Structural Constraints in Intergroup Relations:
A Contextual Approach to Polarization and Conflict in Social Networks

by

Jaemin Lee

Department of Sociology
Duke University

Date:_______________________
Approved:

___________________________
James Moody, Supervisor

___________________________
Christopher A. Bail

___________________________
Martin Ruef

___________________________
Lynn Smith-Lovin

Dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Sociology in the Graduate School of Duke University

2018
ABSTRACT

Structural Constraints in Intergroup Relations:

A Contextual Approach to Polarization and Conflict in Social Networks

by

Jaemin Lee

Department of Sociology
Duke University

Date:_______________________
Approved:

________________________________________
James Moody, Supervisor

________________________________________
Christopher A. Bail

________________________________________
Martin Ruef

________________________________________
Lynn Smith-Lovin

An abstract of a dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Department of Sociology in the Graduate School of Duke University

2018
Abstract

Social network analysis is a powerful tool to describe and explain the dynamics of intergroup relations. Research using political and school networks illuminates the micro assortative mechanisms of social ties that directly contribute to the emergence of macro intergroup outcomes such as polarization and conflict. Yet these studies have not fully explored the ecological insights arising from considering how structural constraints—i.e., demographic distributions and emerging meso-group structures—contextualize tie formation, and thereby produce variation in macro intergroup outcomes. This dissertation examines the impact of higher-level constraints on tie formation and intergroup relations in the two contexts: political polarization in America and enmity formation in Adolescence. Studies 1 and 2 ask where the remarkably high level of political homophily comes from and how such relational antecedents affect opinion polarization. Drawing on macrosociological theory of network formation, I use agent-based modeling and the data from the American National Election Surveys to show the pivotal role that sociodemographic consolidation—the correlation between social positions across multiple dimensions—plays in the rise of political homophily in networks and the amplification of the echo chamber effects. Study 3 asks whether racial segregation is directly linked to conflict in schools. Constructing a unified model of friendship and enmity formation on network data collected in a racially diverse middle
school, I find that the racial segregation-conflict link is not a direct one but complicated by status-group processes. Racial differences segregate friendships, but conflict is mainly triggered by the status demarcation between members and outsiders of “leading crowds” within racial groups. Combined, these three studies find that the contextual properties—consolidation and groups—condition the rates and effects of micro homophily that shape variation in intergroup conflict. In conclusion, I discuss how my contextual approach contributes to our understanding of intergroup relations in each of the substantive fields of study.
Contents

Abstract ........................................................................................................................................... iv

List of Tables ....................................................................................................................................... ix

List of Figures ....................................................................................................................................... x

Acknowledgements .............................................................................................................................. xi

1. Introduction ..................................................................................................................................... 1

2. Study 1: A Consolidation Model of Political Polarization .............................................................. 7
   2.1 Introduction ................................................................................................................................. 7
   2.2 Theoretical Background .............................................................................................................. 10
       2.2.1 Formal Models of Interpersonal Influence and Polarization ...................................... 10
       2.2.2 Consolidation, Segregation, and Polarization ................................................................. 13
   2.3 Model Framework ..................................................................................................................... 18
       2.3.1 Structure and Partner Selection ......................................................................................... 18
       2.3.2 Social Influence and Opinion Formation ......................................................................... 20
       2.3.3 Parameters and Simulation Procedures ............................................................................ 22
   2.4. Results ................................................................................................................................... 25
       2.4.1 Consolidation and the Pool of Discussion Networks ....................................................... 26
       2.4.2 Position Homophily and Opinion Polarization ............................................................... 28
       2.4.3 The Joint Effects of Homophily and Consolidation on Opinion Polarization ............ 32
   2.5. Discussion and Conclusions ..................................................................................................... 35

3. Study 2: State-level Consolidation and Political Homophily in America ...................................... 41
3.1 Introduction .................................................................................................................. 41
3.2 Literature Review and Theory ...................................................................................... 43
  3.2.1 Political Homophily ................................................................................................. 44
  3.2.2 The Choice-constraint Approach on Network Formation ........................................ 46
  3.2.3 Expectations ........................................................................................................... 48
3.3 Methods ....................................................................................................................... 50
  3.3.1 Sample ..................................................................................................................... 50
  3.3.2 Measures ................................................................................................................ 51
  3.3.3 Analytic Strategy ..................................................................................................... 52
3.4 Results ........................................................................................................................ 53
  3.4.1 Descriptive Results ................................................................................................. 53
  3.4.2 Explanatory Model Results ..................................................................................... 59
3.5. Discussion and Conclusions ....................................................................................... 61
4. Study 3: Racial Segregation, Group Conflict, and Enmity Formation in Adolescence .67
  4.1 Introduction ................................................................................................................ 67
  4.2 Theory ........................................................................................................................ 71
    4.2.1 Segregation and Conflict ...................................................................................... 71
    4.2.2 Antecedents of the Formation of Enmities ............................................................. 72
    4.2.3 Expectations .......................................................................................................... 75
  4.3 Data and Methods ....................................................................................................... 77
    4.3.1 Data ....................................................................................................................... 77
    4.3.2 Measures ................................................................................................................. 79
4.3.2.1 Enmity and Friendship Networks .............................................................. 79
4.3.2.2 Crowd Membership ................................................................................... 80
4.3.2.3 Sociodemographic Characteristics .......................................................... 81
4.3.2.4 Propinquity ............................................................................................... 82
4.4 Results ............................................................................................................. 83
  4.4.1 Segregation and Conflict ........................................................................... 83
  4.4.2 Crowd Identification and Member Composition ......................................... 86
  4.4.3 Categories, Crowds, and Tie Formation ...................................................... 89
  4.4.4. The Effects of Crowd Membership Distinction on Intra-racial Enmities .... 92
4.5 Discussion and Conclusions .......................................................................... 96
5. Conclusion ......................................................................................................... 102
References ............................................................................................................. 105
Biography .............................................................................................................. 120
List of Tables

Table 1: Simulation Overview ........................................................................................................... 24
Table 2: Estimates from a Multi-level Linear Regression on Dyadic Partisan Similarity . 59
Table 3: Dyad-pairwise Comparison of Nomination Types ............................................................... 84
Table 4: Odds Ratios N nominating Same-group Peers against Cross-group Peers ............. 85
Table 5: The Estimates from a Dyad-level Multinomial Logistic Regression Predicting Friendship and Enmity ................................................................................................................. 91
Table 6: Estimates from ERG Models Predicting Enmity Tie Formation .............................. 93
Table 7: The Cases Compared .......................................................................................................... 102
List of Figures

Figure 1: Consolidation, Faultlines, and Network Formation .......................................................... 15
Figure 2: Manipulating Consolidation among Social Attributes ..................................................... 23
Figure 3: Consolidation and the Change of the Pool of Networks ................................................... 27
Figure 4: Position Homophily and the Opinion Model Behavior ....................................................... 29
Figure 5: Processual Illustration of Different Homophily and Opinion Polarization .......................... 31
Figure 6: End Results of Opinion Polarization by Position Homophily ........................................... 32
Figure 7: The Joint Effects of Homophily and Consolidation: Rates of Reaching Consensus .............. 34
Figure 8: The Joint Effects of Homophily and Consolidation: Polarization Score ............................ 35
Figure 9: Two Types of Consolidation .............................................................................................. 49
Figure 10: The Distribution of Dyadic Partisan Similarity ................................................................. 54
Figure 11: Mean Dyadic Similarity by States ..................................................................................... 56
Figure 12: Mean Dyadic Similarity by Consolidation and States ...................................................... 58
Figure 13: Two Models of Enmity Formation .................................................................................... 75
Figure 14: Friendship Networks and Crowd Configurations .............................................................. 88
Figure 15: Crowd Composition by Time ............................................................................................ 89
Figure 16: The Odds Ratio Effects Plot of the Dyadic Model ........................................................... 92
Figure 17: Effects Plot of the ERGM Coefficients on Enmity Ties .................................................... 95
Acknowledgements

My graduate studies delightfully benefitted from the privileges to have mentors, colleagues, and friends in the creative and inclusive Duke research community. I would like to express my deep gratitude to Jim Moody for his intellectual influences and exceptional guidance during my years at Duke. He was always there with me whenever I needed intellectual or personal help. I have learned from him what it means to be a true mentor. I am also extremely lucky to have the members of my dissertation committee, Chris Bail, Lynn Smith-Lovin, and Martin Ruef who have gratefully offered careful read and constructive criticism throughout the processes.

I formally own this dissertation, but this work is a product of heavily collective efforts from my close-knit research group – the DNAC (Duke Network Analysis Center) lab. Particularly, I appreciate the close friendship and extensive conversations that I have had with Jon Morgan, which significantly improved many aspects of this study both theoretically and empirically. In addition, I am thankful to Jake Fisher, Molly Copeland, Brian Aronson, and other past and current weekly-lab members who embraced my ideas at each stage of development and made intellectual contributions to my early presentations.

Special thanks are due to my family. I would like to give my heartfelt thanks to my parents and sister whose unconditional love and unwavering support helped me
grow as a scholar. Most importantly, I owe a great debt of thanks to Shinhye Hwang, who is my spouse as well as a wonderful mother to a 1-year-old Tammy Carolyn Lee. This project would have never ever been possible without her incredible warmth, patience, and support during this shared journey. She makes everything it takes worthwhile.

The research in this dissertation was financially supported by the National Institute of Health (1R01HD075712, R25HD079352-01A1) and a Fulbright Graduate Scholarship granted from the Korean-American Educational Committee. I also acknowledge an honorarium from the Mathematical Sociology section of the American Sociological Association. The empirical work in Study 3 rests on data from Duke Transdisciplinary Prevention Research Center’s Processes of Peer Influence project (P.I: Dr. Philip Costanzo) funded by National Institute on Drug Abuse Grant 1 P20 DA017589-01. I appreciate their generosity in providing me with access to the data.
1. Introduction

Social network analysis is a powerful tool to describe and explain the dynamics of intergroup relations. Its analytic strength comes from moving beyond examining individuals’ attitudes and prejudices and investigating how beliefs are realized in the collective patterns of social networks such as segregation and conflict. Two intergroup struggles, political polarization and school segregation, are foci that have arguably attracted the greatest scholarly and public attention. Research in these realms has unveiled the pivotal role that the micro mechanisms of tie formation play in engendering conflict on a macro level—in particular, attribute homophily which refers to individual tendency to form a tie to similar others. I explore these processes in these two domains.

Scholars studying polarization in political attitudes and opinions point to political homogeneity of discussion networks as contributing to the increasing level of opinion polarization over time in America (Baldassarri and Bearman 2007; Iyengar 2016; Mutz 2006; Della Posta, Shi, and Macy 2015). The burgeoning research on social media emphasizes the negative consequence of the new public sphere, because it creates “echo chambers” that segregate people by political orientation and self-reinforce their opinions by limiting their exposure to diverse viewpoints (Bakshy, Messing, and Adamic 2015; Barberá et al. 2015; Boutyline and Willer 2017; Colleoni, Rozza, and Arvidsson 2014).
Research examining friendship segregation in schools highlights the role of assortative mixing in reinforcing homophily and thus limiting exposure to diverse peers at the institutional level. For instance, racial homophily strongly segregates friendship networks even in an integrated school setting (Joyner and Kao 2000; Moody 2001b; Wimmer and Lewis 2010). Recent advance in negative ties suggests that in-group preference brings outgroup hostility (Boda and Néray 2015; Labianca 2014). In short, social networks scholarship has made significant contributions to enhance our understanding of intergroup relations by illuminating the assortative mechanisms of social ties on a micro level that ultimately lead to macro intergroup conflict in political and school contexts.

The link between homophily and intergroup conflict is, however, complicated by a stream of research suggesting that macro relational outcomes are not simply the agglomeration of micro tie-formation mechanisms (Entwisle et al. 2007; McFarland et al. 2014). My dissertation builds on this research by examining how structural constraints influence the ways in which micro tie formation mechanisms cumulate into macro outcomes. By the structural constraints I refer to the social contexts in which individuals make ties. Numerous studies document the existence of the population- and organizational-level features that may contextualize tie formation. Macrosociological theory of network formation suggests that tie formation is not just a function of individual choices but more fundamentally constrained by the population distributions
of attributes (Blau and Schwartz 1984; Fischer 1982; Huckfeldt 1983). In this view, the same generative mechanism can result in very different macro relational outcomes, depending on the context where individuals interact each other. In a similar vein, several empirical studies focus on the contextual effects of cohesive subgroups as a meso-level property on both individual action and higher-level consequences (Frank and Yasumoto 1998; Moody and White 2003). Cohesive subgroups emerging from the pattern of friendship ties reinforce unique norms to individuals and differentiate the diffusion potential of norms for the entire network.

These insights, however, are not well incorporated into the social network research on intergroup relations. How do structural constraints affect the homophily mechanism of network formation, producing different implications for intergroup conflict? This is the main question I pursue in the three studies of my dissertation.

The purpose of my dissertation is thus to examine the impact of the higher-level constraints on tie formation and intergroup relations. I focus on two topics: political polarization in America and enmity formation in adolescence. These are widely different subjects but are formally common in the sense that both involve the role of in-group preferences in provoking intergroup conflict. Furthermore, investigating the contextual properties in these two cases works to not only fill a lacuna existing in each field and but also propose a more unified general theory of intergroup conflict.
I formulate the topic-specific research questions and strategies here. Studies 1 and 2 establish the relational foundation of political polarization. Scholars often attribute political homophily and social influence to the growing political divides in America. Research investigating the effects of political homophily, however, tends to be descriptive rather than explanatory, and there has been scarce attention given to the fundamental antecedents of political echo chambers. If political echo chambers are a key driver for political polarization, then where does the remarkable level of political homophily come from? Drawing on Blau’s macrosociological theory of network formation, I focus on sociodemographic consolidation as a structural constraint that conditions the emergence of political homophily in networks, thereby indirectly shaping political polarization. In Study 1, I develop a “consolidation model of polarization,” through which I investigate how macro consolidation and micro position homophily jointly produce opinion polarization. Study 2 offers an empirical validation of the formal model by using the network batteries of the American National Election Surveys to test whether state-level social and political consolidation is associated with political homophily of individuals’ discussion networks.

Study 3 shifts attention to networks in a youth population. Many studies address racial segregation in a school network. However, does racial segregation really translate into racial conflict in social relationships? The link between segregation and conflict is unclear, as studies overly rely on the partial inferences from friendship nomination
without corroborating “enmities” manifested in social networks. Using the multi-relational data from the Processes of Peer Influence project fielded at a racially diverse North Carolina middle school, I test the two competing theories of enmity formation: categorical homophily versus status processes. The former contends that strong racial homophily in friendship maximizes categorical differences that result in antagonism between cross-race individuals. By contrast, status explanations emphasize the demarcation between members and outsiders of the popularity-based peer groups—or “crowds” drawing from Coleman’s (1961) conceptualization—that places people in conflict with one another. To that end, the third chapter develops a unified model of friendship and enmity relationships that disentangles the determinants leading to segregation or from those leading to conflict in networks.

