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Network closure and integration in the mid-20th century American mafia

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ABSTRACT

Criminal networks are thought to be biased toward decentralization and security rather than integration and efficiency. This article examines this tradeoff in a large-scale national criminal network spanning more than 700 members of 24 distinct American mafia families operating in the mid-20th century. Producing a novel network image of the American mafia as a set of highly differentiated yet intertwined islands of criminal activity, the analysis uncovers a small-world structure that allowed both for strong intragroup closure and high intergroup connectivity. This balance reflected a division of network labor in which integrative bridging connections were disproportionately concentrated among a small number of criminals. Furthermore, the criminals who held such bridging ties tended to be either low- or high-status—but not of middling status—within their respective organizations.

1. Introduction

A long line of research on criminal and covert networks has emphasized the critical tradeoff between efficiency and security (Baker and Faulkner, 1993; Erickson, 1981; Morselli et al., 2007). On one hand, efficient communication across network structure—facilitating timely collective action—depends on low average path lengths, meaning that most nodes can be reached from others either directly or through just a few intermediaries. On the other hand, the integrative ties enabling such efficiency can also make the network less secure when one "discovered" node can easily lead to the discovery of many others.

While previous work has generally analyzed this tradeoff in the context of networks surrounding individual criminals, covert organizations, or conspiratorial incidents (e.g. Baker and Faulkner, 1993; Campana and Varese, 2013; Morselli, 2005; Morselli et al., 2007; Papachristos and Smith, 2014), the same logic of efficiency and security can be applied to the organization of relations *across* criminal organizations. To this end, this article draws on a unique database compiled in 1960 by the Federal Bureau of Narcotics containing biographical information on 726 prominent members and associates of Italian-American mafia—or "Cosa Nostra"—families operating in the mid-20th century United States. Using organizational charts produced by contemporaneous U.S. Senate investigations—together with label propagation techniques from computer science to fill the gaps in the historical record—I map the individual criminal profiles onto membership in 24 mafia families. Based on ties of criminal association identified in these profiles, I produce a novel network image of the mid-century American mafia as a set of highly differentiated yet intertwined islands of criminal activity.

In making this empirical advance, I theoretically extend the efficiency-security tradeoff to the analysis of inter-organizational relations through the concept of network *modularity* (Newman, 2006; Newman and Girvan, 2004). While some criminal industries—such as the distribution of narcotics—require coordination across geographic space, the extensive network ties required for such coordination may make the network less secure by allowing the discovery of any one conspirator to implicate multiple organizations. Yet the absence of bridging ties between organizations makes intergroup coordination impossible or, at the least, inefficient. Capturing this balance, modularity measures the fraction of network ties occurring *within groups* compared to the fraction one would expect in a randomly constructed network of the same size and degree distribution. Thus, high modularity in an inter-organizational criminal network suggests a stronger emphasis on organizational security rather than transactional efficiency.

The analysis finds that the mafia network featured extremely high levels of clustering by group or family. Following the logic of Watts and Strogatz's (1998) "small-world" theory, however, it also turns out that a relatively small number of "bridging" connections was sufficient to ensure relatively low average path length

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between members of different families. While this structure is broadly consistent with previous observations of criminal networks (e.g. Morselli, 2009), the key is to identify the criminal "brokers" who link together the disparate clusters by forming bridging ties beyond their own group (e.g. Baker and Faulkner, 1993; Klerks, 2001; Krebs, 2002; Natarajan, 2006; Morselli, 2009, 2009; Bouchard and Nguyen, 2010; Bright et al., 2012, 2015; Calderoni, 2012; Mancuso, 2014; Papachristos and Smith, 2014; Mastrobuoni, 2015). To this end, I show that—rather than widely dispersed—the key network bridges were disproportionately concentrated among relatively few actors. Furthermore, I find that the occupancy of such inter-organizational brokerage positions features a U-shaped correlation with status and centrality *within* organizations, suggesting that brokerage roles were generally taken either by especially low- or high-status—but not middle-status—actors. This apparent pattern of "middle-status conformity" (Phillips and Zuckerman, 2001) in the occupancy of brokerage positions sheds important light on the potential mechanisms allowing for interconnection between criminal organizations. In particular, to the extent that brokerage is avoided by middle-status members of a criminal group, we might suspect that inter-organizational integration reflects individualistic enterprise—and even a form of deviance from group expectations—rather than group-level coordination.

The remainder of the article proceeds as follows. The second section provides theoretical motivation of the mechanisms underlying the tradeoffs between efficiency and security and between intra-group cohesion and intergroup connectivity in criminal networks. The third section provides historical and empirical background for the present study of mid-20th century American mafia families. The fourth section introduces an archival dataset that allows us to re-create the network of relations within and between these families. The fifth, sixth, and seventh sections present results from three sets of network analyses. The first analysis uses the concept of network modularity to demonstrate the extent to which intrafamily closure dominated the American mafia's network structure. The second analysis shows that, despite such closure, the national network was nonetheless marked by high intergroup connectivity and integration. Taking up this puzzle, the third analysis shows that this integration was enabled by a *division of network labor* in which intergroup bridges were disproportionately maintained by a relatively small number of actors, and that the occupancy of such bridges was nonlinearly correlated with one's status within the family hierarchy. The eighth section concludes.

2. Secrecy, trust, and closure

Erickson (1981) defines a *secret society* "in social network terms as a persisting pattern of relationships which directly or indirectly links the participants in related secret activities" (p. 189). Baker and Faulkner (1993) describe the *security* imperative in such covert networks thusly: "When a secret society works properly, the larger society remains unaware of its existence. If a secret society is discovered and investigated, its organizational structure should offer protection by making it difficult to unravel the conspiracy" (p. 843). The imperative for *efficiency* in the structure of such networks is that the pattern of relationships linking members together must enable them to communicate and coordinate for whatever purpose (e.g. carrying out a planned attack or consummating an illegal transaction) the network exists. As Morselli et al. (2007) put it: "At some point, the hidden group must step forward and execute a crime" (p. 144).

