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Contagious Agendas:
The Spread of Issue Attention in the Policy Process

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Contagious Agendas:

The Spread of Issue Attention in the Policy Process

by

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Dedication

For my mom, Linda, who is dearly missed.

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Contagious Agendas:
The Spread of Issue Attention in the Policy Process

Herschel Fred Thomas III, Ph.D.
The University of Texas at Austin, 2015

Supervisor: Bryan D. Jones

This dissertation is a study of contagion effects in policymaking. The policy process behaves in many ways like a complex system, which is characterized by communication among actors, dynamic interaction, and evolution in behavior over time. As a result, the attention of policy elites rapidly jumps from issue to issue as they struggle to address an array of pressing issues and problems simultaneously. I argue that a process of issue contagion explains these rapid changes as policy elites are highly interdependent actors who are subject to cognitive limits, have incentives to closely monitor the political environment, and frequently mimic the behavior of their peers. Drawing on the methods of computational social science, I build a simulation model of agenda-setting behavior and examine issue contagion through an experimental research design. I test the empirical implications of the model by applying it to real-world datasets—from the disclosed lobbying activity of organized interests to the bill introductions of members of Congress. The core contribution of the project is that patterns in attention to policy issues are a function of a contagion process generated by cue-taking behavior among elites.

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Chapter 1: Introduction

In the course of just 28 hours, a Liberian national flew from the epicenter of the 2014 Ebola outbreak in West Africa to Dallas, Texas. On September 24th, just days after his arrival, the traveler developed symptoms for the deadly disease and became the first diagnosed case in the US. Word of the patient's condition fueled public concern over a new epidemic and triggered a decline in airline stocks on the NYSE (CBS News 2014). Within the next month, media coverage of the outbreak reached saturation and polls by the Pew Research Center found that 41% of Americans worried about exposure to the disease. Speaking after major US airports implemented screening measures for travellers arriving from affected countries, Director of the US Centers for Disease Control and Prevention Dr. Tom Frieden warned that "We can't get the risk to zero here in the interconnected world" (Fantz et al. 2014). In the case of Ebola, and other recent outbreaks such as SARS and Avian Flu, infections were able to traverse oceans and borders through the international networks of modern airlines.

The potential for widespread contagion, however, extends beyond the study of diseases and global pandemics; ideas, behaviors, and opinions can spread through social interaction in similar fashion. Visible in the onset of new fashion trends, rises in the popularity of restaurants, and the spectacle of superstar musicians, among others, human behavior is known to follow patterns akin to the outbreak of viruses (Bikhchandani et al. 1992, Adler 1985, Becker 1991, Sornette 2004). Interconnectedness and communication combine with uncertainty to produce what are sometimes described as bandwagons or herds in decision-making. From the massive bubbles and panics of economic markets to the adoption of certain brands or products, social processes are frequently attributed explanations for rapid changes in behavior. Malcolm Gladwell's (2000) popular *The*

Tipping Point describes many cases of these 'social epidemics,' outlining how and when the behavior of a few individuals can spread to many. Sometimes described as 'opinion leaders' or 'mavens,' certain individuals can generate self-reinforcing processes that spread to others and alter the behavior of large groups.

The world of politics is also not immune to these social phenomena. From the development of civil unrest and the outbreak of violence, to voter turnout and perceptions of momentum in Presidential campaigns, interaction and communication can shape important outcomes in politics and public policy. The Monday demonstrations in East Germany in the fall of 1989 provide an illustrative example. Lohmann (1994) describes how the demonstrations, which began as small, weekly protests of groups of friends in the town of Leipzig, quickly developed through established social groups into the "spontaneous coordination" of tens of thousands of demonstrators. These protests involved the transmission of new information about the regime and sparked others beyond the city, growing to the mass demonstration of one million people in East Berlin just before the Berlin Wall fell.

Drawing on the interdisciplinary work of economists, sociologists, and political scientists, this dissertation focuses on how contagion effects shape the ebb and flow of policymaking. Similar to the study of the spread of disease or the outbreak of civil unrest, I empirically explore links between individual-level decision-making and shifts in the behavior of groups of policy elites (i.e. members of Congress and lobbyists). I examine the attention of these elites to specific issues of public policy; studying patterns in the legislation they introduce, the topics they discuss, and the specific policies they advocate for. My research examines the conditions under which rapid shifts in the aggregate attention of policy elites occur—for example, large-scale changes from the prioritization of national defense issues to healthcare reform—and whether or not social contagion processes contribute to observed patterns. My work leverages the new tools of computational social science, and agent-based modeling in particular, to provide one of the first analyses of the underlying mechanisms that shape policy dynamics over time. In doing so, I reveal the direct links between micro-level behavior and macro-level patterns in the policy process.

A BURST IN ATTENTION: IMMIGRATION REFORM

Following the electoral demise of Mitt Romney in the 2012 Presidential elections, political analysts suggested that Republican resistance to immigration reform may wane and that the issue might soon be in the national spotlight. On April 17, 2013, the makings for renewed attention to immigration where at work as the Senate Committee on the Judiciary began legislative hearings on S. 744, a comprehensive immigration reform package. A month later, Senate Majority Leader Harry Reid (D-NV) offered a preview of his chamber's legislative agenda, stating that "I believe the time for commonsense reform has come." Days afterward, what was known as the 'Gang of 8'—a bipartisan group of eight Senators including John McCain (R-AZ), Lindsey Graham (R-SC), Marco Rubio (R-FL), Chuck Schumer (D-NY), and Dick Durbin (D-IL)—facilitated S. 744's advancement out of committee. With the bill headed to the floor of the Senate in June, Senator Graham provided an account of the behind-the-scenes discussions underway in an interview with *TIME Magazine*: "The 'Gang of 8' is trying to grow the boat. We're talking to people to figure out what their concerns are. We're listening to our colleagues" (Newton-Small 2013).

As Senator Graham lobbied for the support of his fellow lawmakers, speeches in the chamber, as compiled by the Capitol Words Project, rose dramatically from prior months. In June, attention to immigration reform amplified from an average of less than

20 speeches per month from January through May, to nearly 180.[1] In this case, the collective attention of Senators was directed towards immigration – regardless of whether individuals supported or opposed the law. At the height of this attention, on June 26th, 2013, Senator Rubio (R-FL) made what was a highly watched speech on the floor of the chamber. He spoke directly to his conservative colleagues and Tea Party activists in an attempt to assuage their concerns and encourage their support of the reform package.[2]

Soon after, the Senate passed S. 744 and discussion of the issue returned to pre-June levels. In the House, data from the Capitol Words Project indicate steadily rising attention to immigration from April to July, 2015 (from 20 to 60 speeches), but the issue does not receive the same level of collective focus as in the Senate; no clear spike or amplification of attention to immigration reform ensued. This can largely be attributed to Speaker Boehner's (R-OH) control of the formal agenda in the House, but also his clear signal to fellow lawmakers on the issue while the Senate debated the bill. On June 18th, 2015, he stated that no vote on immigration reform would occur in his chamber without support from the majority of his Republican colleagues.

This simple example highlights how communication and interaction among individual members of Congress can shape aggregate levels of attention to a particular policy issue. In the Senate, a small group of legislators—with the support of the majority leader—actively communicated with and sought out supporters of the immigration reform package. Discussion and debate of the issue amplified and the collective attention of many Senators was directed towards the issue. In the House, Speaker Boehner

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[1] Data are counts of speeches mentioning the phrase "immigration reform," as compiled by the author from the Capitol Words Project, http://www.capitolwords.org.

[2] The full-length video of Senator Rubio's speech is available at: http://youtu.be/lnW9Ah4ha4U.

effectively headed-off discussion of the issue before it started, signaling to his colleagues that progress on the issue was unlikely.

WHY ISSUE ATTENTION MATTERS

The discussion of members of Congress on the issue of immigration reform illustrates how quickly, given the behavior of a few influential actors, the focus and activity of a large number of policy elites can shift from one issue to the next. By focus, I am describing the attention elites place on particular policy issues, problems, or solutions in the early stages of the policy process (e.g. through agenda-setting aringrind agenda-building). Broadly defined, attention by members of Congress can be in the form of public debate on the floors of the House or Senate, private discussions among fellow lawmakers, the issuing of public press releases, the introduction of bills, making statements to members of the media, or participating in Congressional hearings. Among other types of elites, such as policy advocates, attention can be in the form of making lobbying contacts on particular issues, the release of policy statements or reports, the issuing of press releases, and issue-specific media or fundraising campaigns. Importantly, attention in this sense occurs irrespective of position or opinion on a policy issue: two elites can pay simultaneous attention to an issue while holding wildly different preferences on policy outcomes. In the case of immigration reform in the Senate, both opponents and supporters of the package can be considered as paying attention to or focusing on the issue of immigration despite competing viewpoints on whether or not the reforms should become law.

A growing literature on the dynamics of issue attention suggests that this it is an important component of the policy process: for government to act, it must first prioritize an issue and allocate attention to addressing it. With an abundance of problems and possible solutions, however, attention by policy elites can be thought of as a necessary, but not sufficient condition for subsequent policymaking activity – S. 744 stalled in the House, after all. Scholars of the policy process describe that when an issue moves from obscurity (e.g. within a subsystem) to the center of attention, significant changes in public policy may result (Green-Pederson and Walgrave 2014; John et al. 2013, Baumgartner and Jones 1993, 2009). These changes occur because widespread attention to an issue creates opportunities for the consideration of new approaches, new solutions, and new issue frames, and the destruction of long-standing policy monopolies. While policymaking outside of the spotlight is often incremental and controlled by stakeholders inside of entrenched subsystems, Baumgartner, Jones, and Mortensen (2014), suggest that "within the spotlight of macro politics, some issues catch fire, dominate the agenda, and result in changes in one or more subsystems" (62).

As an example of how long-term trends in attention to a particular issue relate to outcomes in public policy, it is instructive to look at the general domain of US energy policy. Using data compiled by the Policy Agendas Project,[3] it is possible to compare Congressional hearings on energy issues with federal budget authority on energy-related programs since World War II. From the late 1940s through 1972, Congressional hearings coded by the Project as pertaining to the energy domain (e.g. those discussing hydroelectricity, natural gas, oil, coal, energy conservation, and alternative energy sources) were responsible for between one to four percent of all annual hearings. Between 1972 through the early 1980s, the number of hearings on energy issues rose dramatically to highs near nine and eleven percent in 1974 and 1980 (141 and 251

[3] The data used here were originally collected by Frank R. Baumgartner and Bryan D. Jones, with the support of National Science Foundation grant numbers SBR 9320922 and 0111611, and were distributed through the Department of Government at the University of Texas at Austin. Neither NSF nor the original collectors of the data bear any responsibility for the analysis reported here.

hearings, respectively). During this time, hearings were held on a range of energy issues and concerns as the US economy faced two 'oil shocks' in 1973 and 1979 (following changes in OPEC exports and in the wake of the Iranian Revolution) as well as the incident at the Three Mile Island nuclear power facility in 1979.

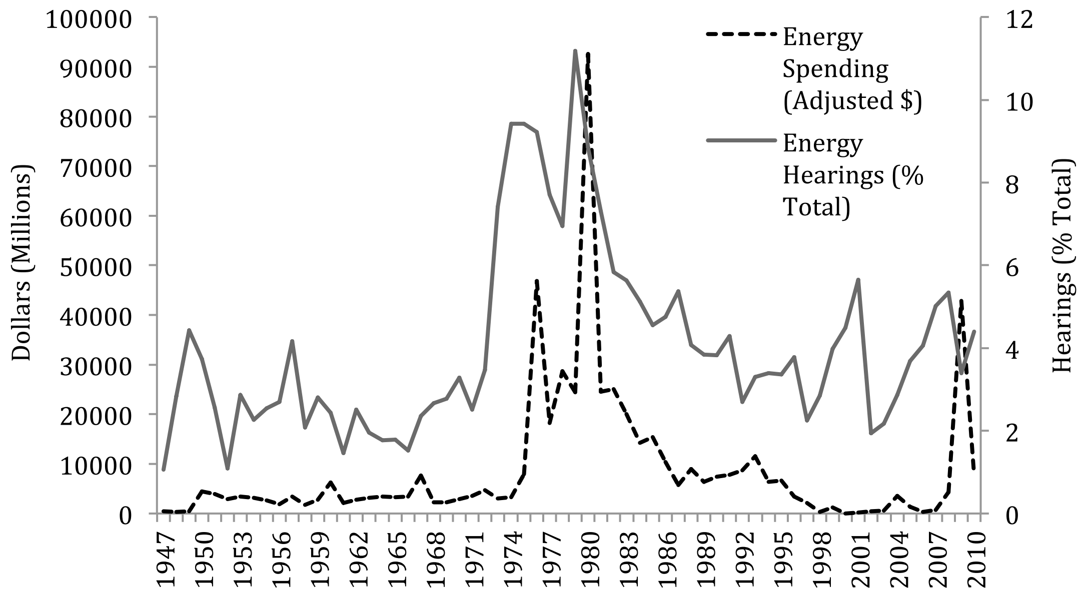

Figure 1: Congressional Attention to Energy Issues and adjusted US Budget Authority on Energy Programs, 1947-2013. Source: Policy Agendas Project.

This attention was not without consequence. Figure 1 also illustrates how federal budget authority on energy-related programs changes over time: spending held at a stable level prior to 1974, then experienced significant rises in both 1975 and 1980. In the first case, inflation adjusted federal spending increased from 7.9 billion to 46 billion, while in 1980 spending skyrocketed from 28 billion to 95 billion. As attention waned after each major budget increase, so too did spending levels over time. The strong correlation between these two trends illustrates a case where the attention of policy elites to public policy issues contributed to major shifts in policy outcomes in the form of the allocation of billions of dollars in federal spending.

Moving beyond the analysis of a single policy issue, if we consider the vast number of pressing and important policy issues on which policy elites (i.e. members of Congress, bureaucrats, lobbyists, and policy advocates) can devote their time and focus, a number of questions arise. Why do some issues rapidly garner massive levels of attention while others go ignored? What underlying processes or mechanisms of decision-making explain patterns in elite attention over time? Does the behavior of actors with high levels of influence dictate the spread of attention to particular issues? How might communication networks and political divisions (e.g. parties or coalitions) impact what issues are discussed among policy elites?

COMPLEXITY IN POLICY DYNAMICS: A PREMISE AND A PROPOSITION

In addressing these questions in the pages and chapters to follow, I leverage the ideas of complexity theory and the study of complex systems. Scholars of complexity describe how, in large systems of interconnected actors, patterns in behavior can 'emerge' (Sawyer 2005). Seemingly simple human behaviors such as standing ovations and residential segregation, for example, are often unpredictable and are subject to sophisticated interactive processes. Small adjustments in the behavior of individual actors can result in dramatic shifts in the overall activity of a social system, even in the case of order and structure (Levy 2000; Érdi 2008; Mitchell 2011). Miller and Page (2007) provide an overview of the interdisciplinary study of these systems and describe how the ideas and concepts of complexity are both evident and important in nearly every field of social science inquiry. In particular, they define the various traits of systems that illustrate the presence of complexity: emergence, networks, self-organization, and adaptation.

Many of these characteristics of complex systems have clear analogues to the dynamics of policymaking. The policy process involves communication among networks of actors, occurs over time and is dynamic in nature, is often unpredictable despite the order and structure of institutions, and is subject to large shifts in outcomes. Jones and Baumgartner (2015), two leading scholars of policy dynamics, write that "we have increasingly come to see governments as complex adaptive systems," and they address complexity 'head-on' in their recent study of information in policymaking (8). Due to the way in which responses to problems are often non-linear (e.g. not proportional) and the difficulty in assessing causality when countless number of factors influence behavior, a systems-level view of public policy—one that focuses on how individuals make decisions and interact with each other to shape patterns in aggregate behavior—can provide new advances when combined with existing theory (Jones and Baumgartner 2012). In addition, Cairney (2012) and Geyer and Rihani (2010) discuss how the study of public policy can benefit from the new perspectives of complexity and complex systems.

Drawing on the perspectives of complexity theory and following the path laid by scholars of the policy process and related fields, this dissertation begins with a simple premise: that policymaking is characterized by high levels of interdependence among elites and that they monitor and respond to the behavior of others. As I will detail in the next chapter, this interdependence exists for multiple reasons, including incentives to closely monitor the political environment for strategic gain and cognitive limits that often lead humans to mimic the behavior of their peers when making decisions. My work expands this premise, with the proposition that collective shifts in attention to policy issues are the product of a contagion process generated by communication and interaction between policy elites. This occurs in two parts: (1) interdependence facilitates cue-taking behavior among policy elites, and (2) cue-taking generates bursts in attention as an issue becomes 'hot' or 'moving.' I define this cue-taking behavior among policy elites as the mimicking of others' attention to a policy issue as a result of either simplistic imitation or more strategic reaction. In addition, I argue that it is a central underlying mechanism of the widespread, and disjointed, patterns commonly observed in policy dynamics.

A Computational Modeling Approach

While scholars of the policy process literature tend to agree that the underlying decision-making mechanisms of observed patterns are important, systematic analysis has yet to be undertaken. This is likely because traditional descriptive and empirical methods simply do not support the study of decision-making processes at the individual level in isolation from other factors. Fortunately, the methodological approaches of computational social science—namely agent-based modeling and social simulation—provide an opportunity to examine individual behavior and macro-level patterns simultaneously within a fully-specified 'policymaking world,' and I rely heavily on them in the chapters to follow.

Research in this field involves both the study of natural phenomena (e.g. extreme weather events and the coagulation of blood cells; Johnson 2007, Menke et al. 2009) and social phenomena (e.g. standing ovations and the timing of retirement; Miller and Page 2004, Mulkay and Turner 1971). Political scientists have recently used agent-based models to study voter response to campaigns (Gulati et al. 2010), ethnic mobilization (Srbljinovic et al. 2003), the size of wars (Cederman 2003), the location of ethnic violence events (Lim et al. 2007), and the outbreak of civil war (Findley 2008), among others. The common link among literature in this field is an emphasis on how simple decision and interaction rules (occurring among heterogeneous actors) shape the emergence of patterns in macro-level activity (Strogatz 2003, Sawyer 2005).

Miller and Page (2007) discuss the benefits and application of multi-agent modeling techniques in these types of settings, writing that "agent-based object models offer a new theoretical portal from which to explore complex adaptive social systems" (78). They suggest that the flexibility of the approach allows researchers to capture a range of behaviors as well as model the adaptive nature of heterogeneous agents. In addition, agent-based models require the detailed specification of interaction rules, decision procedures, and other parameters in order to successfully generate simulation results, which necessitates precision and transparency in modeling. Relative to other methods of statistical analysis, agent-based simulation methods are well-suited for the exploration of theories of social processes, are able to represent dynamic changes, and can support the understanding of relationships between the behavior of individual actors and the properties of larger social groups (Gilbert and Troitzsch 2005). Gilbert (2008) makes a similar argument, which suggests that the complex systems approach may enable, for the first time, the empirical understanding of how patterns in issue attention might develop from cue-taking behavior among policy elites.

OUTLINE OF THE DISSERTATION

The next chapter details the theoretical and empirical foundations of my dissertation. I document observed patterns in the policy process, review explanations for the disjointed nature of policymaking, and then trace ideas about interdependence from the early work of Schattschneider (1960) and Kingdon (1984). In addition, I show how existing research on decision-making, agenda-setting, and the policy process informs my premise that policymaking occurs within a complex system and is subject to high levels of interdependence (Jones and Baumgartner 2005). Policy elites, as my argument goes, take cues from their peers when deciding to attend to the pressing or popular issues of the day—whether through simple imitation of or strategic reaction to others' behavior. These elites are susceptible to cognitive limits, have incentives to monitor the political environment and consider the behavior of their peers, and communicate dynamically over time. As a result, I propose that observed patterns in issue attention result from a self-reinforcing process of 'issue contagion' whereby attention to policy issues rapidly spread among elites.

Next, I discuss how the methods of computational social science enable the systematic examination of issue contagion through simulation and empirical application (Miller and Page 2007). In this third chapter, I describe in detail my novel, generalized simulation model of agenda-setting behavior—AgendaSim—that is broadly representative of issue attention dynamics occurring among multiple types of policy elites such as members of Congress and lobbyists. My model highlights both individual decision-making and aggregate level patterns in issue attention, and precisely specifies interaction among simulated actors. I proceed by examining issue contagion through a series of simulation tests. These tests explore expectations about how changes in certain parameters shape simulated patterns in activity, from the density of communication ties between actors to the presence of political parties and coalitions. I show that issue contagion events occur more frequently when actors are more prone to take cues from their peers, when communication networks are dense, and when actors are not segmented into groups. Most importantly, I confirm my initial expectation that the probability with which simulated policy elites take cues from their peers is the key mechanism shaping aggregate patterns in issue attention.

In Chapter Four, I apply AgendaSim to the dynamic issue attention of individual members of the US Congress. Scholars of Congress have long described how cue-taking impacts legislative decision-making in the form of vote choice (Matthews and Stimson 1975, Kingdon 1973, Box-Steffensmeier et al. 1997), but little is known about how the behavior may shape important patterns in issue attention. Drawing on an expansive dataset of bill introductions compiled and classified according to policy content by the Congressional Bills Project, I use my computational model to generate comparable issue-related activity across simulated 'Congresses.' I then match simulated patterns to the observed dynamics of bill introductions—both at the level of major policy domains and more narrowly defined issue areas—using the methods of stochastic process analysis (Jones and Baumgartner 2005; Breunig and Jones 2010). I find that high levels of cue-taking among simulated policy elites produce outputs that closely approximate the episodic patterns of issue attention observed in both the House and Senate.

In the fifth chapter, I further test the empirical implications of my model by applying it to the issue-related activity of organized interests, as reported on lobbying disclosure reports. One key finding of the literature on lobbying is that there is a 'tremendous skewness' in attention across issues—some are subject to bandwagons while others remain in obscurity over time (Baumgartner and Leech 2001; LaPira et al. 2014). Consistent with my theoretical proposition, existing literature suggests that the organized interest system is characterized by intense monitoring among actors, which may explain this skewed distribution of attention (Baumgartner et al. 2009). Through a systematic comparison of simulated data with observed activity, I test whether an issue contagion process is able to produce both bandwagons and niches in the attention of lobbyists. I find that patterns resulting from simulated policy advocacy closely match observed activity when cue-taking is set a very high levels, leading to the deduction that the behavior of organized interests and the lobbyists who advocate on their behalf is indeed subject to an issue contagion process.

Chapter Six concludes by summarizing the major contribution of my dissertation: the deductive finding that observed patterns in policy agendas result from a contagion process driven by cue-taking among policy elites. I also position my research in the broader literature on attention, policymaking, organized interests, complexity, and social contagion. I end by outlining an agenda for future research that builds on this dissertation. In particular, I discuss how my computational model described in Chapter Three can be extended to study how various factors such as outside events (e.g. crises), interaction between multiple types of policy elites, variations in incoming information streams, and alternative decision rules may impact patterns in issue attention over time.

Chapter 2: Issue Contagion in the Policy Process

In this chapter, I explore the empirical and theoretical foundations of issue contagion in the policy process. I first discuss an important, observed pattern of policymaking: that policy often remains in stasis, but can be interrupted by massive punctuations. I review theoretical explanations for this disjointedness—the presence of stability *and* change—and then trace ideas about interdependence, decision-making, and complexity in the policy process. In describing my notion of issue contagion, I attempt to link unobservable characteristics of individual behavior with observable outcomes in policymaking activity. I then offer my central proposition that large-scale shifts in the attention of policy elites result from simple cue-taking behavior facilitated by high levels of interdependence. I end by exploring potential cases of issue contagion events occurring within the one-minute speeches of US House members.

OBSERVED PATTERNS IN POLICYMAKING

A key empirical finding of decades of research on policy dynamics is that public policy tends to remain stable over time (i.e. experiencing small, incremental changes) yet can be significantly interrupted by large punctuations (i.e. wholesale change in established policy and the allocation of resources). Recall the example of the US budget authority from the last chapter: over time, spending on energy-related programs experienced both periods of stability and periods of dramatic rises and declines. Figure 2 (Part A) illustrates this series individually, showing that between 1950 and 1975, spending oscillated within a range of \$2.2 billion and \$7.9 billion.[4] Over the next decade, substantial jumps, or punctuations, in spending occurred—breaking with the status quo as

[4] The data used here were originally collected by Frank R. Baumgartner and Bryan D. Jones, with the support of National Science Foundation grant numbers SBR 9320922 and 0111611, and were distributed through the Department of Government at the University of Texas at Austin. Neither NSF nor the original collectors of the data bear any responsibility for the analysis reported here.

the federal government allocated $46.8 billion in 1976 and $92.6 billion in 1980 to energy programs. Thereafter, changes in energy spending experienced relative stability and inertia from one year to the next until 2009, when another large spike occurred (increasing spending to $42.8 billion) and was followed by an immediate decline. This series exhibits a high number of large-scale punctuations—attributable to the crisis-politics surrounding energy issues in the 1970's and 1980's—and it provides an illustration of a policy area that is subject to long periods of both stability *and* turbulent change.

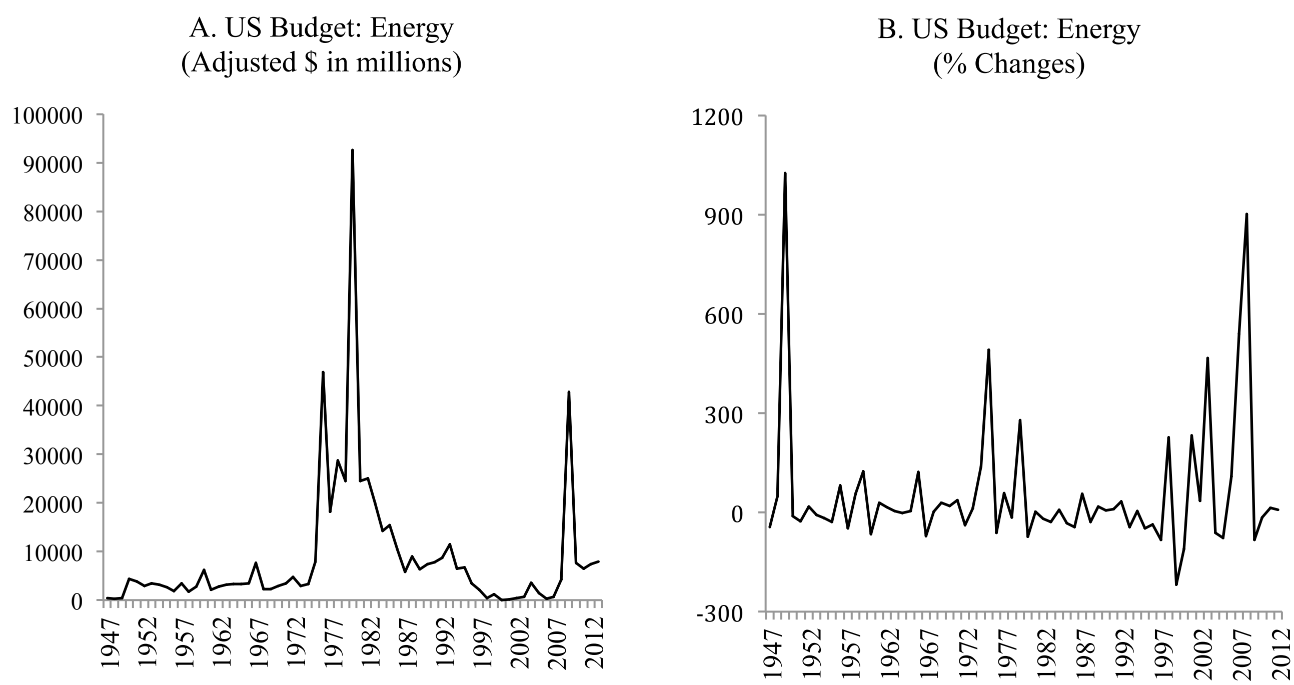

Figure 2: US Budget Authority on Energy Programs (Adjusted Dollars and Percent Change), 1947-2013. Source: Policy Agendas Project.