In summary, these three studies together shed light on the structural constraints imposed on the assortativity mechanisms that create nontrivial variation in patterns of intergroup relations. In the case of politics, the effects of political homophily depend on the consolidation of the population. Consolidation makes political homophily more likely which in turn contributes to the polarization of population’s opinion distribution. In adolescent social networks, I find that the racial segregation-conflict link is complicated by status-group processes. Racial differences segregate friendships, but conflict is mainly triggered by the status demarcation between members and outsiders.
of “leading crowds” within racial groups. In each chapter, I discuss how these findings contribute to each domain of research.
2. Study 1: A Consolidation Model of Political Polarization

2.1 Introduction

Polarization can refer to a state and a process. As a state, polarization describes an opinion distribution with respect to a particular issue as ranging between dispersed and bimodal. Polarization also describes “a process in which opposition increases over time and becomes the foci of social conflict.” (DiMaggio, Evans, and Bryson 1996:693)

During the past couple decades, social scientists have vigorously debated about the degree of political polarization and cultural division in the American public (Baldassarri and Gelman 2008; Fiorina and Abrams 2008; Iyengar, Sood, and Lelkes 2012; Iyengar and Westwood 2015; McCarty, Poole, and Rosenthal 2006; Della Posta et al. 2015).

Longstanding divides across many issues have far-reaching consequences for building a more integrative society and an effective functioning democracy (Abramowitz 2010; Bishop 2008; Sunstein 2018).

Social scientists only relatively recently begun to identify the social mechanisms that underlie the polarization of opinions. Social network scholars focus on interpersonal influence in opinion formation, especially when ideational diffusion occurs with local rules such as homophily and balance (Axelrod 1997b; Baldassarri and Bearman 2007; Dandekar, Goel, and Lee 2013; Flache and Macy 2011; Parigi and Bergemann 2016; Della Posta et al. 2015). Polarization is thus attributed to the rise of “echo chambers,” or formation of ideas or beliefs that are amplified and reinforced by repeated
communication with politically similar others. Pundits lament Americans’ increasing tendency to prefer like-minded others (Bishop 2008; Sunstein 2009).

This study questions the social origins of political polarization. If the rise of echo chambers is supposedly a primary driver, then where does this remarkable level of political homophily come from? It is surprising how little we know about this question. The heavy emphasis of sociological models of opinion dynamics on the micro mechanisms of homophily, while insightful, largely results in descriptive rather than explanatory analyses of sociopolitical phenomenon. Because opinion dynamics models typically treat actors’ relational preferences as given or fixed, peer influences are effectively modeled in a social vacuum. The consequence is that these models primarily attribute individuals-level processes as the driver of the growing political divides, thus failing to consider the fundamental antecedents of political echo chambers.

In this chapter, I focus on developing a novel theoretical model of meso-level social structures to better explain political polarization. Drawing on classic macro theories of network formation suggesting that assortativity in social relationships is bounded by larger opportunity structures (Blau 1977a, 1977b; Blau, Beeker, and Fitzpatrick 1984; Blau and Schwartz 1984), I develop an agent-based model that addresses how sociodemographic consolidation conditions the emergence of political echo chambers, influencing political polarization. This model illuminates social processes and mechanisms underlying opinion polarization: consolidation creates
clustered networks sorted on similarity, which makes political homophily more likely and amplifies the echo chamber effects. The primary merit of building this choice-constraint approach is that we can situate the problem of polarization within the broader societal contexts, taking into account the role of segregation forces in other social dimensions. I argue the rise of ideological echo chambers is not just a matter of changes in individual preferences or attitudes but an inevitable consequence of macro-level changes such as increased income inequality that raise the correlation among stratifying attributes and thereby localize the pool of discussion partners.

This paper is organized as follows. I first review the existing social network models and identify their strengths and weaknesses. Secondly, I turn to the theories of network formation, mainly Blau’s macro theory of social structure, to know how our partner selection is constrained by broader social structures. Third, building on Blau’s formulations of social consolidation, I build a consolidation model of political polarization, illustrating its properties and assumptions. Fourth, I conduct a set of computational simulations designed to investigate how macro consolidation and micro homophily jointly produce the opinion distribution. Lastly, based on the model results, I generate several propositions that link social networks, macro alignments, and opinion polarization.
2.2 Theoretical Background

In this section, I first review formal models of influence and polarization. I then discuss how we can incorporate insights from macro theories of social structure to better account for effects of social contexts on opinion polarization.

2.2.1 Formal Models of Interpersonal Influence and Polarization

Most agent-based models of opinion dynamics focus on how micro-level homophily (the tendency to prefer interacting with similar agents) and influence (the tendency to become more similar to agents they interact with) in social interactions coevolve to produce the macrostructural outcomes such as the population’s opinion distribution or relational segregation (Axelrod 1997a, 1997b; Carley 1991; for a review, Macy and Willer 2002). Agents in these models are socially susceptible. In classic models, agents repeatedly adapt to their network neighbors’ behavior or beliefs by taking a weighted average of peers’ beliefs (DeGroot 1974; Friedkin and Johnsen 1990). Friedkin and Johnsen in their social network influence theory establish that opinions are a function of individual characteristics and interpersonal influences (Friedkin 1998, 1999, Friedkin and Johnsen 1990, 2011). Having a strong interest in the processes that lead to group consensus, earlier models of interpersonal influence tended to model how social influence dynamics can act to eventually dampen cultural differences, leading to consensus in a population (DeGroot 1974; French 1956; Schank and Abelson 1977). These
models, thus, provide less insight about the conditions under which different opinions survive and polarize.

Later models have built on these earlier formulations to model a variety of mechanisms whereby diverse opinions survive and oftentimes lead to divergence and polarization. Some of these mechanisms are found to be special cases of the existing consensus models. For example, in the cultural dissemination model (Axelrod 1997b), the likelihood of polarization increases with fewer cultural dimensions, more alternative traits that can be chosen in dimensions, and a narrower reach of interactions. Friedkin (2015) presents a variant of his social influence model by introducing a “stubbornness” parameter that results in dissensus.

More recent opinion dynamics models have incorporated greater heterogeneity in agent traits, generalized interactions to include repulsive processes, and are beginning to consider the structure of social contexts. More recent research has focused on, for example, how extremists with high confidence and persuasiveness can fragment an entire population (Hegselmann and Krause 2002; Lanchier 2010). A study by Dandekar, Goel, and Lee (2013) proposes a model of “biased assimilation,” a process in which opinions become extreme as individuals facing uncertainty gravitate toward their initial position. A variety of models have also explored cases where influence is not necessarily positive, and thus dissimilarity and negative valence facilitate polarization (Kitts 2006; Macy et al. 2003; Mä̈s, Flache, and Kitts 2014). When the negative mechanisms of social
influence are prevalent, long-range ties—which usually facilitate cultural convergence—act to exacerbate polarization (Flache and Macy 2011). Recognizing that macro outcomes vary not only as a result of agent complexities but also variation in contexts, Baldassarri and Bearman (2007) offer a more realistic model for political polarization where network shifts take place differentially depending on “take off issues.” In sum, opinion polarization represents a special case of the social influence models, as it requires specifying additional factors that differentiate the effects of the self-reinforcing loops.

An important limitation in these models of social influence and opinion change is that they entail no a priori assumptions about how features of social structure control the formation of social ties. From foundational structural theories we know that individuals’ assortativity is not a sole outcome of personal preference but bounded by larger opportunity structures (McPherson, Smith-Lovin, and Cook 2001); population distributions (Blau 1977b), organizations and other foci of activity (Feld 1981; McPherson and Smith-Lovin 1987), and spatial segregation (Massey 1996). By contrast, in many opinion models, interactions happen in a relational vacuum. Similar beliefs typically induce topological patterns among random agents. Network structures are usually either fixed (e.g., a connected caveman graph) or purely induced by agents’ personal opinion preferences.

The under-specification of social contexts leads to conclusions only applicable to individual and dyadic properties. The focus on individual and dyadic properties makes
it difficult to pragmatically identify what social structures are conducive to opinion polarization, what strategies individuals can adopt to change diffusion patterns, and the interplay between the two. Provided that heated political discussions usually involve opinions and interactions that are already highly embedded in actors’ social positions, missing the broader contexts of tie formation inhibits developing a model reasonably sensitive to the dynamics of political discussion. In short, while previous models provide us important knowledge about individual and dyadic properties related to opinion change, they neglect the role of higher level structures that may complicate network formation and the emergence of divergent opinions in such networks.

2.2.2 Consolidation, Segregation, and Polarization

I draw on foundational sociological theories that explain how macro contexts influence social relationships. A general theoretical framework is given by Peter Blau (1977a, 1977b), who extends Simmel (1955) to focus on a population’s distribution of social positions in multiple dimensions. His major insight is that people’s associations seemingly reflecting homophily—or in his term “sociopsychological dispositions”—actually depend on the population distributions of attributes. He presents three macro parameters that regulate the larger opportunity structures in which individuals engage in intergroup associations: (1) heterogeneity (variability of social positions in a population’s distribution of an attribute) (2) inequality (skewness of the distribution of
status and resources across social positions) and (3) consolidation/intersection (the degree to which people’s social position in one attribute correlates with their position in other attributes).

Building on this quantitative conceptualization, Blau and Schwartz (1984) explicate the impact of consolidation on the formation of “cross-cutting social circles” in a society. Consolidation is essentially the degree to which a person’s position on one attribute is correlated with his or her position on another (see also Skvoretz 1983). Blau articulates what he called the multi-from heterogeneity theorem, “the lower the positive correlations between parameters, the more extensive are intergroup associations (Blau 1977:87).” For example, suppose that in-group preference on one attribute (say, race) is realized in social relationships, the combined effect of two or more attributes (say, race, income, and education) depends on the level of consolidation among them. If consolidated, the social network is characterized by highly reinforced social boundaries across the multiple dimensions. When the correlation between these socially salient attributes is low and there is an “intersection” — the inverse concept of consolidation — of people with varying attributes, cross-cutting intergroup relations will emerge although individuals maintain their preference for interacting with similar others in each dimension. Blau and his colleagues provide evidence for this claim by showing that county-level intergroup marriage rates are lower in highly consolidated metropolitan
areas in the US (Blau et al. 1984; Blau, Blum, and Schwartz 1982; Blau and Schwartz 1984).

<table>
<thead>
<tr>
<th></th>
<th>Focal Attribute</th>
<th>Income</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(a) Intersection</strong></td>
<td>Actor 1</td>
<td>Black</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Actor 2</td>
<td>Black</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Actor 3</td>
<td>White</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Actor 4</td>
<td>White</td>
<td>Low</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Focal Attribute</th>
<th>Income</th>
<th>Education</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(b) Consolidation</strong></td>
<td>Actor 1</td>
<td>Black</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Actor 2</td>
<td>Black</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Actor 3</td>
<td>White</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Actor 4</td>
<td>White</td>
<td>High</td>
</tr>
</tbody>
</table>

**Figure 1: Consolidation, Faultlines, and Network Formation**

The gist of Blau’s macrosociological theory is that consolidated societies experience reduced social integration. This theorem has implications for the formation of discussion networks. In a consolidated setting, the distribution of attributes may generate strong faultlines (Mäs et al. 2013). These faultlines can then create clustered networks sorted on similarities across multiple attributes. Figure 1 illustrates these processes. The settings (a) and (b) are different in the distribution of attributes. In the “consolidation” setting, race perfectly predicts income and education. If actors make relationships based on in-group preference, a network of four actors would be segregated along this faultline. In the “intersection” setting, race is not correlated with
the other two stratifying attributes. Although the two actors are different from the other two in terms of race, commonalities in income and education create opportunities for an actor to reach out to others.

Consolidation as a macro-level property thus shapes the spatial segregation of the discussion networks. And, given that opinion integration requires convergence through exposure to broader opinion distributions across different groups, segregated structure generated by consolidation likely precludes ideational consensus required by cross-group interactions. This premise leads to two interrelated claims with respect to homophily and opinion polarization. First, consolidation strengthens the effects of homophily, leading to polarization. This claim is related to the topological constraint created by consolidation. Consolidation escalates the level of segregation, increasing the proportion of interactions occurring in segregated relationships which, in turn, can magnify peer influence on opinion. Thus, consolidation strengthens the effects of homophily—echo chambers—leading to greater opinion polarization than in settings with less consolidation.

Second, consolidation makes political homophily more likely, leading to opinion polarization. This contention is associated with the attributional constraint imposed by consolidation. That is, the configuration of attributes in the setting has qualitatively different implications. Although the attributes given in the setting of Figure 1. are non-political, the correlation between race and stratifying attributes is essentially an indicator
for racial inequality over socioeconomic status. Nevertheless, when income or education are even minimally associated with political opinion, racially clustered interactions may result in the divergence of political opinion between blacks and whites. In other words, consolidated differences in social attributes make political homophily more likely. In this way, consolidation functions as a condition under which between-group inequality is likely generate segregation and polarization. On the other hand, if one of the attributes in Figure 1 had been party identification, the setting would have activated socio-political alignments (e.g., race strongly predicted party identification in the consolidation setting). Consolidation in this case would divide the population even more strongly along the party lines, making political homophily more likely than in non-consolidation settings.

In sum, leveraging consolidation as a higher-level parameter helps us consider formally the following premises: (1) relational patterns come from multiple social attributes; (2) individuals are bounded within social positions when encountering others; and (3) the resulting intergroup relations create social distance and thereby acts to spatially segregate communication. These premises derived from Blau’s macrosociological theory consider the role of population-level opportunity structures in forming discussion networks, and thereby improve the aforementioned individualistic/dyadic models. The key advantage of this contextual approach is that we account for the role of macro-level phenomenon such as between-group inequality over socioeconomic status and political alignment of sociodemographic characteristics that
increase correlations between multiple socially salient dimensions, shaping network formation and opinion distributions.

### 2.3 Model Framework

To theorize how macro consolidation and micro homophily interact to produce opinion polarization, I develop an agent-based model where agents form both networks and opinions. My approach to study network formation and opinion dynamics combines the formal models developed by Centola (2015) and Baldassarri and Bearman (2007). Specifically, my model allows topological patterns and opinion formation to vary based on position alignment across multi-dimensions. Agents are assigned social positions in multiple social dimensions, choose discussion partners, influence each other, and form their opinions. The theoretical goal is to examine how the consolidation manipulation generates variation in Baldassarri and Bearman’s opinion model.

#### 2.3.1 Structure and Partner Selection

The core idea from Blau and Schwartz (1984) is that we have different “dimensions” of social life, and each individual occupies a “social position” with respect to each dimension. Each agent has a single position within each dimension, the dimensions as a whole provide opportunity structures for social interaction. Each dimension is characterized by an attribute that generally induces homophily (e.g., race, religion, income, education). In my model, the attributes can take nominal or stratifying forms. Nominal attributes are binary (-1, 1), and no hierarchy is assumed between these
values. Stratifying attributes are continuous, following a normal distribution (mean = 0, variance = 1). Increasing correlation between these two types of attributes—i.e., increased consolidation—describes the process by which a nominal characteristic acquires status value, such that one group occupies higher status positions and other groups lower status positions regarding a stratifying dimension (status construction theory, Ridgeway 1991).