Security in the covert network can be enhanced through both top-down and bottom-up mechanisms. In his classic essay on the subject, Simmel (1950) highlights top-down organizational features that help to keep the "secret society" secret. Chief among these is a rigid hierarchy that de-individualizes particular members and insulates leaders from the rank-and-file. In addition to socializing members into the group and its purposes (a process that is also often aided by elaborate initiation rituals), limitations on direct communication among members also ensure that the discovery of any one member is unlikely to lead to the discovery of many others (Baker and Faulkner, 1993). Thus, covert networks are often thought to be sparse and decentralized in structure.

Erickson (1981) emphasizes on-the-ground conditions that lead individual members of the secret society to build networks aimed toward trust and closure rather than openness and integration. Based on a comparative analysis of six cases—including the Lupollo mafia outfit chronicled by Ianni and Reuss-Ianni (1972)—Erickson highlights variation in social structure stemming from the riskiness of the conditions faced by the group. Risky conditions, she argues, make it especially important to rely on pre-existing networks of relationships. With each new member who is recruited to the secret group, both the *recruiter* and *recruited* are at risk of being exposed and betrayed by the other. Accordingly, recruitment of new members and the formation of new covert ties proceeds along paths of existing relations, where the prior contact between recruiter and recruited provides a measure of trust. Furthermore, the ties most likely to provide this requisite trust are parochial "strong" ties, such as those within kinship groups. Consequently, network ties formed in the context of criminal or covert activity are unlikely to be the "weak" ties that bridge large gaps between distant social groups lacking a previous basis for connection (Granovetter, 1973).

In the context of criminal networks spanning multiple organizations, Erickson's (1981) argument for heavy reliance on strong ties and pre-existing relations suggests that members will be especially likely to focus on building ties within—rather than across—organizations. There is a *transaction cost* to identifying trustworthy partners for exchange outside of one's own group. Within the organization, dense social networks and hierarchical authority can combine to discourage malfeasance and ensure conformity to group expectations. Beyond these organizational boundaries, however, one must increasingly rely instead on interpersonal trust lacking such built-in assurances. In clan-like groups that emphasize commitment and loyalty, furthermore, there is a potential *reputation cost* to building one's network around ties with "outsiders" (Xiao and Tsui, 2007). There is also an *opportunity cost*—time and effort spent cultivating one relationship implies foregone opportunities to cultivate others. To the extent that ranks (and the resources associated with them) are distributed through internal labor markets within organizations (Gambetta, 1993), we should expect greater return on one's social investment from interactions within group boundaries.

For these reasons, we should expect an inter-organizational criminal network to feature a strong bias toward *social closure* in which intra-group connections dominate the network's structure. This closure can decrease the efficiency of the network when members of one group are foreclosed to communication and potential coordination with individuals in other regions of the network. In extreme cases, individual groups might appear in the network as "caves" disconnected from others. Perhaps more likely, they can resemble a chain of islands with high internal cohesion balanced by a modest number of bridges linking the groups together. The task of this article is to describe—and begin to explain—this balance between closure and integration in the context of a geographically widespread inter-organizational criminal network.

3. The mid-20th century American mafia

In May of 1950, the U.S. Senate formed a special committee led by Tennessee Senator Estes Kefauver to investigate the extent

of organized crime's influence on interstate commerce. Over the course of one year, the Kefauver Committee heard testimony from more than 600 witnesses in 14 cities (U.S. Senate, 1951). The conclusions drawn by Kefauver and his colleagues would ignite decades of subsequent debate. The committee's report read: "There is a nationwide crime syndicate known as the Mafia...Its leaders are usually found in control of the most lucrative rackets in their cities. There are indications of a centralized direction and control of these rackets" (quoted in Bell, 1953, p. 143). Kefauver's assessment invited quite understandable skepticism, including from sociologist Daniel Bell: "Unfortunately for a good story—and the existence of the Mafia would be a whale of a story—neither the Senate Crime Committee in its testimony, nor Kefauver in his book, presented any real evidence that the Mafia exists as a functioning organization" (ibid.).[1] The subsequent scholarly debate is often characterized as positing either *bureaucratic* organization—featuring hierarchical structure and centralized control (e.g. Cressey, 1969)—or *patrimonial* organization—featuring loose patronage structures rooted primarily in kinship and other local relationships (e.g. Ianni and Reuss-Ianni, 1972)—as the foundation of social and economic structure in organized crime.

Subsequent investigation—including the published confession of New York mafioso Joseph Valachi (Maas, 1969)—refined the bimodal arguments. On one hand, Bell was correct in disputing the existence of a single "functioning organization" controlling American-Italian organized crime in all major cities. Valachi described a much less centralized structure comprised of many independent criminal organizations, more commonly termed "families." Each family was generally governed according to an internal hierarchy that usually featured a boss, several *caporegimes* (captains), and soldiers reporting to a *caporegime*. The simplest evidence that these families did not comprise a single overarching organization is that one could not simultaneously be a member of multiple families.

Like their Sicilian progenitors, however, American families formed a loose confederation based on mutual recognition (Paoli, 2003). One of the earliest pieces of evidence for some degree of national coordination came in 1957 when federal officers raided a farm in Apalachin, New York, where more than 50 prominent mafiosi from locales as far-flung as Tampa, Los Angeles, and Denver had assembled for a national meeting. Valachi later attested to the existence of a national Commission on which the most prominent mafia bosses in the United States sat. In fact, this Commission had existed since at least the 1930s, two decades before a similar body first emerged among Sicilian families (Maas, 1969; Paoli, 2003). Though often misconstrued as a "board of directors" or ruling council imposing organizational unity across mafia families, the Commission's main function was apparently that of an informal conduit allowing bosses to coordinate joint ventures, mediate disputes between families, report on the initiation of new members, and foster exchange with counterpart families in Sicily and southern Italy (Abadinsky, 1983).

