THE UNIVERSITY OF CHICAGO

UNRECIPROCATED RELATIONSHIPS AND THE STRUCTURE OF STATUS

A DISSERTATION SUBMITTED TO

THE FACULTY OF THE DIVISION OF THE SOCIAL SCIENCES

IN CANDIDACY FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

DEPARTMENT OF SOCIOLOGY

BY

PETER MCMAHAN

CHICAGO, ILLINOIS

AUGUST 2017

I am grateful for the continued support, patience, insight, and advice of my committee: James Evans, John Levi Martin, and Kazuo Yamaguchi. Each of them has shaped my research and who I am as a researcher immeasurably, probably more than they know.

I am also indebted to countless colleagues and mentors who have helped define me as a scientist over the years: John Padgett, James Iveniuk, Michael Castelle, Jim Murphy, Monica Lee, and so many others.

Above all, I want to thank Colleen, without whom I am certain I would not have made it.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Social status matters for outcomes that are of central importance to sociology. Processes of power, influence, stratification, and inequality all have status as a key mechanism in their enactment. In this dissertation I investigate informal status hierarchies from a relational perspective, showing that such an approach yields social structures with complicated topology. Using three different empirical cases, I argue that this relational approach leads to a richer understanding of the establishment and consequences of social status. The first two cases use statistical analysis of natural conversations to impute status relations and status hierarchies. Using transcripts from President Kennedy's ExComm meetings during the Cuban missile crisis of 1962, I show not only that status differences inform key dynamics in the decision-making process, but that traditional lines of social class helped define those status differences among the committee members. I use similar methods to analyze the status structures among a sub-community on the discussion website Reddit. The online group, organized around the Gamergate controversy in 2014 and still active today, is characterized by an active, often confrontational conversational style. I show that a strong status hierarchy exists among the core participants in this community, and that lines of influence through this hierarchy help determine the topics of discussion. The final empirical setting I use to investigate status uses Add Health, a nationally representative survey of adolescents in the United States. I argue that the rigid status hierarchies that exist among adolescents are defined along two contrasting dimensions, and that both dimensions are needed to understand the role of identity, class, and individual behavior in status differentiation. By using these three, disparate cases, I highlight the benefits, both theoretical and empirical, of viewing status through a relational and topological lens.

1

INTRODUCTION AND THEORETICAL FRAME

Social scientific research on status tends to fall into one of two categories. Most commonly, status is an indication of the prestige associated with categories of people. Professions, formal institutions, neighborhoods, and so forth, are often seen as being differentiated along a vertical dimension of status. This type of status is well established and reasonably agreed upon across a society or community, and is the major determinant of *social class*. The other type of status (and the one that will be the focus of this dissertation) has to do with the small-scale determinations of respect and disdain that are implicit in everyday, informal interactions. In contrast with social status at the large scale of class, this second, informal type of status is turbulent. Informal status distinctions abound when friends discuss a choice of restaurant, coworkers delegate tasks, or groups of strangers negotiate their positions on a crowded bus. Day-to-day interaction necessitates acts of deference and dominance that go mostly unnoticed for their regularity. Of course these two types of status are tightly interrelated, and the distinction between them is rarely straightforward. They nonetheless represent contrasting dimensions of status as it is experienced by—and negotiated among—individuals. Analysis of society-wide, categorical status hierarchies is widespread, but formal analyses of meso-level status structures in everyday interaction are less common. In this work I hope to demonstrate that the interpersonal status differences present in everyday interaction can be uncovered through observations of individuals' behavior, and that analysis of these relations across an entire community or group reveals topological features of the social landscape that have consequences for a wide variety of socio-

logical processes.

The organization of this dissertation is as follows. In this introductory chapter, I will articulate the theoretical basis for my approach to informal status hierarchies. Drawing from the literature on class distinction and stratification, I will focus on the importance of asymmetrical relations of power, influence and affinity that exist between individuals and the social structures that result from the patterns of these relations. In doing so, I conceive of status as simultaneously individual and structural. The contours of status orders are built from the subjective, relational experiences and behaviors of their participants, which are themselves both constitutive of and responsive to the structural features that emerge from their negotiation. By focussing on boundary negotiation at the margin, I will argue that microstructural processes of conflict, resolution, and balance are the basis of macrostructural status hierarchies, and that the topology of these structures have been largely neglected in the literature. I will conclude the chapter with an overview of the implications and predictions of this type of hierarchy, setting the stage for the empirical analyses of the remainder of the dissertation.

Chapter two will focus on status differences that are revealed through patterns of linguistic accommodation in natural conversation. Results from social psychology and sociolinguistics show that people mimic one another's communicative behavior in everyday conversation, and that asymmetry in the degree of this mimicry is linked to differences in social status between conversation partners. Building on these observations, I describe a pair of statistical models that identify patterns of linguistic style matching in transcribed conversations, yielding detailed estimates of dyadic status relationships among participants. These models are applied to two empirical cases. In the first application, the transcripts from President Kennedy's Executive

Committee of the National Security Council (ExComm) for the duration of the Cuban missile crisis are analyzed. I estimate dyadic status relations between each pair of active committee members, and discuss different ways of constructing group-wide status from these relations. I find that the topological features of the status order among ExComm members is consistent with qualitative accounts of influence at the meetings. I also show that the status relations adhere strictly to differences of social class between committee members. The second empirical investigation in the chapter uses similar methods to estimate the status hierarchy in an online discussion community on the website Reddit. I show that influence over the topic of conversation in this large community flows primarily along the lines defined by pairwise status relations.

Chapter three uses a similar analytical strategy to investigate status hierarchies among adolescents. The analytical strategy for this case is similar to that used in chapter two, but the data and model are quite different. I use information on friendship nominations from the Add Health dataset to infer status relations between students in middle and high school. The model relies on asymmetry in the friendship nomination process to discover which pairs of students have clear status differences between them, and which do not. I show that the resulting hierarchy relates both to students' role-based identity and to their ethnic and racial characteristics, but that these two aspects are related to status in contrasting ways. Role-based identity, linked with friend groups and cliques, is related most closely with students' vertical rank in their schools' status systems. Race and ethnicity play a different role, being associated with the degree to which students are well embedded in the status hierarchy overall. I also examine the relationship between status and social cliques directly, finding that a adolescents' status position relative both to their small social circles and to their broader community have strong and distinct ties

to their behavior.

Categorical distinction

Social distinction forms the basis of status differentiation. Categories in particular allow individuals to place objects, ideas, and other people into cognitively manageable groups. Categories are fundamental to sense-making in virtually every cognitive domain (Zerubavel 1993), and the social landscape is no exception. The categorical divide between 'us' and 'them' causes people to exaggerate the differences between themselves and those they perceive as distinct from them, and to overstate the degree of similarity between members of groups other than their own (Taylor et al. 1978; Stangor et al. 1992). Clustering people into groups that are loosely assumed to share the same physical, attitudinal, and behavioral characteristics seems to be a precondition for producing order within the complexity of everyday social interaction (Howard and Renfrow 2006). Social differentiation of this sort, in its many forms, constitutes the gradient across which social-status comparisons are drawn.

Theories of *symbolic boundaries* are the most widespread, and possibly the most thoroughly developed, approaches to sociocultural distinction in the sociological literature. Symbolic boundaries are "the conceptual distinctions individuals make in the course of their everyday lives [that] can – and do – influence more durable and institutionalized social differences" (Pachucki, Pendergrass, and Lamont 2007, 331). Research relying on the concept of symbolic boundaries has flourished in recent decades, underscoring the ways that various social categories enable the establishment, enforcement, and evolution of socioeconomic strata. Many

scholars have investigated the specific ways that racial and ethnic boundaries (see Lamont 2000, chs. 2 and 5; Small 2004, ch. 5) and boundaries along gender lines (see Epstein 2007; Collins 1992) facilitate institutionalized patterns of exclusion in various domains. A bulk of sociological literature on boundaries focuses explicitly on the cultural domain, in particular on the distinctive characteristics of aesthetics and morality. Examinations of the ways taste and consumption influence class–boundary definitions are common. Working broadly within the framework laid out by Bourdieu (2013), researchers have shown that consumption of culturally marked goods like fine art (DiMaggio 1987; Halle 1992), artistic performance (DiMaggio 1992), musical genres (Bryson 1996), and cuisine (Ferguson 1998; Rao, Monin, and Durand 2003) is closely tied to the ways that social status is performed and reproduced. Boundaries are the basic tools of cultural inclusion and exclusion in social life.

But symbolic boundaries exist only in the social imagination, and they are subject to contradiction and contestation. Symbolic (in contrast with physical) boundaries exist insofar as they are acknowledged; they are the prototypical social construct. "Boundaries are both matters of perception and of construction and thus subject to speculation and to gaming" (White 2008, 61). Symbolic boundaries need not be agreed upon in their specifics to have wide-reaching social consequences. For example, one would have a hard time reaching consensus in the United States about the appropriate way to partition the middle from the lower class. Even the relevant characteristics to draw on—income, wealth, education, social contacts—are subject to considerable debate (Krieger, Williams, and Moss 1997). Still, few would argue that class distinction is not a critical force of inequality in the country. Such indeterminacy in boundary definitions is ubiquitous, whether the categories under debate are socioeconomic class, knowledge domains

like science and religion (Gieryn 1999), or even technical practices restricted to limited subcultural domains (Fuller 2003). Boundaries are defined by their constant negotiation among those who utilize them, a process termed *boundary work* (Gieryn 1983).

Given the inherent flexibility of symbolic boundaries, coupled with their importance for allocation of resources, it is no surprise that they are the site of significant contestation. The specific details of how we define what does and does not belong in a culturally legitimated category delineate who is entitled to the benefits of that category. Just as formal certification processes (e.g. standardized qualifications for massage therapists, or visas to work in a country) endow individuals with the expectation of certain privileges, a person's position relative to an informal, symbolic boundary has implications for everything from pay and promotion at work to where and when one is safe walking in public. Recent controversies in the United States regarding police interactions with civilians have underscored both the contestablity and the often drastic consequences of where such lines are drawn. A particularly overt example lies in the debate over racial profiling, and the question of whether one's race is a legitimate criterion for police to use when determining suspicion of law-breaking. Because the suspicion of the police (formally sanctioned or otherwise) directly affects the wellbeing of those who find themselves the target of that suspicion—notably Black and Latino Americans—the boundary becomes a focal point for those concerned with the welfare of the targeted communities.

Such boundaries are not simply the incidental battle sites where existing societal tensions come to a head, however. As many scholars of stratification have argued (see, e.g. Massey 2007; Tilly 1998), symbolic boundaries in a substantial sense *constitute* the underlying inequalities that adhere in society. "Categorical inequality *relies on* establishment of a partial frontier and defined

social relations across that frontier" (Tilly 1998, 14; emphasis mine). The nature of symbolic boundaries is such that, to engage with them, even with the goal of subverting or redefining their contours, reinforces the categorical criteria those boundaries erect. Boundaries define the parameters of the conversation. Moreover, contentious boundaries are inherently asymmetric. A defining feature of boundary conflict is that of exclusion: those who want access to the privileges of categorical inclusion, on one side, are in conflict with those who want to restrict that access on the other. Thus, contentious boundaries are fundamentally about relations of *dominance*, and therefore the foundation of hierarchy (see Gould 2003, chap. 2). As relations of asymmetric power are established between categories they define a hierarchy across those categories, and thereby delineate a higher-order structure among them. Contestable boundaries that exist between pairs of socially weighty categories, as, for example, the boundary between white- and blue-collar professions, define societal status structures like the occupational order in the United States (Blau, Duncan, and Tyree 1978). The hierarchy of such orders are defined by the asymmetric boundaries that exist between categories, and the asymmetry of those boundaries is defined by contention and conflict over the exclusions they enforce.

From categories to interaction

Academic work relating to status-enforcing boundaries and the hierarchies they impose often view the social categories in question as the central units in play, taking a view of categorical distinction as if from a distance. When undertaking the academic excercise of tracing the contours of symbolic boundaries, trying to understand how they are viewed and enforced by

those for whom they have valence, it can make sense to seek individuals who sit solidly within the those boundaries—categorical prototypes. This is the approach used by Michèle Lamont, for instance, in her work describing the class distinctions made by upper–middle class (1992) and working-class (2000) men. From interviews with individuals carefully chosen to represent widely acknowledged status groups, Lamont catalogued the stereotypes and dimensions of distinction that those individuals used to differentiate themselves from other classes and to coalesce their own class identities. Social categories are treated by many researchers of status boundaries as methodologically prior, allowing the existing cultural prototypes of the categories to define the parameters of their investigation. Akin to a physics experiment observing the repelling forces two electrically charged masses inflict on each other, social scientists uncover the constrasts between status groups by placing the representative cores of those groups in opposition.

But understanding how broad categories relate to one another only tells part—albeit an important part—of the story of status distinction. Just as significant are the status relations that occur on the margin, existing not between abstracted types at an obvious distance from one another in a society's status order,[1] but between individuals who must negotiate their relative positions, possibly in lieu of (or in opposition to) the strong prescription of an entrenched hierarchy. A great deal of everyday interaction falls into this latter category, in which status distinctions are less cemented and more subject to reassessment through the informal rituals of interaction (Collins 2004, 271). When new students meet for the first time in a classroom,

1. I do not use the term *order* here to denote the mathematical concept of an order (a relation on a set of elements), but synonymously with *regime* or *hierarchy*. When referring to the mathematical construct I will use *linear order*, *strict order*, or *ordering*.

when constituents attend an elected official's town hall meeting, or when a handful of strangers strike up conversation at a bar, relations of deference or dominance must be worked out from scratch by those present. Research in social psychology on the interactions of participants in small task groups makes this dynamic apparent. Academic studies spanning more than six decades consistently demonstrate the ubiquity of status orders among small groups (see Bales 1976; Hare 1976; Levine and Moreland 1990; Homans 1992). The structure of a group's status hierarchy is remarkably consequential for the patterns of participants' behavior, with high-status individuals receiving disproportionate amounts of attention from the group (Bottger 1984) and enjoying more influence over the actions taken by others (Hopkins 1964).

Although a group must do interactional work to establish the set of status relations between its participants, a great deal of this work is accomplished in the first few moments of copresence, as cultural biases and categorical expectations are applied (Berger, Cohen, and Zelditch 1972; Goffman 1974; Ridgeway 1991). The establishment and crystallization of a status order in such situations nevertheless must be undertaken by the participants in the current context, and is subject to the behavior and negotiations that may work against their initial expectations (e.g. Skvoretz and Fararo 1996; Ridgeway and Cornell 2006). This is the aspect of status hierarchy that depends on the situational context, and it the core difference between status as a structural characteristic of socially understood categorical relations—as between socioeconomic classes, professions, racial groups, etc.—on the one hand, and status as an interpersonal relation on the other. Status differences between individuals, even when strongly influenced by outside status characteristics, are fundamentally *constituted* in the interactions and situations those individuals share.

Symbolic interactionist theories provide a useful lens for understanding the negotiation of status in small-scale, interpersonal exchanges. A theoretical concept fundamental to the interactionist approach is the *definition of the situation* (Goffman 1959) which, in this sense, is the underlying categorizing schema that interaction partners agree upon to make sense of what kind of interaction they are involved in, including the actions, emotions, types of people, and relationships that are appropriate to it (Stryker and Vryan 2006). Is the current situation amicable or antagonistic? Familiar or formal? Casual or anxious? Egalitarian or hierarchical? Negotiation of and agreement on a consistent definition of the situation is a basic driver of human interaction. Participants' relative influence in that negotiation is unequal, however—a characteristic that suggests a relationship between an individual's ability to dominate the negotiation over the situation and their status position in the finalized definition. "The way to tell whether one party to a relation exerts dominance over the other, then, is to look at who decides what goes on in the relation" (Gould 2003, 40). In an immediate sense, power in an interactional situation is based on the ability to exclude others from the process of defining it. And insofar as the status relations among participants is a part of the definition of the situation, high status individuals are precisely those that are able to credibly perform a high status role.

An example will help clarify the role of status relations in interaction. Consider a pair of people waiting at an outdoor bus stop on a cold and rainy day, anxious to get wherever it is they are going. When the bus eventually arrives, a negotiation over which of them will be the first to board ensues. There are clear advantages to boarding first: that person will be sheltered from the weather sooner, and they will have first choice of seating once onboard (ignoring, for the moment the complex and often arcane negotiations that go into seat choice on a public bus).

Table 1.1: Four possible outcomes of status negotiation.

	A **demands**	A **defers**
B **demands**	*conflict*	$B \rightarrow A$
B **defers**	$A \rightarrow B$	*ambiguity*

So who boards first? A number of observable characteristics of these individuals are sure to come in to play; factors like age, physical ability, and (almost certainly) gender, race, and social class are likely candidates. But, even in the absence of observable, status-linked characteristics, a boarding order needs to be determined to resolve the situation. If both passengers insist on boarding first, demanding precedence in the situational outcome, the only possible resolution will come through some sort of conflict. Conversely, if each assumes they should be the second to board and cedes their place to the other, an awkward and sometimes protracted volley of gestures indicating "no, after you!" is likely to ensue. In either case the situation will remain undefined, in both an interactionist and a material sense, until an order is determined. There is a strong tendency to try to resolve the situation. Thus even small signals of status difference, whether inferred from ascriptions of social class or simply from the assertive body language of one of the passengers, will have a path-dependent effect on the settled order.

Status relations, being part of the definition of the situation, are the outcome of a negotiation between interaction partners. As such, the nature of the status relation will depend on the orientation of each partner toward the other, and specifically whether or not each partner believes they ought to be accorded higher status than the other. Table 1.1 describes a greatly simplified schematic of the possible resolved alignments in a status negotiation.[2] Broadly speaking, each

2. Despite the formal similarity of table 1.1 to payoff matrices common in game theory, it is not meant to

interaction partner has two orientations they can take: they can either demand a situation in which they are of higher status than their partner, or they can defer that high-status role to the alter. If they come to an agreement on the status situation—if A and B are in accord regarding which of them is in the higher-status position—then the situation is resolved quickly. An outcome like this is perhaps the norm in everyday social situations; even in the absence of a formalized status relationship (supervisor–employee, parent–child, teacher–student), existing cultural status attributions determined by class, gender, race, or ethnicity have a strong influence on resolved status relations (see, e.g., Ridgeway and Diekema 1989). However even without such culturally marked status characteristics, the drive for a resolved status order among groups means that even arbitrary, experimentally controlled indications of prior status differentiation is enough to determine the outcome of the negotiation (see, e.g., Moore 1968; Harrod 1980). A notable aspect of these two resolved outcomes is that they avoid the conflict inherent in a struggle for dominance (the top–left quadrant of table 1.1) by establishing a dyadic hierarchy that is defined by a relation of power. Thus, contrary to notions of hierarchy based on models of physical or violent domination (pecking orders), the hierarchical relations in this conception are those that are resolved and *free* of conflict.[3]

---

invoke the simultaneous-reveal choices of a so-called *normal-form game*. Whether each interaction parter demands dominance over the situation or defers to the other is the outcome of a contextualized negotiation between the pair.

3. This is the sentiment behind Roger Gould's assertion that conflict comes "not from the collapse or destruction of stable arrangements but from recurrent negotiation, explicit and implicit, verbal or violent, about the terms of those arrangements." (2003, 38)

From interaction to structure

A description of status that treats it simply as a relation that can exist between pairs of individuals fails to capture what is perhaps its most characteristic quality: hierarchy. Among the chief reasons that status caries import in everyday interaction are its *structural* features. Status hierarchies extend beyond our personal relationships in ways that make it feel rigid, keeping those in low-status positions from enjoying the influence of high status and those in high-status positions from being subject to the restrictions of low status. Status as a relation is a trait tied to a pair, while status as a structure is a characteristic of a group, community, or society. In order to link status relations to status structures I define two structural dimensions of status: *verticality* and *horizontality*.

Verticality

Stating that status has a vertical dimension is borderline tautological. Its core spatial metaphor is one of vertical differentiation—up/down, top/bottom, high/low. But to understand how the structural, vertical dimension relates to the idea of status relations introduced above, some further formalization will be useful. Assume, for the moment, that resolved status relations like those summarized in table 1.1 can be represented with a simple, binary characteristic: a given pair of people either exists in an established, ordered status relation or they do not, with no gray area in between these two states (this assumption will be interrogated and relaxed in the next chapter). Such a simplification allows the status structure among a given group to be represented by a directed graph or network. Each individual in a group represents a vertex $\{a, b, c, \dots\}$ in

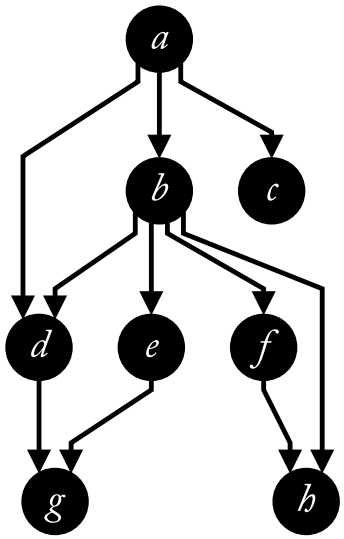


Figure 1.1: Directed graph representing hypothetical status relations.

the graph, and a directed edge (a, b) pointing from a to b indicates that a is higher status than b, producing a structure similar to an organizational chart. As reference, figure 1.1 visualizes a simple, hypothetical graph representing ten status relations (arrows) between eight individuals (circles). Although the example is contrived, it is easy to identify in the figure an overall vertical dimension to the graph's structure, and thus it can help in formalizing intuition about what it meant to be high- or low-status in a group. Tracing edges in the graph, relationships between otherwise unconnected nodes can be inferred.[4] For example, although individuals b and g have no direct status relation between them, it is still possible to say that b is 'higher' in the status structure than g simply because of the direction of the established relations (b, e) and (e, g) (or, analogously, the relations (b, d) and (d, g)).

4. While relations inferred by paths in a structure like this are useful for getting a sense of the vertical dimension of a hierarchy, it is not the case that such relationships are the same as the underlying status relations that make up the edges in the graph (Martin 1998, 204–6). An empirical tests of the transitivity of *influence* along such paths is in chapter 2.

This notion of hierarchy is captured succinctly by the graph-theoretic concept of *acyclicality*. A *path* in a directed graph is defined as a connected sequence of edges that obeys the directionality of those edges. In figure 1.1, $\{a \rightarrow b \rightarrow f \rightarrow h\}$ is a path, but neither $\{d \rightarrow e \rightarrow f\}$ nor $\{d \rightarrow b \rightarrow a\}$ are. A valid path is said to contain a *cycle* if it passes through the same node more than once. The graph in figure 1.1 contains no cycles (by contrivance), but if the direction of the relation between a and d were reversed, the path $\{a \rightarrow b \rightarrow d \rightarrow a\}$ would form a cycle of length three. And, finally, an *acyclic graph* (often referred to as a *directed acyclic graph* or *DAG*) is one that contains no cycles of any length. Acyclicality is fundamental to the vertical dimension of status structures because cycles, especially long cycles, undermine hierarchy. A single status relation pointing from g to a in the figure would form two 4-cycles and one 3-cycle, making it impossible to say which person is at the top of the represented status order. Such a large violation of acyclicality would ensure the structure could no longer be said to be a hierarchy at all.

There is nothing mathematical that ensures that a status hierarchy is acyclical, but the presence of cycles in a status order seems contrary to the idea of status as a stratifying structural occurrence. That status maintains a vertical dimension is an outcome of the process of status negotiation rather than a precondition for its existence.[5] So why is hierarchy a defining feature of status orders, both in their imagined form and in their more overt realizations? One possibility is that people possess some latent, strictly ordered, and inherently comparable characteristic that determines the outcomes of status negotiations. If everyone had a persistent and essential status 'score' determining their worth, and if situational status relations were resolved consis-

5. The transitivity of status hierarchies will be addressed empirically in subsequent chapters.

tently by simple comparison of this score, then the verticality of the resulting status structure would be guaranteed. Such a characteristic would play a role similar to that of dark matter in astrophysics: unobservable outside of its effects, but highly influential on the macro-structure of the system being studied. Indeed, the assumption that status hierarchies result from dominance orders over a single trait is a common theoretical assumption.[6]

Although a theory relying on a single, unobservable status trait has intuitive appeal, experimental research in status construction theory suggests that status hierarchy is determined by a process based more on the subjective judgments and cultural preconceptions of the members of a group (for a review, see Levine and Moreland 1990; see also Chase 1980 for an overview of the inadequacy of the single-characteristic model). There are two interpersonal processes in particular that underlie the vertical stratification of status. The first of these is based on patterns of status beliefs created by culturally defined categories. To the degree that cultural categories are stratified, they are accompanied by widespread, often implicit, beliefs about the ability, competence, and general worthiness of their members. People in upper-class professions in the United States—doctors, lawyers, finance-sector workers, etc.—are broadly assumed to be more competent and deserving of deference than 'average' citizens, and are treated as such. As discussed earlier in this chapter, such beliefs of status difference persist across diverse cultural boundaries. Moreover, beliefs in inherent status-group contrasts are mutually adopted by both those in the higher-status group and those that are thought to be less worthy. Because of these status beliefs, individuals negotiating status relations are likely to respect the broad cultural assumptions about

6. See (Martin 2009a, 106–7) for a discussion of dominance orders of this sort and a rebuttal of their prevalence in status hierarchies.

status order as they work to resolve their particular situation. Extensive experimental research with small task groups confirms that *diffuse status characteristics* of participants, characteristics like gender, class, and race, are tightly related to ascriptions of competence and prestige made by their peers (Berger, Cohen, and Zelditch 1972; Berger 1977; Carli, LaFleur, and Loeber 1995). Society-wide status orders prescribed by symbolic boundaries are mapped with striking consistency onto the highly local status orders negotiated in small groups.

