**The Context of Network Inequality**

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**Abstract.** An individual's network ties are crucial to their well-being and life outcomes, and an emerging literature connects these network effects to the persistence or mitigation of group-based inequality. At the same time, we know very little about how the contexts in which relationships are formed shape individual-level and group-level networks. This leaves our understanding of network-based mechanisms of inequality separate from the contexts in which relationships are formed and operate. This chapter sets forth a model that combines context, ego and global network structure, and inequality arising from network effects into one causal chain. We review evidence on how different characteristics of context – population size and composition, number and kinds of social foci, and organizational practices – contribute to the structure of social networks. We then review research demonstrating how those network features, as well as the overall structure of relationships, contribute to distributions of outcomes in the population. The chapter concludes with applications of the model using examples from student behavior in schools and from evidence about migration. We suggest that network scholars and scholars of inequality build this more expansive perspective into their work in order to better understand mechanisms of inequality.

**Introduction**

      Scholars have now scrupulously documented the ways in which our relationships with others bear on our life outcomes, often maintaining or exacerbating existing inequalities in the process. One important way in which this happens is through the differential diffusion of resources and behaviors through social networks (DiMaggio and Garip 2012). Because many important behaviors are more likely to occur when others around us also do the behavior, individuals who have a particular set of social relationships, and are embedded within a particular configuration of sets of relationships, may be more likely to adopt a behavior that improves their life chances or well-being. Consider two behaviors: putting effort into school, and migrating to achieve prosperity. The behavior of those around a student or potential migrant, the characteristics of an individual's relationships, and the larger structure of relationships in which they are embedded in a school or a village, can shape which students receive social support in improving academic performance (Crosnoe et al. 2003, Frank et al. 2008), and which individuals in a village get help in migrating to a city (Entwisle et al. 2007, Garip 2008). Both of these behaviors have implications for social inequality within schools and villages, as well as between them.

      We know a good deal about some parts of the process of differential diffusion through networks. A large literature examines how personal networks (e.g., Marsden 1987) and network topologies shape how behavior spreads (e.g., Kossinets and Watts 2006, Watts and Strogatz 1998, Centola 2015) in ways that affect social and economic outcomes. A smaller body of work puts social networks in context by linking relationships to the characteristics of institutions, organizations, space, and populations, that shape how individuals come to form the number and types of social ties that they do. For example, Isakov et al. (2019) observe that villages with more antagonistic relationships among members are more likely to be spatially proximate to each other. Within a 1930s Bank Wiring Room (Roethlisberger and Dickson 1939), both the spatial arrangement of work locations and the way that work was structured into units helped explain who became friends with whom and what types of relationships they had with each other (Doreian and Conti 2012).

      The core insights about context, social networks, and inequality represented in these two strands of research have not been integrated, largely leaving our understanding of network-based mechanisms of inequality separate from the contexts in which relationships are formed and operate. In this chapter, we argue for the value of an approach that combines context, ego and global network structure, and inequality arising from network effects into one causal chain. We start with a brief description of our proposed integrated model. We elaborate each of the proposed relationships between the concepts in the model in a discussion of the theory and empirical evidence linking features of context to networks (part I of the model). We then discuss the theory and evidence regarding the relationship between networks and inequality (part II of the model). Finally, we discuss applications of the full model using examples from student behavior in schools and from evidence about migration.

**The Importance of Context**

Contexts, which we understand as social units containing individuals (e.g., schools or villages), impact the quantity and nature of relationships, the characteristics of available network alters, and the overall structure of the network (Entwisle et al. 2007). Linking contexts to networks and their effects, we argue, allows us to clarify our assumptions about the mechanisms that shape network formation and network-based inequality, and to identify the scope conditions for our arguments. For example, a growing literature connects features of neighborhoods (contexts, in our terminology) to various behaviors and outcomes central to social inequality (Sampson et al. 2002). But this work rarely specifies the network-level mechanisms linking context to behaviors (cf. Morenoff et al. 2001). Similarly, studies of social networks often take observed relationships as given, and rarely consider the organizational or spatial features giving rise to the ties (cf. Small 2007, Small and Adler 2019), and potentially shaping their consequences for outcomes. Thinking of context-networks-outcomes as a connected chain allows us to identify such missing links in our thinking.

Practically, however, we often lack full information about the ways that individuals are connected to one another.[1] Even if we are able to gather information about an individual's number and type of relationships (which we refer to here as ego networks), then we very rarely have information about how the individuals with whom they have relationships are related to each other within some group or population (we refer to this as global network structure). Thinking about interaction context, networks, and inequality as interrelated processes might allow us to better understand the emergence of forms of inequality produced through network effects (where connected individuals shape one another's behaviors), and to theorize how they might be linked to features of context, regardless of whether or not we have observed information about relationships.

**Overview of the Model**

Figure 1 illustrates our proposed integration between the literatures connecting context, networks and inequality. (Table A1 in the Appendix connects our model to the existing literature by categorizing specific papers according to the linkages (arrows in Figure 1) they explore.) On the left-hand side of the figure, what we refer to as part I of the model, we start with what we consider to be the key features of the interactional context, the pre-conditions that shape how individuals interact with one another to form relationships: population structure (size and composition), the number and type of contexts for interaction, and organizational practices. These features of context can shape ego network formation (arrow 3), including the number of relationships, whether those relationships are with similar or different individuals, the strength of those relationships, and other characteristics of the individuals in those relationships, directly.

