



# Polarized News Media and the Polarization of the Electorate

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## ABSTRACT

*An increasing amount of empirical evidence suggests that in democracies that usually divide into two camps during a campaign season, the news media environment is fragmented and polarized. An emerging concern is whether the electorate in such divided societies would be pulled by polarized news media outlets and become polarized as well. This study, employing a series of agent-based simulations that takes into account polarized news media, communication networks, and individual differences all together, explores the effect of a polarized news environment on increases in extremist opinions and in the proportion of individuals with divided communication networks. It also identifies circumstances under which individuals perceive division within their communication networks. The findings suggest that the effect of a polarized news media environment on polarizing the electorate may be overestimated, while the homogenizing effect of communication networks may be underestimated.*

*Keywords:* Communication Networks, Extremity, Heterogeneity, News Media Effects, Polarization, Simulation

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## INTRODUCTION

In democracies that usually divide into two camps like the U.S. and Canada, recent political communication research has identified a dramatic change in the media environment: from broadcasting to narrowcasting. Such change is attributed to the increase of news outlets and news programs aiming at segmented audiences. In addressing this phenomenon, some scholars continue to explore and confirm the existence of media fragmentation (e.g., Mendelsohn & Nadeau, 1996; Webster, 2005) while others are paying more attention to possible consequences of media fragmentation (e.g., Galston, 2003; Jones,

2002). Scholars have provided perspectives from different sides, but it remains a question whether a fragmented and polarized news media environment is responsible for the emergence of opinion polarization in the electorate. While there is growing concern about polarization in the news media, particularly in talk shows on TV, it is equally possible that the audience, given more options in terms of media types and program types, are less influenced by specific biased channels. In other words, before we confirm a causal link from the polarized media to the polarized electorate, we should consider if we might have overstated the concern about the influence of a polarized news media on a polarized electorate (Rosentiel, 2006).

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Polarization is a process in which two separate groups are formed with opposite opinions or positions. Besides the meanings of “division” and “split,” the term “polarization” in the article emphasizes the degree of opinion strength and extremity. A divided society may not necessarily be a polarized one, while the reverse is usually true. A 50-50 separated electorate may not be a polarized one if the voters hold mild opinions. The level of polarization, hence, cannot be properly measured or judged by whether or not a group is divided; instead, we need to take into account the level of division and the degree of opinion extremity.

Following this rationale, the term polarization in this article is operationalized in two ways: polarization at the society level and perceived polarization at the community or network level. First, polarization at the society level will increase when there is an increase in the number of voters that hold extreme or relatively strong positions favoring or against a political camp.<sup>1</sup> Second, given that polarized politics is not simply a matter of the actual positions held by partisans but also a consequence of the perceptions each side holds of the other (Huckfeldt, Carmines, Mondak, & Palmer, 2005), perceived polarization at the community or network level will increase when an individual perceives or detects an increase in the number of its network members holding extreme or relatively strong positions.

What would be the effect of a polarized news environment on the polarization of the electorate? What can be the circumstances under which voters perceive less polarization within their communication networks? Given the definition of polarization and the concern of polarized media effect, one would expect that when voters access self-selected news media during a campaign season to form a voter choice, the level of polarization will increase, meaning that voters' opinions will grow stronger and the number of people perceiving preference division within their networks will increase. But, how likely will this expectation hold true when we consider the complexity of the communication processes, such as interactions with multiple

news sources, including news media, family, and close friends?

This article employs Bibb Latane's (1996) simulation approach and presents results of a series of computer-based experiments. Computer-based simulation allows a researcher to look beyond specific contexts and focus on causal effects of certain stimuli on phenomena of interest. Although the design of the study is not fixed to a particular context, the circumstances of concern are well specified, including polarized news media, divided electorate, and self-selected communication networks.

The next section will summarize recent empirical findings about media polarization and its possible effect on the electorate. The third section will detail the design of the computational experiment, composed of polarized news media objects and two types of citizen agents. The fourth section will illustrate experiment results, followed by a conclusion and discussion about the implications of the findings for future research.

## **POLARIZED NEWS MEDIA AS A POSSIBLE CAUSE OF POLARIZATION IN THE ELECTORATE**

In democracies like the U.S. and Canada, scholars have established that the news media have grown into a fragmented and polarized arena of political information, driven by commercial interests and polarized elites. A study found that broadcasting media in Canada can facilitate preference homogenization, while narrowcasting news media can lead to fragmentation among the audience and preference polarization in the electorate (Mendelsohn & Nadeau, 1996). Seeing polarization as the tendency of channel audiences to be composed of devotees and non-viewers, Webster (2005) found that polarization was evident, though modestly, across sixty-two of the most prominent TV networks in the U.S. Although Webster thought it was not strong evidence to confirm a conventional view of selective exposure, he concluded that, “The

audience for each of these networks is loyal in so far as they are more likely than the general population to watch them. This is obviously the result of systematic preferences for types of content.” (p. 379)

An increasing number of empirical findings also point out the polarization of TV audiences and Internet users regarding their political views. For example, Galston (2003) identified the fragmentation of interests of Internet news users, while Iyengar and Hahn (2007) and Morris (2005) found the emerging polarization among cable news users. Morris (2005) showed that Fox News watchers were more likely than CNN watchers and non-watchers to underestimate the number of American casualties in Iraq. Iyengar and Hahn (2007) furthermore attributed audience polarization to the emergence of Fox News, demonstrating that partisan voters were more prone to select news based on anticipated agreement.