It is important at this point to note that status characteristics theory predicts a different process than that frequently presumed in dominance orders discussed above. While the global status order implied by cultural categories can be treated in some sense as a 'latent status trait', it differs from the dominance competitions in two significant ways. First, cultural categories are neither rigid nor inherent; symbolic boundaries are open to negotiation, even at the level of the interaction. Second, and perhaps more significantly, cultural categories are status-ranked based on coarse-grained groups (or types) and are unable to define a linear order on individuals. A status hierarchy based only on the boundaries between cultural categories would have no way to differentiate people occupying the same intersection of categories. Status-group membership can provide a coarse, vertical structure to a status hierarchy, but within-group relations must rely on processes specific to the behavior and interactions of those involved (Fişek, Berger, and Norman 1991; Skvoretz and Fararo 1996; Smith-Lovin, Skvoretz, and Hudson 1986; Skvoretz 1988).

The second type of theorized process underlying the vertical differentiation of status fills exactly this gap, focusing explicitly on the interpersonal relations, observations, and behavior of individuals. *Expectation-states (ES) theory* informs a program of research investigating the expec-

tations people form regarding the performance and prestige of those they interact with (Correll and Ridgeway 2006). While diffuse status characteristics play a role in expectation states theories, ES focuses on the ways that status expectations form in the absence of clear categorical differences. In experiments with task groups, participants' status judgments are extremely sensitive to even minor and arbitrary signals of an existing status order. Research subjects who are fed suggestions of status differences (Moore 1968) or shown evidence of unequal rewards given for previous tasks (Cook 1975) consistently bias their expectations of others to conform to the status implications provided. Moreover, suggestions of status relations between others need not be explicit to have a path-dependent effect on the resolved status hierarchy. Individuals observe the interactions of those in the same situation as themselves to make inferences about the status distinctions and the overall status structure of the group. Randomly allocated categorical memberships become status-marked characteristics if members of the categories are observed consistently interacting in ways that imply a status difference between the groups (Ridgeway and Cornell 2006). The evidence of a 'bystander' effect is strong; observations of the interactions among a pair of others influence an individual's *beliefs* about the status relation among that pair and, subsequently, about the structural characteristics of a group (Chase 1980; Skvoretz, Webster, and Whitmeyer 1999 Leifer (1988)). Hints of existing status positions gleaned from observations of the interactions and relations between others create a tendency toward *transitivity* in networks of status relations. That is, if three people—Ali (a), Bernice (b), and Camilla (c), say—find themselves in a situation like that depicted in figure 1.2, the tendency toward transitivity in status networks suggests that if Camilla is deferential toward Bernice and Bernice is deferential toward Ali (solid arrows), then Camilla is likely to be deferential toward Ali

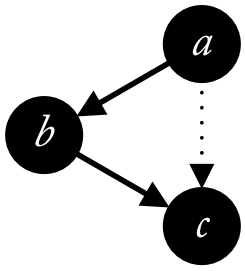


Figure 1.2: Transitive closure.

(dotted arrow). Indeed, if Ali or Camilla try to reject this direction, it is likely to lead to conflict among the group and possibly sanctions from Bernice. Status relations have a strong tendency to resolve in a way that preserves the transitivity of the overall structure, thereby preserving and accentuating the vertical differentiation of its members.

A striking feature of both processes of vertical differentiation is that they are based on the underlying beliefs of individuals that status *should* have a vertical dimension. Vertical stratification in status orders is performed by its participants, and deviation from the order can be punished (Anderson et al. 2006). Status, as it pertains to individual behavior, is both relational (are you higher or lower status *than me*) and structural (are you high or low status *in general*). Fundamentally, status relations between pairs of individuals are determined not only by how they perceive one another, but by how they imagine that one another are perceived by others. As people look for hints of status worthiness among their interaction partners, they are highly tuned to those partners' characteristics and the attention they get from the 'public,' allowing the emergence of strong vertical stratification even in the absence of significant exogenous difference (Gould 2002; Ridgeway and Cornell 2006; also see Merton 1968).

The reliance on subjective beliefs about the verticality of status structures has a further im-

plication: the severity of vertical differentiation among a group relies on the apparent appropriateness of a strong status ordering in the situation. Virtually all of the empirical research cited so far is based on task groups. In experiments, participants are given a motivating goal they are expected to accomplish as a group because having a shared focus induces an expectation of hierarchy (Correll and Ridgeway 2006, 31); some people will be more likely to delegate tasks, while others will tend to act on the suggestions made by group leaders. If status resolution is demanded situationally, and if the appropriateness of status differentiation varies between situations, then the degree of vertical hierarchy should also vary. Indeed, in a comparison of models of status structures within urban communes, Martin (1998) finds that existing power relations between commune members are explained by a strictly ordered, latent status structure only to the degree that those communes have formal, unambiguous leadership structures. Communes with a single established leader also appear to have more *informal* vertical status differentiation among the group's rank-and-file members.

Horizontality

Vertical differentiation on its own does not adequately describe the social phenomenon of status hierarchy. Social scientists studying structures of status, dominance, influence, and power have long recognized the importance of a horizontal aspect to hierarchies in human groups. From a relational perspective, horizontality is the result of pairs of individuals for whom a status comparison is indeterminate in some way or another. The existence of ambiguous relationships is

7. The central graph denoting pure verticality is in fact the *transitive reduction* of a strict rank ordering: redundant transitive edges are omitted.

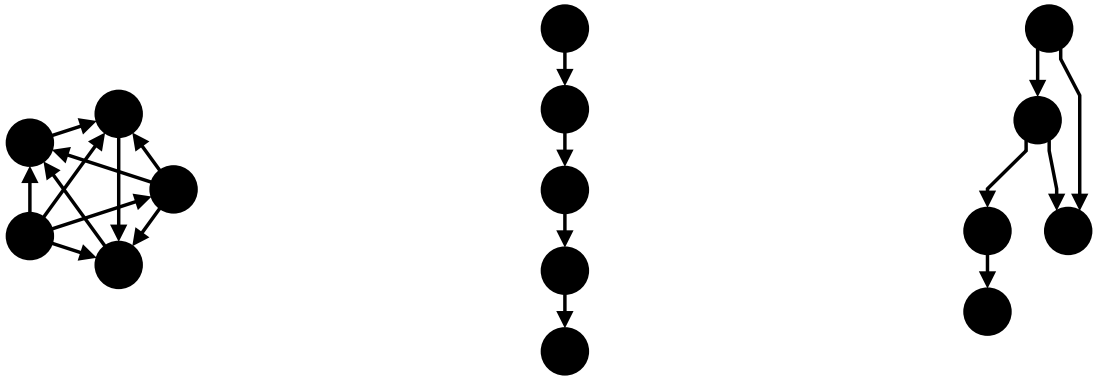


Figure 1.3: Directed graphs demonstrating verticality and horizontality.[7]

the difference between a strict, linear ranking of group members and and its relaxation in a general hierarchy (see figure 1.3). Once again, graph theory (and its tight relation to algebraic structures) provides a useful abstraction for understanding the structural aspects of horizontality in status hierarchies.[8] Network structure was implicit in White's (1943) early analyses of informal influence in street gangs. Formal graph-theoretic treatments of status structures can be found in Friedell (1967), who casts organizations' command hierarchies algebraically as *upper semilattices*, Hart (1974), who uses the specific analysis of network features to describe political influence between nations, and in Martin's (1998) previously mentioned analysis of interpersonal power in urban communes. A key feature underlying each of these network-theoretic approaches to status structure is an emphasis on the role of incomparable relations in the description and explanation of horizontal differentiation.

8. See Krackhardt (1994) for an overview of the graph-theoretic approach to informal organizational hierarchies in general, and Hart (1974) for a typology of algebraic and graph-theoretic models of influence structures.

Given the central role of indeterminate status relations in the topology of hierarchies, it is important to get a handle on what, exactly, produces a non-status relation. Horizontality of status structures is not the result of simple 'absence' of status relations, the lack of a tie in a network representation of the order. Indeed, this is a pitfall of network representations in general: the gaps in a network often represent distinct relations rather than just nonexistence of the relation indicated by an edge. In the case of status structures—the lack of a clearly resolved status relation between a pair of people could be evidence of a number of starkly different dyadic phenomena. Martin (2009a, chap. 5) identifies two such phenomena in networks of influence. First, a pair of individuals may not have an established direction to their relation because their difference in some underlying measure of authoritativeness is insufficient to make a clear determination of order. Perhaps there is some limitation in accurately assessing the authoritativeness of another, or else influence only occurs after some threshold difference in authoritativeness is reached. Either way, there is a lack of a clear, directed relation because the pair of them are somehow too similar in their latent influence score. Martin's second mechanism for unestablished relations is based on a pair's unwillingness, rather than inability, to establish an order between themselves. That is, in most group situations it is possible to opt out of (or simply not have the opportunity for) a direct comparison. The distinction between these phenomena is akin to comparing rank within and across divisions in a corporate hierarchy. If two employees work under the same manager on similar tasks, they are said to be of equal rank because their relative status is highly comparable and found to be more or less equal. Two employees working in middling roles in distant divisions of the same large corporation, in contrast, are simply incomparable by virtue of there being no meaningful criterion for comparison. Status relations

can be ambiguous because they represent a comparison that is difficult or a comparison that is not worth making.

Another approach to hierarchical social structures that underscores the relevance of horizontality is that focussing on triadic analysis. Rather than treating hierarchy as the result of an explicit or implicit global structure, this work takes a bottom-up approach to structural analysis of networks. Goerg Simmel was among the first social scientists to emphasize the triad as a fundamental building block of larger social structures (Simmel and Wolff 1950, pt. 2, chap. 4). Triads are the smallest collection of people that have features of *groups*, and as such they provide a useful lens through which to link small-scale relationships to large-scale structure. Seminal among the analysis of the triad composition of networks is series of research investigating the structural consequences of the presence of different triadic forms. Davis and Leinhardt (1967), Holland and Leinhardt (1971), and Johnsen (1985), among others, show analytically that the exclusion of specific sets of 'forbidden triads' from a network guarantees a strict hierarchy of tightly connected groups in any global network structure. While the proposed sets of allowed and forbidden triads they put forth fit the structures of empirical networks only loosely—real-world networks are rarely as orderly as any ideal type—the link they imply between behavioral tendencies at the individual level and the consequences for global structure cannot be overstated. Moreover, triadic analysis suggests the crucial importance of two distinct types of unordered relations between dyads. In order to build any but the most trivial hierarchical structures, the set of allowed triads must include both those containing null relations (no relation in either direction), as well as *mutual*, bidirectional relations (see figure 1.4). Although the empirical networks motivating this work were so-called *choice* networks rather than networks measuring

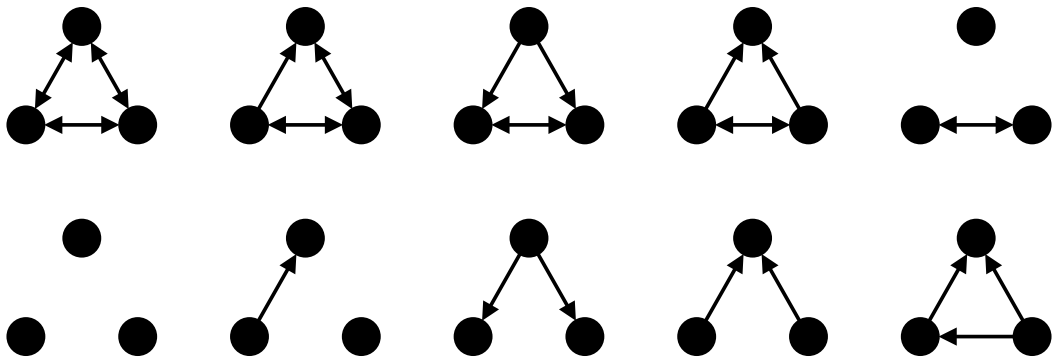


Figure 1.4: The ten triads allowed in Johnsen's (1985) hierarchical $\tilde{M}$-clique model.

relations of explicit dominance or status difference, and significance of an edges direction is therefore distinct, the structural implications are telling. The distinction between mutual edges, which are found within closely connected clusters within the macro-hierarchy, and null edges, which define the relationship between non-adjacent clusters in the macro-hierarchy, is practically akin to the distinction between difficult-to-compare and uncompared status relations discussed above.

Returning now to table 1.1 describing four different outcomes of dyadic status negotiation, we note that it too suggests two distinct types of 'undirected' status relations: conflict (both interaction partners assume the high-status role) and ambiguity (both partners defer to the other's authority). This dichotomy, however, differs from those just described in an important way. While much of the work on status structures takes the underlying relations to be essentially worked out, status relations are often slow to resolve, especially if the nature of the interactions allows status signals to remain inconspicuous. Overt competition over outright social dominance is rare in informal social situations, but subtle, inadvertent jockeying for the esteem of others can be commonplace. Frequently, social situations simply do not lend themselves to

status differentiation at all, and a fully settled interactional situation can leave some or all of the dyadic relations unordered with respect to status. The bottom-right corner of table 1.1 suggests a resolution of the situational definition, but not one that demands an ordered status relation between interaction partners. A pair of individuals might find themselves in a situation defined by status equality—two audience members seated next to each other in crowded movie theater, say—or they could be in a context where interaction between them is simply unlikely. In either case, there is no resolved, asymmetrical status relation that exists between them, but neither is there conflict over the direction of the relation.

The notion of a person's position in a status hierarchy is severely complicated by a structure that contains such indeterminate status relations. In a full, linear status order position is captured completely by one's rank, which simply measures one's distance from the highest-status slot. But when the vertical order is incomplete—when pairs can be related either by a directed status difference or not related at all—the patterns of connection define positions in more nuanced way. It is no longer sufficient to ask just how many people are above a person in a hierarchy, but who those people are. Which members of the community are part of a clearly defined vertical order and which members are situated more ambiguously? Are well defined status relations distributed evenly across the community, or are they more likely to exist within certain subgroups? These kinds of questions suggest that much of the situational 'action' in a status hierarchy exists in the gaps, in the relations that are unclear. Empirically, there is a fair bit of ambiguity about what, exactly, is going on in these gaps. Moreover, as I will show in the empirical analyses in subsequent chapters, these ambiguous relations define a great deal of the consequential topological features of real-world status hierarchies. Horizontality is a

defining feature of status structures among humans, and is at least as important for the social consequences of those structures as vertical status differentiation.

Measurement

Having outlined a definition of social status as a relational concept and explored its structural consequences, I will turn now to a discussion of the measurement of status. A large portion of this dissertation will be devoted to methods that reveal status relations between dyads, thereby uncovering status topologies across communities. But first, it will be worthwhile to review the major existing approaches to the determination of status in informal settings. While a great deal of ethnographic work has examined social status with good results (see Adler and Adler 1998 for an example), here I will focus only on quantitative approaches to status measures. Most such measures rely on network data, where the edges of the network represent either social ties (friendship, mutual membership, business relationships) or measurable interactions (directed or undirected communication, financial transactions). Network theoretic approaches to the description of social status fall into two major categories: those that focus on individuals' *centrality* and those that identify categorical status *positions*.

Of the two approaches just mentioned, centrality is by far the most commonly invoked, in part because theories of network centrality yield intuitive measures that are easily applied to empirical networks. Theories of centrality are based on a conception of status primarily focused on power (Friedkin 1991). Most of these theories were developed in an attempt to understand processes of influence and control on communication networks, a foundation that is apparent

in the formulation of centrality measures. Many such measures are based on notions of *betweenness*, under the implicit assumption that powerful actors will be those that are likely to be exposed to information flowing through channels defined by the network edges (Freeman 1977). The more geodesic network paths pass through an actor, the higher that actor's betweenness score. Other theories concentrate on *closeness*, identifying central actors as those that are in some sense 'nearby' many other actors in the network. The implicit theory of these measures is that central actors will have an easier time accessing resources in diverse parts of the network. Measures based on simple *connectivity* are among the most commonly used. These measures are often based on a node's degree, or a generalization thereof, identifying actors that are closely connected to a large number of other actors. Finally, some approaches to the theory and measure of centrality aim to incorporate elements of all three of these approaches. A very popular measure introduced by Bonacich (1987) ranks nodes in a network using a recursive formulation of power that defines central nodes as those that are closely tied to other central nodes.[9]

Centrality is, with good reason, a popular concept in social network analyses. The methods themselves are widely implemented and easy for any researcher to use. The measures are intuitively accessible in a way that makes them appealing both to producers and consumers of network research. Perhaps most importantly, virtually every measure of network centrality is agnostic to the type of network represented in the data. Centrality is measured on, to name just a few, networks of friendship and advice (Faris and Felmlee 2011; Krackhardt 1990), patent citations (Podolny, Stuart, and Hannan 1996), and economic transactions (Padgett and Ansell

9. Bonachich's measure can be adjusted to account for brokerage processes, defining powerful nodes as those that are closely connected to *non*-powerful alters. This parameterization is rarely used in the literature, however.

1993). The measures of centrality are straightforward to extend to networks that are directed, have valued, edges, or have multiple kinds of edges. However this flexibility is also one of the weaknesses of centrality as a measure of status. The interpretation of the centrality scores generated depends crucially on the meaning of the network ties themselves. A central position in a network of core discussion partners is essentially different from a central position in a corporate email network. But theories based on network centrality share certain features that more basically limit their usefulness in research into social status. First, the measures they promote imply a strictly linear status order. While such an approach is reasonable for certain purposes, such as the identification of the most central individuals in a community, it is inconsistent with the realities of social status hierarchies as they are experienced. As discussed above, while many status orders have a clearly identifiable 'top', most also involve a large number of incomparable pairs of agents for whom a quantifiable status difference is unreasonable. The scoring approach fundamental to status measures presumes a comparability of everybody in the network, thereby neglecting the dyads with no unambiguous status relation. Centrality measures focus exclusively on the vertical dimension of social status and ignore horizontality entirely.

The inappropriateness of a full ordering of individuals in a status hierarchy suggests another difficulty in the application of centrality theory for the measurement of such a hierarchy. While centrality measures are very good at finding core members of a network, they are often not very good at establishing status relations between members. The development of centrality measures rose from a concern with identifying *powerful* actors in a network. As such, the theoretical underpinnings of their formulations are more attuned to notions of instrumentality of network positions themselves. One way to characterize centrality measures is as the identification of

strategically beneficial spots in a network of communications or interactions. Central actors are positioned in a way to be highly visible and to have easy access to network resources. Empirical studies have found that central actors are often not considered high-status by their peers, and that high-status actors are often not central (Lease, Musgrove, and Axelrod 2002; Oldehinkel et al. 2007; Ball and Newman 2013). This underscores the central point that social status and status relations are related to but not isomorphic to notions of centrality in generic social networks.

The second major perspective in status and networks is the positional approach, epitomized by the *blockmodeling* methodology (Lorrain and White 1971; Burt 1976). Blockmodeling is distinct from centrality in that it eschews the idea of giving each agent in a network a score. Positional analysis aims to categorize rather than rank agents based on their position. Thus, the structural features of interest in positional analysis are those of type rather than degree. While the specifics of what defines a 'type' vary both theoretically and methodologically (see Borgatti and Everett 1992), the focus rests on patterns of relations held by members of each type (White, Boorman, and Breiger 1976; Burt 1977; Friedkin 1984; Doreian, Batagelj, and Ferligoj 2005). In terms of modeling hierarchical structures such as status, positional analysis has some appealing features. Most notably, blockmodeling methods emphasize not just the clustering of nodes into structural categories, but also the relationship between those categories. Analyses of core–periphery network structures, for instance, define the two categories (core and periphery) based on the way members of a category relate to other members of that same category *and also* on the way members of that category relate to the other category: peripheral nodes are those that have few interconnections among themselves, but many connections with those in the network's

core (Borgatti and Everett 2000; Rombach et al. 2014). One consequence of defining positions in this way is that the positional categories themselves are naturally embedded into a simplified network of their own, so hierarchical relationships can be understood as a relation on positions (roles) themselves (see, e.g., Hsieh and Magee 2010).

The theoretical and empirical questions that motivated the development of positional analysis in general, and blockmodeling in particular, share a number of characteristics with the underpinnings of centrality. Much of the early work in blockmodeling was concerned with professional and management structures with explicit, exogenous relationships. Perhaps because of this, the applications of positional analysis focus on structural power rather than status relations per se. However in the case of positional analysis, this emphasis on power over status has more to do with the network data sets used than it does with the theory or methods themselves. Relations of corporate subordination (Brass 1984), economic transactions (Snyder and Kick 1979; Padgett and Ansell 1993), and political behavior (Mizruchi 1990) are concerned primarily with processes of strategic power and control. Positional analysis excels at translating networks of relations among *individuals* to hierarchies of relations among *roles* (White, Boorman, and Breiger 1976; Winship and Mandel 1983). As such, blockmodeling provides a useful tool for understanding status roles from a network composed of status relations. Insofar as social status is operationalized as relations of influence or deference, positional analysis of such networks can yield fruitful research on structures of social status (Friedkin and Johnsen 1997; Friedkin 2006).

In contrast with measures of centrality and status position, the approach I take focusses explicitly on the interactional bases of status relations. The methods I develop in this disser-

tation infer status relations from behavioral and interactional cues rather than the structural features of a social network. Recent work in this vein suggests that a good deal can be known about the levels of deference and esteem between individuals from their relations and interactions, especially when observed in the context of a larger community. Some of the most straightforward of this research falls squarely within the tradition of balance theory, concentrating on different types of dyadic relationships in friendship networks. Rather than simply categorizing dyads as 'permitted' or 'forbidden' (as in classic balance theory), researchers such as Ball and Newman (2013) and An and McConnell (2015) interrogate the different status relations implied by different types of dyads. Based on findings from psychology and the study of adolescent interactions, they note that asymmetric friendship nominations — in which one individual nominates another as a friend but that nomination is not reciprocated — are characteristic of a status differential. This observation allows for the statistical inference of status position based on aggregated dyadic relations, in a sense combining the insights of balance theory with those of analyses of network centrality. Other research in this same spirit uses more subtle behavioral interactions to gain insight into status differences. Overt behavior such as bullying (Rodkin and Berger 2008) and even subtle nonverbal aspects of body language and physical orientation (Hall, Coats, and LeBeau 2005) are responsive to status differentials and therefore give interpretable clues about the status orders of entire communities. In chapter three I build on these findings to construct community-wide status hierarchies among middle- and high-school students. Another particularly relevant body of work merges the use of textual corpora with results from social-psychology about the effects of status differences on linguistic style. Psychologists and social-psychologists have noted the tendency of lower-status individ-

uals to mimic the linguistic style of discussion partners of higher-status (e.g. Burgoon, Stern, and Dillman 2007). By modeling this linguistic mimicry, researchers can reveal subtle but powerful syntactic clues that indicate status differentials in both online and face-to-face interactions (Danescu-Niculescu-Mizil et al. 2012; Gonzales, Hancock, and Pennebaker 2010; Romero et al. 2015; Danescu-Niculescu-Mizil and Lee 2011). In chapter two I describe a family of statistical models that estimate the degree of linguistic mimicry, and use the results of these models to analyze status and influence among members of President Kennedy's Executive Committee and users in a subcommunity of the online forum Reddit.

One goal of this dissertation is to demonstrate that asymmetry in interpersonal relationships is frequently tied to differences in status or power. Status has a persistent influence on interaction; there are not many situations in which the configuration of participants' status doesn't help define what is done, said, and left unsaid. Systematic asymmetries between individuals, whether found in patterns of speech, physical gestures, attitudes, economic transactions, or any number of other human social behaviors, are therefore likely to be influenced at least in part by differences in status. What I show in the remainder of this dissertation is that uncovering these relationships on the small scale of the dyad can open the door for the analysis of status structures in natural settings and existing data sets. In each case that I investigate, I focus on the way that a structural description of dyadic status relations, a description that reveals the horizontality, and therefore the topology, inherent in those structures, is vital for a full understanding of how status is realized among a community. I show that the specific topologies of status structures define the paths of influence and the fissures of inequality, and that ignoring the contours of these topologies obscures the consequences of social status in individuals' lives.

2

LANGUAGE, MIMICRY, AND STATUS STRUCTURES IN TWO EMPIRICAL CASES

It is no surprise that people tailor their behavior to their social context. Expectations about appropriate behavior mold they way we communicate depending on the situation. Individuals employ different gestures, facial expressions, and phrases in a meeting with their employer than they would at a baseball game with friends. Communication is tuned to the specific interaction within a situation, sometimes to a striking degree. In a single conversation, a parent will employ drastically different vocabulary and tone as they shift the target of their speech from their young child to a fellow adult and back. The way that an individual talks is closely attuned to the nuances of the social situation and their relationship with their conversation partners. In this chapter, I will discuss some of the ways that interpersonal communication is sensitive to contrast in social status. Building on results from sociolinguistics, I develop a family of statistical models that identify latent status relations from patterns of conversation in natural settings. I will apply the models to two empirical settings: (1) the transcribed recordings from President Kennedy's Executive Committee (ExComm) during the Cuban Missile Crisis of 1962, and (2) conversations among users in a sub-community of the online discussion board Reddit. In both cases, the status hierarchies that are uncovered are consistent with both the structural and behavioral predictions presented in the introductory chapter. Furthermore, I argue that topological features of the status hierarchies that result from the relationality of the model have important consequences for structures of power and influence within the two communities.