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[1] The explosion of traces of relationships between individuals and within groups based on online data is an obvious exception, but we have relatively little evidence about how this type of information about network structure translates to offline contexts.

Features of context might also influence global network structures directly (arrow 2). For example, network density in schools with more students tends to be lower than in schools with fewer students. Based on a dataset of 56 middle schools (Paluck, Shepherd, and Aronow 2013), for example, the correlation between school size and network density is $r$ =-0.83.

[Figure 1 about here]

Given both theoretical and empirical interest, we also focus on one possible indirect pathway between these features of context and relationship formation: through shaping the extent of homophily (bias towards relationships among similar individuals) and consolidation (the extent to which characteristics of individuals tend to co-occur, for example, whether those who are well-educated also have a particular racial identity) within a population (arrows 1, 4 and 5). We then elaborate on how homophily and consolidation might shape both features of ego networks and global network structures, and potentially offer a proxy for network characteristics in the absence of data on social ties.

Part II of the model elaborates on the empirical and theoretical basis linking network structure (both ego and global) to inequality through various network processes, in particular, differential diffusion of resources and behaviors. Characteristics of ego-centric networks (such as the number and strength of ties, and attributes of alters) can shape the nature or strength of interpersonal influence in behaviors and outcomes, as we review below (arrow 8). Similarly, the global structure of networks (such as the extent of clustering and the density of relationships among people) impacts both opportunities for new connections (arrow 6), as well as the potential for network-based diffusion of practices (arrow 7) to the whole or parts of the population. These network processes can ultimately contribute to inequality in outcomes among individuals and groups (arrow 9).

**Part I: Linking Context to Networks**
We might think about how context shapes both ego networks (the number and types of relationships people have and with whom) and global network structures (specifically, how many relationships there are between individuals within a group, how much clustering they exhibit[2] and how many and how redundant pathways are between individuals in the network). We posit both a direct relationship (arrows 2 & 3 in Figure 1), and an indirect one (arrows 1, 4 & 5) —through homophily and consolidation— between context and networks. We single out the role of homophily and consolidation given the theoretical and empirical work establishing their relevance for network

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[2] One way of thinking about and measuring clustering is in terms of the presence of smaller subgroups within the network where ties are more dense among individuals compared to ties across subgroups. Network scholars also often use a measure of the number of groups of three individuals in a network where all three individuals are connected to the other two— closed triplets.

structures, going back to Blau and Schwartz (1984), as well as recent attention to their influence on network-based spread of behaviors (Centola 2015, Zhao and Garip forthcoming). Here, we think of homophily as a global property of the context, that is, the average tendency of individuals in a setting to form connections to others similar to themselves.

It is important to note that researchers distinguish between homophily driven by the choices of individuals, and homophily that is induced by the composition of a population or interaction opportunities in institutions like schools (Fischer 1997), voluntary associations (McPherson and Smith-Lovin 1987), or work environments (Reskin et al. 1999). Research also shows endogenous dynamics in a network (such as triadic closure) that produce more ties between similar individuals (Kossinets and Watts 2006). Observed homophily in any context is invariably a function of all these elements.

To understand the direct relationship, we can ask how and which features of context shape both ego networks and global network structures. To understand the indirect relationship, we can ask (1) how features of context shape homophily and consolidation in some group or population, and then (2) how homophily and consolidation in that group or population shape network structure. We will start with an exploration of the direct relationship between context and network formation.

*Direct Pathway: What features of context matter to network formation?*

What do we know about the link between context and relationship formation? Scholars of social relations have formulated a set of principles regarding the conditions under which people are more likely to form relationships with each other (Blau 1977; Festinger, Schachter, and Back 1950). Relationships are more likely to form between individuals who have opportunities for (a) repeated interaction, under (b) favorable conditions. Context can also shape the number of potential relationships one might have within that interactional space by providing the number of individuals one might encounter and thus form relationships with (we can think about this factor as the size of the relevant population in the setting). Blau (1977) talks about this as a structural feature constraining tie formation: the base number of individuals one comes into contact with and their characteristics.

A necessary, but not sufficient, requirement for relationship formation between individuals is that they have repeated interaction with one another, which requires proximity in physical space or the use of communication technologies that give people the ability to interact repeatedly. As Blau (1977: 79) put it, "social associations depend on opportunities for social contacts." As others have demonstrated, physical proximity shapes relationship formation, regardless of the availability of communication technologies. The physical structure of a community or city, dorms, or seating in a room influences who interacts with whom and how frequently (see Small and Adler 2019 for a review of the role of space in relationship formation). A seemingly trivial additional point, though one with important consequences for understanding context, is that repeated interaction is more likely in situations when individuals spend more time together. For example, relationships are more likely to form at work than when shopping at the grocery store, even if you interact repeatedly with the same individuals

in both contexts, because, for most jobs, you spend far more time with individuals at work than when shopping at the grocery store (though there are also different social rules governing interactions in both contexts).

Mere proximity and time spent together is, however, insufficient for the formation of relationships. Canonical articulations of intergroup contact theory, the idea that members of different groups are more likely to get along across group lines when they have more exposure to each other, has detailed the necessity of shared goals and positive affect (see Pettigrew 1998). We can abstract these principles from conditions of intergroup contact theory to conditions of any contact; individuals are more likely to like each other, to attribute good intentions to each other, and to want to continue interacting with each other when interactions occur in a positive context, with a positive frame.