To compare the behavior of energy spending to other policy areas, scholars of budgeting and the policy process often transform data into timeseries of percentage changes. In Part B of Figure 2, I calculate and plot annual percentage changes in energy budget authority over time, which shows the magnitude of annual changes in spending in relative terms from year to year. Periods of stability are indicated by changes around zero (i.e. both incremental increases and decreases), while percentage changes above approximately 200 percent identify significant shifts away from the status quo.[5] Seven of these punctuations are visible in the energy budget series, while most changes fall within a smaller range. This 'stick-slip' pattern is evident in numerous other policy areas, and Jones and Baumgartner (2005, 97-106) provide a series of additional examples from a range of issues such as income security, crime and justice, and education.

To observe these policy-specific patterns across the entire breadth of US federal policymaking, scholars typically calculate percentage change series for individual policy areas and then pool them across time into a single distribution of changes. This approach leverages stochastic process analysis and focuses on the characteristics of distributions to draw non-parametric inferences (Padgett 1980; see Breunig and Jones 2011 for an overview). In replicating the distributional analysis of Jones, Sulkin, and Larsen-Price (2003) and Jones and Baumgartner (2005) using current budget data, I calculate the percentage changes in US Budget Authority for all budget subfunctions (e.g. individual spending categories) and pool them over time from 1946 to 2014. Shown in Figure 3, this distribution of changes in the US budget exhibits a high degree of both stability and change.

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[5] Note that observations with values above 200% and below -100% are truncated for presentation purposes; the tails of the distribution would otherwise continue outward gradually to their minimum and maximum values. Thresholds for defining policy punctuations vary, but the general consensus among policy process scholars is that percentage changes above 200% are substantially large in size (e.g. a tripling of magnitude).

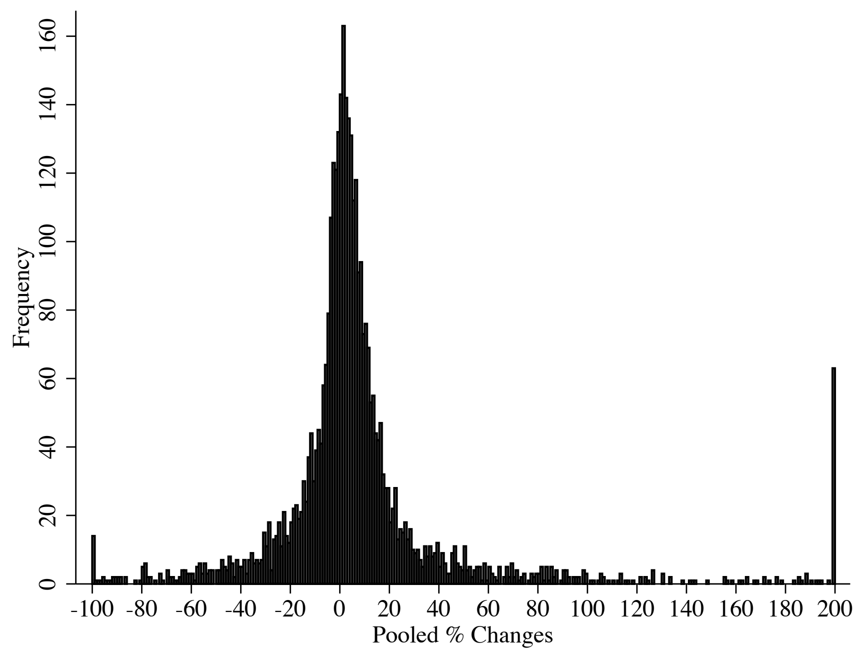

Figure 3: US Budget Authority across All Subfunctions (Pooled Percent Changes), 1947-2014. Source: Policy Agendas Project.

The middle of this distribution (or the peak) is very sharp and indicates tremendous stability in spending over time—the vast majority of changes fall within -10 and 10 percent of the preceding year. However, the ends of the distribution (or the tails) are also very long as a non-trivial number of series experience more than a doubling of spending from one year to the next. This disjointed and episodic pattern in US Budget Authority, however, is not unique to the budgeting procedures of the federal government. Stability interspersed with punctuation is also found to occur across various industrialized democracies including the UK, France, Belgium, Denmark, Germany, and Canada (Breunig et al. 2010; Jones et al. 2009; Baumgartner et al. 2009; Breunig 2006; John et al.

2013) as well as in the budgets of the European Union, Danish localities, US states, and US cities (Mortensen 2005; Breunig and Koski 2006; Jones et al. 2009; Baumgartner et al. 2012). Across multiple levels of government and across multiple contexts, the presence of both stability and change is considered by many scholars as an empirical reality of the policy process. In fact, Jones at el. (2009) explicitly suggest that this pattern of disjointed budgets is an empirical *law* of governmental outputs.

The dynamics of bill introductions, Congressional hearings, and the passage of legislation also exhibit this same general configuration, with increasing levels of disjointedness occurring further along in the policy process (Jones and Baumgartner 2005). The attention of policymakers to individual policy areas is best viewed through the thousands of hearings held in Congress each year. These hearings provide an overview, and illustrative example, of the dynamics of policymakers' attention to policy areas over time as they engage in various information collection, oversight, and legislative activities. In Figure 4, I use currently available data to replicate Jones and Baumgartner's (2005, 254) original plot of the percentage of annual Congressional hearings across the 20 major policy issues in the Policy Agendas coding scheme (e.g. Foreign Trade, Health, Macroeconomics, and Energy). Over time, most issues experience relative stability as attention levels remain within a few percentage points from one year to the next. Yet, there are also numerous instances where policymakers shift their prioritization of issues dramatically—increasing hearings on one issue while ignoring others. These latter shifts are found in Figure 4 by looking for rapid increases in the area of some series (and corresponding rapid declines in others) such as those that occurred in the mid-1950s surrounding a prioritization of civil rights issues.

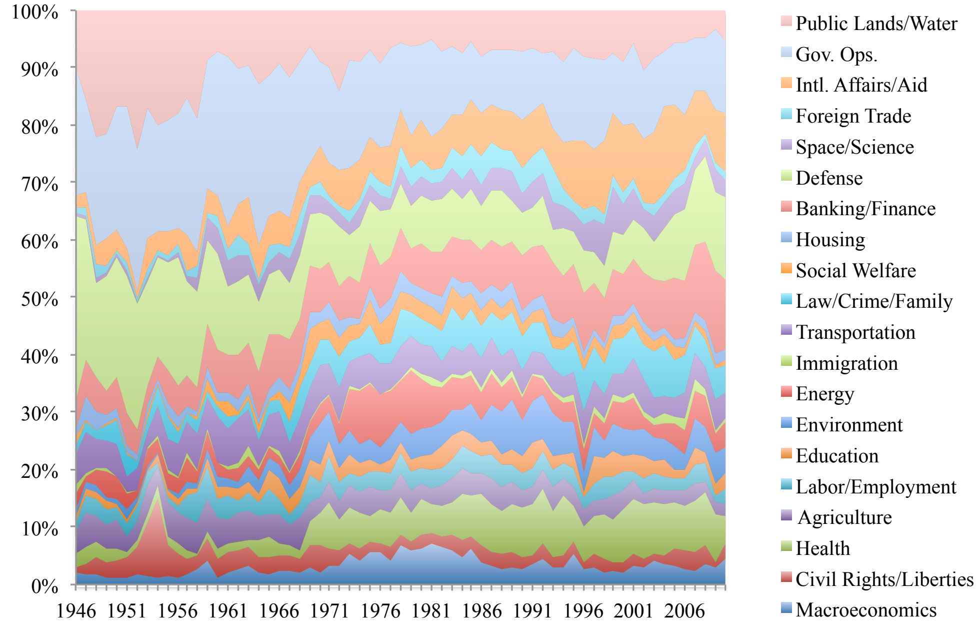

Figure 4: US Congressional Hearings (Percentage of Total Hearings), 1947-2010. Source: Policy Agendas Project.

Focusing on just a few of these series—Civil Rights/Liberties, Environment, and Energy—allows a closer look at the relative allocation of policymakers' attention to some policy areas over others. In Figure 5, the percentage of annual Congressional hearings to each of these major policy topics is shown from 1946 to 2010. While attention to civil rights and civil liberties issues make up, on average, only about two percent of hearings held each year, Congress dramatically increased attention to the policy topic in the early-1950s. This spike in attention is clearly visible in Figure 5 as well as similar rapid increases in focus to both environmental and energy-related policy issues. Attention to these to topics remained stable for the majority of the post-war era, except when collective attention shifted towards environmental issues in 1970 and the late 1980's as well as toward energy issues in the 1970-1980 period.

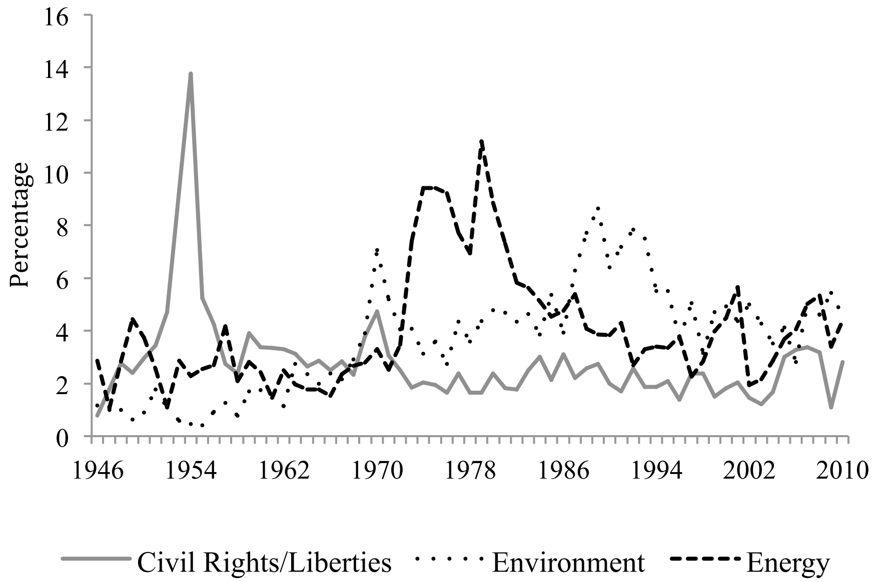

Figure 5: US Congressional Hearings (Percentage of Total Hearings) in Selected Topics, 1947-2010. Source: Policy Agendas Project.

EXPLAINING STABILITY AND CHANGE: PUNCTUATED EQUILIBRIUM THEORY

Why does this pattern occur with regularity both across institutional contexts and venues? A growing body of literature addresses this question and develops a unified theory for both stability and change in the policy process. Largely in response to the classic model that policymaking transpires in an incremental, comprehensively rational fashion—with small changes and adjustments occurring in perpetuity as policymakers engage in 'successive limited comparisons' (Lindblom 1959) or follow pre-determined rules (Wildavsky 1964)—Baumgartner and Jones (1993, 2009) develop a theory rooted in the bounded rationality framework (Jones 2001, 2003). Under Punctuated Equilibrium Theory (PET), they emphasize how the classic notions of policy change do not account for the frequent instances where public policy experiences substantial, and very rapid, shifts away from the status quo. Drawing on their early research on the policy dynamics of tobacco, pesticides, and nuclear policy in the US, Baumgartner and Jones (1993, 2009) first document the disjointedness of the policy process and develop PET in detail.

As Jones and Baumgartner (2012) summarize, their original theory recognizes two related dynamics of "policy-by-policy adjustment" over time (3). On one hand, subsystem politics naturally contain changes around the status quo (e.g. what are described as iron triangles or issue networks monopolize certain policy areas). On the other hand, when the pressures of macro-politics (e.g. when conflict around a policy issue grows to include actors *beyond* the related subsystem) non-incremental changes can, and often do, occur. Simply, subsystems dominate policy areas that are typically out of the gaze of public (or elite) concern, until the spotlight of collective attention redefines the structure of conflict. This occurs because when substantial attention is paid to a particular policy area, opportunities for the consideration of new approaches and issue frames are created and the potential for a shift in institutional venue increases. As a result of "the changing allocation of attention by national political leaders, the media, and the public," long-standing and seemingly entrenched policy monopolies can be destroyed (2009, 59). For example, in their study of nuclear energy policy since World War II, Baumgartner and Jones (1993, 2009) document how widespread enthusiasm and attention to a positive policy image of nuclear energy led to a powerful monopoly associated with the creation of the Atomic Energy Commission in 1946. Nearly thirty years later, however, when nuclear energy entered the spotlight for a second time, the policy image was redefined in negative terms, a shift in institutional venue occurred, and stability was interrupted by a new (more restrictive) regulatory environment.

In an effort to generalize PET, Jones and Baumgartner (2005) expand their analysis to cover the full range of problems and issues to which the federal government routinely devotes attention and resources. They further develop their theory to include the concept of ‘disproportionate information processing’ to describe how the overabundance of information about policy problems combines with the inability of policymakers to focus on all incoming information streams simultaneously. As a result, the processing of information regarding certain problems (e.g. prioritization) can lead to responses that are out of sync with incoming signals. Disproportionality in information processing, Jones and Baumgartner (2005) suggest, interacts with ‘institutional friction’—the sum of transaction and decision costs associated with policy adjustment; see also Jones, Sulkin, and Larsen-Price (2003)—to generate patterns that become increasingly disjointed with each stage of the policy process. They label this argument as the General Punctuation Hypothesis and broaden their original explanation of stability and change in policymaking to account for the nuanced interaction between information, attention, decision-making, and institutional contexts.

A large number of scholars have extended and applied the PET framework (including its central concepts of venue shopping, policy images, issue expansion, and disjointed change) to myriad policy areas and institutional venues since the theory’s early development (see Baumgartner et al. 2014 for a detailed review). Recent studies focus on the dynamics of particular policy areas (both in the US and in comparative perspective, Sheingate 2000; Pralle 2003; Robinson 2004; Repetto 2006; Green-Pederson and Wilkerson 2006; Timmermans and Scholten 2006; Green-Pederson et al. 2007; Worsham and Stores 2012), on the link between media attention and the speed of policymaking (Wolfe 2012), on comparative applications to broad dynamics of policy agendas in comparative perspective (Soroka 2002, John et al. 2013), and on the process of policy diffusion in the American states (Boushey 2010, 2012). New streams of literature are also exploring and modeling policy punctuations with increasing precision (John and Bevan 2012; Hegelich 2015; Epp 2015) and examining patterns of disjointedness in the budgets of non-democratic countries or those with periods of non-democratic regimes (Lam and Chan 2014; Rey et al. 2015).

INTERDEPENDENCE IN THE POLICY PROCESS

Proponents of Punctuated Equilibrium Theory also emphasize that the disjointed patterns they uncover in the attention of policymakers may result from an underlying process of 'positive feedback' resulting from cascades among highly interdependent policy elites (Jones and Baumgartner 2005). This notion of interdependence, while never examined empirically in terms of agenda-setting dynamics, is also found throughout the classic works of the policy process and in the literatures on Congress and organized interests. In his seminal book, E.E. Schattschneider (1960) first discusses how individual behavior can spread into meaningful, aggregate-level patterns in activity. He emphasizes this concept in his discussion of the spread and expansion of conflict, writing that "the central political fact in a free society is the tremendous contagiousness of conflict" (2). Since his strong assertion about the presence of contagion at the heart of political dynamics, scholars of the policy process, Congress, and policy advocacy, routinely characterize decision-makers, policy specialists, interest groups, lobbyists, and even the American states, as interdependent and subject to the effects of similar processes related to positive feedback, bandwagoning, and contagion. A common thread among these works is the notion that elites communicate with one another, monitor the behavior of others and the political environment, and routinely imitate or take cues from their peers.

Kingdon (1984) discusses these ideas as they impact policymaking in two scenarios. Under the first, discussion of a particular idea within a policy community may develop through a bandwagon effect. He writes that "gradually the idea catches on. People in and around government speak of a 'growing realization,' an 'increasing feeling,' a 'lot of talk in the air,' and 'coming to a conclusion.' After some degree of diffusion, there seems to be a take-off point: Many people are discussing the proposal or idea" (1984, 140). In this case, Kingdon (1984) refers only to policy specialists, but later suggests that this type of process may apply differently to those in the political arena. In a coalition building and bargaining scenario, as a coalition of support begins to emerge around a policy issue, he suggests that additional actors will continue to join the coalition in order to prevent the loss of any potential benefits. He summarizes this behavior, stating "once an issue seems to be moving, everybody with an interest in the subject leaps in, out of fear that they will be left out" (1984, 162). In both circumstances, elites involved with policymaking make decisions about their own, individual behavior given the choices and activities of those around them; policy ideas 'catch fire' and coalitions expand with ease.

Drawing on an expansive analysis of lobbying and policy change, Baumgartner et al. (2009b) further elaborate on the interdependence that defines politics in Washington and the policy process. They suggest that interaction and monitoring are key elements in the dynamics of policymaking, and that the initial activity of certain actors can spread and shape the behavior of others. They claim that "… in Washington, things are often not independent. Each of the actors is monitoring the environment, trying to determine what others may be getting ready to do. … Political leaders similarly are anxious to be involved in newly developing issues that appear to have 'legs.'" (252-253). This view that issues can be perceived as 'going somewhere' or 'having legs' implies a high degree of dependence between actors as they each consider the behavior of others in making decisions. Baumgartner et al. (2009b) continue this line of argument, discussing the presence of cue-taking behavior in the policy process and highlighting how important actors can initiate widespread issue-related activity: "the actions of key players in the process may send cues to scores of others" (252-253).

Scholars of the US Congress also examine the impact of intra-Washington influences and the presence of cue-taking in legislative behavior. Matthews and Stimson (1975) show that when members of the US House must cast roll call votes on issues that they have very little knowledge, they take cues from trusted colleagues with formal authority or policy specialization that they would likely agree with given added information. Certain types of individuals regularly act as initial cue-givers (e.g. committee chairs), with others acting as intermediaries (e.g. the state party delegation). Kingdon (1973) also finds that fellow members are an important component in the complex decision process of vote choice, and that satisfying intra-Washington influences is an important objective. Studies of cue-taking within policy areas (Sullivan et al. 1993) and the timing of position-taking (Box-Steffensmeier et al. 1997) show that cue-taking not only occurs on a regular basis in the US Congress, but that fellow legislators within a coalition-mediated environment can have a direct impact on behavior. Moreover, Gross (2010) makes a systematic and convincing case for a relational view of legislative behavior in Congress—identifying the importance of ideologically diverse sources as cue-givers. Recent work examines the myriad factors related to cue-taking among Senators and shows that committee leadership, party leadership, and seniority contribute to the detailed timing of cue-taking behavior in voting procedures (Box-Steffensmeier et al. 2015).

In a study of how the attention of interest groups is distributed across policy issues, Baumgartner and Leech (2001) uncover both issue niches (i.e. many areas with only a handful of actors) and bandwagons (i.e. a few areas with a massive number of actors). They echo Heinz et al. (1993) and claim that the distribution of activity across issues is indicative of a larger phenomenon in the policy process: that actors continually monitor the behavior of others, and react quickly when necessary. This creates inherent instability in the system, as similar issues "may attract greatly different levels of attention in a self-reinforcing process characterized by cue-taking and imitation" (Baumgartner and Leech, 2001, 1206). Further, LaPira et al. (2012) explore the empirical structure of lobbying activity using a network analysis approach. They show that there are 'two worlds of lobbying'—one of which describes issue 'bandwagons' where actors are highly interconnected and represent diverse interests.

In addition, proponents of Punctuated Equilibrium Theory regularly discuss how behavior can rapidly shift when individuals make decisions based on the expectations of others' actions (Jones and Baumgartner 2005, Baumgartner and Jones 2002, MacLeod 2002). They focus on self-reinforcing behavior and use the terms cascades and positive feedback to refer to the underlying behavior of individuals and resulting patterns. They suggest that in similar fashion to economic bubbles or market fads, positive feedback 'produce[s] explosions' in the attention of policymakers due to cascades among individual actors. This feedback and is described as a potential factor responsible for the extreme values present in the distributions of government attention to policy issues, lawmaking, and budgeting mentioned above (Jones and Baumgartner 2005). In fact, they explicitly suggest that "these cascades cause punctuated behavior, because (in a pure situation) either there is no change in behavior or everybody changes" (141).[6] While Jones and Baumgartner (2005) examine institutional friction using a simulation analysis, they conclude that friction alone cannot fully account for the patterns they uncover. As a

[6] See also Boydstun's (2013) study of issue attention in print media, and related discussion of 'institutional momentum' among media outlets.

result, they suggest that an underlying social process may be the key in matching their model to real-world activity.

Recent work on policy diffusion leverages the literature of epidemiology (a field well-versed in interactive processes) to examine the transmission of policy ideas among the American states (Boushey 2010, 2012). Much like the spread of disease, Boushey (2010, 2012) suggests that policy innovations are often rapidly adopted by many states in a process of contagion facilitated by successful policy entrepreneurs and interest groups who engage in 'mimicking campaigns' across states. Jones et al. (2014) also argue that a similar mechanism contributes to overinvestment in policy solutions and the creation of 'policy bubbles.' They follow previous works, and emphasize the behavioral foundations of policy outcomes such as interaction, communication, and expectations about the decisions of others. They suggest that individual-level behavior can contribute, in some part, to the rise of a policy bubble—government overinvestment in a policy solution—through extended positive feedback without countermobilization. Maor (2014) places similar emphasis on the role of human behavior (and herding, in particular) in contributing to the growth of public policy overreaction.

While representing various and mostly disparate literatures, these works all share a common thread regarding the interdependence of policy elites. Speaking generally, Jones and Baumgartner (2005) summarize a trend in social science, that "people may observe carefully not the real world directly, but how others around them are responding to the real world. Then they take action based not on real-world indicators but on their observations of the responses of others" (140). This leads us to the guiding the premise of my research: that policy elites are *interdependent actors*, that they communicate with one another, and that they monitor the behavior of their peers. These ideas are not limited to the study of public policy, of course, as scholars of economics and sociology have long examined ideas about economic bubbles and social contagion resulting from interdependence and communication. Beginning with MacKay's study of financial manias (MacKay 1841), numerous scholars of behavioral economics, and of financial markets in particular, describe how asset bubbles can arise from 'cooperative speculation,' 'irrational exuberance,' or 'animal spirits' such that the price of an asset can grow beyond its fundamental, intrinsic value (Youssefmir et al. 1994; Sornette 2004; Shiller 2005; Ackerlof and Shiller 2009). More recently, Gisler and Sornette (2010) generalize beyond financial markets and show that 'social bubbles'—driven by social interactions—pervade human affairs.

Other scholars explore 'social contagion' and examine how ideas and behaviors spread among individuals via social networks. Christakis and Fowler are prolific scholars of this area, showing the extent (and various mechanisms) of contagion and interpersonal influence in numerous behaviors such as health screening, happiness, divorce, drug use, altruism, music tastes, and voting, among others (Christakis and Fowler 2009; see Christakis and Fowler 2013 for a thorough review). In a commentary on social contagion research, network scientist Duncan Watts (2012) is less optimistic in regard to the prevalence of contagion effects, but suggests that the 'science of influence' has yet to fully develop.

LINKING INTERDEPENDENCE TO OUTCOMES

The works described above each discuss individual behaviors and processes in various terms (e.g. cue-taking, cascades, mimicking, herding, imitation, monitoring, feedback, contagion, etc.), but they agree that aggregate activity is shaped by the micro-level behavior of human actors. Why do these behaviors occur and what are their outcomes? Whether described explicitly, or implied, many of these works operate under the assumption that individuals (and by extension, organizations) are boundedly rational. That is, decision-makers are goal-oriented in that they intend to make informed choices, but are constrained by the cognitive limits of the human mind when facing complex decisions and by uncertainty in anticipating consequences (Jones 2001, 2003; Jones and Thomas 2012; Lewallen and Thomas N.d.). As a result, decision-makers satisfice by making choices that are 'good enough' given their ability to process information, assess uncertainty, and make trade-offs. Jones (2001, 2003) discusses at length the foundations of bounded rationality and develops a behavioral model of policy choice that forms the basis for his and others' work on policy dynamics (Jones and Baumgartner 2005). Bounded rationality also manifests in individuals' use of shortcuts or heuristics to reduce the costs of making choices, and in behaviors such as cue-taking and the imitation of others that are facilitated by communication among actors (Jones and Thomas 2012).

Box-Steffensmeier et al. (2015) provide an illustration of why a behavior like cue-taking may occur among policy elites (in this case, US Senators) given the high cognitive burden of policymaking across many disparate policy areas. Quoting an informant, they write that "[i]t is literally impossible for every single senator to hold in their head every single issue that comes before any body as diverse and complex as the Senate." In fact, scholars of cue-taking in Congress repeatedly make the case that legislators are frequently asked to make decisions on issues that they know substantively little about and that they often turn to colleagues as information shortcuts (Matthews and Stimson 1975; Kingdon 1973; Gross 2010). With regard to which policy areas elites choose to attend to on a given day—faced with competing, pressing issues calling for their attention—cue-taking and imitation behavior may also result from strategic considerations. For example, elites may respond to opponents' activity or follow party leaders' explicit instructions to focus on a certain theme. While cue-taking may occur for various reasons in the practice of policymaking, I do not attempt to adjudicate between these determinants in this dissertation; I simply claim that cue-taking is known to occur with regularity among policy elites and is necessarily facilitated by interdependence.