Communication and accommodation

Mimicry is ubiquitous in human communicative action. Our tendency to automatically adjust our postures, body language, expressions, and style of speech is well established (for an overview, see Chartrand and van Baaren 2009). People copy subtle features of the behavior of those with whom they interact, often without any conscious perception of the specific behavior they mimic. Imitation of facial expressions (Dimberg, Thunberg, and Elmehed 2000), body posture (LaFrance 1985; Brown-Schmidt and Tanenhaus 2008), gestures (Yabar et al. 2006; Chartrand and Bargh 1999), vocal intensity and loudness (Natale 1975; Meltzer, Morris, and Hayes 1971), and linguistic characteristics (Levelt and Kelter 1982; McFarland 2001) occurs spontaneously and almost immediately upon entering into a social situation. Pervasive as it is, such imitation is not constant across social situations. Communication accommodation theory (CAT; Giles, Coupland, and Coupland 1991; Giles 2009) investigates the processes by which the sociolinguistic aspects of interpersonal interaction converge (or, in certain situations *di*verge) within situational contexts. The type of social setting, and in particular the type of relationship that exists between two individuals, can be dramatically predictive of the degree and the direction of communicative accommodation that occurs.

Perhaps unsurprisingly, mimicry in interaction is more prevalent when people feel they are in situations that are characterized by rapport and that involve other people to whom they feel close (LaFrance 1985; Chartrand and Bargh 1999; Gonzales, Hancock, and Pennebaker 2010). There is a strong relation between the degree of communication accommodation and a sense of comfort in a situation. Research into the mechanisms that underlie accommodation sug-

gests that convergence of both verbal and nonverbal behavior is an important part of building shared frames of experience with interaction partners (Richardson, Dale, and Kirkham 2007). By aligning body language, vocabulary, facial expressions, and affect in conversation, people are better able to reach an understanding of what to expect from the exchange. Communication is a joint project undertaken by its participants, and communication accommodation can be seen as a way of developing a shared definition of the situation (Pickering and Garrod 2004; Linell 2009). An important result from research into communication accommodation is that many of the behaviors on which people align are not consciously recognized by those engaging in them or observing them (Levelt and Kelter 1982; Dimberg, Thunberg, and Elmehed 2000; Segalowitz and Lane 2004; Ireland and Pennebaker 2010). In addition to the more overt symbolic attributes of an interaction that lead participants to feel they are aligned with a social situation, such alignment also relies on a multitude of subtle behaviors that participants are unaware of on a conscious level.

Communicative mimicry is tightly tied to group affiliation, and, as such, it plays a significant role in processes of exclusion and inclusion that define social boundaries. While mimicry is present in a wide variety of social situations, it is consistently stronger among members of a defined group. When individuals feel categorically affiliated with an interaction partner—of the same gender (Lakin, Chartrand, and Arkin 2008) or in the same organizational role (Cheng and Chartrand 2003), for instance—they take on more of the behavioral characteristics of that person. By the same token, minimizing the degree of mimicry can serve as a distancing mechanism to strengthen symbolic and social boundaries. Just as asymmetry in symbolic boundary maintenance signifies status differences between social categories, asymmetry in communicative

mimicry can indicate efforts at affiliation and disaffiliation across status boundaries. Because people strive to be affiliated with higher status they adjust their communication patterns to match those of the higher-status individuals, and minimize the degree of matching when interacting with those of lower status (Cheng and Chartrand 2003; Danescu-Niculescu-Mizil et al. 2012).

Although the behavioral dimensions along which communicative alignment occurs are surprisingly diverse, recent research into linguistic accommodation suggests that lexical convergence is a particularly useful indicator of affiliation. Language style matching (LSM) measures linguistic mimicry between individuals by keeping track of the frequency with which particular categories of words are used (Niederhoffer and Pennebaker 2002; Gonzales, Hancock, and Pennebaker 2010). LSM is a relatively simple method that attempts to capture the *style* of speech while avoiding the semantic content. It focusses on how something is said rather that what is being said. Using this methodology, language style is defined through a speaker's use of *function* words, also known as *closed-class* words. Function words, which include parts of speech like prepositions, articles, and conjunctions, serve as the scaffolding of language. They give an utterance its structure but do little to convey the meaning of a statement. Speakers are much less conscious of their use of function words than they are of content words (Ireland and Pennebaker 2010; Danescu-Niculescu-Mizil and Lee 2011), and there is even evidence that function words are processed differently than content words at the neurological level (Segalowitz and Lane 2004; Petten and Kutas 1991). The use of function words is a mostly automatic part of the language-production process.

Linguistic style, measured as the relative frequency of different classes of function words

that occur in a person's written and spoken language, is a remarkably stable individual characteristic. Across different contexts and different topics, speakers maintain a consistent pattern of function-word use (Pennebaker and King 1999; Slatcher et al. 2007). Stylistic stability is an important component of research into LSM. While a basic level of style matching between dyads can be calculated relatively simply by comparing conversation partners' styles across an aggregated conversation (Gonzales, Hancock, and Pennebaker 2010; Danescu-Niculescu-Mizil, Gamon, and Dumais 2011), such measurements neglect possible asymmetry in the degree of linguistic accommodation undertaken by each partner. Certainly, some convergence in language style is mutual, with both parties to an exchange adjusting their speech patterns to be nearer one another. However asymmetric matching, in which one speaker does not alter their speech patterns at all, making the other do all of the stylistic 'work' in the exchange, is common and has been shown to be related to processes of power, influence, and status (Taylor and Thomas 2008; van Baaren et al. 2003; cf. Romero et al. 2015). In a particularly relevant paper, Danescu-Niculescu-Mizil et al. (2012) study linguistic mimicry in two contexts: oral arguments made before the United States Supreme Court, and online conversations between users on Wikipedia. In both cases, they find that institutionalized status differences, as between Justices and lawyers or between administrators and editors on Wikipedia, lead to strong asymmetries in style matching. When a strong difference in status exists between conversation partners, the higher-status individual tends to do little stylistic adjustment, while the lower-status individual alters their style considerably.

In the remainder of this chapter I will use the basic observations of LSM to investigate status relations and status structures among two different groups: members of the Executive Commit-

tee of the National Security Council under U.S. President John F. Kennedy, and participants in a community on Reddit sparked by the so-called "Gamergate" controversy. Although the two groups differ in a number of ways—face-to-face versus online, closed versus open, personal versus anonymous, small versus sprawling—they both provide a detailed record of linguistic interaction in a natural setting. I will show that conversational traces like these are sufficient to uncover dyad-level status relations between individuals, and to construct detailed status topologies for whole communities.

Status in person: Relations among ExComm members

On October 16, 1962, United States intelligence discovered the presence of Soviet missiles in Cuba. Amid concerns of an increase in the Soviet Union's offensive capabilities against the United States (including the possibility that the missiles were capable of delivering nuclear warheads to much of North America), President Kennedy convened a meeting of his top advisors to discuss the administration's response. This group, dubbed the Executive Committee of the National Security Council, or, much later, ExComm, advised the president in his response to the discovery and the subsequent actions.[1] Using the ExComm as a case study of a small task group, I will show that communicative mimicry among its members provides a reliable measure of the relational and structural features of its status hierarchy. In addition to aligning with historical accounts of the status-based roles played by the committee members, I will argue that relations of asymmetric linguistic style matching present among the members of the committee

1. See table 2.1 for a list of key members of the ExComm.

conform to the theoretical and empirical features of status hierarchies. In particular, the hierarchies of asymmetric linguistic accommodation that emerge are acyclic, stratified by social class, and define dyadic relations of influence.

Data

The Cuban missile crisis took place over 13 days, starting with the initial photographs of missile sites on October 16th and ending with an eventual deal with the Soviet Union on October 28th. Unknown to almost all of the members of the ExComm, President Kennedy had earlier set up secret audio recording devices in the Cabinet Room. The transcripts of these recordings, now mostly declassified, are transcribed and reproduced in May (2001).[2] Not every meeting of the ExComm was recorded, either because the tape recorders were not turned on at the time or, more frequently, because the meeting was taking place elsewhere. In total, transcripts of sixteen ExComm meetings are available, as shown in figure 2.1.[3]

In order to analyze patterns of linguistic style matching among ExComm members, I construct a corpus of utterances made during these meetings, with a few exceptions. First, there are a handful of instances in which multiple people said the same thing in unison, which I omit from the corpus. Editorial notes from the translators, often clarifying the referent of a word or phrase, were also deleted. Finally, on several occasions a member of the committee would read a document verbatim, as when the committee would receive an intelligence report, or when they

2. While Gibson (2012, 12–19) provides a convincing argument against using these transcripts (rather than the original audio recordings and detailed conversation analytical transcriptions) for scholarly work, the omissions and errors he points out have little effect on the methodology I use in this chapter.

3. For a thorough account of the crisis in geo-political context, see Fursenko and Naftali (1997).

Table 2.1: Key participants in the ExComm, from Gibson (2012, Appendix B)

Name	Title	College
George Ball	Undersecretary of State	Northwestern
McGeorge Bundy	National Security Advisor	*Yale*
Douglas Dillon	Secretary of Treasury	*Harvard*
Roswell Gilpatric	Deputy Secretary of Defense	*Yale*
Alexis Johnson	Deputy Undersecretary for Political Affairs	Occidental College
Lyndon Johnson	Vice President	Southwest Texas State Teachers College
John F. Kennedy	President	*Harvard*
Robert Kennedy	Attorney General	*Harvard*
Edwin Martin	Assistant Secretary of State for Inter-American Affairs	Northwestern
John McCone	Director of Central Intelligence	Berkeley
Robert McNamara	Secretary of Defense	Berkeley
Paul Nitze	Assistant Secretary of Defense for International Security Affairs	*Harvard*
Dean Rusk	Secretary of State	Davidson College
Theodore Sorensen	Special counsel to president	University of Nebraska, Lincoln
Maxwell Taylor	Chair of the Joint Chiefs of Staff	Kansas City Polytechnic Institute / West Point
Llewellyn Thompson	Former ambassador to the Soviet Union	University of Colorado

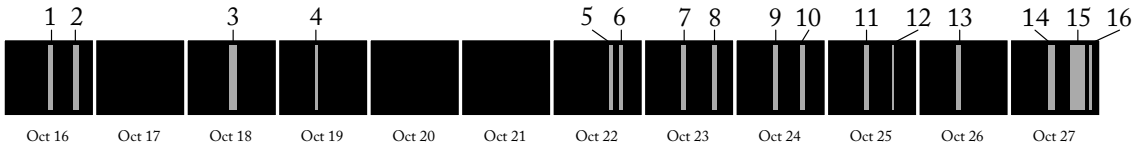


Figure 2.1: Timeline of the 16 recorded ExComm meetings.

would compose a statement together and read parts of it back to each other. These verbatim readings were removed from the corpus, but surrounding talk was kept. After this cleaning, the corpus consists of 5,772 individual utterances made by 54 different people.[4] Figure 2.2 plots the number of distinct utterances against the total number of words for each person who spoke on the transcripts (on a log-log scale). The ten most frequent speakers are labeled. Unsurprisingly, President Kennedy was by far the most active member of the committee, speaking 44,490 words over 1,308 distinct speaking turns.

Each utterance was coded for its frequency of function words, or its linguistic style. Identifying function words in text is relatively straightforward. As closed-class words, function words can be easily enumerated and searched for. While different studies in LSM use different subcategorizations of function words, I use six comparatively inclusive categories (see table 2.2). Mostly these are trivial to identify in the transcripts. However some terms can be used as more

4. I define an *utterance* as a single turn in the transcripts. This is an imperfect definition, as the transcripts were written for readability and omit much of the timing information that would be included in a conversation analysis. Thus when people are talking over each other, it is usually transcribed as a quick back-and-forth of short utterances rather than a single episode of overtalk.

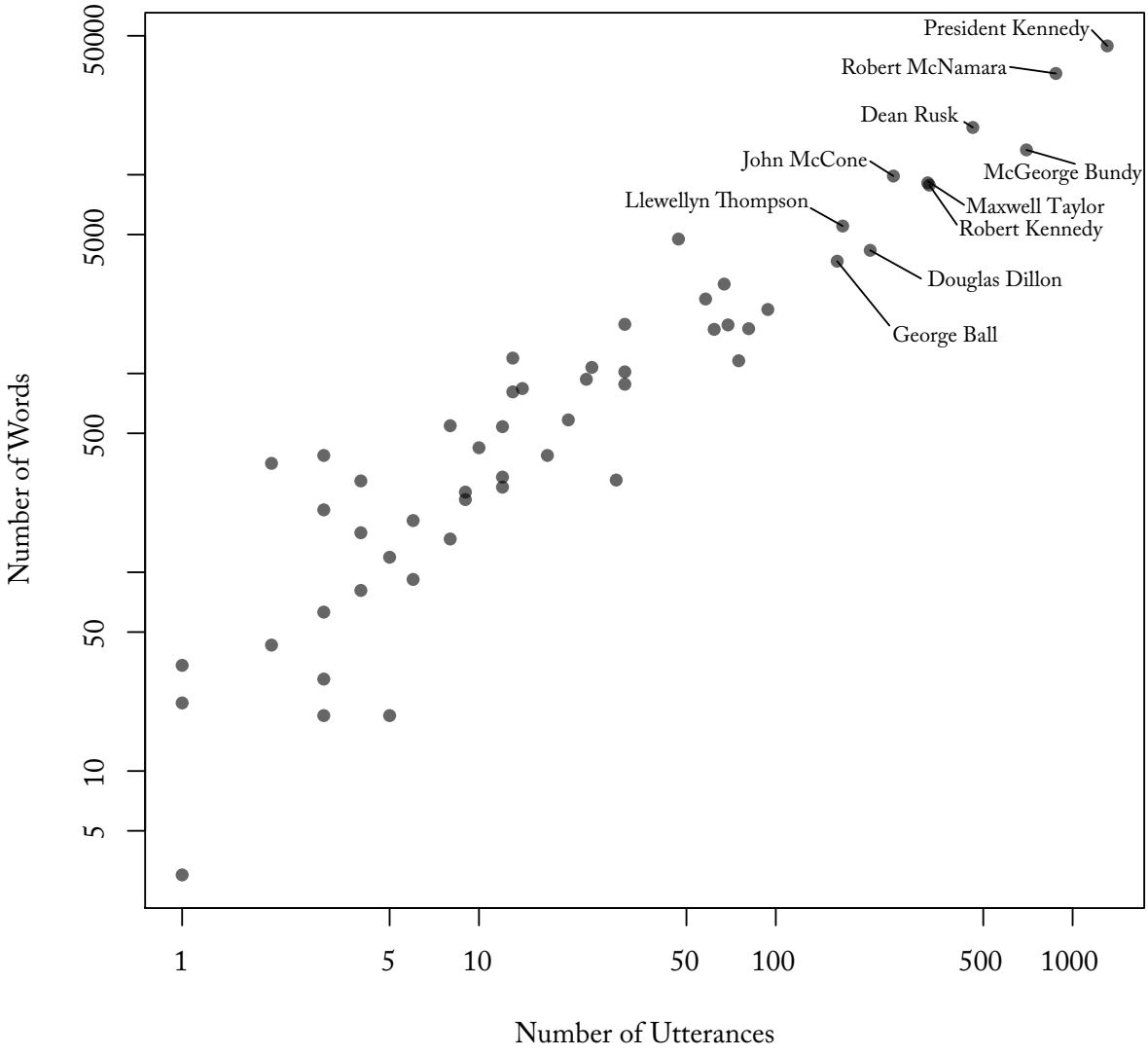


Figure 2.2: Number of utterances and words spoken by ExComm members.

Table 2.2: Function word categories and examples.

	category	example
1	auxiliary verbs	should, must, may, …
2	conjunctions	however, then, and, …
3	determiners	a, any, per, …
4	prepositions	above, of, through, …
5	pronouns	them, mine, anyone, …
6	quantifiers	many, each, some, …

than one type of function word; the term '*those*', for instance, can be used as a preposition or a determiner. In these cases, the term is assigned to one of the function word categories at random.[5]

The model described below estimates the degree of stylistic mimicry between every directed pair of people in the ExComm. In my analysis, I will show that style matching, and in particular *asymmetric* matching, are indicative of social status among the committee's members. Moreover, I will argue that formal positions, past history, and, somewhat surprisingly, socioeconomic class play a large part in the determination of status relations.

Model

Most studies of linguistic style matching treat the degree of matching as a simple measure of the similarity between two individuals' speaking style. Using this approach for the ExComm

5. A more thorough approach would be to attempt to automatically identify the part of speech of ambiguous terms. In pilot analyses using the Reddit corpus (described below) I found that this approach added considerable computational difficulty while providing substantially identical results.

corpus would be straightforward. To look at the degree of matching between, say, President Kennedy and his brother Robert (Bobby), one would count the frequencies of all six categories of function words across the entire corpus. Then, if the brothers tended to use the same proportion of prepositions, pronouns, etc. in their utterances (which they do) we could say they have a high degree of matching between them. This simple, measurement-based approach is lacking in a few important ways. First, as a non-probabilistic method, it gives no real indication of how certain one can be that the measurement is accurate. If, as is the case with Jack and Bobby, they both talk a great deal, then the measurement is probably pretty good. Many of the other speakers do not talk quite so much, though, and any convergence or divergence between their styles could be a fluke emerging from the unpredictability of conversation.

Second, and more important for the study of status and hierarchy, simple measurements of similarity in style are unable to capture the directionality of mimicry. Knowing that, on average, President Kennedy and his brother use a similar style reveals nothing about which of them is accommodating the other in their speech. It could be that they are both adjusting their language toward the other in a mutual show of respect, or it is possible that Bobby is adjusting the way he talks considerably while the President makes no accommodation whatsoever. To differentiate between these two scenarios, one symmetric and the other asymmetric, it is necessary to know something about how the two brothers *would* be speaking outside of an opportunity to accommodate one another. Put differently, one would need to have an idea of their *baseline* linguistic styles. Such a baseline is obviously not available directly in the corpus; the members of the ExComm are always speaking in the context of the meetings and in the presence of the other participants. Nonetheless, it is possible to make inferences about both the baseline lin-

guistic style of the committee members, and of the degree to which they directionally mimic one another. The words that people choose to use are not produced all at once, but are part of the process of a conversation. Bobby Kennedy is reacting to the things his brother says over the course of an entire meeting, and as the President's linguistic style changes from utterance to utterance, Bobby has a chance to change the target of his mimicry. A statistical model of linguistic style production can capture the dynamic processes underlying the patterns of mimicry among the entire group.

The model I describe has two types of unobserved parameters, one representing each individual's baseline linguistic style, and the other describing that person's tendency to mimic every other individual in the group. These parameters play the same role as the coefficients in a linear regression model: although we cannot measure them directly, the statistical model assumes that they establish the relationships between the data that we do observe. The goal of statistical inference is to determine which values of the unobserved parameters would be more or less likely to generate the observed data we have. In a linear regression the unobserved coefficients are simple, each is a one-dimensional real number. In the case of the linguistic mimicry model used here, the parameters are somewhat more complex. Each individual's baseline linguistic style is represented by a vector $\mathbf{b}_i = (b_{i1}, \ldots, b_{i6})$, where the indices 1 through 6 represent the six function word categories in table 2.2. Thus, each person has a probability b_{i1} that a given function word will be an auxiliary verb, a probability b_{i2} that that word will be a conjunction, and so on. Because content words (non-function words) are left out of the analysis the probabilities across all six function words must sum to one: $\sum_{j=1}^{6} b_{ij} = 1$. As an example, consider a person who is quite fond of using prepositions and has a baseline linguistic

style $\mathbf{b}_i = (0.01, 0.2, 0.14, 0.4, 0.2, 0.05)$. If we let this person talk long enough, counting the number of function words they use from each category, we would expect about forty percent (0.4) of those words to be prepositions, and only about five percent (0.05) to be quantifiers.

To model the tendency to mimic the linguistic style of each other person in a group I define a similar vector $\mathbf{m}_i = (m_{i1}, \ldots, m_{in})$, now with a value for each of the n people they are interacting with (including themselves). Again, the vectors represent proportions, so its values are restricted to sum to one: $\sum_{j=1}^{n} m_{ij} = 1$. The value of m_{ij} $(i \neq j)$ is the relative degree to which person i mimics the style of person j, and the value of m_{ii} represents how much person i sticks with their own baseline style, uninfluenced by the speech of others.

Finally I define two observed variable for each utterance k in the corpus. Let $\mathbf{f}_k = (f_{k1}, \ldots, f_{k6})$ be a vector of the integer counts of each of the six function word categories present in utterance k. Further, let $\mathbf{h}_{kj} = (h_{kj1}, \ldots, h_{kj6})$ represent the proportion of function words used from each category by person j *prior to* utterance k.[6] That is,

$$\mathbf{h}_{kj} = \frac{\sum_{\kappa \in U(j,k)} \mathbf{f}_\kappa}{\mathbf{1} \cdot \sum_{\kappa \in U(j,k)} \mathbf{f}_\kappa}$$

where $U(j, k)$ is the set of all utterances made by person j before utterance k, and $\mathbf{1}$ is a vector of all ones (so that the denominator normalizes the numerator to sum to unity). The full model can then be specified:

6. The stylistic history of an individual, $\mathbf{h}_{jk}$ could be specified in other ways as well, such as using a time-based window of recent utterances. In the ExComm model described here, $\mathbf{h}_{jk}$ represents everything person j has said so far in the current meeting only.

$$
\begin{aligned}
\mathbf{f}_k &\sim \text{Multinomial}\left(m_{\overline{k},\overline{k}}\mathbf{b}_{\overline{k}} + \sum_{j \neq \overline{k}} m_{\overline{k},j}\mathbf{h}_{jk}\ ;\ \sigma_k\right) \\
\mathbf{b}_i &\sim \text{Dirichlet}(\alpha_b) \\
\mathbf{m}_i &\sim \text{Dirichlet}(\alpha_m)
\end{aligned}
\tag{2.1}
$$

In this specification, $\overline{k}$ represents the index of the speaker for utterance k, σ_k is the total number of function words in utterance k, and $\text{Multinomial}(p; s)$ is a multinomial distribution with probability parameter p over a number of events s. The Dirichlet parameters α_b and α_m are uninformative priors for the baseline-style and mimicry vectors.

To see how this model of utterances and mimicry functions, consider a corpus in which only two people are having a conversation. Each of those individuals has a baseline linguistic style, $\mathbf{b}_1$ and $\mathbf{b}_2$, and each has some tendency to mimic the other, $\mathbf{m}_1 = (m_{11}, m_{12})$ and $\mathbf{m}_2 = (m_{21}, m_{22})$. After they have been conversing for some time, person 1 is going to say something new. The function words that they will use in this new utterance, f_k, are determined probabilistically from their baseline style $\mathbf{b}_1$, their mimicry of their conversation partner, m_{12}, and the history of everything the partner has said so far in this conversation, $\mathbf{h}_{k2}$. The situation is represented in figure 2.3 with $i = 1$ and $j = 2$. On the top left, person i has a baseline style associated with their unaffected speech (one favoring conjunctions and determiners), and on the top right there is a representation of the style of speech exhibited so far by person j (which has favored pronouns disproportionately). The degree to which person i mimics person j, indicated by m_{ij}, will determine their likelihood of using each category of function words. A low value of m_{ij} means that person i will stick mostly with their baseline style, while a high value of

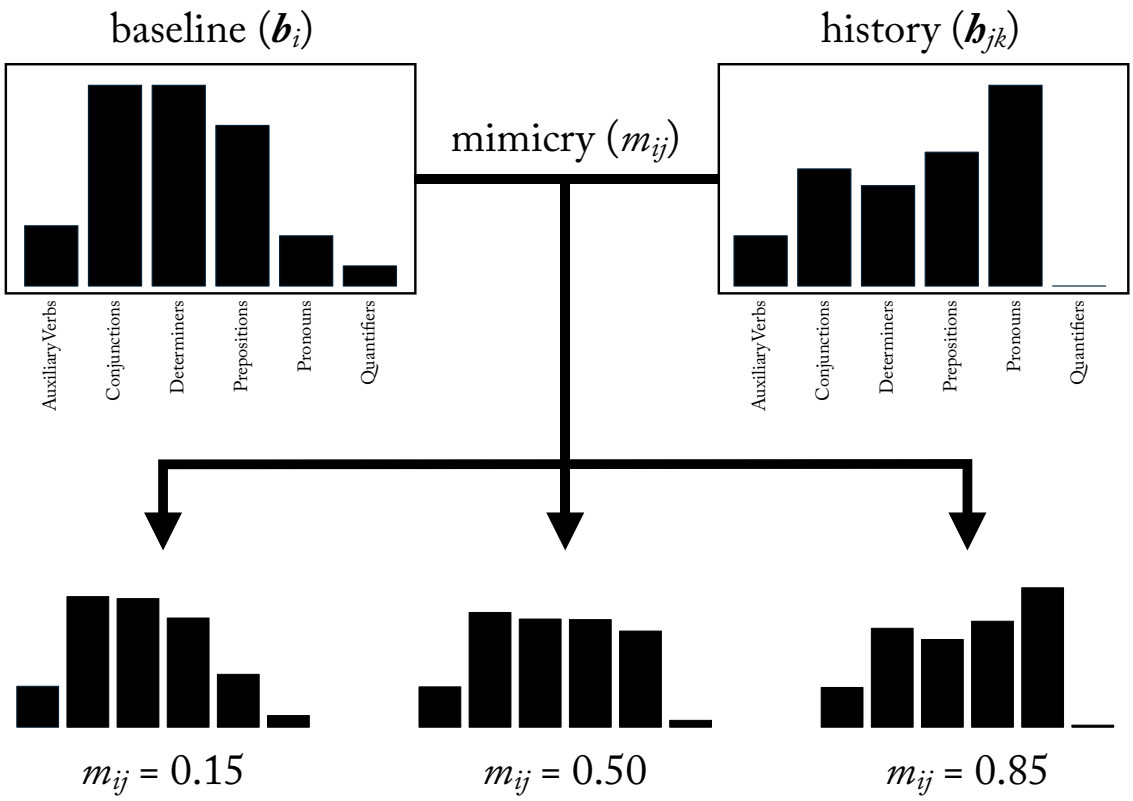


Figure 2.3: Schematic example of linguistic style matching.

m_{ij} suggests that they will use a style more in line with what they have heard their partner use. An important feature of the model is that a person's baseline style is fixed throughout the conversation, but the styles they are mimicking ($\mathbf{h}_{jk}$) change as the interaction progresses.