Political talk radio has been found to be another possible cause of preference polarization in Canada and the U.S. In Canada, exposure to talk radio programs directed toward segmented audiences exacerbated social cleavages (Mendelsohn & Nadeau, 1996). In the U.S., listeners to a particular talk radio program not only held conservative views but also leaned further to the right than they did in the early 1990s (Jones, 2002).

Given this scenario of media fragmentation and selective exposure, some scholars are concerned with consequences of media fragmentation and polarization, which are also responsible for the polarization of the electorate: cynicism about the electoral process and lower voter turnout among the less politically interested. The increasing dependence on horse-race tracking polls is likely to reinforce the audience's perception about the tendencies of polarization. Such emphasis on the strategic aspect of an election will inevitably thin the public's understanding toward who won and away from why. Such growing audience skepticism and political polarization can further result in an environment of distrust about the government and the methodology and integrity of polling

(Rosenstiel, 2005). The more voters think, or get persuaded, that campaign processes are games composed of a series of skillfully formulated strategies and advertisements, the more likely that such “delegitimizing” explanations of election results can lead voters of the losing side to blame the opposite side (see Mutz, 2006, p. 235-238). Furthermore, because of the availability of cable TV, voters have more choices to turn away from political news they dislike to non-political channels, such as entertainment and sports. Prior (2007), therefore, is concerned that the distraction of attention will result in even lower voter participation/turnout among those less politically involved: without involuntary exposure to political media, these more moderate voters will drop out of the electoral process, and result in increasing polarization in the electorate.

While it is possible that polarized media decrease voters' interest in political participation, it remains a question if such environment leads to a greater level of opinion polarization in the electorate. Looking at this linkage from a counter perspective, Rosenstiel (2006) suggests a further examination of the linkage between polarized media and polarized electorate.

*Recent elections suggest that, with more polarized turnout, more people are voting. We do not really know whether that is because moderates stayed home while more polarized voters turned out in greater numbers, or whether moderates themselves have become more polarized. And if moderates did become more polarized, was that attributable to the media or was it the reality of political events, particularly the leadership style of President Bush and the events on the ground in Iraq? (p. 252)*

There are other reasons to challenge the perspective about the linkage of polarized media to polarized electorate. Scholars have shown that the media effect on the electorate is usually mediated by communication networks composed of self-selected individuals. Due to the fact that media are fragmented and that

individuals tend to conduct selective processes, heterogeneity in preferences can be preserved in communication networks (Huckfeldt, Johnson, & Sprague, 2004; Liu, 2007).

Consistent with empirical findings suggesting that the news media in a democracy serve as a force enhancing the level of preference heterogeneity within communication networks (e.g., Mutz & Martin, 2001), simulation results also suggest that, except in the most well-connected networks, the news media can rapidly break down cohesion (Stocker et al., 2003).

## RESEARCH METHOD AND MODEL DESIGN

The above review suggests that the linkage between polarized news media and the polarized electorate still lacks empirical support. In fact, the few conventional methods such as statistical data analysis or field research fall short of exploring how social polarization among the Independent would (or would not) occur given a polarized media environment. It is also difficult to collect time-series data addressing media use, perception of polarization, and interactions within communication networks.

Agent-based modeling (ABM) is one promising alternative to investigate “what if” questions, such as what patterns of polarization could emerge if individuals stop accessing the polarized news media. As Latane (1996) and Latane and Nowak (1997) have introduced to communication scholars, computer-based simulation allows researchers to focus on the effect over time of a stimulus on the system as a whole while controlling for the effects of other factors.<sup>2</sup> They demonstrated a theory of dynamic social impact with a Cellular Automata (CA) model and showed how a homogeneous culture can form over time through interpersonal communication.

The ABM program used for the present research is named S-RAS, a program employing the power of toolkit “Swarm,” the operation of CA, and John Zaller’s (1992) Receive-Acceptance-Sample (RAS) theory of voter

preference.<sup>3</sup> S-RAS makes a progress beyond previous models by incorporating a greater level of complexity and individual difference, as to be described in the subsections below.

Laboratory experiment is usually criticized for (1) simplicity in design that limits the external validity, i.e., the connections between research and the mundane world and (2) the use of assumptions that are less rigid than those used in formal models. In effect, this method is not aimed to prove or to predict certain phenomena of the real world; instead, as a simplified but well-controlled environment, computer-based simulation designed for thought experiments aims to assist researchers to focus on discovering the factors causing the emergence of certain phenomena of interest. The findings of an experiment are expected to help us think further about the phenomena of interest as long as internal validity of model design is achieved; that is, simulation results will generate meanings as long as the assumptions about agent behavior used for model construction and for experiment settings are approximate to our common senses about the behavior of actors in the empirical world. To reflect this perspective, I put the key variables and assumptions held in the present study in italics.

