conformity Model</td>
<td></td>
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</tr>
<tr>
<td>Issue Imp.</td>
<td>1.00</td>
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<tr>
<td>Perc. Comm. Imp.</td>
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<td>1.00</td>
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<td>1.00</td>
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<tr>
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<tr>
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<td>1.00</td>
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<td>0.19</td>
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<td></td>
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<td>Traditional Agenda-Setting Model</td>
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### Table 18.

**Table of Significant non-lagged Covariates from All of the Estimated Models**

<table>
<thead>
<tr>
<th>Year Model</th>
<th>Male Model</th>
<th>Coeff.</th>
<th>Std. Err.</th>
<th>t-score</th>
<th>p &lt;</th>
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<td>0.09</td>
<td>6.98</td>
<td>0.00</td>
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<td></td>
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<td>0.12</td>
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<td>0.04</td>
<td>8.49</td>
<td>0.00</td>
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<td>Day 1</td>
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<td>0.01</td>
<td>-6.72</td>
<td>0.00</td>
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<td></td>
<td>Rain</td>
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<td>0.14</td>
<td>-3.94</td>
<td>0.00</td>
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<td>0.00</td>
<td>-6.63</td>
<td>0.00</td>
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<td>Wind</td>
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<td>0.03</td>
<td>1.33</td>
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<td></td>
<td>Perc. Community Imp.</td>
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<td>0.00</td>
<td>-1.53</td>
<td>0.13</td>
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Appendix F - Time Series Analysis

Time series analyses generally are based on the concept of differencing (stochastic) rather than detrending (deterministic). One would difference a series if one theorized that changes in the series were a function of previous realizations in the series. By differencing, we mean $\Delta y = y_t - y_{t-1}$, where $y_t$ is the current realization of a series. This form of time series analysis is called stochastic since each realization of the series comes from a probability distribution of the underlying population. The current realization of the data-generating process may be a function of previous realizations plus an error term. This is shown by: $y_t = \phi y_{t-1} + \varepsilon_t$. This is a first order autoregression model, where today’s outcome is a function of yesterday’s, plus an error term. The degree of autoregression is determined by the number of lagged $y$ terms that impact the current realization. The current realization of the data-generating process may result from an impact of a system shock on the lagged error terms in the model. This is shown by: $y_t = y_{t-1} - \theta \varepsilon_{t-1}$. This is a first order moving average model, where today’s outcome is a function of a shock to yesterday’s error term. The degree of the moving average is determined by the number of lagged error terms that impact the current realization. One can combine the autoregression and moving average function in the form of an ARMA $(1,1)$ model $y_t = \phi y_{t-1} - \theta \varepsilon_{t-1} + \varepsilon_t$. With the parentheses in the ARMA $(1,1)$ model, the first number indicates the order of the autoregressive function and the second indicates the nature of the moving average function. If one used a differenced model, this would be indicated by an ARIMA model $(1,1,1)$ where the middle term, called the integrated term, denotes the order of differences. For a more complete discussion of ARMA and ARIMA models, see (Enders, 1995; Greene, 1999; Hamilton, 1994; Yaffee & McGee, 2000). If the trend is caused by changes in society, secular movements, technology, social
customs, or conditions that may be long term, then the trends may be considered
deterministic (Farnum & Stanton, 1989; Yaffee & McGee, 2000). In the event of a
deterministic trend, one should regress the current realization of a series on some
function of time ($y_t = \Sigma_i^5 D(t_i) + \epsilon_t$) where D(t) are centered polynomials. The theory of the
issue attention cycle (Downs, 1972) suggests that issues have a deterministic trend.
That is, issue importance should follow a cycle where there is an increase in importance
followed by a topping out and then an eventual decline. Mayer (1992) articulated four
reasons for changes in policy preferences between 1960 and 1988: generational
replacement; demographic changes; external events and mass media effects, which
suggest a deterministic trend in the study of policy formation. Henry and Gordon (2001)
estimated a deterministic trend with five centered polynomials and found that two of the
polynomials were significant. In this paper, the variance will be modeled both
stochastically and deterministically.
REFERENCES


Environmental Protection Division- Air Protection Branch. (1999). *1999 Ambient Air Surveillance Report*. Atlanta, GA: Environmental Protection Division, Georgia Department of Natural Resources.


VITA

Craig Gordon received his Ph.D. from the Georgia Institute of Technology and Georgia State University in public policy.