I assume agents can accurately perceive social distance derived from the positions for multiple dimensions. For a pair of agents $a$ and $b$, the probability of interaction is proportional to an inverse function of the positional distance between the two. I define the social distance between agent $a$ and agent $b$ at time $t$ as the Euclidean distance $d$ in the $k$ dimensions, normalized to a range 0 to 1 by dividing for the maximum value of all pairs.

$$d_{ab} = \frac{\sqrt{\sum_{k=1}^{k} (a_k - b_k)^2}}{\max_{(a,b) \in N} \left[ \sqrt{\sum_{k=1}^{k} (a_k - b_k)^2} \right]}$$

In my model, selecting discussion partners is agents’ key behavior. Simulation and experimental studies have presented a variety of utility functions for network formation such as structural brokerage, triadic closure, reciprocity, and centrality (Anjos and Reagans 2013; Beuchel and Buskens 2013; Burger and Buskens 2009; Buskens and van de Rijt 2008; van de Rijt 2011; Robins, Pattison, and Woolcock 2005). For the purpose
of this study, I simply focus on social similarity, the most general principle of social selection. Agents strive for similarity. The homophily tendency also holds for empirical evidence arising from studies of public opinion and political discussion networks. The likelihood of agents getting into a discussion with others depends on the social distance they have with other people.

2.3.2 Social Influence and Opinion Formation

In my model, following a number of studies (Baldassarri and Bearman 2007; Flache and Macy 2011; Friedkin 1998, 2015), an opinion has a “strength” marked by a continuous value and a “sentiment” that is either positive or negative direction. Specifically, an agent’s opinion for an issue can range from -100 to +100. The level of polarization increases as agents’ opinion values move toward either -100 or -100. The initial opinion distribution follows a normal distribution centered on 0, with a standard deviation of 33.

Much of the prior research addresses the effects of interpersonal influences on opinion change (Friedkin and Johnsen 2011). Discussion with interaction partners (thus reciprocal) may affect an agent’s commitment to his or her opinion. My model specifies two behaviors of opinion change in a dyad. Agents can “reinforce” each other’s opinion when agents share the same opinion sentiment. For example, a liberal meets another liberal, and the two become more liberal. Opinion reinforcement increases opinion
polarization in the distribution. The other behavior is “compromise” where two opinions of different signs (+, -) encounter each other and move their respective opinions towards a middle position of the two original opinions. This is related to the dampening effects of exposure to a different political view on polarization (Allport 1954; Pettigrew 1998).

Regarding opinion change resulting from peer influence, Baldassarri and Bearman (2007) offer a practical formulation. Draw on the group dynamics and public opinion literature, they note that opinion susceptibility to peer influence differs by one’s relative position in the opinion distribution. That is, extremists do not change their opinion dramatically, whereas the moderates can dramatically change their opinions after interacting with extremists (Brauer, Gliner, and Judd 1995; Converse 1964; Zaller 1992). Based on this intuition, I model opinion change as inversely proportional to an agent’s opinion strength. Formally,

$$\Delta O_{a,t+1} = \mu \times \frac{|O_{a,t} - O_{b,t}|}{|O_{a,t}|} \text{ for } O_{a,t} \neq 0$$

where $\mu$ is a normalizing constant to make opinions stay within the range. The amount of agent $a$’s opinion change at $t+1$ is determined by the absolute difference between agent $a$’s opinion, $O_{a,t}$, and the partner $b$’s opinion, $O_{b,t}$, relative to agent $a$’s original opinion at time $t$. Note that the denominator is the agent’s own opinion, so the amount of opinion change decreases as his or her opinion is strong.
2.3.3 Parameters and Simulation Procedures

My model has two core parameters: consolidation and position homophily.

Consolidation: As illustrated in Figure 1, agents occupy social positions across multiple attributes. The consolidation parameter governs the correlation between the attributes. Figure 2 illustrates the construction of the consolidation parameter. Simply I adjust the correlations of the stratifying attributes according to a focal, nominal characteristics (the 1st attribute in Figure 2); for example, we have one extreme where race is totally unrelated to education, income, and other disparities on one extreme (intersection, the upper plot in Figure 2) and the other extreme where race perfectly predicts levels of education, income, and other attributes (consolidation, the lower plot in Figure 2).
Figure 2: Manipulating Consolidation among Social Attributes

*Position homophily:* We have defined social distance as a Euclidean distance calculated from values across multiple dimensions. Interaction between the two agents is proportional to the inverse of distance, or proximity (1-distance). The position homophily parameter is the radius that a given agent can reach in the social position space. The homophily parameter sets different levels of proximity (1-distance) as a
threshold. For example, when the homophily parameter is 0.3, agents choose a partner only among a subset of others whose dyadic proximity to ego is over 0.3 (thus with a narrowed radius). When the parameter equals 0, agents can reach all the other 99 agents and select a partner probabilistically according to the dyadic social proximity (thus with a unconstrained radius). Simply put, agents seek their partners among socially similar others when homophily is high.

Table 1: Simulation Overview

<table>
<thead>
<tr>
<th>Initial Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 actors occupying random positions in 4 nominal binary attributes and 16 stratifying continuous attributes</td>
</tr>
<tr>
<td>Seed opinions for an issue with a normal distribution with mean = 0, variance = 33 [-100, 100]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Iterations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partner Selection</td>
</tr>
<tr>
<td>Randomize the order of agents for an interaction</td>
</tr>
<tr>
<td>For each agent,</td>
</tr>
<tr>
<td>Draw an alter ~ to the positional proximity (Euclidean distance)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opinion Formation</th>
</tr>
</thead>
<tbody>
<tr>
<td>For each dyad,</td>
</tr>
<tr>
<td>Determine the influence type: reinforcement or compromise as a function of the opinion signs</td>
</tr>
<tr>
<td>Compute the magnitude of opinion change for each actor</td>
</tr>
<tr>
<td>Update opinion</td>
</tr>
<tr>
<td>Repeat 1,000 times</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Manipulation Parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consolidation</td>
</tr>
<tr>
<td>Position homophily</td>
</tr>
</tbody>
</table>

The simulation procedures are summarized in Table 1. There are two general approaches to iteratively update an agent’s status in an agent-based modeling:
asynchronous and synchronous updating. Asynchronous updating involves agents updating one at a time given the current state in the world. Synchronous updating, in contrast, involves agents updating their opinions at the same time, based on the end of the previous iteration. Asynchronous updating is more suitable for my model. The model is built in such a way that socially centered agents can be selected by other agents multiple times during an iteration. The asynchronous method takes into account the sequential nature of the interactions occurring within an iteration. Asynchronous updating also avoids generating potential artifacts associated with synchronous updating (Huberman and Glance 1993).

My simulation’s main outcome of interest is the degree of polarization in the opinion distribution. In essence, the state of opinion distribution will be either consensus or polarization, although the degree of the state will be different and substantively meaningful. A simulation procedure is set to repeat network and opinion formation 1,000 times, practically because the model always converges to either state in that time frame.

2.4. Results

Here, I present the results of the computational simulations. I order my discussion of based on the sequence in which I varied the parameters. I vary 1) consolidation; 2) position homophily; and 3) the joint effects of consolidation and position homophily on opinion polarization.
2.4.1 Consolidation and the Pool of Discussion Networks

Drawing on macro theories of network formation, I have established that consolidation is a macro level property that influences the pool of available interaction partners. Increased consolidation shrinks discussion networks by limiting the pool of interaction partners, resulting in localized personal networks. In consolidated contexts, individuals are expected to meet others of the same position (same-race vs cross-race) and are forced to repeatedly select only a certain group of partners despite their random draws.

To model this process, I manipulate the consolidation parameter and, within the changed distribution of attributes, have agents select their discussion partner repeatedly, proportional to the inverse of their positional distance. The results suggest that consolidation exhibits a nontrivial influence on an individual’s pool of networks. Figure 3 summarizes the results from a total of 3,600 trials of computational experiments where I varied the consolidation parameter (the correlation of attributes) and the number of stratifying attributes being correlated with the focal attribute by the consolidation parameter. In these simulations, I hold the radius of an agent constant—the trial is set as random draws entirely dependent upon the pairwise Euclidean distance values of the position.
Figure 3: Consolidation and the Change of the Pool of Networks

Note: This figure plots the mean value over 100 simulated trials for each parameter set, each of which runs 300 iterations (t). Twenty randomly generated attributes—4 nominal (dichotomous) and 16 stratifying (continuous)—were included. K refers to the number of stratifying attributes that are correlated with a focal nominal attribute, being manipulated by consolidation parameter. Y-axis of the left panel is the average proportion of agents getting to meet partners with the same values on the focal attribute. Y-axis of the right panel indicates the average number of unique partners that an agent comes to meet out of 99 alters.

The left-hand side of Figure 3 indicates that, as the correlation of social dimensions increases, agents increasingly meet partners with the same values on the focal attribute. I define dyadic position overlap as the degree to which an agent and his partner share the position on the focal attribute. When there is no association between the focal attribute and stratifying attributes (K=0), the dyadic position overlap obviously converges to a low probability (.500) because agent’s choice of partners is essentially random given the unconstrained associations with the stratifying attributes. When I take more stratifying attributes (K) and increase their association with the focal attribute, the dyadic position overlap increases significantly. For example, when the manipulation is
applied to all 16 stratifying attributes with .75 consolidation, agents share the same value of the focal attribute with on average 76.7% of their interaction partners.

The right-hand plot of Figure 3 displays a similar intuition for the model, more directly counting the number of unique partners among a total of 99 partners that an agent is allowed to select throughout the simulation of 300 opportunities. As expected, high consolidation shrinks the pool such that agents face a fewer unique others.

### 2.4.2 Position Homophily and Opinion Polarization

Having examined the independent effects of consolidation on network formation, I turn to the impact of position homophily on opinion polarization, the focus of most prior opinion polarization models. My outcome measure, opinion polarization, is a distribution, I consider two parameters: variance and kurtosis. Variance captures the dispersion of opinions, while kurtosis captures the degree of bimodality in opinions. Positive kurtosis values indicate consensus; it could be centered at the middle or ends of the opinion continuum. A kurtosis of zero indicates a normal distribution. Slightly negative kurtosis values indicate a flat distribution, while more extreme negative values indicate a bimodal distribution. Consequently, a polarized distribution features opinions that are highly dispersed (high variance) and bimodal (negative kurtosis values). To ease interpretation, we use the negative product of these two measures (Polarization = -1 * Kurtosis * Variance, Baldassarri and Bearman 2007).
Figure 4: Position Homophily and the Opinion Model Behavior

Figure 4 illustrates the change of opinion distribution over the course of the simulation for three exemplar runs: no position homophily (0), low position homophily (0.3), and high position homophily (0.6). In the no and low homophily conditions, the opinion distribution moves from a normal distribution (mean = 0, variance = 33) to a positive generally unimodal distribution. In the high homophily condition, the opinion distribution changes from normal to polarized (high variance and bi-modal) over time.

We need to know by what processes position homophily engenders the different behaviors of the model. The processes are illustrated in Figure 5. When agents have
either no or a low proximity threshold, they can interact with most of the other agents. This increases the likelihood that they will “compromise,” formally agents with opinions of different signs encounter each other and the opinions of both move towards a more moderate central position. Thus, in the upper panel of Figure 5, the population of different opinions (Figure 5: (a)) eventually converges on the single sign of opinions via compromise (Figure 5: (b)), then they go further on that direction via the reinforcement type of peer influence (Figure 5: (c)).

In contrast, if the agent’s positional radius is set small (high homophily, the lower panel of Figure 5: (a)), the repeated interactions within the agent’s small alter group lead to local but not global consensus in terms of the opinion sign (Figure 5: (b)). Because the agents lack cross-group ties, groups that differ in the valence of their opinions move to more extreme disparate directions, which leads to polarization at the global level (Figure 5: (c)). Thus, the logic is that extreme homophily leads to localization that in turn contributes to polarization.
Figure 5: Processual Illustration of Different Homophily and Opinion Polarization

Note: Circles represent the agents in the simulation, and signs (+, -) indicate the valence of the opinion held by agents. The upper panel illustrates the opinion formation processes when the level of position homophily is low while the lower one displays the situation of high position homophily. The opinion changes are presented with time sequence: (a) initial distribution, (b) progress at a mid-point, and (c) final equilibrium state.

How much does it generalize? The end results are summarized in Figure 6. Low and moderate levels of homophily rarely lead to polarization. Rather, polarization arises
when homophily is very high. I find a critical value between 4.0 and 4.5 where the model begins to generate bimodal opinion distributions.

Figure 6: End Results of Opinion Polarization by Position Homophily

Note: This plot summarizes the end results (t=1,000) of computational simulations that conducted 100 trials per each value of position homophily parameter, totaling 1,300 trials. Polarization was calculated by \(-1 \times \text{variance} \times \text{kurtosis}\); higher values indicate polarization, lower values consensus. Each dot represents mean value, and the confidence intervals display the range of 2 standard deviations. Opinions and positions were seeded at random for each trial, so there were no initial correlations within and among those states. Even in this strictly random setting, imposing an extremely small position radius leads agents’ opinions to polarization.

2.4.3 The Joint Effects of Homophily and Consolidation on Opinion Polarization

In the previous section, I have examined the macro consequences of micro homophily. We have seen that polarization emerges when the level of social homophily is high, roughly 4.5 in my simulations. This process arises from localization. In highly
homophilious settings, agents can reach only a small set of peers, making the global network fragmented and inhibiting cross-group opinion consensus. The question remains as to whether there is a “macro” element that creates such localized structures conducive to opinion polarization. Recall that consolidation shrinks the pool of networks. Thus, to answer the macro question, I focus on how consolidation interacts with homophily to affect the occurrence of opinion polarization.

In the simulations discussed below, I vary both consolidation and homophily parameters and repeat 100 times for each parameter set. For each trial, agents select partners and form opinions across 1,000 iterations. Figures 7 and 8 summarize the simulation end results: the former indicates what proportion of the simulations have reached consensus, and the latter plots the average polarization score. For both results, I find that, even with minimal-moderate position homophily, high consolidation makes the opinion distribution polarized. In other words, consolidation reduces the critical value at which homophily leads to polarization. The interaction between consolidation and homophily leads to echo chambers, amplifying the tendency towards bimodality.
Figure 7: The Joint Effects of Homophily and Consolidation: Rates of Reaching Consensus

Note: This plot summarizes the end results (t=1,000) of computational simulations that conducted 100 trials per each parameter regime. The initial correlation between the focal attribute and opinion state was held as a moderate level in empirical research, 0.15. Y-axis indicates the proportion of the trials that have reached consensus in opinions' valence over 100 trials per each parameter set. Hence, no confidence intervals are needed.
Figure 8: The Joint Effects of Homophily and Consolidation: Polarization Score

Note: This plot summarizes the end results (t=1,000) of computational simulations that conducted 100 trials per each parameter regime. Polarization was calculated by $-1 \times$ variance x kurtosis; higher values indicate polarization, lower values consensus. Each dot represents mean value, and the confidence intervals display the range of 2 standard deviations.

2.5. Discussion and Conclusions

The findings of this chapter highlight the social origin of political polarization. I construct a simple agent-based model that blends Blau’s macrosociological theory and a peer influence model of opinion dynamics. This chief advantage of this approach is that illuminates the population-level processes of network formation that give rise to political homophily that in turn leads to opinion polarization. Consolidation—the correlation of positions across multiple social dimensions—is this study’s main
parameter of interests. Positional homophily alone generates consensus for the most part and rarely results in polarization. Rather, opinion polarization arises from the interaction of consolidation and positional homophily. Specifically, consolidation lowers the critical value at which homophily begins to produce opinion polarization and echo chambers. The mechanism is “localization” in networks: consolidation creates clustered networks sorted on similarities in multiple sociodemographic dimensions, and this boosts the effects of politically biased interactions. The social origin of political polarization is, thus, social segregation resulting from the increasing associations between socially salient dimensions that organize social interaction.