## THE UPDATE OF OPINIONS AND VOTER PREFERENCES

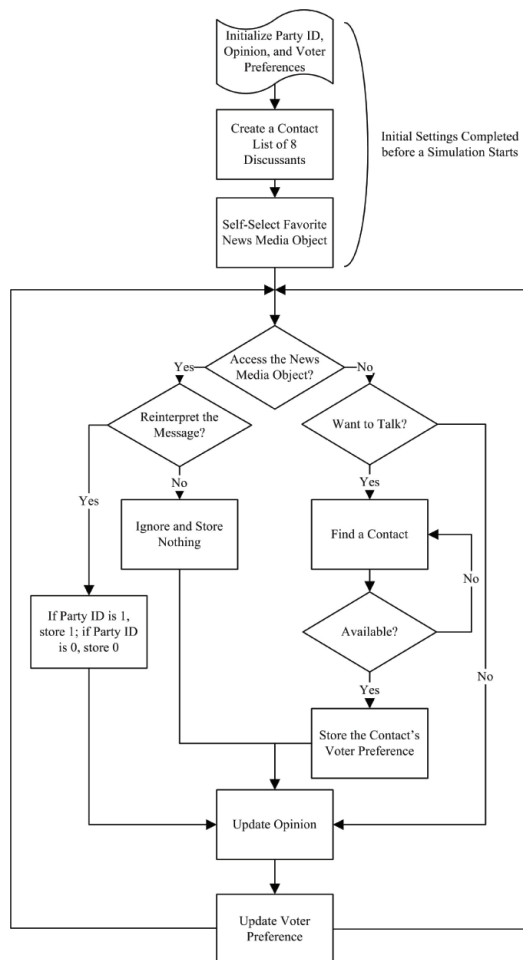
The programming structure of S-RAS is detailed in Liu (2009). Below is a simplified description of the model design. An agent’s context of political information includes self-selected network members and self-selected news media. Agents in S-RAS throughout the simulation will continuously receive messages from this context. To facilitate the study of the complex with a simplified program, S-RAS holds a number of assumptions. First, it is assumed that *agents are concerned with one issue during an election season*, such as a choice between Bush and Kerry in the 2004 American presidential election. Second, it is assumed that *voters are socially cultivated to obtain partisan orienta-*

tions that lead them to access self-selected news sources; when being asked about their opinions in a survey about support for a candidate, they respond with ideas from the top of the head summarized from past impressions. Moreover, even if their opinions are neutral, they still can take sides if they are asked to make choices. Based on these assumptions, Figure 1 presents a flow chart of how agents in the present study acquire and process information at each time step, or every iteration of a simulation.

Each agent object is characterized with four important variables or attributes—*Partisanship*, *Political Knowledge*, *Voter Preference*, and

*Opinion*. The values of these variables are initiated randomly before a simulation starts. *Partisanship* (either 0 or 1) and *Political Knowledge* (a random number drawn from 1 to 5) are critical references by which an agent determines which of its network members is the most like-minded. An agent's favorite discussant will be the one with the highest level of *Political Knowledge* among the network members and of the same *Partisanship*. Agents interact in a dyadic fashion. When an agent finds an available discussant, both agents will become unavailable to the other agents. If its favorite politically aware discussants are

Figure 1. The flow chart of information process at each time step of simulation





unavailable in the neighborhood at the given time step, an agent will turn to those with a lower level of political expertise but of the same *Partisanship*. Hence, the least favorable discussants on an agent's contact list are those with the lowest *Political Knowledge* and those of different *Partisanship*.

*Partisanship* is also a reference by which an agent acquires preferences from the news media. For example, if an agent's *Partisanship* is initiated as 1, it will often get 1 when it accesses the news media and its favorite discussants are likely to be those holding *Voter Preference* 1. An agent's *Voter Preference* is randomly assigned before simulation starts; this is a design that will make possible the scenario that agents will have different *Voter Preferences* and *Partisanship*.<sup>4</sup> An agent's *Opinion* will be initiated as neutral, a random number drawn from a normal distribution bounded between 0.45 and 0.55—a design that mimics a situation where the agent has not developed an opinion when it learns about an event, a candidate, or an issue in the first place. Thus, a change in *Voter Preference* will be a consequence of a change in *Opinion*. Specifically, *Voter Preference* will be 0 when its *Opinion* goes lower than the middle point 0.5; similarly, the agent's *Voter Preference* will be 1 when its *Opinion* goes higher than 0.5.