The science of complexity provides a fruitful framework for exploring the link between this interdependence-facilitated cue-taking behavior and the primary focus of my research: the dynamic patterns in the attention of policy elites over time. Scholars of complex adaptive systems often study how seemingly simple behaviors among individuals contribute to unpredictable and complicated patterns in aggregate activity (Érdi 2008). An overarching goal of this literature, articulated by Mitchell (2011), is to "explain how large numbers of relative simple entities organize themselves, without the benefit of any central controller, into a collective whole that creates patterns, uses information and in some cases evolves and learns" (4). The interdisciplinary science of complexity tends to draw analogies between colonies of insects, the human brain, societies, and economies—focusing on the rise of complicated patterns given simple, underlying choices and behavior (Mitchell 2011). Interdependence and connectedness are key traits of complex systems, in addition to more advanced notions of emergence, networks, self-organization, and adaptation (Miller and Page 2007). In tracing the sociological and psychological history of these ideas, Sawyer (2005) develops the notion of 'social emergence' to describe how complex social structures result from interaction among individuals through discourse, collaboration and negotiation. The defining feature of the complexity perspective is an emphasis on the causal linkages between individual behavior and macro-level patterns.

Indeed, as I noted earlier, scholars of the policy process have begun to recognize the potential benefits of a 'systems-level' view of policymaking. Jones and Baumgartner (2012) and Baumgartner and Jones (2015) are the most vocal proponents of integrating the study of the policy process with the complex systems paradigm, while others have begun to adapt complexity into general discussions of public policy theory (Geyer and Rihani 2010, Cairney 2012). Justifications for linking public policy with complexity theory abound. First, these scholars suggest that governments and policymaking systems are complex adaptive systems in the definitional sense: they dynamically process information and interact with their environment (Baumgartner and Jones 2015) as well as experience both order and chaos (Geyer and Rihani 2010). In addition, Jones and Baumgartner (2012) suggest that the complexity framework is applicable to the study of policy dynamics because documented patterns in policy change occur in a non-linear fashion, are unpredictable, are often unstable, and are subject to feedback processes—all of which are common features of dynamics occurring within complex systems. Moreover, they write that their "punctuated equilibrium [theory fits] squarely within the complex systems approach, which emphasizes complex interactions and positive feedback" (2012, 10). Last, the way in which complexity theory emphasizes how internal dynamics of systems can explain large-scale changes provides new opportunities and tools to study the policy process (Jones and Baumgartner 2012).

Drawing heavily on this perspective, and the varied literatures of the policy process, Congress, and interest groups, I develop the central proposition of this dissertation with regard to the observed patterns in issue attention documented earlier in this chapter. I begin with the premise that a high degree of interdependence exists among policy elites, that they routinely communicate with one another, and that they monitor the behavior of their peers. Given the cognitive architectures (e.g. boundedly rational decision-making) and the documented occurrences of cue-taking among members of Congress in their voting behavior, I offer the following general proposition regarding the dynamics of issue attention: (1) interdependence among policy elites facilities cue-taking behavior, and (2) over time, this cue-taking behavior generates issue contagion events. I define these issue contagion events as instances where a policy issue moves into the spotlight and garners a massive increase in policy elites' aggregate attention. More explicitly, an *issue contagion event* is a rapid shift in collective attention to a policy issue among a population of policy elites resulting from interdependence-facilitated cue-taking behavior. In Figure 6 below, I illustrate the links between these concepts and the two-stage link between interdependence and outcomes. First, interdependence among policy elites (and their associated communication and monitoring activity) facilitates the presence of cue-taking behavior in individual, issue-related focus. Second, over time, this cue-taking behavior among policy elites generates issue contagion events that indicate major shifts in collective attention.

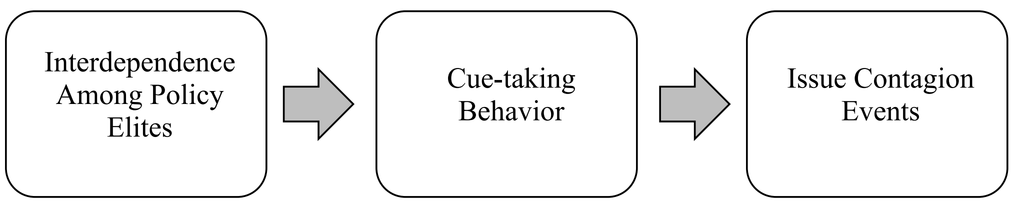

Figure 6: Linking Interdependence to Outcomes: A Proposition

I do not claim, however, that all major shifts in collective attention are the product of interdependence and cue-taking among policy elites. In writing about social contagion processes, Watts (2012) suggests that it would be naïve to consider the near simultaneous opening of umbrellas on a city street as a function of social influence and not the presence of a fresh downpour of rain. Similarly, I contend that issue contagion events are only those major shifts in collective attention that occur *endogenously* and as part of the day-to-day interaction of elites associated with politics and policymaking. The rapid shifting of elite attention from, say, immigration reform to healthcare, or from international trade to agriculture, often occurs as a routine dynamic of the policy process as elites struggle to attend to the many pressing issues of the day (Jones and Baumgartner 2005). In contrast, the simultaneous response to a major crisis (e.g. a terrorist attack, earthquake, nuclear meltdown) or significant political development (e.g. a scandal) is driven by stimuli generated exogenously from the normal or typical activities of policy elites. Much like umbrellas opening amidst a rainstorm, the shifting of elite attention to these types of stimuli occur outside the social aspects of cue-taking and interdependence I describe above. While no doubt important—as shown in my earlier discussion regarding energy policy—attention to crises or unexpected political events fall outside the scope of my central proposition.

LOCATING POTENTIAL ISSUE CONTAGION EVENTS

To uncover likely occurrences of issue contagion events among policy elites, I draw on an original dataset of one-minute speeches from the floor of the US House of Representatives. One-minute speeches are generally 'unconstrained' from the legislative process, provide an opportunity for both less-advantaged legislators and party spokesmen to discuss issues, are focused in scope, and are similar in form (Maltzman and Sigelman 1996; Rocca 2007; Schneider 2013). Political parties may at times coordinate the topical content of speeches (Harris 2005; Morris 2001) and I contend that the giving of coordinated speeches is simply a form of cue-taking *en masse* from party leaders. These speeches are also associated with minimal personal and institutional costs: members only need to sit at the front of the chamber at the beginning of the day's session when they wish to make a one-minute speech. For reasons discussed in the next chapter, it is not immediately possible to explore the micro-level determinants of any large shifts in collective attention captured in one-minute speeches, but they provide a useful indicator of elites' attention to issues that is granular (in terms of time) and specific (in terms of policy content). The presence of any potential issue contagion events in these speeches provide empirical motivation for my modeling effort and validation tests to follow.

In extracting one-minute speeches from the Congressional Record, I identified and compiled 7,703 speeches spanning June 29th, 2010, through February 11th, 2014.[7] The total number of speeches varies dramatically over the 43 months of this period, with an average of 179 speeches per month. To classify these speeches according to policy issue for the purposes of examining attention to specific topics over time, I follow the 'text as data' approach outlined by Grimmer and Stewart (2013) and run an unsupervised learning model on the corpus of speech documents. Specifically, I utilize a single membership clustering model whereby speeches—after being stemmed to remove word endings and transformed into a matrix of terms—are assigned into one of a given number of mutually exclusive topics.[8]

While these topics are dependent on the speeches included in the corpus (i.e. they are not reflective of a comprehensive coding system like the widely utilized Policy Agendas Project scheme), they provide useful and face valid clusters. Some clusters include speeches related to oil and gas, religion, war and the military, spending and the deficit, while others discuss 'Obamacare' and health, climate change, immigration reform, human rights, and Social Security. Aside from the presence of two seemingly 'catch all' categories, lists of the most frequent words found within all other clusters

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[7] I utilize a 'scraping' procedure to extract these speeches from the www.congress.gov website. Observations include those speeches in the Congressional Record that include the phrase "asked and was given permission to address the House for 1 minute."

[8] The model was set to include 75 clusters using the K-Means clustering algorithm within the 'tm' package for R.

suggest that most include a coherent set of terms and identify specific policy issues. On average, 107 speeches are found within each cluster (s.d.=202.94).

When aggregated monthly and plotted over time, the vast majority of clusters experience little variability, with attention only occurring sporadically and staying below 10 speeches in any given month. Some clusters—such as one including speeches on taxation and the middle class—routinely experience a great deal of attention by policy elites (exceeding 20 speeches in a month), yet are not consistent over time. A third set of clusters identify potential issue contagion events as they feature at least one sustained, rapid increase in attention. Eight clusters, plotted below in Figure 7, exhibit these characteristics. Unsurprisingly, they tend to mention significant policy debates of the last four years: implementation of health care reform, the individual health insurance mandate, government debt and spending, the government shutdown, and the federal budget. In addition, three clusters include speeches on more specific issues such as women's health, oil and gas, and higher education (namely student loans).

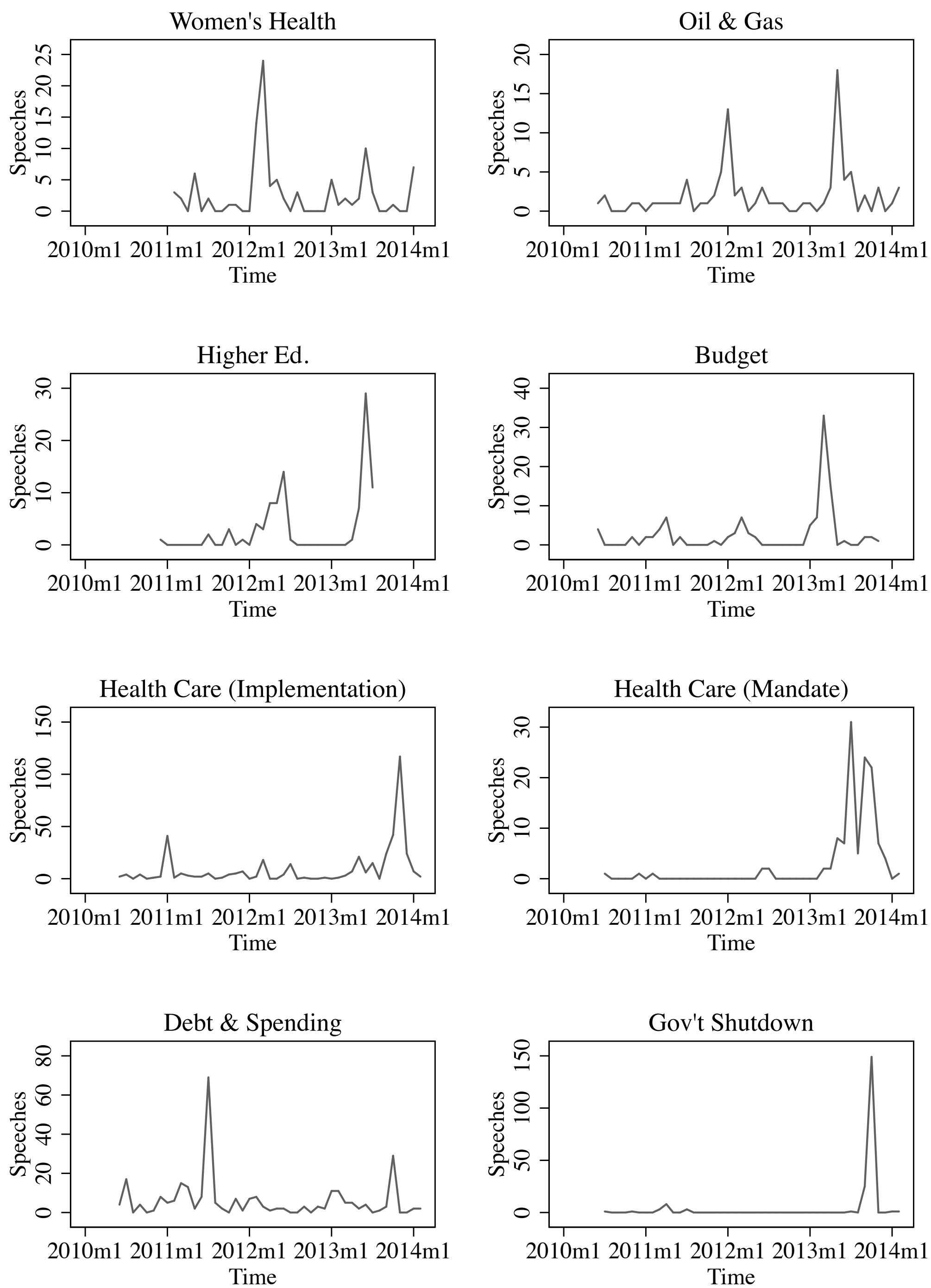


Figure 7: Monthly Frequency of One-minute Speeches, Selected Issue Clusters (June 2010-February 2014)

The magnitudes of these potential issue contagion events among members of the US House vary in size. The largest such increase falls within the government shutdown cluster (nearly reaching 150 speeches in late 2013), with increases in speeches concerning the three specific policy issues and the individual health insurance mandate reach up to 30 speeches in a given month. Are the trends exhibited by all eight clusters potential cases of issue contagion? Possibly. Despite different maximum values, each series includes an increase over time that occurs quickly, spans at least two time periods (months), and depicts an increase from a low level of attention to a much higher level. Moreover, both the higher education and oil and gas clusters appear to exhibit two separate instances of issue contagion events during this time period. While massive shifts in the government shutdown and budget series are likely due to endogenous policy debate associated with budget negotiation (or lack thereof), discussion of the health care-related topics may be the result of exogenous events. Attention associated with the initial failures of the healthcare.gov website and the Supreme Court's decision upholding personal insurance requirements (i.e. the 'individual mandate') suggest that the dynamics of these two series likely fall outside my definition of issue contagion events.

CONCLUSION

This chapter developed my central theoretical proposition that issue contagion events—the rapid spread of issue attention across a system of policy elites—result from cue-taking behavior among highly interdependent individuals. My proposition offers an *explicit and testable* statement regarding the observed presence of large-scale changes in distributions of policy change and policy agendas. This proposition also draws upon the varied, but related literatures of the policy process, Congress, and organized interests and serves to integrate the myriad concepts associated with contagion-like outcomes (e.g.

positive feedback, herding, bandwagoning) into a simple assertion regarding the dynamics of issue attention. I develop this proposition by drawing on the perspective of complexity theory and its emphasis on linking individual behavior to complex, aggregate patterns. In addition, this chapter traces the origins of interdependence and cue-taking behavior among policy elites after documenting patterns of (and explanations for) stability and change in the policy process.

Chapter 3: A Computational Model of Issue Attention Dynamics

In this chapter, I develop and test a novel, generalized model of issue attention dynamics and issue contagion events. I rely on the methods of computational social science to build an agent-based simulation model—AgendaSim—in order to study issue contagion in the attention of policy elites over time. My model is dynamic, interactive, and designed to enable the study of how simple changes in individual decision-making can impact patterns in aggregate behavior among policy elites. In the pages that follow, I first describe the rationale for my simulation approach and then detail the various components of the AgendaSim model including key parameters, decision procedures, interaction rules, and the general simulation environment. I then outline three empirical expectations regarding the density of communication ties between actors, the presence of segmented groups (e.g. political parties and coalitions), and the rate at which actors take cues from one another. Through a series of simulation experiments, I examine each of these expectations in turn. I show that incremental changes in density, segmentation, and cue-taking rate all generate clear and visible trends in the frequency of issue contagion events.

How to Study Unobservable Processes?

In pursuing a new question, a quantitative researcher in the social sciences might first attempt to capture and collect observational data on a particular phenomenon of interest. Scholars of voting count the turnout of registered voters on Election Day; scholars of international trade record import and export flows between countries; scholars of war tabulate battlefield causalities. To explain variation, correlates of these phenomena must also be counted—e.g. campaign advertisements, GDP, military size—however, in many cases quantifiable, causal variables may not be readily available or informative. In these situations, the social scientist is left to pursue research designs involving techniques such as case studies, elite interviews, historical analysis, or natural experiments, among others.

Recall that in the proceeding chapters, I outlined the key proposition that motivates this dissertation: that interdependence among policy elites facilitates cue-taking behavior and that this cue-taking behavior contributes to the presence of issue contagion events. In examining this proposition, however, both the internal decision-making of policy elites and their patterns of private communication and interaction occur out of the gaze of the social scientist. As a result, embarking on a common observational research approach would not feasibly yield sufficient evidence to make conclusions about underlying mechanisms of attention. Fortunately, the approaches of computational social science, and agent-based modeling in particular, enable an appropriate alternative design to study these unobservable processes. It utilizes computer modeling, simulation, pattern matching, and external validation, to make inferences about the links between micro-level decision-making and aggregate patterns in behavior.

Political scientists and policy practitioners are increasingly relying on these methods both to study the underlying mechanisms of political phenomena and to offer simulated forecasts of how policy changes might affect patterns in behavior (e.g. program usage). A number of scholars document the rich history of simulation modeling in these fields (see Miller and Page 2007; Johnson 2007) and examples abound. Ranging from applications in world politics (Cederman 1997) and political economy (Kollman et al. 2003) to specific models of war expansion (Findley 2008; Joyce 2008), civil unrest (Cloffi-Revilla and Rouleau 2010), land-use policy (Guzy et al. 2008), and school choice policy (Maroulis et al. 2014), computational modeling provides a flexible method to examine complex relationships. The approach is powerful because it is "akin to experimental methodology" in that researchers can vary the conditions of a set of simulations in order to determine the effects of specific parameters and clarify causal links (Gilbert and Troitzsch 2005). In contrast to statistical approaches to modeling behavior that often assume independence, computational models enable the study of the dynamic and interactive processes of politics and policymaking discussed throughout Chapter Two.

In building an agent-based model developed for the understanding of political behavior, Gulati et al. (2010) provide an illustrative example that motivates the research presented in this dissertation. Their model, VODYS (Voter Dynamics Simulator), is designed to study the interactive and contextual factors that determine how political campaigns affect voter turnout. In justifying a simulation approach, they claim that social scientists are unable to observe the multitude of activities associated with political behavior and that natural experiments limit analysis to discrete events. They write that "most models of voter turnout cannot capture the dynamics of individuals' interactions during a campaign cycle. Agent-based models offer a way to overcome these data limitations" (Gulati et al. 2010, 250). In developing VODYS as a platform for future research, the authors conduct a series of simulation experiments to isolate the indirect effects of communication among voters, explore the role of context in mediating the importance of contact, and test competing hypotheses. Later in this chapter, I engage in a similar, experimental approach to examine my central proposition about cue-taking and issue contagion among policy elites. In addition, AgendaSim leverages the work of other modelers, such as Castner and Reilly (2011), who develop an interactive and thresholdbased NetlLogo model of academic research discussion, and Stonedahl and Wilensky (2008), who develop a network-oriented NetLogo model of virus diffusion.[9]

AGENDASIM: A GENERAL MODEL OF ISSUE ATTENTION DYNAMICS

Before turning to the formal specifications of AgendaSim, it is helpful, first, to discuss the aims of the model and the major concepts on which it is based. The model is intended to portray the dynamics of policy elites' attention to issues in a stylized policymaking system, with a primary focus on decision-making, interaction, and communication. AgendaSim serves two purposes: (1) it supports the exploration of how individual cue-taking behavior might contribute to aggregate patterns in the attention of policy elites, and (2) it provides a new platform for the study of issue attention dynamics across various policymaking settings. The model enables a fruitful exploration of the link between individual behavior and macro-level patterns in the policy process; yet it is not intended as a systematic model of cue-taking among *specific*, real-world policymakers (in the US Congress or elsewhere), to which other scholars have endeavored with increasing precision (see Gross 2010, Box-Steffensmeier et al. 2015).[10] My emphasis here is on the

[9] AgendaSim benefits from each of these previous modeling efforts. I draw (in part) on the network generation components of Stonedahl and Wilensky's (2008) model of virus diffusion to create dyadic communication links between agents. Castner and Reilly (2011) also provide a useful reference model of how social interaction among academics might influence research activity. For example, AgendaSim follows (in part) Castner and Reilly (2011) in the random assignment of agents' starting activity and the inclusion of agents' 'influence' in decision-making procedures. My model, however, provides multiple contributions beyond my conceptual focus on the issue attention of policy elites: AgendaSim is based upon the presence of network ties and communication pathways among agents, includes the density of these network ties as a central parameter, implements a dyadic interaction procedure among agents that features explicit cue-taking behavior, includes the presence of sub-groups (i.e. 'segments') as a parameter affecting agents' tendency to take cues, derives influence according to the skewed hierarchies of policymaking institutions, and includes a system-wide trait within decision-making procedures (i.e. the popularity of an issue), among others.

[10] Also see Ringe et al. (2013) on social ties among legislators and cue-taking in the UK; Masket (2013) on seat proximity and agreement in the California legislature.

consequences of cue-taking behavior in the policy process and the presence of rapid, collective shifts in attention among elites.

AgendaSim is intended to be realistic enough as to plausibly approximate the contours of US federal policymaking, as well as flexible enough in its treatment of institutional arrangements as to be generalizable to additional contexts. A growing body of literature on the dynamics of issue attention documents the presence of stasis and punctuation in nearly all industrialized democracies (Baumgartner et al. 2009), and AgendaSim is applicable to each of these settings with limited adjustment. Since it is designed to incorporate variation in the characteristics of simulated policymaking worlds (e.g. the number of policy elites and the number of political divisions or parties) the model supports further empirical application and validation beyond my focus on congressional activity and lobbying within the US.

The model is also parsimonious by design—in order to illuminate causal relationships—and draws on a set of stylized facts and assumptions about policy elites, how they interact with each other, and the various characteristics of the generalized policymaking world in which they exist. Within AgendaSim, policy elites (e.g. members of Congress, lobbyists, interest group leaders) are modeled as heterogeneous actors such that they each have unique characteristics that affect their relative position and issue-related activity over time. Any informed observer of politics and the policy process would recognize the high degree of variability in elites: using the US Congress as an example, members each represent diverse constituencies, have differing levels of seniority, hold a range of institutional positions, belong to caucuses, affiliate with political parties, and maintain social relationships with their peers. As depicted in Figure 8, I distill these individual-level differences into four generalized features that define individual agents in the model: status, segment membership, issue focus, and communication links.

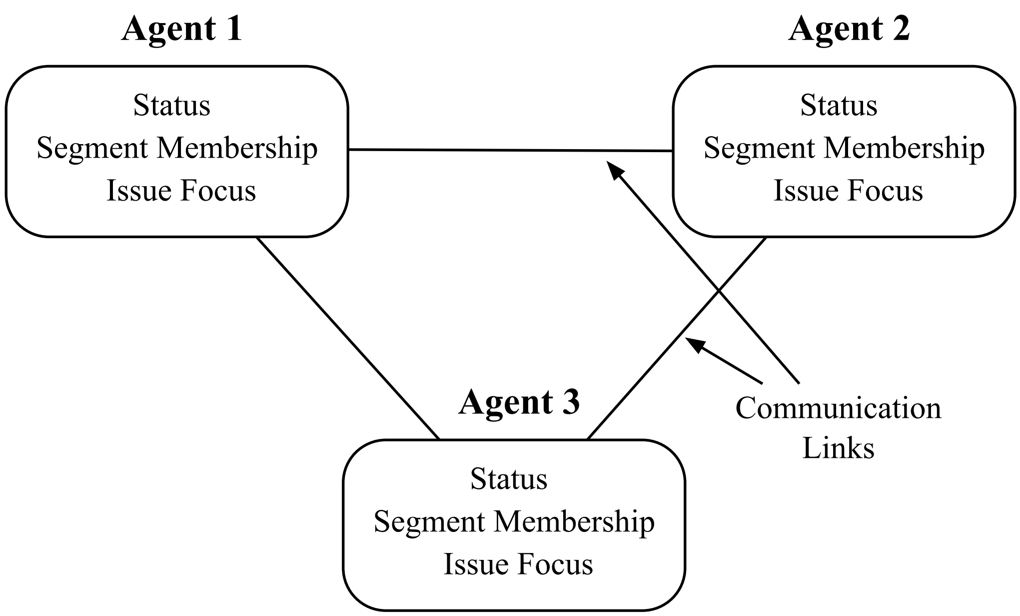


Figure 8: Conceptual Representation of Policy Elites' Characteristics in AgendaSim

The first characteristic of policy elites in AgendaSim is their level of status. It is largely based on the institutionally derived authority of legislators in the US Congress associated with positions of authority and rank (e.g. party leaders, committee chairs and members, seniority) that are known to affect cue-taking and cue-giving behavior. Consider the relative status and visibility of Speaker John Boehner (R-OH), House Ways and Means Committee Chairman Paul Ryan (R-WI), or Charlie Rangel (D-NY) who served continuously since 1971 and founded the Black Caucus. These lawmakers—compared to freshmen serving their first term in Washington—are more likely to serve as the givers of cues and affect the behavior of others (Kingdon 1973; Matthews and Stimson 1975; Sullivan et al. 1993, Box-Steffensmeier et al. 2015). This notion of status also is found in the study of lobbying by organized interests, as some actors are known to develop as 'pivotal players' within coalitions (Hojnacki 1997) and others are inclined to offer 'deference' to organizations with expertise or experience (Scott 2013, Baumgartner et al. 2009b). To account for these differences and incorporate them into AgendaSim, each agent maintains a randomly assigned and unique level of status relative to peers. This characteristic functions as a single measure of each agent's capacity of influence, and the model is designed such that higher levels of status are associated with increasing ability to influence peers. Just as institutional hierarchy grants a handful of actors a significant level of status, my model allocates status in a similarly skewed fashion.

Each individual in AgendaSim also belongs to a segment or sub-group of the population of agents. Whether defined as formal political parties and caucuses among legislators or informal issue-specific coalitions among interest group leaders, policy elites naturally organize into various types of sub-groups. It is important to model these memberships because the behavior of policy elites is known to affect other elites in the same sub-groups (Kingdon 1973; Matthews and Stimson 1975; Sullivan et al. 1993; Box-Steffensmeier et al. 2015). For example, we can easily imagine a scenario where two Republican legislators who are both members of the House Tea Party Caucus are much more likely to imitate the behavior one another than those who do not share party affiliation and are not members of the same caucus. AgendaSim supports the presence of one large segment of the population (e.g. no divisions), and between two to twelve evenly split groups. While simulations with two sub-groups are appropriate for applications to US policymaking when considering partisan divisions, increased levels of division support applications to additional scenarios with higher numbers of established political parties or issue-based coalitions.

Every agent in AgendaSim also has the ability to focus or 'attend to' a particular policy issue (e.g. healthcare reform, defense appropriations, trade tariffs). In much the same way as policy elites allocate their *personal* attention to issues—giving speeches, introducing legislation, and issuing press releases, among other activities—the focus of agents in my simulation is both dynamic and exclusive. It can change over time (according to explicit decisions rules outlined below) and is not shared across multiple policy issues during any one instance of time. Despite the presence of aides or staff members, policy elites are boundedly rational and subject to the constraints of the human mind (Jones 2001); and, for modeling purposes I assume their individual focus is restricted to one policy issue at time. Moreover, legislators, lobbyists, and other policy elites are known to have accumulated or reputational expertise on certain issues of public policy, and the prevalence of cue-taking behavior can vary according to policy domains (Asher 1974; Sullivan 1993; LaPira and Thomas 2014). To incorporate this issue specialization into AgendaSim, every agent maintains one 'preferred issue' that is randomly assigned at the beginning of any simulation of the model. Agents always begin with their attention focused toward this issue and have a strong tendency to return to this issue over time if their attention deviates to other topics.