Given what we know about what conditions are likely to produce relationships between people, we can then ask which features of contexts are important to pay attention to in order to understand relationship formation. Here, we focus particularly on community and organizational population structure (the number of people, the number of types of social categories, and the distribution of people in those categories), the number and type of contexts (or foci) in which people have the opportunity to interact, and the organizational practices of organizations in which individuals interact. We can think of many of these factors as exogenous features of contexts, or pre-conditions of interaction (though we note that there are conditions under which they might be endogenous to the process). For example, Entwisle et al. (2007) show that in migrant-sending Thai villages, network structure is related to how many young adults leave, and hence, connected to both the size and composition of the population. Population structure and the number and type of contexts influence the frequency of interaction; organizational practices influence both the frequency and the conditions of interaction. These contextual factors can surely exert a direct influence on interpersonal influence (above and beyond their impact on network features and structure). The context can also shape inequality outcomes directly. Since our focus here is on personal networks, we do not discuss these linkages (nor show them in the conceptual diagram in Figure 1).

Population structure. We consider population structure to encompass both the number and composition of people available for interaction. In general, there is evidence that there are more relationships, and more dense relationships, in places with fewer people (e.g., Marsden 1987; Richardson, Erickson, and Nosanchuk 1979). But this correlation does not hold in data from Thai villages (Entwisle et al. 2007), where larger villages are more cohesive. The authors reason that in these villages, which experience high rates of out-migration, village size is a consequence of greater social cohesion, instead of a cause of it (here, population structure may be endogenous instead of exogenous to networks). Population size can also affect global network structure; McFarland et al. (2014), for example, find that more clustering occurs in bigger schools.

Number and types of foci. As Fischer (1982: 179) put it, "people can select friends only from among other people available to them and that pool is shrunken tremendously by the social contexts in which people participate." We should think,

then, about the number and type of local contexts in which individuals regularly interact. Feld (1981) refers to these contexts as foci, an entity around which the joint activities are arranged (e.g., school, work, voluntary organizations, see Louch 2000). Small and Adler (2019) refer to this feature as spatial composition. These contexts or foci are important to relationship formation. For example, Frank, Muller, and Mueller (2013) find that high school students who take classes together are 1.77 times more likely to nominate each other as friends than are students who do not take classes together. Similarly, McFarland et al. (2014) find that sharing three extracurricular clubs increase the odds of friendship by 50 percent. Variation in the nature and type of foci for interaction shapes the likelihood of frequent, positive interaction. Schools with these types of foci (extracurricular activities) provide more opportunities for friendship formation than do schools without them. These foci can be, but are not always, deliberately produced through organizational practices.

　　　Organizational practices. Organizational practices themselves, separate from population structure, may facilitate or impede the formation of social ties. Small (2009), for example, documents how practices in daycares can build relationships between women utilizing the centers for their children. In high schools, academic tracking, where students are separated according to assessments of ability, is associated with more social ties between students (McFarland et al. 2014). Within a policy academy, the practice of assigning recruits to squads exerts a strong effect on the friendship relationships formed among recruits (Doreian and Conti 2012). And unpredictable work scheduling in retail organizations reduces the number of both affective and instrumental social ties among co-workers (Shepherd 2020).

*Indirect Pathway: Interaction Context to Homophily and Consolidation to Network Structure*

　　　We can also consider the way that interaction context shapes networks through intervening processes that shape the extent of network homophily and consolidation— the extent to which different features co-occur or overlap within individuals— in a population, which then shape network structure. This indirect pathway may be important given computational evidence provided from Centola (2015), that some levels of homophily, combined with moderate levels of consolidation, give rise to network structures that are particularly amenable to the spread of social practices and behaviors through a population. In this model, homophily leads to the existence of more clustering within a network, while consolidation is associated with cross-cutting ties (Blau and Schwartz 1984), that provide the needed connections between subgroups in the network (as well as optimal density of ties within each group) to allow for diffusion.

　　　How does interaction context shape network homophily and consolidation? Many scholars have examined the role of population structure in the production of network homophily—that individuals are more likely to have relationships with those similar to themselves. A general expectation is that more homogeneous populations produce greater levels of network homophily. This relationship is not always linear, however. For example, Moody (2001) finds that racial homophily in friendship relationships among adolescents increases with moderate levels of population

heterogeneity, but declines at the highest levels of heterogeneity. McFarland et al. (2014) find that as population size increases, homophily along age, race, and SES increases. The number and type of foci also shape network homophily (see McPherson et al. 2001 for a review of organizational foci and homophily). For example, contexts where individuals spend more time together produce more network homophily (Mollenhurst, Völker, and Flap 2008).

Contexts for interaction also vary in the extent to which interactions are institutionally regulated or enforced, often a product of organizational rules and guiding logics. Feld (1981) argues that enforced interactions are more likely to produce relationships. Mollenhurst et al. (2008) test this empirically, and find that relationships formed in contexts where interactions are regulated, such as in workplaces, produce more network homophily than those formed in contexts that are less regulated. In schools, academic tracking produces greater network homophily (McFarland et al. 2014).