Estimation and Results

The number and dimension of unobserved parameters that need to be estimated depends both on the number of participants in the conversations and the number of function word categories. Each member i has an unobserved ($\mathbf{b}_i$) and unobserved mimicry ($\mathbf{m}_i$). To estimate these pa-

rameters, it is necessary to first caclculate the values of $\mathbf{h}$ for each conversation participant at each conversation turn. With N participants, M function word categories, and K total conversation turns, this yields an array $\mathbf{h}$ of dimension $K \times N \times M$. Similarly, the matrix $\mathbf{f}$ has dimension $K \times M$, so the kth row indicates the number of each category of function words that are used in that utterance. In this format, $\mathbf{f}$ can be thought of as the observed outcome variable, and $\mathbf{h}$ the array of observed predictors. The unobserved parameters $\mathbf{b}$ and $\mathbf{m}$ relate the predictors and outcome, as specified in equation 2.1. Using Hamiltonian Markov chain Monte Carlo methods,[7] the parameters for baseline style and mimicry are straightforward to estimate, yielding posterior distributions for both $\mathbf{b}$ and $\mathbf{m}$.

In this way the linguistic mimicry model was estimated for the sixteen committee members listed in table 2.1 using the entire corpus from October 16 through October 27. Among these members, there are 240 potential mimicry relations (recall that mimicry is modeled here as a directed relation). For every pair of individuals, say Bobby Kennedy and McGeorge Bundy, there is an estimate of how much Bobby mimics Bundy, and another of how much Bundy mimics Bobby, each indicating something between no mimicry (zero) and total mimicry (one). Thus, for each directed relationship, the model produces an estimate of the posterior distribution over possible values of m_{ij} for that relationship. Table 2.3 lists the dyads for which at least 95% of the posterior distribution lies above 0.01, along with the distribution's median and the interquartile range.[8] We can see immediately that President Kennedy holds a special place

7. For an overview of these methods see Gelman et al. (2003) and Neal (2011). The analysis was done in the Python programming language using the PyMC module.

8. Using Hamiltonian MCMC, twelve independent chains were run for five thousand iterations each. Although comparison of the chains suggests remarkably fast convergence of the estimator (on the order of a few hundred iterations), the first three thousand iterations were discarded to ensure that the chains had reached a

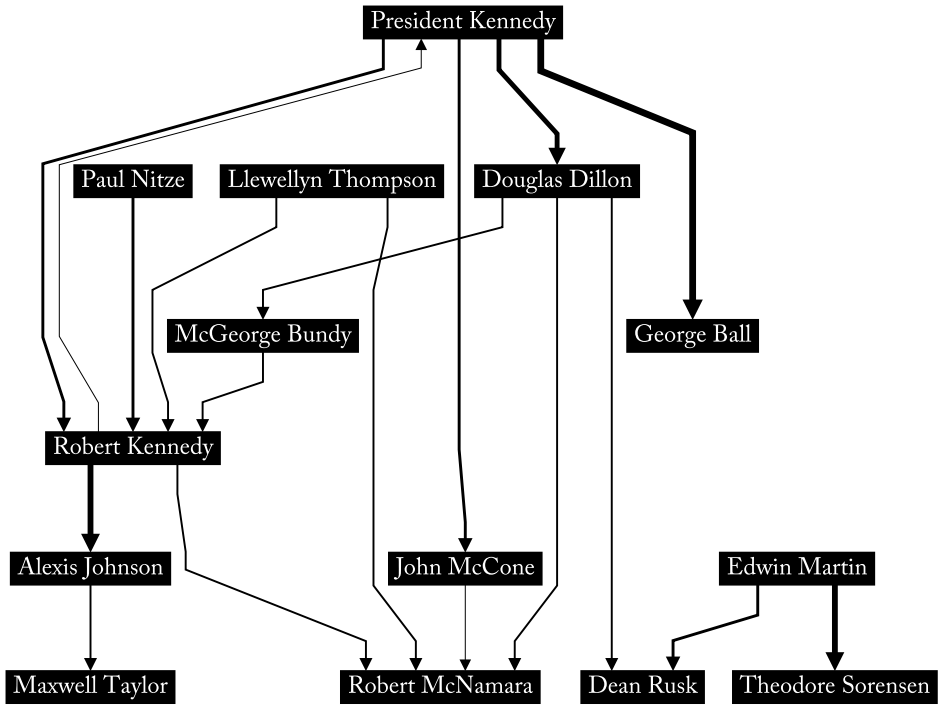


Figure 2.4: Directed linguistic style matching between members of the ExComm.[9]

in these results, being mimicked by the most committee members (4), with high fidelity. Undersecretary of State George Ball, in particular, imitates the President's use of function words almost completely. To gain a better understanding of the structural features of the estimates, however, the results can be visualized as a directed network. In figure 2.4, there is a network edge between each pair of committee members listed in table 2.3, directed from the person being mimicked to the one doing the mimicking. The thickness of the edges is proportional to the posterior median.

Reading this network as a hierarchy of status relations, there are some immediate structural features to be noted. First, this image confirms President Kennedy's position as "presider,

steady state. The remainder are used as a sample to approximate the posterior distribution of the parameters.

9. Vice President Lyndon Johnson and Deputy Secretary of Defense Roswell Gilpatric are omitted from the figure because they are not part of any significant dyads.

Table 2.3: ExComm: Significant LSM estimates and interquartile ranges.

mimickee	mimicker	median	$Pr(> 0.1)$	I-Q range
McGeorge Bundy	Robert Kennedy	0.165	0.028	(0.125, 0.209)
Douglas Dillon	McGeorge Bundy	0.176	0.039	(0.131, 0.226)
Douglas Dillon	Robert McNamara	0.169	0.010	(0.136, 0.206)
Douglas Dillon	Dean Rusk	0.175	0.029	(0.133, 0.223)
Alexis Johnson	Maxwell Taylor	0.159	0.039	(0.120, 0.204)
President Kennedy	George Ball	0.618	0.000	(0.538, 0.703)
President Kennedy	Douglas Dillon	0.419	0.014	(0.334, 0.515)
President Kennedy	Robert Kennedy	0.244	0.030	(0.182, 0.312)
President Kennedy	John McCone	0.213	0.009	(0.170, 0.257)
Robert Kennedy	Alexis Johnson	0.517	0.024	(0.408, 0.646)
Robert Kennedy	President Kennedy	0.126	0.008	(0.100, 0.153)
Robert Kennedy	Robert McNamara	0.185	0.003	(0.150, 0.220)
Edwin Martin	Dean Rusk	0.253	0.006	(0.203, 0.303)
Edwin Martin	Theodore Sorensen	0.499	0.037	(0.381, 0.640)
John McCone	Robert McNamara	0.088	0.035	(0.067, 0.111)
Paul Nitze	Robert Kennedy	0.257	0.042	(0.193, 0.331)
Llewellyn Thompson	Robert Kennedy	0.169	0.032	(0.131, 0.212)
Llewellyn Thompson	Robert McNamara	0.155	0.013	(0.122, 0.191)

decider, and principal recipient" (Gibson 2012, 53) at the top of the hierarchy. But if the President is at the top of this hierarchy, Secretary of Defense Robert McNamara is squarely at the bottom, a position that may come as a surprise. Virtually every account of the Cuban missile crisis identifies McNamara as a central figure in the deliberations (White 1996; Frankel 2004). Often portrayed as a foil to the more hawkish members of the committee, McNamara probably wielded considerable sway over the final decisions that emerged from the ExComm meetings, and in some sense he was a very influential participant (White 2012). Indeed, as Secretary of Defense, he was the highest ranking military official there, above even Chairman of the Joint Chiefs of Staff Maxwell Taylor, and by his position alone had formal authority over a number of the people present. In his interactions in committee meetings, however, it is clear that McNamara acted as if his status in the group was not well established. Often contrarian, McNamara had a tendency to challenge the assessments of others in the group, even when it meant contradicting his own position just moments before. Perhaps more telling, though, were McNamara's frequent interjections in support of others' statements regarding matters of military expertise, as in the following excerpt from the October 18 transcript—part of a discussion of the consequences for U.S. soldiers in Berlin in the event of a Soviet attack on the base there (May 2001, 540):

Taylor: They fight.

McNamara: They fight. I think that's perfectly clear.

President Kennedy: And they get overrun.

McNamara: Yes, they get overrun, exactly.

Gibson interprets exchanges such as these "as a way of asserting a claim to independent authority in spite of being in 'second position,' sequentially speaking" (2012, 62). Although there no doubt that McNamara was *prominent* in the meetings, he was also not held in high regard by many of the committee members. As a political outsider whose most recent position before being appointed Secretary of Defense was as CEO of Ford Motor Company, McNamara was not taken seriously by the more experienced government officials, especially those with long careers in the military. The distinction between *prominence* and *regard* in a status structure speaks to a characteristic of hierarchies that I treat formally in the next chapter: that of rank versus embeddedness. While McNamara is in some respect at the bottom of the network depicted in figure 2.4, he is nonetheless deeply embedded in that network. Comparing his position to that of Undersecretary of State George Ball, for instance, it is no surprise that McNamara is more central to the decision-making processes of the committee. He is not deferred to linguistically, but he is nonetheless an integral part of the conversation.

Hierarchy and social class

To make my point that the hierarchy depicted in figure 2.4 is in fact a *status* hierarchy, though, it is necessary to move beyond analyses of the historical roles played by individual ExComm members. The huge sociological literature on social status suggests that there are a number of features we should expect to see in a status hierarchy in any context. Most obviously, status hierarchies should be hierarchies, meaning they should not have cycles in their network representation. The directed graph of the ExComm status relations is *very nearly* a strict hierarchy, with just one notable exception. All of the arrows point down except for that from Bobby

Kennedy to his brother the President. The two Kennedy brothers have a bi-directional edge between them. This means that they each mimic the other's speech to a significant degree. Recalling the discussion of horizontality from chapter 1, the hierarchy among ExComm members displays multiple types of indeterminate status relations. The obviously absent relations, representing the vast majority of the 240 directed dyads, can come from two sources: either the result of a mutual disregard between pairs of committee members or else a relation of status conflict between individuals (as is likely the case between Maxwell Taylor and Robert McNamara, who were often at odds in the meeting transcripts).[10] But apparently indeterminate relations like those between the Kennedys are of a different sort. Both brothers hold each other in extremely high regard, so the fact that they mutually accommodate, even with John in the position he was in, is unsurprising.

The presence of such mutual status relations suggests a different way of interpreting the output of the model, one that focusses on asymmetry. Rather than just looking at who accommodates whom among the ExComm members, figure 2.5 identifies relations where there is significant asymmetry in the degree of mimicry. Specifically, there is a directed edge from, say, Paul Nitze to Bobby Kennedy because the posterior probability that Bobby mimics Nitze more than Nitze mimics Bobby is at least 95%. Abusing notation slightly, $\Pr(m_{Bobby,Nitze} > m_{Nitze,Bobby}) \geq 0.95$. Edge widths in the figure represent median posterior difference in mimicry. Although they share a lot in common, there are some notable differences between Figures 2.4 and 2.5. As expected, the status relationship between the Kennedy brothers dis-

10. In the shift from theoretical to empirical status hierarchies, a third possibility for missing relations emerges. For people that were present in the meetings but said little or nothing, the uncertainty in their status relations is likely an empirical artifact. This is probably what happens with Vice President Johnson, who said very little during the meetings and therefore has no significant mimicry relations with any of the other participants.

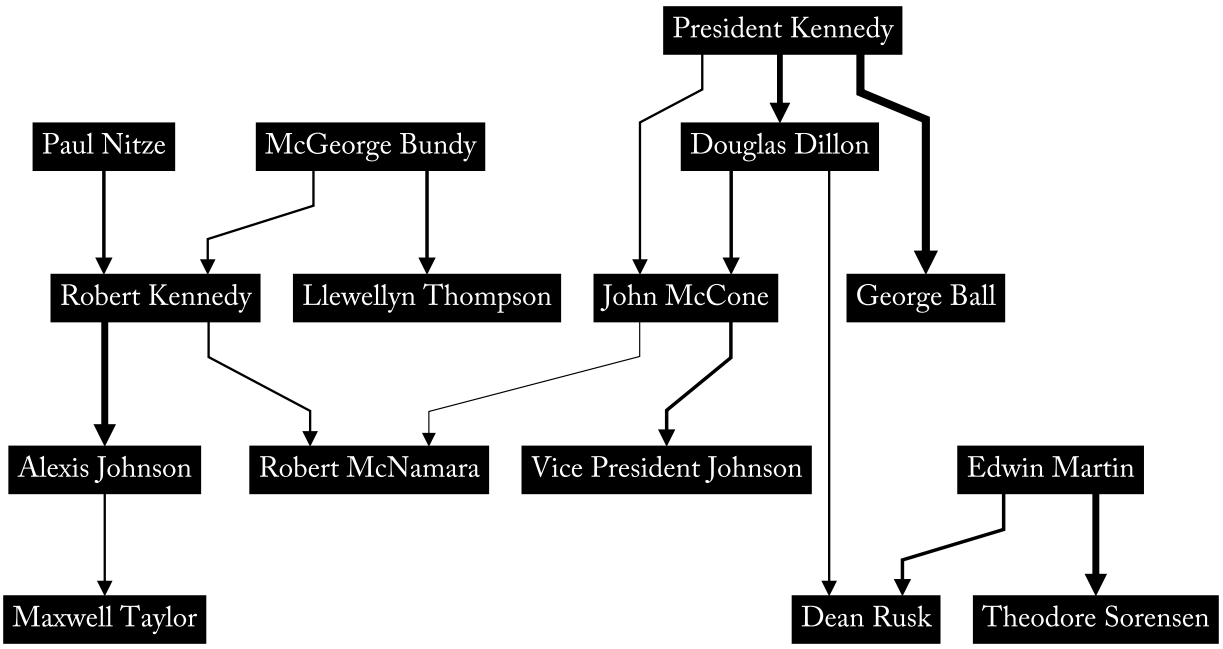


Figure 2.5: Asymmetric linguistic style matching among ExComm members (95% posterior probability).

appears, not because they do not hold each other in high regard, but because they hold each other in mutually high regard and no significant status asymmetry exists. Additionally, some relations that were present in figure 2.4 disappear in figure 2.5, and vice versa. (Notably, Vice President Johnson shows up in the latter, just below Director of Central Intelligence John McCone.) The hierarchy induced by asymmetry is overall clearer than the other, with more obvious 'lines of power' (Martin 1998) defining its vertical dimension. And, importantly, the relation of asymmetric linguistic accommodation defines an unambiguously acyclic hierarchical structure among the ExComm members.

One of the clearest messages from the sociological literature on group status structures is that social class is central to the determination of status rank (Berger 1977; Correll and Ridgeway 2006). It is a ubiquitous finding in task group research that the internal hierarchies in such

groups is largely determined by socioeconomic status. The ExComm, being a small group convened with the explicit task of resolving one of the most significant political crises in the history of the United States, should be no exception. There is certainly diversity in social class among the committee members. Some members were unambiguously elites, such as Secretary of Treasury Douglas Dillon, who attended elite private high schools alongside members of the Rockefeller family, graduated from Harvard magna cum laude, and then took an executive position at his family's investment bank. Others, notably Vice President Johnson and Robert McNamara, came from families of (relatively) modest means, with white-collar parents sending them to public high schools and universities. To test the relationship between social class and status attributions predicted by the literature, consider the members' colleges as a proxy for social class. Specifically, consider the differences between those members who attended Ivy League schools and those who did not. Of the sixteen members included in the model, six had almae matres in the Ivy League: McGeorge Bundy, Douglas Dillon, Roswell Gilpatric, both Kennedy brothers, and Paul Nitze (italicized schools in table 2.1). The status relations depicted in figures 2.4 and 2.5 are remarkably consistent with class distinction along these lines. Of the 18 significant mimicry relations (table 2.3) only one shows a non–Ivy League committee member being mimicked by an elite member (the relation between Bobby Kennedy and Llewellyn Thompson). Of the fifteen relations in figure 2.5, not one contradicts a theory of class-based status distinction. The structural consequences of this tendency are especially apparent in the asymmetry structure, with all five members at the 'top' of the hierarchy being Ivy League alumni. It seems that class background plays a significant role in status distinctions, even among some of the most powerful individuals in the United States government.

A final component of status relations emphasized by research into small group hierarchies is that of social influence. In a sense, the model of linguistic mimicry used in this chapter is itself a model of influence, at least over the narrow domain of LSM. But there is no reason to believe a priori that non-conscious influence over someone's style of speech is linked to influence over their opinions and decisions going forward. It will therefore be useful to investigate whether the status relations estimated by the model in fact constitute channels of influence over a broader space of positions and behavior. The analysis of ExComm presented above, focussed on a small group of people across fewer than two weeks, is not ideal for this type of analysis. To be sure, interpersonal influence was an important dynamic in the ExComm meetings, and individuals were unquestionably swayed by the arguments of others. Systematically tracing such influence is a fraught task, however, involving subjective inference about the motivations, opinions, and emotions of the meetings' participants. Accounts of the decision-making process vary drastically between interpreters of the transcripts. While Gibson (2012) describes the stance of McNamara during the opening days as universally hawkish until he was finally swayed toward more peaceful options by the end of October 18th, White (2012) tells a story in which the Defense Secretary was an early proponent of negotiating with Soviet chairman Nikita Khrushchev, championing a blockade over an immediate airstrike. While both interpretations are convincing, the divergence underscores the difficulty of reliably tracing influence through careful reading of conversations. For this reason, I will turn to a context better suited to the measurement of (certain types of) social influence: an online discussion board.

Status online: Relations among Reddit users

The corpus that I will analyze consists of the online communications of users of the online forum Reddit, a hugely popular website focussed on facilitating discussions among its users. Content on Reddit is entirely driven by its users, and is organized into user-defined sub-forums known as *subreddits*. A conversation thread starts in a subreddit when a user posts a submission, usually a link to content elsewhere on the Internet such as a news story or image, providing a venue for other users to comment either on the original submission or on the comments of other users. There are innumerable topical subreddits on the site, devoted to everything from broad topics like 'politics' or 'humor' to incredibly narrow groups discussing the minutia of specific characters from video games. The corpus I use was collected from five subreddits that are central to discussion of the so-called *gamergate controversy*. The controversy in question began in August of 2014 when a number of video-games journalists and developers who were critical of the representation of women in video games were subject to considerable harassment, both on- and off-line. The community, whose members refer to themselves as 'gamergaters' (or simply 'gaters'), organized primarily on Reddit around an anti-feminist message, sparking widespread debate (see, e.g., Wingfield 2014). In the years since, the gamergate community has remained active on Reddit, though the focus has broadened somewhat to include issues of media representation of gender, race, and sexuality in general.

The corpus used here consists of 1,438,479 comments made by 63,760 individual user accounts. The comments span 840 days starting in September of 2014, shortly after the subreddits were created. The vast majority of the users made virtually no contribution to the discussions:

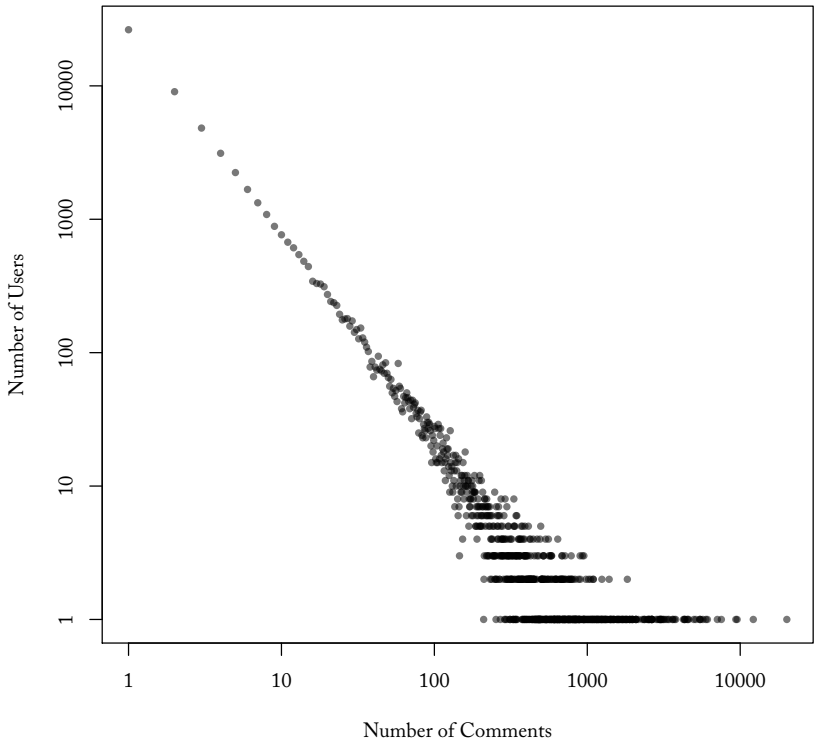


Figure 2.6: Distribution of user accounts by number of comments (log–log scale).

the median number of comments per user is just two (see figure 2.6). Because of this, the analysis presented will focus on the subset of the 100 most active participants in the community, excluding obvious 'bots' who comment frequently with formulaic text but do not take part in the conversations themselves. This corpus has a few features that make it especially useful for studying linguistic accommodation and status. First, the site structures comments in hierarchical 'threads' in which every comment has exactly one parent comment or submission to which it is a response, but can have any number of comments that respond directly to it. This tree structure determines unambiguously which text a commenter is responding to, a clear divergence from the face-to-face audio recordings of the ExComm meetings. Figure 2.7 demonstrates the hierarchical threading of Reddit comments. Moreover, the gamergate community is unusual in the degree to which individual user accounts gain reputations and are referred to in conversation. Most of the 100 central users under consideration were active throughout the entire corpus, and many were known specifically for their positions on certain issues or for their style of argument. Conversations in the subreddit are often heated, and persisting feuds and alliances between users are common. These factors make the community an ideal case for studying status relations and for measuring topical influence among users.

Comments were extracted using Reddit's public API, updating at regular intervals. Although the data go back to September 13, 2014, data collection did not begin until 2016. Due to limitations in Reddit's API, certain comment threads from 2014 and 2015 may have been lost either due to lack of interest from the community or to deletion by users or site administrators. Patterns of use across the dataset suggest that these omissions are minor if they exist. Some very active accounts were used only by bots—programs written to participate automati-

Figure 2.7: Sample threaded conversation from Reddit, with user names obscured.

cally in the forum, usually providing statistics or other information relevant to a conversation. These bot accounts were easy to identify and remove. The text of the comments was processed to remove verbatim quotations, which are denoted using specific markup in the API. Finally, each comment was parsed for frequency of function words using the same methods as for the ExComm corpus.

Model

The Reddit corpus contains considerably more structure than the simple transcripts available for the ExComm meetings. Face-to-face conversations, especially those accessible only through audio recordings, make determinations of who is addressing whom practically impossible. Because of the sequential nature of spoken conversation, it can be reasonably assumed that everyone in the committee meetings was exposed to the statements of everyone else, and that many of the statements were addressed to the room as a whole rather than intended for only a specific individual. Reddit conversations, in contrast, are highly structured. The format forces users to respond to exactly one other comment, or else to start a new branch of the comment tree by responding directly to an original submission. To take advantage of these characteristics, and to allow computationally for the inclusion of considerably more participants, I alter model 2.1 to account for linguistic mimicry on pair-by-pair basis, rather than for the group as a whole. The altered model defines the baseline style of each user $\mathbf{b}_i$ exactly as before, but relaxes the restrictions on $\mathbf{m}_i = (m_{i1}, \ldots, m_{in})$ so that the vector need not sum to one. In essence this turns mimicry away from a question of partitioning—of asking how much of my linguistic style in

this conversation will I get from one person versus another. Instead, each participant's realized style is determined in the interaction, and depends on who they are responding to and what that person said. Thus, for each comment $\mathbf{f}_k$, let $\mathbf{h}_k$ be the proportion of function words used from each category of the comment to which $\mathbf{f}_k$ is responding. This definition of $\mathbf{h}_k$ represents a substantial difference between the two models. While the mimicry in model 2.1 was in response to everything said by anyone so far in a particular meeting, the mimicry in this model is a reaction only to the single previous comment in the thread. The altered model becomes:

$$\begin{aligned} \mathbf{f}_k &\sim \text{Multinomial}\left((1 - m_{\overline{k},\underline{k}})\mathbf{b}_{\overline{k}} + m_{\overline{k},\underline{k}}\mathbf{h}_k \; ; \; \sigma_k\right) \\ \mathbf{b}_i &\sim \text{Dirichlet}(\alpha_{bi}) \\ m_{ij} &\sim \text{Beta}(\alpha_m) \end{aligned} \tag{2.2}$$

As before, $\overline{k}$ represents the index of the user that posted comment k. The new terminology $\underline{k}$ refers to the index of the user to whom $\overline{k}$ is responding. This specification models each comment's style as a simple linear mixture of their own baseline style and the style of the comment to which they are responding. The unobserved variables m_{ij} are drawn from uninformative prior distributions. $\mathbf{b}_i$ is given an informative prior α_{bi}: the frequency of function word categories from user i in response to anybody not in the core set of 100 users. In this case, $\text{Dirichlet}(\alpha_{bi})$ is simply the analytical posterior distribution of category probabilities for user i. The core users interact quite frequently with non-core users, but in most cases only one or two times, providing a reasonable proxy for 'baseline' linguistic behavior. The frequency of these interactions makes for a highly informative prior on $\mathbf{b}_i$.