Since I argue that interaction among agents facilitates the presence of cue-taking and leads to large shifts in attention among policy elites, a central feature of the model is that agents exist within a network of communication ties among pairs of elites. In fact, I treat the relative level of communication among actors as a parameter in the model to examine the extent to which it impacts aggregate patterns independent of cue-taking behavior. These connections—which are assigned randomly until the network reaches a pre-defined level of links—are intended as representations of 'pathways of communication' among policy elites, with some more visible than others. This network-oriented structure of communication is based on a wealth of literature that documents underlying networks of affiliation and communication among members of Congress, lobbyists, and organized interests (see Fowler 2006; Cho and Fowler 2010; Peng et al. 2014; LaPira et al. 2014; Heaney 2014; Box-Steffensmeier and Christenson 2014).

AgendaSim: Formal Specifications

This section outlines the specifications of my generalized AgendaSim model. The assumptions, parameters, and interaction rules of the model attempt to capture the known characteristics of issue attention dynamics at both the individual and system levels mentioned above. Since the model is computational, it is written programmatically (e.g. in replicable computer code; see Appendix A) using the Netlogo modeling software and corresponding programming language (Wilensky 1999). However, it is possible to formally express each of the major components of the model for descriptive purposes, and I do so in turn below. Table 1 provides a simple list of the notation used throughout the discussion to follow. In addition, I report the potential value range for the model's quantitative parameters, which are generally set for programmatic feasibility (e.g. the minimum number of agents is set to 10 to ensure a baseline level of interaction, while the maximum value is set to 2000 and is only limited by computational resources). I also list the default settings for each system-level parameter utilized for simulation experiments discussed in the latter parts of this chapter.

Table 1. Summary of Model Parameters and Notation

System-level Parameters

Symbol	Name	Range	Default
α	Number of Agents	10-2000[11]	100
γ	Number of Issues	10-225	50
Ψ	Cue-taking Rate	0.05-1.00	0.75
β	Number of Agent Segments	1-12	1
ω	Average Degree Input	0.15-0.35	0.28
Ω	Starting Issue Distribution Input	Uniform/Normal	Normal
ξ	Decay Rate	0-50	20

Agent-level Parameters

Symbol	Name	Values/Range
λ_i	Status	~lnN(0, .75)
ϕ_i	Segment Membership	[1-β]
π_i	Issue Focus	[1-γ]

Outputs

Symbol	Name
τ	Number of Issue Contagion Events
χ	Maximum % Change
δ	Diversity of Agenda
ϑ	Number of Changes in Popular Issue

The AgendaSim model includes a set of similar agents, *i*, that each represents a single policy elite (e.g. a member of the US Congress, a lobbyist, an interest group director, etc.), with the series of heterogeneous characteristics. The first is a level of status (akin to one's reputation or influence), λ_i, which is drawn from a log-normal random distribution: *~lnN(0, .75)*. As mentioned above, this distribution approximates the skewed hierarchy common to policymaking settings where a few agents have much higher levels of status, or the potential for influence, than the typical agent (e.g. party

[11] Limited only by available computational resources.

leaders, senior legislators, or high-profile lobbyists). Second, each agent maintains membership into one (and only one) segment or group of agents, ϕ_i, selected at random. This segment membership represents policy elites' association in defined sub-groups such as political parties, caucuses, or issue-specific coalitions, which may structure decision-making behavior among members. In addition, each agent maintains attention to a policy issue at every instance of time in the model. Upon the 'set-up' of the simulation environment, the value of this parameter, $\pi_{i,t}$, is selected at random and can change according to a set of rules governing agents' interaction with others according to the procedures described below. Agents are allowed to attend to only one issue at any given instances of time. This is not unrealistic, however, as both individuals and organizations are subject to limits in information processing and attention (Jones 2001, Jones and Thomas 2012), and since the primary application of the model is the attention of policy elites as individuals.

Further, a series of system-level parameters explicitly determine the overall 'environment' or 'world' required for the set-up of each simulation and the variables required to generate agent characteristics. These include the number of agents, α (10-2000), the number of issues, γ (10-225), and the number of segments among agents, β (1-12). Communication ties between agents are drawn according to Stonedahl and Wilensky's (2008) model of virus diffusion with links assigned randomly with uniform probability. While the characteristics of the dyadic ties between individual agents can be held constant over model runs for exploratory purposes, individual ties are recreated with each simulation. Links are drawn between pairs of agents until the overall network of ties reaches a density where the average degree is equal to the value resulting from $(\omega * \alpha^2) / 2$, where ω can range from 0.15-0.35 and α is the number of total agents. By design, network ties remain independent from agents' status in the model such that communication can easily be separated from influence in assessing causal relationships. In practice, AgendaSim draws a moderate to high level of communication ties (within the set range of the parameter) such that nearly all actors will have the *possibility* of communicating with the majority of other agents throughout a simulation run.

Three additional parameters control important components of the model and define the way in which issues are initially selected by agents, the rate at which cue-taking occurs (probabilistically) among actors, and the rate at which agents return to their starting issue over time. The first parameter, Ω, sets the form of the distribution from which each agent's initial issue focus is chosen at random: uniform or normal. If uniform is selected, the result is that the simulation begins with multiple issues receiving very similar levels of attention as each issue has an equal probability of selection. If normal is chosen, each agent selects the number of an issue from the distribution $\sim N(\gamma/2, \gamma/10)$, where γ equals the number of total issues. This results in a few issues receiving disproportionally higher attention than others at the start of a simulation (i.e. a skewed starting agenda).[12] The second parameter, cue-taking rate, Ψ (0.15-1.00), sets the probabilistic component of agent cue-taking during interaction as outlined in more detail below. Last, the decay rate parameter, ξ (0-50), sets the probabilistic decay process of the model whereby agents attending to the most popular issue return attention to their preferred issue.

AgendaSim: Agent Behavior

Interaction among agents in the model follows a set of explicit rules and involves the decision of one actor to take a cue (or not) from a selected peer. If an actor takes a cue, they simply change their focus to the issue of their peer. At each instance of time

[12] This latter parameter setting is utilized primarily for exploration purposes. All simulation runs presented in this and further chapters use the 'uniform' starting distribution of issue attention.

every agent selects, in a random consecutive order, one connected peer and follows the below procedure.

Given an agent *a*, the agent selects another agent from the set of agents *i,* with whom *a* shares a network tie. Considering agent *b* is selected for interaction,

- If agent *a*'s status is greater than agent *b*'s status *and* the two agents are members of the same segment or group of agents, then agent *b* takes a cue from agent *a* and switches his/her issue attention. This switch is probabilistic and occurs according to the specified cue-taking rate parameter. Formally,

  If $\lambda_a > \lambda_b$, $\phi_a = \phi_b$, and $r <= \Psi$, then set $\pi_{b,t} = \pi_{a,t}$; where $r \sim U(0, 1)$.

- If, however, agent *a* and agent *b* are *not* members of the same segment or group of agents, the probability by which cue-taking occurs is set to half the given cue-taking rate. Formally,

  If $\lambda_a > \lambda_b$, $\phi_a != \phi_b$, and $r <= (\Psi / 2)$, then set $\pi_{b,t} = \pi_{a,t}$; where $r \sim U(0, 1)$.

- If agent *a*'s status is less than agent *b*'s status, no cue-taking occurs and agent *a*'s issue focus remains unchanged. Formally,

  If $\lambda_a <= \lambda_b$, then set $\pi_{b,t} = \pi_{b,t-1}$.

Next, the decay procedure is implemented to account for known patterns in the 'issue attention cycle,' such that when one issue rises to the top of the agenda it does not easily maintain that position (Downs 1972).

- If agent *a*'s issue is the most popular issue at time *t*, then agent *a* switches focus back to its initial starting issue. This switch is rare, probabilistic, and occurs according to the specified decay parameter divided by 1000. Formally,

If $\pi_{a,t} = \pi_{popular,t}$ and $q <= (\xi / 1000)$, then set $\pi_{a,t} = \pi_{a,t0}$; where q $\sim U(0, 1)$ and $\phi_{popular}$ is the issue attended to by the largest number of agents.

While these specifications of the model simplify the otherwise complicated interactive behavior of policy elites, this abstraction attempts to walk the fine line between parsimony and realism much like a traditional stylized formal model. With a consistent interaction process, it is possible to measure and test how small changes in system-level parameters affect aggregate patterns in issue attention over time.

AgendaSim: Simulation Environment

The full computer code of my AgendaSim model is shown in Appendix A, and Figure 9 depicts the user-facing interface of the model represented within NetLogo (Wilensky 1999).[13] It includes three major sections, the first of which is the main 'simulation environment' of the model on the left side. This area illustrates the set of agents as they exist in the simulation, plotting their characteristics (size = status, λ_i; shape = segment membership; ϕ_i), their connections to each other, and the most recent issue they attended to (color = issue, $\pi_{i,t}$). The second section (to the top right) includes the set of tools used to adjust each of the global model parameters. These can be adjusted manually by the user, or according to predefined ranges across multiple runs when using the software's included experimental tools.

[13] Appendix A1 provides the complete code of AgendaSim found within the model's .nlogo file. A compiled and easily accessible version is available at http://herschelfthomas.com/agendasim.

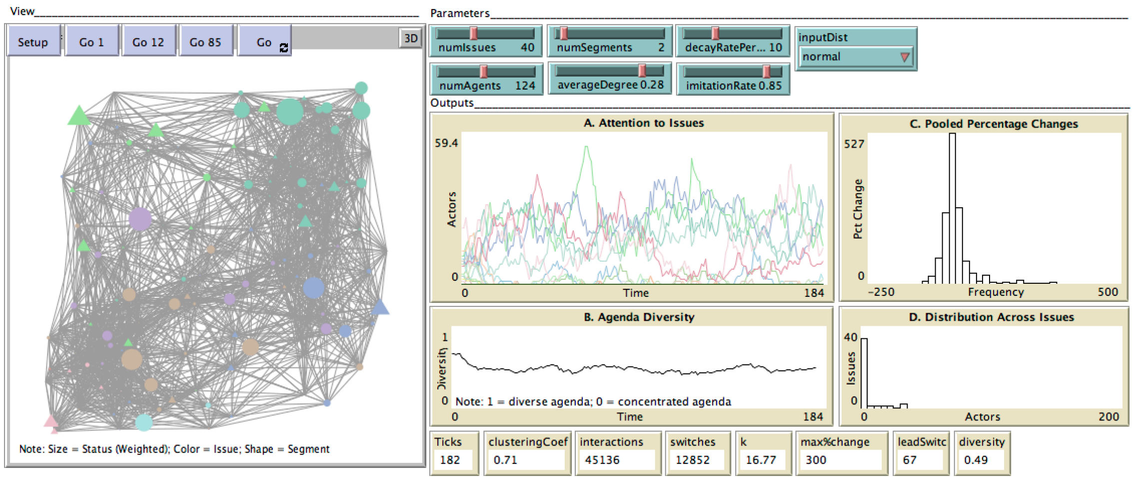


Figure 9: Screenshot of AgendaSim Implementation in NetLogo, Example Run

The third component of the implementation (bottom right) includes a series of plots and monitors that continually depict the underlying activity of the simulation during a run. They include four common ways to summarize macro-level patterns in the study of policy agendas. Two depict simple time-series: plot A shows the count of agents attending to each issue, while plot B illustrates the diversity of the policy agenda (as measured by a normalized Shannon's H entropy score, see Boydstun et al. 2014). Higher values indicate a more spread out or diverse simulated agenda (i.e. moderate attention to many issues), while lower values indicate a focused or concentrated agenda (i.e. high levels of attention to one issue). Next, plot C includes a histogram of percentage changes from period-to-period and pooled across all issues, which is easily comparable to existing empirical work by Jones and Baumgartner (2005) and others that use the stochastic process analysis approach. Plot D includes a histogram of the count of the number of agents by issue, which is directly comparable to the static analysis of lobbying activity by Baumgartner and Leech (2001). Each of these included plots enable visual inspection and comparison of the issue-related activity occurring within a given simulation.

Objective, quantifiable indicators of model outputs are utilized in simulation analyses to summarize model dynamics into measures that can be compared across runs, to other models, and to observed data. At the conclusion of each run of the model, values are recorded for a series of monitors: (1) the maximum percentage change value (across all issues), χ, as a comparable measure of the magnitude of collective shifts resulting over time; (2) the number of times the most popular issue changes over the course of a simulation run, ϑ, which indicates the extent that aggregate attention oscillates from one issue to another; and, (3) issue diversity, δ, as described above. In addition to these three measures, the model quantifies the shape of the distribution of percentage changes pooled across issues and time by calculating the kurtosis statistic (following Breunig and Jones 2010) as well as the number of interactions between actors and the number of issue attention switches that occur to aid in exploratory analysis and testing.

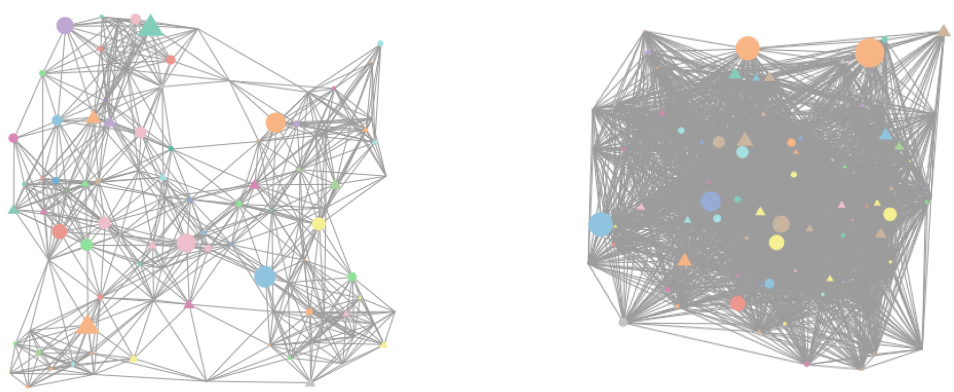
Most importantly, the model also calculates the number of issue contagion events occurring during each simulation run as the key informative indicator of aggregate patterns in issue attention. These events, operationalized as large changes in the percentage of actors focusing on a particular issue from one time period to the next, indicate the extent to which simulated policy elites rapidly shift collective focus. Recall the immigration reform example from Chapter One where speeches on the floor of the US Senate on the topic of immigration reform increased from 19 to 176 from May to June, 2013. This represents a massive percentage increase in speeches of 826% from one month to the next and a collective shift in attention among Senators. Similarly, within AgendaSim, I consider any shift above 200%—e.g. a rise from 15 to 45 agents focusing on a particular policy issue between any two instances of time—as the occurrence of a unique issue contagion event. Multiple shifts occurring during different time periods or within separate issues are counted as individual events and the outcome variable, τ, records the total number events occurring within one simulation run.

EMPIRICAL EXPECTATIONS

In order to draw conclusions from simulations of the AgendaSim model, it is necessary to complete a large number of runs to account for natural variability resulting from the randomly generated components of both system and individual-level parameters (e.g. the distribution of status among agents). Since the number of issue contagion events variable is consistently calculated as a summary measure of simulated patterns, it is possible to make comparisons across any number of runs, regardless of parameter settings. A series of expectations about what factors may influence the number of issue contagion events can be drawn both from my central proposition and existing literature on networks and policy dynamics. My proposition—that cue-taking behavior shapes aggregate patterns in the issue attention of policy elites—implies that the cue-taking rate parameter, Ψ, will have a positive relationship with the frequency of issue contagion events. As agents engage in higher levels of mimicry and cue-taking, the policy-related attention of a few high-status agents is likely to spread with ease across individuals. When cue-taking is at its highest value, we would expect a substantial number of issue contagion events as collective attention to policy issues wavers between those preferred by the most influential agents in the system.

Cue-taking Expectation: An increasing rate of cue-taking behavior among agents will lead to more frequent issue contagion events.

Network scientists also detail the impact that highly connected individuals can have on the global activity of a dense network and show that the presence or lack of a system-wide behavior can be attributed to network structure (Watts 2004). Particular individuals who are tied to many actors (i.e. 'hubs') are widely known to have tremendous ability to transmit the behavior of their neighbors and facilitate shifts in behavior (Watts 1999, Barabási 2002, Buchanan 2002, Watts 2004). As a result, the overall density of communication ties among policy elites should affect patterns in their issue attention over time. With increasing density in ties, we might expect a higher degree of large shifts in resulting activity as small changes in the behavior of a few policymakers can spread more quickly to others—from one side of the network to the other.



Low Density **High Density**

Figure 10: Low Density Versus High Density in Hypothetical Communication Networks.

Figure 10 illustrates two hypothetical communication networks. The first has a low level of density: the overall level of ties between actors is low, the network is 'sparse,' and actors on one side of the network have very few (if any) ties to those on opposite sides. The second network has a high level of density as there is a general abundance of ties between actors and those from opposite sides are often connected with each other. Technically speaking, the low-density network exhibits significantly less dyadic ties between pairs of actors than the high-density network (Hannemann and Riddle 2005). It follows that very dense communication networks, all else equal, may result in more frequent issue contagion events as any single agent's 'reach' expands across all parts of a policymaking system; high-status actors can shape behavior in otherwise more difficult to influence regions of the communication network.[14]

Network Density Expectation: Increasing network density among actors will lead to more frequent issue contagion events.

Studies of dynamic networks (see Sharpanskykh and Treur 2013) suggest that the strength of links between clusters of actors impact patterns in activity. If a population of policy elites is organized into segmented these clusters, or subgroups—whether in political parties, advocacy coalitions, or along other lines—the spread of behavior across those groups may be less frequent than if no sub-groups existed. Within policymaking institutions, Jones and Baumgartner (2005) argue that organized groups of actors may generate different levels of within-group monitoring and mimicking behavior that have the effect of mitigating the size of large shifts. They write that "Democrats in Congress organize separately from Republicans and may be sensitive to different informational cues. This deconcentrated organizational structure limits the size of the cascade" (141). As segmentation in a policymaking system increases, then, we would expect the magnitude of collective shifts to decrease and the number of shifts above 200% to decline.

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[14] Though it is not included as a user-changeable parameter in the model, the topology of the communication network (e.g. power-law, small world, random; see Barash et al. 2012) can also mitigate the impact of density.

Segmentation Expectation: Increasing segmentation (e.g. more coalitions or parties) among actors will lead to less frequent issue contagion events.

TESTING EXPECTATIONS THROUGH SIMULATION EXPERIMENTS

Since my agent-based model enables the study of issue attention dynamics in a parsimonious system of simulated policy elites, an experimental approach both possible and fruitful. By holding various parameters of the model constant while incrementally adjusting others, I can record how objective, quantitative indicators of the simulation vary across runs. Following a similar approach to Gulati et al. (2010) and the 'modeling cycle' recommended by Railsback and Grimm (2011), I conduct three simulation experiments in order to test each of the expectations discussed above. Results from these experiments provide two important benefits: (1) they provide empirical evidence in support of (or in contrast to) expected relationships between model parameters and simulated patterns, and (2) they enable the mapping of the *functional forms* of these relationships.

I follow the same procedure for each of the three simulation experiments, which involve incremental adjustments to the model parameter associated with each expectation (e.g. adjusting the cue-taking rate to test the *Cue-taking Expectation)*.[15] I first set all but the parameter of interest to the default values listed in Table 1: the number of actors at 100, the number of issues at 50, and the decay rate at 20. Holding these values constant creates a simplified, yet plausible simulated world for each of the experiments and provides a comparable baseline. I then run a large number of simulations for each level of a parameter (at least 100 per level and over 1000 in total) across its range and record

[15] Appendix A-2 provides sample code for one of these simulation experiments, which use RNetLogo to programmatically interface with AgendaSim.

the number of issue contagion events that occur within simulations at the conclusion of every run. This enables the systematic analysis of how small increases in each parameter affect the frequency of issue contagion events.

Simulation Results: Cue-taking

To examine the relationship between the rate of cue-taking among individual agents and the prevalence of large-scale issue contagion events, I increment AgendaSim's cue-taking rate parameter across its range of 0.05-1.00 over a set of 1000 simulation runs. For every increase of 0.05 (e.g. 0.05, 0.10, 0.15) in the cue-taking rate parameter, I run 10 sets of 100 simulations. During all simulation runs, the decision *process* of agents remains the same, but the parameter changes the probability with which cue-taking occurs at the last step in the process. For example, if the cue-taking rate parameter is set to its lowest value, when a high-status actor interacts with a lower status peer the lower status peer will engage in cue-taking approximately 5% of the time. When the value of the cue-taking rate is at its maximum, cue-taking occurs in all possible circumstances. Figure 11 plots the results of these simulations below.

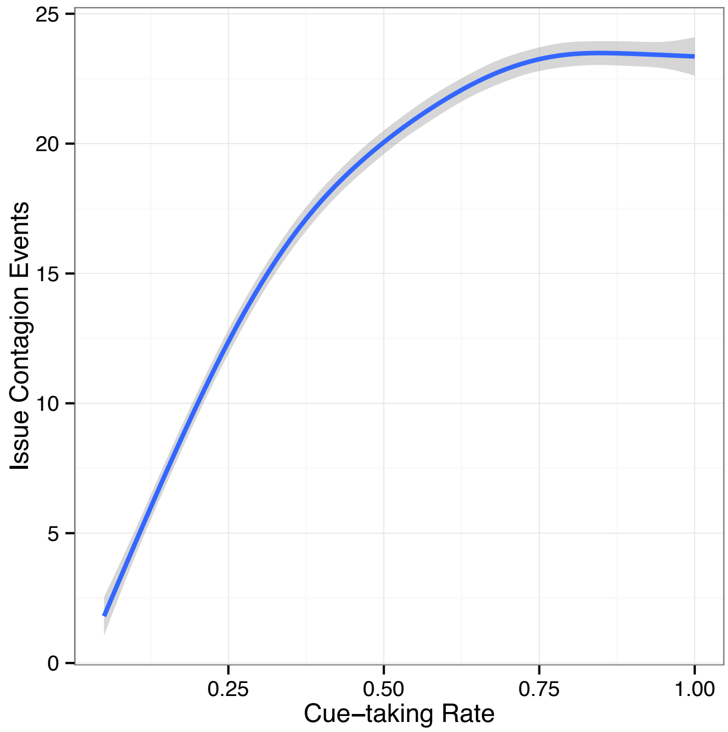

Figure 11: Simulation Results: The Effect of Increasing Cue-taking Rate on the Number of Issue Contagion Events

This figure plots the average number of issue contagion events (for each set of 100 simulations) for different levels of the cue-taking rate parameter, and the corresponding confidence interval around the mean. As expected, the rate of cue-taking among individual agents has a positive relationship with the frequency of issue contagion events, holding all else constant. When cue-taking is less prevalent, so too are the number of large, collective shifts in the attention of simulated actors: a cue-taking rate of 0.10 yields five contagion events on average. The slope of the relationship is steep, as the average number of contagion events rises to 20 when cue-taking occurs in approximately 50% of possible interactions. As the cue-taking rate continues to increase, however, the rate at which issue contagion events occur slows such that the relationship becomes curvilinear. As a result, the average frequency of contagion events do not consistently rise for the full range of the parameter. Between values of 0.75 and 1.0 in the cue-taking rate parameter, the mean number of simulated issue contagion events remains stable around 24.

Simulation Results: Network Density

Following the same procedure as above, I conduct a second simulation experiment to determine the relationship between changes in the network density of communication ties and the prevalence of issue contagion events. Recall that my expectation is that as communication ties become increasingly dense, then the attention of policy elites will be subject to more significant shifts in collective attention. Simply, added communication ties facilitate the rapid contagion of elites' focus across a communication network. For this experiment, I hold all parameters at their default value, set the cue-taking rate parameter at the point where the curvilinear relationship shown above begins (0.75) and run 100 simulations for every small change in the average degree input parameter. This yields 1100 simulations in total, and Figure 12 illustrates the mean number of issue contagion events occurring across resulting network densities.

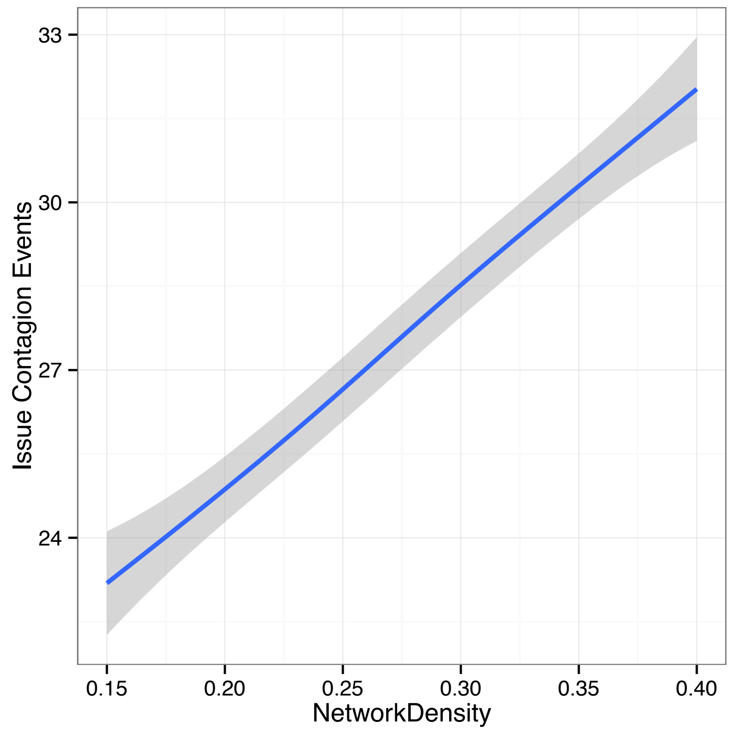

Figure 12: Simulation Results: The Effect of Increasing Network Density on the Number of Issue Contagion Events

Figure 12 indicates a clear, positive relationship between the average degree input parameter (i.e. network density) and the frequency of issue contagion events within the simulation experiment. When the communication of agents in the model is more sparse (e.g. there are limited, if any, ties connecting agents from one side of the network to the other), an average of 23 issue contagion events occur. When the network is extremely dense, with an average degree input parameter value of 0.4, nearly 33 major shifts in the collective attention of agents occur. This relationship is visibly linear in form and has a moderate slope. Compared to the first simulation experiment, increases in network density appear to have less measurable impact on the frequency of issue contagion events (from 23 to 33) than do increases in the probability of cue-taking behavior (from 4 to 24).