Below is an example of the relationships between the variables. What agents obtain from their discussants and the news media are general impressions of either 0 or 1. Suppose that an agent X's current *Opinion* is 0.45, which is lower than the threshold value of 0.5, therefore its *Voter Preference* will, accordingly, be 0. This 0 is what another agent Y, say, X's discussant, will get from a dyadic interaction. The messages that Y obtains from X, other agents, and the news media at a certain time step is stored as an array (0, 1, 0, 1, 1, 0, 1, 1, 0, 1); thus, Y's *Opinion* at this time step will be 0.6, a moving average of this array. At the next time step, if Y accesses the news media and obtains an impression of 1, the value 1 will be added onto the end of this array and the 0 in the beginning of the array will be dropped. The updated array of messages at this time step will then be (1, 0,

0, 1, 0, 1, 1, 0, 1, 1) and the updated *Opinion* at this second time step will be 0.7. As 0.7 is higher than the threshold value 0.5, its *Voter Preference* will remain as 1.<sup>5</sup>

Figure 1 shows two other important features of S-RAS. First, S-RAS holds that *agents are more likely to think about accessing news media than to find someone to discuss politics* (see Mutz & Martin, 2001). Communication networks and the news media are the two important exogenous factors that influence agents' *Opinion* and *Voter Preference*. Each agent resides in a 3x3 Moore neighborhood or communication networks composed of eight discussants. The grid is virtually and spatially wrapped by edges like a torus so that each agent will have eight neighbors around its edges.<sup>9</sup>

Second, each agent acts independently. For each time step or iteration, every agent finishes its own loop of processing political information—accessing the news media, discussing politics, or doing nothing. For an experiment that lasts for 1,000 time steps, each agent will go through this loop for 1,000 times. The next two sections, aiming to achieve a higher level of internal validity of S-RAS, will detail how the agents are uniquely initialized and how they acquire information from the news media.

## INDIVIDUAL DIFFERENCES

S-RAS maximizes individual differences among agents by considering general distinction between the politically aware and the less politically aware, or simply put, as ordinary citizens in the present study (see Bartels, 2004; Fiorina et al., 2006; Oliver, 2002). See Table 1.

As Table 1 summarizes, there are two types (or classes in programming language) of agents in S-RAS. It is assumed that *the politically aware have a higher level of political knowledge, are more likely to access the news media, to discuss politics, to perform selective perception about news media messages, and to memorize a greater number of messages*. The number in the brackets in Table 1 indicates the boundary for a normal distribution from which

Table 1. The differences between the three types of agents

	Ordinary Citizens	The Politically Aware
The Level of Political Knowledge	[1, 5]	[6, 10]
Propensity to Access Media	[0.1, 0.5]	[0.6, 0.9]
Propensity to Discuss Politics	[0.1, 0.5]	[0.6, 0.9]
Propensity to be Selective about Media Messages	[0.1, 0.5]	[0.6, 0.9]
Memory Capacity	10	20
Initial Opinion	[0.45, 0.55]	[0, 0.5] or [0.5, 1]

a random value is drawn. For example, that the propensity to discuss politics varies from 0.6 to 0.9 means that S-RAS will draw a random number from a normal distribution bounded between 0.6 and 0.9 as an agent's *Propensity to Discuss Politics*. When a simulation starts, every agent will have its unique *Propensity to Discuss Politics*. If a politically aware agent's *Partisanship* is initiated as 0, its *Opinion* will be initialized with values drawn from a normal distribution bounded between 0 and 0.5; similarly, if the value of its *Partisanship* is initialized as 1, its *Opinion* will be drawn from a normal distribution bounded between 0.5 and 1.0.

Given that the politically aware are more likely to and more able to reinterpret political messages and avoid cognitive dissonance (Festinger, 1957; Klapper, 1960; Zaller, 1992), the S-RAS model addresses the mechanism of selective exposure to news media and communication networks.<sup>6</sup> A politically aware agent is more likely than an ordinary agent to frequently acquire news media messages consistent with *Partisanship*. Suppose an agent whose *Partisanship* is 0, when it performs a selective perception, it will take 0 and add it to its array of impressions; when an agent does not perform selective perception at a time step, it takes no message from the news media.

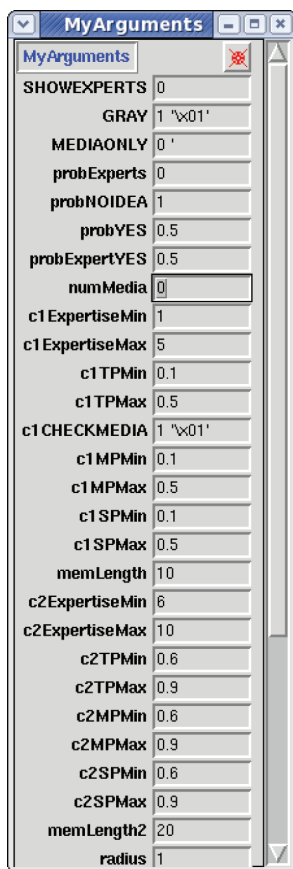
Regarding memory capacity, a politically aware agent is able to process twenty messages, which means that its *Opinion* will be the moving average of an array of twenty 0s or 1s. An ordinary citizen agent is more "forgetful," meaning that it will "remember" or process only

the most recent ten 0s or 1s obtained from its information context.

## INTERACTION WITH A POLARIZED NEWS MEDIA ENVIRONMENT

A news media object in S-RAS refers to any source of information other than dyadic interpersonal discussion, including political elites who usually appear on TV, newspapers, Internet, and other kinds of news channels.<sup>7</sup> Every time agents access their self-selected media, they will receive one of two positions from the object, usually the one consistent with their own *Partisanship*. For every agent in the present study, therefore, the news media object will be regarded as a globally accessible 9<sup>th</sup> discussant. Because the model design pays attention to what each agent actually receives from the news media environment, the news media objects can refer to any type of public or private news source that transmits a position favoring one side of the political camp—a TV channel, a newspaper, a radio program, a magazine, a news website on the Internet, a town hall meeting, etc. The polarized news media environment in S-RAS—one side favoring 1 and the other favoring 0—can be seen as politically polarized media groups. Note that a polarized media object does not always consistently broadcast 1 or always broadcast 0. Instead, the news media objects are designed so that one-third of the messages broadcast is neutral (0.5).