The distinct contribution of my model is that it establishes sociodemographic consolidation as a fundamental antecedent of political polarization. My model incorporates characteristics of the broader social environments into an agent-based simulation framework, an innovation to past social influence models of opinion dynamics (Baldassarri and Bearman 2007; DellaPosta, Shi, and Macy 2015; Friedkin and Johnsen 1990, 2011; Macy and Flache 2011). This new conceptualization allows us to consider how changes in the socio-demographic composition and distribution of the U.S. population are likely to affect the growing political cleavages reported in research in new ways.

The assertion that political polarization increases with social consolidation leads us to speculate what changes of consolidation of population distributions mean, i.e., the
changing correlations between nominal characteristics and stratifying attributes. On one hand, change in consolidation could be the increased the result of between-group inequalities over status resources; for example, income inequality by social class, cultural disparity by gender, educational inequality by race, the gap of neighborhood quality between rich and poor, and so forth. If we assume the homophily principle is operative for each of the dimensions and the associations between dimensions increase, individuals are more likely to encounter similar others across multiple attributes including political orientation. With this interaction structure, a small amount of political affinity can be magnified through highly segregated structures. This is a structural effect in the sense that, regardless of individual efforts to avoid similar others or shifts in the political contexts such as party control of the legislature or executive, individuals will routinely encounter a shrunken pool of discussion partners compared to points in history where, for example, income inequality has been less. My model therefore links inequality to political polarization through the consolidation-inducing self-reinforcing dynamics of homophily and influence. Although research in political scientists has focused on an association between economic inequality and political polarization (McCarty 2015; McCarty et al. 2006), this model identifies testable relational mechanisms that previously were not identified in the literature.

Abundant empirical evidence has emerged regarding the increasing association among a variety of attributes that organize our social relationships in the United States.
American society has experienced the growing inequality in personal income and increasing income differences between social classes since the early 1980s (McCall and Percheski 2010; Morris and Western 1999; Piketty and Saez 2003; Wodtke 2016). Furthermore, income and family type are increasingly related (Burtless 1999). The educational assortativity in marriage has also been increasing (Schwartz and Mare 2005). Racial inequalities—particularly between blacks and non-blacks—in social, physical, mental, and material dimensions appear to persist or increase in the past several decades (Fischer and Hout 2006). These trends clearly demonstrate my model’s applicability.

On the other hand, the dynamics of consolidation can also appear as the increasing political salience of socio-demographic characteristics. If we take the political spectrum within a society and its association with sociodemographic characteristics, the resulting associations would be the level of political sorting along race, gender, religion, occupation, etc. For example, this “political” version of consolidation would mean that, for instance, blacks will continue and potentially increase the support for the Democratic party, while Mormons may continue and potentially increase their support for the Republican party, and so forth. The increasing associations between these multiple dimensions lead to highly segregated structures that reinforce and amplify peer influences. Indeed, research finds the increasing correlations between religion and political affiliation (DiPrete et al. 2011) and between income and political partisanship (McCarty et al. 2006). This is also related to political party’s sorting strategies to mobilize
voters such as the Southern strategy to render the strong alignment between race and political preference (McVeigh, Cunningham, and Farrell 2014). Evidence also suggests an over-time increase of political residential segregation indicated by a larger number of “landslide” counties in presidential elections (Bishop 2008).

In addition, I want to note that this “political” consolidation framework is also applicable to recent social movements that have polarized both institutional politics and public debates such as Black Lives Matter and the #MeToo movement. Although seemingly the result of historically contingent triggering events, the burst of the “identity politics” (Bernstein 2005)—claims of basic rights based on the most inherent social groups with which people identify—arguably has its antecedents in longstanding inequalities (most notably in terms of race and gender) and the eventual realization of common interests by members of these groups (King 2018; Roberts 2018). Historically, the increasing association between the nominal characteristics such as race and gender and other stratifying/political characteristics segregated the social networks with respect to both race and gender. The increasingly closed interactions of racial minorities and of women during the Gilded Age contributed to the formation of both the civil rights movement and first wave of feminism. Of course, this is a claim purely stretched out of the theoretical model. Future work is needed to test the claim more empirically.

I conclude this chapter by generating several propositions that are hopefully addressable empirically, the first two of which I test in the next chapter.
Proposition 1. Consolidation within a spatial unit will have a positive association with an individual’s social similarity with their partners in discussion networks.

Proposition 2. Consolidation within a spatial unit will have a positive association with an individual’s political similarity with their partners in political discussion networks.

Proposition 3. As an individual becomes more highly similar on more social attributes with their discussion partners, the likelihood of choosing politically similar partners over dissimilar ones increases.

Proposition 4. The level of political polarization will increase with the level of social segregation.
3. Study 2: State-level Consolidation and Political Homophily in America

3.1 Introduction

Political polarization has drawn much attention from social scientists in recent decades. Scholars, particularly in a burgeoning body of research on polarized social media, increasingly address the role of social networks played in exacerbating or alleviating the extremism of public opinions (Adamic and Glance 2005; Bail et al. forthcoming; Bakshy et al. 2015; Barberá 2015; Sunstein 2018). Political opinions are not only formed by individual attributes and social categories but also significantly shaped by people with whom an individual discusses in everyday life (Huckfeldt, Johnson, and Sprague 2004; Huckfeldt and Mendez 2008; Huckfeldt and Sprague 1987; Zuckerman 2005). Political discussion networks warrant a research imperative. These comprise a foundational element of a healthy public sphere, where a variety of opinions and information are exchangeable, or, conversely, of echo chambers that reinforce established viewpoints and exasperate political divisions (Habermas 1984).

What transforms a social network into an echo chamber? Why do some individuals turn to highly similar friends to discuss political matters while others have more diverse discussion partners? While there is ample research on political networks and discussion, it is remarkable how little we know about social determinants of political homophily. Much of the literature on political discussion networks concentrates
on either documenting political similarity or describing partisan differences in their network composition, lacking a comprehensive explanatory model for the formation of political networks (Boutyline and Willer 2017; Colleoni et al. 2014; Huber and Malhotra 2017; Lazer et al. 2010). Failing to address how political networks form impedes a fuller understanding of the rise of echo chambers and makes it difficult for us to identify solutions to remedy such biased interactions. Investigating what breeds political assortativity is the central task undertaken in this paper.

Drawing on a line of foundational sociological theories suggesting that personal network formation is constrained by broader social contexts (Blau 1977a; Blau and Schwartz 1984; Fischer 1982; Huckfeldt 1983), this paper examines whether state-level sociodemographic consolidation exerts a contextual influence on individual-level choice of political discussion partners in the United States. According to macro network theory, political similarity in networks is a particular manifestation of the homophily principle that also applies for many other population characteristics (McPherson et al. 2001; Smith, McPherson, and Smith-Lovin 2014). The key insight is that the distribution of population characteristics regulates spatial segregation, thereby constraining an individual’s pool of discussion partners. It follows that in a state where sociodemographic characteristics such as race and religion are highly aligned with political affiliation, individuals may get to meet more politically similar others. In this view, political similarity in networks is shaped not just by individual preferences but also by a spatial and social context. I build
and test this claim by using the data from the American National Election Surveys, 2008-2009.

This study is among the first to directly model political homophily and link state-level characteristics to personal networks, considering the historical significance of state political culture in the United States (Elazar 1966; Erikson, McIver, and Wright 1987; Tocqueville 2002). I find that state-level political consolidation of sociodemographic characteristics is a strong predictor of dyadic partisan similarity in discussion networks. My findings suggest that extreme partisan sorting is rooted in sociocultural cleavages varied by states; especially the alignment between sociodemographic characteristics and political identification in a state has contextual effects on individuals’ network characteristics. Overall, this paper adds a contextual perspective in explaining political network formation and its consequence on political polarization. In the conclusion section, I discuss the implications of this study on the current debate about sources of political polarization.

3.2 Literature Review and Theory

The goal of this paper is to examine whether political similarity in personal networks is shaped by sociodemographic constraint in a state level. In this section, I first conceptualize political similarity as part of general attribute homophily of network formation processes. Then I assess the existing literature that could be more fruitful understanding by considering broader social contexts. Next, I draw on
macrosociological theory of network formation to show how demographic distributions can affect the degree of political homogeneity in social networks. Lastly, I develop a couple of hypotheses linking sociodemographic consolidation to political networks.

### 3.2.1 Political Homophily

Homophily is the principle that people prefer friends who are like themselves along multiple dimensions (Hallinan and Williams 1989; McPherson and Smith-Lovin 1987; McPherson, Smith-Lovin, and Cook 2001). Such a dimension can be political belief, attitudes, or affiliation. Political homophily, in turn, refers to the degree to which an individual makes relationships with politically similar partners compared to politically different ones.

Past research has documented a strong tendency towards political homogeneity in social networks. For example, earlier studies find similarity with respect to political behavior and practices among close contacts or “strong ties” (Huckfeldt and Sprague 1987; Knoke 1990; Laumann 1969; Verbrugge 1977), although these studies are not sufficiently sensitive to a possibility that this political homophily is due to other social characteristics that are correlated with political identities (McPherson et al. 2001). Later studies examine the relative impact of “choice homophily” and “induced homophily.” Lazer and his colleagues (2010), for instance, use their longitudinal sample from a professional graduate program to show that political homophily is largely dampened by the magnitude of homophily with respect to race, ethnicity, and religion. Huber and
Malhotra (2017) find evidence of individuals seeking politically similar partners in their romantic relationships, and its magnitude is comparable to that of educational homophily and half as large as racial homophily. Evidence of political homogeneity is not confined within confidants, as DiPrete et al. (2011) reveal in their analysis of the 2006 General Social Survey that broad acquaintanceship networks are also segregated by political orientation.

The lacuna in the research on political homophily is the lack of explanatory work that asks what glues people together politically. There are empirical efforts to explain variation in the rates of political homophily (Adamic and Glance 2005; Bakshy et al. 2015; Barberá et al. 2015; Boutyline and Willer 2017; Colleoni et al. 2014). However, most studies focus on the effects of individuals’ political spectrum of either offline or online networks, yielding mixed findings with respect to the difference between liberals and conservatives. Assuming there is a different social system by political orientation, researchers tend to focus almost exclusively on political features that shape political discussion partner selection. If we treat political similarity among individuals as a general process of tie formation, then those politics-centered studies are seriously missing other contextual mechanisms that generate political homophily (see Rivera, Soderstrom, and Uzzi 2010 for a review on dyadic tie formation). To firmly address the gap, the next section describes the choice-constraint approach.
3.2.2 The Choice-constraint Approach on Network Formation

To explain the pattern of political associations in interpersonal networks, it is useful to draw on a branch of macrosociological theory that seeks to explain the formation of social relationships, namely the choice-constraint approach (Feld 1981; Fischer 1982; Mollenhorst, Völker, and Flap 2008). This approach claims that forming a relationship between individuals is not merely driven by an individual choice. The choice is constrained by the social contexts that shape the pool of discussion partners. That is, individuals can forge ties only among people available to them (Fischer 1982). These contexts can be any broader aggregation of individuals such as places, organizations, and populations. For example, the racial distribution within a school significantly determines a student’s level of racial homophily, possibly beyond the individual preference (Moody 2001b). Likewise, if your neighborhood is in a landslide county in terms of voting, you are more likely to encounter the certain party voters more often than the others (Bishop 2008). Huckfeldt pointedly notes that “the available pool of socially similar individuals varies as a function of context, so that the same set of preferences might produce different friendship groups in different environments (Huckfeldt 1983:654).” This line of theoretical claims points to the “supply side” of network dynamics.

Following the choice-constraint approach, political homophily cannot be merely a product of individual choices but rather a result of individual choices constrained by
broader social processes. A more general framework is given by Peter Blau (Blau 1994; Blau and Schwartz 1984), who sheds lights on how a population’s distribution among social positions along multiple attributes contextualizes (seemingly) homophilous associations among individuals. His key insight is that homophily that unfolds in one dimension is affected by in-group preferences realized in other dimensions. Blau argues that this process is governed by a consolidation parameter, which is the correlation between social positions along the multiple dimensions. Take religion and economic status for example, if all Protestants are rich and all Catholics poor, religion and status are perfectly correlated. Social differences in this setting are consolidated, and economic status reinforces group boundaries between Protestants and Catholics. If the two dimensions are uncorrelated, then intersecting social differences would promote intergroup relations. Network formation is certainly different in these two settings. The level of choice homophily on political dimension should also be understood in relation to in-group preferences realized on other dimensions. Blau and his colleagues provide empirical evidence for this claim by finding that county-level intergroup marriage rates are lower in highly consolidated metropolitan areas in the US (Blau, Beeker, and Fitzpatrick 1984; Blau, Blum, and Schwartz 1982; Blau and Schwartz 1984).

The notion of consolidation speaks to the importance of the composition and distribution of a given population, because a population’s level of consolidation among homophily-inducing attributes exert a contextual influence on dyadic political similarity
in personal networks. I focus on the impact of state-level consolidation on political homophily in discussion networks. The reason is that states are an important spatial unit that structures American’s self-identity and social life, and political culture has historically varied by state (Gelman 2008; Haider-Markel 2009). The state characteristics are an important predictor for partisan and ideological identification (Elazar 1966; Erikson et al. 1987; Tocqueville 2002). Research also finds significant state-level variation in various aspects of social life, such as the negative relationship between state-level social heterogeneity and volunteerism (Rotolo and Wilson 2012), the state-level association between racial fragmentation and social capital (Alesina and La Ferrara 2000), and the effect of state income inequality on individual mortality risk (Lochner et al. 2001; Xu 2006), to name a few.

3.2.3 Expectations

The general expectation is that state-level social consolidation will have a positive association with the level of political similarity in an individual’s political discussion networks. High correlation among attributes at the state level means that residents in that state are unlikely to have the intergroup relations necessary to maintain a diverse personal network. Thus, individuals in a state with higher consolidation are expected to choose partners from the pool of politically similar people.

Unlike Blau’s original formulation that was concerned with the aggregate effects of consolidation by just including as many dimensions as possible, I derive hypotheses
by identifying two distinct types of consolidation in consideration of the political context (see Figure 9). The first one is socioeconomic status consolidation (“SES consolidation”), which correlates nominal characteristics (race, gender, religion) with stratifying characteristics (income, education). Associations between multiple nominal characteristics and stratifying attributes imply that between-group inequalities over status resources are pronounced at the state level. State-level inequalities across multiple dimensions would lead to the consolidated social differences, making discussion partner selection highly homogenous.

**Hypothesis 1:** State-level SES consolidation will have a positive association with the likelihood of an individual to nominate a politically similar partner.