Simulation Results: Segmentation

As noted above, scholars of both social networks and the policy process suggest that the division of a population of actors into smaller groups will limit the prevalence of large-scale changes in behavior. To test this third expectation regarding segmentation, I conduct a final simulation experiment where I hold all values constant—except the number of segments among actors—across 1200 simulation runs. I conduct 100 runs of the simulation with only one segment (e.g. a system with no divisions among actors) and then iterate over increasing values of segmentation through the parameter's maximum value of 12. Here, it is important to recall that the cue-taking rate is set to decline by a static factor of two when agents' peers are outside of their particular sub-groups. Unlike the previous two simulations, our expectation here is that a negative relationship between segmentation and contagion events will occur. As shown in Figure 13, which plots the mean number of issue contagion events within each interval of segmentation and their associated confidence intervals, the empirical results confirm this expectation.

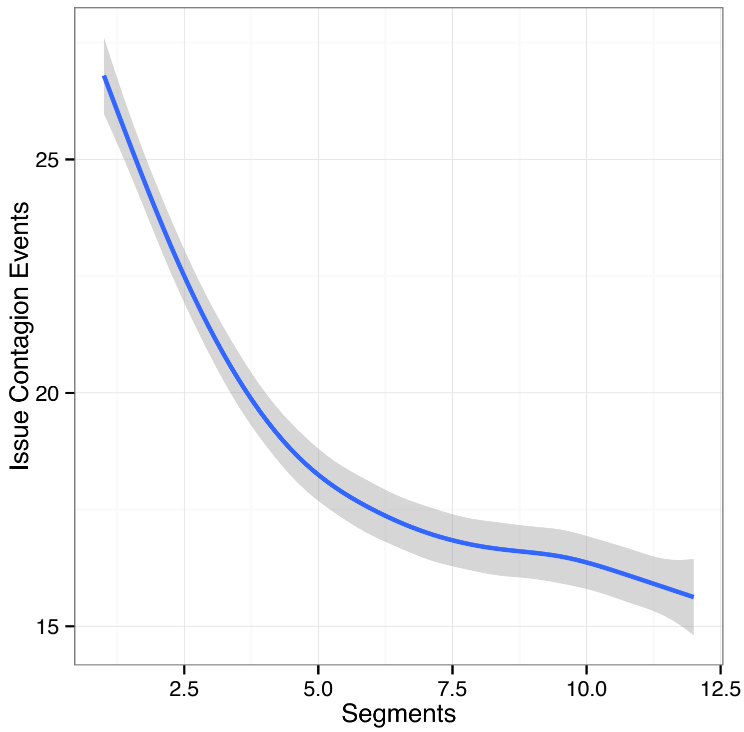

Figure 13: Simulation Results: The Effect of Increasing Segmentation on the Number of Issue Contagion Events

This figure indicates that contagion events occur most frequently when all agents belong to the same segment (e.g. zero sub-divisions), with a mean value of 24. As segmentation increases and the number of sub-groups moves to a value of five, the prevalence of issue contagion events decreases dramatically to approximately 17, on average. This rate of decrease declines, however, and the number of issue contagion events remains above 16 as the segmentation parameter reaches its maximum value. This figure illustrates that the relationship between segmentation and the presence of collective shifts in simulated attention is large, negative, and curvilinear in form. In a real-world setting, then, we would expect that as the number of parties, caucuses, or coalitions increase across policymaking systems, collective shifts in attention would also occur with decreasing frequency.

CONCLUSION

This chapter provides an overview of my computational model of issue attention dynamics, describes in detail the simulation of policy elites within policymaking worlds, and outlines key empirical expectations. I conducted three simulation experiments to test these expectations, in which I varied one model parameter across its range while holding all other model specifications constant. Results of these simulations indicated that clear relationships exist between the frequency of issue contagion events and the probability of cue-taking among individual actors, the network density of communication ties, and the level of segmentation of actors into sub-groups. I showed that, as expected, increasing cue-taking rates and network density contribute to more frequent large-scale shifts in simulated issue attention, while increasing segmentation mitigates the rapid spread of behavior. In addition, I documented the functional forms of the relationships between these three parameters and the average frequency of issue contagion events: the cue-taking rate has a positive relationship and curvilinear form, network density has a positive relationship and linear form, and segmentation has a negative relationship and curvilinear form.

Chapter 4: Issue Contagion in Congress

In this chapter, I study bill introductions in the US Congress in order to empirically validate my computational model and explore the dynamics of issue attention among legislators. I draw on a growing literature that examines the sources, timing, and prevalence of cue-taking behavior with regard to roll call voting, and extend these studies to the attention that members devote to specific policy issues. Using the Congressional Bills Project's expansive dataset on the policy content of bills introduced in both chambers since 1945, I empirically apply AgendaSim to the dynamics of bill introductions over time. Through a systematic comparison of real-world activity and the simulated patterns generated by my model—under settings intended to approximate each chamber of Congress—I provide evidence that extends the central proposition of this dissertation to the ebb and flow of bill introductions. I show that when simulated agents engage in cue-taking with high frequency, patterns in the dynamics of simulated issue attention most closely match those observed in the policy content of bill introductions.

OBSERVATIONS OF CUE-TAKING

Members of Congress are often faced with an abundance of competing information about the policymaking environment as well as experience high levels of uncertainty regarding particular choices (Jones 2003). As I mention in the preceding chapters, scholars of the institution have long explored how individual members turn to their colleagues in order to reduce the costs associated with making decisions about roll call votes (Matthews and Stimson 1975; Kingdon 1973; Gross 2010; Box-Steffensmeier et al. 2015). This behavior of cue-taking occurs at the level of the legislator as individuals seek out information and direction from those with expertise, seniority, committee leadership positions, or party leadership roles for making decisions on topics with which they have little knowledge. In the most recent study of cue-taking in Congress, Box-Steffensmeier et al. (2015) summarize the phenomenon, writing that "in the different information environments of Congress, senators sometimes must rely on their fellow members' votes as cues to help them make their choices; … some senators act as *cue-givers* … while other senators act as *cue-takers*, receiving signals and making voting decisions based on them" (14, emphasis in original). These cue-givers, who are often committee chairs, party leaders, members with institutional seniority, or members with particular issue-area expertise, provide decision short-cuts (or, heuristics) to their colleagues who cast votes on the assumption they would agree with the cue-giver given added information (Matthews and Stimson 1975).

Through a careful analysis of C-SPAN footage of roll call votes, Box-Steffensmeier et al. (2015) explore the temporal dynamics of voting in the Senate. They show that Senators holding committee leadership positions and those with seniority routinely act as cue-givers to their colleagues. Moreover, Gross (2010) draws on the early work of scholars interested in the interactive processes of voting and provides a relational account of decision-making among members of Congress, claiming that "relationships are among the essential means through which [Members of Congress], intending to act as rational decision-makers, may take shortcuts to cope with the serve constraints on time and information" (2). In a comprehensive analysis of roll call voting, Gross (2010) develops models of cue transmission, finds that those who vote early frequently act as cue-givers to their colleagues, and shows that ideologically diverse cues are among the most informative.

As Box-Steffensmeier et al. (1997) explore the prevalence of cue-taking activity with regard to the timing of position-taking on legislation associated with the implementation of NAFTA, I extend this logic of cue-taking to legislators choices to attend to (or focus on) particular policy areas. When facing numerous problems and issues that each call for the limited attention of legislators, I contend that members of Congress may engage in the same type cue-taking behavior evident in roll call votes with varying frequency. This is not simply an exercise in conceptual stretching, however, as the desire to be involved in issues that are 'moving' or have 'legs' is recognized among scholars of the policy process literature (Jones and Baumgartner 2005; Baumgartner et al. 2009b). As I describe in Chapter Two, independence pervades Washington policymaking such that cue-taking and imitation in issue attention (in the form of introducing bills, discussing policy issues in public, issuing press releases, etc.) may not only occur, but may be part of the normal behavior of policymakers as they allocate their limited policy-related attention.

APPLYING AGENDASIM TO CONGRESSIONAL ACTIVITY

To empirically validate my computational model and apply AgendaSim to patterns in Congressional activity, I utilize the Congressional Bills Project's (CBP) publicly available dataset that catalogues over 400,000 bills introduced in both chambers from 1945-2013.[16] In addition, the Project classifies each piece of legislation according to policy content, at two levels of analysis. Every bill is exclusively assigned one of 20 'major' topic categories as well as one of 220 'minor' topic categories based on the Policy Agendas Project topic coding scheme (2014 Comparative Agendas Project version).[17] For example, S. 317 was introduced by Senator Dianne Feinstein (D-CA) during the 110th session of Congress and is classified by the CBP as relating to the 'Environment' major topic and the 'Air/Noise Pollution and Global Warming' minor

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[16] E. Scott Adler and John Wilkerson, Congressional Bills Project: (1975-2012), NSF 00880066 and 00880061. The views expressed are those of the authors and not the National Science Foundation.
[17] See http://www.policyagendas.org/page/datasets-codebooks for more information on the Policy Agendas Project topic coding system and methodology.

topic. Senator Feinstein's 'Electric Utility Cap and Trade Act of 2007' sought to amend the Clean Air Act and require the EPA to initiate a Cap and Trade program for the release of greenhouse gas emissions from electricity generating utilities. In this case, the CBP-assigned codes capture the primary policy content—related to greenhouse gas emissions—of the proposed legislation. These exclusive codes enable the tracing of valid time series in the policy related attention of legislators, at the level of both major policy domains and narrowly defined minor topics, such that shifts in bill introduction patterns are visible over time. As a result, it is possible to determine that the introduction of S. 317 bill occurred in a Congressional session marked by a large increase (of over 130 percent) in bills relating to air pollution compared to the preceding session: in the 109th Congress 39 bills were introduced on the topic, with 91 in the 110th Congress.

In the analysis to follow, I apply AgendaSim to patterns at each level of analysis and each chamber of Congress. For my purposes, I draw on these bill introductions as a best available measure of legislators' attention to and focus on specific policy topics. I echo Woon (2009) and Lazarus (2013) who view bill introductions as indicators of 'issue salience' and early-stage issue attention among individual legislators. While both of these scholars examine the determinants of issue-specific bill introductions—such as constituency pressures, committee membership, national politics, or majority party status—neither considers the important *interactive dynamics* of issue attention (discussed at length in Chapter Two) as I do below.

Bill Introductions by Major Topics

At the level of major policy topics (e.g. 'Defense,' 'Health,' 'Agriculture,' 'Foreign Trade'), trends in bill introductions provide a window into the aggregated legislative priorities of members of Congress. Drawing on the Congressional Bills

Project dataset, Table 2 lists the top 10 major policy topics that received the largest share of associated bill introductions from 1988 through 2010. Of the 68,041 bills introduced in the House and the 37,784 bills introduced in the Senate during this time period, over 11 percent in both chambers are classified by the Congressional Bills Project as related to the 'Health' policy domain. The domains of 'Government Operations, 'Public Lands and Water,' 'Foreign Trade' and 'Domestic Commerce' make up the next four popular areas in both chambers, though Senators more frequently introduce legislation related to 'Foreign Trade' issues. Over time, 2007 exhibited the highest percentage of bills introduced on the most popular major topic as 13.7 percent of all bills were classified as mentioning health issues across both chambers. Twice, however, bill introductions related to 'Foreign Trade' eclipsed attention to health issues: in rapid increases from 3.5 percent in 2001 to 22.4 percent in 2002; and, from 12.4 percent in 2005 to 22.1 percent in 2006.

Table 2. Bill Introductions by Major Policy Topic and Chamber (Top 10), 1988-2010

House		Senate	
Topic	%	Topic	%
Health	11.1	Health	11.6
Government Ops.	10.5	Foreign Trade	10.6
Public Lands and Water	8.7	Public Lands and Water	10.4
Foreign Trade	7.7	Government Ops.	8.5
Domestic Commerce	7.1	Domestic Commerce	6.4
Defense	6.4	Law/Crime/Family	6.2
Law/Crime/Family	6.0	Defense	5.9
Environment	4.9	Environment	4.9
Education	4.4	Education	4.4
Macroeconomics	4.4	Transportation	4.1
Total	68,041	Total	37,784

Recall from the description of AgendaSim in Chapter Three that some features of my computational model vary only across *separate* simulation runs. They control parts of the model such as the distribution of status among agents and the structure of network ties that do not change during any one simulation run. Six of these parameters determine the creation and simulation of 'policymaking worlds' and are designed such that they can be adjusted for application of the model to various policymaking settings. These parameters control components of AgendaSim including the extent that simulated policy elites can communicate with one another, the number of available issues that they may focus on, and the rate at which they take cues from their peers over time. In order to apply AgendaSim to the issue attention dynamics of legislators in the US Congress—and their patterns of bill introductions, in particular—I make a number of adjustments to the default values of these six parameters originally listed in Table 1 of the preceding chapter.

To approximate the general contours of the US House, I set the number of agents to 435 to represent the number of voting members in the chamber and the number of segments parameter to a value of two. This latter setting represents the partisan organization of members into the two major political parties. As listed in Table 3, I also set the number of issues parameter to 20 such that it matches the major topic classification scheme of the CBP as well as set the network degree parameter to 0.30. This value produces a network that is dense (i.e. with a high level of communication pathways between agents) and is as similar in structure as possible to the co-sponsorship network identified by Fowler (2006). I then set the cue-taking rate parameter to 0.95 such that—given the decision-making procedures of the model that dictate agent behavior—cue-taking occurs in 95 percent of possible instances between agents that are members of the *same* party and occurs in 47.5 percent of possible instances between agents that are members of *different* parties. Last, the decay rate parameter is set to 50 such that simulated agents return with moderate urgency to their preferred policy issues over time.

Table 3. Parameter Settings: Comparison of Simulated Patterns to Bill Introductions with High Cue-taking, House from 1988-2010, Major Topics.

Parameter	Value
Num. of Agents	435
Num. of Issues	20
Cue-taking Rate	0.95
Num. of Segments	2
Network Degree	0.30
Decay Rate	50
Runs	50

Given these settings, I run 50 simulations of AgendaSim in order to account for natural and necessary variation in the randomized components of the model including the exact placement of network ties among agents and the values of status assigned to each agent. During each simulation run, I record the number of agents focusing on each issue at all instances of time. This supports the calculation and analysis of percent changes in the levels of attention to each of the 20 policy topics available in the model that is both generalizable and comparable to patterns in bill introductions. Following the same approach I utilized in the Chapter Two to illustrate observed patterns in the US Budget Authority (i.e. stochastic process analysis; see Breunig and Jones 2010 and Jones and Baumgartner 2005), Figure 14 plots the density of the percentage changes pooled over time and pooled across issues. Shown as individual lines (in red), patterns in the distribution of percentage changes resulting from fifty separate simulations follow a consistent shape—overlapping within a small range across nearly all values.

These simulated patterns provide a clear picture of the dynamics of issue attention occurring within AgendaSim when model settings approximate the features of the US House: stability is the norm, yet it is frequently interrupted by large-scale shifts in attention. The central tendency and sharp peak of the simulated percentage change distributions are indicative of many small changes around zero (e.g. shifts in attention ranging from -10 percent to 10 percent from one time period to the next). In addition, a non-trivial number of changes greater than 200 percent occur and are visible in the extended, positive 'tail' of the distribution. These large values of percentage change (upwards of 600 percent) are indicative of issue contagion events occurring within simulation runs as agents collectively shift attention from one issue to another. This leads us to the primary question guiding the analysis in this chapter: do simulated patterns approximate real-world bill introduction activity? If not, then we can conclude that AgendaSim does not provide a face valid model of issue attention dynamics in Congress. If simulated patterns match real-world indicators, however, it will be possible to make initial, deductive inferences about the underlying decision-making process that generates patterns in issue attention.

Also illustrated in Figure 14 is a histogram of the pooled percentage changes calculated across time and across major policy topics from trends in the Congressional Bills Project dataset. The correspondence between this observed distribution of changes in the issue attention of House members—in the form of bill introductions—and simulated patterns generated by AgendaSim is remarkable. Just as in the simulated series, the distribution of observed changes among bill introductions has a sharp, central peak around zero that indicates that the majority of changes occur within -10 percent to

10 percent. In addition, the observed distribution of changes also has an extended positive tail with multiple values occurring above 200 percent and extending to 800 percent.[18] Some instances of incongruence do appear (e.g. at approximately 100 percent), but this is not unexpected given that AgendaSim is designed as a *general* model applicable to a wide range of policy elites and policymaking scenarios. Overall, the shape and features of the distribution of percentage changes drawn from the policy content of bills introduced in the House closely approximate those produced by AgendaSim when agents exhibit high levels of cue-taking behavior.

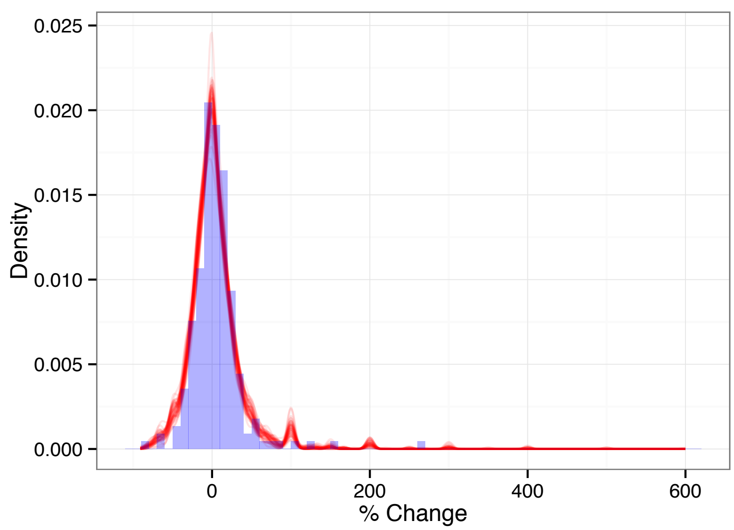

Figure 14. Empirical Validation: Comparison of Simulated Patterns to Bill Introductions with High Cue-taking, House from 1988-2010, Major Topics.

To examine whether or not this same degree of similarity exists between simulated issue attention and observed patterns in the bill introduction activity of US Senators, I follow the same matching approach as described above. I first make a series of adjustments to the parameter settings that govern the simulated policymaking worlds

[18] I drop observed percentage changes with values equal to or above 800% for presentation purposes.

of AgendaSim, in order to best approximate the general characteristics of the Senate. As with the application to bill introductions in the House, I set the number of actors in the model to the number of members of the chamber (100) and the number of issues to those found in the Congressional Bills Project dataset (20). I also increase the density of the communication network by setting the network degree parameter to 0.40. This has the effect of increasing the number of available communication pathways among simulated actors, with the purpose of representing the deeper social ties derived from the 'folkways' of Congress' upper chamber (Matthews 1959; Schneier 2010). Importantly, I continue to set the cue-taking rate parameter to 0.95 such that *within party* interactions are subject to very high levels of cue-taking among simulated agents and *between party* are interactions subject to moderate levels of cue-taking. These parameter values are listed in Table 4 below.

Table 4. Parameter Settings: Comparison of Simulated Patterns to Bill Introductions with High Cue-taking, Senate from 1988-2010, Major Topics.

Parameter	Value
Num. of Agents	100
Num. of Issues	20
Cue-taking Rate	0.95
Num. of Segments	2
Network Degree	0.40
Decay Rate	50
Runs	50

Under these settings, I run 50 simulations of my computational model and record levels of attention to each of the 20 possible policy areas at every instance of time. I then calculate percentage changes for all series (from one period to the next, by policy area) and pool them over time and across policy areas. Shown in Figure 15, I plot the density of these simulated percentage change distributions. Over the 50 simulation runs, the resulting pattern of percentage changes exhibits a high degree of overlap across runs—divergence from the ‘typical’ simulation is evident mainly at the peak of the distribution and in the low shoulders (between percentage change values of approximately -25 through -75 as well as 50 and 100). These various simulated distributions illustrated as lines (in red) in Figure 15 contain sharp central peaks around values of zero and within the range of -10 to 10 percentage change. These indicate substantial stability in simulated issue attention over time, just as in the preceding simulation analysis and the early examples of budgetary change described in Chapter Two. Simulated patterns also exhibit long, positive tails that indicate the presence of large-scale issue contagion events driven by cue-taking behavior.

In addition, Figure 15 plots the distribution of percentage changes occurring within observed bill introductions in the Senate as a histogram. The general shape of these observed percentage change values, pooled across all 20 major policy topics and across congressional sessions, approximates simulated patterns. Though correspondence between the observed and simulated distributions is less consistent across the range of percentage change values than in the analysis of House bills above (particularly in the shoulders of the observed distribution), both the simulated and observed distributions exhibit similar configurations. Observed patterns are subject to high levels of stability over time, with the majority of changes falling within -25 to 25 percent. While slight incongruence exists at the edges of this range and around values of 100 percent relative to patterns generated by AgendaSim, observed and simulated activity are indicative of stability interspersed with rapid change.

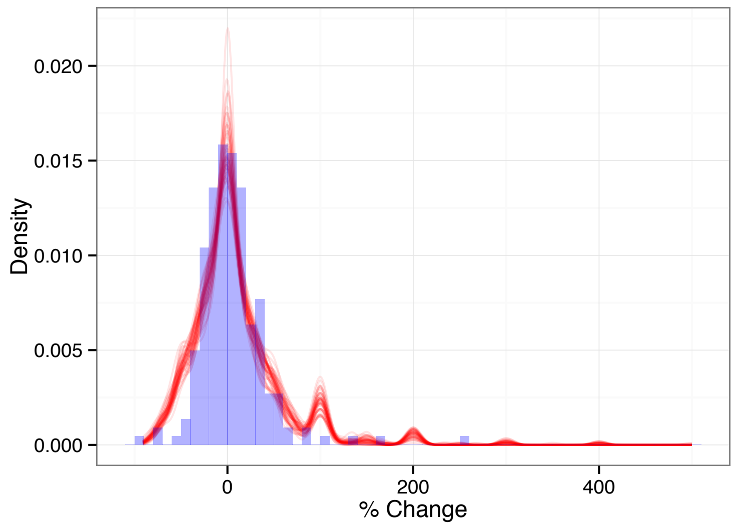

Figure 15: Empirical Validation: Comparison of Simulated Patterns to Bill Introductions with High Cue-taking, Senate from 1988-2010, Major Topics.

Bill Introductions by Minor Topics

At the level of major policy topics, my analysis above provides initial empirical validation of AgendaSim and evidence in support of the deductive finding that cue-taking behavior contributes to observed patterns in the issue attention of members of Congress. I now turn to the application of AgendaSim to bill introductions at a more granular level of analysis—the 220 minor topic codes of the Policy Agendas Project topic coding scheme. With added categories comes the problem of sparseness of observations across my original time period of study (1988-2012). To ensure sufficient levels of attention across all policy topics needed to compile meaningful distributions of percent changes, I include all bills introduced from 1975 through 2012. Table 5, below, lists the ten most popular minor policy topics and the percentage of bill introductions associated with each.

Table 5. Bill Introductions by Minor Policy Topic and Chamber (Top 10), 1975-2012

House		Senate	
Topic	%	Topic	%
Tariff and Import Restrictions	5.1	Tariff and Import Restrictions	7.8
Military Personnel	3.6	National Parks	3.3
Taxation	3.1	Natural Resources & Lands	3.0
National Parks	2.5	Taxation	2.8
Elderly Issues	2.5	Military Personnel	2.7
Natural Resources & Lands	2.2	Native American Affairs	2.2
Civil Service Issues	2.1	Water Resources	1.9
Employee Benefits	1.9	Natural Gas and Oil	1.6
Federal Crime Issues	1.8	Employee Benefits	1.5
Higher Education	1.7	Higher Education	1.5
Total	129,124	Total	58,783

Between 1975 and 2012, over 129,000 bills were introduced in the House and nearly 59,000 in the Senate. In both chambers, the minor policy topic of 'Tariff and Import Restrictions' accounts for the highest percentage of these bills with 5.1 percent in the House and 7.8 percent in the Senate. Representatives in the House also regularly introduce legislation related to 'Military Personnel' and 'Taxation,' while the topics of 'National Parks' and 'Natural Resources and Lands' account for greater than three percent of Senators' bills. Other issues such as 'Employee Benefits' and 'Higher Education' are also included in both lists, but Senators are associated with higher levels of attention to 'Native American Affairs' and 'Water Resources' than their colleagues in the House. Of course, I am mainly interested in the dynamics of this attention to specific policy issues, and if we look at trends in these popular minor policy topics, substantial shifts are visible.

The most notable dynamics occur in the bills related to 'Tariff and Import Restrictions' as introductions vary wildly from session to session since 1975. Figure 16, below, plots the percentage changes in the number of bills introduced on this minor policy topic across Congressional sessions. Two massive increases in bill introductions are visible and occur in the 105^{th}, 109^{th}, and 111^{th} sessions. In the first instance, introductions in both the House and Senate experience an increase above 300 percent following moderate declines in the preceding session (from 61 to 252 bills in the House and from 32 to 198 in the Senate). In the second, the House exhibits an increase in tariff-related bill introductions of 385 percent (from 147 to 713) while introductions rise dramatically, above 2000 percent in the Senate (from 83 to 838). A similar large-scale shift occurs between the 110^{th} and 111^{th} sessions, with bill introductions in the Senate increasing nearly 3000 percent. These latter shifts in bill-related activity in the Senate occur across a range of Senators and frequently seek to amend specific duties outlined in the Harmonized Tariff Schedule of the US (e.g. tariffs on children's swimming pools in S.1996 or suspension stabilizer bars in S. 1973). These episodic dynamics are not limited to trade tariffs and import issues, however, as bill introductions in a number of minor policy topics experience large shifts (e.g. a 245 percent increase in bills related to 'Natural Gas and Oil' occurs in the 109^{th} session).

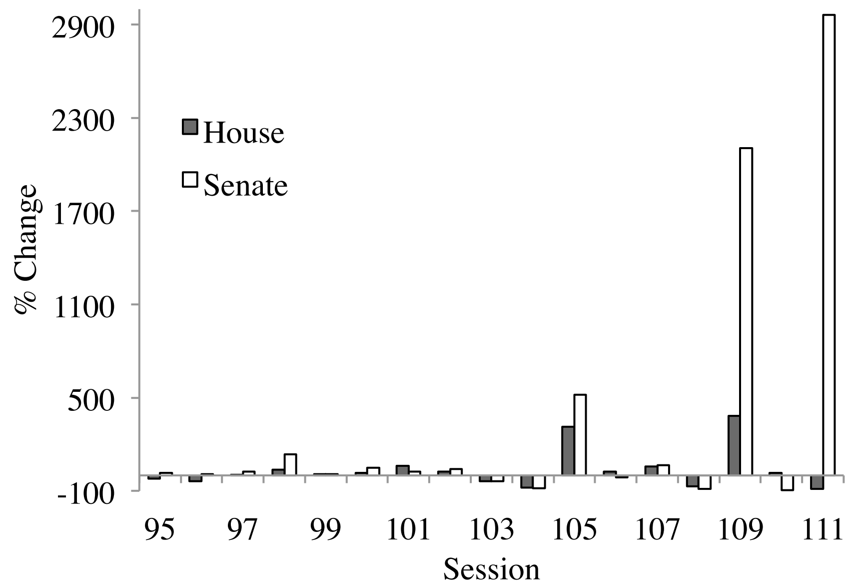

Figure 16: Percentage Changes in Bill Introductions Related to 'Tariff and Import Restrictions' by Congressional Session, 1975-2012.