Figure 2. The parameter panel of S-RAS



## EXPERIMENT DESIGN

The above section details the design of S-RAS. This section will detail the application of this program to study media effects on the increase of extremity in opinion and perceived division within communication networks. Simply put, the experiment of this research was conducted by assigning four sets of parameter values to S-RAS that mimic specific environments of political context. Given these environment settings, the main task was to monitor changes of the 1,600 agents and identify patterns emerging within a certain period of time. See Figure 2.

The four parameters used to formulate the series of experiments, as shown in blocked areas in Figure 2, include (1) whether or not agents

interact with their self-selected discussants, (2) the proportion of the politically aware, (3) the proportion of the Independent, and (4) the number of positions the news media posits. Below is the summary of the four experiments:

- Experiment 1 (Communication Networks Only) was initialized with a setting that self-selected communication network members were the only source of political information for the agents.
- Experiment 2 (Networks plus Polarized Media) was an extension of Experiment 1 that included a polarized media environment. Agents were free to access self-selected news media as well as their network members based on their propensities to do so.
- Experiment 3 (Polarized Media Only), which was modified from Experiment 2, emphasized net effects of accessing polarized news media. The agents in this experiment were like egocentric atoms—not interested in interacting with self-selected communication networks but going to self-selected news media as the only source of political information.
- Experiment 4 (Politically Aware Added) was a replication of Experiment 2, except that 40% of the population were designated as politically aware agents, as characterized in Table 1.

The simulation of each experiment lasted for 1,000 time steps, a period long enough to identify a pattern. To ensure that the simulation results were robust, i.e., insensitive to exceptional random values caused by irregular geographical distribution and general propensities of agents, each of the four experiments was replicated 100 times, and each replication was done with a different random seed.

## EXPERIMENT RESULTS

The experiment results will be reported in three aspects. The first subsection will give summary



statistics for comparison across the four experiments. The second subsection will present two graphs that show the dynamics of changes in opinion extremity and in the polarization of networks. The third subsection will present the distribution of agents' opinions that assist further comparisons.

## SUMMARY STATISTICS

Table 2 presents the proportion means and standard deviations of the 100 replications of each experiment. The rows report five aspects of the results collected at the end of the experiments: (1) the proportion of agents whose *Voter Preference* was 1; (2) the proportion of agents who held extreme opinions (higher than 0.9 or lower than 0.1); (3) the proportion of agents who remained neutral, i.e., agents whose *Opinions* fell between 0.45 and 0.55; (4) the proportion of agents who perceived at least one discussant holding the opposite *Voter Preference* within their communication networks; and (5) the proportion of agents who perceived that their communication networks were evenly divided.

Note first that all of the standard deviations are small, indicating that the simulation results are insensitive to random seeds that S-RAS automatically generates for initializing attributes of agents and the allocation of agents. Below is a summary of comparisons across the four experiments.

First, all of the four experiments ended with a 50-50 division in *Voter Preference*, the same pattern as the initial setting of the experiments—half of the agents were initiated with *Voter Preference* 1 and the other half 0. If we count the number of agents favoring Candidate 1 over the period and see no dramatic change in this proportion, we may conclude that this 50-50 division seems not to have been affected by any of the four experimental settings. The problem is, however, that this pattern of 50-50 division is not informative enough to suggest that the distribution of opinion will remain the same over a period of 1,000 time steps; the following four aspects will help spot such changes.

The second pattern is that agents accessing polarized news media environments were able to resist the homogenizing effect of com-

Table 2. Summary statistics of each experiment

	Experiment 1	Experiment 2	Experiment 3	Experiment 4
% Favoring "1"	49.72	48.68	49.78	50.30
	(0.06)	(0.09)	(0.01)	(0.07)
% Extreme	78.21	19.66	2.13	31.00
	(0.02)	(0.01)	(0.004)	(0.01)
% Neutral	5.28	13.98	39.93	8.81
	(0.01)	(0.01)	(0.01)	(0.01)
% Perceiving Diversity	21.29	18.53	50.05	21.53
	(0.01)	(0.02)	(0.01)	(0.02)
% Network Polarized	14.65	11.61	49.46	13.98
	(0.01)	(0.01)	(0.02)	(0.01)
Note: 1. Experiment 1: Communication Networks Only; Experiment 2: Networks plus Polarized Media; Experiment 3: Polarized Media Only; Experiment 4: The Politically Aware Added. 2. Each experiment was run for 1,000 time steps and the proportion was obtained at the 1001 <sup>st</sup> time step. The means in the table are the averages of the proportions obtained from 100 replications of each experiment. In the parentheses are standard deviations.				

munication networks. The proportion of agents holding extreme opinions fell between those of Experiments 1 and 3. In Experiment 1 where agents only accessed communication networks, the majority of agents (78.21%) turned out to hold extreme opinions. This pattern contradicts the results of Experiment 3 (2.13%) where agents could access nothing but their favorite news media outlets. Experiment 4 also shows that the polarized politically aware, who accounted for 40% of the population, increased this proportion.