The standard mafia racket (i.e. the provision of "protection") featured a large degree of centralized control: individual mafiosi gained access to the racket—a license to operate—as a form of patronage from their more powerful superiors within the family (Paoli, 2003). As noted by Reuter (1983), however, other rackets lacked such top-down regulations on access and participation. This was particularly true of rackets that required coordination across geographic distance and thus could not be easily managed by one local family. For example, the drug trade was highly decentralized and featured participation from many rank-and-file mafiosi but few high-ranking leaders, since the latter often held the drug racket in poor regard (Gambetta, 1993; Maas, 1969).

In principle, the mafioso was free to form ties with partners both inside and outside of the family (Abadinsky, 1983; Gambetta, 1993; Maas, 1969; Paoli, 2003; Reuter, 1983; Haller, 1992). The mafioso depended on the family organization for resources and patronage but was otherwise relatively autonomous in business dealings. Yet, there were limits to this autonomy. Families maintained monopolistic control over certain rackets and administered privileged access through personalistic patron-client ties. Within the family, one's access increased with rank in the group hierarchy. One moved up the ladder, in turn, by currying favor with the group leadership, often with ostentatious displays of loyalty (Gambetta, 1993). Finally, family membership was "greedy" and exclusive (Coser, 1974)—the mafioso could only belong to one family. By thus internalizing and restricting the distribution of resources within the criminal organization, families were able to encourage commitment and loyalty among their members.

4. The American mafia network

Network analysis of the relationships both *within* and *between* families offers a promising avenue for further investigating the balance between bureaucratic and patrimonial organization—and, more broadly, between networked interconnection and local closure—in the American mafia. In taking this approach, the present article builds on previous work investigating mafia networks in Europe (e.g. Berlusconi, 2014; Calderoni, 2014; Scaglione, 2011; Varese, 2006) and the United States (e.g. Mastrobuoni and Patacchini, 2012; Mastrobuoni, 2015; Papachristos and Smith, 2014; Smith and Papachristos, 2016), as well as previous work on inter-group relations in criminal networks more generally (Malm et al., 2011; Malm and Bichler, 2011). Most importantly, this previous work emphasizes the degree to which network structure in organized crime conforms entirely to neither bureaucratic nor patrimonial modes of organization, but is rather contingent, variable, and fluid depending on circumstance (also see Lombardo, 1994).

The network data set for the present study comes from a dossier produced in 1960 by the Bureau of Narcotics. The dossier contains profiles for 726 individuals residing in the United States who were known members or affiliates of American-Italian mafia families and still alive as of 1960.[2] Though there were only fifty copies originally produced and distributed within the Bureau, a facsimile of the dossier was declassified and published in 2007 (Bureau of Narcotics, 2007; Mastrobuoni and Patacchini, 2012).

Each profile includes a list of the person's known criminal associates. These ties of criminal association are different from ties of direct communication gathered through wiretaps and similar records. Rather than focusing on any single instance of communication, the ties of criminal association are meant to capture the broader array of relationships facilitating collaboration in criminal affairs among mafiosi. They also reflect the local knowledge of investigators, since the Federal Bureau of Narcotics in particular was known to have undercover operations in major mafia families (Maas, 1969). As pointed out recently by Agreste et al. (2016), reconstructions of mafia networks from wiretaps and related communication records—despite the many insights gleaned from such studies—are limited by the fact that the criminals known to rank most highly in the organization seldom appear most centrally in the communication network. This is not the case for the network of criminal association studied here, in which bosses and other

[1] For more examples of this early debate, see Anderson (1965), Cressey (1969), Albini (1971), and Gallhier and Cain (1974).

[2] The dossier also contains a smaller number of mafiosi residing outside the United States. Since exploratory analysis suggested that the non-U.S. mafiosi were largely separate from the U.S.-based families, I exclude them here.

high-ranking mafia leaders consistently occupy more central roles in the network (these analyses are available upon request from the author). Still, we should be cognizant of the many ways in which the source of criminal network data can impact the resulting structures (Rostami and Mondani, 2015). To this end, one apparent benefit of the Bureau of Narcotics data set is that its ties of criminal association clearly draw from a combination of available information from intelligence and investigations, criminal co-offending, and even collaboration in legal enterprises, thus lessening the risk of "missing" important connections.[3]

In previous work, Mastrobuoni and Patacchini (2012) have independently introduced and analyzed the American mafia network as reconstructed from the Bureau of Narcotics dossier (also see Mastrobuoni, 2015), focusing particularly on the demographic correlates of individual status and centrality in the network. Among other findings, they show that the most central mafiosi tended to be those who were older, Sicilian born, connected to diverse illegal and legal enterprises, and tied to other mafiosi through intermarriage and kin relations. While this analysis has many merits, it only indirectly addresses the question of closure and integration *across* mafia families. Indeed, Mastrobuoni and Patacchini (2012) explicitly show that the ties of intermarriage focused upon in their analysis appeared to solidify alliances within already-established network clusters rather than bridging larger distances and producing network integration (p. 34). More crucially, Mastrobuoni and Patacchini (2012) do not explicitly map individual mafiosi to the family organizations to which they belonged, meaning that their analysis does not directly analyze interorganizational network structure. In contrast, I approach this question directly by drawing on both historical sources and computational induction to map individual mafiosi to the known mafia organizations with which they were affiliated, and then analyzing the resulting structure of relations across these organizations.

