New Methods of Mapping

The Application of Social Network Analysis to the Study of the Illegal Trade in Antiquities

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Abstract. This study examines the application of a human-agent based network to the illegal trade in antiquities. Specifically, this study tests whether the hierarchical pyramidal structure proposed by law enforcement in the case of Giacomo Medici's trafficking ring is accurate. The results of the analysis reveal discrepancies in perceptions of how antiquities trafficking networks are organized, how they operate, and how cultural patterns and representation of criminal activity influence the perception of such network structures.

Keywords: Illegal Antiquities Market, Social Network Analysis, Network Theory, Ucinet, Anthropology, Economics, Criminology, Law.

1   Introduction

How do we understand the nature, structure, and function of a phenomenon like the antiquities market?[1] Because it operates in both legal and illegal spheres of society, it poses a unique challenge to social scientists and law enforcement. The trade in illegal antiquities has been closely compared to other illegal trafficking markets and to organized crime. These comparisons, while providing insight into the motivations behind transnational criminal activity in general, have propagated the misconception that the illegal antiquities trade is hierarchically structured, similar to the mafia [1]. The illegal antiquities market is distinct from other forms of trafficking in that the cultural heritage being moved is a "finite resource that cannot be cultivated or manufactured…and artifacts must be laundered in order to appear legitimate" [2].

This study examines networks of individuals operating both legally and illegally in the antiquities market inductively through the application of social network analysis. Specifically, this study asserts that the hierarchical pyramidal structure most often

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[1] The art market in general and the antiquities market are distinguished in this study. The art market includes contemporary art and antiquities. Here, the antiquities market is defined as dealing with archaeological and ethnographic objects. While there is no clear definition of what makes an object old enough to be an antique, the objects discussed in this study are from archaeological sites at least five hundred years old. As such in this study an object must be at least five hundred years old to be considered an "antiquity."

proposed by law enforcement is an accurate representation of the structure of an antiquities trafficking. This research is excerpted from a larger study and will only focus on one case study involving the dealer Giacomo Medici and the Italian carabinieri. Social network analysis is used to test two hypotheses: (1) when using the same set of data[2] the program Ucinet [3] will produce a non-hierarchical visualization of the network that differs from what was described by the Italian police; (2) Ucinet's representation of the network will more accurately describe the structure and dynamics of the network and its actors.

2   Methodology

The present study combines the fields of criminology, social network analysis, and the illegal trade in antiquities to examine the structure of an Italian network of smugglers first uncovered in the early 1990s with investigations continuing for over a decade. Specifically, it focuses on one branch, or cordata, of the network involving Giacomo Medici. The literature that informs the larger study from which this case study is abstracted pulls from the scholarship in criminology, anthropology, economics, and network theory. The literature covers transnational criminal organization [1,4], theories on influence and power in the illegal antiquities market [5], and the use of centrality and betweenness in determining network structure in corporate hierarchies and quasi-legal activities [6-9].

To test the first hypothesis, the network is first visualized based on the categories of the actors in the network (i.e., tombaroli, middleman, dealer, etc.). Each node represents a category of actor and each relationship encompasses buying, trading, and selling. The movement of objects through the network is used to validate the new model generated by social network analysis. Interpersonal relationships of the actors are used to analyze the nature of influence and power in the network. For the second hypothesis, Medici's ego-network is examined. Statistical measures developed by Linton Freeman are used to examine the centrality and prestige both at the actor and network level [8,9]. Four measures within centrality are used due to a lack of specific data on directed relations:

  o Degree Centrality: Assesses prominence within the network as measured by the amount of "activity" a node experiences.
  o Closeness Centrality: Uses proximity to determine the centrality of an actor. The faster an actor can interact with others, the more central it is to the operation and structure of the network [10].

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[2] Every effort was made to use the same primary sources as were used by the Italian police in the original investigation. Italian legal policy states that all original documentation pertinent to a trial is not available to the public until the trial is completely resolved. Although Giacomo Medici's trial and appeal have concluded, the documents are not yet available. "Data" here refers to the information available in the organigram and associated qualitative open-source data available on the relationships between actors in the network.

o Betweenness Centrality: Assumes that all paths are equally likely in the communication of information and looks at those actors who act as gateways and tollbooths for information in the network [8,11].

o Information Centrality: Assumes that information may easily take a more circuitous route either by "random communication" or by being "channeled" through intermediaries to "shield" or "hide' information [12].