![Figure 9: Two Types of Consolidation](image)

The second form of consolidation I consider is “political consolidation.” Political consolidation refers to the correlation between party identification and sociodemographic characteristics. Political consolidation would govern the degree to which sociodemographic characteristics are politically salient in a state. For instance,
political consolidation is high when there is disparate party identification between blacks and whites. Political consolidation incentivizes political strategies that seek to sort voters along party lines. The “Southern strategy,” the strategy adopted by the Republican Party in the wake of the Civil Rights era, is an archetypical example that continues to amplify political polarization. The Southern strategy sought to mobilize political support for the Republican Party among white voters in the South by making appeals to racially coded issues such as law and justice to minimize the perceived threat posed by African Americans (Aistrup 1996; Carter 1996; McVeigh et al. 2014).

Hypothesis 2: State-level political consolidation will have a positive association with the likelihood of an individual to nominate a politically similar partner.

3.3 Methods

3.3.1 Sample

The data for this study come from the American National Election Surveys (ANES) 2008-2009 Panel Study. The ANES recruited two cohorts of a nationally representative sample by random-digit-dialing methods, one beginning in January 2008 and the other in September 2008, resulting in a total of twenty waves of data. Along with very fruitful information about political preferences, practices and attitudes, the September wave (9th) includes survey items that probe respondents about political discussions in their interpersonal networks. Respondents were allowed to nominate up
to three people with whom they talked about the government or elections during the last six months (on average 2.76 valid discussion partners per person). Respondents then provided information on each partner’s partisanship, race, gender, education, religion, age, and whether he or she is a family member. This survey setting makes it possible to examine self and partner’s similarity in multiple characteristics, which fits the goal of this study. I use the September cross-section of the ANES 2008-2009 to investigate my hypotheses (N=2,140).

3.3.2 Measures

The key outcome variable is dyadic similarity in partisan identification. Partisan identification is a typical 7-point scale variable ranging from strong Democrat to Independent to strong Republican. I use respondents’ and their nominated partner’s partisan identification to calculate dyadic partisan similarity, with this formula (Mollenhorst et al. 2008):

\[ P_{i,j} = -1 \times |P_i - P_j| \]

where \( P \) is party identification score from ego \( i \) and the nominated alter \( j \). Dyadic partisan similarity is measured as the negative absolute difference in partisan identification between self and a partner.

The main predictor variable is SES and political consolidation. These are a population-level construct, so states are the measurement unit. For each state, I derive bivariate correlations among the constituents’ covariates such as race, gender, religion,
education, income, and political affiliation. The SES consolidation pertains to the average of these bivariate correlations: race-income, race-education, gender-income, gender-education, religion-income, religion-education, and income-education. I operationalize political consolidation as the mean of the correlations that party identification has with race, gender, religion, income, and education.

I also account for confounding variables that might disrupt the association between consolidation and political homophily in networks. Political homophily could be an incidental consequence from a dyad sharing similarity on other dimensions. I include dyad-level variables indicating whether a dyad is same or similar with respect to their race, gender, religion, age, and education, and whether the two are relatives. I also include individual covariates.

As theory suggests, consolidation is hypothesized to unfold in the form of social segregation across the multiple dimension. To isolate the effects of consolidation, other segregation indices should be accounted for. To that end, I control for racial segregation index (estimates by the University of Michigan Social Science Data Analysis Network's analysis on the 2005-9 American Community Survey), urbanization rates (by U.S. Census Bureau), Gini coefficient, and the proportion of whites.

3.3.3 Analytic Strategy

The main analytic goal is to predict dyadic similarity in party identification between self and the chosen discussion partner. We need to take into account the
hierarchical structure of the data, as dyads—the primary unit of analysis—are nested within individuals. For this reason, I use multilevel techniques, using hierarchical linear modeling. Previous research shows that the multilevel approaches are appropriate for ego network analysis, addressing the nestedness of the data and the dependence between observations within individuals (van Duijn, van Busschbach, and Snijders 1999; Mollenhorst et al. 2008; Perry, Pescosolido, and Borgatti 2018; Snijders 2003).

3.4 Results

3.4.1 Descriptive Results

I first present the descriptive findings to help make sense of the sample characteristics, main variables, and their bivariate associations. Figure 3.2 is the histogram of the political dyadic similarity of the respondent and their chosen discussion partners. It is measured by the negative absolute difference in a 7-point scale of party identification. The highly skewed distribution indicates that most respondents chose their discussion partners with very similar political leanings to theirs, with the mean value -1.50 (s.d. = 1.76).
Does the dyadic political similarity vary by states? Figure 11 plots the mean dyadic similarity by states. I find a moderate amount of variation. The variation doesn’t seem to be solely attributed to certain known state-level difference in partisanship, regional characteristics, or urbanization rates. Southern states, for example, do not show a collective pattern of being either highly similar or diverse in discussion networks. The highest mean dyadic similarity is found in Washington, D.C. One might imagine a metropolitan city is a mixing environment, and people there are expected to have diverse networks. My finding prima facie seems contradictory. But, in official statistics,
DC has been and remains a highly racially segregated area. Its economic inequality, measured by Gini coefficient, has also been constantly high. These together imply that race and class stratify Washington D.C. My data also indicate that DC has a high consolidation score. So, it suggests that none of the common collective characteristics—whether it is traditional partisanship, region, or urban—determines the level of political similarity in networks.
Figure 11: Mean Dyadic Similarity by States
Next, I correlate the state mean dyadic similarity with my primary predictor variable, social and political consolidation (see Figure 12). Political consolidation is highly correlated with dyadic political homogeneity, with an adjusted r-squared value of .374 from a simple linear model. SES consolidation comes next. Other spatial characteristics, however, do not display a strong association - proportion whites, gini coefficients, segregation index, and urbanization rates.
Figure 12: Mean Dyadic Similarity by Consolidation and States

<table>
<thead>
<tr>
<th></th>
<th>Correlation</th>
<th>R-squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Political Consolidation</td>
<td>0.612</td>
<td>0.374</td>
</tr>
<tr>
<td>SES Consolidation</td>
<td>0.492</td>
<td>0.242</td>
</tr>
<tr>
<td>% White</td>
<td>-0.432</td>
<td>0.187</td>
</tr>
<tr>
<td>Gini Coefficient</td>
<td>0.382</td>
<td>0.146</td>
</tr>
<tr>
<td>Racial Segregation</td>
<td>-0.103</td>
<td>0.011</td>
</tr>
<tr>
<td>Urbanization</td>
<td>-0.121</td>
<td>0.015</td>
</tr>
</tbody>
</table>
3.4.2 Explanatory Model Results

The main hypothesis of this study is that state-level consolidation—identified as SES and political consolidation—is associated with the level of political homophily in political discussion networks. I test this hypothesis using a multi-level linear regression model that predicts dyadic similarity. Table 2 gives the estimates from the multi-level regression of dyadic political similarity. The results suggest that political consolidation is a strong predictor of dyadic political similarity. The coefficient for political consolidation is positive and significant. These findings suggest that the more politically consolidated a respondent’s voting state, the higher the political similarity between a respondent and her nominated discussion partner.

Table 2: Estimates from a Multi-level Linear Regression on Dyadic Partisan Similarity

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SES Consolidation</td>
<td>0.963</td>
<td>0.568</td>
<td>0.0901</td>
</tr>
<tr>
<td>Political Consolidation</td>
<td>1.875</td>
<td>0.732</td>
<td>*</td>
</tr>
<tr>
<td>Dyad: Same Race</td>
<td>0.320</td>
<td>0.085</td>
<td>***</td>
</tr>
<tr>
<td>Dyad: Same Gender</td>
<td>-0.076</td>
<td>0.049</td>
<td></td>
</tr>
<tr>
<td>Dyad: Same Religion</td>
<td>0.227</td>
<td>0.057</td>
<td>***</td>
</tr>
<tr>
<td>Dyad: Age Similarity</td>
<td>0.006</td>
<td>0.002</td>
<td>**</td>
</tr>
<tr>
<td>Dyad: Same Education Level</td>
<td>0.112</td>
<td>0.049</td>
<td>*</td>
</tr>
<tr>
<td>Dyad: Relative</td>
<td>0.235</td>
<td>0.056</td>
<td>***</td>
</tr>
<tr>
<td>Number of Alter</td>
<td>0.012</td>
<td>0.081</td>
<td></td>
</tr>
<tr>
<td>Racial Segregation</td>
<td>0.003</td>
<td>0.005</td>
<td></td>
</tr>
<tr>
<td>Gini Index</td>
<td>-0.150</td>
<td>2.782</td>
<td></td>
</tr>
<tr>
<td>% White</td>
<td>-0.232</td>
<td>0.472</td>
<td></td>
</tr>
</tbody>
</table>
It is worth examining potential confounders for the effects of consolidation. This model includes a set of dyadic covariates in terms of race, gender, religion, age, education, and family. These capture the possibility that similarities in other social dimensions induce political homophily between self and partner. I find that political similarity is high when the partners are relatives or in the same religious denomination. One might suspect that state-specific characteristics such as Southerners, urbanism, and racial homogeneity, which might have arranged the state-level association between consolidation and political homophily. I do not find significant effects for those variables. Additionally, I test whether conservatives are more likely than liberals to sort on
political characteristics. My model results indicate that Democrats and Republicans do not significantly differ in their homogeneity of discussion networks.

3.5. Discussion and Conclusions

My findings suggest that political similarity in political discussion networks is rooted in the broader contexts. The main contextual element unveiled in this study is state-level consolidation, the correlation among homophily-inducing attributes. I identify two specific forms of consolidation—SES and political consolidation—and conduct hypothesis testing on whether each form of state consolidation predicts dyadic partisan similarity in individuals’ political discussion networks using the 2008-2009 American National Election Survey. Using a multi-level regression model, I find a strong support for political consolidation and weak effects for SES consolidation. So, if an individual is in a voting state where race, gender, religion, education, and income are highly associated with political identification, because networks tend to be homophilous on those features, he or she will also have more homogenous networks in terms of partisan identification. The results hold after controlling for dyadic similarity with respect to other social characteristics, spatially segregating forces, and demographic composition. This paper serves as a more specified empirical validation of my own formal model (Study 1 in this dissertation).

The explanation for the association between sociodemographic consolidation and political homophily is given by the impact of demographic distribution on the pool of
social networks. People consider multiple attributes when forming social relationships. No single attribute can dictate network formation. Tie formation is governed by the homophily principle on each attributional dimension. Then, the combined effect of multiple dimensions on network formation is highly dependent upon the level of consolidation. This means that high consolidation creates segregated environment on a macro level (a state in this study) for individuals to make ties. Individuals, then, are forced to face the limited pool of networks within which they can choose a partner to discuss about political matters. This explains the strong effect of consolidation. This effect is “structural” in the sense that, regardless of individual efforts to avoid similar others, individuals are forced to face the pool of political discussion partners that is already shrunken by the consolidated social differences in a place.

These findings echo the insights from the contextual approach that thrived some decades ago (Blau 1994; Blau and Schwartz 1984; Fischer 1982; Huckfeldt 1983). To be clear, this study builds on a fundamentally sociological approach, which is not new. However, its applications and implications for the political realm have not been fully explored. My revisits to sociological classics add a “structural” viewpoint on political echo chambers and the resulting extremism. In general, prior research tends to attribute the political extremism to agent-level mechanisms—homophily, biased assimilations, distancing (Baldassarri and Bearman 2007; Dandekar et al. 2013; Levendusky 2009; Della Posta et al. 2015)—and institutional influences such as elite politics sorting (Baldassarri
and Gelman 2008; McCarty et al. 2006), partisan media (Prior 2013), and social movements (McVeigh et al. 2014). This paper makes contributions by illuminating the contextual elements of network formation and thereby balancing the individualistic perspective with the structuralist explanation.

Further, the contextual approach enables us to focus on the changes in social structures as a potential driver for the rise of the political echo chambers and political polarization. Formulated in my own agent-based model (Study 1), my argument is that political polarization has gradually increased with the macro-level changes that raise the correlation among nominal and stratifying attributes and thereby localize the pool of networks. For such macro-level changes, this study finds the effect of “political” rather than “SES” consolidation of sociodemographic characteristics.

In fact, many empirical indicators in the literature suggest that political consolidation has increased over time. Research finds the increasing correlations between religion and political affiliation (DiPrete et al. 2011) and between income and political partisanship (McCarty et al. 2006). An over-time increase of political residential segregation (Bishop 2008)—i.e., the greater association between neighborhood choice and political partisanship, indicated by the larger number and higher degree of ‘landslide’
counties—is also important to note, as political consolidation of sociodemographic differences can readily be crystallized in the spatial form.¹

The assertion that political polarization increases with social consolidation obviously requires a more careful, rigorous investigation of long-term changes. Establishing the causal relationship further requires the changes of the two phenomena occur congruently in terms of timing (Morgan 2013; Morgan and Winship 2014). That is, political polarization on the surface can be faster than social consolidation that occurs in the underlying social structures. The inconsistency of timing might undermine the causal link that I suggest. However, unlike SES consolidation which would indeed appear to change slowly in the form of between-group inequalities over “materialized” resources, political consolidation involves “ideational” alignment between social attributes and political orientation, which is relatively easier to change in response to the sorting dynamics of elite politics. Although anecdotal, it has happened so—from the Southern strategy that politically sorted race groups in 1960s (Aistrup 1996; Carter 1996; Gelman 2008; McVeigh et al. 2014) to the mobilizations of white blue collar workers, often termed “Hillbilly”, in support of Donald Trump in the most recent election (Lamont, Ayala-Hurtado, and Park 2017; Vance 2016). Empirical findings generally

¹ Whether the nation is segregated by the political preferences of its electorate should be carefully distinguished from gerrymandering, an argument that redistricting by legislators produces overwhelming majorities. There is little evidence that gerrymandering was responsible for the increase in landslide districts because there was no immediate increase in lopsided districts after redistricting (Bishop 2008). A study using data for millions of partisan migrants across 7 states observes that migration patterns indeed reflect preferences to relocate in areas populated with co-partisans (Tam Cho, Gimpel, and Hui 2013).
converge that political parties are more polarized in recent decades and therefore better at sorting ordinary citizens (Baldassarri and Gelman 2008; Fiorina, Abrams, and Pope 2011; Hetherington 2001; Moody and Mucha 2013). It is possible that political consolidation of social characteristics has emerged due to the interdependent relation between party sorting and social life. This speculation needs future empirical work.

Lastly, I address this study’s limitations that warrant cautious interpretation as well as future research. Especially, the measurement of consolidation is not perfect. Given the data constraints, I have derived state-level consolidation from within-state individual covariates. This has created missingness in the data because I had to omit some states where there were too few respondents or no variability in some key variables (e.g., all respondents in a state are whites). One might also raise a concern about whether states are an appropriate unit of analysis, provided that there is so much variability in terms of inequality, racial composition, urbanization, etc. within a state. An alternative would be to use zip codes to model county-level consolidation. The apparent trade-off in taking a smaller unit is that one must rely on even fewer respondents to calculate bivariate correlations, which decreases the accuracy of the measure. Combining population-level data seems necessary to better estimate consolidation. I believe that, however, state-level consolidation is the second best choice at this point with the data available.
4. Study 3: Racial Segregation, Group Conflict, and Enmity Formation in Adolescence

4.1 Introduction

Segregation of social networks is a persistent problem in the United States, and one of the most studied in the social networks literature (Freeman 1978; Hallinan and Williams 1989; Schelling 1971). Scholars note that Americans are socially divided along the multiple dimensions defined by social categories such as race, gender, religion, socioeconomic status, and political affiliation, to name a few (McPherson et al. 2001). Racial divides are arguably the most entrenched, indicated by studies of a wide variety of social relationships including discussion, acquaintanceship, friendship networks, and even organizational founding teams (DiPrete et al. 2011; Moody 2001b; Mouw and Entwisle 2006; Quillian and Campbell 2003; Ruef, Aldrich, and Carter 2003; Wimmer and Lewis 2010). The tendency towards racial homophily in schools and communities remains virtually unchanged since the weakening enforcement and abandonment of Civil Rights Era legislation starting in the early 1980s (Smith et al. 2014). Segregation of social networks, especially with respect to race, continues to contribute to racial disparities in health (Williams and Jackson 2005), educational outcome (Charles 2003), and employment (Mouw 2000).