I first generate the network of ties between mafia criminals by linking any two individuals connected by a tie of criminal association. Since "association" implies a bi-directed tie, I do not require that *both* individuals appear in the other's list; rather, any two individuals are tied if one appears in the other's list of criminal associates. The asymmetry in which person A appears in person B's list but B does not appear in A's list usually reflects the dossier creators' attempts to prioritize associates based on the closeness of the tie or the relative importance of the person being listed. The lists of criminal associates in some cases include individuals not profiled in the dossier.[4] I exclude these ties and focus instead on the network of relations among profiled mafiosi. I also exclude from the network 19 "isolates" lacking ties of criminal association with any other profiled criminals. This leaves a network of 707 individuals with 2,801 total ties among them and an average degree of 7.92. The network is well-connected: All but five mafiosi are contained in a single large connected component in which any node can be reached from any other.

Having reconstructed the network of ties between individual mafiosi, the next task is to match each individual to an affiliated mafia family. Since mafiosi could only belong to one family, furthermore, these inferred memberships must be exclusive. Drawing on previous work and archival sources (Maas, 1969; Paoli, 2003; U.S. Senate, 1963, 1988), I identify 24 families represented in the Bureau of Narcotics dossier.[5] For most nodes, we can infer family affiliations directly from archival sources. First, the dossier describes many mafiosi as belonging to the family in control of a particular city. Since most cities had only one mafia family, this information is sufficient to infer family memberships in most cases. However, New York City had five families and Miami was an "open" city occupied by mafiosi from several families. U.S. Senate (1963) includes organizational charts with known memberships of the five N.Y.C. families as well as several others. Together, the Federal Bureau of Narcotics dossier and Senate records provide confirmed family affiliations for 478 of 707 nodes.

A total of 229 nodes remain unlabeled from archival sources, meaning that we need other means for assigning them to the mafia families with which they were primarily affiliated. To this end, I employ a computational technique known as *label propagation* that categorizes unlabeled nodes according to the dominant affiliations among their network neighbors (Raghavan et al., 2007). The 478 previously labeled nodes act as "seeds" with fixed labels. Then, one unlabeled node is selected at random and adopts the modal label from among its network alters. If two or more labels are tied in popularity, each has an equal probability of being selected. This continues until every node has acquired a label. In addition to the random breaking of ties between equally popular labels in a given node's neighborhood, classification solutions can also vary across runs of the algorithm due to the random order in which nodes are chosen to adopt a label. To account for this stochasticity, I compared many independent runs of the algorithm and found high classification agreement (Rand index >.95) in all examined cases. Despite the general consistency of these outcomes, I still conducted 100,000 independent replications and classified nodes according to their modal label across all replications.

Table 1 gives membership counts for all 24 families both before and after this procedure. Unsurprisingly, there is wide variation in family size, including several very large New York families (particularly the Genovese, Lucchese, and Gambino families), sizable Midwest contingents in Chicago and Detroit, moderately sized outfits in cities such as New Orleans and Los Angeles, and a number of smaller groups—including the Springfield family with just two identified affiliates—in other locales. As expected, furthermore, the main effect of the label propagation routine is to identify main families of affiliation for New York-based mafiosi whose primary allegiances among the five N.Y.C. families were previously unclear from archival sources.

5. Modularity and group closure

Since the network is expected to feature a strong bias toward intragroup closure, we should expect network ties to be heavily concentrated *within* rather than *across* family boundaries. To assess

[3] As pointed out by Rostami and Mondani (2015), however, there are other biases that might remain, particularly those stemming from anchoring and "halo" effects.

[4] In nearly all such cases, the un-profiled criminal only appeared in one profiled criminal's list of associates. In the cases where a single un-profiled criminal appeared in multiple lists, I typically found that the person had either recently deceased or had become less active in mafia affairs by the time the dossier was compiled. Finally, while the lists of criminal associates include redacted names, contextual clues suggest that the redactions targeted people who were not themselves profiled in the dossier.

[5] Estimates can vary based on the classification of smaller mafia outfits as either independent families or subsidiary "crews" of another family. I have made several coding decisions in this regard. First, I include mafia affiliates from the Rochester and Utica-Rome areas of New York as part of the Buffalo family. Rochester was only regarded as an independent family in later years. While the Utica-Rome faction seems to have operated with some degree of autonomy, the faction leader was usually regarded as a capo in the Buffalo family rather than an independent boss. Following evidence presented in Joseph Valachi's U.S. Senate testimony (1963), I code the Newark group as a faction of the Genovese family. While the Springfield, I.L. group is sometimes regarded as a faction of the Chicago family, I code it separately based on Valachi's categorization of Springfield leader Frank Zito as a mafia boss and by the fact that Zito represented himself independently at the 1957 Apalachin meeting (Maas, 1969). Also, while historical accounts say little about the Omaha group, I have coded them as a separate family due to the lack of evidence for any affiliation with other families (in fact, the five-person Omaha group is the only one that does not belong to the same network component as the other 23 families).

Table 1
Number of nodes affiliated with each family before and after label propagation.

Family	Before LP	After LP
New York City:		
Genovese	88	152
Lucchese	34	127
Gambino	44	69
Profaci	17	25
Bonanno	13	18
Elizabeth, N.J.	4	4
Buffalo	17	18
Pittston, P.A.	18	19
Pittsburgh	6	6
Philadelphia	13	13
New England	9	10
Detroit	42	47
Chicago	38	42
Kansas City	18	19
St. Louis	11	11
Cleveland	11	19
Springfield, I.L.	2	2
Omaha	5	5
New Orleans	18	20
Tampa	15	16
Dallas	7	7
Colorado	9	9
Los Angeles	24	32
San Francisco	15	17
Total	478	707

this tendency, I rely on the measure of *modularity* proposed by Newman and Girvan (2004). Modularity Q gives the fraction of edges that occur within communities (i.e. mafia families) minus the expected fraction of within-community edges in a random network with the same degree distribution. Thus, high modularity indicates that dyadic relations are heavily constrained to occur within group boundaries. More formally, modularity is expressed as

$$Q = \sum_i (e_{ii} - a_i^2) \quad (1)$$

where communities are indexed by i, e_{ii} represents the fraction of edges within community i, and $a_i = \sum_j e_{ij}$ where other communities (besides i) are indexed by j. Thus, a_i gives the total fraction of edges that connect to community i. In a random network, $e_{ij} = a_i a_j$. Newman and Girvan (2004) propose that as a general rule, networks with $Q > .3$ (meaning that the proportion of within-group ties is 30 percent greater than random chance) feature strong community structures (p. 8). The mafia network features modularity $Q = .56$, indicating that the network structure is dominated by internally cohesive and externally differentiated closed groups. This closure is not a product of the network neighbor-based label propagation; if we were to examine only the network ties among the 478 nodes whose family affiliations were inferred from archival sources independent of the label propagation algorithm, $Q = .61$.