As to how many agents remained neutral or independent in their *Opinions*, Experiment 3 is the condition that retained a relatively high level of neutral agents (39.93%). Apparently, this pattern can be attributed to the setting that individuals are immune from the homogenizing effect of their self-selected network members. A further comparison between Experiment 1 and Experiment 2 suggests that exposure to a polarized media does not necessary lead to the decrease in the number of neutral agents; instead, this proportion can increase. Moreover, a further comparison between Experiment 2 and Experiment 4 suggests that the net effect of the 40% of politically aware is to increase the proportion of extreme agents and decrease the proportion of neutral agents.

Fourth, regarding how many agents perceived diversity, an individualistic society can result in the greatest number of such agents. The setting of Experiment 3 resulted in the highest percentage of agents (50%). Note that, although the polarized news media environment decreased the level of perceived diversity in communication networks in Experiment 2, this impact was mild. By comparing Experiments 1 and 2, one will notice that the decrease in the proportion was only about 2% and, by comparing Experiments 2 and 4, this negative impact was offset by the influence of the politically aware, which increased the proportion by 3%.

Fifth, the level of perceived polarization was measured by the proportion of agents perceiving that their communication networks were evenly divided. Consistent with the patterns identified above, the figures confirm that the

polarized news media environment resulted in a mild decrease in the proportion of this aspect (Experiment 3), while such decrease could be offset by the influence of the politically aware agents.

## TIME-SERIES GRAPHICS

The two graphs shown below will provide a time-series comparison across the four experiments regarding (1) the extremity of *Opinion* and (2) the division of a communication networks. Beyond the findings described above, these two graphs will present the dynamic process of change.

First, Figure 3 shows the changes in the proportion of agents perceiving extreme opinions in the four experiments. The increase of this figure is sharpest for Experiment 1, suggesting that agents supporting one camp strongly opposed those of the opposite camp and that network homogenization was the direct cause of such polarization.

Second, Figure 4 gives more details about the fifth dimension of observation in Table 2—the level of division within a communication network. Apparently, agents who were randomly allocated in a completely atomized society (Experiment 3) will perceive the greatest level of diversity. Experiment 2 is a situation where agents will perceive the lowest level of division within their community networks.

The dramatic drops in the lines before the 200<sup>th</sup> time step should be attributed to the design of S-RAS, in which the agents first chose their favorite like-minded network members so that the majority of communication networks in Experiments 1, 2, and 4 will not be evenly divided. What is worth noting is how little difference there was between these three experiments in which communication networks were taken into account after the 200<sup>th</sup> time step. This similarity leads one to generate a hypothesis that the polarized news environment may not lead to an increase in the level of perceived polarization within one's communication networks.

Figure 3. The proportions of agents holding extreme opinions

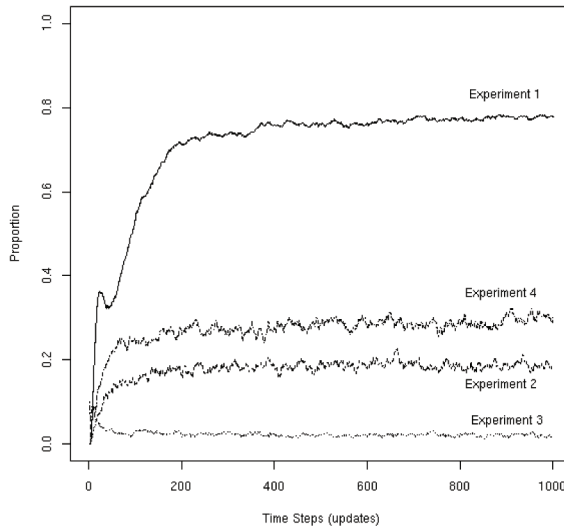
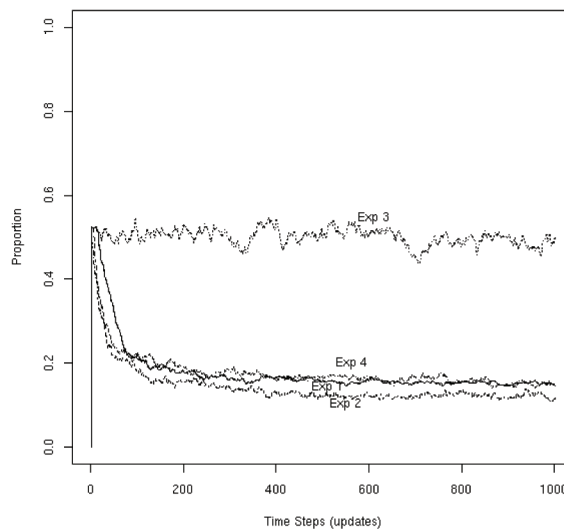