We have much less information about how context shapes consolidation in a group. Blau and Schwartz (1984) describe the presence of high levels of consolidation in places such as company towns. It may be the case that consolidation is governed by features of context like economic structures and opportunities, and by cultural meanings circulating in a place, more than by conditions of interaction. Centola's (2015: 1302) observation that "potentially minor changes to social institutions that reduce or increase the level of social consolidation within a society can be unintentionally amplified through the vehicle of social networks into significant consequences for a population's collective capacity for social diffusion" suggest that better understanding the link between context and consolidation may be particularly fruitful.

How does homophily and consolidation shape global network structure? The next leg of the indirect pathway links network homophily and consolidation to global network structure. For this, we rely on computational evidence due to the lack of other forms of evidence. Based on varying parameters in models of network formation and diffusion, Centola (2015) finds that the level of consolidation in a group has an inverse-U shaped relationship to diffusion; groups with low and high levels of consolidation produce network structures that are less conducive to the spread of behaviors (due to a lack of opportunities for reinforcement within network cluster and/or opportunities for spread across clusters through sufficient and multiple network pathways; see Centola and Macy 2007). The extent of consolidation seems to be particularly important to producing network structures that allow for diffusion: moderate levels of consolidation produce network structures that allow for diffusion across different levels of network homophily. Given that there is only computational evidence for this claim, future work can take up examining the relationship between consolidation and multiple opportunities for reinforcement (clustering) and sufficient pathways between clusters in a network (average shortest pathway and the width of bridges in a network) using other data sources. We might additionally theorize and examine which types of consolidation (i.e., the co-occurrence of which types of personal attributes) are most related to global network structure. Furthermore, there is little theory or empirical evidence regarding

the relationship between context and consolidation, which provides an opportunity for researchers.

**Part II: Linking Networks to Inequality**

Sociologists have long documented 'network effects' where alters' characteristics, resources, or choices shape ego's behavior. While a vast literature connects network effects to adoption and diffusion of behaviors (as reviewed in Centola's chapter for this volume), few studies to date connected network effects to patterns of social inequality (DiMaggio and Garip 2011, Durlauf and Ioannides 2010).

Several mechanisms give rise to network effects (DiMaggio and Garip 2012). Personal networks provide information or other resources that allow individuals to achieve desirable outcomes such as finding a job (Smith 2005). Apart from their instrumental value, peers exert behavioral influence that is not always towards strategic ends. Network peers apply rewards and sanctions to make individuals adopt beneficial behaviors or avoid risky ones (Christakis and Fowler 2008). Social networks, in some cases, incidentally modify the returns to a given practice. Wide-spread adoption of communication technologies, for example, makes those technologies all the more valuable to network members, and facilitates further adoption (DiMaggio and Garip 2011).

There are comprehensive accounts of network effects in different domains like education (Sacerdote 2011), migration (Boyd 1989, health (Pampel, Kruger & Denney 2010, and Smith & Christakis 2008), labor markets (Marsden & Gorman 2001), and political participation (Campbell 2013). This literature is too vast to cover comprehensively here. But the findings largely support the positive influence of network peers in school participation, performance, and social media adoption (Calvó-Armengol, Patacchini & Zenou 2009; Shepherd & Lane 2019); learning about migration opportunities (Haug 2008); choosing a medical provider (Pescosolido 1986), for mental health outcomes (Perry and Pescosolido 2015), using contraception (Behrman, Kohler, and Watkins 2002), and adopting healthy behaviors (Christakis and Fowler 2008); finding work (Marmaros and Sacerdote 2002, Peterson et al. 2000) and receiving good salaries (Seidel, Polzer and Stewart 2000); and civic participation (Lewis, MacGregor and Putnam 2013) and voting (Pattie and Johnston 1999). But, crucially, this work also identifies different characteristics of networks that shape interpersonal influence, and thus, produce differential outcomes for different individuals and groups. For example, while referrals by social ties are important to obtaining job opportunities in professional occupations (Fernandez, Castilla and Moore 2000), they are less commonly utilized or available in low-income occupations (Smith 2005, 2007). Similarly, while individuals' network positions in work environments are related to their likelihood of promotion, the value of different network positions is different for men compared to women (Burt 1998).

Here, we focus on describing the characteristics of networks that shape the extent of interpersonal influence, as well as its variation across individuals and groups. We cover those characteristics that are shaped by measurable aspects of the context (that is, those discussed in Part I above). In doing so, we aim to connect studies

exploring how context shapes networks (as reviewed in the previous section) with the vast literature on how networks affect behaviors and outcomes for individuals and groups. To the extent that behaviors assumed, or outcomes achieved, are positively related to individuals' life chances, network effects can shape patterns of social inequality. In connecting context to features and effects of social networks, we also suggest a practical direction for empirical studies. Given the dearth of network data, we speculate that researchers can turn to contextual attributes, as well as intervening factors (such as homophily and consolidation discussed above), as a proxy for network processes.[3]

Previous section discussed various aspects of the context (population structure, number and types of contexts, organizational practices, and indirectly, network homophily and consolidation) that shape features of personal networks (number and types of ties, characteristics of alters and ego, global structure). We now consider how these features factor into network effects (arrows 7 and 8, Figure 1), that is, adoption of positive behaviors (or avoidance of negative ones) through interpersonal interactions, and discuss the implications for differences between different individuals and groups, and ultimately, patterns of social inequality (arrow 9).