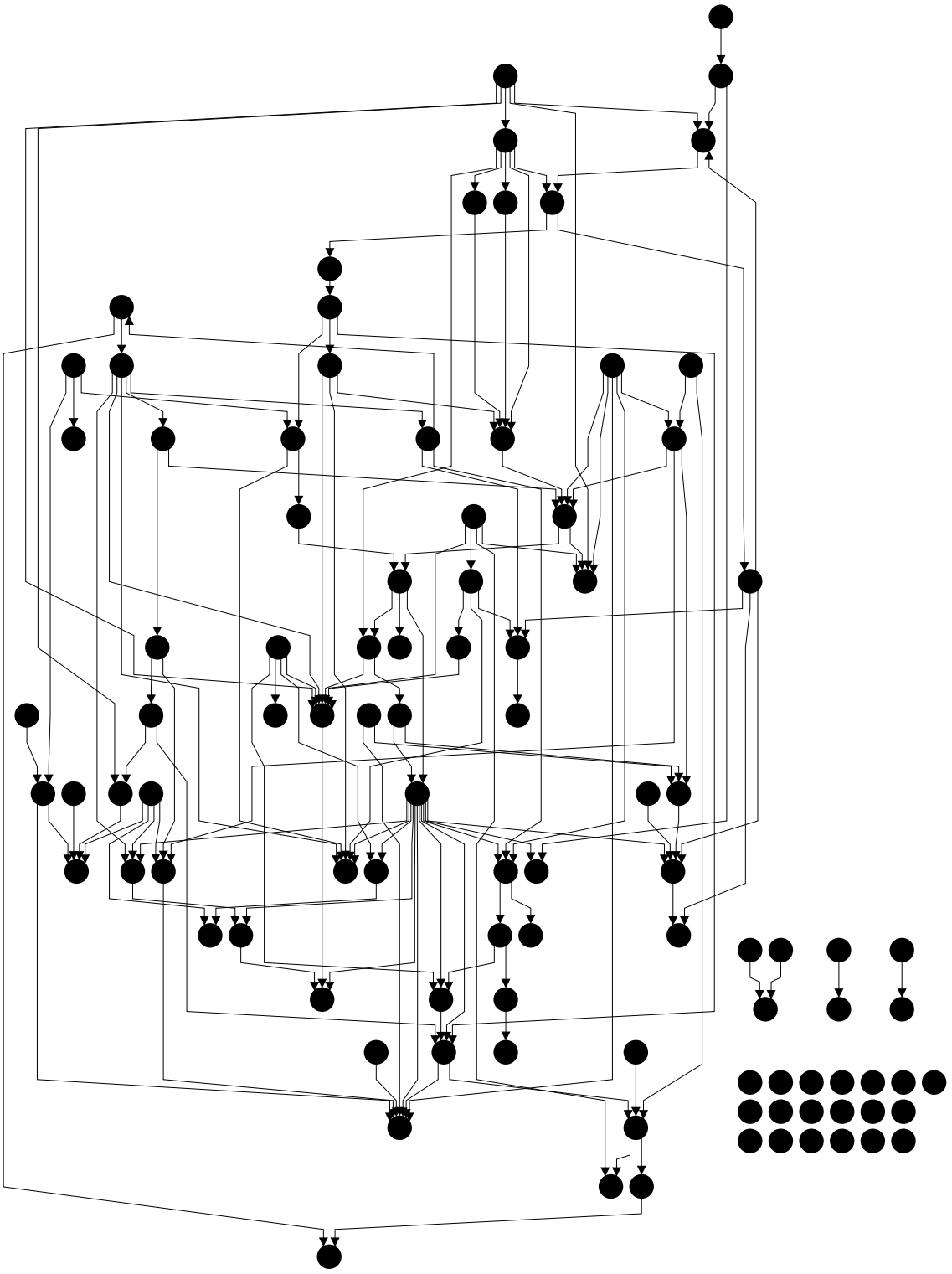


Figure 2.8: Asymmetric linguistic accommodation among Reddit users (95% posterior probability).

Estimating model 2.2 using MCMC yields the hierarchy shown in figure 2.8. The figure focusses on asymmetry of mimicry, so there is a directed edge from user i to user j if $\Pr(m_{ij} > m_{ji}) \geq 0.95$. There are 131 significant relations, and nineteen of the 100 users had no clear relation to another user. Structurally, the network forms a clear hierarchy. The graph is almost entirely acyclic, with only two cycles, each consisting of just three nodes. However the scarcity of cycles in itself is not a remarkable outcome: even entirely random graphs this sparse are likely to exhibit few or no cycles. What is remarkable about this structure is the degree of transitive closure. Relations are hierarchical to the degree that they are responsive to underlying strata in the community. If one observes that Alexandra defers to Barbara, and that Barbara defers to Cheng, this suggests that Alexandra is lower in the hierarchy than Cheng and that, if Alexandra and Cheng needed to resolve their relative status, Cheng would come out on top. Hierarchical structures have a vertical dimension.

There are two network statistics that do a good job measuring the verticality of a network. The first, which I denote as a function of a graph g, $\mathrm{V_t}(g)$, is simple triad transitivity, which takes the set of triads containing a chain of two directed ties and calculates the proportion that are transitive (030T) rather than cyclic (030C) or incomplete (021T).[11] Transitivity effectively captures hierarchy at a local level. The second measure of hierarchy is sensitive to verticality at larger distances by calculating the number of distinct paths that exist between pairs of vertices. A path ($A \rightarrow B \rightarrow C \rightarrow D$) in a DAG might suggest that A is above D in a hierarchy, but a second path ($A \rightarrow E \rightarrow F \rightarrow D$), substantially strengthens that suggestion. The second measure of

11. The term *transitivity* often refers to the clustering coefficient, or the proportion of *un*directed closed triads in a network. I use it here in the sense of directed triadic analysis, contrasting transitive with cyclic directed triads. The standard triad labels are denoted in parentheses (see Johnsen 1985).

verticality, call it $\mathrm{V_p}(g)$, calculates the number of simple paths that exist between every pair of vertices in a network (after inducing acyclicality by removing any edge that is part of a cycle), and reports the mean across all pairs. The network depicted in figure 2.8 has $V_t(g) = 0.056$ and $V_p(g) = 0.316$. These statistics can be tested against a null model of a directed network with the same number of nodes and edges as g, but with the edges distributed randomly between nodes. Consistent with the network in figure 2.8, self-loops and bidirectional (mutual) edges are excluded from the null model. By generating a sample of 50,0000 random networks from the null model, one can calculate the expected triad transitivity under the null model as $\overline{V_t(g_0)} = 0.0132$, significantly below the statistic for the model estimate: $\Pr\left(V_t(g_0) \geq V_t(g)\right) = 0.0001$. Similarly, the expected average number of paths in the under the null model is $\overline{V_p(g_0)} = 0.061$, again significantly less than the model estimate: $\Pr\Big(V_p(g_0) \geq V_p(g)\Big) = 0.0098$. Together these statistics show that the asymmetric linguistic mimicry is consistent with a vertical hierarchy among these Reddit users. The structure alone implies stratification between users, with a definite vertical directionality.

Of course, vertical differentiation alone does not imply that a hierarchy represents social status relations. The task, then, is to determine whether the stratification that occurs between Reddit users reflects an underlying status structure. Social status is meaningful because its ascription has consequences in the experiences of those it differentiates, affecting the allocation of resources and the distribution of power in a community. As discussed in the first chapter, these consequences are diverse, but a large online corpus like the one used here lends itself especially to an investigation of status and social influence. Online communication provides distinct benefits for the discernment of social influence, not least of which is the sheer volume

of communicative acts it conveys. Ready access to years of complete conversational records from large online communities allows methods that are inapplicable for face-to-face groups like the ExComm. A popular tack for tracing influence through online communication is to identify discrete semantic objects and to track their 'transmission' through a community. Because the data being used is free-form text, the identification of objects to trace is a crucial part of this methodology. Certain snippets of text found in Internet communication, things like 'hash tags' and URLs, are designed explicitly to be unambiguous and easy to trace, and have been used to trace the spread of ideas in a number of online contexts (Romero, Meeder, and Kleinberg 2011; Leskovec et al. 2007; Gomez-Rodriguez, Leskovec, and Krause 2012). Other research has tried to identify more complex constructs through communications, accounting for ambiguity and errors in transmission (Leskovec, Backstrom, and Kleinberg 2009; Simmons, Adamic, and Adar 2011).

In this analysis, I use a similar approach of tracing lexical transmission, but I gear it toward the more focused community represented in the Reddit corpus. The conversation among the Gamergate community on Reddit frequently centers on discussions about people. Initially formed to organize attacks against journalists, bloggers, and games developers, Gamergate's origins are firmly rooted in outrage directed at individuals. As such, it is easy to identify specific people that the conversations perennially turn to. In principle, if people at the top of the hierarchy were the first to start conversations about someone like Martin Shkreli (for instance), and if those lower in the hierarchy subsequently took those conversations up, then we could say that those at the top were influencing those at the bottom. A problem with this method, and one that plagues much of the work on influence, is that of the limited scope of the data available.

It is often impossible to tell whether the impetus for a topic comes from within the community or from somewhere else entirely. In the case of a widely known individual like Martin Shkreli, the investor and businessman made infamous by raising the price of the life-saving drug Daraprim, there is no easy way to decide whether a user decided to mention Shkreli because they saw another Reddit user do the same, or in response to a news story, YouTube video, or in-person conversation that leaves no trace in the corpus.[12] To uncover influence that occurs within the community, it is necessary to identify topics of conversation that are unlikely to be talked about in other situations. To this end, I distinguish textual references to people who are known in a broader social context, who I will refer to as celebrities, from references to specific members of the Reddit Gamergate community, for whom I will use the popular colloquial term *redditor*. This distinction allows me to highlight the dissimilar patterns of transmission of celebrities versus redditors, and to show that that only topics pertaining to redditors can be attributed to the hierarchy depicted above. If the status relations predicted by the model mediate social influence among the users, that mediation should be visible only for words that are specific to the community:

Hypothesis 1: Topics that are specific to the community (such as redditors within the community) will exhibit influence along the status hierarchy, while more general topics (such as celebrities) will not.

To test this hypothesis, I construct categories of names to track using a mixture of automatic identification and curation by hand. First, the corpus is scanned for novel terms, which are

12. "Daraprim: At $750, a hard pill to swallow," *Chicago Tribune*, September 27, 2015.

terms that are not used at all in the first 100 days of the corpus' span, but are then used at least 5 times in each subsequent, rolling, 100-day window. Of the 639 terms found in this way, terms that were references to a person were identified. These terms were mapped to individuals, such that multiple terms could refer to the same person (e.g. "zuckerberg", "cuckerberg", "zuck", and "zuckerberg's" were considered references to Mark Zuckerberg). Finally, names that were too common to reliably refer to just one person (e.g. "martin") were dropped, as were terms that were used fewer than ten times by the core 100 users present in the hierarchy. This process resulted in the names of 9 celebrities and 17 redditors to analyze.

I estimate the effect of hierarchy on social influence with a Cox proportional-hazards model with time-varying covariates. The model predicts the probability that a given user will refer to a particular person for the first time on a specific day.[13] Each user's hazard function is calculated by partitioning rest of the community into four pieces: those above the user in the hierarchy (P_{above}), those below the user in the hierarchy (P_{below}), those neither above nor below the user in the hierarchy (but still among the core 100 users, P_{core}), and those outside of the core hierarchy (P_{rem}). Figure 2.9 demonstrates these partitions for a sample individual (filled black). In the figure, the partitions P_{above} and P_{below} are labeled with arrows pointing up and down, respectively, while the members of P_{core} are represented by unfilled circles. The remainder of the 63,760 contributers to the community make up P_{rem}. The groups P_{above} and P_{below} are identified by tracing directed paths through the network: a vertex A is considered to be above a vertex B if there is any directed path from A to B (edges that are part of a cycle, depicted in gray

13. The unit of analysis for the proportional hazards model is effectively the user–reference pair, meaning that a user's hazard of mentioning Mark Zuckerberg is independent of their hazard of mentioning Donald Trump (conditional on the model covariates).

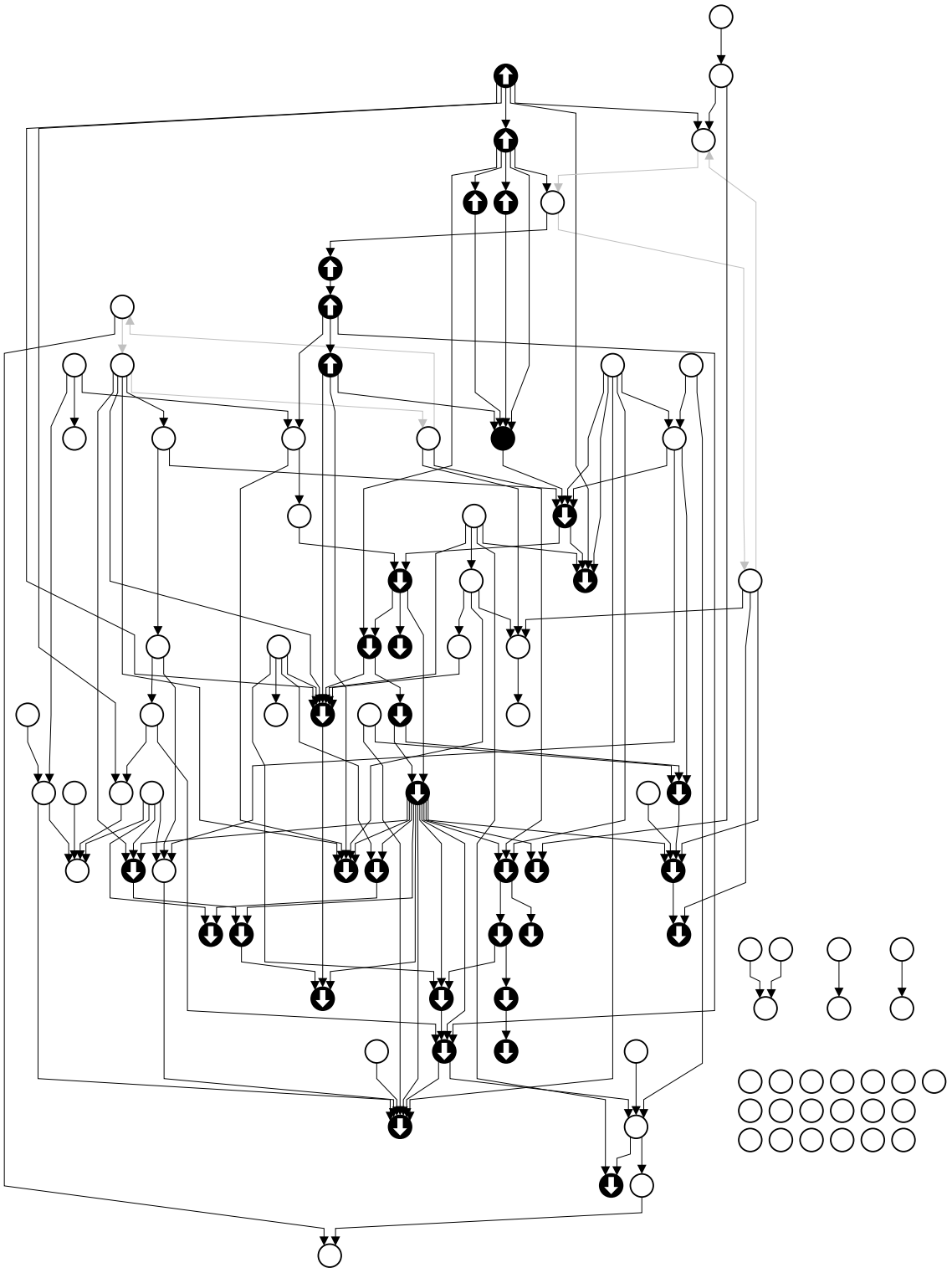


Figure 2.9: Example of hierarchical influence sets. Users above (below) the focal vertex are marked with an arrow pointing up (down).

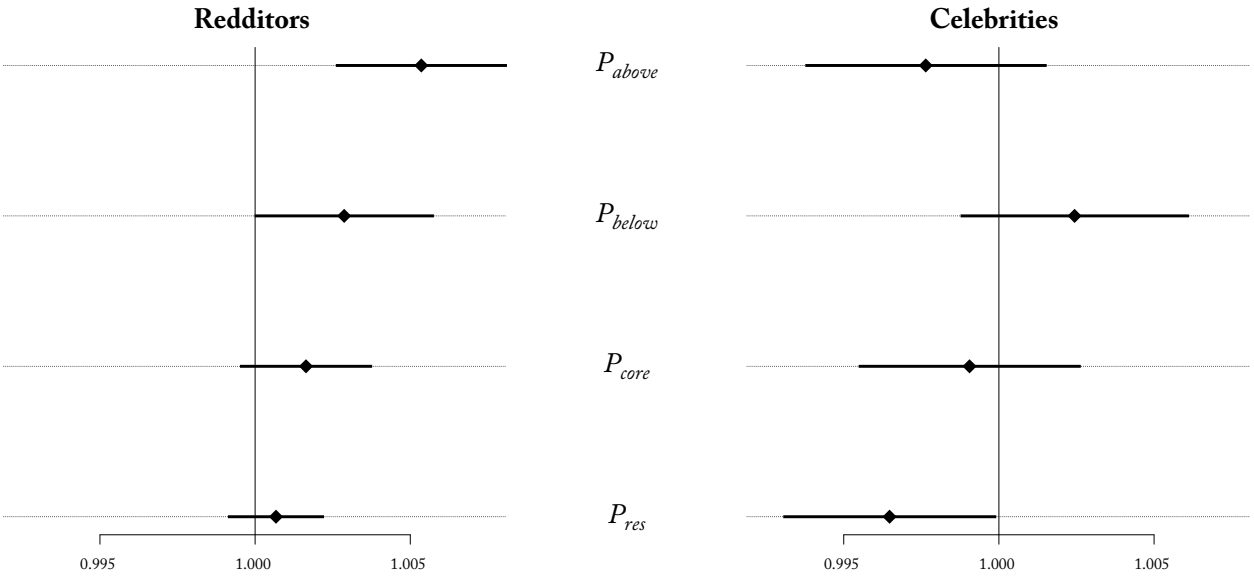


Figure 2.10: Topic influence among Reddit users (estimates and 95% confidence intervals).

in the figure, are ignored). Thus each user is associated with a potentially distinct partitioning. Model covariates are constructed for each user by counting the cumulative number of times a person has been referenced by a member of each partition prior to that day, and that user's individual hazard for mentioning that person is a function of their potential exposure from the four groups.

The proportional-hazards model was run twice: once predicting references to redditors, and once predicting references to celebrities. The results are summarized in figure 2.10, which shows the (exponentiated) point estimates and 95% confidence intervals for the two models. On the left, we see evidence of a strong hierarchical influence. The only coefficient significant is P_{above} ($p = 0.0001$), which predicts that *each* individual reference to a specific redditor by somebody above a user in the hierarchy increases that user's chance of mentioning that redditor by a factor of $\exp(0.0053) = 1.0053$. It should be noted that the small magnitude of the effect is a result of the relatively narrow interval used in the model (one day). An example will put

the result in context: if a member of the community had never referenced the user '*spez*' in the past, but people above them had mentioned '*spez*' on ten occasions, then that member has an expected probability of about 5.5% of talking about '*spez*' *every day going forward*. On the right side of 2.10, the results for references to celebrities tell a very different story. Here the only significant group are those outside of the core community participants: $\hat{P}_{res} = -0.0035$ ($p = 0.0446$). The model predicts that the most active members of the Gamergate community are somewhat *less* likely to talk about a celebrity that has been discussed by less active members in the past. Moreover, the vertical dimension of the hierarchy appears to have little relation to the transmission of celebrity references among the users. The findings of both models are consistent with hypothesis 1.

An especially interesting implication of these findings is that influence is related not just to the vertical dimension of the status hierarchy, but, implicitly, to the horizontal as well. The influence sets pictured in figure 2.9 depend as much on who is not included as who is included, and their membership varies considerably across the community. There are no users who are universally above or below all other users. A result of this fact is that the missing edges, the pairs of people for whom no clear status relation exists, are responsible for the boundaries that exist between lines of influence, and these boundaries determine the paths of social influence. Of course a person's vertical position in the hierarchy is related to their influence over the group in general, but the topology of the status structure determines where that influence can flow.

Discussion

The empirical cases presented in this chapter demonstrate that small, systematic asymmetries in interaction can reveal otherwise hidden social structures. Linguistic style matching, like many forms of interpersonal accommodation, is responsive to differences in social status, and as such its observation can be used to identify status gradients in social space. The statistical methodology I develop is promising both for its wide applicability and its relatively simple implementation. A benefit of textual analyses like these is the diversity of contexts in which text is available. For studies of social status, in particular, this is a boon. Few approaches to measuring status hierarchies in 'natural' settings exist, and those that do rely either on carefully targeted survey instruments or painstaking and error-prone coding of individual interactions. The methodology presented here, relying only on textual records of conversations, allows the study of status through relatively unobtrusive means.

However my hope for these analyses is that they will not be taken only as a methodology of measurement. By treating status relations as epistemologically primary to the structures they define, certain features of those structures are drawn into sharper focus. Verticality is basic to the definition of status hierarchies, but in the analyses presented above horizontality plays an equally starring role. A focus on the interactional locus of status negotiation emphasizes that relations of influence *and* relations of non-influence define the landscape of power and dominance in these communities. It is not just the ability to identify status in non-experimental domains that sets these methods apart. The kind of status structures they identify are distinct from existing quantitative approaches. They succeed in recovering status as a dimension of vertical

stratification, but they also show that there is more to status than just vertical differentiation.

3

ASYMMETRIC FRIENDSHIP NOMINATIONS AND STATUS AMONG ADOLESCENTS

There is perhaps no better venue to witness the tumultuous negotiation of social status than among adolescent peer groups. Most anyone who attended middle and high school can attest that students in those environments exaggerate the severity of status differences and overperform the consequences of status signals. From the perspective of a social scientist interested in the subtle dynamics of status hierarchies, such exaggeration is a boon. Researchers have long recognized that status is an overt driving force of adolescent and pre-adolescent interaction (Coleman 1961). Status is central to these groups' understanding of of their social dynamics and identities (Adler and Adler 1998; Adler and Adler 1996), and status mobility motivates both pro-social and anti-social behavior (Faris and Ennett 2012; Sijtsema et al. 2009; Closson 2009). Status attainment is closely linked with achievement and wellbeing of adolescents. High-status students are more likely to perform well academically (Hollingshead 1949; Meijs et al. 2008; Diego, Field, and Sanders 2002), are less likely to suffer from depression and social exclusion (Oldehinkel et al. 2007; Diego, Field, and Sanders 2002; Adler and Adler 1996), and are more often victimized by their peers (Faris and Felmlee 2014; Rodkin and Berger 2008). It is difficult to imagine an aspect of adolescent life in which social status is not a defining force.

A conclusion drawn universally by scholars in this area is that adolescent social status is a complex institution, and that a single scale from 'top' to 'bottom' is insufficient to describe the role status plays in adolescents' lives. In quantitative research, a division in commonly drawn

between *sociometric* and *perceived* popularity as distinct dimensions of social status (Parkhurst and Hopmeyer 1998; cf. Lease, Musgrove, and Axelrod 2002). Sociometric popularity, also described as *likability*, describes people who are well liked by their peers and who have many friends. Perceived popularity is more subjective, measuring the degree to which a person's peers *believe* that the person is high-status, popular, cool, or well liked. The distinction between these two dimensions of status arises from empirical necessity; researchers have long known that different measures of popularity among children and adolescents produced divergent outcomes (Terry and Coie 1991). Sociometric popularity is ascertained simply, by asking students about who their friends are, who they like, and who they dislike, while perceived popularity is measured by asking students who they think others are friends with and like. Despite the seemingly subtle difference between the measures, empirical studies overwhelmingly support the distinction (Coie, Dodge, and Coppotelli 1982; Cillessen and Rose 2005; Oldehinkel et al. 2007) Most adolescents who are perceived as popular by their peers do not have many friends, and most who have many friends are not perceived as popular (Parkhurst and Hopmeyer 1998). Whereas sociometrically popular adolescents are thought of as kind and trustworthy, those who are perceived as popular are also thought to be meaner and are more overtly and relationally aggressive toward their peers (Merten 1997; Rose, Swenson, and Waller 2004).

A separate dividing line drawn by researchers into adolescent status structures distinguishes between local and global status dynamics. Adolescents, especially those in a bounded social environment like a middle school or high school, are exceptionally cliquish. Students partition themselves into distinct social groups, the boundaries of which are usually carefully policed. Cliques are central to the definitions of social identities (Adler and Adler 1995; Adler and

Adler 1996). Cliques, in turn, provide a scaffolding for community-wide status distinctions (Merten 1997; Closson 2009; Dijkstra et al. 2010). A cool student's coolness is contingent on being friends with the other cool students, and exclusion from established cliques is a primary mechanism for the maintenance of a community-wide status order (Adler and Adler 1995). But as much as group boundaries structure inter-clique status relations, they also suggest the importance of intra-clique dynamics of dominance. Among members of small adolescent groups, conflicts over status are prevalent, and strong, within-clique hierarchies commonly emerge (Martin 2009b). The negotiation of status, whether achieved through subtle jockeying or outright conflict, has a markedly different character for those 'close' to each other in the status order than for those more distant (Closson 2009).