To apply AgendaSim to bill introductions in the House, at the level of minor policy topics, I utilize the same parameter settings described in the first application shown above. As listed in Table 6, the parameters controlling the number of agents (435), cue-taking rate (0.95/0.475), the number of segments, network degree (0.30) and decay rate (50) remain unchanged. I do, however, change the number of issues parameter to correspond to the 220 minor policy topics identified by the Congressional Bills Project. This ensures that comparisons to simulated activity generated by AgendaSim are made under the closest possible approximation of real-world indicators. With these settings, I then run a set of 50 simulations of my model—again, to account for variation in the random components of the model—and record levels of simulated issue attention across all policy areas and for each instance of time.

Table 6. Parameter Settings: Comparison of Simulated Patterns to Bill Introductions with High Cue-taking, House from 1975-2012, Minor Topics.

Parameter	Value
Num. of Agents	435
Num. of Issues	220
Cue-taking Rate	0.95
Num. of Segments	2
Network Degree	0.30
Decay Rate	50
Runs	50

In Figure 17, below, I plot the corresponding percentage change distributions of these 50 runs of AgendaSim. Shown as separate lines, the distributions of simulated issue attention overlap very closely, with only subtle variation in the shape of resulting patterns. These pooled percentage changes—when simulated actors are able to focus on any of 220 policy topics—are evidence of very disjointed trends at the level of individual issues. Narrow and high central peaks (within the range of -10 to 10 percentage change) indicate a high level of stability, yet the simulated distributions also exhibit a number of shifts above 200 percent in size with long, positive tails extending through 800 percent. In order to compare these patterns with observed bill introduction activity, Figure 16 illustrates, as a histogram, the distribution of percent changes corresponding to introduced legislation in the House. This distribution of observed values follows the same general configuration as my simulations, but with an important caveat. Though the central tendency of the observed distribution falls around zero, many values occur across a wider range. It appears that—in this application—AgendaSim overestimates the prevalence of hyperincremental shifts, and slightly underestimates moderately sized decreases (between -25 and -100). In looking to at the positive tails of both the simulated and observed distributions, congruence is high as observed changes at 100 percent, 200 percent, and above, occur with similar frequency.[19]

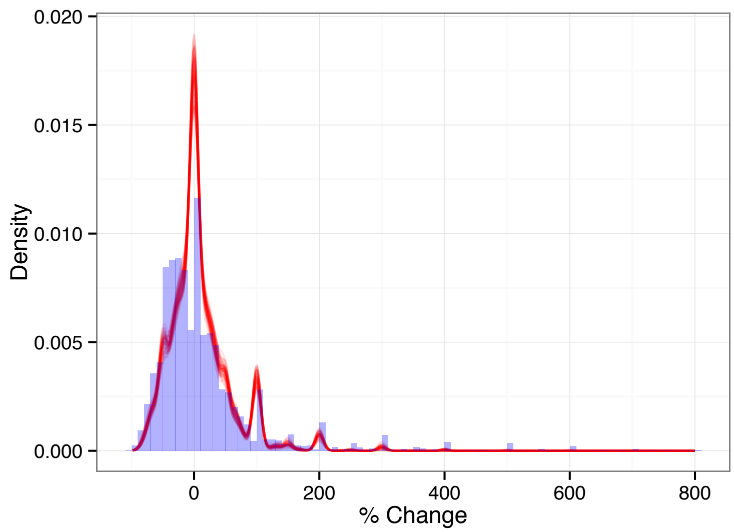

Figure 17. Empirical Validation: Comparison of Simulated Patterns to Bill Introductions with High Cue-taking, House from 1975-2012, Minor Topics.

To make a comparison between Senate bills coded according to minor policy topics and patterns in issue attention generated by AgendaSim, I make only one major adjustment to the parameter settings utilized in the preceding application to Senators' activity. As listed in Table 7, I set the number of issues parameter to 220 in order to reflect the number of minor policy topics included in the Congressional Bills Project dataset. All other parameters are unchanged: the number of agents is set to 100, the cue-taking rate is set to 0.95 for *within party* interactions (and, thus, 0.475 for *between party* interactions), the number of segments is set to 2, and the network degree parameter is set

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[19] For presentation purposes, I drop values above 800 from the distribution of observed percentage changes.

to 0.40. With these settings, I run fifty simulations of AgendaSim and record the dynamics of issue attention occurring within the model over time.

Table 7. Parameter Settings: Comparison of Simulated Patterns to Bill Introductions with High Cue-taking, Senate from 1975-2012, Minor Topics.

Parameter	Value
Num. of Agents	100
Num. of Issues	220
Cue-taking Rate	0.95
Num. of Segments	2
Network Degree	0.40
Decay Rate	50
Runs	50

Figure 18, below, plots the corresponding pooled percentage change distribution for each of the 50 simulation of AgendaSim under these parameter settings. These results are nearly identical to those produced with higher number of simulated agents, except that values around the shoulders of the distributions (between -25 and 50 percentage change; between 25 and 50 percentage change) are smoother in shape—indicating more fluid adjustment in attention among individual series. Again, the central peak of this distribution is very sharp and narrow, which suggests a high degree of stability within simulated patterns. Yet, simulated activity also experiences many increases with magnitudes around 100 percent (i.e. a doubling of attention) and a positive, long tail through values of 800 percent.

Compared to observed bill introduction activity in the Senate, calculated across 220 minor topics and congressional sessions since 1975, AgendaSim produces dynamics of issues attention that approximate the general characteristics of real-world patterns. Notably, the central tendency of the histogram of percentage changes occurring among

Senate bill introductions falls at zero and the distribution exhibits numerous instances of large-scale change at 200 percent and above. As with comparisons to House bills at this level of analysis, AgendaSim appears to underestimate values that are negative and moderate in size (e.g. between -25 and -50 percent change) as well as slightly underestimate the frequency of large values (e.g. at approximately 200, 300, and 400 percentage change).

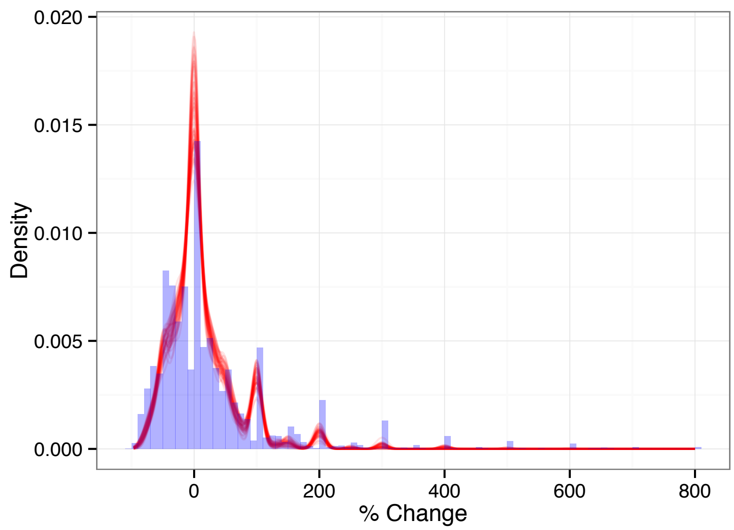

Figure 18. Empirical Validation: Comparison of Simulated Patterns to Bill Introductions with High Cue-taking, Senate from 1975-2012, Minor Topics.

A DEDUCTIVE FINDING AND COUNTERFACTUAL CLAIM

Taken in sum, the four comparisons discussed above—which compare observed bill introduction activity with simulated patterns generated by AgendaSim—lead us to an important deductive finding related to the central proposition of this dissertation. Under model settings where *within party* cue-taking is high, simulated patterns of issue attention approximate the general configuration of real-world patterns of legislative activity across both minor and major policy topics. Thus, it is possible to deduce that cue-taking behavior among members is, at least in part, a contributing factor in the dynamics of issue attention in Congress. But what of the counterfactual claim that such patterns could emerge in policymaking worlds with minimal, or no, presence of cue-taking behavior among individual actors? Given the purposeful flexibility of AgendaSim, it is possible to test this counterfactual argument through an additional set of model simulations. Utilizing the same settings as the above simulations that approximate issue attention in the House across minor policy topics (shown in Table 6), I make only one change to these values in order to adjust the setting of the cue-taking rate parameter to 0.05. This has the effect of decreasing the prevalence of *within party* cue-taking such that agents take cues from higher status peers only 5 percent of the time as well as decreasing *between party* cue-taking such that it occurs in only 2.5 percent of possible instances. With this minimal level of cue-taking, simulated percentage change distributions exhibit no clear relationship with observed patterns in bill introductions. Illustrated in Figure C6, below, each of the 50 closely overlapping lines depicts the density of percentage changes occurring within individual simulations of issue attention. These distributions exhibit markedly different patterns than those presented earlier in this chapter. The peak of these distributions are extremely narrow such that nearly *all* observations occur within a very small range (-5 to 5 percent), no large-scale shifts beyond 100 percent are visible, and there is little variability across the range of percentage change values.

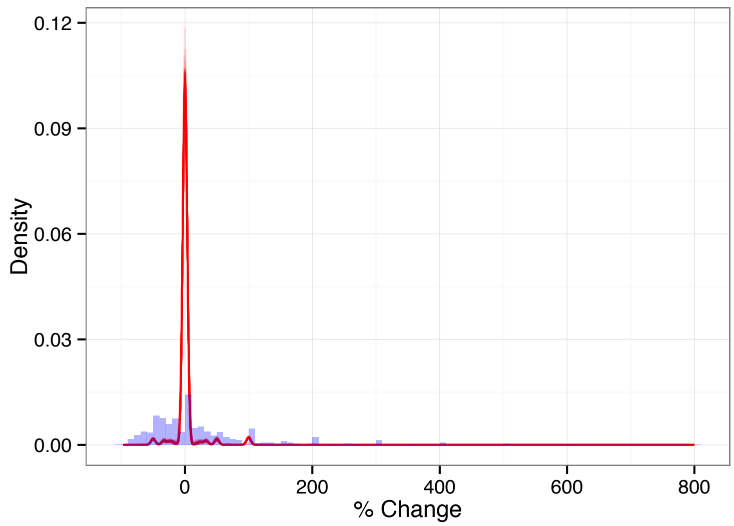

Figure 19: Counterfactual: Comparison of Simulated Patterns to Bill Introductions with Low Cue-taking, House from 1975-2012, Minor Topics.

Figure 19 also plots the percent changes drawn from observed bill introductions in the House. Relative to simulated patterns, there is little (if any) correspondence between the two sets of distributions. If we move closer into this figure we can see with more detail the central area of the distribution of observed percentage changes. Figure 20, below, provides a 'zoomed in' view and confirms the very clear lack of congruence between simulated issue attention patterns with minimal levels of cue-taking to those observed in the bill introductions. The counterfactual claim, given the way that AgendaSim models the dynamics of issue attention, simply does not hold.[20] Of course, it would be naïve to assert that cue-taking behavior is the only factor associated with the dynamics of policy-related attention found in bill introductions. But, the analysis in this chapter provides empirical validation for what is a purposely simplified and general model of issue attention dynamics among policy elites.

[20] Additional tests of this counterfactual claim under simulations with either 20 major or 220 minor policy topics as well as either 435 or 100 agents yield the same result (not pictured).

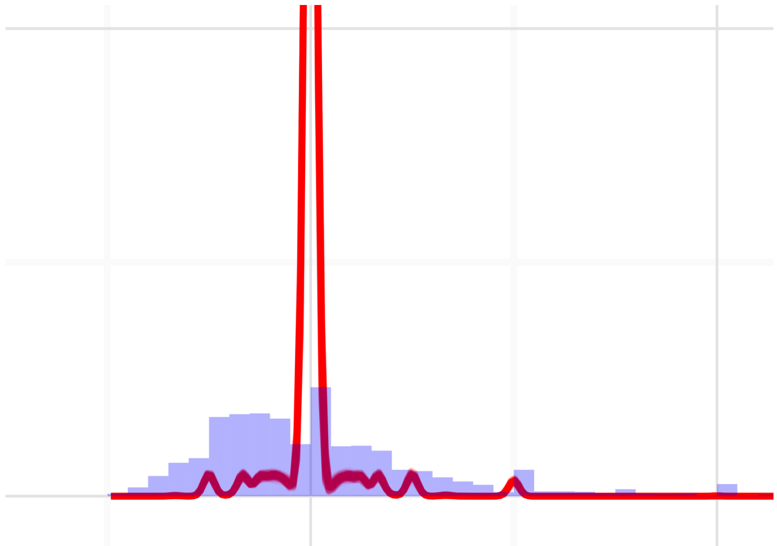

Figure 20: Counterfactual: Comparison of Simulated Patterns to Bill Introductions with Low Cue-taking, House from 1975-2012, Minor Topics (Zoomed-in View)

CONCLUSION

This chapter matches patterns in the bill introductions of members of the US Congress with the issue attention of simulated agents produced by AgendaSim. By drawing on nearly 190,000 bills compiled and coded according to policy content by the Congressional Bills Project, I examine the extent to which cue-taking may shape patterns in the real-world activity of members from both chambers of Congress. Through systematic comparisons between simulated policymaking worlds that approximate the general contours of the House and Senate with observed trends in bill introductions, I show that high levels of cue-taking produce dynamics of attention that correspond with actual activity. As an empirical validation of my computational model, this chapter provides support for the deductive finding that cue-taking behavior among individual policy elites (member of Congress, in this case) can generate patterns of stability and change in issue attention. This claim extends the central proposition of this dissertation, and suggests that cue-taking behavior contributes to both large-scale issue contagion events as well as general, ‘stick-slip’ patterns in issue attention.

Chapter 5: Issue Contagion among Organized Interests

In the previous chapter, I explored the dynamics of issue attention among members of the US Congress and applied my computational model to members' bill introductions and public statements. While data on the issue attention of members of Congress support a dynamic analysis of issue contagion events, similar longitudinal indicators are not readily available regarding the activity of organized interests in Washington. In order to apply my model to the behavior of these actors—who account for $3.2 billion in annual, policy-related spending on lobbying and whose activity is speculated by many scholars to exhibit high levels of interdependence—I rely on public lobbying disclosure reports that summarize the activity of registered lobbyists.[21] Through multiple simulations of AgendaSim, I compare resulting patterns to the number of organizations reporting lobbying activity across both specific issues and large policy domains. I find that simulated issue attention closely matches patterns in real-world policy advocacy when cue-taking occurs with high frequency.

Bandwagons and Issue Contagion in Policy Advocacy

In one of the first studies drawing on the public reporting of policy advocacy as mandated by the Lobbying Disclosure Act of 1995, Baumgartner and Leech (2001) document a "tremendous skewness" in the distribution of organized interests' lobbying across policy issues. Drawing a random sample of 137 issues selected from these lobbying disclosure reports, they find that five percent of all issues receive nearly half of all lobbying activity reported in 1996. Moreover, four issues were subject to lobbying by a massive number of organizations (over 500), while the median issue was of interest to

[21] As calculated and reported by the Center for Responsive Politics for 2014. Annual lobbying expenditure figures are available at https://www.opensecrets.org/lobby/.

just 15. Baumgartner and Leech (2001) describe this phenomenon—the highly skewed distribution of lobbying across issues—as evidence of both ‘issue niches’ and ‘policy bandwagons.’ These bandwagons in attention exist in stark contrast to the traditional notion of the issue niche where organizations seek out narrow, uncompetitive issues for strategic reasons (Browne 1990). In replicating Baumgartner and Leech’s (2001) distributional approach in the context of UK executive policymaking, Halpin (2011) analyzes 25 years of policy advocacy in public consultation procedures. He finds the same pattern of issue niches and bandwagons across policy areas and suggests it is a “common feature of policy systems” (206).

A recent, large-scale study of the structure of lobbying activity in Washington further confirms this skewed pattern. LaPira et al. (2014) utilize network analysis to map patterns in the advocacy of lobbyists across 79 policy domains specified by the Lobbying Disclosure Act between 1998 and 2008. As with Baumgartner and Leech (2001) and Halpin (2011), LaPira et al. (2014) find a striking separation between those niche issues that exist on the network’s “periphery” and bandwagon issues that account for its “core.” Policy domains like ‘Education,’ ‘Clean Air & Water,’ ‘Defense,’ and ‘Health’ are shown as empirically derived bandwagon, issues while ‘Homeland Security,’ ‘Banking,’ and ‘Telecommunications’ are representative of issue niches. Policy advocacy, as LaPira et al. (2014) claim, can not be described in terms of ‘average’ behavior, but is subject to two distinct worlds—one where diverse interests crowd around bandwagon issues and one where narrow interests attend to issues that are out of the public spotlight.

These studies all show clear, empirical differences between issues that receive the lion’s share of advocates’ attention and those that would typically be described as walled-off issue niches. Why might these patterns of develop over time? In their early study, Baumgartner and Leech (2001) point to a 'crowding effect' whereby attention begets more attention in a positive feedback cycle. Importantly, and as mentioned in the beginning pages of this dissertation, they describe how issues with similar scope or breadth can garner massively different levels of attention as a result of a "self-reinforcing process characterized by cue-taking and imitation" (Baumgartner and Leech 2001, 1206). Of course, however, organized interests have strong priorities in terms of those issues with which they focus their time, attention, and lobbying expenditures. Indeed, issue-specific organizations are part and parcel of Washington politics (e.g. organizations like the Americans for Marriage Equality or Americans for Tax Reform with narrow policy goals).

Yet Baumgartner and Leech (2001) illustrate a case where an organization that typically focuses its attention on individual issues, one at a time, was drawn into lobbying on energy issues. Not because it had a primary focus on energy policy, but due to the dynamics of the political environment. They explain that "when a major legislative reform takes shape, groups have no option but to become involved." Further elaborating on the interactive nature of advocacy, Baumgartner and Leech (2001) suggest that even privileged "business groups also are forced to act on some issues because the attention of others has focused there" (1204). Prior to their empirical work, Baumgartner and Leech (1998) discuss the interdependence associated with policy advocacy in their seminal assessment of the literature on organized interests. In describing the role of context and expectations in lobbying activity, they define the "social nature of lobbying" where "mimicry, cue-taking, and bandwagon effects" affect the issues on which lobbyists devote their attention. They write that "[Lobbyists] actions often will not be determined independently but in rapid response to commonly perceived threats and opportunities" as they engage in monitoring activity of each other and of those in government (Baumgartner and Leech 1998, 140; see also Carpenter et al. 2004).

This sentiment is strongly echoed in Baumgartner et al.'s (2009b) expansive study of policy change and lobbying, in which they describe how and why policy elites in Washington carefully monitor the behavior and issue-related activity of others. These expectations, they write, can manifest in 'social cascades': as specific proposals gain new interest and legislative vehicles arise, elites build expectations about and react to the activity of their peers in terms of how they allocate attention. Just as stability and change occurs in public budgeting and the attention of policymakers, Baumgartner et al. (2009b) suggest that a pattern of "all or nothing" occurs in the issue attention of policy advocates as cascades dictate the spread of attention. Here, issues that are 'moving' can emerge quickly as expectations and activity spread among stakeholders and are amplified as others are drawn into advocacy.

Most recently, in a sophisticated longitudinal analysis of the lobbying agenda related to retirement policy (e.g. the targeting of specific bills, as distinct from the agenda of Congress and the public), Scott (2013) explores this 'social process of lobbying.' Focusing on the dynamic patterns of network relationships among interest groups and the bills on which they invest lobbying resources, Scott (2013) finds support for the presence of social interdependence in lobbying activity. He shows that organized interests, and the lobbyists that they hire, exist with a 'social community' and that the skewed pattern of attention to issues described by Baumgartner and Leech (2001) is "a function of social processes" (611). Moreover, Scott (2013) concludes that "both a bandwagon process in which organizations choose bills that are already popular and a social influence process in which choices by a lobbying organization are likely influenced by another organization" are observable in the targeting of specific bills within the retirement policy domain (609).

In this chapter, I extend the arguments of these scholars and—with similar goals as Scott (2013)—explore the underlying mechanism of behavior that leads to the skewed nature of lobbying activity observed by Baumgartner and Leech (2001). Recall that my central proposition is that interdependence among policy elites facilitates cue-taking behavior, and that this cue-taking behavior generates issue contagion events. In the preceding chapter, granular data on the behavior of members of Congress allowed me to examine this proposition dynamically, but available data on lobbying restrict my analysis to the distribution of attention across issues visible at the end of any one reporting period as mandated by the Lobbying Disclosure Act of 1995 (e.g. recorded at the end of a filing quarter).

Importantly, I contend that my proposition naturally applies to the issue attention of policy advocates and that observed skewness in distributions of lobbying occur as a by-product of issue contagion events. When issue contagion events launch specific issues to the top of the lobbying agenda such that they dominate the focus of policy advocates (even for brief periods of time), any analysis of summary data will indicate skewness. Issues experiencing numerous or substantial issue contagion events would makeup the top of the distribution, while issues that routinely fell by the wayside would be located at the bottom. Using AgendaSim, it is possible to examine these causal links in detail and deduce whether cue-taking activity among organized interests (and the lobbyists they employ) generates patterns of skewness across issues.

APPLYING AGENDASIM TO LOBBYING ACTIVITY

Utilizing a similar approach as the previous chapter, I empirically validate my computational model by matching simulation results with indicators of the issue-specific lobbying activity of organized interests. I draw on two datasets: lobbying on a random sample of specific issues (e.g. 'Superfund' and 'Small Business Job Protection Act') compiled by Baumgartner and Leech (2001), and lobbying on the 79 policy domains identified by the Lobbying Disclosure Act (LDA) of 1995 (e.g. 'Transportation' and 'Health') compiled and released by the Center for Responsive Politics. While these two sources of data differ in the categorization of lobbying activity and their coverage over time, both are drawn from reports filed with the Senate Office of Public Records and are known to exhibit skewed distributions across issues.

Lobbying on a Random Sample of Issues, 1996

By selecting randomly among the issues that lobbyists mention in the open-ended response fields of LDA disclosure forms, Baumgartner and Leech (2001) provide an ideal dataset for empirical validation of AgendaSim. Activity is recorded by the self-reported "specific lobbying issues" on which lobbyists devote their time and energy and responses are not constrained to pre-determined categories. In Table 8, below, I list the top 15 most popular issues on which organizations lobbied the federal government in 1996 as originally compiled by Baumgartner and Leech (2001). I also calculate and report the total percentage of organizations associated with each issue. Of the 10,435 organizations reporting lobbying across their sample of 137 issues, the average issue received less than one percent of all attention. In contrast, these top 15 issues account for more than half (64.8 percent) of organizations' reported lobbying. The most frequently reported issue—'Omnibus Consolidated Appropriations'—garnered the attention of 17.1% of organization, which was followed by the 'Small Business Job Protection Act,' the

‘Budget Reconciliation Act,’ and ‘Defense Appropriations.’ Each of these issues were lobbied on by over 5 percent of organizations included in the Baumgartner and Leech (2001) sample.

While two of these popular issues correspond to far-reaching budget and appropriations bills that would naturally attract organizations with myriad policy interests, recall how Baumgartner et al. (2009b) suggest that legislative vehicles can become venues for social cascades among groups. When a vehicle or proposal is perceived to be ‘moving,’ organizations are prone to respond to their peers and engage in targeting issues beyond more narrowly defined issues. After the ‘Health Insurance Reform Act,’ which attracted 4.5 percent of lobbying organizations, a mix of departmental appropriations bills, transportation and telecommunications legislation, and particular topics (e.g. ‘Superfund’) account for the top 15 bandwagon issues as self-reported by registered lobbyists.

Table 8. Lobbying on 137 Randomly Selected Issues as Identified by Baumgartner and Leech (2001) (Top 15), 1996

Issue	% of Organizations
Omnibus Consolidated Appropriations	17.1
Small Business Job Protection Act	5.8
Budget Reconciliation Act	5.7
Defense appropriations	5.5
Health Insurance Reform Act	4.5
Transportation appropriations	3.4
Superfund	3.0
Energy and Water Development Approps. Act	3.0
Labor/HHS/Education appropriations	2.7
Immigration & refugees	2.6
Telecommunications Act	2.4
Dept. of Interior appropriations	2.4
Internal Revenue Code & tax issues	2.3
Department of Energy appropriations	2.3
Intermodal Surface Transportation Efficiency Act	2.1

Note: See Baumgartner and Leech (2001) for the full list of issues; percentages calculated by the author. Total of 10,435 organizations.

To apply AgendaSim to this indicator of real-world lobbying activity, I make a series of adjustments to the parameters of the model such that they approximate the activity measured by Baumgartner and Leech (2001). First, I set the number of agents in the model to its feasible maximum of 1000. Given limits in computing power, it is not immediately possible to represent the more than 10,000 organizations associated with federal lobbying in 1996 within my computational model; however, preliminary testing shows that there is no clear reason to suspect that the model would produce meaningfully different *patterns* in simulated activity as the number of agents increases beyond 1000. Next, as listed in Table 9, I set the number of issues that agents can potentially attend to in a given simulation run to match the 137 issues found in the Baumgartner and Leech (2001) dataset. Just as in the empirical validation of bill introductions and public statements by members of Congress in the preceding chapter, ensuring that the number of issue categories occurring in both simulated and real-world attention is the same allows for more precise comparisons—the general 'rules of the game' match between the two worlds.

Given that my central proposition suggests high levels of micro-level cue-taking behavior will generate patterns that approximate observed behavior, I set the cue-taking rate parameter in AgendaSim to 0.95. Under this setting, cue-taking occurs 95 percent of the time in situations where it is possible given the decision process of agents in the model. Without clear measures of coalition patterns or divisions among sub-groups in observed lobbying activity (as compared to partisanship in Congress), I also set the number of segments parameter to one such that all agents have equal probability of accepting cues from other actors in the simulations to follow. Last, I set the decay rate parameter to its default value and set the network degree parameter to 0.20. This produces a network of communication ties that is markedly less dense than among members of Congress and approximates those networks identified among organized interests as closely as possible given the random network tie formation underlying the model (see Box-Steffensmeier and Christenson 2012).