*How network characteristics shape network effects and social inequality*

Number of ties. An important feature of personal networks is the number of ties (or degree of a node). Empirical work finds the distribution of ties in a population to be nonuniform, with many individuals having few ties, and few individuals having many, approximating a power-law distribution (Barabási and Bonabeau 2003). In the United States, the average number of ties increases with education, and is higher for whites compared to blacks (Marsden 1987, McPherson, Smith-Lovin and Brashears 2006).

The number of social relationships an individual has can determine the extent of network effects s/he will be subjected to. Empirical work shows the number of ties to prior adopters increase the adoption propensity for several practices that can help individuals succeed, such as finding a job (Granovetter 1974) or adopting a new technology (Goolsbee and Klenow 2002). For these practices, individuals with larger networks, all else equal, are more likely to be exposed to prior adopters, and become adopters themselves, compared to their those with smaller networks. But, the size of a personal network can also turn into a disadvantage if it facilitates adoption of potentially harmful behaviors, such as substance abuse (Case and Katz 1991).

Given that large networks are more common among the more advantaged in the U.S. setting, beneficial practices (for which prior adopters provide crucial resources for adoption) can quickly become concentrated among the more educated and the rich. Indeed, empirical research documents growing inter-group inequality for many practices where adoption probability is proportional to the number of prior adopters in one's

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[3] From a methodological standpoint, the absence of network data allows us to estimate the total effect of the context on behaviors (rather than the residual effect left after accounting for the network-mediated effect) (see Pearl and Mackenzie 2018). Yet, without network data, it is not possible to fully test interpersonal mechanisms through which context shapes individual behaviors.

network, such as smoking cessation (Christakis and Fowler 2008), internet adoption (DiMaggio and Garip 2011), and participation in retirement savings programs (Duflo and Saez 2002).

Strength of ties. Interpersonal influence can also depend on the nature of ties between the nodes in a network. Granovetter (1974) famously argued that weak ties – those that are infrequently activated, and low in intimacy – provide access to novel resources, like information, that can help individuals get ahead. This argument conditions network effects (where alters matter to ego's choices) on the strength of the tie between ego and alter (a proxy for the potential for alter to bridge the ego to distant parts of the network).

Empirical work establishes network effects perpetrated through weak ties in job search (Ericksen and Yancey 1987, Lin, Ensel and Vaughn 1981), adolescent dating and drinking behavior (Kreager and Haynie 2011), and various health outcomes (Smith and Christakis 2008). But studies also report evidence for the importance of strong ties for outcomes, and in particular, in economically insecure communities (Stack 1974). Research notes significant differences in the effects of weak ties across social groups, with minorities (Smith 2005) and women (Burt 1998) benefiting less from weak-tie or bridging connections.

Characteristics of network alters. For many practices, network effects depend not just on the quantity and quality of ties, but also on the characteristics of alters. Researchers show ties to high-status individuals to lead to more prestigious jobs (Lin, Ensel and Vaughn 1981), promotions at work (Burt 1998), better access to health care (Freese and Lutfey 2011), and stronger discouragement from unhealthy habits (Christakis and Fowler 2008). Any contextual factor that distributes ties to different kinds of network alters, then, shapes inter-group differences in behaviors and outcomes, and to the degree that those behaviors and outcomes shape life chances, also alter patterns of inequality. Bias towards homophily or residential segregation, for example, can cluster together individuals of similar characteristics, and therefore, concentrate stronger network effects among the already advantaged.

Characteristics of ego. Network effects are also contingent on the characteristics of the ego; the distribution of characteristics depends on the context. Higher-status individuals typically get more returns to their network connections. Individuals with high socio-economic status, for example, are more likely to use their networks to find a job compared to their lower-status counterparts (Smith 2005), and also to land better-quality jobs by doing so (Lin 1999, Ioannides and Loury 2004). Similarly, men benefit more than women from using networks in labor market outcomes (Burt 1998, Ensel 1979), and whites more than African-Americans in the U.S. context (Korenman and Turner 1996; Smith 2005). High-achieving students reap greater returns from having other high-achieving peers in the classroom (Hoxby and Weingarth 2005). And migrant men receive higher returns to ties to co-ethnics in the migration destination than do migrant women (Hagan 1998). The superior ability for high-status individuals to reap benefits from their networks, as demonstrated in these empirical studies, charts a clear pathway for network effects to accumulate to higher levels of social inequality.

Global network structure. While the majority of work on network effects in sociology focuses on ego-centric ties, some studies point to the importance of network topology for the diffusion of behaviors. Watts (1999) and Watts and Strogatz (1998) define 'small worlds' – networks with high local clustering and short global separation – that quickly disseminate information. Centola and Macy (2007) show that networks with 'wide bridges' are ideal for 'complex contagion', that is, spreading of practices that require reinforcement from multiple network peers. But, it is difficult to empirically link different network topologies to variations in network effects, as such a link requires comparable data from multiple networks. To overcome this difficulty, Centola (2010) creates artificially structured online communities, and shows stronger network effects in the diffusion of health behaviors with purposive clustering of networks to facilitate complex contagion.

## Applications

In order to illustrate the added value of thinking of the parts of this model holistically, we discuss two empirical contexts: student academic achievement in schools and migration from communities. We show the analytical value of an integrated perspective in illuminating glaring gaps in theory and evidence, and in suggesting novel hypotheses that call for empirical scrutiny.