One lesson to take from the complexity and heterogeneity of status processes among adolescents is that a simple, trait-based conception of social status is insufficient to describe the role of status in adolescent communities. A linear attribute (like a rank ordering) captures neither the multidimensionality of status nor the categorical distinction between global and local status negotiations. I will argue that a focus on status as a dyadic relation rather than a monadic attribute can account for the nonlinearity of adolescent status hierarchies. As discussed in previous chapters, relational structures can describe the vertical differentiation that is basic to social status, and at the same time incorporate horizontal separation, which generates a type of multidimensionality as well as a rich notion of locality within the larger structure. The model I describe below identifies just this kind of topological structure on status communities, using the relatively sparse data on friendship nominations among students. I will first describe the survey data I use (although the model is quite flexible in its application), and then describe the

statistical model in detail. I will use the results of the model to argue that relational hierarchies capture the complexities of adolescent status more completely than other quantitative methods.

Model

I use friendship nomination data from the National Longitudinal Study of Adolescent to Adult Health (Add Health; Harris and Udry 2016). Add Health is a nationally representative study of students in 7th through 12th grades in the United States, begun in the 1994–95 school year. The survey is notable for its immense breadth, collecting data on more than 90,000 students at 132 schools. In addition to in-depth information about behavior, academic performance, and physical and psychological wellbeing, the in-school survey asked middle- and high-school students to

> List your closest (male/female) friends. List your best (male/female) friend first, then your next best friend, and so on. (Girls/Boys) may include (boys/girls) who are friends and (boy/girl) friends

Although the survey weights the strength of friendship nominations through follow-up questions on types of interactions (going to their house, talking on the telephone, etc.), the data used here is a simple binary measure counting a friendship if any of those interactions took place. The survey allowed students to name up to five friends from each of the two gender categories, for a total of no more than ten nominations per respondent. Table 3.1 lists some

summary statistics for the 26 pairs of middle and high schools used in this analysis.[1] It is important to note that more than half of the ties are unreciprocated. This means that in most cases when a respondent nominated another student as a friend, that student did not nominate the respondent.

I concentrate on the asymmetry of these friendships to model status relations among students. Friendship homophily (the strong tendency for people to be friends with those similar to themselves) is among the most well established results in social network research. Not only do people tend to be friends with others of the same age, race, and socioeconomic background, but close friendships are heavily biased toward those of similar social status (Marsden 1988; Laumann and Senter 1976; Shrum, Cheek, and Hunter 1988). Recent scholarship indicates that friendship might be particularly sensitive to status asymmetry. Declarations of friendship are tightly tied to the processes of status maintenance, and individuals treat higher-status alters differently than those of lower status (Gould 2002; Fiske 2011). Put differently, "more popular actors are ranked higher and the asymptotic ties are directed 'upwards' " (Doreian, Batagelj, and Ferligoj 2000, 5). Importantly, the difference in treatment of high-status versus low-status alters is not based on community-wide determinations of status, but on relative status differences centered on the individual making the distinction. The opinions we hold of our superiors differ markedly from of our inferiors (Berger and Dijkstra 2013; Fiske 2011; Fiske, Cuddy, and Glick 2007). Dijkstra et al. (2010) note the importance of status asymmetry specifically in adolescent friendships, and Ball and Newman (2013) model this asymmetry directly, finding significant

1. The schools analyzed in this chapter were selected for the size of their grades, and are therefore not representative of the United States. They do, however, vary considerably in size, racial composition, geography, and along urban/rural divides. The subsample notably excludes large schools which, in the case of community-wide status structures, could induce important biases.

Table 3.1: Summary statistics for the school pairs, including total number of nominations (directed edges), proportion of reciprocated nominations (bidirectional edges), and percent of students that identify as white.

	size	nominations	reciprocity	grade range	prop. white
1	352	1786	0.43	7–12	0.78
2	380	2036	0.48	9–12	0.91
3	425	2167	0.40	7–12	0.74
4	427	2047	0.38	7–12	0.95
5	499	2722	0.43	7–12	0.83
6	553	2634	0.42	7–12	0.65
7	574	2386	0.38	7–12	0.80
8	574	3402	0.39	6–12	0.82
9	576	3236	0.41	7–12	0.94
10	609	1898	0.32	6–12	0.41
11	624	3155	0.43	7–12	0.44
12	656	3636	0.40	6–12	0.90
13	659	2960	0.40	7–12	0.78
14	688	3482	0.37	7–12	0.92
15	710	3602	0.38	7–12	0.87
16	720	2028	0.28	6–12	0.33
17	727	3477	0.40	7–12	0.86
18	740	1827	0.36	6–12	0.56
19	792	4203	0.32	7–12	0.65
20	864	3817	0.31	7–12	0.03
21	883	4306	0.35	6–12	0.79
22	902	4605	0.38	7–12	0.88
23	925	5271	0.44	7–12	0.92
24	998	5456	0.38	7–12	0.95
25	1012	4972	0.39	7–12	0.95
26	1012	5536	0.38	7–12	0.66

differences between reciprocated and unreciprocated friendship declarations (see also An and McConnell 2015).

The statistical model of status among adolescents differs from the model of linguistic mimicry described in chapter 2, even though the status structures they produce are substantially similar. The relative sparseness of friendship nomination data, compared to the rich and repeated interactions in a conversational context, require that more structure is assumed in the formal model specification. The goal of the model is to estimate directed status relations between each pair of students, inferring whether a status difference exists between the two and, if so, what direction it points. This is a tall order, considering that each directed pair has just one data point: whether or not a nomination was made. For a model to be able to use such sparse data to infer a complex structure, some of that structure must be built in. To that end, the mathematical model I present assumes a strict, unobserved, rank ordering of the students within a community. This may seem at first like a strange modeling decision, in light of the arguments just put forth in opposition to status as a strict, rank ordering. I suggest that the assumption is reasonable for two reasons, one theoretical and one technical.

First, while research shows that unidimensional measures so a poor job of explaining status structures among adolescents, it also suggests that students within those structures view status myopically in terms of those above and below them (Berger and Dijkstra 2013; Goodman et al. 2001). Because the model considers each edge to be the result of a subjective choice by one student to nominate another, specifying the likelihood of that edge in terms of the direction and distance in a one-dimensional status space is reasonably justified. Moreover, even though the model specifies a latent status order underlying the nomination process, the probabilistic

nature of the model and its estimation allow the recovery of nonlinear status structures. As I will describe in more detail below, the relations that have a hard time fitting into the strict linear order—that do not have a particularly high posterior probability of existing in one direction over another—constitute the horizontal dimension of the resulting status order. With some caveats, the Bayesian estimation framework can produce a nonlinear structure from a linear ordering.

To this end, consider a school grade consisting of n adolescents, $V_1, \ldots, V_n$, and assume that each occupies one slot in an unobserved ranking. Denote this ranking with the vector $\mathbf{r} = (r_1, \ldots, r_n)$, so that r_i is the ranking of student i, with the lowest-status student having a rank of $r_i = 0$, and the highest rank student $r_i = n - 1$. Define the directed distance between student V_i and student V_j to be $d_{ij} = r_j - r_i$, so that $d_{ij} > 0$ if student V_i is lower-status than student V_j, and $d_{ij} < 0$ otherwise. The probability that V_i will nominate V_j as a friend is given by

$$\Pr(V_i \rightarrow V_j) = \begin{cases} \pi_b \pi_h^{(d_{ij})} & \text{if } d_{ij} > 0 \\ \pi_b \pi_l^{(-d_{ij})} & \text{if } d_{ij} < 0 \\ 0 & \text{otherwise} \end{cases} \tag{3.1}$$

$$\pi_b, \pi_h, \pi_l \sim \text{Beta}(\alpha, \beta)$$

Here π_b refers to the baseline probability of a nomination (analogous to an intercept term). The terms π_l and π_h represent the discount rate on that probability for those of higher and lower status, respectively, allowing asymmetry in the in the likelihood of nominations up and down the hierarchy (see figure 3.1 for an example of how this asymmetry manifests). Each of the

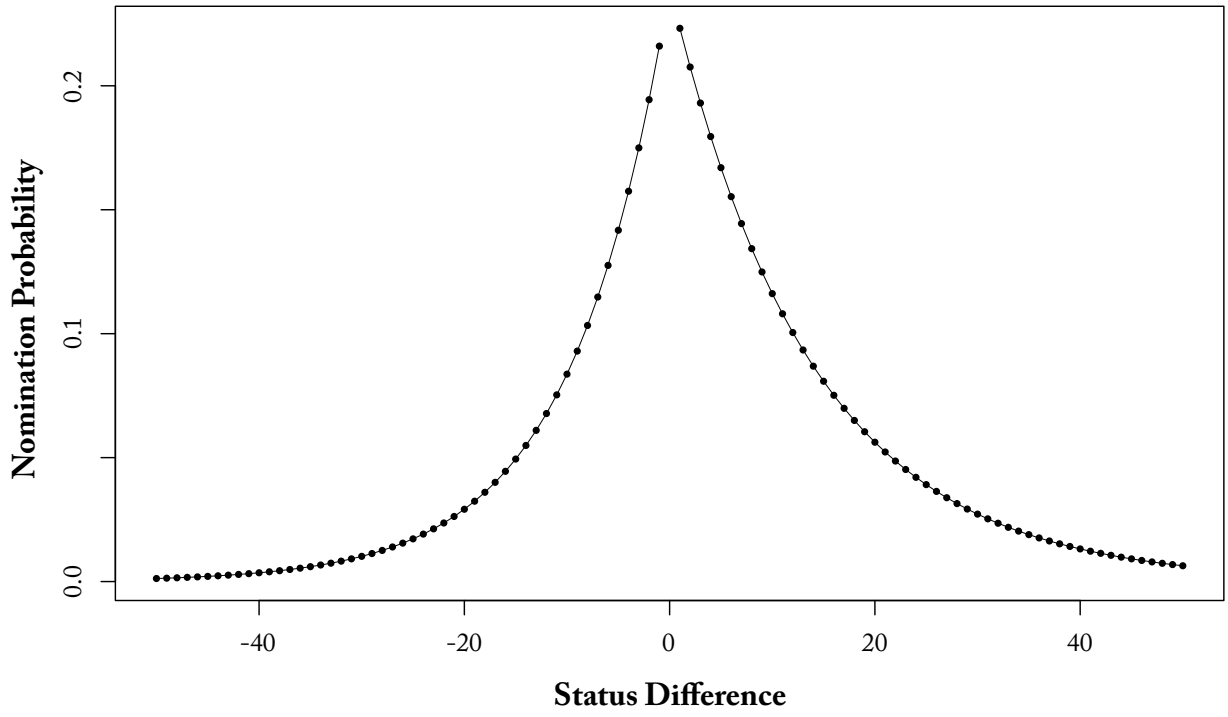


Figure 3.1: Example of nomination probabilities with $\pi_b = .24$, $\pi_h = .93$, and $\pi_l = .90$.

π parameters is drawn from a minimally informative Beta distribution with shape parameters $\alpha = \beta = 1.05$. To prevent the model from being underspecified, it is necessary to also restrict $\pi_h > \pi_l$.

Model 3.1 is relatively simple, and has four unobserved parameters: π_b, π_h, π_l, and $\mathbf{r}$. The π parameters are straightforward to estimate, but $\mathbf{r}$ is a complex parameter, with a large and uneven support. The key to estimating the model is therefore the use of Markov chain Monte Carlo sampling of the posterior. MCMC generates a sample of arbitrary size from the posterior distribution of each model parameter, and it is able to handle non-standard parameters like the

order vector $\mathbf{r}$.[2] Given a large posterior sample from $\mathbf{r}$, it is trivial to recover estimates of the status order for each individual pair of students, $\Pr(r_i > r_j)$, and generate a directed status network at a given level of certainty. To see how this works in practice, consider the hypothetical group of four high school boys, Harris, Sam, Neal, and Bill.[3] Sam, Neal, and Bill are a tight-knit group, and all nominate one another as friends. They also nominate Harris, a slightly older student they look up to, as a friend. Harris, however, does not list any of the three other boys as friends. The posterior distribution for this group of four would look something like the left-hand side of figure 3.2. In virtual every sample, Harris is ranked higher than the rest of the group—with $\pi_h > \pi_l$ it is very unlikely that $r_{Harris} < r_{Sam}$, for instance. But any rank ordering of the Sam, Bill and Neal is equally likely, so the posterior sample will contain all six possible orders for them in roughly equal proportions. If we create a dyadic relation between students for whom the posterior probability of difference in rank order is at least 95%, say, $\Pr(r_i > r_j) > 0.95$, it will yield a hierarchy like that on the right side of figure 3.2. Similarly to the linguistic model from chapter 2, empirical uncertainty is the basis for indeterminate status relations.

The model was fit independently for each individual grade level in the sample schools.[4] Thus a typical high school yields four distinct hierarchies: one each for the 9th, 10th, 11th, and 12th grade populations. The sample contains a total of 154 such school–grade pairs, ranging

2. For an overview of these methods see Gelman et al. (2003) and Neal (2003). The analysis itself was done in the Python programming language using the PyMC module with a custom-written slice sampler.

3. Inspired by characters from the television show *Freaks and Geeks*.

4. Very few of the friendship nominations in Add Health cross from one grade level to another, and hierarchies estimated on entire schools did not differ significantly from those estimated grade by grade. There is significant motivation to estimate the model on smaller communities, as the support space of the model parameter r increases quadratically with the size of the population.

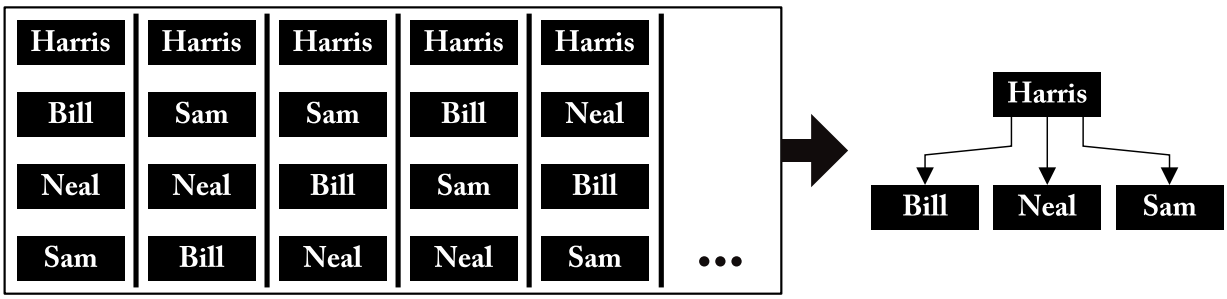


Figure 3.2: Recovering horizontality from posterior sample of vertical orders.

in size from 50 to 191 students. Figure 3.3 displays the hierarchies generated for a few of the smaller grades at 95% posterior probability.[5] The remainder of this chapter is devoted to formal analyses of these hierarchies.

Status rank

As a first analysis of the model estimates, I consider a simple measure of students' *status rank*. This statistic is calculated by identifying the size of the set of students who are below each respondent in the hierarchy, following arrows only downward. In figure 3.2, this number would be three for Harris, and zero fro Sam, Neal, and Bill. The count is divided by the total number of students in the grade, resulting in the proportion of the community that is below the focal individual, ranging from zero to $(n-1)/n$. This measure gives a concise summary of student's relative vertical height in their grade's status order (see left panel of figure 3.4). To investigate the

5. The images of hierarchies displayed for this model have all been transitively reduced, meaning that all transitive edges have been removed. While this does not change any of the calculations that follow, it makes the visualizations easier to interpret. Because the status hierarchies are modeled using a latent rank ordering, most relations implied by transitivity are present in the final estimate. One result of this is that triadic analyses like those performed in chapter two are not useful here.

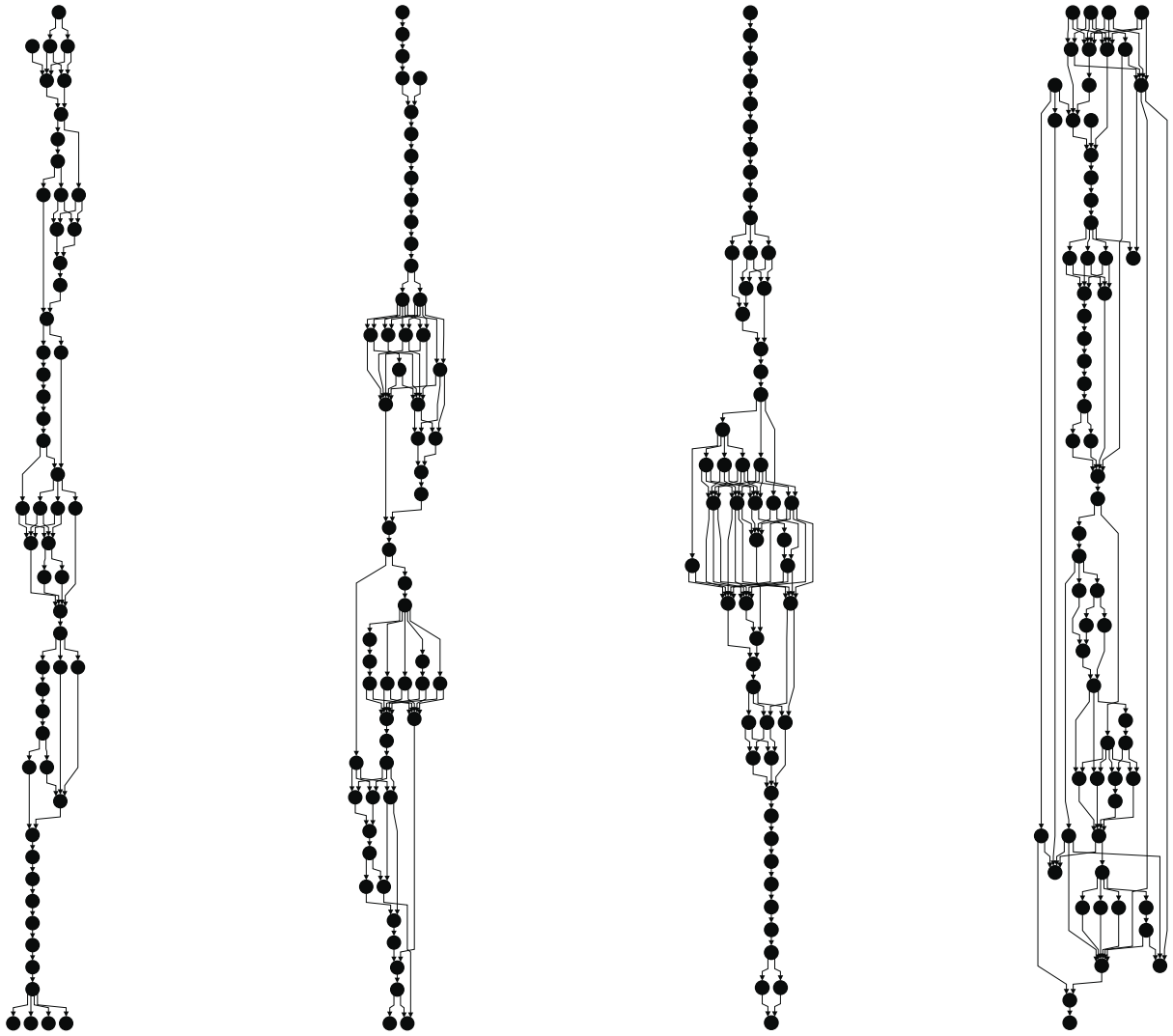
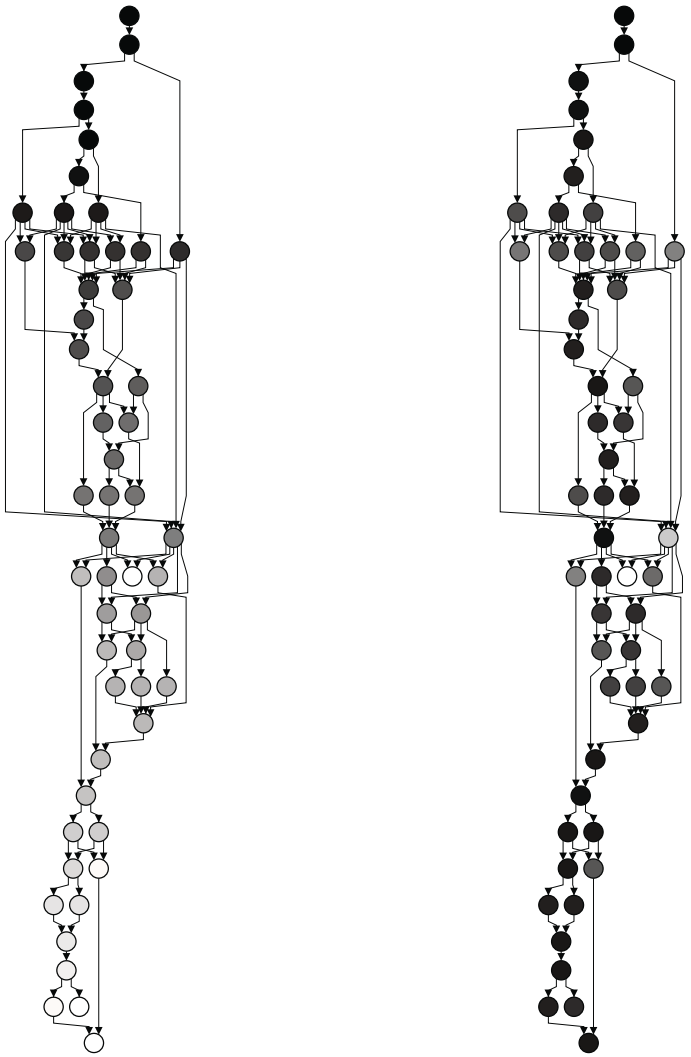


Figure 3.3: Estimated hierarchies for four sample grades (95% posterior probability, transitive reduction).

relationship between this measure of status rank, estimate a random effects model. Because the dependent variable (rank) is constrained between zero and one, and because many students are clustered near the limits of the range, I use a logistic transformation on the rank (first shrinking it's range to the interval [0.001,0.999]). In addition to control variables (standardized grade size, number of incoming friendship nominations), and demographic variables (sex, age, ethnicity and race), I include covariates for students' membership in twelve school clubs and thirteen school sports. The literature on adolescent status structures emphasizes the importance of role and social identity in status determination. Clubs and teams, while not a perfect proxy for such roles, capture much of the variation in how and with whom students identify at their schools. The effects of race and ethnicity can depend on the racial and ethnic makeup of a school—it is very different to be a black student at a predominantly white school than at a school that is mostly black—so I include variables and interactions for proportion Hispanic, black, Asian, and American Indian. The model incorporates a random-effects term for each school–grade group to account for possible variation in the intercept from community to community.

The center column of table 3.2 lists the results of the regression predicting status rank (N=8883). The coefficient for number incoming nominations is positive and significant, indicating a positive relationship between sociometric status and status rank as measured by this model. If, as I argue, status rank as characterized by this model is akin to perceived popularity, this result is unsurprising. Most work comparing sociometric to perceived popularity finds a positive but small correlation between the two (Lease, Kennedy, and Axelrod 2002). Before discussing the relationship between student demographics and status rank, it is informative to inspect the coefficients for memberships in the various clubs and teams. Figure 3.5 shows



Rank **Embeddendess**

Figure 3.4: A sample 12th-grade hierarchy with nodes shaded to indicate status rank (left) and status embeddedness (right).

Table 3.2: Results of random-effects model predicting status rank and status embeddedness. Estimates in **bold** are significant at $p = 0.05$.