One reason we care about racial segregation is that it might also lead to intergroup conflict. One classic theoretical and policy response to address racial divides and disparities is to advocate the integration of social networks in schools (Feld and
By integrating school settings, researchers and policy makers hope to promote intergroup contact in such a way as to promote friendships and mutual understanding. The logic of institutional integration efforts has been that conflict is a consequence of segregation, and thus integration is a solution to interracial conflict. That is, segregated structures suppress intergroup contact during socialization, inhibiting learning about and developing affinities for outgroup members (Allport 1954). The presupposition here is that the absence of ties in a segregated network necessarily imply conflict, as individuals in these structures are more likely to develop prejudices that contribute to intergroup conflicts (Pettigrew 1998; Pettigrew and Tropp 2006).

Given the longstanding concern about the link between segregation and conflict, it is remarkable how little we know how segregation and conflict manifest concretely in actual friendship and enmity relationships. While we have much research on friendship, we have very little on enmity. Focusing on enmities allows us to rigorously examine the assumption that the absence of interracial friendship corresponds to the presence of interracial enmities. It might be easier to assume that lack of cross-category friendship ties would turn conflictual, but classic theory and recent advances in research on “negative ties” suggest a more nuanced view, highlighting the role of status processes that plays in the formation of enmities. Individuals strive for not only categorical similarity but also positive attention from peers (Cartwright and Harary 1956; Heider
Social rank is thus of utmost importance for interaction, and conflicts arise when relative status is in dispute (Gould 2003). Particularly relevant to the school context, research finds that strategies for achieving popularity often accompany aggression and exhibit negative consequences for maintaining friendships (Faris and Felmlee 2011). Dislikes from the status differences among peers are related to the hierarchical nature of the social system in school. In many settings, we expect that high-status adolescents will form an exclusive cluster called “leading crowds,” which occupies the position that controls social and behavioral norms (Coleman 1961; Faris and Ennett 2012). The resulting status demarcation may develop into subtle dominance struggles expressed in negative ties. Because past research on segregation has tended to rely heavily on friendship networks as a sole outcome, we are still inconclusive as to whether or not the formation of enmities is jointly triggered by attribute homophily and status processes in friendships.

Consequently, disentangling the effects of categorical segregation and status processes on the likelihood of forming enmities is the central task of this paper. We present a new approach by building a unified model of multiple relationships that identifies the sources of conflict beyond network segregation. The goal of this paper is to find: (1) where and how friendship and enmity relationships are distinct in their formation processes, and (2) how categorical differences and status demarcation in friendship jointly affect the formation of enmity ties. To address these questions, this
study uses a unique longitudinal data from *The Process of Peer Influence (PPI) Study* for the years 2004-2007, fielded at a magnet school in North Carolina (Killeya-Jones, Nakajima, and Costanzo 2007). One key advantage of these data is that they feature multiple relations, including not only friendship and enmity networks but also peer nominations for groups, identities, and behaviors. Another advantage is that there is near parity between whites and blacks, which allows us to observe racial homophily in an integrated setting. A final advantage of these data is that respondents in this setting were selected by lottery from a pool of eligible applicants, dampening neighborhood effects and related confounders.

To preview, our findings are somewhat counter-intuitive: The racial segregation-conflict link is not so much direct but complicated by status processes. Social categories that contribute to segregating friendships have a less pronounced effect on the formation of enmities. Rather, strong segregation makes within-race status group dynamics more important in developing negative ties. We identify parallel core-periphery structures for Black and White students, and our dyadic and random graph models show that conflict is mainly triggered by the enmities that form between members and outsiders of “leading crowds” within race. This study contributes to social networks scholarship and the race relations literature by theorizing segregation and conflict as distinct dimensions expressed through multiple concrete social relationships and by providing a new
framework where the occurrence of interracial enmities is contingent upon the segregated structures and the distribution of status values.

4.2 Theory

4.2.1 Segregation and Conflict

Social networks scholars study racial and ethnic relations largely based on the concept of segregation and homophily. Racial segregation in networks refers to the degree to which friendship choices of members of one race are confined to members of their own race and do not encompass to members of another race (Freeman 1978). Homophily is a more local-level principle, referring to the tendency to have more same-race friends than expected by chance (Feld 1981; McPherson et al. 2001).

What is left unclear rests on the implications and consequences of racial segregation. On one hand, primarily focusing on the beneficial effects of intergroup contact (Allport 1954; Pettigrew 1998), research tends to lament the lack of interracial ties being implicitly treated as conflictual/antagonistic (Moody 2001; Smith et al. 2016). Racial conflict is, however, not an inevitable outcome of friendship segregation. In many instances, segregation leads to isolation rather than conflict. Being unable to distinguish isolation from conflict seriously limits the literature’s scope condition and conclusions. On the other hand, as balance theory suggests (Cartwright and Harary 1956; Davis 1963; Goodreau, Kitts, and Morris 2009; Heider 1946), segregation can indeed be a
fundamental antecedent of conflict. Even when that is the case, the question becomes when and how racial homophily develops into conflict or isolation with the racial out-group.

This study answers the question of segregation and conflict by investigating the formation of both friendship (who you are friends with) and enmity (who you least like) relationships in a racially diverse school. A key merit of this multi-relational approach is that we are able to clearly define the dyads in combination of the two relationships—actors \( i \) and \( j \) can be friends, enemies, or segregated (i.e., the absence of either ties). The question is whether the social processes making enmities and segregation are distinct and, if so, which predictors make individuals enmities rather than segregated. For example, do racial differences lead to enmity over segregation while gender contributes segregating friendships, not the development of enmity? More broadly, how can categorical attributes and status characteristics be different in predicting enmity and segregation?

4.2.2 Antecedents of the Formation of Enmities

To anticipate predictors of enmity, here we build on a small but growing body of studies on negative ties. Negative ties “represent an enduring, recurring set of negative judgments, feelings, and behavioral intentions toward another person” (Labianca and Brass 2006:597). The idea is that individuals are tied by not only amity but also enmity
relations (Boda and Néray 2015; Huitsing et al. 2012; Labianca 2014; Offer and Fischer 2017; Rambaran et al. 2015).

The primary principle of friendship formation is the well-known preference of similarity in networks, homophily. Attribute homophily in friendship usually happens across the sociodemographic lines, and the separation of friendship can result in enmity against the outgroup. This is the scope condition of contact hypothesis and intergroup contact theory (Allport 1954; Pettigrew 1998). Biased interactions increase outgroup prejudice, inhibiting enhancing mutual understandings between the groups. The relational consequence for an individual is a large degree of both in-group selection of friends and outgroup selection of enmities. On a global level, if attribute homophily perfectly explains peer enmities, conflict will exactly be the inverse of segregation—i.e., a dyad not being friends will be enmities. This is also consistent with the prediction from social balance theory (McPherson et al. 2001).

Enmities are also likely formed by a function of peer status. Peer status here refers to adolescents’ position within their informal school prestige, hierarchy, based on other students’ assessments. Gaining status and being popular constitutes a central goal in adolescence (Coleman 1961). Peer status shapes enmity in two ways. First, the imbalance of status leads to dislikes among students. Research suggests that there is a tendency that adolescents are close to those who are similar in status to their own (Ball and Newman 2012). Enmity relationships likely follow from dissimilarity in peer status
(Berger and Dijkstra 2013). Low-status peers may dislike high-status kids because of peer rejection and the frustration of status goals. By contrast, high-status peers can be in opposition to low-status kids since they want to distinguish themselves and avoid status loss. Secondly, peer status puts individuals into conflict by involving status behavior such as aggression. Faris and Felmlee (2011) use the term “status struggles” to point out that peer status increases the capacity for aggression and competition to gain or maintain status motivates further use of aggression.

On a group level, this study attends to the pivotal role of crowds played in the development of peer enmities. In his seminal work, Coleman (1961) identifies the leading crowd as a core cluster of high-status teenagers and shows that membership to the “leading crowd” is a fundamental basis of popularity and peer status. Most teenagers aspire to get into the crowd, and the leading crowd members enjoy greater popularity and higher self-esteem than outsiders (Brown, Eicher, and Petrie 1986; Brown, Mory, and Kinney 1994). The most relevant point for this study is that crowd membership provides a vantage point where members and outsiders become hostile against each other. And the collective nature of the leading crowd helps define what we are not, activating differences in status and behavioral characteristics that prior literature recognizes as individual factors generating hostility toward others (that is, I don’t like you because I don’t like the crowd you hang with). In sum, peer groups’ demarcation of status hierarchies can generate enmity.
In summary, while the main source for segregation comes from differences in social categories, we emphasize that peer status and its relevant group dynamics—captured by the notion of crowd membership—also constitute an important predictor for peer enmities. In the following section, we consider these antecedents more comprehensively and establish our expectations.

4.2.3 Expectations

Figure 13: Two Models of Enmity Formation
In Figure 13, we display a conceptual diagram to visualize our expectations based on the two competing models for intergroup conflict and network formation. The initial condition is as following. The population is comprised of individuals who have attributes X or Y of a social category, whites and blacks, for example. They befriend others based on the principle of attribute homophily; white students have a disproportionately larger number of white friends than black ones, and vice versa. The resulting friendship networks are thus segregated by the social category. Given this setting, the two models derived are different in their prediction of the distribution of enmity ties.

First, the proposition of “homophily model” is that enmity is simply the inverse of friendship segregation. This assertion is in line with the fundamental assumption of contact hypothesis. That is, segregation leads to outgroup bias toward the people of different attributes. Intergroup conflict occurs there. In this case, the likelihood of forming cross-category enmity ties will be higher than within-category enmity ties.

Second, the proposition of “crowd model” is that enmity is concentrated within the boundaries that segregation reinforces. Segregation leads people of different attributes (say, race) to form homogenous crowds respectively (say, black and white crowds). This separation establishes the status hierarchy and thereby relational hostility within their own friendship group. In this case, the main driver of enmities is the cross-crowd negative nomination among same-attribute peers. As a consequence, the
likelihood of forming cross-category enmity ties will be lower than within-category enmity ties.

4.3 Data and Methods

4.3.1 Data

Our sample comes from the Process of Peer Influence (PPI) project conducted by the Duke Transdisciplinary Prevention Research Center between the years 2004-2007 (Killeya-Jones et al. 2007). The goal of the study was to examine how a variety of interpersonal relationships influence the development of problem behaviors during adolescence. The PPI study took place in a magnet school comprising of grades 6–12 in a mid-sized southeastern city in the United States. The survey design is longitudinal, with students being followed from 7th grade through 9th grade (cohort 1) or 10th grade (cohort 2). Cohort 1 (N=168) was recruited from the 2004-2005 7th grade class, and Cohort 2 (N=156) students were recruited from the 2005-2006 7th grade class. The resulting data include four time points for two cohorts: the fall of their 7th grade year (Time 1), the spring of 7th grade (Time 2), the fall of 8th grade (Time 3), and the fall of 9th grade (Time 4). Response rates at Time 1 were 83 and 80 percent for Cohorts 1 and 2, respectively. The Cohort 1 sample suffered a total of 28 percent attrition, while cohort 2 suffered 30 percent by Time 4. The race/ethnic composition of the combined grade-wide population was 49% Black/African–American, 37.5% White/European–American, 6.5% Hispanic, 4.5% multi-racial/multi-ethnic, 2% Asian, and 0.5% other race/ethnicity.
Approximately 21% of students in the school receive free or reduced school lunch, compared to 45% district-wide.

For the purposes of this study, the key advantage of these data is that they feature a variety of sociometric nominations and Social Cognitive Mapping (SCM) measures. The sociometric nominations include a variety of behavioral and social influence descriptors, while the SCM measures provide group measures at multiple levels of granularity. We leverage both variable types to identify “crowds” in our sample and investigate multiple social networks. To generate the sociometric nominations, participants were provided a roster of all the students in their grade and were asked to make unlimited nominations of not only friends but also peers who fit into various behavioral and social influence descriptors. Students were hypothetically free to nominate the entire class. We eliminated nominations by students whose total number of nominations was more than 1.5 interquartile ranges above the third quartile (but retained as recipients in the data).

In addition to the networks data, we use the data created from SCM, a memory-based method for identifying peer groups (for an excellent review, see Neal and Neal (2013)). We used the SCM procedures developed by Cairns and colleagues to identify social groups (Cairns et al. 1988; Cairns, Perrin, and Cairns 1985). The students were first asked: “Are there some kids here in your grade who hang around together a lot?” The students were then instructed to list together the names of the children who hang
around together and to name all of the groups. We use a co-occurrence matrix of the number of nominations each student received for being a member of a clique along with other particular peers to define individuals’ level of centrality within the group (ranging from the peripheral members who are infrequently nominated as being members of the clique to the nuclear members who are frequently nominated as being members of the clique). Gest, Moody, and Rulison (2007) among others have found that observed interaction frequencies are highly correlated with observed overlap in SCM group nominations.

### 4.3.2 Measures

#### 4.3.2.1 Enmity and Friendship Networks

This study takes enmity in peer relations as a response variable to measure racial conflict. Participants were provided with a roster of all the students in their grade and asked to make unlimited nominations of the peers that they least like (DeRosier and Thomas 2003). We use this item to construct enmity networks. The use of the least like questionnaire has also been found in past studies (Rambaran et al. 2015; Yap and Harrigan 2015). Although we are most interested in predicting enmity relationships, we also consider friendship as another dimension in identifying peer groups and examining racial segregation. Friendship networks were created by asking students whom they hang around with.
4.3.2.2 Crowd Membership

Crowd membership is our primary predictor. Because crowds refer to a collection of cohesive peer groups that evoke a common set of category memberships and stereotypic associations (Brown et al. 1986, 1994, Coleman 1960, 1961), they require careful operationalization to identify. To be a crowd, a peer group must be both structurally cohesive and qualitatively coherent (Moody 2001a; Moody and White 2003). By structurally cohesive, we mean that the groupings identified by the analytical method identify groups of students that actually hang together. By coherent, we mean that the crowd encompasses a stable set of category memberships and group memberships. This obligates us to consider a range of identity and school culture measures such as peer nominations to identify patterns of stereotypic attributions, as well as club memberships and personal behaviors to identify differences in school-culture orientation between crowds.