### Student Academic Achievement

A persistent concern for scholars of inequality is what happens within schools that produces alignments between particular social identities (e.g., race and ethnicity, gender), resources (e.g., economic, parental social and cultural capital), and student achievement, whether measured in terms of standardized tests, grades, or future educational and income trajectories. We suggest that considering all of parts of the conceptual model allows us to further theorize the mechanisms underlying observed relationships, to interpret existing findings, and to ask new questions.

Completing the context-networks-outcomes chain helps us generate hypotheses. For example, Moody (2001) illustrates the first part of the causal chain: how context in the form of school size and racial composition, the extent to which social interaction is concentrated within grades, and organizational practices that shape interactions (extracurricular activities and academic tracking), affects racial segregation in friendships. We might then ask what the implications for such racial segregation in friendships are in terms of differential network diffusion: how does information about homework or studying techniques spread or fail to spread between students with different social identities within the school? How is this differential diffusion at the individual or group level conditioned by the global structure of the school?

Frank et al. (2008) illustrate the latter part of the causal chain: students' positions within network clusters and the academic behaviors among students in those clusters help explain which girls achieve academic success (assessed in terms of math courses), producing more similar outcomes within these local network positions and divergent outcomes between them. We can ask: what characteristics of school context produce more or fewer of these local network positions? What features of context

shape which students get sorted into which positions in the school? These types of questions allow us to transcend the specificity of our datasets and samples, to consider larger contexts that bring those conditions into existence.

Thinking about context, networks, and inequality as part of one chain may also allow us to better situate existing findings. For example, Crosnoe, Cavanaugh, and Elder (2003) find that students whose friends are academically oriented behave in ways more conducive to learning and academic success. The extent of this network effect on student academic effort does not depend on the race of the student, but it does depend on the extent of economic disadvantage in schools. Put differently, the authors find a differential peer influence effect such that having academically oriented friends in low-performing schools exerts more of an influence on behaviors relevant to school performance than does having academically oriented friends in high-performing schools. We can use our proposed chain to better understand what is it about economic disadvantage that might be linked to the extent and nature of interactions between students. For example, one way the authors operationalize school disadvantage in that study is using school size, which we know is associated with both population parameters and network characteristics. How might other manifestations of economic disadvantage in schools, for example, having older and often more crowded buildings, shape the extent and nature of interactions between students? Using data from 56 public middle schools in New Jersey (see Paluck, Shepherd, and Aronow 2013), we find a strong relationship between physically crowded conditions and school disadvantage. We can ask what these interactional features of school disadvantage create particular network characteristics that change extent of peer influence.

*Migration Decisions*

In developing regions of the world, migrating to a city or to another country provides an important strategy to improve individuals' economic prospects. While achieving prosperity (or avoiding destitution) is not the only reason to move, it is certainly a major one (Garip 2016). Research considers characteristics of the context – such as population size (Entwisle et al. 2007), economic and social organization (Fussell and Massey 2004), presence of institutions like schools and community centers (Curran et al. 2006) – as important to migration decisions. Research also shows migrant networks – web of relationships connecting migrants in destination to people in origin – to be important conduits for resources or interpersonal influence that increase likelihood of further migration (Massey 1990).

Thinking of context, networks, and outcomes together allows us to identify the mechanisms implicit in observed relationships. For example, studies demonstrate vast variation (or inequality) in migration rates out of economically and demographically similar communities (Garip 2008, 2014). Research also finds sustained migration flows between specific origin-destination pairs (Durand, Massey and Zenteno 2001), connecting these patterns to characteristics of sending and receiving contexts. Riosmena and Massey (2012), for instance, show that economic structuring simultaneously occurring in Mexico and the United States is associated with where migrants originate from as well as where they are headed to across the border. But,

attributing such patterns to economic factors alone runs the risk of overlooking the social process of migration decision-making that is well established in the literature. Linking these strands of work pushes us to consider how context translates into individual choices. For example, we can ask: How do social relationships mediate links between context (for example, its economic organization) and migration choices? Or, how does context change the features of social ties (for example, by clustering individuals into particular social units) in ways that contribute to migration patterns?

In addition to bringing network theorizing into context-based explanations of migration, we can also take the opposite route, and bring context into studies of migrant networks. This effort, we suggest, forces us to specify the scope conditions of our arguments, and consider their dependence on the characteristics of particular contexts.

It is worth noting that, in the migration literature, network processes are largely assumed, but not always captured with data on actual relationships. Rather, the presence of migrants in a social unit (such as community) is often taken as a rough proxy for the size of networks available to prospective migrants (e.g., Massey and Espinosa 1997, Curran and Rivero-Fuentes 2003). In a similar vein, the characteristics of prior migrants (most notably, gender) are used to differentiate presumed network effects. Curran et al. (2006), for example, show that former trips by female migrants are positively associated with both men's and women's migration in Thailand, while trips by male migrants are related only to men's migration.

Studies that focus on the social process of migration decisions would benefit from thinking further about how the context might impact network features and effects. For example, agricultural communities might induce stronger and denser links among households (especially if households need to collaborate in production as is the case in many developing country contexts). In such communities, former migrants might induce larger influence on the mobility of prospective migrants. Similarly, the gender composition of migrant networks might affect migration patterns differently in urban areas compared to rural villages, where gender norms tend to be stronger and more rigid. These examples, we hope, illustrate how an integrated approach to context-networks-migration linkages opens up new avenues of inquiry, and inspires original questions on an outcome that is central to inequality in both migrant-sending and migrant-receiving countries.