	Rank	*Embeddedness*
Coefficient	Estimate (Std. Error)	Estimate (Std. Error)
(Intercept)	**-0.635824** (0.073372)	-0.102702 (0.130750)
Grade size (stdzd)	**0.123617** (0.024881)	**0.283143** (0.056282)
Incoming nominations	**0.115420** (0.002911)	**0.066001** (0.002591)
Female	0.017838 (0.021910)	0.009621 (0.019446)
Age (grade centered)	**-0.069389** (0.014948)	**-0.073665** (0.013254)
Hispanic	0.035915 (0.062212)	**-0.120892** (0.055298)
Prop. Hispanic	-0.531909 (0.453251)	-0.926176 (1.022778)
Black	0.026444 (0.053361)	**-0.188015** (0.049611)
Prop. Black	**-0.346089** (0.159445)	**-1.012438** (0.309308)
Asian	0.015262 (0.065443)	-0.109978 (0.058264)
Prop. Asian	**1.410283** (0.355042)	0.612266 (0.799610)
Amer. Indian	**-0.303792** (0.110987)	-0.083882 (0.098483)
Prop. Amer. Indian	-1.505056 (1.053791)	-1.391472 (2.380173)
Other race	**-0.084974** (0.042689)	**-0.101572** (0.037872)
Hispanic × Prop. Hispanic	-0.095144 (0.397924)	0.551703 (0.354245)
Black × Prop. Black	-0.098408 (0.171164)	0.235743 (0.163516)
Asian × Prop Asian	**-1.989873** (0.311714)	**0.955945** (0.278243)
A. Indian × Prop. A. Ind.	**4.528440** (1.834480)	2.728534 (1.156156)
Born in USA	**0.172752** (0.046006)	0.044339 (0.040861)
Language club	**0.052299** (0.025599)	**0.068013** (0.022952)
Computer club	**-0.277638** (0.064346)	-0.078842 (0.057155)
Debate club	0.007130 (0.066652)	-0.005491 (0.059239)

Table 3.2, continued

	Rank	*Embeddedness*
Coefficient	Estimate (Std. Error)	Estimate (Std. Error)
Drama club	**-0.168160** (0.033676)	-0.035100 (0.029979)
Math club	**-0.261304** (0.050877)	0.056808 (0.045296)
Science club	-0.068789 (0.066385)	-0.034811 (0.059015)
Band club	**-0.084062** (0.025267)	0.007060 (0.022519)
Choir club	-0.038296 (0.026815)	0.022514 (0.023902)
Newspaper club	-0.040760 (0.043516)	0.054794 (0.038731)
Honor Society	0.003667 (0.030545)	**0.096871** (0.027266)
Student Council	**0.103924** (0.031700)	-0.025735 (0.028167)
Yearbook	0.045375 (0.031698)	-0.006687 (0.028209)
Baseball team	**0.087493** (0.022911)	**0.072733** (0.020355)
Basketball team	**0.178128** (0.022992)	0.009641 (0.020433)
Cheerleading	**0.177239** (0.031821)	0.025948 (0.028263)
Field hockey team	-0.052443 (0.083553)	**-0.177213** (0.074287)
Football Team	**0.221607** (0.028817)	-0.022867 (0.025629)
Ice hockey team	-0.072130 (0.067949)	-0.102640 (0.060389)
Socker team	**0.174227** (0.033629)	-0.007042 (0.030010)
Swim team	-0.056472 (0.040458)	0.013478 (0.035942)
Tennis team	0.012719 (0.038636)	0.019496 (0.034367)
Track team	**0.064349** (0.025397)	0.027933 (0.022578)
Volleyball team	**0.092326** (0.033457)	-0.007302 (0.029783)
Wrestling team	0.043823 (0.043727)	0.008005 (0.038852)
Other team	0.044182 (0.028849)	0.025690 (0.025673)

the estimates and 95% confidence intervals for the membership coefficients, sorted by estimate. There is a clear pattern in the order of these coefficients. The variables with positive, significant coefficients are participation in football, basketball, cheerleading, soccer, student council, volleyball, baseball, track, and language clubs. The memberships significantly associated with lower status are computer club, math club, drama, and band. These results fit cultural stereotypes of high school popularity to a remarkable degree. The observation that the football players and cheerleaders are popular and that the students involved in computers and math are unpopular (recalling that the survey was conducted in the mid 1990s) is blatant enough to be uninteresting, but it also provides strong validation that the relation revealed by the model can be interpreted as social status.

Still, a striking feature of the regression estimates is the lack of correspondence between individual demographic characteristics and status rank. With the exception of American Indians and students that identify as a race not listed on the survey, both of whom make up a very small percentage of the sample population, it seems that race and ethnicity have minimal connection to status rank. Hispanic students and black students, in particular, do not seem to fare much differently than white students, once the racial and ethnic demographics of their classmates are taken into account. Interestingly, grades with a high proportion of black students have a lower overall status rank, suggesting that those communities have somewhat less vertical stratification in their status hierarchies. The relationship between Asian students and status rank stands out. Schools with large a proportion of Asian students have considerably higher rank on average, which can only mean that those schools have a more vertically differentiated hierarchy. But this effect is largely nullified for Asian students in majority-Asian classes. Together, these re-

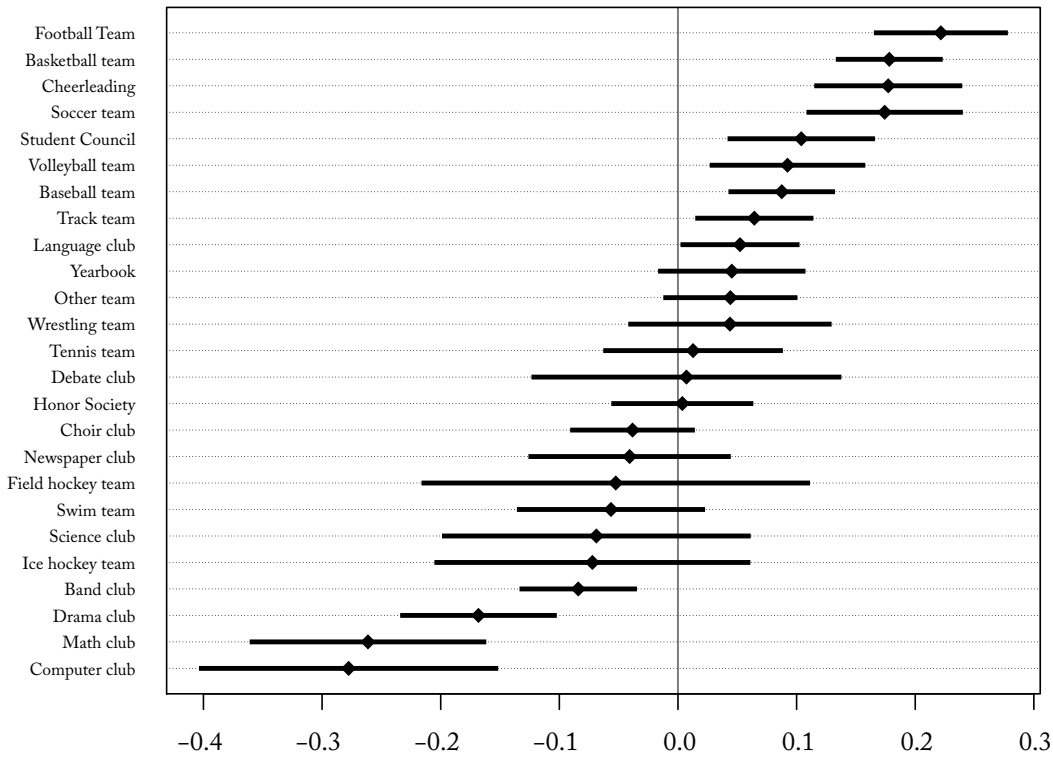


Figure 3.5: The relationship between status rank and membership in clubs and teams, coefficient estimates and 95% confidence intervals.

sults suggest that non-Asian students enjoy markedly higher popularity on average if they are at a predominantly Asian school. Finally, students not born in the United States appear to be less popular than their native-born peers on average, though this could have to do with language barriers as much as with the ethnicity of the foreign students. The contrast between the results for demographics and club and team memberships is telling. Perceptions of popularity seem to be more closely linked with students' role at the school than with their race or ethnicity. On its surface, this finding is at odds with traditional wisdom about the relationship between race and social status; minorities, an in particular Hispanic and black individuals, are often understood to be at a disadvantage in social hierarchies of power. To make sense of this apparent contradiction, I introduce a second measure of individual status position in the hierarchy, one that takes into account the horizontality of the structure directly.

Status embeddedness

One benefit of conceiving of status as a directed relation comes directly out of the idea of incomparability – it becomes possible to identify with which students a particular person is in a direct status hierarchy. For some, it is clear whether they are higher- or lower-status than every other student in their class. For others, there is much more ambiguity about their relation to most of their classmates. The hierarchy of 12th graders in figure 3.4 provides a good example of this dynamic. The single student at the bottom of the figure is unambiguously lower-status than every other student in the school, and therefore has the lowest status rank in the community. The isolated student on the far right of that hierarchy (toward the top in the figure) is in a

much different situation. It is clear that there are some more popular students at the top of the hierarchy that she is below, and that she is higher status than most of the students toward the bottom of the hierarchy, but her relationship with the rest of the students at the school is unclear. She is relatively isolated from the much of the status hierarchy, with an ambiguous relationship to a substantial number of its members.

To examine this situation in more detail, I define a measure of a node's *status embeddedness* in a hierarchy. A student's status embeddedness is simply the number of other students with whom they are in a direct status hierarchy — the number of students that either higher- or lower-status than themselves. Thus the relatively isolated 12th grader mentioned above would have an embeddedness of 34, while the lowest-status student in that class would have an embeddedness of 53 (the size of the class minus one). Clearly status embeddedness represents an aspect of the status order distinct from straightforward status rank examined above — highly embedded students can be of high or low status rank. Rather, status embeddedness indicates something of a core–periphery dynamic among the students. Unembedded (peripheral) students are those that other students do not define their status against because they lie on an uncontested boundary. They are simply not major players in the class-wide status order.

What kinds of students are highly embedded in their class status hierarchy? I interrogate this question using the same modeling framework as for status rank. The estimates and standard errors for this model are in the rightmost column of table 3.2. The coefficient estimates predicting status embeddedness differ starkly from those predicting rank. While there is a smattering of significant but middling positive coefficients relating to club and sport participation,

these are likely just the result of increased social interaction those memberships imply.[6] They certainly don't indicate the kind of strict ordering of status groups that the first regression did. But estimates for black and Hispanic students indicate that embeddedness is capturing something that rank does not. Both black and Hispanic students are on average less well embedded in their grade's social hierarchy than white students. This means that, even taking into account the racial and ethnic composition of schools' population, students who are black or Hispanic tend to be poorly integrated into their community's hierarchy of popularity. Moreover, this community exclusion does not appear to be mitigated for students at schools with large proportions of students in their same ethic or racial category.

Comparing the results from the two regressions side by side, it becomes apparent that status rank and status embeddedness play very different roles in the school communities. Rank, associated most strongly with the roles and groups that students are parts of, is concordant with prevailing conceptions of popularity or 'coolness' in adolescent groups. Complementary to rank is status embeddedness, linked strongly with race and ethnicity in a way that is usually associated with socioeconomic status. This suggests that two important dimensions of adolescent popularity are embedded in the topology of status relations. It would be a mistake, however, to map these dimensions directly onto the space of sociometric versus perceived popularity common in the literature. Although there is reason to believe that status rank as measured here has a good deal of overlap with perceived popularity, it is not the case that status embeddedness has much in common with sociometric popularity. The coefficient estimate in the second regression for

6. The notable exception here is for students on their school's field hockey team. While few of the schools had a team for which students could play, the effect of participation is strong and negative, suggesting that field hockey has an isolating effect on students.

incoming nominations, a standard measure of sociometric popularity, is significant but not of great enough magnitude to claim that it is driving the dependent variable. Still status rank and status embeddedness capture distinct facets of the schools' hierarchical orders, facets that are distinguished from one another by the presence of ambiguous status relations.

Global and local status dynamics

Research into the social interactions of adolescents and children emphasizes the importance of within-group relationships toward both the determination and the consequences of social status (Adler and Adler 1995; Merten 1997). Cliques often have internal hierarchies, with certain members exercising some sort of social control over the others (Martin 2009b). It is somewhat predictable, then, that conflict and physical violence are tied to location in the within-clique hierarchies. What is especially interesting, however, is the interaction between within-clique status and between-clique status in their relationship with violent behavior. The global (community-wide) status order has been linked to violent tendencies among adolescents, with higher-status students often more likely to get into fights than those lower in the hierarchy (Faris and Felmlee 2014). Closson (2009) looks specifically at within and between-clique status relations to understand aggressive behavior among students, using in-depth questionnaires administered to middle-school students. She finds that social status relates to aggression on both levels: within cliques, the high-status peers are more aggressive on average, but comparing different cliques, it is the groups at both the top and the bottom of the global hierarchy that display the most aggression. Studies like Closson's rely on focused surveys with targeted questions. But

relational hierarchies like those estimated above provide structures that are detailed enough to examine the same kind of processes. In this section, I will investigate a question very similar to Closson's, interrogating the relationship between status at two different levels and physical violence among adolescents.

An advantage of topologically rich structures like those depicted in figure 3.3 is their tractability using the tools of social network analysis (SNA). Among the most mature subfields within network science is community detection, which allows the identification of 'natural' groups within a relational structure. While there are innumerable different theories and methods for the identification of these groups, I use modularity maximization (one of the most common community detection methods) to identify the approximate boundaries of cliques within status hierarchies. The emphasis of this method will be to identify groups of students that exhibit a disproportionate number of status relations between group members rather than between members and non-members. This method, while not perfect, does a remarkably good job of identifying coherent status substructures in the hierarchies. Specifically, maximum-modularity clusters find groups that are tightly connected by status relations, but that have large numbers of indeterminate relations as well. Thus groups consisting largely of amicable friends and groups made up of competing rivals are equally easy to recognize.

Once such cliques[7] are identified, it is straightforward to calculate a within-clique status rank by counting the number of clique members that are below each student in their clique's hierarchy, as in figure 3.6. To investigate the relationship between physical violence and within-

7. The term *clique* has a special significance in SNA, indicating a group of maximally interconnected nodes. Here I use it in the colloquial sense of a generally tight-knit group of students.

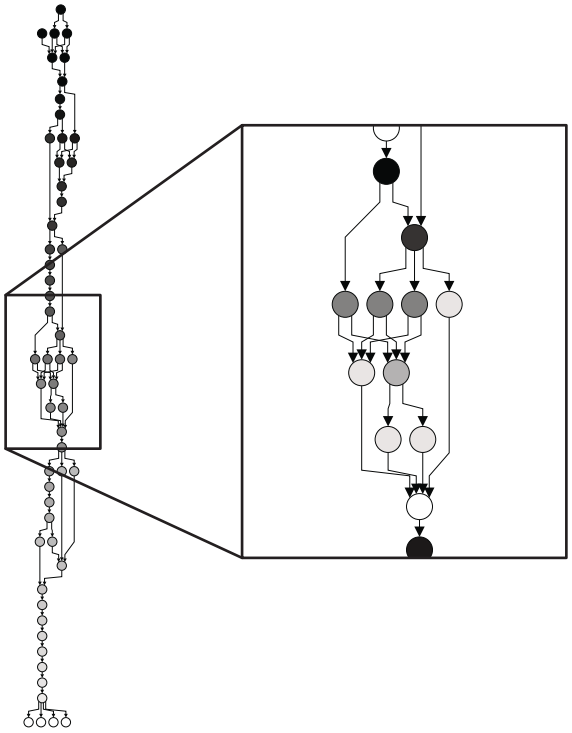


Figure 3.6: Example of within-cluster status rank.

Table 3.3: Results of random-effects model predicting physical fights. Estimates in **bold** are significant at $p = 0.05$.

Coefficient	Estimate (Std. Error)
(Intercept)	0.21094 (0.02866)
Hispanic	**0.09167** (0.04149)
Black	0.06760 (0.03623)
Asian	-0.04314 (0.04646)
Amer. Indian	**0.25636** (0.05333)
Other race	**0.16509** (0.04988)
Female	**-0.39459** (0.02070)
Age (grade centered)	**0.09137** (0.01726)
Within-clique rank	**0.12666** (0.05166)
Status rank	**-0.76668** (0.14235)
(Status rank)^2	**0.93784** (0.17839)

and between-clique status rank, I use an item from the in-home portion of the Add Health survey.[8] Respondents were asked "[In the past 12 months], how often did you get into a serious physical fight?" Responses were collected on a four-point scale: *never*, *1 or 2 times*, *3 or 4 times*, and *5 or more times*. About a third of respondents reported getting into at least one serious physical fight in the last year.

Table 3.3 describes the results from a random-intercept linear model predicting the standardized four-point scale of frequency of fights. In addition to race, ethnicity, sex, and age, all of which are important predictors of violent behavior in the Add Health sample, I include three covariates related to status. Within-clique rank is the proportion of a student's clique

8. Add Health Wave I administered a wide-reaching in-school survey that collected all of the variables mentioned in table 3.2, and another, more in-depth survey to a subset of the students in their home.

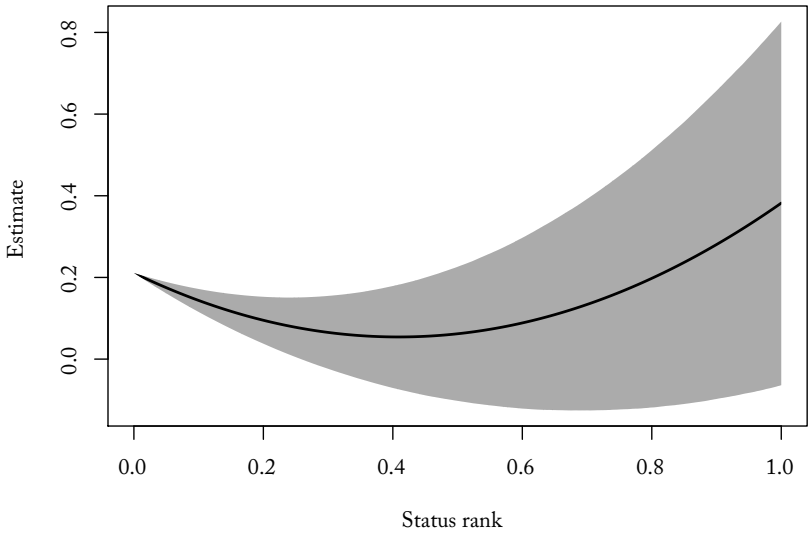


Figure 3.7: Expected probability of having been in a recent, physical fight, as a function of status rank. Shaded region indicates 95% confidence interval.

(identified using maximum-modularity community detection) that is below that student in the status hierarchy. For global status rank, calculated exactly as in table 3.2, both a linear and a quadratic term are considered to account for potential nonlinearities identified by multiple studies (Closson 2009; Faris and Felmlee 2014). A class-level random effects term was also included in the model to account for otherwise unexplained differences in communities.

The estimates from the analysis demonstrate some striking results. Female students are considerably less likely to be involved in physical fights, a result that is consistently reported in the literature. Students who are young compared to their peers are also less prone to violence, though the effect is smaller. Race and ethnicity have a strong relationship with violent behavior, with Hispanics being somewhat more likely than non-Hispanics to have fought, and American Indians and those in the 'other race' category fighting much more frequently on average than

white students. The coefficients for black and Asian students are not significantly different than zero. The relationship between fighting and status is particularly interesting in these results. First, within-clique status rank has a strong positive relationship with frequency of fighting. Taking the liberty of interpreting each step up in the four-point scale to be associated with two more fights in the past year, those at the top of their clique would be expected to get into about 0.2 more fights per year on average than those at the bottom. Community-wide status rank has a similarly dramatic association with fighting. Figure 3.7 displays graphically the relationship between predicted fighting and global status rank (for a white male of average age for his grade and at the bottom of his particular status clique). There is a clear nonlinear relationship, with students toward the middle of the status spectrum having lower expected frequencies of fighting than those at either the high end or the low end ($p = 0.00204$). Taken together, these results describe exactly the relationship between social status and aggression reported by Closson (2009).

Discussion

In many ways, the methods used here are most the most traditional of any in the dissertation. They assume, at least formally, a strict rank ordering of status, which is a common approach for research into status dynamics status. The data used are straightforward social networks, putting these methods in the same category of applicability as a host of network-metric approaches to status, power, and influence. But the models and the analysis just presented insist that status hierarchies are complex, and that there is more to one's position in such a hierarchy than a rank or

a score can convey. Just like the analyses in chapter 2, this complexity is achieved by treating indeterminate status relations as first-class citizens of the status structure. Indeterminate relations were key to defining status embeddedness, but were also instrumental for the determination of status cliques. They constitute the horizontal dimension of the status hierarchies.

A recurring theme throughout the analyses in this dissertation has been that horizontality matters. I do not make this point to argue that vertical status differentiation does not matter—it undoubtedly does. By emphasizing horizontality I hope to underscore the importance of status structures' nonlinear topology for the consequences they have for communities. Status is instrumental in outcomes that are of central importance to sociologists: power, influence, stratification, inequality. I have shown in the empirical analyses that each of these outcomes is best understood by viewing status through a relational lens, taking both the determined and the non-determined relations into account when mapping status hierarchies. Thinking of status in a structural sense is not new—diagrams like organizational charts are a common way to represent relationships of precedence in organizations. But such structures are often nothing more than a small relaxation of the fundamental metaphors of verticality, of chains of command. The hierarchies in this chapter and the previous chapter are identified instead by the pairwise relations that constitute them. The interactions between people are primary, and the structural outcomes are empirical consequences. Such a bottom-up approach to the study of community-spanning status structures is rare, but it uncovers topographical subtleties that would otherwise remain hidden. The large-scale rifts between parallel vertical hierarchies and the localized status cliques that define social landscapes are only visible by starting with the relations between individuals.

REFERENCES

Adler, Patricia A., and Peter Adler. 1995. "Dynamics of Inclusion and Exclusion in Preadolescent Cliques." *Social Psychology Quarterly* 58 (3): 145–62.

———. 1996. "Preadolescent Clique Stratification and the Hierarchy of Identity." *Sociological Inquiry* 66 (2): 111–42.

———. 1998. *Peer Power: Preadolescent Culture and Identity*. Rutgers University Press.

An, Weihua, and Will R. McConnell. 2015. "The Origins of Asymmetric Ties in Friendship Networks: From Status Differential to Self-Perceived Centrality." *Network Science* 3 (02): 269–92.

Anderson, Cameron, Sanjay Srivastava, Jennifer S. Beer, Sandra E. Spataro, and Jennifer A. Chatman. 2006. "Knowing Your Place: Self-Perceptions of Status in Face-to-Face Groups." *Journal of Personality and Social Psychology* 91 (6): 1094–1110.

Bales, Robert Freed. 1976. *Interaction Process Analysis: A Method for the Study of Small Groups*. Chicago: University of Chicago Press.

Ball, Brian, and M. E. J. Newman. 2013. "Friendship Networks and Social Status." *Network Science* 1 (1): 16–30.

Berger, Christian, and Jan Kornelis Dijkstra. 2013. "Competition, Envy, or Snobbism? How Popularity and Friendships Shape Antipathy Networks of Adolescents." *Journal of Research on Adolescence* 23 (3): 586–95.

Berger, Joseph. 1977. *Status Characteristics and Social Interaction: An Expectation-States Approach*. Elsevier Scientific Pub. Co.

Berger, Joseph, Bernard P. Cohen, and Morris Zelditch Jr. 1972. "Status Characteristics and Social Interaction." *American Sociological Review* 37 (3): 241–55.

Blau, Peter Michael., Otis Dudley Duncan, and Andrea Tyree. 1978. *The American Occupational Structure*. New York: Free Press.

Bonacich, Phillip. 1987. "Power and Centrality: A Family of Measures." *American Journal of Sociology* 92 (5): 1170–82.

Borgatti, Stephen P., and Martin G. Everett. 1992. "Notions of Position in Social Network Analysis." *Sociological Methodology* 22: 1–35.

———. 2000. "Models of Core/Periphery Structures." *Social Networks* 21 (4): 375–95.

Bottger, Preston C. 1984. "Expertise and Air Time as Bases of Actual and Perceived Influence

in Problem-Solving Groups." *Journal of Applied Psychology* 69 (2): 214–21.

Bourdieu, Pierre. 2013. *Distinction: A Social Critique of the Judgement of Taste*. Routledge.

Brass, Daniel J. 1984. "Being in the Right Place: A Structural Analysis of Individual Influence in an Organization." *Administrative Science Quarterly* 29 (4): 518–39.

Brown-Schmidt, Sarah, and Michael K. Tanenhaus. 2008. "Real-Time Investigation of Referential Domains in Unscripted Conversation: A Targeted Language Game Approach." *Cognitive Science* 32 (4): 643–84.

Bryson, Bethany. 1996. "'Anything but Heavy Metal': Symbolic Exclusion and Musical Dislikes." *American Sociological Review* 61 (5): 884–99.

Burgoon, Judee K., Lesa A. Stern, and Leesa Dillman. 2007. *Interpersonal Adaptation: Dyadic Interaction Patterns*. Cambridge University Press.

Burt, Ronald S. 1976. "Positions in Networks." *Social Forces* 55 (1): 93–122.

———. 1977. "Positions in Multiple Network Systems, Part One: A General Conception of Stratification and Prestige in a System of Actors Cast as a Social Topology." *Social Forces* 56 (1): 106–31.

Carli, Linda L., Suzanne J. LaFleur, and Christopher C. Loeber. 1995. "Nonverbal Behavior, Gender, and Influence." *Journal of Personality and Social Psychology* 68 (6): 1030–41.

Chartrand, Tanya L., and John A. Bargh. 1999. "The Chameleon Effect: The Perception–behavior Link and Social Interaction." *Journal of Personality and Social Psychology* 76 (6): 893–910.

Chartrand, Tanya L., and Rick van Baaren. 2009. "Chapter 5: Human Mimicry." In *Advances in Experimental Social Psychology*, 41:219–74. Academic Press.

Chase, Ivan D. 1980. "Social Process and Hierarchy Formation in Small Groups: A Comparative Perspective." *American Sociological Review* 45 (6): 905–24.

Cheng, Clara Michelle, and Tanya L. Chartrand. 2003. "Self-Monitoring Without Awareness: Using Mimicry as a Nonconscious Affiliation Strategy." *Journal of Personality and Social Psychology* 85 (6): 1170–9.

Cillessen, Antonius H. N., and Amanda J. Rose. 2005. "Understanding Popularity in the Peer System." *Current Directions in Psychological Science* 14 (2): 102–5.

Closson, Leanna M. 2009. "Aggressive and Prosocial Behaviors Within Early Adolescent

Friendship Cliques: What's Status Got to Do with It?" *Merrill-Palmer Quarterly* 55 (4): 406–35.

Coie, John D., Kenneth A. Dodge, and Heide Coppotelli. 1982. "Dimensions and Types of Social Status: A Cross-Age Perspective." *Developmental Psychology* 18 (4): 557–70.

Coleman, James S. 1961. *The Adolescent Society: The Social Life of the Teenager and Its Impact on Education*. [New York]: Free Press of Glencoe.

Collins, Randall. 1992. "Women and the Production of Status Cultures." In *Cultivating Differences: Symbolic Boundaries and the Making of Inequality*, edited by Michèle Lamont and Marcel Fournier, 213–31. Chicago: University Of Chicago Press.