To identify crowds that are both structurally cohesive and qualitatively coherent, we combined the peer group information derived from SCM with a cluster analysis of key individual attributes associated with each crowd. SCM offers peer groups verified by multiple informants. To investigate the group’s characteristics, we performed a cluster analysis using individual attributes, and then identified the intersection between the resultant clusters and the SCM groups. To generate the clusters, we included variables that are known to inform the social status and school orientations of adolescent
friendship groups (Sussman et al. 2007). In particular, we included various ascribed identities derived from peer nominations data. These include:

- **Leadership**: *who are leaders and good to have in charge?*
- **Popularity**: *who is the most popular?*
- **Deviance**: *who is good at getting other kids to break the rules?*
- **Aggression**: *who fights a lot, hits others or says mean things?*
- **Victimization**: *who gets picked on or teased?*

In turn, we identify the two large, racially homogeneous leading crowds—each consisting of popular, high-status adolescents from the respective racial group. From this, we make 4 categories in combination with race, namely Black crowd member, Black non-member, White crowd member, and White non-member. They are positioned at the “core” for their racial component, largely consistent with Coleman’s (1961) concept of a “leading crowd”. A close analysis on these crowds will be reported in details in the Results section.

### 4.3.2.3 Sociodemographic Characteristics

Along with crowd membership, *race* is our key predictor. We dichotomized race into whites and nonwhites. The majority of nonwhites are African-American students (71%). We also control for other sociodemographic characteristics that have been found to be important sources of friendship homophily (McPherson et al. 2001), as these factors also influence the patterning of enmity nominations. These factors include: *gender* and
SES. We code gender as a dichotomous variable, with 1 = male and 0 = female. We operationalize SES using the parents’ occupational codes as measured by the Hollingshead scale, with 1 being low SES occupations and 9 being high SES occupations (Hollingshead 1975). We averaged the mother’s and father’s SES. If there is data only for one parent, we use that parent’s score. We then transformed our SES variable into a 4-point categorical variable, using increments of .50 of the continuous z-score as cutoff points.

4.3.2.4 Propinquity

Another potential confounder is propinquity; being in close proximity to others increases the odds of interacting with them and thus of befriending or hating them. To account for propinquity, we create dyadic-level variables for extracurricular activities and friendship. Adolescents reported their participation in up to 15 activities (e.g., sports, academic clubs, honor societies). We follow Haas and Schaefer’s (2014) approach by constructing a dyadic-level variable, where we count the number of shared activities for each dyad. Friendship dyads are another cause of propinquity. Although it might appear obvious to control for friendship, the primary reason to control for friendship dyads when predicting enmity relationships is not to control for enmity opportunities but to distinguish the effects of “crowd membership” from dyadic effects. For example, we need to isolate the effect of A not disliking B because they’re friends from the effect of A not disliking B because they’re in the same crowd.
4.4 Results

This section consists of four subsections. We first present our descriptive findings that conflict is not simply a reflection of segregation. We show that the core categories that come into play in segregating friendships are far less pronounced in enmity nomination patterns. Second, seeking within-category status structures that might complicate the link between segregation and conflict, we identify leading crowds, cohesive, high-status peer groups, among both white and black students. Third, we use a dyad-level multinomial logit model to display that differences in crowd membership rather than the categorical differences lead to enmity over segregation. Lastly, we specifically focus on the relationship between race and crowds by using an exponential random graph model (Robins et al. 2007) to test whether differences in crowd membership among same-race peers explain why we observe less interracial but more intraracial enmity ties.

4.4.1 Segregation and Conflict

We first describe how friendship and enmity nomination patterns are associated in our sample. Does the absence of friendship imply conflict? We approach this question by examining how friendship nominations correlate with enmity nominations. If yes, we would expect a significant negative correlation. The table 3 lists the pairwise correlations of friendship and enmity. The correlation between friendship and enmity is very low, nearing 0. The lack of a strong correlation conveys a simple truth that not being friends
does not necessarily imply a state of conflict. Further, we reveal that the perceived identities being strongly related to friendship are not associated with enmity, and vice versa. That is, while students tend to be friends with whom they perceive as popular (.305) and leader (.278), it is not evident that they form enmities with peers that they do not nominate as popular or leaders (.026, .009 respectively). Likewise, students tend to form enmities with those they perceive as aggressive (.197) and deviant (.154), but it is not evident that students avoid befriending kids identified in this way (both Pearson correlations for friendship are under .100). These network-level bivariate analyses suggest that enmity is not simply the inverse of friendship.

<table>
<thead>
<tr>
<th></th>
<th>Friends</th>
<th>Enmity</th>
<th>Popular</th>
<th>Leader</th>
<th>Aggression</th>
<th>Deviant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friend</td>
<td>1.000</td>
<td>-0.047</td>
<td>0.305</td>
<td>0.278</td>
<td>0.099</td>
<td>0.084</td>
</tr>
<tr>
<td>Enmity</td>
<td>-0.047</td>
<td>1.000</td>
<td>0.026</td>
<td>0.009</td>
<td>0.197</td>
<td>0.154</td>
</tr>
</tbody>
</table>

Another way to determine the relationship between segregation and conflict is conduct a subgroup analysis, focusing on in-group selections with respect to friendship and out-group selections with respect to enmity. If race, for example, explains the friendship and enmity nomination pattern well, we would expect white students would be substantially more likely to report friends with white students and enmities with black students, and vice versa. We calculate the odds ratios of nominating same-group
peers versus cross-group peers for both friendship and enmity relations, applying race and gender categories (Table 4).

Table 4: Odds Ratios Nominating Same-group Peers against Cross-group Peers

<table>
<thead>
<tr>
<th></th>
<th>Friendship</th>
<th>Enmity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Black</td>
<td>2.971</td>
<td>2.753</td>
</tr>
<tr>
<td>White</td>
<td>4.018</td>
<td>3.265</td>
</tr>
<tr>
<td>Male</td>
<td>2.397</td>
<td>2.031</td>
</tr>
<tr>
<td>Female</td>
<td>2.669</td>
<td>2.978</td>
</tr>
</tbody>
</table>

We find that the students have a disproportionately larger number of same-race and same-gender friends than friends with different attributes. The odds of a friendship are generally around 2 for both group categories, where a value of 1 indicates no difference between the groups. This pattern of attribute homophily in friendship, however, does not seem to translate into outgroup enmity patterns. The odds of an enmity are slightly larger than or close to 1, meaning that respondents are generally more likely to report in-group rather than cross-group enmities. For instance, the odds that a white kid reports white enmities are consistently larger than 1, even though they are also 3.66 times more likely on average to nominate a white friend than a black one. The same patterns are observed regarding gender. The fact that students consistently are more likely to report an in-group rather than a cross-group enmity indicates that the core categories that segregate the friendship network are not sufficient to explain...
intergroup conflict. This leads us to examine the relationship patterns around crowds—the high-status peer groups—in a segregated friendship structure that are our analytical focus for the next subsection.

4.4.2 Crowd Identification and Member Composition

To identify crowds as a collection of cohesive peer groups that share salient characteristics, we combine the peer group information derived from social cognitive mapping (SCM) with a cluster analysis of key individual attributes that are known to be associated with adolescent crowds (Sussman et al. 2007). Our strategy is to maximize the intersection of SCM groups and clusters so that we can find both structurally robust and categorically salient collectivities. To that end, along with the SCM group information, we perform a cluster analysis using the school culture variables, including respondent’s z-score for peer nominations for leadership, physical aggression, deviance, popular, and victimization. We include this nomination data to identify group-based stereotypic associations.

Once we derived clusters for all individuals, we single out a subset of SCM groups that present substantial consensus on the cluster assignment among their members. Specifically, we use the following criteria/threshold: 1) The majority of the members in an SCM group (>75%) should belong to the same kind of cluster. By this we are able to rule out the groups that are too diverse to represent salient identities; 2) The size of an SCM group is large enough to be recognized as a group (>5); and 3) we verify
our crowd identifications by seeing if the group assignments are consistent with what we find in friendship networks. On a local level, members of an SCM group should be adjacent each other in friendship networks. Globally, the SCM groups that share a certain cluster assignment should be adjacent each other in friendship networks to form a crowd.

Figure 14 shows the school’s friendship networks and the crowds identified by our method. We find two large crowds as a result of matching the SCM groups with clusters. Because the crowds are embedded in racially segregated friendship networks and SCM groups, they are also, for the most part, highly homogeneous with respect to race. A distinct feature of the crowds is that each crowd consists of popular, high-status adolescents from the respective racial group. Positioned at the “core” of their racial component of the sociogram (and thereby popular in friendship), our crowds, thus, closely match Coleman’s notion of a “leading crowd”. To get a sense of how status characteristics might inform the clustering, we compare the aggregated characteristics of crowd members to non-crowd-members in Figure 15. We focus on perceived attributions such as popularity and aggression, extracurricular activities, and individual behaviors.
Figure 14: Friendship Networks and Crowd Configurations

Note: The nodes are colored by race (white: Whites, dark: Nonwhites) and shaped by gender (square: male, circle: female). Gray lines are friendship ties. Bolded lines indicate the SCM groups that share common cluster membership. Shaded regions encapsulate these groups as a crowd. The sample for the sociogram consists of a total of 163 7th graders of the first cohort, Spring 2005 (Time 2).

Race and popularity seem to be the most defining characteristics. Figure 15, the odds ratio effects plot, shows that these two crowds are significantly different in the proportion of whites but are commonly more popular than non-crowd members. One other significant attribute was their perception of physical aggression. Black crowd members tend to be perceived more aggressive than those in the white crowd or non-members. It is interesting that the crowds do not differ in other personal characteristics, which implies that behavior or attribute homophily—other than aggression—is a less salient feature of the leading crowds. Rather, the leading crowds are chiefly held by their
high peer status racial homogeneity. There results suggest that the racially segregated structure of the school’s friendship network facilitates the development of separate core crowds of popular individuals. Given these concentrations of high status individuals, do crowd boundaries demarcate students’ status that results in conflict? This is a primary guiding question for the following subsection.

**Figure 15: Crowd Composition by Time**

Note: Odds ratios were derived from multinomial logistic regression models predicting membership to the crowds that we detected. The reference category is non-crowd membership. Panels indicate each wave of the study period. We omit the Honors club membership variable at Time 1 because very few students participated in this club.

4.4.3 Categories, Crowds, and Tie Formation

The gist of our descriptive findings was that categorical differences—by race and gender—are associated with friendship segregation but less pronounced in the
distribution of enmity ties. The puzzle then becomes what generates enmity, if not attribute homophily. Our claim is that the negative interactions between insiders and outsiders of the leading crowds better explain the formation of enmities rather than friendship segregation. To test this idea, we build an explanatory model that considers friendship and enmity in a unified framework. Our strategy is to set dyads as a unit of analysis and predict which relationship \( i \) and \( j \) form, using a multinomial logistic regression model. The dyads take three mutually exclusive types: friendship, enmity, and segregation (i.e., the absence of a tie), constituting a discrete outcome variable. The focus of this analysis is whether the logit of each relationship type relative to other relationship types varies by our dyadic predictor variables. The resulting model, for example, produces logit estimates comparing cross-crowd dyads to same-crowd dyads for forming friendship or enmity relative to segregation type relationship (reference category). The resulting model compares, for example, the logit estimates of cross-race dyads to same-race dyads of forming either friendship or enmities relative to forming no tie at all, the reference category.

In Table 5, Model 1 focuses on race and other baseline parameters that affect network formation, and we add our crowd membership variable in Model 2. The AIC of the second model is smaller than the first, indicating that crowd affiliation contributes to explaining the variance of dyadic connections. The models control for the number of nominations (degree), as the effects of our predictors could be confounded simply by
individuals making more or less nominations. Another important control is common foci captured by shared extra-curricular activities. The number of shared extra-curricular activities between the dyads increases with the likelihood of forming a friendship tie; however, we do not find statistically significant effects on enmity tie formation.

Table 5: The Estimates from a Dyad-level Multinomial Logistic Regression Predicting Friendship and Enmity

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enmity</td>
<td>Friendship</td>
</tr>
<tr>
<td>Coefficient</td>
<td>95% CI</td>
<td>Coefficient</td>
</tr>
<tr>
<td>Different Race</td>
<td>-0.147 ***</td>
<td>[-0.202, -0.092]</td>
</tr>
<tr>
<td>Different Crowd</td>
<td>0.068 *</td>
<td>[0.009, 0.127]</td>
</tr>
<tr>
<td>Different Gender</td>
<td>-0.163 ***</td>
<td>[-0.218, -0.108]</td>
</tr>
<tr>
<td>Different SES</td>
<td>0.042</td>
<td>[0.012, 0.096]</td>
</tr>
<tr>
<td>Difference in Popularity</td>
<td>-0.028</td>
<td>[-0.064, 0.028]</td>
</tr>
<tr>
<td>Aggression Nomination</td>
<td>0.441 ***</td>
<td>[0.407, 0.475]</td>
</tr>
<tr>
<td>Degree</td>
<td>0.876 ***</td>
<td>[0.830, 0.922]</td>
</tr>
<tr>
<td>Shared ECA</td>
<td>0.008</td>
<td>[-0.046, 0.061]</td>
</tr>
</tbody>
</table>

Note: The reference category for this association is segregation (a dyad of neither friend nor enmity). Coefficients are from a multinomial logistic regression model (standardized).

To ease interpretation, Figure 16 plots the odds ratios derived from the dyadic model. Most importantly, the results show that race and crowd membership generate qualitatively different network patterns. For race, the odds of cross-race dyads forming either an enmity or a friendship compared to forming no tie are below 1, indicating that cross-race dyads are more likely than same-race dyads to remain segregated. In other words, racial differences lead to segregation rather than enmity. The same holds for gender. For crowd membership, in contrast, the odds ratio that a cross-crowd dyad reports an enmity is significantly higher than 1, indicating that cross-crowd dyads are
more likely than same-crowd dyads to be enemies than either friends or segregated. That is, differences in crowd membership lead to enmity over segregation. In addition, these results indicate that enmity is not simply a function of perceiving aggression, as aggression nominations are found to significantly increase the odds of forming both an enmity and a friendship.

Figure 16: The Odds Ratio Effects Plot of the Dyadic Model

4.4.4. The Effects of Crowd Membership Distinction on Intra-racial Enmities

So far, we have demonstrated that 1) the racial composition of leading crowds in our sample reflects the racially segregated friendship network in which they are embedded, and that 2) enmity is most likely to occur between adolescents of the same race and gender but who differ with respect to crowd membership. In this subsection, we focus on the relationship between race and crowds, testing whether differences in
crowd membership among same-race peers contributes to the overall preponderance of same-race enmities compared to cross-race enmities. To that end, we use an ERGM to predict enmity tie formation. A key advantage for this model is that it enables us to obtain tie probabilities for specific race-crowd combinations while controlling for structural, node-level, and dyadic-level parameters that can confound the relationship between crowd membership and enmity connections. In table 6, Model 1 includes race-only parameters while Model 2 gives parameters for all the tie types based on race (white/black) and crowd membership (crowd member/non-member). Figure 17 summarizes the estimates of such within-race ties by race and time points.