Fig. 1 visualizes this network structure with nodes colored according to family affiliation. In the figure, families are clustered and relatively clearly demarcated from one another. Of course, much of this group closure would seem to reflect geographic proximity. Given the local scope of the protection racket and many other mafia businesses, a high degree of network differentiation among families located in different cities and regions is hardly surprising (Gambetta, 1993). However, Fig. 2 "zooms in" to depict network ties only among mafiosi affiliated with the five N.Y.C. families (Genovese, Lucchese, Gambino, Profaci, and Bonanno). Compared to $Q = .56$ in the larger network, the modularity in this N.Y.C. sub-network decreases to $Q = .33$. In the network visual, family boundaries are more difficult to distinguish than in the national

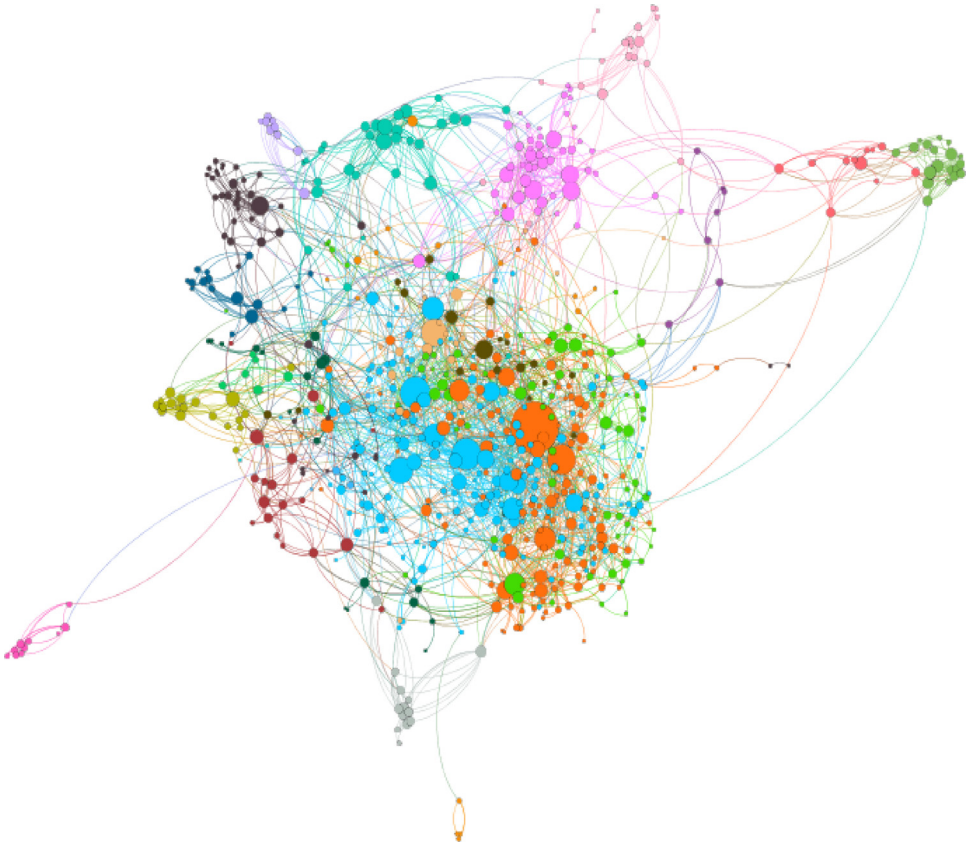

Fig. 1. The American mafia network. *Note: Nodes are colored according to family membership and sized according to degree.*