Table 9. Parameter Settings: Comparison of Simulated Patterns to Lobbying Activity with High Cue-taking, Sample of Issues in 1996

Parameter	Value
Num. of Agents	1000
Num. of Issues	137
Cue-taking Rate	0.95
Num. of Segments	1
Network Degree	0.20
Decay Rate	30
Runs	10

After making these adjustments, I run ten simulations of the AgendaSim model in order to account for natural variation associated with the randomized components of the model (e.g. the distribution of status across agents and the formation of dyadic ties between agents). During each run, the dynamics of issue attention are subject to a similar episodic patterns shown in the previous chapter as issue contagion events are present and occur with regularity. Given the summarized indicators of lobbying activity mentioned above, however, my focus in this chapter is on the distribution of attention at the conclusion of each simulation run. For comparison purposes, I calculate and the record the percentage of agents attending to each of the 137 possible issues at the conclusion every simulation run.

Figure 21 plots these results for each of the ten simulations as separately connected series (shown in red). Every marker represents one of the 137 possible issues and their position is indicative of the issues' sequential rank (in order of most popular to least, from right to left) as well as the percentage of agents focusing on the issue at the conclusion of a simulation. The general pattern is apparent—across all simulations with the parameter settings specified above, the majority of issues receive little (if any) attention while the majority of agents focus their attention on a small number of issues (about 15-20). Relative to the observed distribution of lobbying attention across issues documented by Baumgartner and Leech (2001) (shown in the Figure 21 as the larger, blue-colored series) these simulated patterns follow the same, curvilinear distribution across issues and "tremendous skewness" is visible in all cases.[22]

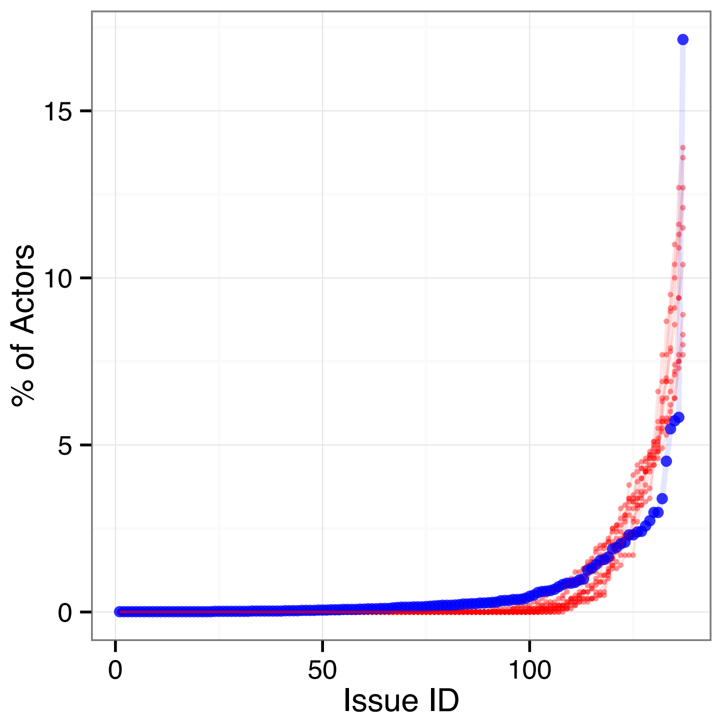

Figure 21: Empirical Validation: Comparison of Simulated Patterns to Lobbying Activity with High Cue-taking, Sample of Issues in 1996

While observed lobbying attention includes one very dominant issue that exceeds the highest percentage of all ten simulation runs (above 17 percent), each simulated series has an approximate maximum value of between 10 to 15 percent. The simulation results

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[22] Appendix A-3 provides the code for this simulation and empirical comparison, which uses the RNetLogo Package to programmatically interface with AgendaSim.

also experience a more evenly spaced decline in the percentages of attention across the distribution than real-world lobbying activity. This is as expected, however, since there is no difference in the 'scope' of simulated issues—unlike in the real-world, all issues have *identical* probability of initial selection at the beginning of every simulation run. The simulated series also confirm Baumgartner and Leech's (2001) conjecture that skewness can develop among issues with equal scope as a result of cue-taking behavior and provides evidence in support of my central proposition. In this case, I show how the issue attention of organizations (and the lobbyists advocating on their behalf) closely approximates the distribution of attention by simulated agents under high levels of cue-taking. It is possible, then, to deduce from this comparison that an underlying cue-taking mechanism is occurring among organized interests, that this cue-taking behavior produces issue contagion events, and that these events (over time) contribute to the skewed patterns visible in summary measures of lobbying activity.

To trust this deduction, however, we must explore the counterfactual scenario and ask: does a pattern of skewness occur in simulated lobbying activity when cue-taking and imitation occurs with lower (or minimal) probability? Fortunately, AgendaSim is designed such that counterfactual or alternative scenarios are easily considered. To answer this question, I conduct a second series of ten simulations using the same parameter settings as those presented above with only one major change. Shown in Table 10, I shift the setting of the cue-taking rate parameter from 0.95 (as in the previous simulations) to 0.05 such that simulated agents only engage in cue-taking behavior in five percent of all possible scenarios where cue-taking is a possible. This enables an apples to apples comparison of the extent to which cue-taking can be linked to observed outcomes in real-world policy advocacy.

Table 10. Counterfactual Parameter Settings: Comparison of Simulated Patterns to Lobbying Activity with Low Cue-taking, Sample of Issues in 1996

Parameter	Value
Num. of Agents	1000
Num. of Issues	137
Cue-taking Rate	0.05
Num. of Segments	1
Network Degree	0.20
Decay Rate	30
Runs	10

If the cue-taking rate parameter has no bearing on the resulting distribution of issue attention among simulated actors, then we should see the same shape and allocation of attention from the preceding simulations—one that closely matches the observed activity documented by Baumgartner and Leech (2001). In Figure 22, below, I plot the results from this second set of simulations: the percentage of simulated agents attending to one of 137 possible issues at the conclusion of ten simulation runs. The difference between the simulated series (shown in the overlapping set of red, connected markers) and the observed lobbying data (shown in the single blue series) is striking. While some issues do indeed garner increased levels of attention, no issue receives more than three percent of the overall attention by simulated agents. As the percentage of agents decreases, it does so in a nearly linear form such that the majority of issues receive a small portion of possible attention. This leads us to conclude that without the strong presence of cue-taking behavior, attention to specific issues occurs in a comparably even fashion such that a few issues do not dominate the focus of simulated actors (at least in the way I model attention dynamics) and my earlier deductive finding holds.

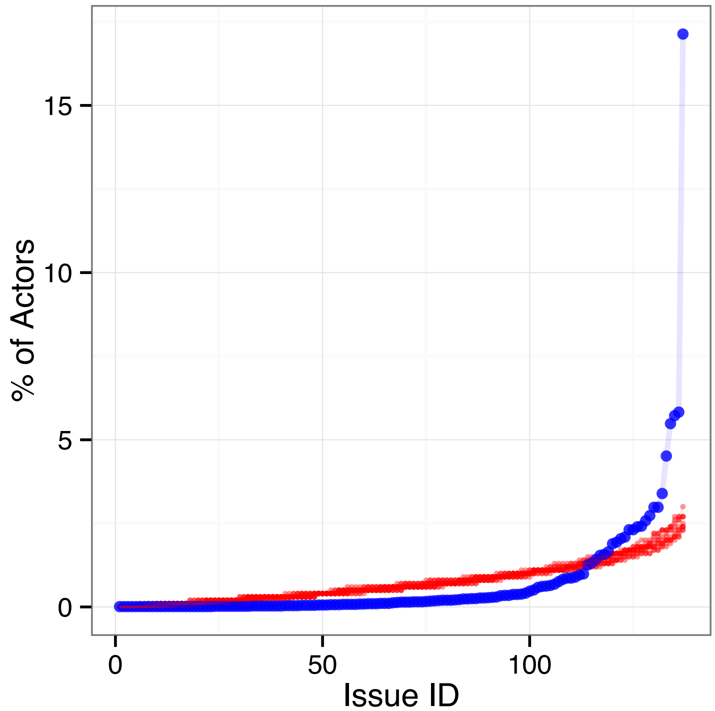

Figure 22: Counterfactual Application: Comparison of Simulated Patterns to Lobbying Activity with Low Cue-taking, Sample of Issues in 1996

Lobbying on LDA Policy Domains, 2012

Though the dataset of randomly selected issues identified and compiled by Baumgartner and Leech (2001) provides a unique empirical summary of the specific lobbying activity of organized interests in 1996, it is increasingly outdated given updated norms and requirements of LDA reporting. With the passage of the Honest Leadership and Open Government Act of 2008, rules associated with lobbying activity were updated to reflect more restrictive 'cooling off' periods, increased penalties for noncompliance, and more frequent reporting deadlines. As a result, I replicate my analysis above using the most recent and available summary data on lobbyists' activities in Washington. I draw on the lobbying data available in bulk from the Center for Responsive Politics who compile and clean (e.g. disambiguate the names of lobbyists and clients) raw reporting information released by the Senate Office of Public Records. These data provide a double-edged sword for analysis purposes: while comprehensive in coverage of lobbying activity reported in the second quarter of 2012, the policy-related content of activity is recorded according to the 79 domains listed on LDA forms. These categorizations are mandated by statute and do not reflect lobbyists' specific issue targeting; they capture only the general content of lobbying activity. They also suffer from curious overlap (e.g. there are separate topics for 'Health Issues,' 'Medicare and Medicaid,' 'Pharmacy,' and 'Medical Research and Clinical Labs' which creates some degree of known measurement error when looking across the domains). Using these data, I calculate the percentage of lobbying clients (i.e. organized interests) associated with each of the 79 policy domains and report the twenty most popular domains in Table 11.

Of the 22,335 total clients listed in lobbying disclosure forms filed in the second quarter of 2012, which include lobbying that occurred in months of April through June of that year, 12.1 percent focused their attention on the "Federal Budget & Appropriations" domain while another 7.3 percent lobbied on tax issues. As with the lobbying activity observed by Baumgartner and Leech (2001), the most dominant LDA policy areas are those with seemingly broad scope such that organized interests with myriad policy goals might find them attractive. I contend, however, that the appropriations process and tax code provide legislative and policy vehicles prone to the cascades in activity described by Baumgartner and Leech (2001)—as more interests target general appropriations and tax bills, others may respond in kind in order to secure (or protect) their interests in a self-reinforcing process. After these two popular policy areas, 'Health Issues,' 'Transportation,' 'Defense,' and 'Energy & Nuclear Power' each received attention by over four percent of all active clients. The percentage of organized interests associated with lobbying activity on the remaining issues decreases steadily thereafter, with the 20th most popular policy area, 'Telecommunications,' associated with just 1.3 of all clients. Just as with lobbying on specific issues, lobbying across LDA policy domains follows a severely skewed pattern: a small minority of popular issues account for the lobbying of the majority of clients.

Table 11. Lobbying on Lobbying Disclosure Act Policy Domains (Top 20), 2nd Quarter Filing Period 2012

Issue	% Clients
Federal Budget & Appropriations	12.1
Taxes	7.3
Health Issues	6.6
Transportation	4.8
Defense	4.6
Energy & Nuclear Power	4.4
Environment & Superfund	3.3
Medicare & Medicaid	3.2
Trade	3.0
Education	3.0
Agriculture	2.8
Homeland Security	2.4
Finance	2.2
Natural Resources	2.2
Labor, Antitrust & Workplace	1.9
Government Issues	1.9
Clean Air & Water	1.7
Banking	1.4
Science & Technology	1.3
Telecommunications	1.3

Note: Total of 22,335 clients.

To empirically apply AgendaSim to these observed patterns in lobbying activity, I run ten simulations with similar parameter settings to the first application described above. Again, and as listed in Table 12, I set the number of agents to the highest feasible value (1000) given available computing resources. I also set the cue-taking rate parameter to 0.95 such that cue-taking occurs among agents at a high level (e.g. in 95 percent of possible circumstances), the network degree parameter to 0.20 as to approximate real-world network ties among organized interests, and the number of segments to one such that all agents have similar propensity to take cues from one another. Last, in order to make valid comparisons to lobbying recorded according to LDA policy domains, I set the number of possible issues that agents may attend to at 79.

Table 12. Parameter Settings: Comparison of Simulated Patterns to Lobbying Activity with High Cue-taking, Sample of Issues in 1996.

Parameter	Value
Num. of Agents	1000
Num. of Issues	137
Cue-taking Rate	0.95
Num. of Segments	1
Network Degree	0.20
Decay Rate	30
Runs	10

Figure 23, below, plots the results of these ten simulation runs recorded as the percentage of simulated agents attending to individual policy domains at the conclusion of each run. These series (shown separately, in red) include markers for all 79 LDA policy domains and are listed (from right to left) in rank order of popularity. Across simulation runs, the issue receiving the highest level of attention garnered between 15.1 percent and 9.2 percent of all simulated actors, while the majority of issues receive minimal (if any) attention. In comparison to observed lobbying activity (indicated by larger markers, in blue), the simulated distribution of activity across issues closely follows the same general shape and exhibits visibly high levels of skewness. Both observed and simulated patterns of attention, given 79 possible issue areas, indicate the presence of both bandwagons and issue niches—a few areas dominate the agenda, while most issues fall outside the spotlight.

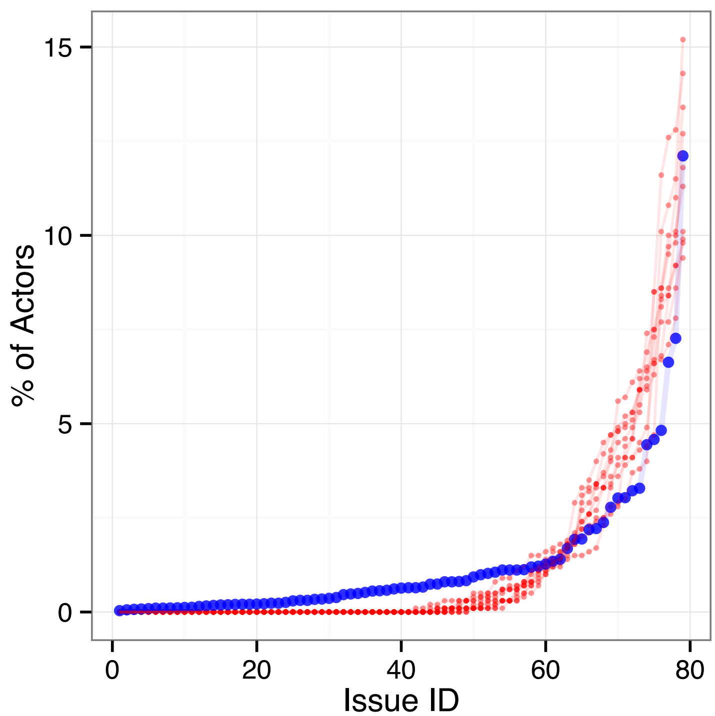

Figure 23: Empirical Validation: Comparison of Simulated Patterns to Lobbying Activity with High Cue-taking, LDA Policy Domains in 2012.

These distributions are not identical in all respects, of course, as observed lobbying experiences a more dramatic decline in percentages among the top 20 most popular policy areas and the 59 remaining areas garner steadily decreasing levels of attention. Yet, both distributions exhibit the same degree of "tremendous skewness" first documented by Baumgartner and Leech (2001) and follow a curvilinear form. These results further support the inference that cue-taking behavior associated issue contagion events may contribute to the skewed distribution found in lobbying behavior when examined across policy issues and summarized in lobbying disclosure reports. To rule out the counterfactual argument that these skewed distributions of issue attention can occur in settings without high levels of cue-taking, I run ten additional simulations of my model. Listed in Table 13, I maintain the same parameter settings as above—with 79 possible issue areas and 1000 simulated agents—and make a major adjustment to the cue-taking rate parameter. I decrease the probabilistic frequency with which agents take cues from their peers within a given simulation run, from 0.95 to 0.05, such that cue-taking occurs in just five percent of all possible instances.

Table 13. Counterfactual Parameter Settings: Comparison of Simulated Patterns to Lobbying Activity with Low Cue-taking, LDA Policy Domains in 2012.

Parameter	Value
Num. of Agents	1000
Num. of Issues	79
Cue-taking Rate	0.05
Num. of Segments	1
Network Degree	0.20
Decay Rate	30
Runs	10

Given these parameter settings, the results of ten simulation runs indicate no support for the counterfactual claim. As illustrated in Figure 24, the most popular policy area garners approximately three percent of simulated agents, on average. This percentage declines steadily, in nearly linear fashion from three percent to minimal levels across the range of policy areas. In comparison to observed lobbying activity, the differences between the simulated distribution are visibly apparent: bandwagons and issue niches exist in the real-world distribution of attention, yet simulated issue attention yields a flatter, more even distribution across policy areas. Simply, without high levels of cue-taking, simulated lobbying activity does not meaningfully approximate observed patterns.

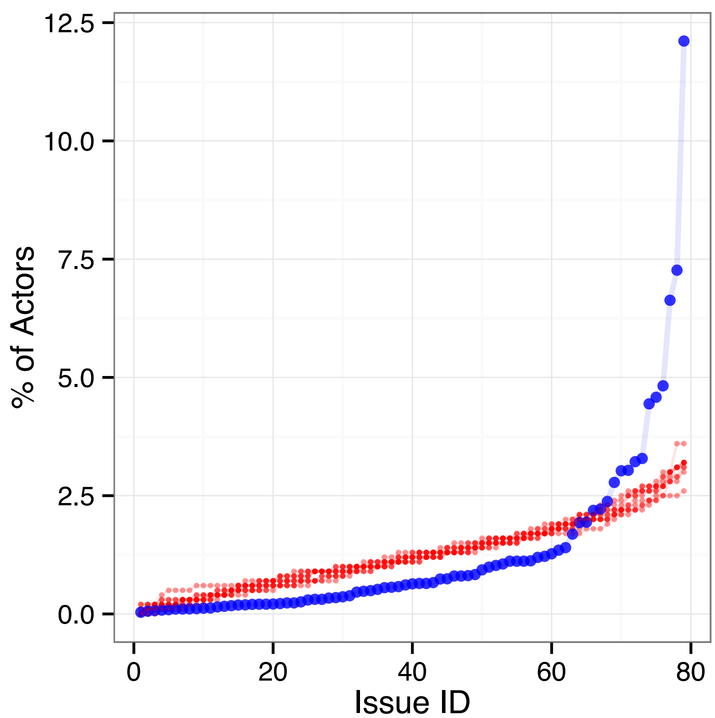

Figure 24 Counterfactual Application: Comparison of Simulated Patterns to Lobbying Activity with Low Cue-taking, LDA Policy Domains in 2012

CONCLUSION

This chapter extends the empirical application of my computational model to the issue-specific lobbying activity of organized interests. In doing so, I examine how the decision-making tendencies of the thousands of organizations and the lobbyists they employ in Washington can contribute to the skewed distribution of the lobbying agenda documented by Baumgartner and Leech (2001) and others. Skewness in the allocation of attention, I suggest, results from interdependence and the 'social nature of lobbying' as policy advocates closely monitor and react to the activity of their peers. This monitoring and communication facilitate cue-taking behavior that produces the same dynamic patterns of issue contagion events described in Chapter 4. The presence of these events, which move issues into (and out of) the spotlight of collective attention, then generate the feast or famine distribution of lobbying across issues found when analyzing summaries of activity provided by LDA disclosure forms.

In tracing the causal links between micro-level behavior and macro-level outcomes, the simulation analysis presented in this chapter offers support for the deductive finding that high levels of cue-taking behavior occur among networks of lobbyists and their organizational clients. By matching simulated patterns with real-world indicators of lobbying activity—both at the level of randomly selected specific issues and the 79 policy domains of the LDA—I show that similarly skewed patterns occur only when cue-taking occurs in nearly all possible instances (i.e. 95 percent of the time). These results indicate how a mechanism akin to the "social cascades" mentioned by Baumgartner et al. (2009) can dramatically affect resulting distributions of activity within simulations of my model. Lobbying behavior is, as this analysis suggests, subject to the interactive and self-reinforcing behavior of cue-taking among policy advocates.

Chapter 6: Conclusion

In this dissertation, I broadly explore why policy elites (e.g. members of Congress or lobbyists) focus on some issues and ignore others. I begin with the premise that these elites exist within a complex system and are highly interdependent actors. I make the argument that as they watch, monitor, and anticipate the activities of their peers, individual policy elites frequently engage in cue-taking behavior as they decide which of the many pressing issues on which to focus their limited attention. I then propose that this behavior of cue-taking contributes to the observed and well-documented 'stick-slip' patterns in policymaking activity. Leveraging the methods of computational social science to explore this claim, I develop a novel agent-based simulation model of issue attention dynamics—AgendaSim—that is generalizable to many policymaking scenarios and types of policy elites. I continue by conducting an experimental analysis of simulated 'policymaking worlds,' to examine the extent to which cue-taking contributes to large-scale shifts in collective attention or, as I label them, 'issue contagion events.' These events—when the spotlight of elite attention focuses on a particular policy issue—are important because they are known to coincide with significant changes in public policy such as the destruction of deeply entrenched policy monopolies.

The results of my simulation tests, shown in Chapter Three, reveal the functional forms of relationships between key parameters in my model and simulated patterns in issue attention. First, I show that as the level of cue-taking among simulated agents increases, a higher frequency of issue contagion events occur. This result provides support for my central proposition and illustrates a direct-link between individual decision-making and patterns in aggregate activity. I also show that as the density of the communication network among simulated agents increases (e.g. the presence of more pathways for interaction among individuals) so, too, does the frequency of issue contagion events. Last, I confirm expectations drawn from the policy process and network literature, and show that the division of agents into an increasing number of sub-groups (e.g. political parties or coalitions) reduces the prevalence of issue contagion events.

In order to empirically test my model, such that these experimental results can be validated, I apply AgendaSim to the issue-specific activity of both members of Congress and lobbyists. I first draw on an expansive dataset released by the Congressional Bills Project that categorizes all bills introduced in Congress since 1945 according to policy content. In comparing observed patterns in bill introductions to those resulting from simulated 'Congresses,' I show that AgendaSim produces results that closely approximate real-world activity when cue-taking behavior occurs with regularity among simulated agents. This similarity exists both at the level of large policy domains (e.g. 'Health,' 'Defense,' and 'Energy') and more narrowly defined topics (e.g. 'Tariffs and Import Regulation,' 'Oil and Gas,' and 'Air Pollution'). Just as members of Congress are known to engage in cue-taking in order to make voting decisions, these results suggest that similar behavior affects how they choose to allocate their attention to specific issues over time.

Next, I apply my model to the disclosed lobbying of policy advocates in Washington as made publicly available through the reporting requirements of the Lobbying Disclosure Act of 1995. In comparing the activity of simulated 'policy advocates' with observed lobbying behavior, I show that the aggregate patterns produced by AgendaSim closely approximate real-world activity when cue-taking occurs at very high levels. Just as scholars of organized interests allude, I show how cue-taking and imitation among individual policy advocates can produce patterns of 'tremendous skewness' in resulting distributions of issue attention: some issues garner the lion's share of attention (e.g. bandwagons) while others remain in obscurity (e.g. issue niches). In this analysis, as well as my application to bill introductions, I study the counterfactual case where minimal (or very low) cue-taking occurs among simulated agents. Under simulations when cue-taking is set to the lowest possible value, the patterns produced by AgendaSim do not approximate real-world activity in comparisons to bill introductions or lobbying activity.

CONTRIBUTION

The major contribution of this dissertation is two-fold. First, I develop a new tool for the study of issue attention dynamics that is transparent, generalizable, flexible, and applicable to many different types of policy elites. As with Gulati et al.'s (2010) simulation model of voter response to campaigns, scholars of agenda-setting and the policy process can draw on AgendaSim as a platform for the exploration of decision-making in alternative settings with minimal customization. The most promising application lies in the comparative application of my model to observed patterns in issue attention across institutional venues. In a process of application and comparison to different settings (e.g. across legislatures of the US states each with different levels of professionalization) one could deduce the underlying tendency of decision-makers to engage in cue-taking behavior as a function of institutional characteristics.

Second, I provide what is the first explicit analysis of the link between individual decision-making and macro-level activity in the study of how governments prioritize different issues. In responding to the call of Jones and Baumgartner (2012) as well as building on the foundation of work generated by these scholars and their colleagues, I link the ideas of social contagion, complexity, and interdependence with the study of the policy process and agenda-setting. Using the new tools of computational social science, I provide a fully-specified model of issue attention that is theoretically motivated and can be validated in different real-world scenarios. In showing how my purposefully simply model—which includes cue-taking as a key parameter—can generate patterns that approximate observed activity, I also move the literature beyond speculation and towards an empirical understanding of underlying mechanisms associated with human decision-making. As the literature surrounding Punctuated Equilibrium Theory continues to grow, it is increasingly important that we do not leave the theory's roots in the bounded rationality micro-foundation behind in the pursuit of further empirical study of aggregate patterns. For reasons I discuss in Chapter Three, analysis of these underlying mechanisms of decision-making is difficult, but this dissertation aims to begin a new line of inquiry into individual-level behavior.

In addition, I attempt to reconcile the disparate ways in which scholars of the policy process, agenda-setting, Congress, and organized interests discuss self-reinforcing processes. Though theorizing about individual-level behavior takes many forms (e.g. from bandwagons and herds to cascades and positive feedback), my discussion and labeling of 'issue contagion events' attempts to provide a new, unambiguous way to talk about a specific causal sequence. How I define issue contagion events considers them as a class of 'punctuations' or 'bursts' (e.g. outcomes) resulting only from cue-taking behavior among policy elites (e.g. a certain type of behavior occurring among individuals). I do not seek to add another concept to the long list of terms describing self-reinforcing processes, but instead hope to clarify *one* causal link between micro-level behavior and macro-level outcomes.

EXTENSIONS AND ADDITIONAL CONSIDERATIONS

My computational model of issue attention dynamics is designed to be as simple as possible such that causal linkages between micro-level behavior and aggregate patterns can be explored. However, this simplicity comes at the cost of nuance and detail in creating the specification of the model. A number of extensions and revisions are possible that will increase the strength of my claim about cue-taking behavior as well as add increased face validity for future applications to observed patterns. These include, the addition of a parameter and decision process associated with exogenous events, the provision of a major actor (e.g. a President or Prime Minister) that garners a specific level of visibility among agents, the provision of multiple agent classes (e.g. interaction *between* lobbyists and members of Congress), the inclusion of an exogenous stream of incoming information, and the testing of alternative decision rules.

As I briefly discussed in Chapter Two, issue contagion events describe only those bursts in attention that are generated from cue-taking behavior among agents and not those that result from simultaneous reaction to the same stimuli (e.g. a major international crisis such as an earthquake). By specifying the occurrence of these type of events as an independent parameter within AgendaSim, it will be possible to make comparisons to observed behavior while controlling for a known number of large-scale events that may impact patterns in policymakers' attention. Experimental analysis could also be undertaken to examine how changing the ratio of event-driven responses relative to endogenous cue-taking behavior shapes resulting patterns in simulated activity. Arbitrating between the specific roles of both event-driven and cue-taking driven bursts in attention is crucial in building further empirical support for the central proposition of this dissertation.