All four measures are calculated at the actor level or the network level. At the actor level, they indicate the actor's prominence in relation to the specific measure. At the network level, they indicate how variable or heterogeneous the actor centralities are in the network.

The Italian police and prosecutor asserted that Giacomo Medici was part of a pyramidal hierarchical network based on two pieces of evidence: an organigram[3] [13] found in the home of an actor in the network describing a rough hierarchy of relationships and (2) the use of the term "cordata" to describe the structure of the network by a looter (or tombarolo) [13].[4] The four centrality measures above were used to verify whether these assumptions about the structure of the network are accurate both in the specific case of Medici and in the Theoretical network (see Figure 2). They also informed how the perception of the network affected assumptions about its operations.

3   The Italian Network

3.1   Overview

The theft of several Melfi vases on January 20, 1994 triggered an investigation of an extensive underground network of antiquities smuggling by the Italian Art Squad led by Roberto Conforti.[5,6] The investigation quickly expanded to include prominent and influential dealers in Italy, including Giacomo Medici. Several of the central figures in the investigation, Medici included, maintained meticulous records of their involvement not only with the network's other branches' (or cordate's) dealers and

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[3] The organigram is an organized chart of the structure of the network drawn from the perspective of one inside the network. The relationships were defined as primarily unidirectional on the bottom and bi-directional towards the top of the hierarchy. Based on this information, a relationship was defined as buying, selling, or trading. It was most likely created sometime between 1990 and 1993.

[4] Cordata refers to a mafia-like structure in Italian, which, as a classic structure in organized crime, is typically considered hierarchical.

[5] Roberto Conforti, a veteran carabinieri, has worked in drugs, homicides, and spent considerable time undercover working against "the most formidable, well-equipped, determined, and organized criminals that Italy has produced," [12]. At the time of the theft under investigation, Conforti had already been the head of the Art Crime Unit for four years and had expanded the unit to operate in Palermo, Florence, and Naples.

[6] The Melfi vases stolen from the museum were terracotta pots, each roughly 2,500 years old. They depicted stories from the Greek classics of goddesses, athletes, and scenes of dancing and feasting [12]. The condition and artistic quality of the vases made them very important culturally and historically to the Melfi region and very desirable to collectors and museums.

middlemen, but also with a periphery of museums, collectors, and scholars in both Europe and the United States. The expanse of the network required effective tracking of the movement and sale of objects. Along with the organigram, four archives of information were discovered during the course of the investigation. The broader network's activities were found to cover at least Italy, Switzerland, France, Germany, England, Japan, and the United States. These included looting, smuggling, theft, and laundering of objects to auction houses. By 2006 Giacomo Medici had been convicted in Italy, while other prominent members were awaiting trial in England and Egypt. As of 2012, Medici was serving an 8 year term and owed a €10 million fine to Italy for damage caused to cultural heritage [14].

3.2   Comparison of Network Structure

The results of the visual analysis supported the first hypothesis. Using the same network-level dataset on the relationships as defined in the organigram, the visualization produced by Ucinet featured a highly centralized network with two actors of equal interest: the dealer and the international dealer. The pyramidal structure proposed by Italian law enforcement places the international dealer underneath the buyers (auction house, collectors, and museums), suggesting that while the international dealer is important, the buyers would be most influential.

As shown in Figures 1 and 2, the relationships between the categories in both the pyramid and centralized networks do not change; however, their representations of the influence of actors within the networks differ. In order for the pyramidal structure to be an effective description of the structure of the network, participants would have to be subject to a monopoly, long-term agreements, and sanctions [2]. Based on the available data on Medici's branch of the larger trafficking network, no monopolies existed on the sources or buyers of antiquities. Nor did agreements to purchase or work together (formal or otherwise) exist between the tombaroli, capa zona, middlemen, and dealers [13]. Without the first two, it would have been impossible for sanctions to exist. The hierarchical nature of the pyramid, then, does not reflect the nature of influence or power in the network.
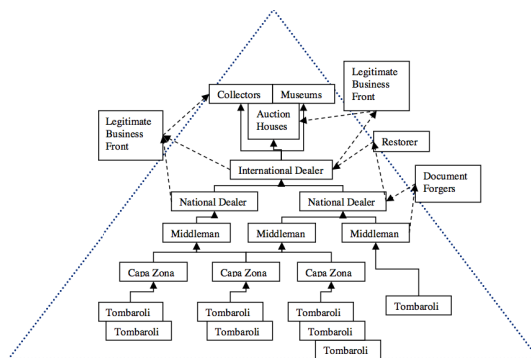