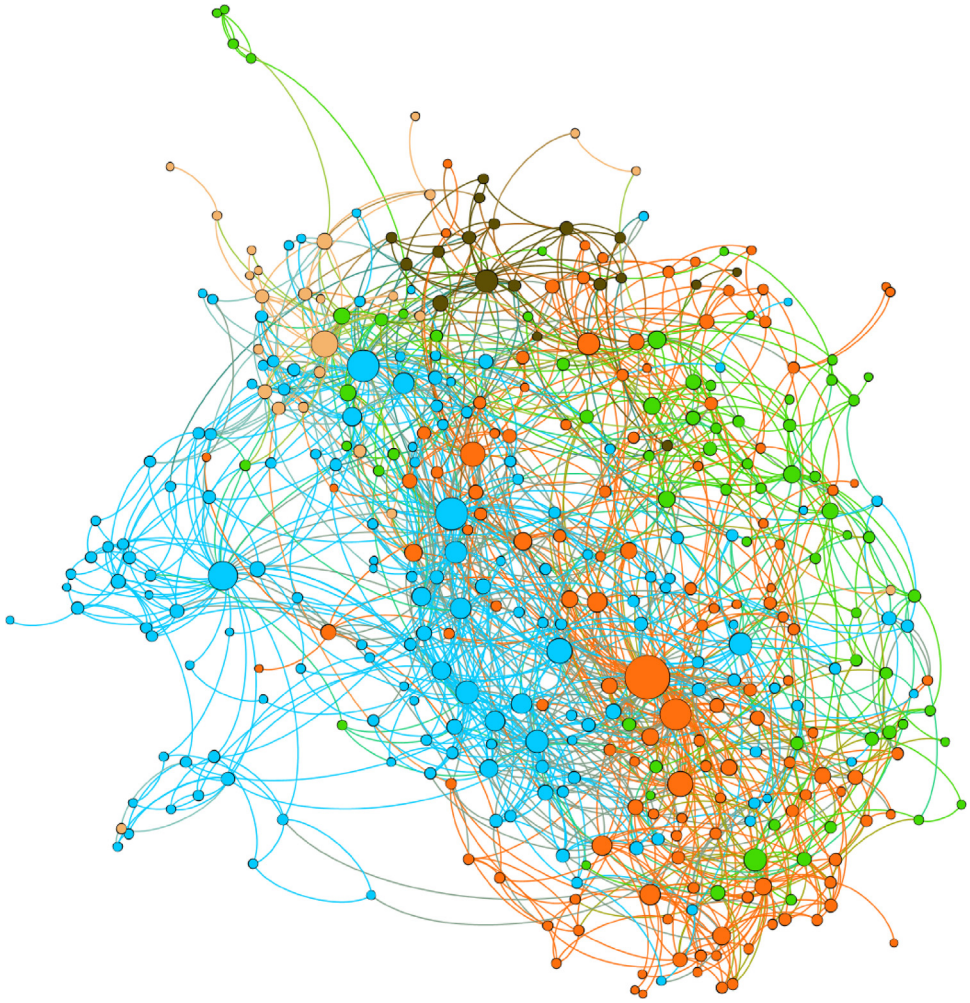

Fig. 2. The Five Families of New York City. *Note: Nodes are colored according to family membership and sized according to degree.*

network. Yet, even within a single city, the degree of network clustering remains relatively high and any given mafioso is much more likely to share a network tie with someone in the same family.

6. Network integration

Despite the high modularity of the mafia network, the structure nonetheless retains other features associated with the potential for efficient communication and reachability across group boundaries. Fig. 3 depicts the bridging ties between families. With the exception of the disconnected Omaha cluster, all other families are tied into a single network component. While closeness in the interfamily network often correlates with geographic nearness, even families located on opposite coasts could be linked through bridging ties. One simple measure of network integration would be to find how many nodes can be placed into a single *bicomponent*—defined as a grouping within which any node can reach any other through at least *two* independent pathways. When most nodes fit within a single bicomponent, the network is integrated in the sense that individuals have multiple different ways of reaching those with whom they are not directly connected (Erikson and Bearman, 2006). For the mafia network, 94 percent of nodes (665 of 707) fit within a single bicomponent.

Another indicator of integration and efficiency is the *average path length* of the graph, or the average number of network steps between pairs of nodes. For the mafia network, this quantity equals 3.92, indicating that most pairs of mafiosi—even those operating in different cities and families—were just a few degrees of separation apart in the national network. This combination of high local clustering and inter-cluster connectivity observed in the mafia network is consistent with the small-world network structures famously described by Watts and Strogatz (1998). The co-presence of these seemingly contradictory properties minimizes the trade-off between security and efficiency because it provides for both dense local networks in which trust and assurance are likely to be higher (Coleman, 1988) and well-integrated networks that keep opportunity costs low by allowing both direct and indirect access to diverse resources located in other network clusters (Burt, 1992, 2004; Granovetter, 1973).

A more formal test of the small-world properties of the mafia network can be made by comparing the observed network to "rewired" random networks of the same size with regard to two quantities: (a) the *average path length* (APL) between two nodes in the network and (b) the *clustering coefficient* (CC)—defined as the proportion of closed triads (transitive structures in which an A connected to B who is connected to C also implies that A and C are connected)—of the network (Watts, 1999; Watts and Strogatz, 1998; Uzzi and Spiro, 2005). I generated 10,000 simulated random rewirings of the mafia network and compared each of them to the empirically observed structure. Random networks are marked first by low average path lengths, owing to the lack of local clustering. In a small-world structure, however, the APL should not be

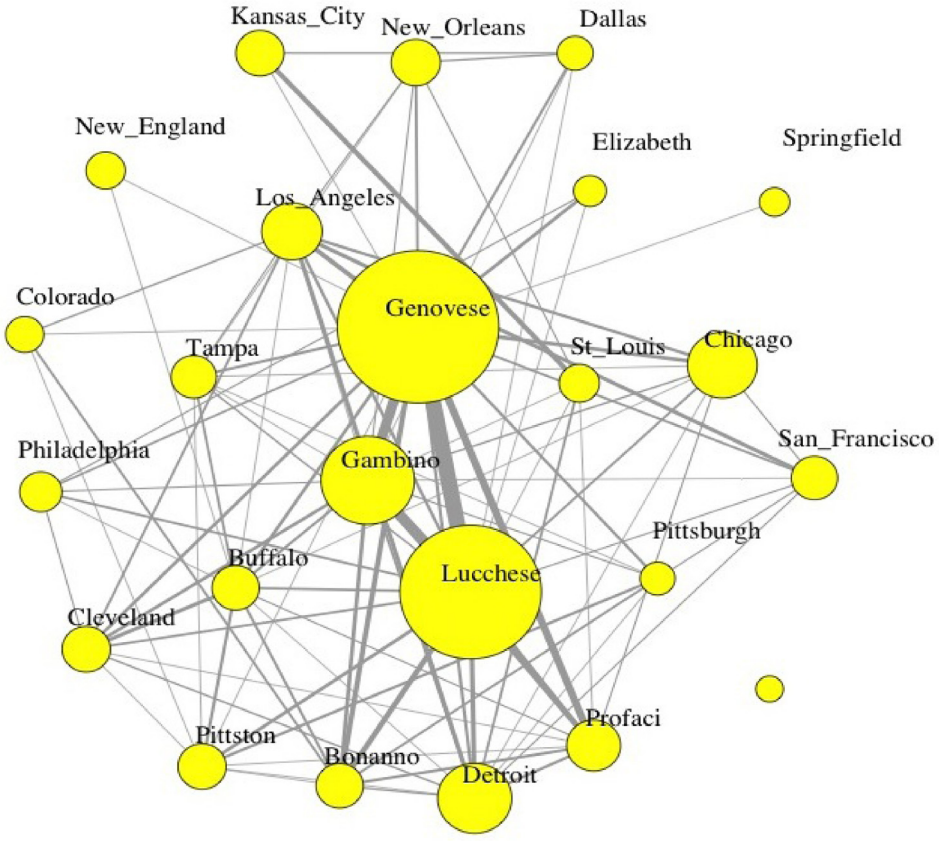

Fig. 3. Bridging ties between mafia families. *Note: Nodes are collapsed by family and sized by membership count. Edges are weighted by the number of network ties between members of the respective families.*