**Discussion**

There is growing interest among social scientists in how social contexts and social relationships contribute to patterns of inequality. Contexts (which we understand as social units within which individuals interact) determine the kinds and numbers of people we meet, how we relate to them, and how we are influenced by each other. The structures of social relationships, in turn, shape who has access to resources or influences that matter for critical life outcomes. Despite this natural connection between contexts, social networks, and outcomes, existing analytical approaches have largely separated this causal chain into two separate parts. While one strand of the literature has focused on linking contexts, such as schools (McFarland et al. 2014) and

organizations (McPherson and Smith-Lovin 1987, Small 2009) to features and structures of social ties, another line of work has focused on linking social relationships, and interpersonal influences (network effects as we call them), to differential choices and outcomes between individuals and groups (Smith 2005, Garip and DiMaggio 2011).

In this chapter, we have argued for bringing these two strands of research together. We first reviewed evidence on how different characteristics of context – population size and composition, number and kinds of social foci, and organizational practices –  feed into features and structures of social networks. We then covered examples of research showing how those network features (number of ties, characteristics of alters), as well as the overall structure of relationships (for example, density and clustering), contribute to distributions of outcomes in the population. We presented the implications of taking a more integrated approach, and thus explicitly linking contexts, networks, and outcomes, for research on two questions central to our respective substantive interests: student academic achievement and migration choices. We argue that considering the full chain of linkages allows us to expand our arguments beyond the cases we study (for example, by asking how school context might contribute to observed links between social ties and academic achievement), and also identify the mechanisms underlying key relationships (for example, by considering how migrant networks intervene in the effect of economic organization on migration decisions). We suggest these questions as fruitful paths of future inquiry.

Yet we also recognize the dearth of data (especially on comparable social networks from multiple contexts) that presents a clear obstacle to moving forward in these directions. We argue that an integrated approach is useful even in the absence of the possibility of direct measurement of social networks, as it pushes researchers to clarify the contextual (or network-based) assumptions underlying their arguments. For example, a researcher with network data from a single context might still discuss how features and structure of that network might be specific to a given context, and suggest hypotheses that other researchers can test with different data. Or, a researcher lacking network data, but seeking to connect context to an outcome, might still lay out potential relational mechanisms shaping individual outcomes. Such efforts, if consistently pursued, allow us to move away from reverting to rational-choice based explanations for observed patterns, and develop a more sociological account of individual choice.

Here, we also speculate on a particular direction research might move in to circumvent issues related to lack of network data. Classical sociological work has long theorized the potential of population parameters – such as tendency for individuals to connect with similar others (homophily) or the correlations between different social attributes (consolidation) – to shape social networks (Blau and Schwartz 1984). Recent computational evidence has further shown such parameters to shape global structure of networks, and ultimately, network-based diffusion of behaviors (Centola 2015, Zhao and Garip, forthcoming). Crucially these parameters can be captured with socio-demographic data available in most surveys. For example, distribution of different attributes in a population might serve as a proxy population homogeneity (closely related to homophily), while the correlations between attributes might measure the

degree of consolidation. Including these parameters in analyses might allow researchers to partially account for structural properties of networks (for example, the degree of clustering or density). Yet, in order to move in that direction, we need further empirical evidence showing the implications of these population parameters for the structure of real-life networks. We also need more theorizing and evidence on how characteristics of contexts are related to population parameters. We can then begin to unpack the complex connections between where we spend our lives, who we relate to, and how we affect, and are affected by, one another, and answer why only some of us benefit from our social relationships to improve our social and economic standing. Answers to these questions can serve to build a uniquely sociological account of social inequality.