**Table 6: Estimates from ERG Models Predicting Enmity Tie Formation**

<table>
<thead>
<tr>
<th></th>
<th>Model 1: Race</th>
<th>Model 2: Crowd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edges</td>
<td>-3.695</td>
<td>-3.676</td>
</tr>
<tr>
<td></td>
<td>0.105</td>
<td>0.114</td>
</tr>
<tr>
<td>Reciprocity</td>
<td>0.687</td>
<td>0.675</td>
</tr>
<tr>
<td></td>
<td>0.105</td>
<td>0.109</td>
</tr>
<tr>
<td>Transitivity (GWESP)</td>
<td>0.918</td>
<td>0.918</td>
</tr>
<tr>
<td></td>
<td>0.053</td>
<td>0.052</td>
</tr>
<tr>
<td>Two Path</td>
<td>-0.021</td>
<td>-0.022</td>
</tr>
<tr>
<td></td>
<td>0.004</td>
<td>0.004</td>
</tr>
<tr>
<td>Gender Homophily</td>
<td>0.197</td>
<td>0.192</td>
</tr>
<tr>
<td></td>
<td>0.048</td>
<td>0.049</td>
</tr>
<tr>
<td>Male Outdegree</td>
<td>-0.538</td>
<td>-0.540</td>
</tr>
<tr>
<td></td>
<td>0.045</td>
<td>0.045</td>
</tr>
<tr>
<td>Male Indegree</td>
<td>0.158</td>
<td>0.161</td>
</tr>
<tr>
<td></td>
<td>0.053</td>
<td>0.053</td>
</tr>
<tr>
<td>Friend Dyad</td>
<td>-1.338</td>
<td>-1.293</td>
</tr>
<tr>
<td></td>
<td>0.112</td>
<td>0.112</td>
</tr>
<tr>
<td>Aggression Dyad</td>
<td>2.074</td>
<td>2.077</td>
</tr>
<tr>
<td></td>
<td>0.079</td>
<td>0.078</td>
</tr>
<tr>
<td>Popularity Homophily</td>
<td>-0.229</td>
<td>-0.209</td>
</tr>
<tr>
<td></td>
<td>0.060</td>
<td>0.065</td>
</tr>
<tr>
<td>Popularity Outdegree</td>
<td>0.199</td>
<td>0.200</td>
</tr>
<tr>
<td></td>
<td>0.024</td>
<td>0.028</td>
</tr>
<tr>
<td>Popularity Indegree</td>
<td>-0.151</td>
<td>-0.137</td>
</tr>
<tr>
<td></td>
<td>0.028</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>Race Homophily (Black)</td>
<td>0.252</td>
<td>0.049</td>
</tr>
<tr>
<td>Race Homophily (White)</td>
<td>0.285</td>
<td>0.061</td>
</tr>
<tr>
<td>ref: Cross-race Ties</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Black Ties</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crowd Same</td>
<td>-0.025</td>
<td>0.140</td>
</tr>
<tr>
<td>Non-crowd Same</td>
<td>0.154</td>
<td>0.071</td>
</tr>
<tr>
<td>Crowd → Noncrowd</td>
<td>0.394</td>
<td>0.082</td>
</tr>
<tr>
<td>Noncrowd → Crowd</td>
<td>0.339</td>
<td>0.104</td>
</tr>
<tr>
<td><strong>White Ties</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crowd Same</td>
<td>0.034</td>
<td>0.118</td>
</tr>
<tr>
<td>Non-crowd Same</td>
<td>0.273</td>
<td>0.125</td>
</tr>
<tr>
<td>Crowd → Noncrowd</td>
<td>0.382</td>
<td>0.108</td>
</tr>
<tr>
<td>Noncrowd → Crowd</td>
<td>0.326</td>
<td>0.122</td>
</tr>
<tr>
<td>ref: Cross-race Ties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIC</td>
<td>12,020</td>
<td>12,015</td>
</tr>
</tbody>
</table>

Note: *** p<0.001, ** p<0.01, * p<0.05
As we found in the dyadic model, the positive estimates for race homophily in Model 1 indicate that there is a higher likelihood of same-race peers forming an enmity than cross-race peers. The results for Model 2 suggest differentiation in enmity tie patterns as a function of crowd to non-crowd membership. Holding the same reference category (cross-race ties), the estimates of the cross-crowd ties (Crowd ⇨ Non-crowd) for both racial groups in Model 2 turn significant positive. This finding suggests that enmity ties are more likely to be formed among same-race peers who are different in crowd membership relative to cross-race ties. As compared to the coefficients for race homophily parameters in Model 1, the estimates for the same-crowd (and thus same-race) parameters are substantially decreased. This indicates that, despite the preponderance of same-race enmities, enmity is rare among the insiders of the leading crowds. Combined, the cross-crowd negative nomination among same-race peers
explains why we observe less interracial but more intraracial enmity ties. And this tendency generally holds across the time points (Figure 17).

4.5 Discussion and Conclusions

This paper has presented a new approach to studying social segregation and intergroup conflict by investigating the formation of friendship and enmity relationships in a racially diverse school. Three major findings emerge from this study. First, segregation and conflict are distinct dimensions. We find that dyads lacking a friendship tie are not readily expressed as least liking ties. In addition, the core categories such as race and gender that come into play in segregating friendships have a less pronounced effect on the formation of enmities. Notably, we find that racial differences lead to friendship segregation but not to interracial enmities.

Second, the formation of enmities is better explained by peer status than by social categories. Categorical differences with respect to race and gender make social connections fragmented, not conflictual. Rather, we find that peer status is the primary driver of enmity. We reveal how peer groups demarcate status hierarchies within social networks: High status peers are clustered at the core, and conflict is triggered by the enmities that form between members and nonmembers of the “leading crowds.”

Third, we explored the impact that crowd membership and exclusion have on racial conflict. Because whites and blacks in segregated friendship networks tend to form racially homogenous crowds respectively, the negative nominations cutting across
crowd boundaries primarily contribute to intra-racial enmities rather than inter-racial ones. Therefore, our crowd model shows how attribute homophily sometimes does not translate into intergroup conflict, as segregation can make in-group status dynamics more important in building negative relationships.

This study highlights the role of peer groups in channeling social networks and generating interpersonal conflict. Why are differences in crowd membership strongly related to enmity? Many adolescents attach utmost importance to their school’s leading crowds since they organize status structures and set peer norms (Coleman 1960, 1961). Once formed, the crowds serve as contexts where the quality of social relationships, especially between members and outsiders, is substantially shaped by the crowd’s norms, orientation, and status position (Brown et al. 1986, 1994). Analytically, the collective nature of crowds seems to activate differences in status and behavioral characteristics that prior literature recognizes as individual factors generating hostility toward others. Peer interactions usually expand beyond individual choice or dyadic relationships to include peer groups, so an individual’s peer enmities hinge upon the affinity or hostility that one’s crowd has for the others. Crowd affiliation, thus, promotes enmity rather than segregation. Specifically, this study provides further evidence that crowd exclusion entails peer rejection and the frustration of status goals, and that social status entails maintaining crowd boundaries as a means of distinguishing social elites from others.
Our finding that social categories, particularly race, contribute to friendship segregation, but not, to nearly the same degree, to intergroup conflict is worth discussing. Implicit in the literature is the assumption that attribute homophily leads to conflict, which is not the case here. This finding can be better understood by considering insights from status construction theory and intergroup contact theory. Status construction theory suggests that the condition under which categorical differences matter for social relationships is whether or not race as a nominal category acquires status value (Ridgeway 1991). Intergroup conflict likely occurs when status hierarchy in a given setting is correlated with race, and thereby stereotypes about inherent group differences are magnified (i.e., the “equal status” element for effective contact; Allport 1954). In our case, friendship segregation acts to pool status resources within same-race peer groups, particularly access to high status friends and the distinction associated with membership to the leading crowd. Thus, race is not sufficiently correlated with status in our school sample to engender conflict over status resources. Consequently, friendship homophily prevents racial differences from developing into antagonism.

This work joins recent empirical efforts moving beyond a single tie analysis in the field of social networks. Given that past studies overly focused on friendship and other types of positive ties, a growing body of research attempts to shed light on the processes and mechanisms in forming various “negative” ties such as enmity (Boda and Néray 2015; Rambaran et al. 2015), aggression (Faris 2012; Faris and Felmlee 2011, 2014;
Huitsing et al. 2012), avoidance (Harrigan and Yap 2017), and burdensome ties (Offer and Fischer 2017). Although insightful, these studies typically model each relation separately. This paper departs from the single-model-for-single-relation approach by providing a unified framework for multi-relational networks that can examine how one type of relation informs another type and identify determinants specific to different types of ties. Our analysis of friendship, enmity, and aggression networks uncovers how friendship as one type of relation is linked to enmity another type of relation: the core-periphery structure of friendship directly informs peer enmities in our model. In a similar vein, our framework finds some relational elements that exhibit more “escalating effects” than others, such that peer group affiliation not just segregates students but puts them into conflict with one another.

Our study has implications on race relations. Unlike most extant research that exclusively focused on segregation (Joyner and Kao 2000; Moody 2001b; Smith et al. 2016), this paper adds a “conflict” dimension measured by interracial enmities, asking how racial segregation is related to racial conflict. In our sample, segregation rather ends up concentrating relational hostility within racial groups, dampening interracial conflict. Although we are limited by a one-school sample, this finding is critical because it raises questions about fundamental assumptions regarding the effects of friendship segregation. What does lack of interracial contact mean in these settings? Constrained outgroup visibility (remaining segregated), or increased outgroup prejudice (likely
conflict)? Our work demonstrates that this sort of question cannot be answered without interrogating how enmity unfolds in concrete social relationships.

Some caveats, the generalizability of our findings may be constrained by the characteristics of the sample. This study was based on a magnet school in North Carolina. The school has near parity in the proportion of White to non-White students. In fact, this unique setting was rather advantageous for our study. The number of individuals in each group was sufficient to support two parallel status hierarchies, and the parity in size acted as a natural control for the volume effects of crowds. If our sample had mirrored the general racial composition of the US population, we most likely would not have observed parallel status hierarchies or the interaction of two elite groups. As school-level research on racial segregation suggests (Joyner and Kao 2000; Moody 2001b; Smith et al. 2016; Vermeij, van Duijn, and Baerveldt 2009), school integration can result in significant variation in the contact opportunities and racial threat level of a given school. From this standpoint, our heterogeneous setting represents a special case where the majority ethnic group might have experienced a heightened sense of threat because of the large minority out-group. Consequently, examining how the effects of a school’s ethnic composition may vary with respect to interracial enmity remains a future research agenda. Applying our approach to multiple school samples will reveal how different crowd configurations influences the formation
of antipathies, and thereby the extent to which the effect of crowds depends on achieving near racial parity.
5. Conclusion

This dissertation concerns the relationship between micro homophily mechanisms and macro intergroup relations, and my specific focus is given to what is in between the two. I find there are higher-level antecedents that differentiate the micro homophily, which then puts structural constraints in the emergence of intergroup relations at a macro level. I find evidence of this theoretical claim in the two empirical cases: political polarization in America and enmity formation in a school. The key elements and focus of the two cases are summarized in Table 7.

Table 7: The Cases Compared

<table>
<thead>
<tr>
<th></th>
<th>Political Networks</th>
<th>Adolescent Networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro mechanism</td>
<td>Political homophily</td>
<td>Racial homophily</td>
</tr>
<tr>
<td>Macro outcome</td>
<td>Political polarization</td>
<td>Racial conflict</td>
</tr>
<tr>
<td>Constraint</td>
<td>Sociodemographic consolidation</td>
<td>Status groups</td>
</tr>
<tr>
<td>Key function</td>
<td>Regulate political homophily</td>
<td>Concentrate enmity</td>
</tr>
<tr>
<td>Explanation</td>
<td>Self-reinforcing dynamics contingent on consolidation</td>
<td>Escalation of conflict contingent on status groups</td>
</tr>
<tr>
<td>Method</td>
<td>Agent-based model</td>
<td>Group identification</td>
</tr>
<tr>
<td></td>
<td>Egocentric network analysis</td>
<td>ERGM</td>
</tr>
</tbody>
</table>

For the political context (Studies 1 and 2), consistent with the literature, political homogeneity and social influence in networks contribute to opinion polarization via self-reinforcing loop toward the extreme. My novel finding is that this effect is embedded in the structure of population distributions. My formal and empirical models
show consolidation among social attributes highly determines the rates of political homophily, indirectly shaping polarization in networks.

In the school context (Study 3), as prior research suggests, categorical differences—i.e., attribute homophily—are a strong determinant of friendship segregation. This study finds, however, that what is escalating to conflict over segregation is contingent upon the structure of cohesive peer groups. In my study, the leading crowds are formed within a racially segregated friendship structure, and status struggles around leading crowd membership contribute to concentrating enmity among same-race peers. Together, these findings call for an analytic focus upon the mediating elements between micro in-group preference and macro conflict.

My contextual approach not only presents unique theoretical contributions in social networks research/structural sociology but also yields strong implications for the substantive fields of political sociology and race relations. Political polarization is a longstanding subject, but the micro focus often leads to the portrayal of political conflicts as an individual problem. Scholars and pundits seem to problematize individuals as if people went through the fundamental changes in our preference for similar others or tolerance for diverse opinions. This perspective masks the changes in the underlying social contexts, which my study illuminates. By the contextual approach, one can consider the increasing between-group inequalities or the growing political alignment of
sociodemographic characteristics as the potential antecedents of political polarization and take one step closer to finding what we can do about it.

Social network approach to race relation overly focused on segregation in friendship, without explicitly investigating enmity. My multi-relational investigation improves an understanding in that regard. The key implication is racial segregation does not directly translate into racial conflict due to the existence of other properties that are functionally specific to enmity formation. My contextual approach unveils the meso-level high-status clusters that create dislikes between insiders and outsiders. These status processes complicate the function of individuals’ racial homophily mechanism. A main takeaway for researchers in this realm is that we should understand race relations in school with a comprehensive framework that considers how groups form, not just assuming that negative relationships are just the inverse of positive relationships.

In sum, my dissertation provides a new contextual perspective on social network studies of intergroup relations. This perspective identifies higher-level properties that shape tie formation and complicate the pathways from interactional mechanisms to intergroup relations. I hope I have clarified its usefulness in better explaining social conflict. I also look forward to future research that applies my contextual approach to other important topics.
References


Hollingshead, August B. 1975. *Four Factor Index of Social Status*.


Biography

Jaemin Lee was born to Kwan Hee Lee and Jie Seon Chung on April 21, 1983 in Seoul, South Korea. Lee graduated with honors from Yonsei University in February 2009, earning Bachelor of Arts in Sociology with minor in Economics. During his undergraduate years, he completed an exchange semester in University of Technology Sydney in Australia in 2008. Lee received a Master of Arts in Sociology from Yonsei University in 2011 and Duke University in 2015, respectively. He holds a Doctor of Philosophy in Sociology granted by Duke University in 2018. He has one elder sister, Jaeeun Lee.

He has co-authored a number of peer-reviewed journal articles:


Jaemin Lee has received several research awards and fellowships in support of his research. For this dissertation work, Lee won the 2017 Outstanding Dissertation in Progress Award from the Mathematical Sociology section of the American Sociological Association. His graduate studies were partly funded by a Fulbright Graduate Study Award. Lee was also awarded a Graduate Research Fund from the Department of Sociology at Duke University to attend a computational modeling workshop at the University of Massachusetts at Amherst. Additionally, he received Dr. James W. Plonk Summer Fellowship, Linda K. George’s and Duke Graduate School’s Summer Research Fellowships, Korean Honor Scholarship from the Korean Embassy in the US, and travel grants from Duke Sociology.