dramatically higher than in a comparable random network. The average APL across the random networks was 3.40, compared to just 3.92 in the observed network. In contrast, the clustering coefficient for an observed small-world network should far exceed that of comparable random networks. This was also the case for the mafia network, in which the observed CC was .23 compared to an average of just .011 in the random networks. The *small world quotient* is defined as the *clustering-coefficient ratio (observed to random) / path-length ratio (observed to random)*; the greater this quotient, the more the network resembles a small-world structure. The mafia network averages 17.67. For reference, this small-world quotient exceeds those for two of the three example small-world networks originally used by Watts and Strogatz (1998).

7. Division of network labor

What explains the co-existence of high local clustering with significant bridging ties between otherwise clearly separated mafia groups? One explanation would be that most mafiosi in the network maintained a balance of within-family and between-family ties. A different explanation would be that there emerged a *division of network labor* in which relatively few mafiosi maintained most of the key bridges generating network integration and structural efficiency. Fig. 4 shows the distribution of the number of bridging (extra-family) network ties maintained by each mafioso and clearly suggests evidence for the second explanation. In fact, 32 percent of mafiosi had *zero* ties outside their own family and another 19 percent had just one. Yet, a smaller number of mafiosi acted as key brokers maintaining many extra-family ties. This skewness is not a mere reflection of differences in network degree, either; a similar distribution appeared when I instead looked at the *proportion* of bridging ties in each mafioso's egocentric network.

The natural next question is *to whom* the distinctive role of network bridge was most likely to fall. A long literature associates the occupancy of bridging positions in network structure with personal influence, access to diverse information and resources, and higher social status (Burt, 1992, 2004; Emerson, 1962; Fernandez and Gould, 1994; Marsden, 1983; Stovel and Shaw, 2012). Yet the bridge-status association is also seen as conditional and dependent on group context, with actors who occupy boundary-spanning network positions at risk of being perceived as duplicitous or untrustworthy in contexts where collectivism and group solidarity are paramount (Xiao and Tsui, 2007).

To observe the bridge-status association in the mafia network, I leverage a unique feature of the data set—the directed nominations of criminal associates contained in each mafioso's criminal profile. Since each profile is limited in space, the number of criminal associates that can be listed in a given profile is also limited. Consequently, the investigators who constructed the dossier tended to prioritize better-known associates. Thus, a high-ranking mafia leader is more likely to appear in a lower-level mafioso's list of criminal associates than the reverse, allowing us to exploit the directed nominations for leverage in measuring status and centrality in the mafia organization (Mastrobuoni and Patacchini, 2012). Using this directed network, I measure each mafioso's centrality using *pagerank* (Page et al., 1999). The pagerank measure is a variant of eigenvector centrality and is best known as the method through which Google ranks search results. Just as the highest-scoring web pages are those that are linked to by many and higher-ranked other pages, the highest-scoring criminals in the data set are those

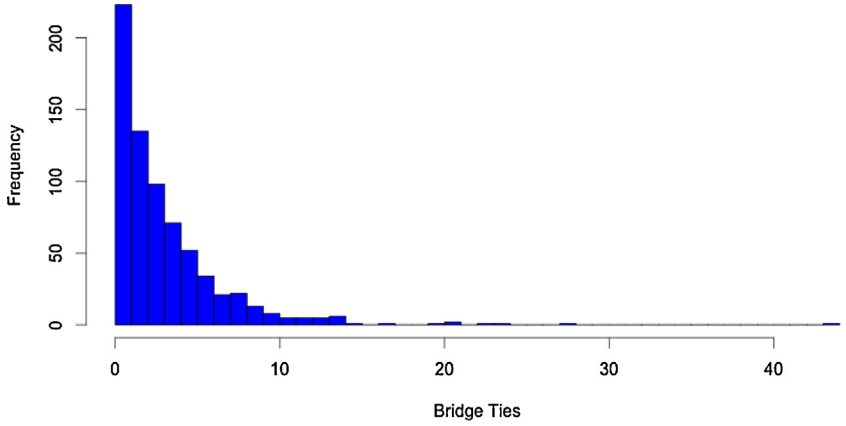

Fig. 4. Histogram of bridging ties in egocentric networks.

that receive nominations from many and higher-ranked other criminals.[6] For robustness, I also look at both *in-degree* (number of incoming nominations) and *betweenness* (number of geodesics or shortest paths on which the focal node lies).

To make the analysis more meaningful, I generate family-specific centrality scores that only consider the network of ties *among* members of each family. This approach is needed because we want to see how the role of inter-organizational broker is distributed within the hierarchy of individual families.[7] In order to adjust for overall differences in the connectedness of different families, each mafioso's centrality score is centered by subtracting the family mean. Fig. 5 displays nonparametric local polynomial fits of the relationship between the three adjusted measures of network centrality and the proportion of bridging ties in each mafioso's egocentric network. Interestingly, the results suggest a roughly U-shaped association between bridging and status, meaning that the mafiosi with networks built around bridging ties tended to be those with either relatively low or high status within their family of affiliation, but not those of relatively middling status.