Figure 4. The proportions of divided communication networks

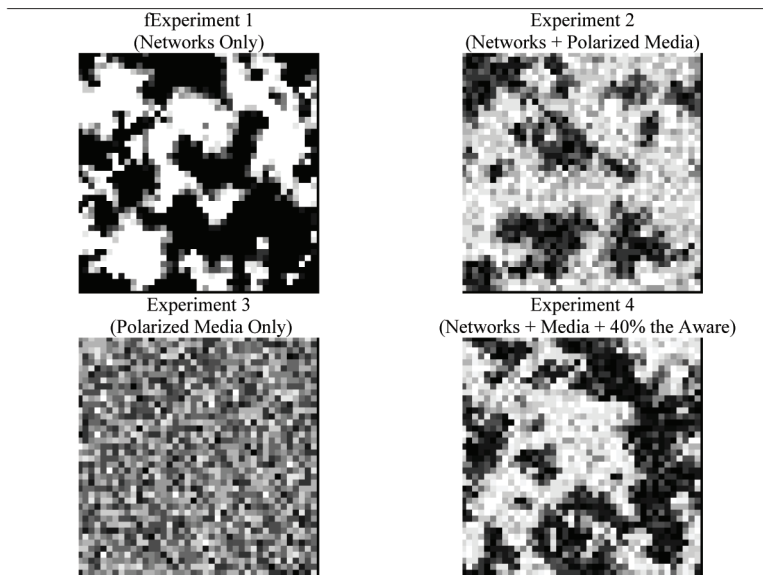


### VISUALIZED PATTERNS

The *Opinions* of the 1,600 agents are shown on a 40x40 lattice or grid. The gray scale of each cell represents the level of opinion strength or

extremity. Figure 5 presents the distributions of *Opinion* for each experiment. The snapshots were taken at the last (the 1001<sup>st</sup>) time step of the simulation. These graphs help interpret the meaning of the patterns outlined above. As one

Figure 5. The patterns of agents opinions in the four experiments



Note:

- (1) The pictures were taken at the 1001st time step of simulation.
- (2) The agents appearing in Experiments 2 and 3 are the same as those in Experiment 1.

shall see, the pictures differ significantly from each other regarding the level of diversity and opinion strength. Agents within clusters of Experiment 1, for example, are homogeneous (almost completely white or completely black) and the boundaries between black clusters and white clusters are sharp. This pattern suggests a high tension between the two camps holding opposite preferences.

The lattices of Experiments 2 and 4, compared to that of Experiment 1, present a greater number of light-gray cells and dark-gray cells. This pattern suggests that polarized media moderate the homogenization of communication networks and help preserve disagreement within communication networks. This pattern further implies that, if a society is growing individualistic, the opinion extremity of the electorate cannot be pulled further by the polarized news media; instead, this is the circumstance where the highest level of perceived diversity is achieved.

Two more explanations for these patterns can be drawn from the original design of S-RAS: First, because the ordinary citizen agents were less interested in accessing the news media and discussing politics, they were less influenced by the polarized media environment (Experiment 2), particularly when they stopped interacting with their self-selected network members (Experiment 3). Second, the ordinary citizen agents were more forgetful about past impressions than the politically aware were; therefore, biased information might not have lasted long in their heads, especially when there were no politically aware within their communication networks stimulating interpersonal political discussion (Experiment 4).

In sum, the above simulation results suggest that it is not likely that a polarized news media environment polarizes the electorate by increasing the level of opinion extremity or the perception of network division. While communication networks have a homogenizing effect on voter preference at the individual

level, polarized elites and polarized news media play a role of enhancing diversity at the aggregate level.

## CONCLUSION AND DISCUSSION

During an intensive campaign season, it is common to see critiques that polarized news media will polarize the electorate. However, it is not well discussed whether this is true or not, and how this mechanism takes effect. This article is the first attempt to solve this inquiry with the assistance of agent-based simulation and by controlling for the effects of communication networks and the politically aware during the process of preference formation and changes. The results suggest that a polarized news media environment has a mild effect on polarization: it will decrease perceived diversity in communication networks but will not result in a significant decrease in the number of neutral individuals; instead, it will result in an increase in the proportion of neutral individuals. This article not only demonstrates that the electorate cannot be polarized solely by the polarized media, a mechanism consistent with Mutz and Martin (2001). Moreover, this article proposes a possible scenario that a polarized news media environment helps the survival of disagreement at the community level. The effect of a polarized news media environment on the electorate may be overestimated and the homogenizing effect of communication networks may be underestimated.

Even if the electorate were divided 50-50, it is important to check if such division implies polarization and if this division is driven by the media environment. This article answers “no” to both inquiries. First, polarization can be a reflection of party politics or polarized news media in countries adopting the presidential system like the U.S. and Taiwan, where polarization along the party line is a possible and salient phenomenon.<sup>8</sup> Such division does not mean that the electorate holds extreme opinions. Second, given that the elites may not be a primary and

direct cause of social division (e.g., Fiorina et al., 2006; Liu, 2007), this article further suggests that a polarized media environment is not, either. About a decade ago, Latane (1996) introduced to communication scholars a dynamic simulation approach that facilitates the study of how homogeneous opinion clusters form through interpersonal communication. Recent research using computational simulation further suggests conditions in which extreme and divided societies are likely to emerge: when individuals are less willing to communicate a point of view from out of their community, and when there are strong attempts by the broadcast media to convince people to move towards extreme positions (e.g., Mckeown & Sheehy, 2006). The present study advances these works by showing that self-selected communication networks are more responsible for the increase in the level of opinion extremity and, ironically, the level of perceived homogeneity within daily interaction with family and close friends.