Fig. 1. Pyramidal Structure proposed by law enforcement as adapted from descriptions of the network by Watson and Todeschini and interpreted based on the organigram created by Pasquela Camera
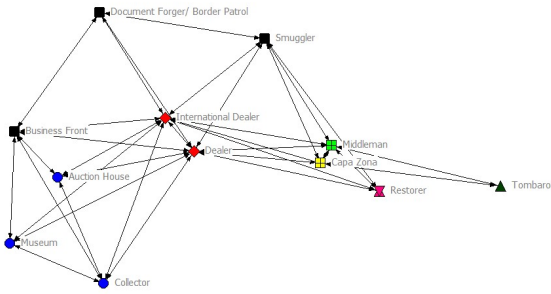
Fig. 2. Theoretical Model of Medici Network. Node color reflects the category of the actor. Node shapes correspond to function in the network: buyers are circular, laundering experts are square, diamonds are dealers, triangles are sources of looted objects, and boxes are intermediaries.

The centralized network represented in the Theoretical Model (Figure 2) more accurately represents the flexible nature of the relationships in the network and the movement of antiquities through it. The dealer and international dealer control the flow of objects from the source to the buyers in that they have the most direct relationships with the buyers.[7] Giacomo Medici, as a dealer, had significant influence over his connections in the network both to persuade buyers to consider objects of questionable provenance and work directly with peripheral actors to prepare the objects for transportation. Yet, there was opportunity for other actors in the network to work with others should they chose, even their influence over the network was not significant. The Theoretical Model is more realistic in reflecting how objects move through the network; the flexibility accounts for the unpredictability of movement that is sometimes seen in the movement of illegal antiquities.

3.3   Representation of Network- and Actor-Level Structure and Dynamics

The results of the statistical analyses support the second hypothesis. Analyses run on both the network level and the actor level datasets confirmed the central role of the dealer and international dealer in the network. They also suggested several patterns in the structure of power and influence in the network based in the behavioral patterns known to have occurred during the height of Medici's activity.

Overall, the results found that for the degree, betweenness, and closeness measures, the network-level results indicated a much more decentralized network than the

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[7] It is interesting to note that here unidirectional relationships tend to be shown more on the peripheries than bidirectional relationships, despite the fact that in reality this is not always the case. While it is true that the buyers do not have a "relationship" with the dealer, they do know of him and are often closely associated with him. This shows one of the weaknesses of this type of visualization – whether a path exists between two actors depends on how "relationship" is defined. In this case it encompasses buying, trading, and selling. Because most buyers only buy and do not sell or trade, they are shown as further out in the network. One must add weights (e.g, closeness of relationship) to get a more realistic visualization.

results of the actor-level analyses.[8] With centrality indices ranging from 22 – 60 percent for these three measures, the network-level model (Figure 2) is only moderately centralized.[9] At the actor-level, results showed a highly centralized network with measure results ranging from 76 – 86 percent.

Table 1. Comparison of Summary Statistics for Theoretical Model (Network-Level) and Network Model (Actor-Level)

	Maximum	Minimum	Mean	Standard Deviation
Theoretical Model	3.316	1.364	2.463	0.504
Network Model	1.980	0.655	1.158	0.322

Of particular interest is the information centrality measure, as seen in Table 1 above. The results showed that both at the network and actor-level, there was a large amount of variation between actors that are highly influenced and influential.[10] Yet the variation was not consistent across categories of actors in the Network Model. The activities of the tombaroli were similar, yet not all of them were equally influenced by the capa zona and middlemen. The same is true across every category of actor (see Figure 3). This suggests that while the network may be centralized, assumptions of who has power and influence among the actors is fluid, which may be a reflection of the fluid participation of the actors in both legal and illegal activities [1].
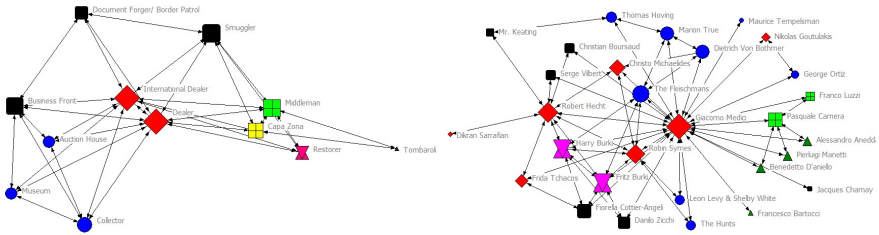