Substantively, these patterns suggest a dynamic akin to what Phillips and Zuckerman (2001) call *middle-status conformity*. Lower-status mafiosi can afford to occupy boundary-spanning bridge positions in the network because—by virtue of their already-low status—they have relatively little to lose from the approbation of peers who might view their boundary-spanning activity with suspicion. Conversely, high-status mafiosi can engage in boundary-spanning activity because their high status insulates them from the judgment of lower-ranked peers. The suggested presence of middle-status conformity in criminal organizations merits more in-depth future investigation, particularly since the simultaneous measurement of bridging and status in the present data set only allows us to observe association rather than causal direction.

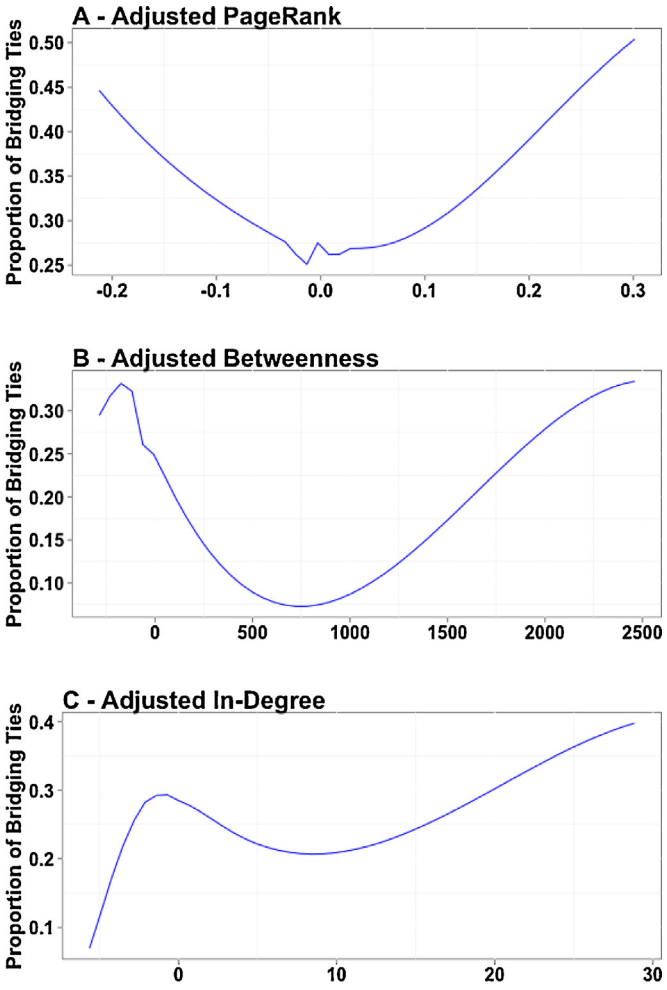

Fig. 5. Proportion of bridging ties by centrality. *Note: Plotted values are based on local polynomial smoothing.*

8. Conclusion

Network scholars have long argued that criminal and covert organizations are biased toward decentralized, less discoverable—and thereby more secure—structures at the expense of the diverse, cross-cutting relationships that classically make communication and coordination across network space more efficient (Baker and Faulkner, 1993; Erickson, 1981; Morselli et al., 2007). While previous work has illustrated this argument within

[6] I established the face validity of the *pagerank* scores by comparing them to available measures of formal position in the mafia hierarchy, finding that they corresponded closely. These analyses are available upon request from the author.

[7] Mastrobuoni and Patacchini (2012) similarly rely heavily on measures of network centrality in their analysis of the mafia network. The key difference is that they measure centrality purely in terms of the global network. While this approach is surely suitable for some purposes, it also very likely conflates individual-level centrality with group-level attributes such as organizational size and geographic locale.

the context of particular criminal organizations or conspiratorial incidents, the present article extended it to the analysis of a larger-scale national criminal network spanning more than 700 members of 24 distinct American mafia families operating in the mid-20th century. There are limitations to the analysis taken up here. For example, the focus on ties of criminal association is in some ways too broad and in others too narrow—too broad in the sense of missing the precise behavioral content of individual connections and yet too narrow in the sense of missing the richer matrix of political, social, and economic ties within which organized crime is embedded (Papachristos and Smith, 2014). Despite these limitations, two key sets of findings have emerged from the analysis.

First, I showed—using Newman and Girvan's (2004) concept of *modularity*—that the American mafia network was dominated by intragroup ties that gave rise to dense networks of criminal association within particular organizations or "families." While organizational boundaries were lower in the case of New York City, where five families operated in the same urban area, I still found that intragroup ties appeared with far greater regularity than one would expect by chance. Nonetheless, the national network featured substantial integration across organizational clusters such that a mafioso in Providence or New York could typically reach one in San Francisco or Los Angeles through just a few degrees of separation. By comparing the observed structure with randomly "rewired" networks of the same size, I showed that the American mafia was an example of a small-world structure featuring both high local clustering and low average path lengths (Watts and Strogatz, 1998). These small-world properties point toward a balance in network structure that allowed for both high security—by virtue of dense local clusters with relatively few outgoing connections—and high efficiency—due to bridging ties that greatly increased each criminal's reachability from any other.

Second, in attempting to shed light on the mechanisms that gave rise to this structure, I demonstrated evidence for a *division of network labor* in which a relatively small number of actors occupied the bulk of the bridging connections giving rise to network integration. Rather than broadly dispersed, occupancy of inter-organizational network bridges was heavily concentrated among a minority of network members. Furthermore, by applying several measures of status centrality within families, I found suggestive evidence for a dynamic of middle-status conformity (Phillips and Zuckerman, 2001) in which bridging ties were most prevalent in the networks of either low- or high-status—but not middle-status—criminals. Future work should examine the mechanisms that might give rise to such patterns, especially whether and how the status benefits of brokerage—and inter-organizational brokerage in particular—operate in the context of criminal networks where a large premium is placed on closure, solidarity, and loyalty to the group.

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