Next, it is well known that the US President has a privileged agenda-setting power (Rutledge and Larsen-Price 2014) and that potential influence varies according to context (e.g. popularity, see Lovett et al. 2015). Presently, AgendaSim's allocation of status among agents does provide a small number of agents with very high levels of influence relative to their peers, but there is no provision for the presence of a unique and highly visible actor. Moreover, the model supports the study of interaction and communication among only a single class of policy elites (e.g. members of Congress or lobbyists) at a time and does not attempt to model the impact of cue-taking behavior or influence *between* them. These two limitations—which occur due to my focus on explicitly examining the causal links between cue-taking and patterns in issue attention—can be addressed simultaneously with the provision of multiple actor types and varying decision rules associated with interaction among types. For example, to represent a President in the model, one actor could be allocated an extraordinary level of status, connected to all other actors in the model, and be granted special cue-giving privileges. Such additions complicate the detection of causality, but would improve the face validity and breadth of the overall model.

Third, and as I outline in Chapter Three, AgendaSim randomly assigns every simulated agent a 'preferred issue' at the start of a simulation. It does not change over time and agents' attention is purposefully drawn back to this issue as simulations progress. This design reduces the policy environment to a static representation of agent priorities at the start of each simulation run, yet much effort has been devoted to studying the 'input stream' of policy problems and issues facing decision-makers (Jones and Baumgartner 2005; Epp 2015). A potential improvement to AgendaSim might involve the provision of an input stream to simulate changes in real-world policy problems over time. Agent decision rules could then be adjusted to account for shifts in problems demanding their attention *in addition to* considering the behavior of their peers.

Last, my analysis of counterfactual claims in Chapters Four and Five seeks to examine how alternative specifications of my model affect resulting patterns in simulated issue attention and comparisons to observed activity. By limiting the rate of cue-taking among simulated agents to extremely low values, it is possible to determine that (in the absence of cue-taking) AgendaSim produces results that have no meaningful alignment with real-world patterns. Since the programming of the model only provides for variation in decision-making within the range of the cue-taking parameter, further tests are constrained and it is not yet possible to consider alternative decision-making procedures. To increase the plausibility of my claims, it is feasible to include more nuanced mechanisms of behavior as parameterized options within AgendaSim. One could then analyze how specific configurations of decision-making procedures affect patterns in aggregate behavior: for example, agents could be programmed such that they focus on individual priorities 40 percent of the time, respond to opponents 20 percent of the time, take cues from party leaders 65 percent of the time, respond to a major actor 50 percent of the time, and respond to events 95 percent of the time. Testing the impact of various configurations like these would support a more comprehensive analysis of cue-taking as a mechanism of behavior relative to the known and alternative considerations policy elites face in choosing which issues to attend to and which to ignore.

Appendices

A-1. Code of AgendaSim Model in Netlogo

```
;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
;;Herschel F. Thomas III
;;UT-Austin, Dept. of Government
;;AgendaSim Model (v.2.9)
;;To run in Netlogo, original .nlogo file is required
;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;

;;;;; SET-UP ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
extensions [array]
turtles-own [segment status issue preferredIssue]
globals [issuePctChangesArray contagionCount segmentsNum interactionCounter clusteringCoef node-clustering-coefficient leadSwitches nEntropy sumIssuePropLnProps issuePropLnProp issuePropsT issueentropy tempRand tempRand2 tempRand3 tempRand4 tempRand5 tempRand6 decaySwitches popularIssueSwitches kNumerator kDenominator kurtosis issuePctChanges ipcMean issuePctChangesSd pctChangeIndex issuePctsTMinusOne issuePctsTimeT statusMu goCounter decayCounter similarityMuDiff counter numRuns mostPopularIssue tempMostPopularIssue maxIssueCount issueCounts issueCountsTList popularCounter switchCounter interactLoopsCounter]

to setup
ca
set leadSwitches 0
set numRuns 0
set statusMu 30
set similaritySd 2
set popularCounter 0
set decayCounter 0
set pctChangeIndex 0
set decaySwitches 0
set popularIssueSwitches 0
set shockCount 0
set issueCounts array:from-list n-values 225 [0]
set issuePctsTMinusOne array:from-list n-values 225 [0]
set issuePctsTimeT array:from-list n-values 225 [0]
set issuePctChanges []
set issuePctChangesArray []
set issuePropLnProp []
set issuePropsT []
set nEntropy 0
set similarityMu1 0
set similarityMu2 0
set switchCounter 0
set contagionCount 0
setup-patches
setup-turtles
updatePlots
reset-ticks
end
```

```
to setup-patches
ask patches [
set pcolor white
]
end

;;;;; SET-UP AGENTS AND NETWORK ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
to setup-turtles
crt numAgents
;;Network set-up from Wilensky (2008)
[
setxy (random-xcor * 0.95) (random-ycor * 0.95)
]

let num-links (numAgents * averageDegree * numAgents) / 2
while [count links < num-links ]
[
ask one-of turtles
[
let choice (min-one-of (other turtles with [not link-neighbor? myself])
[distance myself])
if choice != nobody [ create-link-with choice ]
]]
calculateClusteringCoef
repeat 10
[
layout-spring turtles links 0.1 (world-width / (sqrt numAgents)) 1
]

ask turtles [
ifelse (statusFromNetworkDegree?)[
set status (count my-links)
]
[
set status (exp random-normal 0 .75)
]
setIssue
setPreferredIssue
set issue PreferredIssue
setInterests
let randsegment random (numsegments)
if (randsegment = 0) [
set segment 1
set shape "circle"
]
if (randsegment = 1) [
set segment 2
set shape "triangle"
]
if (randsegment = 2) [
set segment 3
```

```
set shape "square"
]
if (randsegment = 3) [
set segment 4
set shape "pentagon"
]
if (randsegment = 4) [
set segment 5
set shape "star"
]
if (randsegment = 5) [
set segment 6
set shape "x"
]
if (randsegment = 6) [
set segment 7
set shape "default"
]
if (randsegment = 7) [
set segment 8
set shape "target"
]
if (randsegment = 8) [
set segment 9
set shape "circle 2"
]
if (randsegment = 9) [
set segment 10
set shape "square 2"
]
if (randsegment = 10) [
set segment 11
set shape "triangle 2"
]
if (randsegment = 11) [
set segment 12
set shape "wheel"
]
set size ((status) / (sizeWeight))
changeColor
]
end

to-report in-neighborhood? [ hood ]
report ( member? end1 hood and member? end2 hood )
end

to calculateClusteringCoef
ifelse all? turtles [count link-neighbors <= 1]
[
set clusteringCoef 0
]
```

```
[
let total 0
ask turtles with [ count link-neighbors <= 1]
[ set node-clustering-coefficient "undefined" ]
ask turtles with [ count link-neighbors > 1]
[
let hood link-neighbors
set node-clustering-coefficient (2 * count links with [ in-neighborhood? hood ] /
((count hood) * (count hood - 1)))
set total total + node-clustering-coefficient
]
set clusteringCoef total / count turtles with [count link-neighbors > 1]
]
end

;;;;; GO SEQUENCES ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
to go
calculatePctChangesOld
calculatePctChangesNew
set contagionCount 0
updatePlots
interact
setMostPopularIssue
clear-output
output-print issuePctChanges
set numRuns numRuns + 1
end

to go12
set goCounter 0
loop [
go
set goCounter goCounter + 1
if (goCounter >= 12) [ stop ]
]
end

to go200
set goCounter 0
loop [
go
set goCounter goCounter + 1
if (goCounter >= 200) [ stop ]
]
end

to goOnce
set goCounter 0
loop [
go
set goCounter goCounter + 1
if (goCounter >= 1) [ stop ]
```

```
]
end

;;;;; SET AGENT PREFERRED ISSUE ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
to setPreferredIssue
if (inputDist = "uniform") [
 set preferredIssue (round (random numIssues) + 1)
 ]
if (inputDist = "normal") [
set preferredIssue (round (random-normal (numIssues / 2) (numIssues / 10))) + 1
]
end

;;;;; MOST POPULAR ISSUE ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
to setMostPopularIssue
foreach [0  1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24  25  26  27  28  29
30  31  32  33  34  35  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52  53  54  55  56  57  58
59  60  61  62  63  64  65  66  67  68  69  70  71  72  73  74  75  76  77  78  79  80  81  82  83  84  85  86  87
88  89  90  91  92  93  94  95  96  97  98  99  100  101  102  103  104  105  106  107  108  109  110  111
112  113  114  115  116  117  118  119  120  121  122  123  124  125  126  127  128  129  130  131  132
133  134  135  136  137  138  139  140  141  142  143  144  145  146  147  148  149  150  151  152  153
154  155  156  157  158  159  160  161  162  163  164  165  166  167  168  169  170  171  172  173  174
175  176  177  178  179  180  181  182  183  184  185  186  187  188  189  190  191  192  193  194  195
196  197  198  199  200  201  202  203  204  205  206  207  208  209  210  211  212  213  214  215  216
217  218  219  220  221  222  223  224] [
array:set issueCounts ? (count turtles with [issue = (? + 1)])
]

set maxIssueCount 0
foreach [0  1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24  25  26  27  28  29
30  31  32  33  34  35  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52  53  54  55  56  57  58
59  60  61  62  63  64  65  66  67  68  69  70  71  72  73  74  75  76  77  78  79  80  81  82  83  84  85  86  87
88  89  90  91  92  93  94  95  96  97  98  99  100  101  102  103  104  105  106  107  108  109  110  111
112  113  114  115  116  117  118  119  120  121  122  123  124  125  126  127  128  129  130  131  132
133  134  135  136  137  138  139  140  141  142  143  144  145  146  147  148  149  150  151  152  153
154  155  156  157  158  159  160  161  162  163  164  165  166  167  168  169  170  171  172  173  174
175  176  177  178  179  180  181  182  183  184  185  186  187  188  189  190  191  192  193  194  195
196  197  198  199  200  201  202  203  204  205  206  207  208  209  210  211  212  213  214  215  216
217  218  219  220  221  222  223  224] [

if (array:item issueCounts ? > maxIssueCount) [
set maxIssueCount array:item issueCounts ?
set tempMostPopularIssue (? + 1)
]]

ifelse (tempMostPopularIssue = MostPopularIssue) [
set popularCounter popularCounter + 1
]
[
set MostPopularIssue tempMostPopularIssue
set leadSwitches leadSwitches + 1
]
```

```
end

;;;;; INTERACTION SEQUENCE ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
to interact
set interactLoopsCounter 0
while [interactLoopsCounter <= interactLoops] [
ask turtles [
let turtleStatus status
let turtleIssue issue
let turtlesegment segment

if (any? link-neighbors) [
ask one-of link-neighbors [
set interactionCounter interactionCounter + 1
ifelse (turtlesegment = segment) [
if (turtleStatus > status) [
let randomSwitch random-float 1
if (randomSwitch <= imitationRate) [
set issue turtleIssue
set switchCounter switchCounter + 1
]]]
[
if (turtleStatus > status) [
let randomSwitch random-float 1
if (randomSwitch <= imitationRate / 3) [
set issue turtleIssue
set switchCounter switchCounter + 1
]]]]]

if (decayRatePer1000 > 0)  [
if (turtleIssue = mostPopularIssue) [
let randDecay random-float 1
if (randDecay <= (decayRatePer1000 / 1000)) [
set issue preferredIssue
set decaySwitches decaySwitches + 1
]]]

changeColor
]
set interactLoopsCounter interactLoopsCounter + 1
]
end

;;;;; COLORS ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
to changeColor
ifelse (issue <= 13) [
set color (issue * 10) + 5  ]
[ ifelse (issue <= 26) [
set color (((issue - 13) * 10) + 6)  ]
[if (issue > 26) [
set color (((issue - 26) * 10) + 7)  ]]]
end
```

```
;;;;; PCT CHANGES ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
to calculatePctChangesOld
foreach n-values numIssues [?] [
if (numRuns >= 0) [
array:set issuePctsTMinusOne ? (array:item issuePctsTimeT ?)
]
]
end
to calculatePctChangesNew
foreach n-values numIssues [?] [
if (numRuns >= 1) [
array:set issuePctsTimeT ? ((count turtles with [issue = (? + 1)] / numAgents) * 100)
if (array:item issuePctsTMinusOne ? != 0) [
if (array:item issuePctsTimeT ? != 0) [
set issuePctChanges lput (( ((array:item issuePctsTimeT ?) - (array:item issuePctsTMinusOne ?)) / (array:item issuePctsTMinusOne ?) ) * 100) issuePctChanges
]]]]
end

;;;;; UPDATE PLOTS ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
to updatePlots
set-current-plot "Status"
set-current-plot-pen "default"
histogram [status] of turtles
set-current-plot "A. Attention to Issues"
;plots first 40 issues only
if (numIssues >= 1) [
if (count turtles with [issue = 1] >= 0) [
set-current-plot-pen "issue1"
plot count turtles with [issue = 1]
]]
if (numIssues >= 2) [
if (count turtles with [issue = 2] >= 0) [
set-current-plot-pen "issue2"
plot count turtles with [issue = 2]
]]
if (numIssues >= 3) [
if (count turtles with [issue = 3] >= 0) [
set-current-plot-pen "issue3"
plot count turtles with [issue = 3]
]]
if (numIssues >= 4) [
if (count turtles with [issue = 4] >= 0) [
set-current-plot-pen "issue4"
plot count turtles with [issue = 4]
]]
if (numIssues >= 5) [
if (count turtles with [issue = 5] >= 0) [
set-current-plot-pen "issue5"
plot count turtles with [issue = 5]
]]
```

```
if (numIssues >= 6) [
if (count turtles with [issue = 6] >= 0) [
set-current-plot-pen "issue6"
plot count turtles with [issue = 6]
]]
if (numIssues >= 7) [
if (count turtles with [issue = 7] >= 0) [
set-current-plot-pen "issue7"
plot count turtles with [issue = 7]
]]
if (numIssues >= 8) [
if (count turtles with [issue = 8] >= 0) [
set-current-plot-pen "issue8"
plot count turtles with [issue = 8]
]]
if (numIssues >= 9) [
if (count turtles with [issue = 9] >= 0) [
set-current-plot-pen "issue9"
plot count turtles with [issue = 9]
]]
if (numIssues >= 10) [
if (count turtles with [issue = 10] >= 0) [
set-current-plot-pen "issue10"
plot count turtles with [issue = 10]
]]
if (numIssues >= 11) [
if (count turtles with [issue = 11] >= 0) [
set-current-plot-pen "issue11"
plot count turtles with [issue = 11]
]]
if (numIssues >= 12) [
if (count turtles with [issue = 12] >= 0) [
set-current-plot-pen "issue12"
plot count turtles with [issue = 12]
]]
if (numIssues >= 13) [
if (count turtles with [issue = 13] >= 0) [
set-current-plot-pen "issue13"
plot count turtles with [issue = 13]
]]
if (numIssues >= 14) [
if (count turtles with [issue = 14] >= 0) [
set-current-plot-pen "issue14"
plot count turtles with [issue = 14]
]]
if (numIssues >= 15) [
if (count turtles with [issue = 15] >= 0) [
set-current-plot-pen "issue15"
plot count turtles with [issue = 15]
]]
if (numIssues >= 16) [
if (count turtles with [issue = 16] >= 0) [
```

```
set-current-plot-pen "issue16"
plot count turtles with [issue = 16]
]]
if (numIssues >= 17) [
if (count turtles with [issue = 17] >= 0) [
set-current-plot-pen "issue17"
plot count turtles with [issue = 17]
]]
if (numIssues >= 18) [
if (count turtles with [issue = 18] >= 0) [
set-current-plot-pen "issue18"
plot count turtles with [issue = 18]
]]
if (numIssues >= 19) [
if (count turtles with [issue = 19] >= 0) [
set-current-plot-pen "issue19"
plot count turtles with [issue = 19]
]]
if (numIssues >= 20) [
if (count turtles with [issue = 20] >= 0) [
set-current-plot-pen "issue20"
plot count turtles with [issue = 20]
]]
if (numIssues >= 21) [
if (count turtles with [issue = 21] >= 0) [
set-current-plot-pen "issue21"
plot count turtles with [issue = 21]
]]
if (numIssues >= 22) [
if (count turtles with [issue = 22] >= 0) [
set-current-plot-pen "issue22"
plot count turtles with [issue = 22]
]]
if (numIssues >= 23) [
if (count turtles with [issue = 23] >= 0) [
set-current-plot-pen "issue23"
plot count turtles with [issue = 23]
]]
if (numIssues >= 24) [
if (count turtles with [issue = 24] >= 0) [
set-current-plot-pen "issue24"
plot count turtles with [issue = 24]
]]
if (numIssues >= 25) [
if (count turtles with [issue = 25] >= 0) [
set-current-plot-pen "issue25"
plot count turtles with [issue = 25]
]]
if (numIssues >= 26) [
if (count turtles with [issue = 26] >= 0) [
set-current-plot-pen "issue26"
plot count turtles with [issue = 26]
```

```
]]
if (numIssues >= 27) [
if (count turtles with [issue = 27] >= 0) [
set-current-plot-pen "issue27"
plot count turtles with [issue = 27]
]]
if (numIssues >= 28) [
if (count turtles with [issue = 28] >= 0) [
set-current-plot-pen "issue28"
plot count turtles with [issue = 28]
]]
if (numIssues >= 29) [
if (count turtles with [issue = 29] >= 0) [
set-current-plot-pen "issue29"
plot count turtles with [issue = 29]
]]
if (numIssues >= 30) [
if (count turtles with [issue = 30] >= 0) [
set-current-plot-pen "issue30"
plot count turtles with [issue = 30]
]]
if (numIssues >= 31) [
if (count turtles with [issue = 31] >= 0) [
set-current-plot-pen "issue31"
plot count turtles with [issue = 31]
]]
if (numIssues >= 32) [
if (count turtles with [issue = 32] >= 0) [
set-current-plot-pen "issue32"
plot count turtles with [issue = 32]
]]
if (numIssues >= 33) [
if (count turtles with [issue = 33] >= 0) [
set-current-plot-pen "issue33"
plot count turtles with [issue = 33]
]]
if (numIssues >= 34) [
if (count turtles with [issue = 34] >= 0) [
set-current-plot-pen "issue34"
plot count turtles with [issue = 34]
]]
if (numIssues >= 35) [
if (count turtles with [issue = 35] >= 0) [
set-current-plot-pen "issue35"
plot count turtles with [issue = 35]
]]
if (numIssues >= 36) [
if (count turtles with [issue = 36] >= 0) [
set-current-plot-pen "issue36"
plot count turtles with [issue = 36]
]]
if (numIssues >= 37) [
```

```
if (count turtles with [issue = 37] >= 0) [
set-current-plot-pen "issue37"
plot count turtles with [issue = 37]
]]
if (numIssues >= 38) [
if (count turtles with [issue = 38] >= 0) [
set-current-plot-pen "issue38"
plot count turtles with [issue = 38]
]]
if (numIssues >= 39) [
if (count turtles with [issue = 39] >= 0) [
set-current-plot-pen "issue39"
plot count turtles with [issue = 39]
]]
if (numIssues >= 40) [
if (count turtles with [issue = 40] >= 0) [
set-current-plot-pen "issue40"
plot count turtles with [issue = 40]
]]

if (numRuns = 0) [
set issuePctChangesSd 0
set ipcMean 0
set kurtosis 0
]
if (numRuns >= 2) [
set issuePctChangesSd standard-deviation issuePctChanges
set ipcMean mean issuePctChanges
set-current-plot "C. Pooled Percentage Changes"
set-current-plot-pen "default"
set-plot-pen-interval 20
histogram issuePctChanges

;;;;; KURTOSIS ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
set kNumerator 0
set kDenominator 0
foreach issuePctChanges [
set kNumerator kNumerator + ((? - ipcMean) ^ 4)
set kDenominator kDenominator + ((? - ipcMean) ^ 2)
]

set kNumerator (kNumerator / length issuePctChanges)
set kDenominator ((kDenominator / length issuePctChanges) ^ 2)
set kurtosis ( kNumerator / kDenominator )
;;;;; ENTROPY ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
set sumIssuePropLnProps 0
set issuePropsT []

foreach n-values numIssues [?] [
ifelse (((array:item issuePctsTimeT ?) / 100) = 0) [
set issuePropsT lput (.000000000000000001) issuePropsT
]
```

```
[
set issuePropsT lput ((array:item issuePctsTimeT ?) / 100) issuePropsT
]]

foreach issuePropsT [
set sumIssuePropLnProps (sumIssuePropLnProps + ((?) * ln(?)))
]

set nEntropy (-(sumIssuePropLnProps)) / ln(numIssues)
set-current-plot "B. Agenda Diversity"
set-current-plot-pen "default"
plot nEntropy

set issuePctChangesArray array:from-list issuePctChanges
foreach n-values (array:length issuePctChangesArray) [?] [
if ((array:item issuePctChangesArray ?) >= (200)) [
set contagionCount contagionCount + 1
]]]

;;;;;DISTRIBUTION ACROSS ISSUES;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
set issueCountsTList []
foreach n-values numIssues [?] [
set issueCountsTList lput ((array:item issueCounts ?)) issueCountsTList
]
set-current-plot "D. Distribution Across Issues"
set-current-plot-pen "default"
histogram issueCountsTList
end

;;;;;COPYRIGHT NOTICE;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;; ;;;;;
;Permission to use, modify or redistribute this model is hereby granted, provided that both of the following
;requirements are followed:
;a) This copyright notice is included.
;b) This model will not be redistributed for profit without permission.
```

A-2. Simulation Experiment Example (Cue-taking) using RNetlogo Package for R and Netlogo

```
####RUN CUE-TAKING SIMULATION EXPERIMENT IN PARALLEL

##Set-up
library(parallel)
Sys.setenv(NOAWT=1)
#Paths of Netlogo application and AgendaSim model
nl.path <- "/Applications/NetLogo 5.1.0/"
model.path <- "/models/agendasim_v2.9_forsimulationtesting.nlogo"
#Running in headless mode
gui <- FALSE

#Parallel: Set-up
processors <- detectCores()
cl <- makeCluster(processors)

##Functions
#Parallel pre-processing
prepro <- function(dummy, gui, nl.path, model.path) {
library(RNetLogo)
NLStart(nl.path, gui=gui)
NLLoadModel(paste(nl.path,model.path,sep=""))}

#Simulation set-up
sim <- function(cuetaking) {
NLDoCommand(1, "set imitationRate ", cuetaking, "set numAgents 100", "set numIssues 50","set
numSegments 1", "set averageDegree 0.27", "set decayRatePer1000 15", "setup", "go85")
ret <- NLReport("contagionCount")
return(ret)
}

#Parallel: Closing NetLogo
postpro <- function(sim) {
NLQuit()
}

#Parallel: Loading NetLogo in each processor/core
invisible(parLapply(cl, 1:processors, prepro, gui=gui, nl.path=nl.path, model.path=model.path))

#Parallel: Running the simulation
cr <- seq(0.05, 1, .05)
contagioncount <- replicate(100, parSapply(cl, cr, sim), simplify="array")

#Parallel: Quitting NetLogo in each processor/core
invisible(parLapply(cl, 1:processors, postpro))

#Parallel: Stopping clusters
stopCluster(cl)
##Post-Analysis
```

```
library(ggplot2)
library(reshape2)
df <- data.frame(cr,contagioncount)
names(df) <- gsub("X", "run", names(df))
df.long <- melt(df,id.vars = "cr")
pdf("/PATH/cuetakingRate1.pdf", height=5, width=5)
ggplot(data = df.long, aes(x = cr, y = value)) + geom_smooth(size = 1) + labs(x = "Cue-taking Rate", y =
"Issue Contagion Events") + theme_bw(base_size = 12, base_family = "Helvetica")
dev.off()
```

A-3. Validation Comparison Example (Random Sample of Lobbying Issues) using RNetlogo Package for R and Netlogo

```
#### RUN LDA COMPARISON TEST #1

##Set-up
Sys.setenv(NOAWT=1)
library(RNetLogo)
#Paths of Netlogo application and AgendaSim model
nl.path <- "/Applications/NetLogo 5.1.0/"
model.path <- "/models/agendasim_v2.9_forsimulationtesting.nlogo"
#Running in headless mode
gui <- FALSE

##Functions
#Parallel pre-processing
prepro <- function(dummy, gui, nl.path, model.path) {
NLStart(nl.path, gui=gui)
NLLoadModel(paste(nl.path,model.path,sep=""))}

#Parallel: Set-up
processors <- detectCores()
cl <- makeCluster(processors)

#Simulation set-up
sim <- function(cuetaking) { NLDoCommand(1, "set imitationRate ", cuetaking, "set numAgents 1000",
"set numIssues 136","set numSegments 1", "set averageDegree 0.2", "set decayRatePer1000 30", "setup",
"go85")
ret <- NLReport("issueCountsTList")
return(ret)
}

#Parallel: Closing NetLogo
postpro <- function(sim) {
NLQuit()
}

#Parallel: Loading NetLogo in each processor/core
invisible(parLapply(cl, 1:processors, prepro, gui=gui, nl.path=nl.path, model.path=model.path))

#Parallel: Running the simulation
cr <- .95
contagioncount <- replicate(50, parSapply(cl, cr, sim), simplify="array")

#Parallel: Quitting NetLogo in each processor/core
invisible(parLapply(cl, 1:processors, postpro))

#Parallel: Stopping clusters
stopCluster(cl)
```

```
## Post-analysis
#Requires file "lda1_pctofactors_temp.csv" with percentage changes calculated from Baumgartner and Leech (2001) dataset listed by issue
lda1 = read.csv("/PATH/lda1_pctofactors_temp.csv")
library(reshape2)
lda1.output.names <- ls(pattern='contagioncount')
lda1outputs <- lapply(X=lda1.output.names, FUN=get)
lda1long <- melt(list(lda1outputs))
library(plyr)
lda1long_sorted <- arrange(lda1long, Var3, value)
lda1long_sorted$pctofactors <- (lda1long_sorted$value/1000)*100
lda1long_sorted$seq <- indices <- seq(1,137,1)
library(ggplot2)
pdf("/PATH/lda1_comparison05.pdf", height=4, width=4)
ggplot() + geom_point(data=lda1long_sorted, aes(x=seq, y=pctofactors, group=Var3), size=1, alpha=.4, position="identity", color="red") + theme_bw(base_size = 12, base_family = "Helvetica") + labs(x = "Issue ID", y = "% of Actors") + guides(colour=FALSE) + geom_point(data=lda1, alpha=.8, aes(x=seq, y=pctofactors), color="blue", size=2) +  geom_line(data=lda1long_sorted, aes(x=seq, y=pctofactors, group=Var3), size=.5, alpha=.1, position="identity", color="red") + guides(colour=FALSE) + geom_line(data=lda1, alpha=.1, aes(x=seq, y=pctofactors), color="blue", size=1)
dev.off()
```

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