Fig. 3. Freeman Information Centrality measures calculated at the actor level for the Theoretical Model (top) and the Network Model (bottom). Node size indicates prominence of actors in the network; nodes color reflects the category of the actor (dealer, restorer, etc.). Node shapes correspond to their function in the network: buyers are circular, laundering experts are square, diamonds are dealers, triangles are sources of looted objects, and boxes are intermediaries.

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[8] Differences in the degree of centrality between the Theoretical and Network Models can in part be explained by the differences in the number of nodes in each graph.

[9] The centrality measures for degree, closeness, and betweenness provided a network-level centralization index that aggregated the individual actor results. The degree index expresses the inequality, or variance, of the distribution of influence in the network as a percent out of 100. Closeness indicates variability in the data in terms of the proximity of the actors as a percent out of 100. the more valuable the data, the closer to100 the index will be. Betweenness has only one statistic for centralization out of 100 percent and includes all individual centralization measures, including those without intermediaries, so can be misleading.

[10] Information centrality does not provide an index; it assumes that all paths are not equally likely, instead relying on choices of actors in the network.

4   Discussion

The results of the centrality measures suggest that Medici's network of actors, while highly centralized, also had the capacity to be extremely fluid and adaptable in terms of power and influence. This is contrary to the notion of a mafia-like hierarchical structure [1]. Such a network would have stronger relationships outside of business, possibly including familial relationships, of which Medici's network had very few. Instead, the fluidity of the influence and power can be attributed to the ease with which actors in the network are required to operate in both the legal and illegal markets [1]. Their influence over other actors at any one time would be determined by which sphere they are operating in. A tombaroli selling to Medici directly under a legal sale has equal authority and influence over the transaction, whereas the same situation in the illegal sphere would have a different balance of power.

Of all the centrality measures, information centrality portrays the complexity of the perception of power and influence best. The measure uses a system of weights to calculate the most probable path based on the strength of relationship and the frequency of interactions, what Stephenson and Zelen call "strength of signals" [12]. In the antiquities market, this is called "triangulation" [13] and from what studies have been able to show, is the most frequent and effective means of evading authorities [13]. As shown in Figure 3, with the exception of a few categories, most of the nodes are of roughly equivalent size, suggesting that there are a number of equally likely paths depending on the situation, which is an accurate reflection of the transportation methods used by Medici described in the data [13].

5   Conclusion

Ultimately the results of this study suggest that a network perspective on the structure of illegal antiquities trafficking is a more accurate reflection of the complexities of power and influence among the actors. It also can help to inform our understanding of the current perceptions of criminal organization that guide the work of law enforcement. Further, it suggests that the inductive method taken here can provide a more flexible framework from which generalizations across antiquities networks may be elucidated.

Power and influence in the illegal antiquities market is fluid and depends on the specific actors involved at any one time. This is contrary to the perception held by the Italian law enforcement. The notion of a single prominent actor controlling the activities of all others would not only be unsustainable but also unrealistic given the scale of operations crossing continents, like the larger network Medici was. This more nuanced view of the illegal antiquities network is more realistic and can provide deeper insight into the perception of criminal activities.

More broadly, this study suggests that a means of generalizing across different antiquities networks, while not necessarily possible at the actor-level due to difference in social norms and mores, may be possible at the methodological-level. The methodology used could provide one possible means of generalizing. Using both deductive

and inductive research methods and a modeling method, like social network analysis, that can incorporate both allows for consistent analyses across different countries. One important feature of a generalized framework not considered here is the effect of social norms and mores of the society in which networks operate on the decisions and behaviors of both the criminals and law enforcement officials that pursue them. Most importantly, such a methodology would require time and additional data for new observations on the behavioral patterns of the participants in order to increase the validity and reliability of the model.

Obtaining data will always be a challenge for this kind of research due to the nature of illicit markets. However, using social network analysis to better understand the market based on the data that is available may reveal new sources information in existing records or better new ways of collecting data during investigations.

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