The present research suggests two conditions under which the level of opinion extremity will be mild: when individuals are immune from the homogenizing effect of their self-selected network members, and when individuals interact with the politically aware in a society that is not completely atomic. In addition, the negative impact of polarized media on perceived diversity can be offset by the influence of the politically aware. This conclusion reminds us to look more closely at how audiences are influenced, if not homogenized, by their self-selected political discussants, and how individuals grow extreme under the cover of supportive messages. This does not imply that interacting with family and close friends is a problem; instead, this implies that the problem of cultivating extreme opinions can be attributed to selective perception of messages from these network members.

The discussions of the present study are based on laboratory simulation results. Therefore, further applications of the findings to the empirical world will require more examination of the patterns and hypotheses presented in this article, such as using specified survey questions to acquire the level of perceived polarization in



one's daily interaction with family and friends. Additionally, for future studies applying S-RAS, there are two suggestions. First, due to the program design, the homogenizing effect of communication networks is strong. Researchers are welcome to introduce mechanisms that help release tight connections and overlapping between networks, such as adding a proportion of random blank cells into the lattice. Second, the proportion of the politically aware is fixed at 40%. While the effect of the politically aware is beyond the scope of this article, future studies are invited to explore the net effect of the politically aware on the changes of preferences in the electorate.

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## ENDNOTES

<sup>1</sup> I don't simply count the number of voters favoring or against an issue because by such definition the number of those in favor of and against an issue may be even and make it difficult to see the strength of support.

<sup>2</sup> ABM is an approach or method facilitating a study of how large-scale social dynamics result from micro-level individual behavior. John Patty and Maggie Penn describe this method in a very clear way. In their syllabus of "Introduction to Agent-Based Modeling" for undergraduate students at Harvard University, they describe ABM this way: "In its basic form, a collection of individuals, or agents, are programmed into a computer, along with a simple behavioral algorithm describing how they act. The computer then allows the agents to interact possibly in both space and time, and

ultimately generates a social dynamic that can then be analyzed in terms of the behavioral rules."

<sup>3</sup> The RAS theory summarizes that individuals form opinions through a process of selective perception, information filtering, and sampling from recently memorized impressions obtained from their political context. Because the RAS theory explains how individuals acquire and process political information, and respond to surveys during an electoral campaign, it is important to note that the results and implications of the present study are limited to media effects on the electorate during a campaign season. Swarm is one of the toolkits for constructing objected-oriented agent-based models, available online at <http://www.swarm.org>. The source code of S-RAS is available from the author.

<sup>4</sup> Because an agent's *Party Identification* is a fixed value and its *Voter Preference* is contingent on changes of its *Opinion*, one should expect that the *Voter Preference* of an agent whose *Voter Preference* is inconsistent with its *Party Identification* will become consistent with its *Party Identification* as simulation progresses.

<sup>5</sup> The concept of autoregressive influence refers to the influence of perceived external pressure, including peer pressure. Such social influence depends on the distribution of opinion across all other individuals within the network who are also connected to the first individual (Huckfeldt, Johnson, & Sprague, 2004, p. 20). In other words, when individuals perceive that messages from their social context turn to oppose their current preferences, they are likely to conform to the majority. In S-RAS, an agent whose current value in *Opinion* is or higher than 0.5 will be recorded by the super monitor as 1 in *Voter Preference*, be regarded by its network members as 1 in *Voter Preference*, and will also see itself as favoring 1 over 0.

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- monitor as 1 in *Voter Preference*, be regarded by its network members as 1 in *Voter Preference*, and will also see itself as favoring 1 over 0.
- <sup>6</sup> This simplified setting is based on an assumption that the composition of communication networks remains stable during a campaign season, because messages that make sense to an individual and can be remembered for a certain period of time are obtained from network members who are most trusted. It may be interesting to modify the program in such a way that agents can move around and interact with new contacts or strangers, but doing so requires further understanding about the selective process of information obtained from strangers. To stay close with the RAS theory, I kept to the setting wherein an agent's network members and the priority list of contacts are fixed during a simulation period.
- <sup>7</sup> Messages obtained from one's political context are filtered through selective processes. As a result, agents in S-RAS do not perform sophisticated learning processes but simply use the moving average mechanism to accumulate impressions collected from their political context.
- <sup>8</sup> Note that the politically aware are different from political elites appearing in the news media. Zaller (1992) suggested that the news media and political elites are one entity of information source, which means (1) that political elites usually exert their influence through TV, newspapers, radio, etc., and (2) that the news media, in effect, exert their influence by reporting news, talks, and activities of political elites.
- <sup>9</sup> I here take the perspective that polarization issues are less salient and serious in parliamentary systems such as those in most European countries than in presidential systems, particularly in two-party presidential systems.

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