———. 2004. *Interaction Ritual Chains*. Princeton University Press.

Cook, Karen S. 1975. "Expectations, Evaluations and Equity." *American Sociological Review* 40 (3): 372–88.

Correll, Shelley J., and Cecilia L. Ridgeway. 2006. "Expectation States Theory." In *Handbook of Social Psychology*, edited by John Delamater, 29–51. Handbooks of Sociology and Social Research. Springer US.

Danescu-Niculescu-Mizil, Cristian, and Lillian Lee. 2011. "Chameleons in Imagined Conversations: A New Approach to Understanding Coordination of Linguistic Style in Dialogs." In *Proceedings of the 2nd Workshop on Cognitive Modeling and Computational Linguistics*, 76–87. CMCL '11. Stroudsburg, PA, USA: Association for Computational Linguistics.

Danescu-Niculescu-Mizil, Cristian, Michael Gamon, and Susan Dumais. 2011. "Mark My Words!: Linguistic Style Accommodation in Social Media." In *Proceedings of the 20th International Conference on World Wide Web*, 745–54. WWW '11. New York, NY, USA: ACM.

Danescu-Niculescu-Mizil, Cristian, Lillian Lee, Bo Pang, and Jon Kleinberg. 2012. "Echoes of Power: Language Effects and Power Differences in Social Interaction." In *Proceedings of the 21st International Conference on World Wide Web*, 699–708. ACM.

Davis, James A., and Samuel Leinhardt. 1967. "The Structure of Positive Interpersonal Relations in Small Groups." August.

Diego, Miguiel A., Tiffany M. Field, and Christopher E. Sanders. 2002. "Academic Performance, Popularity, and Depression Predict Adolescent Substance Use." *Adolescence* 38 (149): 35–42.

Dijkstra, Jan Kornelis, Antonius H. N. Cillessen, Siegwart Lindenberg, and René Veenstra. 2010. "Basking in Reflected Glory and Its Limits: Why Adolescents Hang Out with Popular Peers." *Journal of Research on Adolescence* 20 (4): 942–58.

DiMaggio, Paul. 1987. "Classification in Art." *American Sociological Review* 52 (4): 440.

———. 1992. "Cultural Boundaries and Structural Change: The Extension of the High Culture Model to Theater, Opera, and the Dance, 1900–1940." In *Cultivating Differences: Symbolic*

Boundaries and the Making of Inequality, edited by Michèle Lamont and Marcel Fournier, 21–57. Chicago: University Of Chicago Press.

Dimberg, Ulf, Monika Thunberg, and Kurt Elmehed. 2000. "Unconscious Facial Reactions to Emotional Facial Expressions." *Psychological Science* 11 (1): 86–89.

Doreian, Patrick, Vladimir Batagelj, and Anuška Ferligoj. 2000. "Symmetric-Acyclic Decompositions of Networks." *Journal of Classification* 17 (1): 3–28.

———. 2005. *Generalized Blockmodeling*. Cambridge University Press.

Epstein, Cynthia Fuchs. 2007. "Great Divides: The Cultural, Cognitive, and Social Bases of the Global Subordination of Women." *American Sociological Review* 72 (1): 1–22.

Faris, Robert, and Susan Ennett. 2012. "Adolescent Aggression: The Role of Peer Group Status Motives, Peer Aggression, and Group Characteristics." *Social Networks* 34 (4): 371–78.

Faris, Robert, and Diane Felmlee. 2011. "Status Struggles Network Centrality and Gender Segregation in Same- and Cross-Gender Aggression." *American Sociological Review* 76 (1): 48–73.

———. 2014. "Casualties of Social Combat School Networks of Peer Victimization and Their Consequences." *American Sociological Review* 79 (2): 228–57.

Ferguson, Priscilla Parkhurst. 1998. "A Cultural Field in the Making: Gastronomy in 19th-Century France." *American Journal of Sociology* 104 (3): 597–641.

Fiske, Susan T. 2011. *Envy up, Scorn down: How Status Divides Us*. Russell Sage Foundation.

Fiske, Susan T., Amy J. C. Cuddy, and Peter Glick. 2007. "Universal Dimensions of Social Cognition: Warmth and Competence." *Trends in Cognitive Sciences* 11 (2): 77–83.

Fişek, M. Hamit, Joseph Berger, and Robert Z. Norman. 1991. "Participation in Heterogeneous and Homogeneous Groups: A Theoretical Integration." *American Journal of Sociology* 97 (1): 114–42.

Frankel, Max. 2004. *High Noon in the Cold War: Kennedy, Khrushchev, and the Cuban Missile Crisis*. 1st ed. New York: Ballantine Books.

Freeman, Linton C. 1977. "A Set of Measures of Centrality Based on Betweenness." *Sociometry* 40 (1): 35–41.

Friedell, Morris F. 1967. "Organizations as Semilattices." *American Sociological Review* 32 (1): 46–54.

Friedkin, Noah E. 1984. "Structural Cohesion and Equivalence Explanations of Social Homogeneity." *Sociological Methods & Research* 12 (3): 235–61.

———. 1991. "Theoretical Foundations for Centrality Measures." *American Journal of Sociology*

96 (6): 1478–1504.

———. 2006. *A Structural Theory of Social Influence*. Cambridge University Press.

Friedkin, Noah E., and Eugene C. Johnsen. 1997. "Social Positions in Influence Networks." *Social Networks* 19 (3): 209–22.

Fuller, Sylvia. 2003. "Creating and Contesting Boundaries: Exploring the Dynamics of Conflict and Classification." *Sociological Forum* 18 (1): 3–30.

Fursenko, A. V., and Timothy J. Naftali. 1997. *One Hell of a Gamble: Khrushchev, Castro, and Kennedy, 1958-1964*. 1st ed. New York: W.W. Norton.

Gelman, Andrew, John B. Carlin, Hal S. Stern, and Donald B. Rubin. 2003. *Bayesian Data Analysis, Second Edition*. CRC Press.

Gibson, David R. 2012. *Talk at the Brink: Deliberation and Decision During the Cuban Missile Crisis*. Princeton University Press.

Gieryn, Thomas F. 1983. "Boundary-Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Scientists." *American Sociological Review* 48 (6): 781.

———. 1999. *Cultural Boundaries of Science: Credibility on the Line*. Chicago: University of Chicago Press.

Giles, Howard. 2009. "The Process of Communication Accomodation." In *The New Sociolinguistics Reader*, edited by Nikolas Coupland and Adam Jaworski, 276–86. Basingstoke: Palgrave Macmillan.

Giles, Howard, Justine Coupland, and Nikolas Coupland. 1991. *Contexts of Accommodation: Developments in Applied Sociolinguistics*. Cambridge University Press.

Goffman, Erving. 1959. *The Presentation of Self in Everyday Life*. Anchor.

———. 1974. *Stigma: Notes on the Management of Spoiled Identity*. Social Theory. New York: J. Aronson.

Gomez-Rodriguez, Manuel, Jure Leskovec, and Andreas Krause. 2012. "Inferring Networks of Diffusion and Influence." *ACM Trans. Knowl. Discov. Data* 5 (4): 21:1–21:37.

Gonzales, Amy L., Jeffrey T. Hancock, and James W. Pennebaker. 2010. "Language Style Matching as a Predictor of Social Dynamics in Small Groups." *Communication Research* 37 (1): 3–19.

Goodman, Elizabeth, Nancy E. Adler, Ichiro Kawachi, A. Lindsay Frazier, Bin Huang, and

Graham A. Colditz. 2001. "Adolescents' Perceptions of Social Status: Development and Evaluation of a New Indicator." *Pediatrics* 108 (2): e31–e31.

Gould, Roger V. 2002. "The Origins of Status Hierarchies: A Formal Theory and Empirical Test." *American Journal of Sociology* 107 (5): 1143–78.

———. 2003. *Collision of Wills: How Ambiguity About Social Rank Breeds Conflict*. University of Chicago Press.

Hall, Judith A., Erik J. Coats, and Lavonia Smith LeBeau. 2005. "Nonverbal Behavior and the Vertical Dimension of Social Relations: A Meta-Analysis." *Psychological Bulletin* 131 (6): 898–924.

Halle, David. 1992. "The Audience for Abstract Art: Class, Culture, and Power." In *Cultivating Differences: Symbolic Boundaries and the Making of Inequality*, edited by Michèle Lamont and Marcel Fournier, 131–51. Chicago: University Of Chicago Press.

Hare, A. Paul. 1976. *Handbook of Small Group Research*. 2d ed. New York: Free Press.

Harris, Kathleen Mullan, and J. Richard Udry. 2016. "National Longitudinal Study of Adolescent to Adult Health (Add Health), 1994-2008." Inter-university Consortium for Political and Social Research (ICPSR) [distributor].

Harrod, Wendy Jean. 1980. "Expectations from Unequal Rewards." *Social Psychology Quarterly* 43 (1): 126–30.

Hart, Jeffrey. 1974. "Structures of Influence and Cooperation-conflict." *International Interactions* 1 (3): 141–62.

Holland, Paul W., and Samuel Leinhardt. 1971. "Transitivity in Structural Models of Small Groups." *Small Group Research* 2 (2): 107–24.

Hollingshead, August de Belmont. 1949. *Elmtown's Youth: The Impact of Social Classes on Adolescents.* New York: J. Wiley.

Homans, George Caspar. 1992. *The Human Group*. New Brunswick, U.S.A.: Transaction Publishers.

Hopkins, Terence K. 1964. *The Exercise of Influence in Small Groups*. [Totowa, N.J.]: Bedminster Press.

Howard, Judith A., and Daniel G. Renfrow. 2006. "Social Cognition," 259–81.

Hsieh, Mo-Han, and Christopher L. Magee. 2010. "A New Method for Finding Hierarchical Subgroups from Networks." *Social Networks* 32 (3): 234–44.

Ireland, Molly E., and James W. Pennebaker. 2010. "Language Style Matching in Writing:

Synchrony in Essays, Correspondence, and Poetry." *Journal of Personality and Social Psychology* 99 (3): 549–71.

Johnsen, Eugene C. 1985. "Network Macrostructure Models for the Davis-Leinhardt Set of Empirical Sociomatrices." *Social Networks* 7 (3): 203–24.

Krackhardt, David. 1990. "Assessing the Political Landscape: Structure, Cognition, and Power in Organizations." *Administrative Science Quarterly* 35 (2): 342–69.

———. 1994. "Graph Theoretical Dimensions of Informal Organizations." In *Computational Organization Theory*, edited by Kathleen M. Carley and Michael J. Prietula, 89–111. Hillsdale, N.J.: Lawrence Erlbaum Associates.

Krieger, N., D. R. Williams, and N. E. Moss. 1997. "Measuring Social Class in US Public Health Research: Concepts, Methodologies, and Guidelines." *Annual Review of Public Health* 18 (1): 341–78.

LaFrance, Marianne. 1985. "Postural Mirroring and Intergroup Relations." *Personality and Social Psychology Bulletin* 11 (2): 207–17.

Lakin, Jessica L., Tanya L. Chartrand, and Robert M. Arkin. 2008. "I Am Too Just Like You: Nonconscious Mimicry as an Automatic Behavioral Response to Social Exclusion." *Psychological Science* 19 (8): 816–22.

Lamont, Michèle. 1992. *Money, Morals, and Manners: The Culture of the French and the American Upper-Middle Class*. University of Chicago Press.

———. 2000. *The Dignity of Working Men: Morality and the Boundaries of Race, Class, and Immigration*. New York, NY: Russell Sage Foundation.

Laumann, Edward O., and Richard Senter. 1976. "Subjective Social Distance, Occupational Stratification, and Forms of Status and Class Consciousness: A Cross-National Replication and Extension." *American Journal of Sociology* 81 (6): 1304–38.

Lease, A. Michele, Charlotte A. Kennedy, and Jennifer L. Axelrod. 2002. "Children's Social Constructions of Popularity." *Social Development* 11 (1): 87–109.

Lease, A. Michele, Karen T. Musgrove, and Jennifer L. Axelrod. 2002. "Dimensions of Social Status in Preadolescent Peer Groups: Likability, Perceived Popularity, and Social Dominance." *Social Development* 11 (4): 508–33.

Leifer, Eric M. 1988. "Interaction Preludes to Role Setting: Exploratory Local Action." *American Sociological Review* 53 (6): 865–78.

Leskovec, Jure, Lars Backstrom, and Jon Kleinberg. 2009. "Meme-Tracking and the Dynamics of the News Cycle." In *Proceedings of the 15th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, 497–506. KDD '09. New York, NY, USA: ACM.

Leskovec, Jure, Mary McGlohon, Christos Faloutsos, Natalie Glance, and Matthew Hurst. 2007. "Patterns of Cascading Behavior in Large Blog Graphs." In *Proceedings of the 2007*

SIAM International Conference on Data Mining, 551–56. Proceedings. Society for Industrial and Applied Mathematics.

Levelt, Willem J. M, and Stephanie Kelter. 1982. "Surface Form and Memory in Question Answering." *Cognitive Psychology* 14 (1): 78–106.

Levine, John M., and Richard L. Moreland. 1990. "Progress in Small Group Research." *Annual Review of Psychology* 41 (1): 585–634.

Linell, Per. 2009. *Rethinking Language, Mind, and World Dialogically: Interactional and Contextual Theories of Human Sense-Making*. Advances in Cultural Psychology : Constructing Human Development. Charlotte, NC: Information Age Pub.

Lorrain, François, and Harrison C. White. 1971. "Structural Equivalence of Individuals in Social Networks." *The Journal of Mathematical Sociology* 1 (1): 49–80.

Marsden, Peter V. 1988. "Homogeneity in Confiding Relations." *Social Networks* 10 (1): 57–76.

Martin, John Levi. 1998. "Structures of Power in Naturally Occurring Communities." *Social Networks* 20 (3): 197–225.

———. 2009a. *Social Structures*. Princeton University Press.

———. 2009b. "Formation and Stabilization of Vertical Hierarchies Among Adolescents: Towards a Quantitative Ethology of Dominance Among Humans." *Social Psychology Quarterly* 72 (3): 241–64.

Massey, Douglas S. 2007. *Categorically Unequal: The American Stratification System*. A Russell Sage Foundation Centennial Vol. New York: Russell Sage Foundation.

May, Ernest R. 2001. *The Presidential Recordings: John F. Kennedy: Volumes 1-3, the Great Crises*. Edited by Timothy Naftali, Ernest May, and Philip D. Zelikow. New York: W. W. Norton & Company.

McFarland, David H. 2001. "Respiratory Markers of Conversational Interaction." *Journal of Speech, Language, and Hearing Research* 44 (1): 128–43.

Meijs, Noortje, Antonius H. N. Cillessen, Ron H. J. Scholte, Eliane Segers, and Renske Spijkerman. 2008. "Social Intelligence and Academic Achievement as Predictors of Adolescent Popularity." *Journal of Youth and Adolescence* 39 (1): 62–72.

Meltzer, Leo, William N. Morris, and Donald P. Hayes. 1971. "Interruption Outcomes and

Vocal Amplitude: Explorations in Social Psychophysics." *Journal of Personality and Social Psychology* 18 (3): 392–402.

Merten, Don E. 1997. "The Meaning of Meanness: Popularity, Competition, and Conflict Among Junior High School Girls." *Sociology of Education* 70 (3): 175–91.

Merton, R.K. 1968. "The Matthew Effect in Science: The Reward and Communication Systems of Science Are Considered." *Science* 159 (3810): 56.

Mizruchi, Mark S. 1990. "Cohesion, Structural Equivalence, and Similarity of Behavior: An Approach to the Study of Corporate Political Power." *Sociological Theory* 8 (1): 16–32.

Moore, James C. 1968. "Status and Influence in Small Group Interactions." *Sociometry* 31 (1): 47–63.

Natale, Michael. 1975. "Convergence of Mean Vocal Intensity in Dyadic Communication as a Function of Social Desirability." *Journal of Personality and Social Psychology* 32 (5): 790–804.

Neal, Radford M. 2003. "Slice Sampling." *The Annals of Statistics* 31 (3): 705–67.

———. 2011. "MCMC Using Hamiltonian Dynamics." In *Handbook of Markov Chain Monte Carlo*, edited by Steve Brooks, 113–62. Chapman & Hall/Crc Handbooks of Modern Statistical Methods. Boca Raton: CRC Press/Taylor & Francis.

Niederhoffer, Kate G., and James W. Pennebaker. 2002. "Linguistic Style Matching in Social Interaction." *Journal of Language and Social Psychology* 21 (4): 337–60.

Oldehinkel, Albertine J., Judith G. M. Rosmalen, René Veenstra, Jan Kornelis Dijkstra, and Johan Ormel. 2007. "Being Admired or Being Liked: Classroom Social Status and Depressive Problems in Early Adolescent Girls and Boys." *Journal of Abnormal Child Psychology* 35 (3): 417–27.

Pachucki, Mark A., Sabrina Pendergrass, and Michèle Lamont. 2007. "Boundary Processes: Recent Theoretical Developments and New Contributions." *Poetics*, Culture lines: Emerging research on boundaries, 35 (6): 331–51.

Padgett, John F., and Christopher K. Ansell. 1993. "Robust Action and the Rise of the Medici, 1400-1434." *American Journal of Sociology* 98 (6): 1259–1319.

Parkhurst, Jennifer T., and Andrea Hopmeyer. 1998. "Sociometric Popularity and Peer-Perceived Popularity Two Distinct Dimensions of Peer Status." *The Journal of Early Adolescence* 18 (2): 125–44.

Pennebaker, James W., and Laura A. King. 1999. "Linguistic Styles: Language Use as an Individual Difference." *Journal of Personality and Social Psychology* 77 (6): 1296–1312.

Petten, Cyma Van, and Marta Kutas. 1991. "Influences of Semantic and Syntactic Context on

Open- and Closed-Class Words." *Memory & Cognition* 19 (1): 95–112.

Pickering, Martin J., and Simon Garrod. 2004. "Toward a Mechanistic Psychology of Dialogue." *Behavioral and Brain Sciences* 27 (02).

Podolny, Joel M., Toby E. Stuart, and Michael T. Hannan. 1996. "Networks, Knowledge, and Niches: Competition in the Worldwide Semiconductor Industry, 1984-1991." *American Journal of Sociology* 102 (3): 659–89.

Rao, Hayagreeva, Philippe Monin, and Rodolphe Durand. 2003. "Institutional Change in Toque Ville: Nouvelle Cuisine as an Identity Movement in French Gastronomy." *American Journal of Sociology* 108 (4): 795–843.

Richardson, Daniel C., Rick Dale, and Natasha Z. Kirkham. 2007. "The Art of Conversation Is Coordination." *Psychological Science* 18 (5): 407–13.

Ridgeway, Cecilia L. 1991. "The Social Construction of Status Value: Gender and Other Nominal Characteristics." *Social Forces* 70 (2): 367–86.

Ridgeway, Cecilia L., and Shelley J. Cornell. 2006. "Consensus and the Creation of Status Beliefs." *Social Forces* 85 (1): 431–53.

Ridgeway, Cecilia L., and David Diekema. 1989. "Dominance and Collective Hierarchy Formation in Male and Female Task Groups." *American Sociological Review* 54 (1): 79–93.

Rodkin, Philip C., and Christian Berger. 2008. "Who Bullies Whom? Social Status Asymmetries by Victim Gender." *International Journal of Behavioral Development* 32 (6): 473–85.

Rombach, M. Puck, Mason A. Porter, James H. Fowler, and Peter J. Mucha. 2014. "Core-Periphery Structure in Networks." *SIAM Journal on Applied Mathematics* 74 (1): 167–90.

Romero, Daniel M., Brendan Meeder, and Jon Kleinberg. 2011. "Differences in the Mechanics of Information Diffusion Across Topics: Idioms, Political Hashtags, and Complex Contagion on Twitter." In *Proceedings of the 20th International Conference on World Wide Web*, 695–704. WWW '11. New York, NY, USA: ACM.

Romero, Daniel M., Roderick I. Swaab, Brian Uzzi, and Adam D. Galinsky. 2015. "Mimicry Is Presidential: Linguistic Style Matching in Presidential Debates and Improved Polling Numbers." *Personality and Social Psychology Bulletin* 41 (10): 1311–9.

Rose, Amanda J., Lance P. Swenson, and Erika M. Waller. 2004. "Overt and Relational Aggression and Perceived Popularity: Developmental Differences in Concurrent and Prospective

Relations." *Developmental Psychology* 40 (3): 378–87.

Segalowitz, Sidney J., and Korri Lane. 2004. "Perceptual Fluency and Lexical Access for Function Versus Content Words." *Behavioral and Brain Sciences* 27 (02).

Shrum, Wesley, Neil H. Cheek, and Saundra MacD. Hunter. 1988. "Friendship in School: Gender and Racial Homophily." *Sociology of Education* 61 (4): 227–39.

Sijtsema, Jelle J., René Veenstra, Siegwart Lindenberg, and Christina Salmivalli. 2009. "Empirical Test of Bullies' Status Goals: Assessing Direct Goals, Aggression, and Prestige." *Aggressive Behavior* 35 (1): 57–67.

Simmel, Georg, and Kurt H. Wolff. 1950. *The Sociology of Georg Simmel*. Glencoe, Ill.: Free Press.

Simmons, Matthew P., Lada A. Adamic, and Eytan Adar. 2011. "Memes Online: Extracted, Subtracted, Injected, and Recollected." *ICWSM* 11: 17–21.

Skvoretz, John. 1988. "Models of Participation in Status-Differentiated Groups." *Social Psychology Quarterly* 51 (1): 43–57.

Skvoretz, John, and Thomas J. Fararo. 1996. "Status and Participation in Task Groups: A Dynamic Network Model." *American Journal of Sociology* 101 (5): 1366–1414.

Skvoretz, John, Murray Webster, and Joseph Whitmeyer. 1999. "Status Orders in Task Discussion Groups." *Advances in Group Processes* 16: 199–218.

Slatcher, Richard B., Cindy K. Chung, James W. Pennebaker, and Lori D. Stone. 2007. "Winning Words: Individual Differences in Linguistic Style Among U.S. Presidential and Vice Presidential Candidates." *Journal of Research in Personality* 41 (1): 63–75.

Small, Mario Luis. 2004. *Villa Victoria the Transformation of Social Capital in a Boston Barrio*. Chicago: University Of Chicago Press.

Smith-Lovin, Lynn, John Skvoretz, and Charlotte G. Hudson. 1986. "Status and Participation in Six-Person Groups: A Test of Skvoretz's Comparative Status Model." *Social Forces* 64 (4): 992–1005.

Snyder, David, and Edward L. Kick. 1979. "Structural Position in the World System and Economic Growth, 1955-1970: A Multiple-Network Analysis of Transnational Interactions." *American Journal of Sociology* 84 (5): 1096–1126.

Stangor, Charles, Laure Lynch, Changming Duan, and Beth Glas. 1992. "Categorization of Individuals on the Basis of Multiple Social Features." *Journal of Personality and Social Psychology* 62 (2): 207–18.

Stryker, Sheldon, and Kevin D. Vryan. 2006. "The Symbolic Interactionist Frame." In *Handbook of Social Psychology*, edited by John Delamater, 3–28. Handbooks of Sociology and Social

Research. Springer US.

Taylor, Paul J., and Sally Thomas. 2008. "Linguistic Style Matching and Negotiation Outcome." *Negotiation and Conflict Management Research* 1 (3): 263–81.

Taylor, Shelley E., Susan T. Fiske, Nancy L. Etcoff, and Audrey J. Ruderman. 1978. "Categorical and Contextual Bases of Person Memory and Stereotyping." *Journal of Personality and Social Psychology* 36 (7): 778–93.

Terry, Robert, and John D. Coie. 1991. "A Comparison of Methods for Defining Sociometric Status Among Children." 27 (5): 867–80.

Tilly, Charles. 1998. *Durable Inequality*. Berkeley: University of California Press.

van Baaren, Rick B., Rob W. Holland, Bregje Steenaert, and Ad van Knippenberg. 2003. "Mimicry for Money: Behavioral Consequences of Imitation." *Journal of Experimental Social Psychology* 39 (4): 393–98.

White, Harrison C. 2008. *Identity and Control: How Social Formations Emerge*. 2nd ed. Princeton: Princeton University Press.

White, Harrison C., Scott A. Boorman, and Ronald L. Breiger. 1976. "Social Structure from Multiple Networks. I. Blockmodels of Roles and Positions." *American Journal of Sociology* 81 (4): 730–80.

White, Mark J. 1996. *The Cuban Missile Crisis*. Basingstoke, Hampshire: Macmillan.

———. 2012. *Fifty Years on: The Cuban Missile Crisis Revisited and Reinterpreted*. Lecture Series Paper 9. London: Institute for the Study of the Americas [u.a.].

Whyte, William Foote. 1943. *Street Corner Society: The Social Structure of an Italian Slum*. Chicago, IL: The University of Chicago Press.

Wingfield, Nick. 2014. "Feminist Critics of Video Games Facing Threats in 'GamerGate' Campaign." *The New York Times*, October 15.

Winship, Christopher, and Michael Mandel. 1983. "Roles and Positions: A Critique and Extension of the Blockmodeling Approach." *Sociological Methodology* 14: 314.

Yabar, Yanelia, Lucy Johnston, Lynden Miles, and Victoria Peace. 2006. "Implicit Behavioral Mimicry: Investigating the Impact of Group Membership." *Journal of Nonverbal Behavior* 30 (3): 97–113.

Zerubavel, Eviatar. 1993. *The Fine Line: Making Distinctions in Everyday Life*. Chicago: University of Chicago Press.