**Appendix.**
[Table A1]

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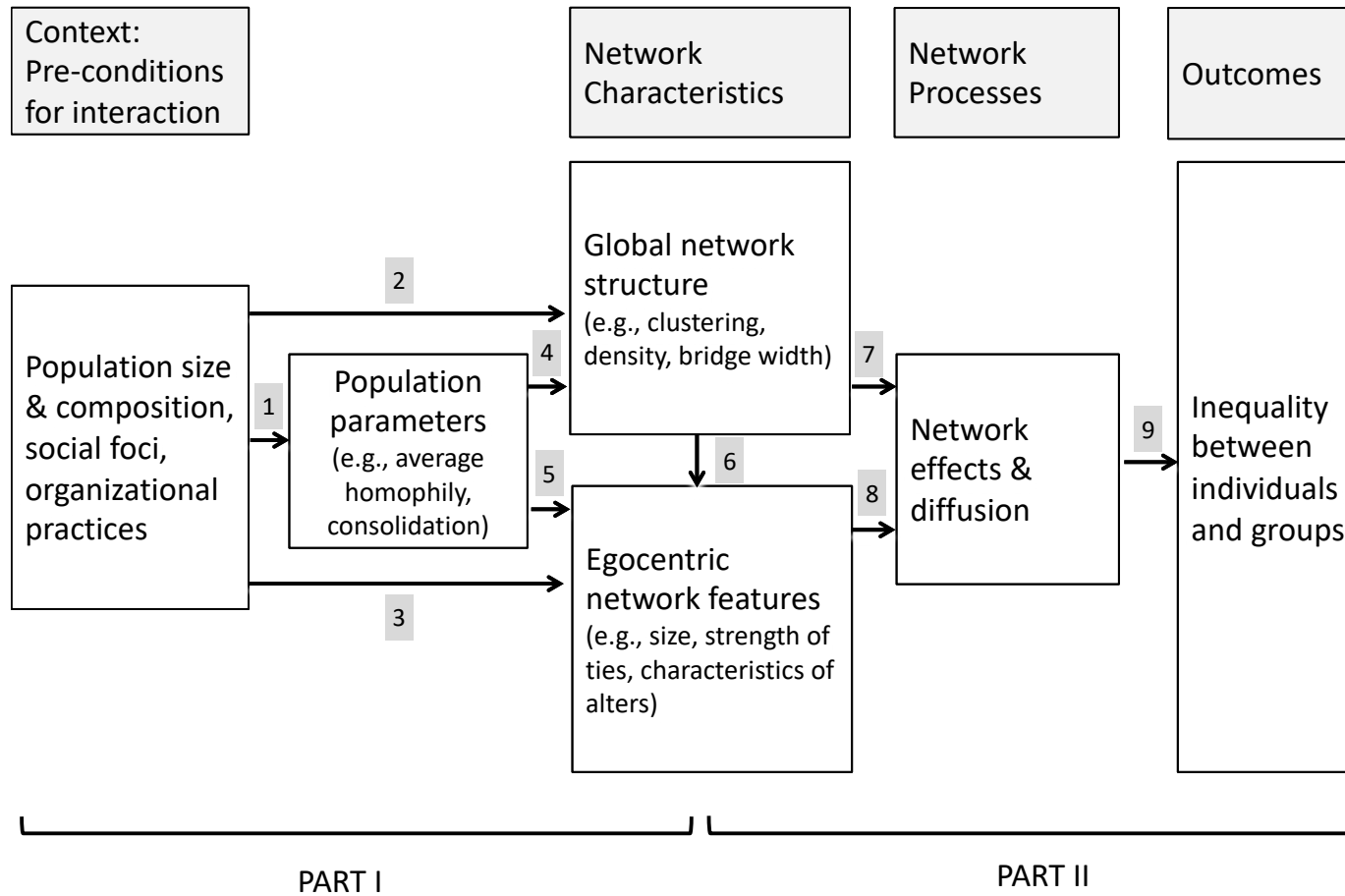**Figure 1 Theoretical links between Context, Networks & Outcomes**

**Table A1. Selected research linking context, networks, and inequality.** (Gray-shaded numbers correspond to the arrows in Figure 1.)

**I. CONTEXT TO NETWORK CHARACTERISTICS**

**2 CONTEXT TO GLOBAL NETWORK STRUCTURE**

**Population size** related to **density of ties.**
United States population: Marsden (1987)
Canadian communities: Richardson et al. (1979)
Thai villages: Entwisle et al. (2007)

**Population size** related to **clustering of ties.**
U.S. schools: McFarland et al. (2014)

**3 CONTEXT TO EGOCENTRIC NETWORK FEATURES**

**Population size** related to **number of ties.**
Canadian communities: Richardson et al. (1979)

**Number of foci** related to **number of ties.**
Extracurricular school activities: McFarland et al. (2014)

**Organizational practices** related to **number of ties.**
Daycare centers: Small (2009)

**4 POPULATION PARAMETERS TO GLOBAL NETWORK STRUCTURE**

**Homophily** related to **clustering** (and searchability).
Formal model & experimental data: Watts et al. (2002)

**Homophily and consolidation** related to **bridge width.**
Simulated data: Centola (2015)

**5 POPULATION PARAMETERS TO EGOCENTRIC NETWORK FEATURES**

**Consolidation** related to **characteristics of alters.**
Intermarriage in the United States: South and Messner (1986)

**6 GLOBAL STRUCTURE TO EGOCENTRIC NETWORK FEATURES**

**Density of ties** related to **characteristics of alters.**
United States population: Marsden (1987)

**Clustering of ties** related to **characteristics of alters.**
University networks: Kossinets and Watts (2006)

**II. NETWORK CHARACTERISTICS TO NETWORK PROCESSES & OUTCOMES**

**7 GLOBAL NETWORK STRUCTURE TO NETWORK EFFECTS**

**Clustering of ties** related to **diffusion of behaviors.**
Formal models: Watts & Strogatz (1998)

**Bridge width** related to **diffusion of behaviors.**
Simulated data: Centola (2015)

**8 EGOCENTRIC NETWORK FEATURES TO NETWORK EFFECTS**

**Number of ties** related to **network effects.**
Adopting technology: Goolsbee and Klenow (2002)

**Strength of ties** related to **network effects.**
Finding a job: Granovetter (1974)

**Characteristics of alters** related to **network effects.**
Internal migration in Thailand: Curran et al. (2006)
Adolescent drinking: Kreagar and Haynie (2011)
Promotion at work: Burt (1998)

**9 NETWORK EFFECTS & DIFFUSION TO INEQUALITY**

**Network effects** related to **inequality.**
Internet adoption: DiMaggio & Garip (2011)
Academic performance: Calvó-Armengol et al. (2009)
Health outcomes: Christakis and Fowler (2008)